ERC/EIS - 0050

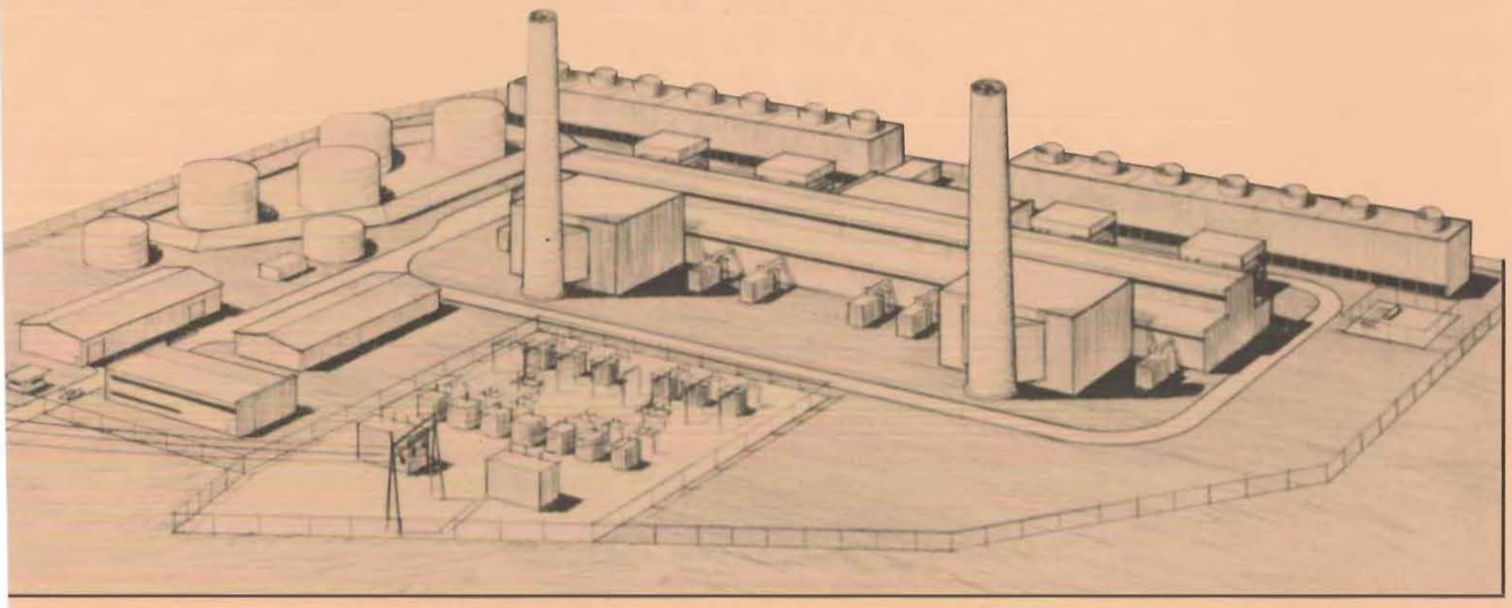
OCEAN STATE POWER PROJECT

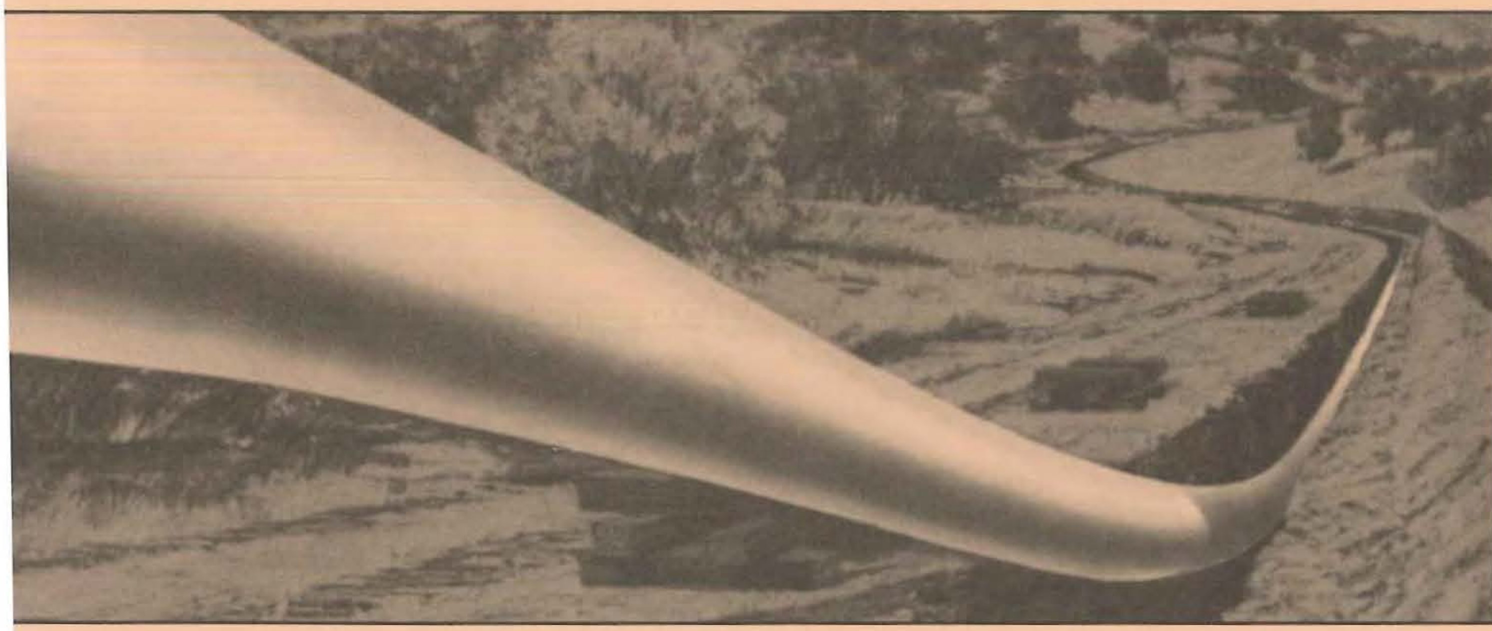
Final Environmental Impact Statement

VOLUME I

Ocean State Power
Tennessee Gas Pipeline Company

July 1988





FEDERAL ENERGY REGULATORY COMMISSION
Office of Pipeline and Producer Regulation
Washington, D.C. 20426

Docket Nos. CP87-131-001
CP87-132-001

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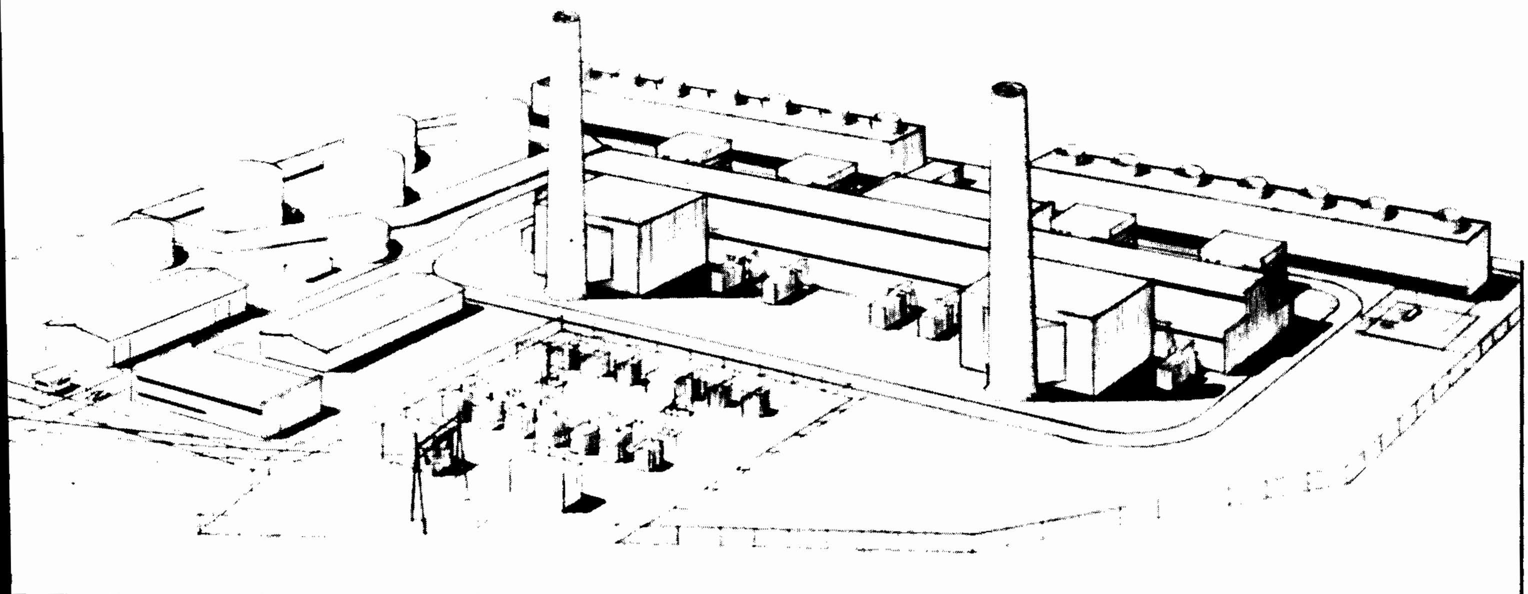

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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Tennessee Gas Pipeline Company — Docket Nos. CP87-131-001 and CP87-132-001

OCEAN STATE POWER PROJECT
NOTICE OF AVAILABILITY OF
FINAL ENVIRONMENTAL IMPACT STATEMENT

(July 8, 1988)

Notice is hereby given that the staff of the Federal Energy Regulatory Commission (FERC), in cooperation with the State of Rhode Island Office of Intergovernmental Relations (OIR), has made available a final environmental impact statement (FEIS) on the natural gas pipeline facilities proposed in the above-referenced dockets, and a related proposal to construct a 500-megawatt power plant in northwestern Rhode Island.

The FEIS was prepared under the direction of the FERC and OIR staffs to satisfy the requirements of the National Environmental Policy Act and the Rhode Island Energy Facility Siting Act. The staff has determined that approval of the proposed project, with appropriate mitigating measures including receipt of all necessary permits and approvals, would have limited adverse environmental impact. The FEIS evaluates alternatives to the proposals.

The proposed action involves construction and operation of a new natural gas-fired, combined-cycle power plant which would be located on a 40.6-acre parcel in the town of Burrillville, Rhode Island. The proposal includes construction of a 10-mile pipeline to transport process and cooling water to the plant from the Blackstone River, and a 7.5-mile pipeline to deliver No. 2 fuel oil to the site for emergency use when natural gas may not be available.

The natural gas pipeline facilities covered in the FEIS include a total of 25.5 miles of 30-inch diameter looping in 5 separate segments located adjacent to existing gas transmission pipelines in New York and Massachusetts, and approximately 11 miles of new 20-inch-diameter pipeline in Massachusetts and Rhode Island. The FEIS includes analysis of an additional 7,700 horsepower of compression at 3 existing compressor stations in New York and Massachusetts, and a new 4,500 horsepower compressor station in New York.

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 motions to intervene in this case has expired, motions to intervene out-of-time can be filed with the FERC in accordance with the requirements of 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 has been placed in the public files of the FERC and the OIR, and is available for public inspection in the FERC's Division of Public Information, Room 1000, 825 North Capitol Street, N.E., Washington, DC 20426, and at the OIR, 275 Westminster Mall, Providence, Rhode Island 02903. Copies have been mailed to Federal, state and local agencies, public interest groups, interested individuals, newspapers, libraries, and parties in this proceeding.

Additional copies of the FEIS, in limited quantities, are available from the FERC's Division of Public Information or from Mr. Lonnie Lister, Project Manager, Environmental Analysis Branch, Office of Pipeline and Producer Regulation, Room 7312, 825 North Capitol Street, N.E., Washington, DC 20426, telephone (202) 357-8874 or FTS 357-8874

Lois D. Cashell,
Acting Secretary.

MAJOR CONCLUSIONS

Ocean State Power (OSP), a partnership, proposes to construct and operate a 500-megawatt (MW) combined-cycle electric generating station at a site on Sherman Farm Road in Burrillville, Rhode Island. In addition, Tennessee Gas Pipeline Company (Tennessee), a division of Tenneco, Inc., proposes to construct and operate a delivery line from its existing pipeline to serve the proposed OSP project as well as provide service to Providence, Rhode Island. This proposed pipeline is known as the Rhode Island Extension. To enable Tennessee to serve OSP, additional modifications are required to Tennessee's Main Line and a segment of pipeline known as the Niagara Spur. These proposed modifications are interrelated with the OSP project, and therefore are jointly addressed in this Final Environmental Impact Statement (FEIS). [a]

Construction and operation of the proposed Ocean State Power project at Sherman Farm Road would have a limited adverse environmental impact and would be an environmentally acceptable action. The Federal Energy Regulatory Commission (FERC) Staff recommends certain additional mitigating measures to further reduce the anticipated environmental impacts.

Construction and operation of the proposed Tennessee gas pipeline facilities addressed in this FEIS, would have a limited adverse environmental impact and would be an environmentally acceptable action. The FERC Staff recommends certain additional mitigating measures to further reduce the anticipated environmental impacts.

Construction of the proposed Ocean State Power project at two other sites--Ironstone in Uxbridge, Massachusetts, and Bryant College in Smithfield, Rhode Island--would have a limited adverse environmental impact and would be environmentally acceptable alternatives to the Ocean State Power preferred site at Sherman Farm Road. None of these three sites is wholly environmentally superior to another. All have distinct environmental advantages and disadvantages. Recommendation of a site becomes a matter of environmental trade-offs, and therefore, a policy rather than environmental decision which is outside the scope of this FEIS.

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[a] Bars in the right-hand margin indicate changes for the FEIS.

Construction of the proposed power plant at the Sherman Farm Road site would have significant effects on water use and local land use and would affect protected wetlands. Other resources, such as air quality, terrestrial and aquatic ecology, and cultural resources, will be affected to a lesser extent.

Withdrawal of the plant's water needs of 4 million gallons per day from the Blackstone River would not itself be a significant consumptive loss; however, this use could preempt other potential uses of the water. Effects of water withdrawals on water quality in the Blackstone River also would not by themselves be significant. Since the Blackstone does not presently meet water quality standards for heavy metals and dissolved oxygen, any further degradation of the river's quality has regulatory significance. OSP and Rhode Island Department of Environmental Management (RIDEM) have agreed to mitigation measures to ensure acceptable dissolved oxygen levels in the river during low flow periods.

Significant effects would occur within the surrounding rural residential neighborhood during construction due to noise and traffic. Analysis of operational effects from noise, night lighting, and cooling tower fogging and icing have shown that these impacts would not be severe, but would be perceived as significant by local residents. Construction and operation of the plant facilities would result in the loss of approximately 17 acres of woodlands.

Wetlands would be affected at the plant site, at the water intake, and along pipeline routes. While the total acreage of affected wetlands would not be great, the effects would be important due to their sensitive nature and protected status. Approximately 0.5 acre of wetland would be lost and several acres temporarily altered as a result of the project's development. Six streams would be crossed by the proposed water/oil pipeline route, but no significant impacts are expected.

Residents in the immediate vicinity of the proposed site could suffer a loss in property value. Some of the loss may be offset by a reduction in property tax resulting from the infusion of tax revenue from the OSP facility. Residents outside the immediate vicinity would benefit from the tax revenues, but would bear none of the burden in lost property values. OSP has established funds to distribute benefits throughout the local community as well as a property value stabilization program for residents in the immediate vicinity of the power plant.

Construction of the proposed Tennessee gas pipeline facilities would result in the disruption and deforestation of approximately 360 acres of farmland, forested areas, and wetlands. Approximately 200 acres of this land would be retained as permanent rights-of-way, or held in fee (compressor and meter station sites). The marketable timber cleared along rights-of-way would be returned to the landowners. In most cases, affected cropland would be out of production for one growing season. Wetlands would be allowed to return to their natural state except that woody vegetation (trees and shrubs) would be kept clear from the permanent rights-of-way.

Nelson Swamp in Madison County, New York, would be adversely impacted by the proposed pipeline project. Approximately two acres of Nelson Swamp would be cleared during construction, one-third of which would be retained as new right-of-way where woody plants would not be allowed to revegetate.

Construction activities along the proposed route of the 11-mile Rhode Island Extension represent the greatest amount of clearing and grading to occur along the proposed action. This is because the Extension requires considerable new right-of-way. Much of the route is forested and would require clear cutting a 75-foot-wide swath, with retention of a 50-foot width for permanent right-of-way. Many sections of the Extension's route also cross areas of shallow soils over bedrock or bedrock outcrop. Blasting through these areas may create a short-term nuisance situation for area residents in terms of noise and vibrations and may temporarily degrade groundwater quality in bedrock formations.

AREAS OF CONTROVERSY

A continuing area of controversy is the quantifiable impact the proposed action would have on the Blackstone River's water quality. Extensive modeling has been performed to quantify these impacts. Efforts are continuing to monitor Blackstone River water quality during low periods and thus determine ambient dissolved oxygen levels during these critical periods.

Operational noise emissions from the OSP plant is the subject of considerable local concern. While OSP has agreed to limit noise emissions to the EPA Guideline level of 55dBA (L_{dn}) at the nearest noise-sensitive areas, some local residents contend that an unacceptable increase over current ambient levels would result.

ISSUES TO BE RESOLVED

A primary issue to be finally resolved is the nature and extent of restrictions and/or mitigation that the Rhode Island Department of Environmental Management would place on the power plant's withdrawal of water from the Blackstone River. Mitigation for dissolved oxygen would likely be required during certain low flow conditions when OSP's withdrawal could adversely impact downstream quality of water. No other water withdrawal or water quality restrictions are presently anticipated to be imposed. FERC Staff recommends, however, that OSP consider a backup water supply such as development of the Branch River aquifer near Slatersville to minimize disruption of plant operations if mandatory shutdowns are stipulated as a Rhode Island Department of Environmental Management mitigation measure.

Another issue to be resolved in this proceeding, as pointed out by EPA in its comments on the DEIS, is the question of how, when, and by whom mitigation relative to the power plant would be implemented and enforced. The FERC Staff has made recommendations in Section Five of this document which it believes to be appropriate and reasonable. However, neither the Staff nor the general public will know which, if any, of these recommendations will be imposed as conditions to the various authorizations until final decisions are issued by the Rhode Island Energy Facility Siting Board (EFSB), the Economic Regulatory Administration (ERA), and the FERC. The FERC Staff believes that the EFSB has the principal authority to impose mitigation measures and conditions upon OSP's license. From the Federal standpoint, the ERA would have more direct control over OSP through its granting of an exemption under the Power Plant and Industrial Fuel Use Act. Should the above actions not occur, the Staff recommends that the FERC, through its authorization of the Tennessee pipeline facilities, require OSP to implement appropriate mitigation measures not imposed by others.

THE PROPOSED ACTION

The Ocean State Power project is a two-phased, natural gas-fired combined-cycle electric generating station to be located at Sherman Farm Road in Burrillville, Rhode Island. The project is being developed by a partnership consisting of subsidiaries of TransCanada Pipelines, Eastern Utilities Association, New England Electric System, Newport Electric Company, and J. Makowski

Associates. The purpose of constructing and operating the Ocean State Power project is to provide base-load electricity to the New England Power Pool grid.

The proposed OSP plant site is a 40.6-acre parcel of land leased from Blackstone Valley Electric, a subsidiary of Eastern Utility Associates. Within the leased area, a 15.4-acre parcel would be developed for the plant. An additional 1.4 acres of land would be committed for an access roadway.

Natural gas, which is the primary fuel for the plant, would be supplied for Unit 1 from a delivery line off Tennessee's 200 Main Line. Natural gas would be supplied and transported to the plant on a year-round basis under a firm 20-year contract. The plant's secondary fuel is No. 2 fuel oil supplied from a delivery line off of the Mobil Oil Corporation oil pipeline in North Smithfield, Rhode Island.

The primary water supply proposed for the plant would be the Blackstone River. OSP proposes to construct a 10-mile water pipeline extending from an intake structure on the river to the plant site. The water pipeline would be located entirely within existing rights-of-way of city streets, state highways, and existing power transmission lines.

Tennessee Gas Pipeline Company proposes to transport a maximum quantity of 50 million cubic feet per day of natural gas for Ocean State Power from the U.S.-Canadian border near Niagara, New York, to Burrillville, Rhode Island, and to construct the facilities necessary to transport and deliver this quantity. This quantity is sufficient to supply the first phase of the OSP project; gas commitments for the second unit have not yet been finalized, although precedent agreements have been signed between OSP and its gas suppliers.

New facilities required for the proposed action include 11 miles of 20-inch pipeline extending from Sutton, Massachusetts, to Burrillville, Rhode Island; a new compressor station (230C) with 4,500-horsepower compression in Niagara County, New York; and, a new metering station near the Sherman Farm Road site to serve the OSP facility.

Tennessee also proposes to construct a total of 25.5 miles of 30-inch diameter pipeline looping along various segments of its Niagara Spur and 200 Main Line as well as to add 7,700-horsepower compression at existing stations along the route to serve the OSP facility. Metering capability would be expanded to 300,000 decatherms per day at the Lewiston Meter Station.

ALTERNATIVES

Alternatives examined and recommended for review by permitting and licensing agencies include the following:

Consideration should be given to the environmental trade-offs associated with two alternative sites to the OSP-preferred site at Sherman Farm Road. These alternative sites are Ironstone in Uxbridge, Massachusetts, and Bryant College in Smithfield, Rhode Island.

Modifications to the proposed routes for the oil and water pipelines are recommended to minimize the amount of pipeline required and the impact of pipeline construction along major roadways.

Variations and alternatives to the proposed Tennessee gas pipeline route that were examined in this FEIS are intended to avoid wetlands and sand and gravel resources, minimize impinging on property development potential, and minimize the amount of virgin right-of-way required. The increased economic and socio-cultural impacts diminish the viability of many of the variations and alternatives, and they are not recommended for further review. Other variations and alternatives appear to have net positive effects overall and are preferred by the FERC Staff.

TABLE OF CONTENTS

Ocean State Power and Tennessee Gas Pipeline Company Projects
Final Environmental Impact Statement

<u>VOLUME I</u>

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

CONTENTS (cont'd)

FIGURES

FIGURES (cont'd)

FIGURES (cont'd)

TABLES

TABLES (cont'd)

TABLES (cont'd)

TABLES (cont'd)

ACRONYMS AND ABBREVIATIONS

AAQS	Ambient air quality standards
ACHP	Advisory Council on Historic Preservation
AQCR	Air quality control region
A-1	Algonquin Gas Transmission Company alternative to Rhode Island Extension
BACT	Best available control technology (for air pollution)
Bbls	Barrels
BOD	Biochemical oxygen demand
Btu	British thermal unit
CA-5	Nelson Swamp (State of New York designation)
CBO	Congressional Budget Office
CeC	Canton and Charlton Fine Sandy Loam (SCS Soil)
CELT	Capacity, Energy, Loads and Transmission report
CFR	Code of Federal Regulations
cfm	Cubic feet per minute
cfs	Cubic feet per second
cm	Cubic meters
CO	Carbon monoxide
CO_2	Carbon dioxide
COE	U.S. Army Corps of Engineers
dB	Decibels
dBA	Decibels (A-weighted)
DEIS	Draft Environmental Impact Statement
DEQE	Department of Environmental Quality Engineering (State of Massachusetts)
DO	Dissolved oxygen
Dt/d	Decatherms per day (approximately equivalent to Mcfd)
EDR	Electrodialysis reversal
E&E	Ecology and Environment, Inc.
EFSB	Energy Facility Siting Board (Rhode Island)
EG-1	Papscanee Creek (State of New York designation)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency

ERA	Economic Regulatory Administration (Department of Energy)
°F	Degrees Fahrenheit
FBC	Fluidized bed combustion
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
fps	Feet per second
F-5	Zoning classification, agriculture (Town of Burrillville)
g	Gravity
GE	General Electric
GEP	Good Engineering Practice
gigajoule	10 million Btu
gpd	Gallons per day
gpm	Gallons per minute
gps	Grams per second
ha	Hectare = 10,000 m^2 = 2.47 acres
hp	Horsepower
HQII	Hydro-Quebec II
hr/day	Hours per day
HRSG	Heat recovery steam generator
Hz	Hertz
IGCC	Integrated gasification/combined cycle
IP	Interested parties
ISC (ST)	Industrial Source Complex (Short Term) air quality model
kg/ha/yr	Kilograms per hectare per year
$kg/km^2/mo$	Kilograms per square kilometer per month
KOA	Kampgrounds of America, Inc.
kV	Kilovolts
kW	Kilowatts
kWh	Kilowatt-hours
lb/hr	Pounds per hour
L_{dn}	Day-night sound level
L_{eq}	Equivalent sound level
LP	_Legionella pneumophia_
m	Meters
Mcfd	Thousand cubic feet per day

mgd	Million gallons per day
mg/l	Milligrams per liter
MIT	Massachusetts Institute of Technology
MLV	Main Line Valve
MMBtu	Million British thermal unit
MMI	Modified Mercalli intensity
MMcfd	Million cubic feet per day
μmhos	micromhos
MMWEC	Massachusetts Municipal Wholesale Electric Company
MP	Milepost (on gas pipeline)
mph	Miles per hour
mps	Meters per second
msl	Mean sea level
MVR	Mechanical vapor recompression
MW	Megawatt (1,000 kW)
MWe	Megawatt electric
NAAQS	National Ambient Air Quality Standards
NALCO 2388	Boiler water additive (trade name)
NEPA	National Environmental Policy Act of 1969
NEPOOL	New England Power Pool
NERC	National Electric Reliability Council
NGVD	National Geodetic Vertical Datum of 1929 (mean sea level)
NHPA	National Historic Preservation Act
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register Historic Places
NSA	Noise sensitive area
NSPS	New source performance standards (Clean Air Act)
NYCMP	New York Coastal Management Program
NYDEC	New York State Department of Environmental Conservation
O_3	Ozone
O&M	Operation and maintenance
OSP	Ocean State Power
PAF	Public Archeology Facility, Inc.
PAL	Public Archeology Laboratory, Inc.

PAH	Polyaromatic hydrocarbons
PCB	Polychlorinated biphenyls
PM	Particulate matter (air pollution, similar to TSP)
ppm	Parts per million (by weight)
ppmV	Parts per million by volume
PSD	Prevention of significant deterioration (air quality)
PURPA	Public Utility Regulatory Policy Act
QUAL2E	EPA-recognized water quality model
RCRA	Resource Conservation and Recovery Act
RIDEM	Rhode Island Department of Environmental Management
RIHPC	Rhode Island Historic Preservation Commission
ROW	Right-of-way
SACTI	Seasonal/Annual Cooling Tower Plume and Drift Impaction Prediction model
SCS	Soil Conservation Service (U.S. Department of Agriculture)
SDA	Southern Worcester Delivery Area
SHPO	State Historic Preservation Office(r)
SPCC	Spill Prevention and Countermeasures Plan
SO_2	Sulfur dioxide
TSP	Total suspended particulates (air pollution, similar to PM)
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service (U.S. Department of the Interior)
USGS	U.S. Geological Survey (U.S. Department of the Interior)
VOC	Volatile organic compounds
V-1	Sutton Forest pipeline route variation
V-2	Swans Pond pipeline route variation
V-3	Lackey Pond/Town Line pipeline route variation
V-4	Lackey Pond/Transmission Line pipeline route variation
WWTP	Wastewater treatment plant (Woonsocket, Rhode Island)
7Q10	7-day, 10-year low-flow discharge
$\mu g/l$	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter

SECTION ONE

PURPOSE OF AND NEED FOR PROPOSED ACTION

Ocean State Power (OSP), a general partnership, proposes to construct and operate a 500-megawatt (MW) combined-cycle electric generating station at a site on Sherman Farm Road in Burrillville, Rhode Island. In addition, Tennessee Gas Pipeline Company (Tennessee), a division of Tenneco Inc., proposes to construct and operate a delivery line from its existing pipeline to serve the proposed OSP project as well as provide service to Providence, Rhode Island. This proposed pipeline is known as the Rhode Island Extension. To enable Tennessee to serve OSP, additional modifications are required to Tennessee's Main Line and a segment of pipeline known as the Niagara Spur. These proposed modifications are interrelated with the OSP project, and therefore are jointly addressed in this Final Environmental Impact Statement (FEIS).

This FEIS contains the following sections and appendices:

- Section 1--Purpose of and Need for Proposed Action
- Section 2--Alternatives Including the Proposed Action
- Section 3--Affected Environment
- Section 4--Environmental Consequences of the Proposed Action
- Section 5--Conclusions
- Appendix A--List of Preparers
- Appendix B--EIS Distribution List
- Appendix C--Literature Cited
- Appendix D--Staff Report, Alternative Site Analysis (not reissued for FEIS)
- Appendix E--Discussion of Noise Terminology
- Appendix F--AES Riverside, Inc., Property Value Protection Plan
- Appendix G--Letter to FERC, Rhode Island Department of Environmental Management, Division of Fish and Wildlife
- Appendix H--Subject Index.

1.1 RELATIONSHIP TO NATIONAL ENERGY GOALS

In keeping with national energy goals, the OSP project is intended to provide economical and reliable electric power for its wholesale purchasers to meet the growing electricity needs of the New England region. This project is designed to promote the nation's self-sufficiency in electricity production at an economic cost and with a minimum of environmental impact.

1.2 GOVERNMENTAL RESPONSIBILITIES IN THIS ACTION

While construction of the OSP project is not within the Federal Energy Regulatory Commission's (FERC) jurisdiction, authorization is necessary from the Rhode Island Energy Facility Siting Board (EFSB). Inasmuch as the gas pipeline facilities improvement/extension proposed by Tennessee is a related, if not necessary, part of the OSP proposal, the FERC Staff worked with the Rhode Island Office of Intergovernmental Relations (on behalf of the Siting Board) on review of OSP's proposed project and review of the Tennessee Gas applications for constructing and operating the proposed pipeline facilities. As part of the Memorandum of Understanding between FERC, the State of Rhode Island, and OSP, FERC produced an Environmental Impact Statement (EIS) for these proposed projects, as required by 18 CFR Parts 2 and 380, Regulations Implementing the National Environmental Policy Act of 1969. Dames & Moore, a consulting engineering firm, assisted the FERC Staff in preparation of this EIS for FERC under a third-party agreement with OSP.

The Department of Energy's (DOE) Economic Regulatory Administration (ERA), a cooperating agency, has additional regulatory functions directly related to this project. On June 10, 1988, DOE issued its conditional authorization under Section 3 of the Natural Gas Act to allow Ocean State Power to import gas to be used at this facility from Canada. ERA's import approval is conditioned upon its review of this FEIS. Also, under the Powerplant and Industrial Fuel Use Act, an exemption from the requirement that the plant be capable of buring coal must be issued for Ocean State to construct and operate the power plant as proposed.

Other cooperating agencies for this project are identified as: the Rhode Island Department of Environmental Management (RIDEM) and the Office of Intergovernmental Relations (OIR), representing the State of Rhode Island; the Department of Environmental Quality Engineering (DEQE) and the Massachusetts

Energy Facilities Siting Council, representing the Commonwealth of Massachusetts; the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), and the U.S. Department of Energy Economic Regulatory Administration. The U.S. Army Corps of Engineers did not participate as a cooperating agency.

1.3 RELATIONSHIP TO OTHER ACTIONS

In Docket No. CP87-75-000, Tennessee Gas Pipeline Company proposes to construct 36 miles of pipeline, beginning at an intersection with Tennessee's existing Main Line in Worcester County, Massachusetts, proceeding southeasterly, and terminating near Cranston, Rhode Island. In addition, Tennessee proposes to construct five sections of Main Line loop on its 200 Main Line system in New York and Massachusetts, and to construct metering facilities at Lewiston, New York; Burrillville, Rhode Island; and Cranston, Rhode Island. These proposed facilities are referred to as the Niagara Spur Expansion and the Ocean State Project. The delivery portion of the pipeline discussed and evaluated in this FEIS is also included in the 36 miles of proposed pipeline described above. Should Tennessee be denied authorization to construct the Rhode Island Extension in Docket No. CP87-75-000, the company would retain its request for authorization of the 11 miles of delivery pipeline in its Ocean State application (Docket No. CP87-132-001).

It should be noted that Tennessee's current proposal in Docket No. CP87-132-001 is for transportation of 50 million cubic feet per day (MMcfd) to fuel OSP Unit 1. While this impact analysis of the OSP plant covers both Units 1 and 2, the FERC Staff understands that another 50 MMcfd would be needed to fuel Unit 2 once it is constructed. It is not possible at this time to state exactly what additional facilities, if any, Tennessee would need for firm transportation of the Unit 2 fuel requirement, nor whether Tennessee would even be involved in supplying fuel for Unit 2. The FERC Staff would conduct an appropriate environmental analysis if and when Tennessee (or some other applicant) files an application for transportation of fuel for OSP Unit 2.

As part of this EIS, FERC has identified other existing and proposed energy facilities along the Blackstone River to evaluate their relationship to the proposed OSP project. The cumulative environmental impacts of these actions and the OSP project are considered in this FEIS.

Relevant environmental permits and approvals required for the proposed action are listed in Table 1.3-1. The Rhode Island EFSB serves as the licensing and permitting authority for all licenses, permits, assents, or variances that, under any State statute or ordinance of any political subdivision of the State, would be required for siting, construction, or alteration of a major energy facility in the State of Rhode Island. Permit approvals that have been delegated to the State by Federal authority, such as water quality certifications and prevention of significant air quality deterioration permits, are authorized by Rhode Island Department of Energy Management and are not subject to EFSB control. Other relevant Federal and State regulations that may affect the proposed project are listed in Table 1.3-2.

The New York State Department of Public Service and others have submitted comments on the DEIS that raise the issue of whether another proposal, currently before the FERC, could be combined in some way with the Ocean State project, specifically that portion referred to as Loop 1 in Niagara County, New York. The referenced application of National Fuel Gas Supply Company (Docket No. CP88-94-000) is part of the TEMCO Project, which is currently under review by the FERC Staff. In its environmental analysis of the TEMCO Project, Staff will consider alternatives to the proposed facilities. These would involve either rerouting the proposed 24-inch-diameter National Fuel pipeline parallel to the Tennessee pipeline, or the possible option of moving the gas through Tennessee's pipeline. Staff notes that, on the basis of a preliminary modeling analysis, the 30-inch-diameter pipeline proposed as Loop 1 in Tennessee's project would be capable of transporting the proposed TEMCO volumes without being looped again. Therefore, approval of Tennessee's Loop 1, as proposed, would not adversely affect consideration of that pipeline as part of an alternative to the National Fuel proposal.

1.4 PURPOSE AND SCOPE OF THE STATEMENT

As a Federal regulatory agency, the Commission does not initiate projects; its mission is to evaluate applications filed for natural gas, hydroelectric and electric projects. This EIS was prepared by the FERC Staff in compliance with the National Environmental Policy Act (NEPA). The Rhode Island OIR, acting at the request of the EFSB, on behalf of other state or local agencies, has cooperated in preparation of this EIS for purposes of the licensing proceedings before the EFSB. "FERC Staff" as used herein and throughout this document also refers to OIR. Among the principal purposes of the EIS are to:

TABLE 1.3-1

Environmental Permits and Approvals
Required for OSP Plant and Related
Pipeline System Improvements

Agency	Permit	Part of Action*
FEDERAL		
Federal Aviation Administration	Aircraft Obstructions Construction Permit	OSP
U.S. Army Corps of Engineers	Nationwide Permit (Section 404)	TGP/OSP
U.S. Army Corps of Engineers	Roadway Streamcrossing Construction Nationwide Permit	TGP/OSP
U.S. Army Corps of Engineers	Section 10 permits	TGP
U.S. Environmental Protection Agency	NPDES determination for discharge of hydrostatic test water	TGP
U.S. Department of Energy	Natural Gas Act Import License	TGP
U.S. Department of Energy	Fuel Use Act Exemption	TGP
STATE		
State of Massachusetts, Department of Environmental Quality Engineering	Air Emissions Plan Approval for Compressor Engines (MGL C 30, S 61-62H)	TGP
State of Massachusetts Department of Environmental Quality Engineering	Letter of Authorization for Hydrostatic Test Water Discharge	TGP
State of Massachusetts, Department of Environmental Quality Engineering	Wetland and Water Quality Certification (MGL C 131, S40)	TGP

TABLE 1.3-1 (cont'd)

Agency	Permit	Part of Action*
STATE (cont'd)		
State of Massachusetts, Department of Public Utilities	Eminent Domain and Road Crossing Permit	TGP
State of Massachusetts, Department of Public Works	Underground Utility Installation Permit	TGP
State of Massachusetts, Division of Wetlands and Waterways	Waterways License (pending determination)	TGP
State of Massachusetts, Executive Office of Environmental Affairs	Environmental Notification Form for Massachusetts Environmental Policy Act Certification, projects over 10 miles require environmental impact report	TGP
State of New York, Department of Environmental Conservation	Air Permit (Certificate to Operate) for compressor engines	TGP
State of New York, Department of Environmental Conservation	Authorization for Construction at Lewiston Landfill	TGP
State of New York, Department of Environmental Conservation	Letter of Approval for Discharge of Hydrostatic Test Water	TGP
State of New York, Department of Environmental Conservation	Stream/Wetland Crossing Permits (Title 15 and Title 24)	TGP
State of New York Department of Public Service	Certificate of Environmental Capability and Public Need (Article VII)	TGP
State of New York, Department of State	Coastal Zone Management--Letters of Consistency (Federal Coastal Zone Management Act of 1972)	TGP

TABLE 1.3-1 (cont'd)

Agency	Permit	Part of Action*
STATE (cont'd)		
State of New York, Niagara Frontier State Park Commission (Joseph Davis State Park)	Right-of-Way Agreement	TGP
State of Rhode Island Department of Environmental Management	Dams and Reservoirs Approval	OSP
State of Rhode Island Department of Transportation	Highway Crossing Permits	TGP/OSP
State of Rhode Island Department of Environmental Management	Pollutant Discharge Elimination System Permit for Stormwater Runoff	OSP
State of Rhode Island Department of Environmental Management	Water Quality Certification	TGP/OSP
State of Rhode Island Department of Environmental Management	Wetland Permits	TGP/OSP
State of Rhode Island, Coastal Resources Management Council	Waiver/Assent	OSP
State of Rhode Island, Department of Environmental Management	Approval of Blackstone River Intake Structure	OSP
State of Rhode Island, Department of Environmental Management	Operating Permit (specification) of air control equipment, hours of operation	OSP
State of Rhode Island, Department of Environmental Management	Certification of Wastewater Treatment Facilities	OSP

TABLE 1.3-1 (cont'd)

Agency	Permit	Part of Action*
STATE (cont'd)		
State of Rhode Island, Department of Environmental Management	Erosion and Sedimentation Control Plan approval	OSP
State of Rhode Island, Department of Environmental Management	Fresh Water Wetlands Alteration Permit	OSP
State of Rhode Island, Department of Environmental Management	Fuel Oil Storage and Spill Prevention Control and Countermeasure Plan approval	OSP
State of Rhode Island, Department of Environmental Management	Prevention of Significant Deterioration of Air Quality Permit (AAQS and BACT compliance)	OSP
State of Rhode Island, Energy Facility Siting Board	License	OSP
State of Rhode Island, Historic Preservation Commission	Approval to construct facility on proposed site	OSP
LOCAL		
Towns	Building permits for compressor station additions	TGP
Counties and Towns	Road Crossing Permits	TGP/OSP
County Health Department	Permits to Install Septic Systems at Compressor Station 230C	TGP
Zoning Board	Approvals for compressor station sites	TGP

*OSP = Ocean State Power Facilities
TGP = Tennessee Gas Pipeline Facilities
(see Table 2.2-1)

Relevant Federal and State Regulations That May Affect the Proposed Project

Federal/State Agency	Act/Regulation[1]	Statutory Authority
U.S. Environmental Protection Agency	The Clean Water Act (CWA) (P.L. 92-500 as amended by P.L. 95-217, 95-576, 33 U.S.C. 1251 et seq.)	Nation's primary statutory authority for regulating surface water pollution; requires that water quality standards be established for particular surface waters, and that pollution of such waters be controlled through the NPDES permit program.
	• The National Pollutant Discharge Elimination System ("NPDES") (CWA Section 402.)	EPA required to regulate discharges of pollutants from point sources through a permit system.
	• The Dredge and Fill Permit Program (CWA Section 404.)	Army Corps of Engineers required to regulate discharges of dredged or fill material through a permit system.
	• Oil and Hazardous Substance Liability Program (CWA Section 311.)	EPA authorized to impose civil penalties and recover removal costs from persons who discharge oil or hazardous substances.
	• Non-Point Source Pollution Control Program (P.L. 100-4, S319.)	EPA authorized to provide funds for State Non-Point Source Management Programs.
	The Resource Conservation and Recovery Act of 1976 (RCRA) (P.L. 94-580, 90 stat. 2795 (1976), as amended.)	
	• Subtitle C - Hazardous Waste Management (RCRA Sections 3001-3019.)	EPA required to regulate hazardous wastes from generation to disposal ("from cradle to grave") in a manner which protects human health and the environment.
	• Subtitle D - State of Regional Solid Waste Plans (RCRA Sections 4001-4010.)	EPA required to promulgate guidelines for State and regional solid waste management plans.
	The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 ("Superfund") (CERCLA Section 104.)	EPA authorized to respond to releases of hazardous substances, or of pollutants or contaminants which may present an imminent and substantial danger to public health or welfare.
	The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) (FIFRA Section 2(a).)	EPA authorized to regulate pesticide distribution and use under comprehensive registration scheme. No pesticide may be solid or distributed unless it is properly registered with EPA.
	The Toxic Substances Control Act of 1976 (TSCA) (TSCA Sections 4-6, 8.)	EPA authorized to prohibit or regulate manufacture, distribution, use and disposal of certain statutorily defined chemical substances and mixtures.
U.S. Department of Transportation	The Hazardous Materials Transportation Act and the Hazardous Liquid Pipeline Safety Act of 1979 (P.L. 93-633, 88 stat. 2156 (1975), as amended) (P.L. 96-129, 93 stat. 1003 (1979).)	U.S. DOT authorized to regulate the transportation of hazardous materials by air, highway, rail, water, and pipeline. The classification, packaging, labeling, shipping, and the reporting and cleanup of accidents and spills are also regulated.

[1] C.M.R. = Code of Massachusetts Regulations; M.G.L. = Massachusetts General Law; NY ECL = New York Environmental Conservation Law; NY OCRR = New York Official Codes, Rules and Regulations; R.I.G.L. = Rhode Island General Law

Source: Environmental Reporter (State Air Laws, State Water Laws, State Solid Waste-Land Use) Bureau of National Affairs, Inc. Statutory Authorities for Federal Regulation of Groundwater Quality. Jan. 1988. Prepared for the Groundwater Task Force of the Edison Electric Institute.

TABLE 1.3-2 (cont'd)

Federal/State Agency	Act/Regulation[1]	Statutory Authority
U.S. Department of Agriculture (USDA)	Watershed Protection and Flood Prevention Act (P.L. 92-419, 68 stat. 666 (1954))	The Soil Conservation Survey (SCS) of the USDA is authorized to assist states and their political subdivisions in undertaking structural and nonstructural projects designed to promote the conservation, development, utilization and disposal of water.
U.S. Environmental Protection Agency	Clean Air Act (P.L. 88-206, as amended)	
	• Ambient Air Quality Standards (AAQS) (40 CFR Part 50)	These standards are independent of any particular source of emissions and prescribe levels that are not to be exceeded as a result of all contributing emission sources combined.
	• PSD Regulations (40 CFR Part 52)	Incremental increases from specified sources are allowed. Also a BACT demonstration is needed.
	• New Source Performance Standards (NSPS)	
	40 CFR Part 60 Subpart GG	Limit emissions for electric utility/stationary gas turbines.
	40 CFR Part 60 Subpart Db	Standards of performance for industrial-commercial-institutional steam generating units. Limits NOx emissions.
Mass., DEQE, Div. of Water Pollution Control	Mass. Surface Water Discharge Permit Rules (C.M.R., Title 314, Chapter 3.00)	Regs establish the program whereby discharges of pollutants to surface waters of the Commonwealth are regulated by the Division and require that the Division regulate the outlets for such discharges and any treatment works associated with these discharges.
Mass., DEQE, Div. of Water Pollution Control	Mass. Hazardous Wastewater Treatment Regulations (C.M.R., Title 314, Chapter 8.00)	Establishes the program whereby wastewater treatment works exempted from M.G.L. c.21C, which treat, store, or dispose of hazardous wastes generated at the same site are regulated pursuant to M.G.L. c.21, S. 43 to ensure that such activities are conducted in a manner which protects public health and safety and the environment.
Mass., DEQE, Division of Air Quality Control	Mass. Air Pollution Control Regulations (C.M.R., Title 310, Regulations 7 and 8)	Certain review and approval activities of the Dept. are subject to the requirements of the Mass. Env. Pol. Act, which require the Dept. to assess the impact on the environment of any proposed facility subject to said regulations and not categorically exempted.

[1] C.M.R. = Code of Massachusetts Regulations; M.G.L. = Massachusetts General Law; NY ECL = New York Environmental Conservation Law; NY OCRR = New York Official Codes, Rules and Regulations; R.I.G.L. = Rhode Island General Law

Source: Environmental Reporter (State Air Laws, State Water Laws, State Solid Waste-Land Use) Bureau of National Affairs, Inc.
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Federal/State Agency	Act/Regulation[1]	Statutory Authority
Mass. DEQE	Mass. Ambient Air Quality Standards (C.M.R., Title 310, Section 6.00)	Primary ambient air quality standards define levels of air quality which the department judges are necessary to protect the public health. Secondary ambient air quality standards define levels of air quality which the department judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Note - the AAQS enforced by Mass. are identical to NAAQS with the exception of a 1-hour ambient NO2 standard of 320 ug/m3. Mass. DEQE adopted the Federal regulations governing PSD with no additional stipulations.
Mass. Supreme Judicial and Superior Courts	Mass. Environmental Cause of Action Law (M.G.L., Chapter 214)	The defendant is subject to, and in compliance in good faith with, a judicially enforceable administrative pollution abatement schedule and implementation plan for the purpose of alleviating the damage to the environment complained of.
Mass., DEQE Division of Hazardous Waste	Mass. Oil and Hazardous Material Release Prevention and Response Act (M.G.L., Chapter 21E)	The department shall take all action appropriate to secure the Commonwealth the benefits of FWPCA, CERCLA, and other pertinent federal laws.
Mass. DEQE	Mass. Hazardous Waste Management Rules (C.M.R., Title 310, Chapter 30)	These regs are intended to protect public health, safety and welfare, and the environment, by comprehensively regulating the generation, storage, collection, transport, treatment, disposal, and use of hazardous waste in Mass.
Mass. DEQE Wetlands Division	Mass. Wetlands Protection Laws (M.G.L., Chapter 131, Section 40.)	No person shall remove, fill, dredge, or alter any bank, fresh water wetland, ... without filing written notice of his intention to so remove, fill, dredge or alter, including such plans as may be necessary to describe such proposed activity and its effect on the environment.
Mass. DEQE	Mass. Wetlands Protection Regulations (The Wetlands Protection "Act") (M.G.L., Title 310, Chapter 10)	The act sets forth a public review and decisionmaking process by which activities affecting areas subject to protection under the act are to be regulated in order to contribute to the protection of the following interests: i.e. ground water supply, prevention of pollution.
New York Department of Environmental Conservation (NYDEC)	Substances Hazardous to the Environment (NYECL Article 37)	NYDEC is authorized to promulgate rules and regulations pertaining to the storage and discharge to the environment of substances hazardous to the environment.
NYDEC	Environmental Regulatory Program Fees - Waste Transporter Program Fee and State PDES Program Fee (NYECL Article 72)	All persons required to obtain a permit, or approval for their above actions must annually submit a fee.
NY Department of State	Coastal Zone Management Act of 1972	Federally approved activities affecting State-designated coastal areas must be consistent with Coastal Zone Management Program.

[1] C.M.R. = Code of Massachusetts Regulations; M.G.L. = Massachusetts General Law; NY ECL = New York Environmental Conservation Law; NY OCRR = New York Official Codes, Rules and Regulations; R.I.G.L. = Rhode Island General Law

Source: Environmental Reporter (State Air Laws, State Water Laws, State Solid Waste-Land Use) Bureau of National Affairs, Inc. Statutory Authorities for Federal Regulation of Groundwater Quality. Jan. 1988. Prepared for the Groundwater Task Force of the Edison Electric Institute.

TABLE 1.3-2 (cont'd)

Federal/State Agency	Act/Regulation[1]	Statutory Authority
NYDEC	Oil Spill, Control, and Compensation Act (NY Navigation Law Article 12, Chapter 845)	The legislature intends to exercise the powers of this state to control the transfer and storage of petroleum and to provide liability for damage sustained within this state as a result of petroleum discharge by requiring cleanup and providing a fund for compensation.
NYDEC	NY Water Pollution Control Regulations (NYOCRR Chapter V, Subchapter D)	Except as provided, no person or local corporation shall change, modify or disturb any protected stream or its banks, nor remove sand or gravel without a permit issued.
NY Div. of Water Resources	NY Regulations on State Pollutant Discharge Elimination System (NY OCRR Title 6, Chapter X)	These regulations prescribe procedures and substantive rules concerning the state PDES pursuant to NYECL, Article 17, Title 8.
NYDEC	NY Regulations on Oil Spill Prevention and Control (NYOCRR, Title 17, Chapter 1 (parts 30-32))	The commissioner is given the authority to adopt, amend, repeal, and enforce such rules as he deems necessary to accomplish the purposes of Navigation Law, Article 12. No person shall operate a major facility without a license issued by the department pursuant to this part.
NY Div. of Water Resources	NY Water Classifications and Quality Standards (NYOCRR, Chapter X, Article 2)	Part 701 - Classifications and standards of Quality and Purity Part 703 - Groundwater classifications, quality standards, and effluent standards and/or limitations - prevents pollution of groundwaters and protects their use as a potable water.
NYDEC	NY Air Pollution Control Regs (NYOCRR, Title 6, Chapter III, Subchapter A)	These regulations list the specific provisions, control measures, compliance schedules, etc. for air pollution control measures.
NYDEC	NY Ambient Air Quality Standards (NYOCRR Title 6, Chapter III, Subchapter B)	No person shall permit or allow the emission of contaminants from an emission source which alone or in combination with emissions from other sources cause contravention of air quality standards.
NYDEC	NY Rules on Environmental Regulatory Program Fees (NYOCRR, Title 6, Part 482)	Each person required to get a permit or approval to the state air quality control program must annually submit to an annual fee to the department.
NYDEC	NY Freshwater Wetlands Act (NYECL, Article 24)	To preserve, protect and conserve freshwater wetlands and the benefits derived therefrom, to prevent the destruction of wetlands, and to regulate use and development of such wetlands.
NY Dept. of Public Service	(16 NYOCRR Parts 85, 86, & 87)	Article VII—Certificate of environmental compatibility and public need for major utility transmission facilities and its implementing regulations.

[1] C.M.R. = Code of Massachusetts Regulations; M.G.L. = Massachusetts General Law; NY ECL = New York Environmental Conservation Law; NY OCRR = New York Official Codes, Rules and Regulations; R.I.G.L. = Rhode Island General Law

Source: Environmental Reporter (State Air Laws, State Water Laws, State Solid Waste-Land Use) Bureau of National Affairs, Inc.
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Federal/State Agency	Act/Regulation[1]	Statutory Authority
State of Rhode Island Department of Environmental Management (RIDEM) Division of Water Resources	Rhode Island (RI) Water Quality Regulations for Water Pollution Control (R.I.G.L. Chapters 46-12, 42-17.1, and 42-35)	Purpose of the regs is to restore, preserve, and enhance the quality of the waters of the state and to protect the waters from pollutants so that the waters shall, where attainable, be fishable and swimmable, be available for all beneficial uses, and thus assure protection of the public health, welfare and environment.
RIDEM, Division of Groundwater and Freshwater Wetlands	RI Oil Pollution Control Rules and Regulations	No person(s) shall discharge any liquid waste, including storm water runoff, into any of the waters of the state from oil-related industrial processes unless plans and specifications of a system to be installed to prevent the escape of oil have been submitted to RIDEM and approval entered.
RIDEM, Division of Water Resources	RI Pretreatment Regulations (Regulations adopted pursuant to R.I.G.L. Chapters 46-12, 42-17.1, and 42-35)	These regs establish a state and local pretreatment system in conjunction with National Pretreatment Standards in order to control pollutants which pass through or interfere with treatment processes in publicly owned treatment works or which may contaminate sewage sludge. Also imposes responsibilities on the state, local government, industry and the public to help implement pretreatment standards.
RIDEM, Division of Water Resources	RI PDES Regulations (Regulations adopted pursuant to R.I.G.L. Chapters 46-12, 42-17.1, and 42-35)	These regs restore, preserve, and enhance the quality of the surface waters and protect the waters from discharges of pollutants so that the waters shall be available for all beneficial uses and thus protect the public health, welfare, and the environment.
RIDEM, Division of Water Resources	RI Discharge Fee System Regulations (Regulations adopted pursuant to R.I.G.L. Chapters 46-12, 42-17.1, and 42-35)	These regs establish a user fee system for point source discharges that discharge pollutants into the surface waters of the state. The funds from such fees are to be used by DEM to develop and operate a pollution monitoring system and to protect, preserve and upgrade the surface waters into which the discharges flow.
RIDEM, Division of Water Resources	RI Water Quality Standards (Section 6 of RI Water Quality Regulations for Water Pollution Control)	Water quality standards serve the dual purpose of establishing the water quality goals for a specific water body and serve as the regulatory basis for the establishment of water-quality-based treatment controls and strategies beyond the technology-based levels of treatment required by Sections 301(b) and 306 of the Clean Water Act.
RIDEM, Division of Air and Hazardous Materials	RI Air Pollution Control Acts ("RI Clean Air Act") (Title 23, Chapter 23)	To preserve, protect, and improve the air resources of the state so as to promote the public health, welfare and safety, prevent injury or detriment to human, plant and animal life, physical property and other resources and to foster the comfort and convenience of the state's inhabitants.

[1] C.M.R. = Code of Massachusetts Regulations; M.G.L. = Massachusetts General Law; NY ECL = New York Environmental Conservation Law; NY OCRR = New York Official Codes, Rules and Regulations; R.I.G.L. = Rhode Island General Law

Source: Environmental Reporter (State Air Laws, State Water Laws, State Solid Waste-Land Use) Bureau of National Affairs, Inc.
Statutory Authorities for Federal Regulation of Groundwater Quality. Jan. 1988. Prepared for the Groundwater Task Force of the Edison Electric Institute.

TABLE 1.3-2 (cont'd)

Federal/State Agency	Act/Regulation[1]	Statutory Authority
RIDEM, Division of Air and Hazardous Materials	RI Increment Consumption Standards (Regulation 9.15.1(a)	RIDEM adopted the Federal PSD regulations with the following addition. No source or modification will be allowed to consume more than 75% of the remaining 24-hr increment or 25% of the remaining annual increment.
RIDEM, Division of Air and Hazardous Materials	RI Primary and Secondary Ambient Air Quality Standards	The AAQS enforced by the state are identical to NAAQS for all pollutants. RI also adopted the Federal NSPS for gas turbines.
RIDEM, Division of Air and Hazardous Materials	RI Refuse Disposal Law (R.I.G.L., Title 23, Chapter 18.9)	Each city and town is required to make provision for the safe and sanitary disposal of all refuse generated within its boundaries, including refuse from commercial and industrial sources. Each city and town is required to adopt rules and regulations, governing the hauling and disposal of refuse within their boundaries.
RIDEM, Division of Air and Hazardous Materials	RI Hazardous Waste Management Act of 1978 (R.I.G.L., Title 23, Chapter 19.1)	Purposes of this chapter shall be to protect the environment, and the public health and safety, from the effects of improper, inadequate, or unsound management of hazardous wastes, and to encourage recycling and safe management of wastes.
RIDEM, Division of Groundwater and Freshwater Wetlands	RI Wetlands Laws (R.I.G.L., Title 2, Chapter 1)	The state has the authority to restrict the uses of wetlands and to adopt or modify rules and regulations in accord with purposes of S2-1-18 to 2-1-24.

[1]C.M.R. = Code of Massachusetts Regulations; M.G.L. = Massachusetts General Law; NY ECL = New York Environmental Conservation Law; NY OCRR = New York Official Codes, Rules and Regulations; R.I.G.L. = Rhode Island General Law

Source: Environmental Reporter (State Air Laws, State Water Laws, State Solid Waste-Land Use) Bureau of National Affairs, Inc.
Statutory Authorities for Federal Regulation of Groundwater Quality. Jan. 1988. Prepared for the Groundwater Task Force of the Edison Electric Institute.

- Ensure that appropriate weight is given to factors affecting the human environment during all phases of the decisionmaking process.
- Encourage and facilitate public involvement in the decisionmaking process.
- Identify and assess reasonable alternatives to the proposed action that will avoid or minimize adverse effects on the human environment.

The EIS addresses environmental impacts of both the proposed OSP project and the proposed pipeline and upgrades to existing pipelines by Tennessee Gas Pipeline Company, as stated in FERC Docket Nos. CP87-131-000, CP87-131-001, CP87-132-000, and CP87-132-001. The environmental issues given consideration include land resources, water resources, air quality, sound quality, ecology, and sociocultural resources. Assessments of archeological and historic sites, endangered and threatened species, flood plains and wetlands, and prime or unique farmlands are also addressed.

1.5 OCEAN STATE POWER PLANT LOCALE AND DESIGN

The proposed OSP project would be located at a site on Sherman Farm Road in Burrillville, Rhode Island, approximately 7 miles west of Woonsocket, Rhode Island (Figure 1.5-1). The approximately 40-acre site, shown in Figure 1.5-2, is located in northwest Rhode Island at coordinates approximating N 42°00'37" and W 71°40'29". The closest population center within the Town of Burrillville is the Village of Harrisville, about 3 miles south of the site. The site property is bounded on the west by Sherman Farm Road (RI Route 98), on the east by the Douglas Pike (RI Route 7), on the south by house lots on West Ironstone Road, and on the north by the Massachusetts border.

The proposed site is located in the upland section of the New England physiographic province, situated in the upland till plain formed by glacial deposition during the Wisconsin glaciation. The topography is maturely eroded and is characterized by large smooth hills and narrow valleys. The till is predominantly littered with glacial stones and boulders, with numerous rock outcrops. The plant grade within the site property would rest approximately at an elevation of 520 feet NGVD.

The OSP project is a natural gas-fueled, combined-cycle electric generating station. OSP would construct the plant in two phases, each with an electrical generating capability of approximately 250 MW. The initial phase is scheduled for

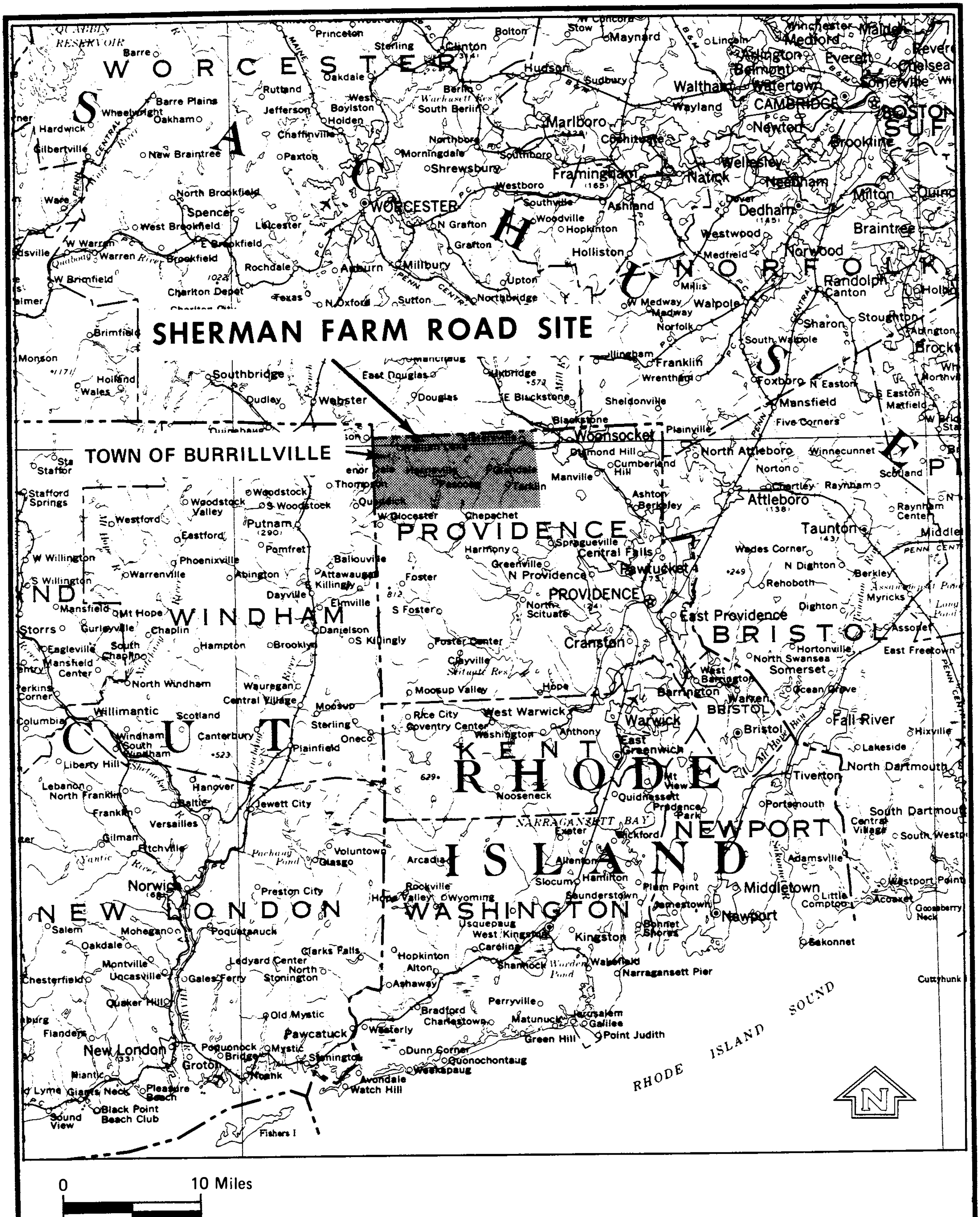
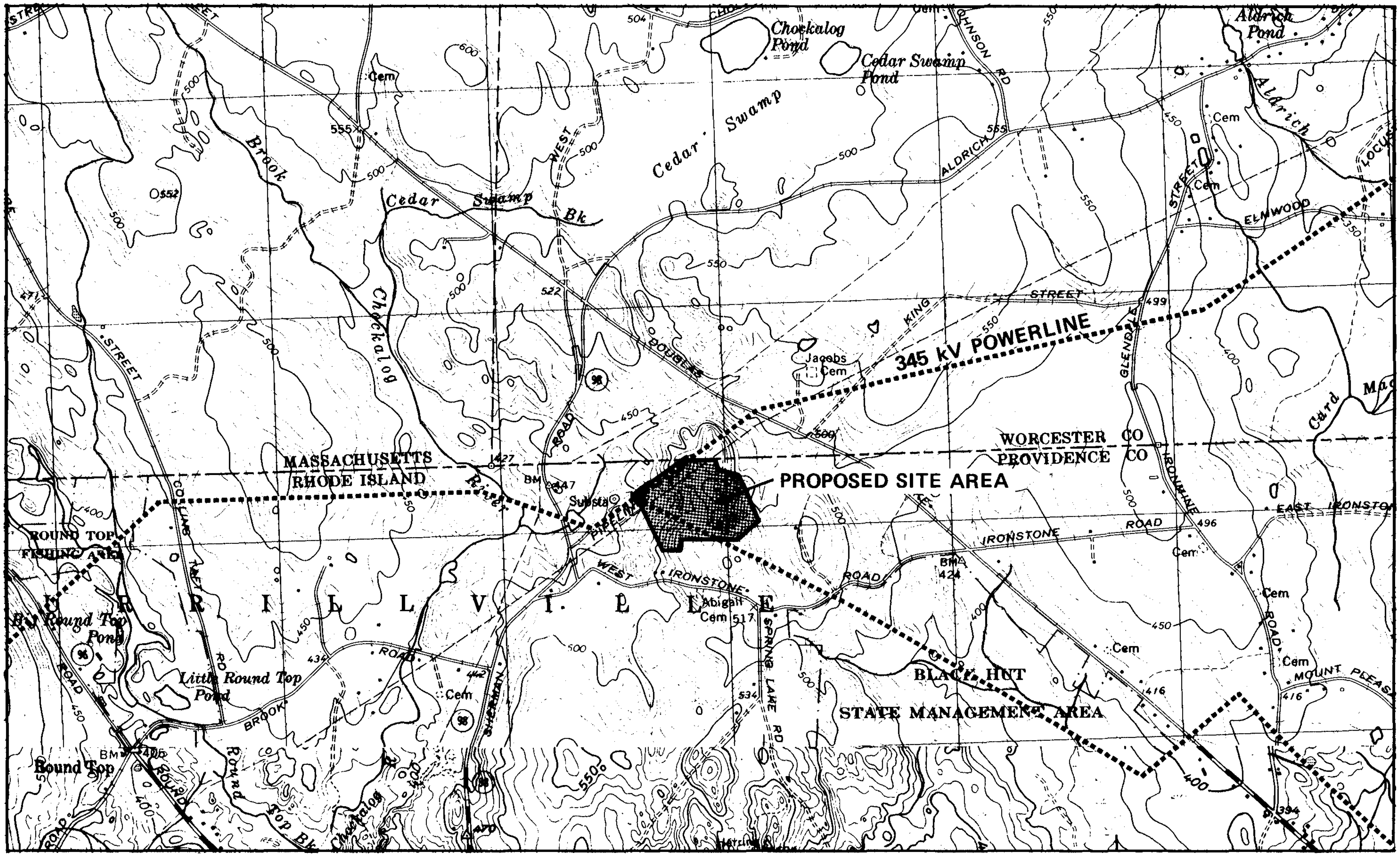


FIGURE 1.5-1
PROJECT LOCATION



Base Map Source: U.S.G.S. 7½' Quads; Uxbridge, MA/RI, 1969, Photorevised 1979; Chepachet, RI, Photorevised 1970 and 1975.

0 2000 4000 Feet

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FIGURE 1.5-2
LOCATION OF PROPOSED SHERMAN FARM ROAD PLANT SITE AREA

commercial operation in November 1989; the second phase is to be constructed at a later date. This FEIS addresses both phases of the OSP project.

Natural gas--the primary fuel for the plant--would be supplied from a delivery line off Tennessee's 200 Main Line. Natural gas would be supplied and transported to the plant on a year-round basis under firm 20-year contracts.

The water supply proposed for the plant will be the Blackstone River. OSP proposes to construct a 10-mile water pipeline extending from an intake structure on the river to the plant site. The water pipeline would be located entirely within existing rights-of-way of city streets, state highways, and power transmission lines. The OSP plant would also have low sulfur fuel oil available for use in emergency supply situations. OSP plans to construct a 7.5-mile oil pipeline to tap into an existing Mobil Oil Company pipeline in North Smithfield, Rhode Island. The oil pipeline would be located in the same trench as the water pipeline.

1.6 GAS PIPELINE LOCALE AND FACILITIES

Tennessee Gas Pipeline Company is seeking authority to transport a maximum quantity of 50 MMcf of natural gas for OSP from the U.S.-Canadian border near Niagara, New York, to Burrillville, Rhode Island, and to construct the facilities (Figure 1.6-1) necessary to transport and deliver this quantity. This quantity is sufficient to supply the first phase of the OSP project. Authorization to supply the second phase is not specifically addressed in this EIS. Facilities required to serve the OSP project have been proposed under the following pipeline projects:

Providence, FERC Docket No. CP87-75-000

- Rhode Island Extension--construct 11 miles of 20-inch pipeline extending from Sutton, Massachusetts, to Burrillville, Rhode Island. (This pipeline is sized to service both units at the OSP plant.)

Niagara Spur, FERC Docket No. CP87-131-001

- Lewiston Meter Station--expand metering capability to measure a total of 300,000 decatherms per day (Dt/d).
- Compressor Station 233--convert from temporary to permanent operation the 3,500 horsepower of compression authorized in FERC Docket No. CP86-251-000 and CP86-251-001.

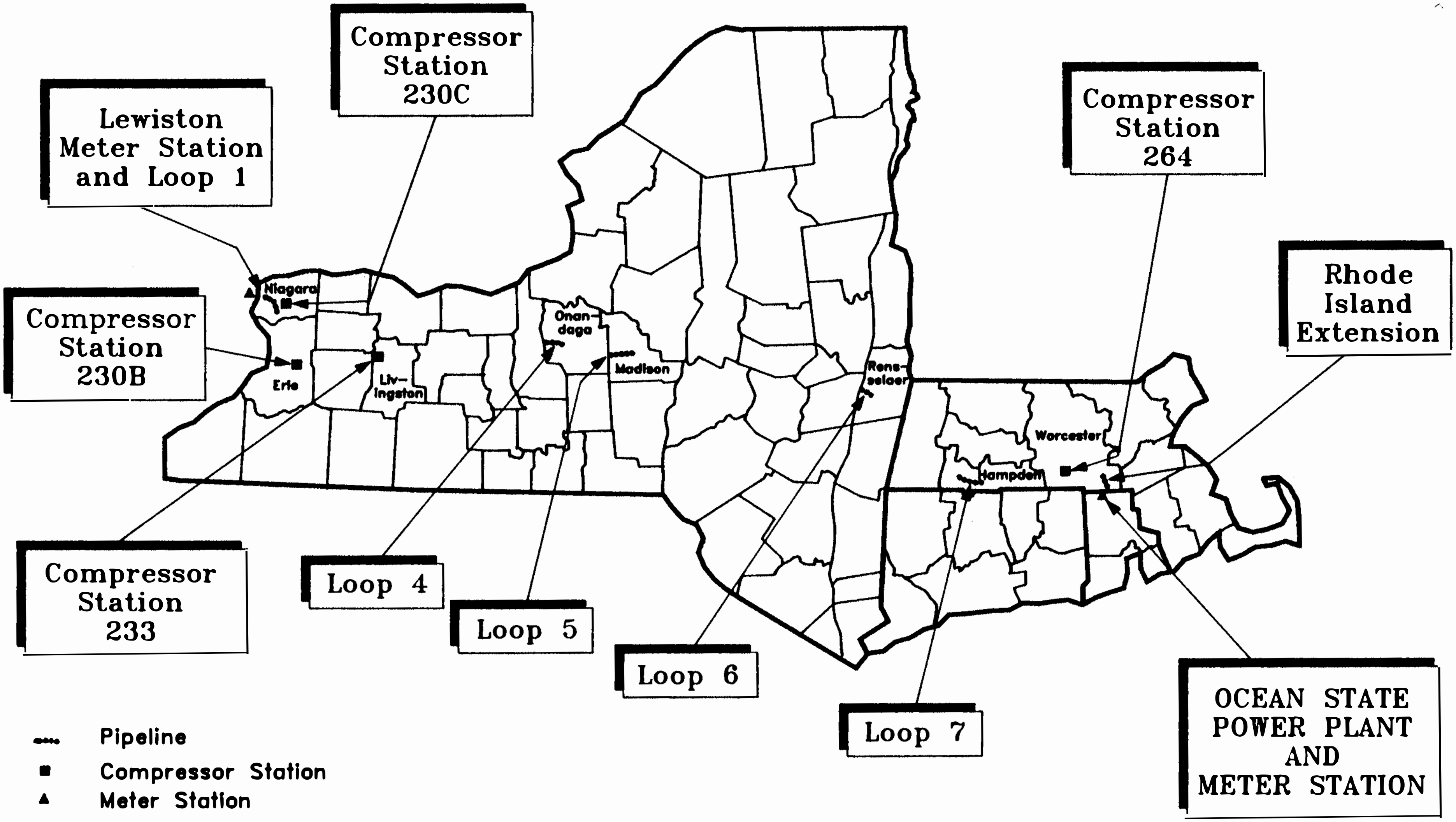


FIGURE 1.6-1
LOCATIONS OF PROPOSED FACILITIES

- Compressor Station 230B--convert from temporary to permanent operation 1,000 horsepower of compression and add 1,200 horsepower of compression.
- Compressor Station 230C--construct a new 4,500-horsepower compressor station in Niagara County, New York.

Ocean State, FERC Docket No. CP87-132-001

- Loop 1--construct 11.2 miles of 30-inch pipeline loop in Niagara County, New York.
- Loop 4--construct 2.3 miles of 30-inch pipeline loop in Onondaga County, New York.
- Loop 5--construct 3.7 miles of 30-inch pipeline loop in Madison County, New York.
- Loop 6--construct 3.9 miles of 30-inch pipeline loop in Rensselaer County, New York.
- Loop 7--construct 4.4 miles of 30-inch pipeline in Hampden County, Massachusetts.
- Compressor Station 230B--add 1,000 horsepower to existing compression.
- Compressor Station 233--add 3,500 horsepower to existing compression.
- Compressor Station 264--add 2,000 horsepower to existing compression.
- Sherman Farm Road Metering Station--construct new metering station in Burrillville, Rhode Island, to measure deliveries to the OSP generating station.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 OCEAN STATE POWER PLANT

The proposed OSP plant is a two-phased, natural gas-fired, combined-cycle electric generating station. The project is being developed by an independent power production consortium consisting of subsidiaries of TransCanada Pipelines, Eastern Utilities Associates, New England Electric System, Newport Electric Company, and J. Makowski Associates--a group of private investors. The project is an independent venture, and thus does not have the power of eminent domain usually held by electric generating companies. If the plant is constructed at the proposed site, the project developers would be required to obtain permission to construct and operate the power plant from the Rhode Island Energy Facilities Siting Board.

The purpose of constructing and operating the OSP plant is to provide base-load electricity to the New England Power Pool (NEPOOL) grid. Construction is planned to be concluded in time to meet an expected need for power in the early 1990's. Purchased power contracts have been negotiated with New England Electric Systems, Eastern Utilities Associates, Newport Electric, and Boston Edison.

Section 2.1 includes the following discussions:

- Section 2.1.1--Need for Power
- Section 2.1.2--No Action or Proposed Action
- Section 2.1.3--Proposed Action
- Section 2.1.4--Alternatives to Proposed Action
- Section 2.1.5--Alternative Site Study
- Section 2.1.6--Environmental Comparison of Alternatives and Applicant's Site

2.1.1 Need for Power

The construction and operation of a power generating station requires an expensive, long-term commitment of utility or independent power producer's resources. The cost of new generating capacity is passed on to consumers in an effort to recover the costs of expansion and gain a return on investment. For these and other reasons, the commitment to new generating capacity should be approached cautiously after a justifiable need for power is determined.

The assessment of electricity requirements involves two distinct information needs:

- Data on the consumption of electricity, measured in watts over time (usually 1 month).
- Data on the instantaneous consumption of electricity during any point in time, usually measured as the maximum consumption during any 15-minute time interval.

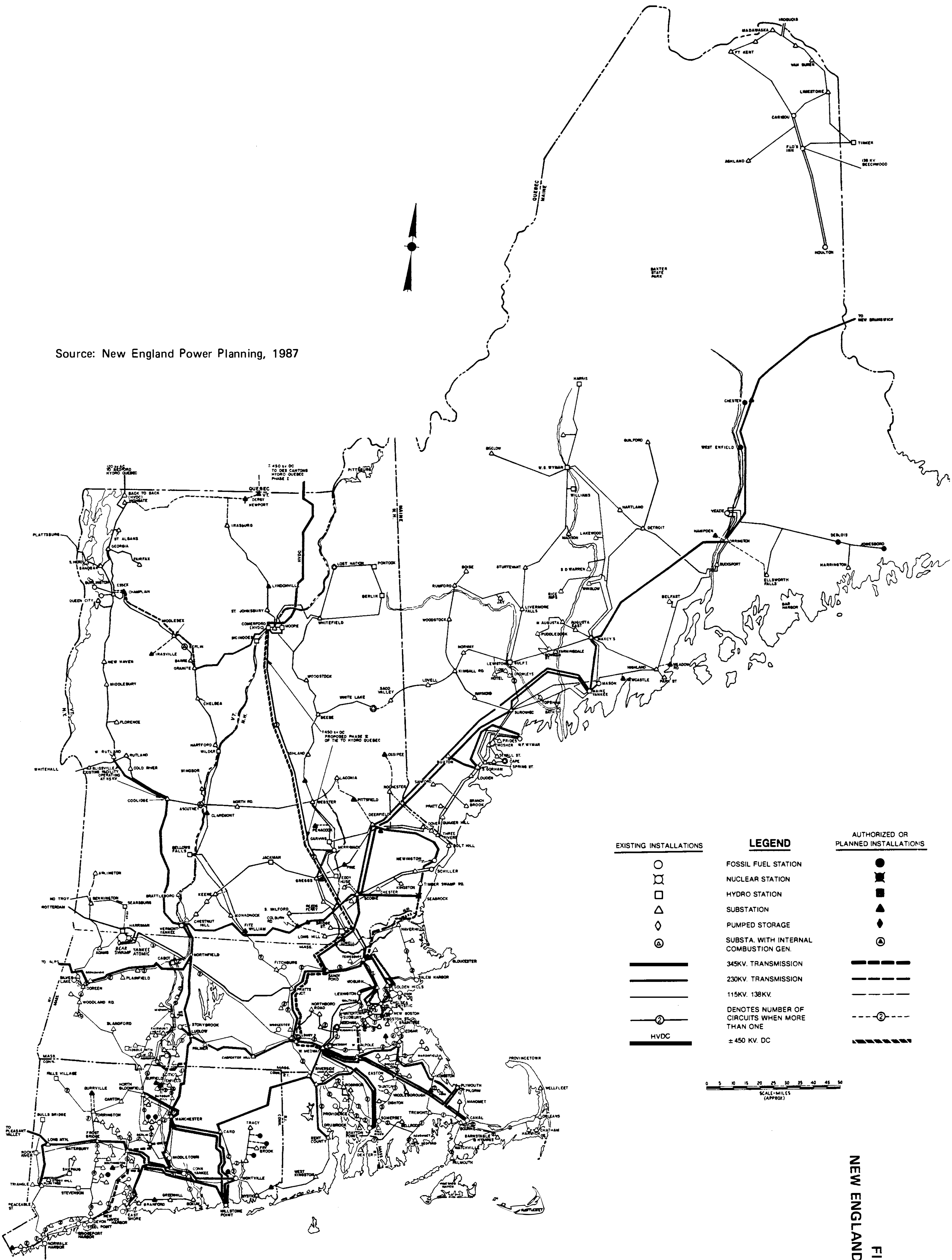
The former is referred to as energy and is measured in units of 1,000 watt hours (or kilowatt-hours (kWh)). The latter is referred to as load or demand and is measured in units of 1,000 watts (or kilowatts (kW)). The generating equipment required to meet load and peak demand is referred to as capacity.

The need for power assessment in this EIS is based on a critical review of six independent studies to determine the future electricity and resulting capacity needs for New England. A brief description of NEPOOL--the group of electric generating utilities that supplies power to New England--is provided in Section 2.1.1.1. The need for power assessment is discussed in Section 2.1.1.2, and options for meeting this need for power--including the proposed OSP project--are presented in Section 2.1.1.3.

2.1.1.1 New England Power Pool

NEPOOL consists of 53 member investor-owned, cooperative, and municipal utilities serving the states of Connecticut, Maine, Massachusetts, Vermont, New Hampshire, and Rhode Island and the provinces of Ontario and Quebec. These utilities' generation and transmission facilities are interconnected and centrally dispatched (i.e., turned on and operated), so that the region's overall electricity requirements are met efficiently at the lowest cost possible. Figure 2.1-1 presents a map of NEPOOL.

Electrical energy consumption in New England has increased substantially in the last 4 years, growing at an average annual rate of 4.3 percent since 1982. In 1986, New England's net load growth increased 4.9 percent over 1985 (NEPOOL, 1987). Peak demand has increased by more than 12 percent since 1983. NEPOOL



Source: New England Power Planning, 1987

FIGURE 2.1-1
NEW ENGLAND POWER POOL (NEPOOL)

experienced a new all-time system peak of 17,500 MW in January 1987, surpassing the previous peak by 99 MW. This increase is equivalent to the power produced by the South Street generating unit in Providence, Rhode Island.

New England's substantial increase in energy requirements is attributed to a strong regional economy, with high rates of growth in nearly all sectors. This growth has strained the New England power system, according to NEPOOL, and in 1986 resulted in capacity deficiencies on 32 occasions, which required the implementation of NEPOOL emergency operating procedures.

2.1.1.2 Need for Power Assessment

This EIS examines six separate studies of the need for power in New England:

- The NEPOOL interconnection regularly forecasts load and capacity requirements for 15- to 20-year periods.
- The New England Governors' Conference, in response to a presentation by NEPOOL representatives on their assessment of the issue, conducted its own assessment of New England's power needs. The study was based on NEPOOL's 1986 capacity and load forecast.
- The U.S. Committee for Energy Awareness, an energy lobbying and informational organization, conducted a study of New England's need for power in November 1986. The study examined the benefits of power development on the New England economy.
- The New England Energy Policy Council, a group of public interest organizations and state consumer agencies, also conducted a need-for-power assessment of the region. The council's report focused on energy efficiency (e.g., conservation and load management) as a means of meeting or reducing future energy requirements.
- The Foundation for Economic Research--a nonprofit, nonpartisan institution devoted to protecting the free-enterprise system--published a report on New England's future electricity needs.
- In response to the proposed OSP project and other energy projects proposed for Rhode Island, the Rhode Island Governor's Office conducted an assessment of the State's energy needs. These studies form the basis of an evaluation and assessment of New England's need for power and the role of the OSP project in the power system.

NEPOOL Forecast Report of Capacity, Energy, Loads, and Transmission, 1987-2002

Tables 2.1-1 and 2.1-2 present NEPOOL's forecast of energy and peak demand and capacity required to meet this load for the years 1987 through 2002. Net annual energy--defined as total energy minus energy saved through load management (including conservation techniques)--is expected to increase at an average annual rate of 1.7 percent between 1986 and 1996. Summer peak demand is forecasted to increase 4,807 MW between 1986 and 1996 to a peak of 20,827 MW, averaging 2.7 percent growth per annum. This increase is equivalent to or slightly greater than the capacity of four generating units the size of Seabrook 1. Winter peak demand is expected to increase at an average annual rate of 1.5 percent to a level of 20,222 MW, which is 2,714 MW above the 1986 peak demand.

Table 2.1-3 shows the forecasted supply of generating capacity that will be available to meet electricity demand in New England for the years 1996 and 2002. By 1996, summer capacity in NEPOOL is projected to increase to 24,550 MW, a net increase of 1,996 MW. Similarly, by 1996 winter capacity in NEPOOL will increase by a net 2,031 MW. Summer capacity in NEPOOL is forecasted to decrease to 22,288 MW by the year 2002, a net loss of 266 MW. The net loss in winter generating capacity is projected to be 288 MW by 2002. The change in available generating capacity over time includes both additions to generating capacity and losses to capacity due to deratings and retirements of old units. Table 2.1-4 presents NEPOOL's list of new generating capacity currently planned by member utilities.

Table 2.1-5 presents the demand for electricity as forecasted by NEPOOL for the years 1996 and 2002, with the 1986 load shown for reference. Total electricity demand is adjusted (reduced) to account for projected conservation and load management techniques that will reduce the total projected electricity consumption. "Adjustments to Load" include management techniques and conservation incentives designed to reduce the customer's demand for electricity. "Existing Interruptible Contracts" are loads that can be reduced by utility load controls at the time of the system peak. "Peak Load Management" includes loads that can be reduced or shifted off system peak with minimal or no change in energy consumption. "Energy Reductions at Peak" consist of loads that are part of a utility program to reduce customer loads during different hourly periods throughout the year. "Net Customer Generation" consists of cogeneration and small power

TABLE 2.1-1

Summary - NEPOOL and New England System Capabilities and Estimated Peak Loads Summer 1986-2002 August Capabilities

- MW -

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
NEW ENGLAND CAPACITY [a]	22660	22780	24400	24401	24527	25940	25524	25114	25094	24956	24652	24630	24354	24102	23968	22434	22390
ADJUSTED NEW ENGLAND LOAD	16119	16105	16223	16292	18351	18684	19159	19527	19916	20375	20932	21522	22003	22531	23100	23636	24145
NEPOOL CAPACITY [a]	22554	22674	24293	24295	24421	25634	25423	25013	24992	24854	24550	24529	24253	24001	23866	22332	22288
UNADJUSTED NEPOOL LOAD	16503	165[illegible]6	16774	16965	19143	19606	20201	20882	21181	21730	22363	23000	23520	24059	24652	25211	25751
ADJUSTMENTS TO LOAD:																	
EXIST. INTERRUP. CONTR.	115	123	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109
PEAK LOAD MANAGEMENT	132	157	216	297	384	474	563	848	729	800	871	920	965	983	1008	1032	1065
ENERGY REDUCTION ON PEAK	62	93	128	167	201	242	275	306	333	356	363	362	358	352	353	353	353
CUST. GEN. - NETTED	174	186	190	193	193	193	193	193	193	193	193	193	193	193	193	193	193
ADJUSTED NEPOOL LOAD	16020	16007	16131	16199	18256	18588	19061	19426	19817	20272	20827	21416	21895	22422	22989	23524	24031

[a] Assumes Seabrook 1 is online by November 1987.

SOURCE: NEPOOL CELT REPORT, 1987.

TABLE 2.1-2

Summary - NEPOOL and New England System Capabilities and Estimated Peak Loads Winter 1986/87-2002/03 January Capabilities

- MW -

	86/87	87/88	88/89	89/90	90/91	91/92	92/93	93/94	94/95	95/96	96/97	97/98	98/99	99/00	00/01	01/02	02/03
NEW ENGLAND CAPACITY [a]	23109	24781	24920	24974	26600	28140	25909	25886	25528	25185	25185	24863	24597	24452	22909	22909	22816
ADJUSTED NEW ENGLAND LOAD	17617	16646	18659	18644	18625	18834	19154	19388	19635	19952	20355	20808	21166	21604	22058	22462	22678
NEPOOL CAPACITY [a]	23001	24673	24612	24866	26492	26037	25806	25583	25425	25082	25082	24760	24494	24349	22806	22806	22713
UNADJUSTED NEPOOL LOAD	18146	19235	19310	19410	19503	19799	20222	20551	20885	21282	21746	22246	22636	23072	23560	24010	24463
ADJUSTMENTS TO LOAD:																	
EXIST. INTERRUP. CONTR.	117	125	111	111	111	111	111	111	111	111	111	111	111	111	111	111	111
PEAK LOAD MANAGEMENT	273	290	327	392	450	509	574	642	705	765	822	866	911	946	983	1034	1066
ENERGY REDUCTION ON PEAK	74	103	140	188	244	274	313	343	369	392	398	401	390	357	356	353	355
CUSTOMER GEN. - NETTED	174	188	190	193	193	193	193	193	193	193	193	193	193	193	193	193	193
ADJUSTED NEPOOL LOAD	17508	18529	18542	18526	18505	18712	19031	19262	19507	19821	20222	20673	21031	21465	21917	22319	22738

[a] Assumes Seabrook 1 is online by November 1987.

SOURCE: NEPOOL CELT REPORT, 1987.

TABLE 2.1-3

Forecast of Capacity Changes in NEPOOL
(megawatts)

	1996		2002	
	Summer	Winter	Summer	Winter
Projected Capacity[a]	22,554	23,001	22,554	23,001
Additions to Generation[b]	2,117	2,305	2,266	2,494
Deratings/Retirements	-121	-274	-2,532	-2,782
Net Capacity[a]	24,550	25,032	22,288	22,713

[a]Includes purchases of electricity from outside the region.

[b]Includes OSP Phases 1 and 2 and Seabrook 1.

SOURCE: NEPOOL CELT Report, 1987.

TABLE 2.1-4

Proposed Additions to NEPOOL Generating Capacity
January 1987 through January 2003

OPERATING COMPANY	STATION	TYPE	FUEL	STATUS	CAPABILITY - MW SUMMER	CAPABILITY - MW WINTER	EXPECTED OPERATION
NEW ENGLAND ELECTRIC SYSTEM	WILDER 3	HY		P	3.20	3.20	6/30/ 1987
PUBLIC SERVICE OF NEW HAMPSHIRE	SEABROOK 1	NP	UR	V*	1,150.00	1,150.00	11/ 1/ 1987
VERMONT GROUP	BELDEN	HY		T	0.60	1.20	11/ 1/ 1987
BANGOR HYDRO ELECTRIC COMPANY	WEST ENFIELD	HY		P	6.60	7.40	4/ 1/ 1988
VERMONT GROUP	HIGHGATE FALLS	HY		U	3.10	5.50	5/ 1/ 1988
VERMONT GROUP	HUNTINGTON FALLS	HY		T	0.60	1.40	11/ 1/ 1988
NORTHEAST UTILITIES	FALLS VILLAGE 4	HY		P	6.30	6.30	1/ 1/ 1989
NORTHEAST UTILITIES	BULLS BRIDGE 7	HY		P	6.60	6.60	1/ 1/ 1989
OCEAN STATE POWER	OCEAN STATE POWER 1	CC	NG	L	210.00	250.00	1/ 1/ 1990
VERMONT GROUP	C. RUTLAND	HY		P	0.30	0.60	4/ 1/ 1990
VERMONT GROUP	FAIRFAX FALLS	HY		P	2.60	3.50	6/ 1/ 1990
VERMONT GROUP	W. RUTLAND	CC	NG	P	210.00	250.00	7/ 1/ 1990
CENTRAL MAINE POWER COMPANY	LEWISTON	HY		L	25.00	25.00	9/ 1/ 1990
COMMONWEALTH ELECTRIC SYSTEM	COMBINED CYCLE	CC	GAS	P	89.00	109.00	1/ 1/ 1991
COMMONWEALTH ELECTRIC SYSTEM	COMBINED CYCLE	CC	GAS	P	89.00	109.00	1/ 1/ 1991
NORTHEAST UTILITIES	CABOT 7	HY		P	23.90	23.90	7/ 1/ 1991
BANGOR HYDRO ELECTRIC COMPANY	MILFORD	HY		P	0.70	0.60	11/ 1/ 1991
BANGOR HYDRO ELECTRIC COMPANY	VEAZIE	HY		P	4.00	4.40	11/ 1/ 1992
OCEAN STATE POWER	OCEAN STATE POWER 2	CC	NG	P	210.00	250.00	1/ 1/ 1994
COMMONWEALTH ELECTRIC SYSTEM	GAS TURBINE	GT	GAS	P	80.00	80.00	1/ 1/ 1995
BANGOR HYDRO ELECTRIC COMPANY	BASIN MILLS	HY		P	15.50	17.00	11/ 1/ 1996
COMMONWEALTH ELECTRIC SYSTEM	GAS TURBINE	GT	GAS	P	80.00	80.00	1/ 1/ 1998
COMMONWEALTH ELECTRIC SYSTEM	COMBINED CYCLE	CC	GAS	P	89.00	109.00	1/ 1/ 2001

NOTE: UNITS WITH STATUS CODES T,U,V, AND ALL ASTERISK ITEMS ARE INCLUDED IN CAPABILITY TOTALS (SEE APPENDIX-A FOR DEFINITIONS).

Type Codes:

- HY Hydro
- NP Nuclear
- CC Combined cycle
- GT Gas Turbine

Status Codes:

- P Planned for installation but not utility-authorized
- V* NEPOOL planned capacity under construction and more than 50 percent completed
- T Regulatory approval received but not under construction
- U Under construction but less than 50 percent completed
- L Regulatory approval pending

Fuel Codes:

- UR Uranium
- NG Natural Gas
- GAS Gas (general)

SOURCE: NEPOOL CELT REPORT, 1987.

TABLE 2.1-5

NEPOOL Forecast of Demand (Load) Changes
(megawatts)

	1986		1996		2002	
	Summer	Winter	Summer	Winter	Summer	Winter
Unadjusted NEPOOL Load	16,503	18,146	22,363	21,746	25,751	24,463
Adjustments to Load:						
Existing Interruptible Contracts	115	117	109	111	109	111
Peak Load Reductions	132	273	871	822	1,065	1,066
Energy Reductions at Peak	62	74	363	398	353	355
Net Customer Generation	174	174	193	193	193	193
Adjusted NEPOOL Load	16,020	17,508	20,827	20,222	24,031	22,738

SOURCE: NEPOOL CELT report, 1987.

producer loads after self-use. The net result of the demand forecast is a projected increase in average adjusted NEPOOL load growth of 2.7 percent per year between summer 1986 and 1996; winter load for the same period is projected to increase at an average annual rate of 1.5 percent.

The net result of comparing the supply and demand forecasts is a deficiency in generating capacity to meet load growth by the mid to late 1990's. According to the National Electric Reliability Council (NERC) standards, regional reserve margins (calculated as 1 minus the adjusted load, divided by capacity) should be no lower than 20 percent to ensure a reliable supply of electricity when needed. Table 2.1-6 presents the reserve margins for summer and winter over the 1986 to 2002 period. Reserve margins measure the amount of additional capacity, beyond what is needed to reliably meet projected demand, that is available to meet unexpected increases in demand or the unavailability of some generating units. Assuming that both Seabrook 1 and OSP 1 and 2 are operational as planned, a need for power would exist in New England by the year 1996. If OSP 1 and 2 are not constructed, the need for power would be even more critical in 1996.

The capacity additions to the NEPOOL system predicted by NEPOOL include the service of Seabrook 1, which was scheduled to begin operation by November 1987. NEPOOL and Seabrook's construction supervisors no longer forecast updates to Seabrook's online date. The online date is essentially dependent on the Nuclear Regulatory Commission approving Seabrook's operating license. If Seabrook fails to achieve an operating status during the forecast period and OSP 1 and 2 are not constructed, the 1996 and 2002 summer reserve margins become 10.3 percent and -13.8 percent, respectively. Under this assumption, the reserve margin would fall below NERC standards by 1994, creating a supply shortage and a need for new generating capacity to be constructed and available by the early 1990's. The expected amount of shortfall in capacity under this assumption would be approximately 2,012 MW by 1996 to maintain a reserve margin of 20 percent; by 2002, this capacity shortfall would grow to 8,119 MW.

New England Governors' Conference, Inc.

The basis of the New England Governors' need-for-power assessment is the 1986 NEPOOL projection of capacity and load (i.e., 1 year prior to the forecast discussed above). At the September 1985 meeting, NEPOOL presented its

TABLE 2.1-6

NEPOOL Reserve Margin Forecast
(percent)

	1996	2002
Summer	17.9	-7.3
Winter	24.0	-0.0

SOURCE: Calculated from NEPOOL CELT forecast.

assessment of the electric system in New England, thus raising concern about the adequate supply of electricity in its near future. As a result, the Conference directed its New England Energy Directors and Power Planning Committees to conduct an independent assessment of the region's electricity supply and demand situation.

The conference reviewed the NEPOOL forecast of electricity supply and demand, and expressed concern over several assumptions incorporated into the forecast:

- Hydro-Quebec II capacity credit allowances
- Reserve margin required
- Derating of cogeneration and small power production capacity
- Use of 1986 as the base year of the forecast
- Use of weather-adjusted summer peak load as the base figure.

While questions about the specific forecast estimates projected by NEPOOL were unresolved, the conference and NEPOOL concurred on the recommended action plan and policy conclusions based on these estimates. Table 2.1-7 presents the base case used in the conference study. The OSP project is included in planned generation forecasts by both the conference and NEPOOL. The results of the conference base case indicate a need for additional capacity of 0 to 100 MW by 1995 and 1,700 to 2,500 MW between 1995 and 2000. The base case assumes a slightly lower rate of load growth than the forecast issued by NEPOOL in 1987. Conservation, load management, customer generation, and life extension are assumed to reduce the need for power during the forecast period, but not to eliminate new capacity requirements.

The conference study identifies six options for reducing or meeting the need for power projected by the base case:

- Load management and conservation
- Cogeneration and small power production
- Independent generation
- New utility generation
- Purchases from Canada
- Improvement in the flexibility of generating options.

TABLE 2.1-7

New England Load and Capacity
1987 to 2000--Base Case
(megawatts)
(assumes 2.2 percent demand growth 1986-2000)

		Years			
		1987	1990	1995	2000
1.	Load	18,491	19,494	21,664	23,582
2.	Required Capacity	23,040	23,217	26,430	28,770
3.	Planned Capability	23,728	24,575	25,711	24,785
4.	Excess (Deficiency)	688	1,358	(719)	(3,985)
	Added Resources (not in "Planned Capability" line)				
5.	Ocean State I		200	200	200
6.	Additional Load Management and Conservation	20	100-200	200-500	500-1,000
7.	Additional Cogeneration and Small Power	--	--	100	300
8.	Plant Life Extension	--	--	100	500-800
9.	Subtotal of "Added Resources"	20	300-400	600-900	1,500-2,300
10.	New Resource Requirements	--	--	0-100	1,700-2,500

Notes:

Line 1. Total New England summer peak load as estimated in the April 1986 NEPOOL Forecast Report of Capacity, Energy, Loads and Transmission (CELT). The average compound annual growth rate through the year 2000 is 2.2 percent applied to actual 1985 summer peak load. Actual year-to-year growth rates vary from a high of 4.3 percent to a low of 1.0 percent. The average year-to-year rate 1985-1990 is 2.7 percent; 1991-1995 is 2.23 percent; 1995-2000 is 1.77 percent.

Line 2. Required capacity represents an estimate of installed generating capacity necessary to meet the Northeast Power Coordinating Council (NPCC) criterion of not disconnecting firm customers more often than once in 10 years, based on the assumed load forecast in Line 1. The required capacity assumes reserve margins, consistent with additions to planned capacity of Seabrook I and Hydro Quebec Phase II, of 24.6 percent, 19.1 percent, 22.0 percent and 22.0 percent for 1987, 1990, 1995 and 2000, respectively.

TABLE 2.1-7 (cont'd)

Line 3. The planned summer capabilities are found in the April 1986 CELT Report, and include Seabrook I and Hydro Quebec II. These numbers include about 2,000 MW of units which will have their lives extended through the forecast period. By the year 2000, the oldest of these extended units will be 45 to 50 years old.

Line 5. We have included Ocean State I on the assumption that this resource will be available by 1990. Because this project still needs licensing and other regulatory approvals, NEPOOL and the utilities believe its availability is uncertain. While approvals are still pending, the project is one that has been generally supported by many state officials.

Line 6. The load management and conservation (LM&C) numbers contained here are above and beyond the 490 MW and the 1066 MW estimated for 1990 and 2000, respectively, which were included in the April 1986 CELT Report. These added LM&C resources anticipate a major expansion of programs that utilities are now planning to implement and/or complete in the mid to late 1990's. These programs are based on very preliminary estimates of market acceptance in response to price signals and/or other financial incentives.

Line 7. The Additional Cogeneration and Small Power numbers contained here reflect capacity from cogeneration and small power production above and beyond the 1990 MW of customer generation and the 251 MW deducted from load, in the year 2000, already reflected in the CELT Report.

Line 8. The Plant Life Extension numbers are based upon the retention of a portion of the units now scheduled for retirement between the years 1990 and 2000. These units are in addition to the life extended units included in line 3.

SOURCE: New England Governors' Conference, Inc., April 1986.

Included in the independent generation option are the OSP project; a proposed combined-cycle plant in West Rutland, Vermont (250 MW); and the Medway-Bellingham natural gas plant in Massachusetts (240 MW). Without the OSP phases 1 and 2 units, the need for power increases to between 400 and 500 MW by 1995 and reaches 2,100 to 2,900 MW by 2000. The report also identifies purchases from Canada that are only now being examined--Hydro-Quebec III, Central Maine Power purchases from Hydro-Quebec, and Vermont purchases from Hydro-Quebec over the Highgate transmission project. No estimate is given of the amount of power available from these sources.

The Conference recommends a number of policies and energy planning options that should be pursued to meet the expected need for power in the mid-1990's. Of importance to this report is the recommendation that NEPOOL investigate the development of new peaking units that could be available with a lead time of less than 2 years and consider the concept of "site banking," which would allow NEPOOL to identify and receive prior approval on sites that could be used for power plants.

U.S. Committee for Energy Awareness

In its report, Regional Economic Growth and the Need for Power: New England as a Case Study (1986), the U.S. Committee for Energy Awareness examines the need for power in New England and the resulting economic consequences of both shortfalls in capacity and construction of new generating capacity. The report describes the high rate of economic growth in the New England region, which has outpaced average economic growth in the rest of the nation. The committee predicts that reserve margins could fall below 20 percent as early as the late 1980's, but no later than the early 1990's, with a possible shortfall of 3,000 to 5,000 MW by the mid-1990's.

The basis of the need-for-power assessment by the committee is the projected rate of economic growth in the New England region. Citing most economic forecasters' predictions that real economic growth for the United States over the period 1986 to 1990 will average between 3 and 4 percent, and using the Congressional Budget Office (CBO) and Reagan Administration forecasts of economic growth, the committee predicts an average annual rate of growth of about 0.5 percent above the national average. This growth is attributable to high growth industries, a highly skilled and educated labor force, and the strong economic policies of the region's three largest states--Massachusetts, Connecticut, and New Hampshire.

Using the historical relationship between economic growth and electricity demand (1 percent demand growth for each 1 percent of growth in the economy), and assuming that several factors will cause electricity growth to increase faster than economic growth (e.g., lower real electricity prices), the committee predicts electricity demand to increase at an average annual rate between 3 and 4.5 percent. Figures 2.1-2 and 2.1-3 present the committee's forecast of the need for power under the CBO and Administration economic growth assumptions. The CBO scenario results in a capacity shortfall of over 3,000 MW by 1990, while the Administration scenario results in a shortfall of about 500 MW.

These estimates are based on several supply assumptions. First, they assume that all contributions from renewable resources predicted by NEPOOL (i.e., low head hydro, windmill, waste-to-energy, cogeneration, and small power production projects) are realized. The forecast assumes purchase from Canada of about 2,000 MW in the early 1990's, which gradually declines to 1,500 MW by 2000. This decline is attributed to increased electricity requirements in Canada, limitations to Canada's ability to finance large-scale multiple projects, aggressive bidding for Canadian power between the New England and New York regions, and a lack of firm purchase agreements extending beyond 2000.

The committee recommends two strategies for preventing the capacity shortage--increased electricity imports from Canada and construction of new base load plants. The first option is limited by the assumed availability of only 2,000 MW from Canada; in addition, engineering issues are cited regarding the transmission of large amounts of power over long distances. In contrast, the committee cites significant economic benefits from the second option--construction of new base load capacity--which include lower construction and operating costs, employment and economic benefits, a more stable energy system from increased diversity of generation, and increased negotiating leverage with Hydro-Quebec and other suppliers.

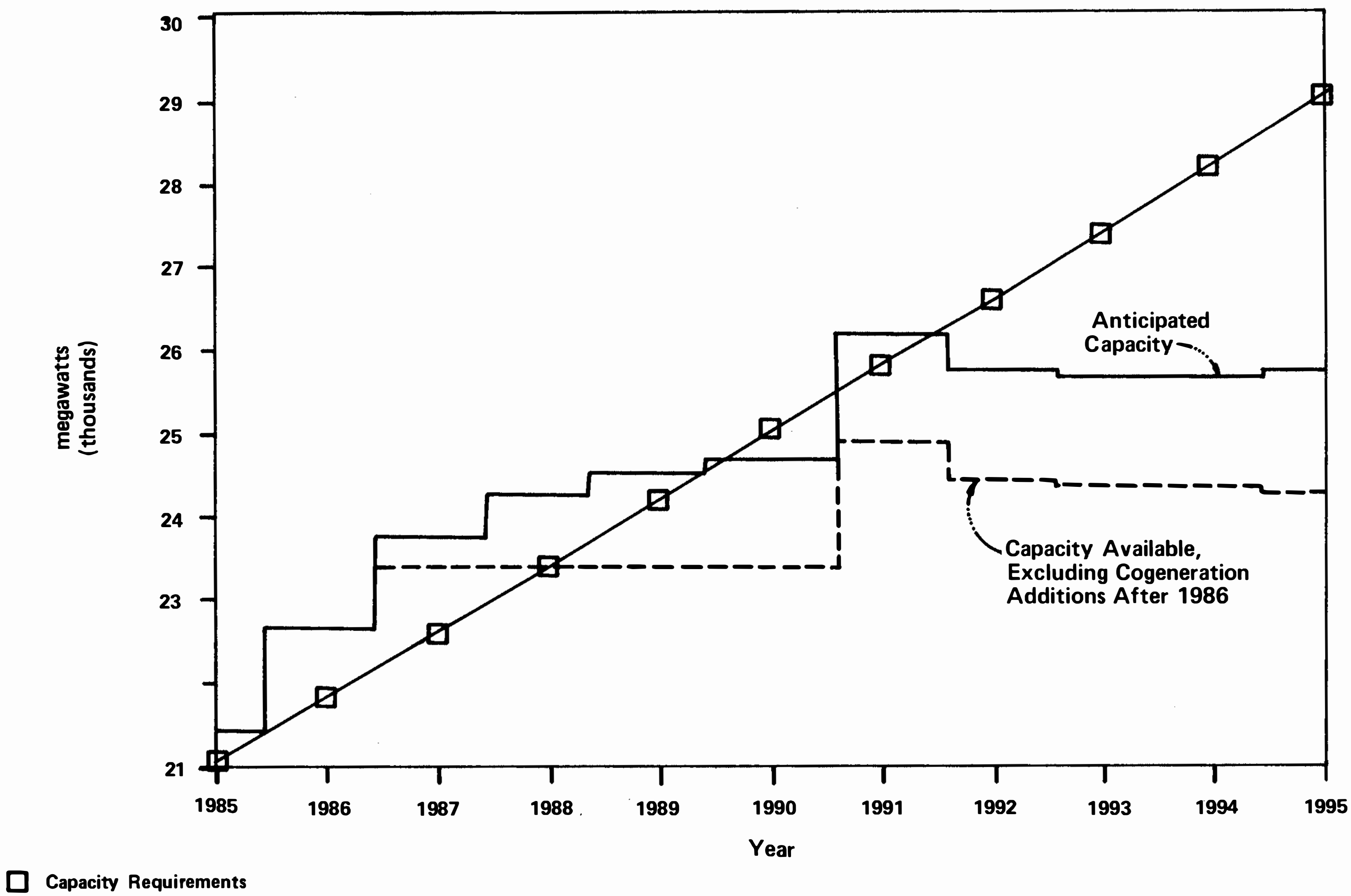


FIGURE 2.1-2
NEW ENGLAND ELECTRIC LOAD VERSUS CAPACITY
CONGRESSIONAL BUDGET OFFICE CASE

SOURCE: U.S. Committee for Energy Awareness, 1986

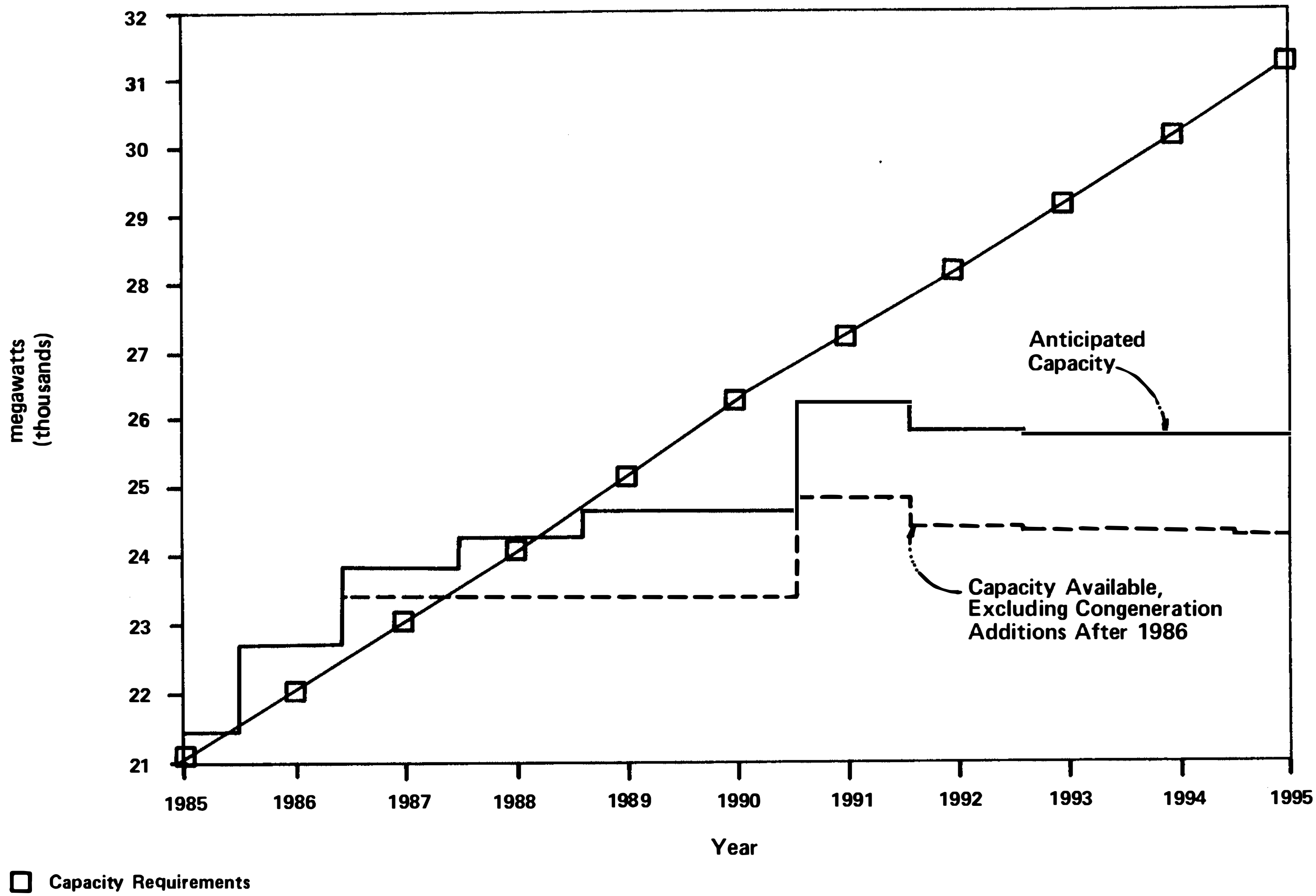


FIGURE 2.1-3
NEW ENGLAND ELECTRIC LOAD VERSUS CAPACITY
ADMINISTRATION CASE

SOURCE: U.S. Committee for Energy Awareness, 1986

New England Energy Policy Council

In the report Power to Spare (1987), the New England Energy Policy Council presents a plan for meeting New England's future electricity needs. The study was undertaken to determine if New England could meet a substantial amount of its power needs by "dramatically increasing the efficiency with which energy is used rather than by producing more of it." The results indicate that by using proven, commercially available technologies, New England could meet between 35 and 57 percent of its total electricity requirements by the year 2005. The analysis examines the results achieved if all cost-effective electrical efficiency improvements are fully realized. If only half of these efficiencies are realized, the potential electricity requirements met would be the lower (35 percent) estimate. The study makes no attempt to predict the level of efficiency that will actually be achieved over the period. Hence, this analysis is not a need-for-power study, but rather an assessment of other options to reduce or eliminate need for power.

The council discusses several obstacles to achieving increased electricity efficiency. First among these is a lack of information on the part of consumers; second is a lack of direct benefits and control among the parties involved (e.g., leased commercial and industrial space where multiple tenants as well as owners receive the economic benefits from increased efficiency). Lack of financing is another obstacle. Homeowners and often businesses have limited resources to invest in energy-saving devices. Lastly, the council cites a lack of strong utility action as being a major obstacle to increased efficiency.

The report presents an action plan for New England to overcome some of the primary obstacles to electricity efficiency. The council advocates a phased plan, with both short- and long-term actions. The short-term plan consists of increased pressures on utilities to encourage electricity efficiency. Programs include comprehensive end-use efficiency design, customized rebates, mass retrofits, increased efficiency in new construction, load management, and improved regulatory treatment of efficiency investments. The long-term plan includes development of a New England Energy Laboratory, integrated least-cost planning, auctions for efficiency improvements, and more energy-efficient building codes. Long-term plans for the region as a whole include regional least-cost electricity markets and coordination, a free market in regional electricity services, and regional power planning coordination.

Foundation for Economic Research

In its report, Will the Lights Go Out in New England? (June 1987), the Foundation for Economic Research concludes that the region may face electricity supply shortages of "substantial magnitude" as early as summer 1987. The foundation uses a contingency case that assumes a 2.2 percent load growth and excludes Seabrook 1, Pilgrim 1, and Hydro-Quebec II. (Pilgrim Nuclear Power Plant was shut down in April 1986, and the time frame for bringing the plant back online is uncertain). The OSP project is assumed to be online by 1990. This worst case scenario results in a capacity shortfall of 3,000 to 4,000 MW by 1995. Assuming that Seabrook 1, Hydro-Quebec II, and Pilgrim are all online on schedule, New England will just meet its electricity demand in 1995. Without the OSP project, the region will be unable to meet its load requirements under the worst case scenario. If electricity demand continues to grow at the current level of over 4 percent, as it has for the past 3 years, New England will be unable to meet its electricity demand requirements.

State of Rhode Island

Under contract to the State of Rhode Island, Energy Research Group, Inc., recently completed a report entitled An Assessment of the Need for Power and Generating Alternatives to the Ocean State Power Project in Support of the Advisory Opinion to the Energy Facilities Siting Board (1987)." The purpose of the study was to determine the need for electric energy at regional-, State-, and utility-specific levels during the OSP time frame; and whether OSP would generate electricity at the lowest reasonable cost compared to the alternatives.

Under most scenarios, the analysis shows that the OSP Unit 1 is needed in 1990. Unit 2 is shown to be needed between 1991 and 1994, based on utility forecasts. A key issue identified in the report is the availability and timing of new generating units, specifically Seabrook 1 and Hydro-Quebec Phase II. Both are scheduled to be operational prior to OSP's online date. Seabrook 1 is entangled in licensing problems, though some progress was made in October 1987. The Hydro-Quebec II export license was recently denied by Canada's National Energy Board; although considered a temporary setback, this action may affect the schedule for coming online.

A 1-year delay for Hydro-Quebec and a no-Seabrook scenario could create a need for new generation temporarily in 1990 and more definitely by 1993. The report considers a levelized growth in customer generation in its forecasts and predicts lower growth in customer generation than projected by NEPOOL.

The Energy Research report also examines the need for power within the State of Rhode Island. The share of ownership of Rhode Island utilities in the first unit of OSP is 53 percent. Even if OSP is added to generating capacity in Rhode Island, a wide gap still exists between load and in-State capacity, which will be only 30 percent of load by 1990.

Table 2.1-8 presents a list of projected costs of OSP and alternatives examined in the report. Of those considered likely alternatives to OSP on the bases of economics and applicability in New England, only cogeneration (at PURPA avoided-cost ceiling) and Hydro-Quebec II are less expensive on a busbar power cost basis. The next best alternative is plant life extension, which is 27 percent higher in cost than OSP Unit 1.

2.1.1.3 Conclusions: New England's Need for Power

A comparison of the future electricity requirements projected by the studies discussed above is difficult since they are based on widely varying assumptions. At most, this EIS can evaluate the reasonableness of the assumptions used to predict electricity requirements and discuss the likelihood that a need for power will exist during the next two decades.

To bound the discussion, the U.S. Committee for Energy Awareness study could be considered an upper limit on New England's electricity requirements. This study assumes a higher rate of electricity demand growth than the other studies and assumes a limit to the amount of imports available to meet New England's power needs. The study also assumes that NEPOOL's forecast of load management, conservation, and customer generation will be realized. It is the FERC Staff's judgment that the actual need for power will fall below the committee's need-for-power forecast for several reasons. Although there is an eventual limit to Canadian imports, this limit will occur for U.S.-induced reasons (e.g., transmission contraints and increased opposition to new and larger transmission lines, and increased concern about depending solely on imports to meet future electricity requirements). Unless environmental siting problems arise in Canada, exports will

TABLE 2.1-8

Summary of Projected Busbar Power Costs of OSP and Alternatives Examined in State of Rhode Island Report (¢/kWh, current dollars)

Year	Ocean State Power Unit 1	Ocean State Power Unit 2	PURPA Avoided Cost Ceiling	Hydro-Quebec Phase 2	Plant Life Extension	Oil-fired Combined Cycle	Midwest Coal	Coal
1990	6.38		3.09					
1991	6.50	6.22	3.35	4.87	6.16			
1992	6.63	6.39	3.70	4.96	6.45			
1993	6.79	6.56	4.39	5.08	6.74	8.11	12.19	
1994	6.99	6.78	5.19	5.21	7.17	8.55	12.20	
1995	7.29	7.09	6.88	5.41	7.70	9.07	12.20	
1996	7.67	7.47	6.87	6.43	8.32	9.64	12.24	
1997	8.05	7.87	8.94	6.85	9.13	10.38	12.33	17.17
1998	8.55	8.38	9.58	7.34	10.08	11.24	12.44	17.21
1999	9.12	8.96	9.77	8.03	11.17	12.22	12.59	17.30
2000	9.74	9.60	10.32	8.59	12.38	13.33	12.76	17.42
2001	10.46	10.32	10.93	8.84	13.57	14.40	12.98	17.59
2002	11.26	11.14	11.14	9.70	15.11	15.85	13.23	17.81
2003	12.15	12.04	11.71	10.87	16.47	17.11	12.45	18.07
2004	12.87	12.77	12.38	11.92	17.86	18.41	12.92	18.37
2005	13.63	13.54	13.25	12.66	19.28	20.15	13.45	18.72
2006	14.60	14.50	14.03	13.80	20.65	21.42	14.00	19.10
2007	15.59	15.49	14.90	14.99	22.11	22.78	14.59	19.50
2008	16.61	16.52	15.26	16.14	23.68	24.24	15.23	19.97
2009	17.47	17.39	16.33	17.39	25.22	25.69	15.93	20.48
2010		18.20	17.14	18.16	26.49	26.91	16.68	21.05
Levelized	8.80	9.07	7.72	7.89	11.18	13.44	12.87	18.14

SOURCE: State of Rhode Island, September 1987.

continue to be a lucrative market for Canada as long as cost increases can be passed on to U.S. consumers.

In contrast, the New England Energy Policy Council's forecast of 35 to 57 percent reduction in electricity requirements is based on an admittedly optimistic assumption of full energy efficiency in New England. Using the council's comparative estimate of 40.5 percent savings in electricity efficiency, New England's summer peak demand in 2005 would fall below the 1987 summer peak; hence, New England would have no need for power during the next two decades. It is the judgment of the FERC Staff that energy efficiencies of the magnitude described by the council require considerable investment on the part of both consumers and utilities. Considerable time is required before such energy-saving devices can be widely used by the public. For these reasons, FERC believes that such efficiencies would not be achieved in time to circumvent the need for power some time during the mid or late 1990's.

Based on the NEPOOL, State of Rhode Island, Foundation for Economic Research, and New England Governors' Conference studies, the FERC Staff agrees that a need for power will occur in the mid to late 1990's, but disagrees with several assumptions made by the studies. Opposition may prevent Seabrook 1 from coming online until an immediate shortage of electricity capacity is realized. Based on estimates by NEPOOL and the the National Governors' Conference, this shortage is not likely to occur until the mid or late 1990's; hence, it is likely that Seabrook may not be given an operating status until this time. Secondly, the reluctance of utilities to construct new capacity and the resulting necessity for increasing the reliability and life expectancy of existing units will help to forestall the need for power. Lower reserve margins should increase the capacity credits given to cogenerators and small power producers, thus meeting some of the need for power from independents and customer generators.

Need for the Ocean State Power Project

The OSP project is supported by both NEPOOL and the Masssachusetts and Rhode Island state governments. It is included by both NEPOOL and the New England Governors' Conference as capacity in addition to the projected need for power. The FERC Staff agrees that such a capacity addition would be beneficial to New England. Since the need for power will not be realized until the mid to late

1990's, new capacity additions such as OSP must be constructed before this period. A combined-cycle plant such as proposed has a construction time of 2 to 2.5 years; therefore, construction should begin prior to 1992.

In view of the Rhode Island Governor's Office of Intergovernmental Relations and the Governor's Office of Energy Assistance, the need for additional power resources in New England in the early 1990's has been clearly established in the "Assessment of New England's Electricity Situation" of the New England Governors' Conference Power Planning Committee, adopted by the Governors in December of 1986. This position was further accredited in the need assessment prepared by Energy Research Group, Inc. (October, 1987) for the Rhode Island Division of Public Utilities and Carriers, the Governor's Office of Energy Assistance and the State Division of Planning. The need assessment analysis was endorsed by these agencies, and by the Public Utilities Commission in its Advisory Opinion submitted to the Energy Facility Siting Board in November, 1987.

These studies clearly demonstrate that electrical energy consumption and peak demand in New England have been increasing far faster than the 1987 NEPOOL CELT forecast. A system peak was reached in January, 1988 of 19,311 megawatts, even though NEPOOL's operating procedures (OP4) was used to curtail the load. The peak reached in January, 1988 is the projected winter peak for 1993-1994. Without the effects of OP4, it is estimated that the peak would have been 19,800 MW, which is the 1995-1996 forecast peak.

Prudent planning would argue for building both units of the Ocean State facility by 1991.

2.1.2 No Action or Postponed Action

If the proposed OSP natural gas-fired electric generating facility is not built, the environmental impacts directly associated with it would not occur. However, there are several adverse consequences of this no-build alternative.

Failure to construct the proposed facility would mean that its expected power output would not be generated. It has been demonstrated that there is a need for the power that would be produced by this plant, and the no-build alternative results in a failure to meet that need. If the need continues to be unmet, the existing supply of power in the region would be insufficient to meet demand. Failure to satisfy such reasonable demand may have an adverse impact on the economy of the region as well as diminish the quality of life.

Failure to construct the proposed facility would also mean an opportunity loss of substantial tax revenue to the Town of Burrillville, and a loss of employment opportunities to it and surrounding towns. Therefore, the no-build alternative would have the effect of loss of opportunity to Burrillville and the surrounding area. However, failure to construct the proposed facility would also negate the construction and operational impacts identified and discussed in this EIS. The environmental and economic status quo would be unaffected.

If the demonstrated demand for electricity cannot be met because the no-build alternative is chosen, an additional impact would be that existing public utility companies in the region would need to look elsewhere for an alternative supply of electricity to meet demand. If the alternative supply is provided by electric generating facilities that use oil, coal, or nuclear fission as fuel sources, substantial adverse environmental impacts would occur from that use, in contrast to the minor environmental impacts of the proposed facility. Finally, the cost to produce power using oil, coal, or nuclear fission is substantially greater than the cost to produce power from the proposed facility. These environmental and economic impacts are discussed in Section 2.1.4.2.

A decision to postpone action on the proposed OSP generating facility will delay the start and completion of the plant. Postponement could result in the loss of a 6.5 percent investment tax credit that is predicated on completion on or before December 31, 1990. Over a 20-year lifetime for the two units, consumers would save about $30 million with this tax credit.

A decision to postpone action may also result in a shortfall of reliable electric generating capacity in New England during the early 1990's. The result would be an increase in the price of electricity to consumers.

2.1.3 Proposed Action

2.1.3.1 Location and Description

The site selected by OSP for this project is located in northwest-central Rhode Island at coordinates approximating S 42°00'37" and W 71°40'29". It is situated approximately 7 miles west of Woonsocket, in the Town of Burrillville, Providence County. The closest population center within the Town of Burrillville is the Village of Harrisville about 3 miles south of the site. The site property is bounded on the west by Sherman Farm Road (RI Route 98), on the south by West Ironstone Road, on the north by the Massachusetts State border, and on the east by Douglas Pike (RI Route 7).

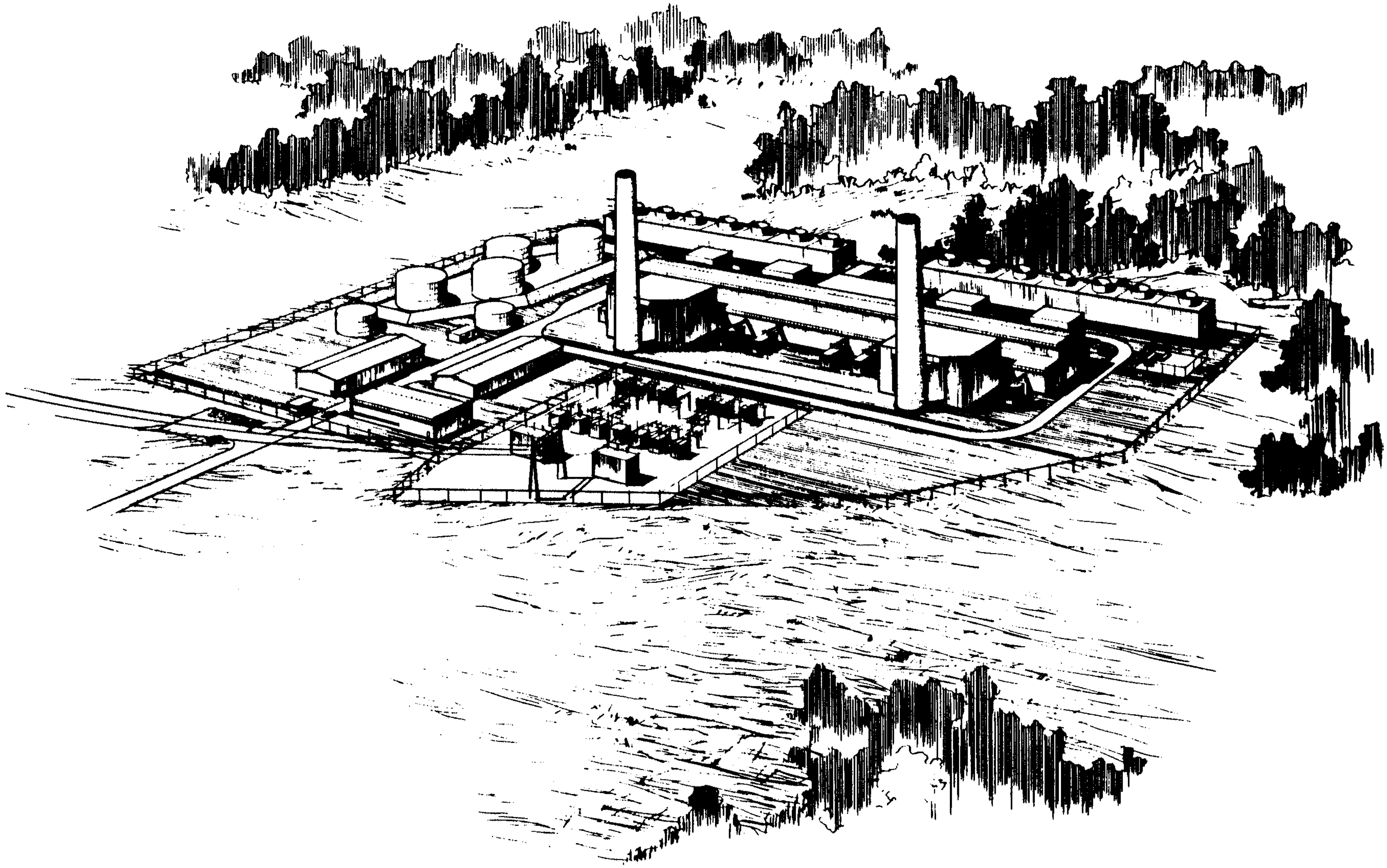
The site is located in the upland section of the New England physiographic province. It is specifically situated in the upland till plain, which was formed by glacial deposition during the Wisconsin glaciation. The topography is maturely eroded and is characterized by large smooth hills and narrow valleys. The till is predominantly littered with glacial stones and boulders, with numerous rock outcrops. The main plant grade within the site property will rest approximately at an elevation of 529 feet NGVD (National Geodetic Vertical Datum of 1929).

The proposed site is located within an approximately 140-acre parcel owned by Eastern Utilities Associates, and currently dedicated to utility use. The site includes an existing switchyard and two 345-kV transmission lines. An Algonquin Gas Transmission right-of-way traverses the site in a southwest-to-northeast direction. An artist's conception of the proposed plant is presented as Figure 2.1-4.

2.1.3.2 Generating Station Systems

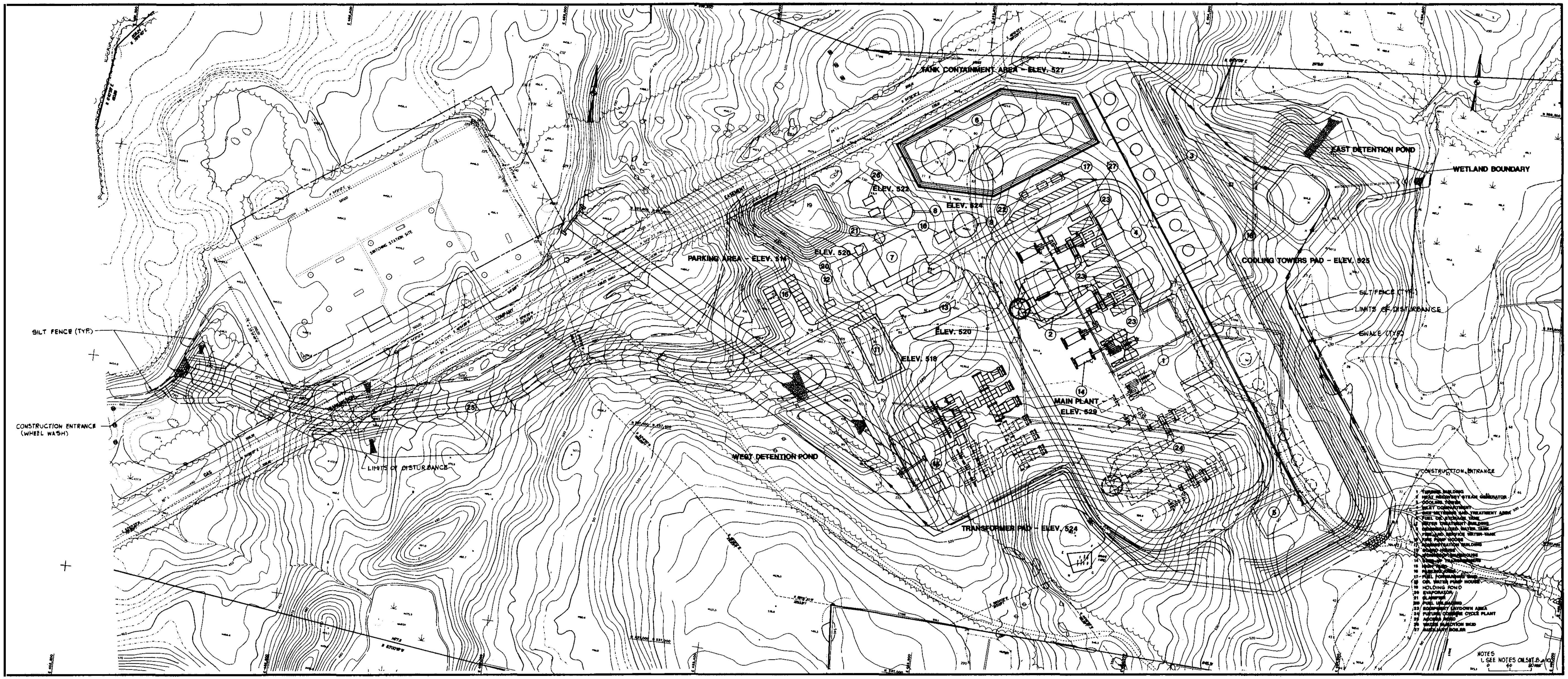
2.1.3.2.1 Plant Site

The proposed OSP plant site is located on a 40.6-acre parcel of land leased from Blackstone Valley Electric, a subsidiary of Eastern Utilities Associates. The location of the proposed site is illustrated in Figure 1.5-2 and a more detailed layout of the plant itself is shown in Figure 2.1-5. Within the leased area, a 15.4-acre parcel would be developed for the plant. It would include the main turbine and generator buildings (one 120-foot-long by 100-foot-wide by 60-foot-high



Source: General Electric, 1987.

FIGURE 2.1-4
VIEW FROM ABOVE WEST IRONSTONE ROAD TO PROPOSED OSP FACILITY



0 160 320 Feet

SOURCE: General Electric. Undated a.

LEGEND:
- UTILITY POLE
- CLF CHAIN LINK FENCE
- DEPRESSED CONTOUR
- MARSH LINE
- STREAM
- UNPAVED ROAD
- TREELINE
- PAVED AREA
- 100. SPOT ELEVATION
- 100 WETLAND LOC. FLAG
- WETLAND BOUNDARY
- DRAINAGE FLOW
- WETLAND BUFFER BOUNDARY
- SILT FENCE
- SEDIMENT TRAP
- UNDER ROAD CULVERT

1. Turbine Building
2. Heat Recovery Steam Generator
3. Cooling Tower
4. Inlet Compartment
5. Gas Metering and Treatment Area
6. Fuel Oil Storage Tank
7. Water Treatment Building
8. Demineralized Water Tank
9. Fire and Service Water Tank
10. Fire Pump House
11. Administration Building
12. Guard House
12 Workshop /Warehouse
14. Step-Up Transformers
15. High Yard
16. Parking Area
17. Fuel Forwarding Skid
18. Cir. Water Pump House
19. Holding Pond
20. Evaporator
21. Clarifier
22. Fuel Unloading
23. Equipment Laydown Area
24. Future Combined-Cycle Plant
25. Access Road
26. Water Injection Skid
27. Auxiliary Boiler

Note: Wetland Boundaries Are Also Shown On Figure 3.1-9.

FIGURE 2.1-5
DETAILED LAYOUT-SHERMAN FARM ROAD SITE

(Including Conceptual Erosion and Sediment Control Measures)

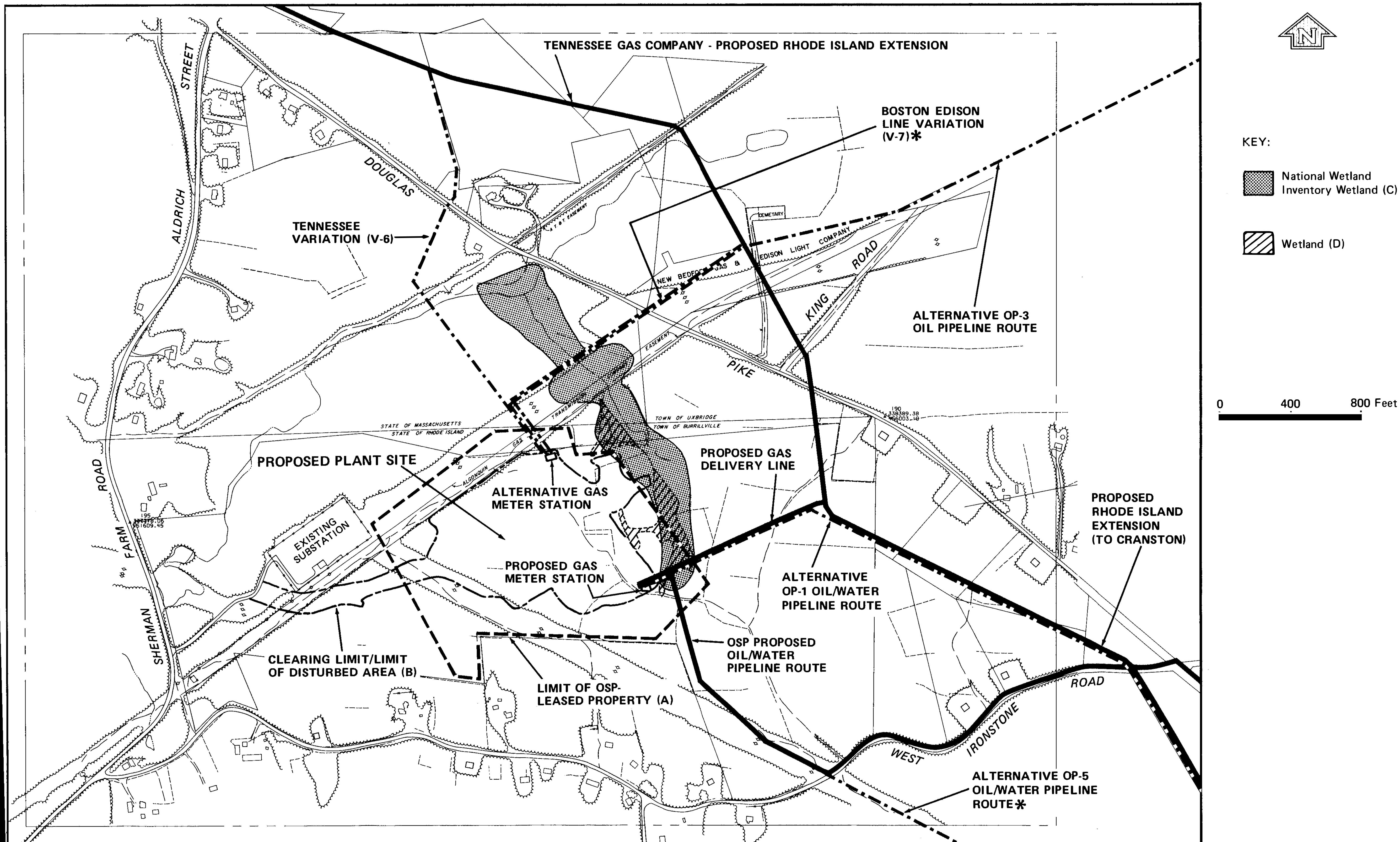
structure per phase), the stacks (two at 150 feet (45.7 meters) each), administration and shop buildings, a water treatment building, and other facilities. A small (0.25-acre) water holding pond would be constructed outside the main, fenced plant area at the northeast corner of the site. Access to the plant would be off Sherman Farm Road; a spur road off the existing access road to the switchyard would be extended to the plant area. This new access road would encompass approximately 1.4 acres. Figure 2.1-6 illustrates the relative location of the plant with respect to surrounding residences, roadways, and existing or proposed rights-of-way for transmission lines and pipelines.

2.1.3.2.2 Power Generation Equipment

The proposed power plant is a combined-cycle plant consisting of two 250-MW phases. The facility would house two frame combustion turbines per phase, each of which would drive an 80-MW generator. Two waste heat recovery steam generators and one 90-MW steam turbine for each phase are included in the facility design. Each phase would require one stack with two flues per stack, approximately 150 feet high. Table 2.1-9 presents the estimated operating parameters of the facility using both natural gas and the facility's backup fuel oil supply. A schematic of the plant generating systems is shown as Figure 2.1-7.

2.1.3.2.3 Heat Dissipation and Cooling Towers

Heat (thermal energy) is a byproduct of the generation of electricity from any fuel. A combined-cycle unit efficiently recaptures heat to produce electricity. Even in a combined-cycle unit, however, heat byproduct is produced. The heat dissipation system removes this heat by circulating water through the main condenser and auxiliary heat exchangers. The heated water is conveyed to cooling towers where the heat is dissipated to the atmosphere. Some water is evaporated during this dissipation process, resulting in an increase in the natural dissolved solids level in the water. To maintain a fixed solids concentration, a portion of the cold water must be continually removed or discharged. Additionally, a small percentage of water droplets is lost from the system through the top of the cooling towers. The water droplet loss is referred to as drift. Makeup water, supplemented by processed plant wastewater, replaces that which is lost by evaporation, drift, and removal for treatment to maintain water quality (blowdown).



SOURCES:

(A) General Electric, Undated, b.
(B) General Electric, Undated c.
(C) Fish and Wildlife Service, 1979a.
(D) Bechtel Eastern Power Corporation, 3-16-88.

BASE MAP SOURCE: Tennessee Gas Pipeline Company, Proposed Providence Pipeline, 1988. Photography 1986. Revised by FERC Staff, July, 1988.

* Route preferred by FERC staff.

FIGURE 2.1-6
SHERMAN FARM ROAD SITE
VICINITY MAP

TABLE 2.1-9

OSP Plant Operating Parameters

Type of facility:	Combined cycle
Fuel:	Natural gas (fuel oil during emergencies, i.e., gas flow interruptions)
Facility size:	Two phases of 250 MWe each
Number of combustion turbines:	Two (frame) per phase
Number of heat recovery steam generators (HRSG):	Two per phase
Number of steam turbines:	One per phase
Number of stacks:	Two flues per stack, one stack per phase
Stack height:	45.7 meters (150 ft) (Good Engineering Practice height). Derived by multiplying the height of the nearby critical structure (HRSG) by 2.5; the HRSG is 120 ft L x 100 ft W x 60 ft H.

	Natural Gas Without Supplementary Firing	Natural Gas Supplementary Firing[a]	Fuel Oil
Stack exit temperature (°F):	207	207	284
Exit mass flow (x 10^3 lb/hr per phase):	5,235.8	4,256.3	5,294.8
Exit velocity (fps):	63.6	51.8	64.6
Exit diameter (ft):	15.75	15.75	15.75
Heat input (x 10^6 Btu/hr per phase):	2,116.8	1,846.3	2,172.8

TABLE 2.1-9 (cont'd)

	Natural Gas Without Supplementary Firing	Natural Gas Supplementary Firing[a]	Fuel Oil
Controlled emissions (per phase)			
NO_x (gps):[b,c] (ppmV):[d]	44.0 42 ppmV	37 40 ppmV	48 42 ppmV
CO (gps):	6.0	11.8	20.6
SO_2 (gps):	0.0	0.0	147.0
TSP/PM_{10}:[e]	2.9	2.2	2.9
VOC (gps):[f]	0.56	1.2	2.6
Stack Gas Analysis			
Constituent (percent)			
N_2	73.47	72.02	73.24
Ar	0.88	0.87	0.89
O_2	13.17	12.35	12.95
CO_2	3.30	3.52	4.38
H_2O	9.18	11.24	8.54

TABLE 2.1-9 (cont'd)

Auxiliary boiler (one per phase)--use will be limited to startup and emergency conditions or during normal maintenance to provide internal plant power.

	Natural Gas	Fuel Oil
Stack exit temperature	490 F	503 F
Exit mass flow	34,500 lb/hr	34,698 lb/hr
Exit velocity	42.3 fps	43.0 fps
Exit diameter	0.81 ft	0.81 ft
Heat input	43.5×10^6 Btu/hr	41.8×10^6 Btu/hr
Controlled emissions (per phase)		
NO_x (g/s):	0.75	0.75
CO (g/s):	0.19	0.17
SO_2 (g/s):	0.015	2.7
TSP/PM_{10}:e	4.6	5.8
VOC (g/s):	0.07	0.08

[a] Supplemental firing capability allows increased power output during periods of high ambient temperature and when one gas turbine is out of service.

[b] grams per second, gps.

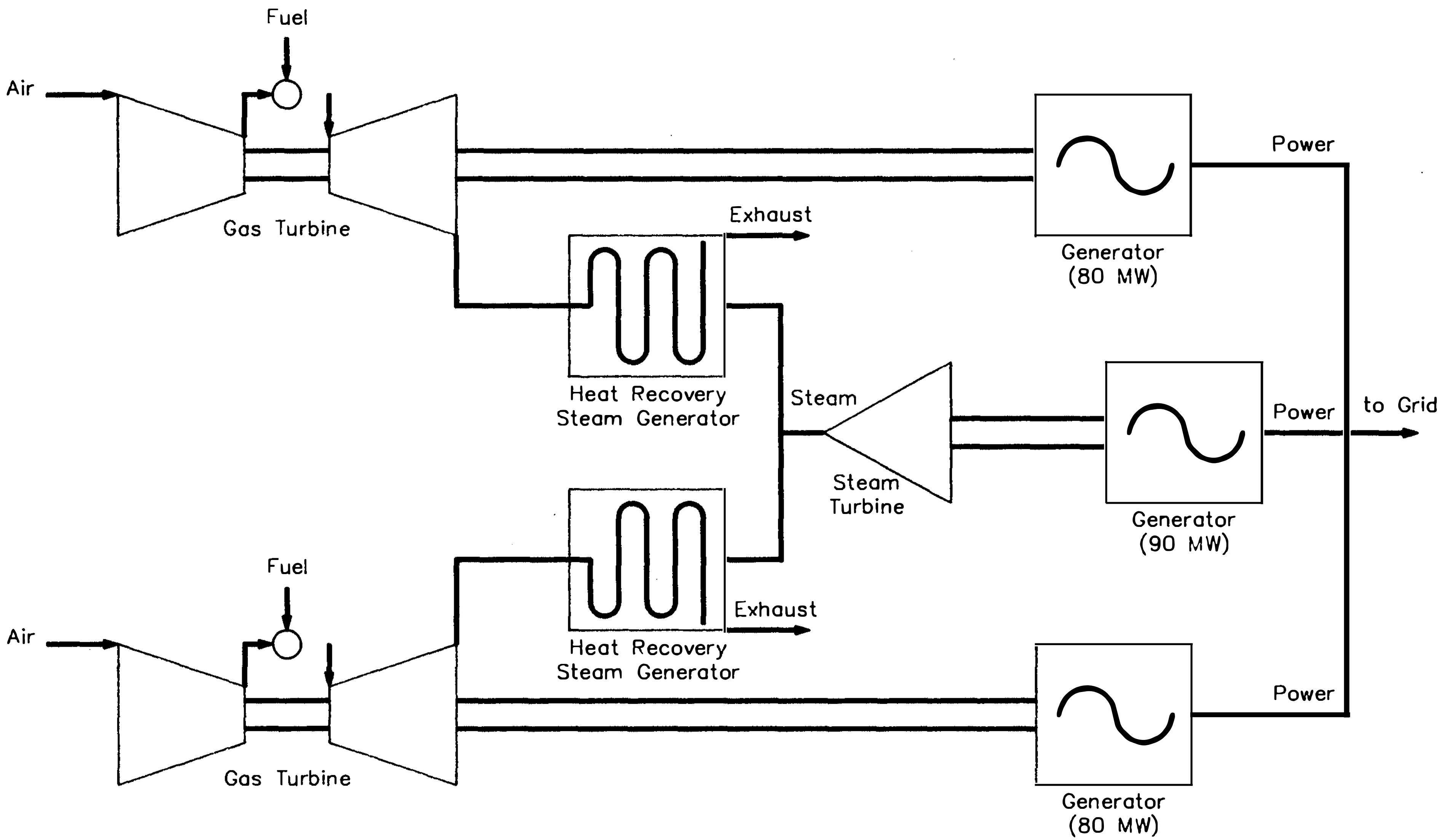
[c] NO_x control is water injection.

[d] Dry referenced to 15% O_2.

[e] As a conservative measure, all emitted particulate matter (PM) is assumed to be equal to or less than 10 microns in diameter to facilitate comparison of modeled particulate impacts with PM_{10} standards.

[f] VOC's will be limited to less than 100 tons/yr, based on 1,500 hours of operation per year at full load on specified fuel oil. The 1,500 hours on fuel oil are based on the assumption that fuel oil would be burned approximately 15 percent of the time the plant is in operation.

SOURCE: Bechtel Eastern Power Corporation, September 1987.



NOTE: Schematic shown is for one of two identical Phases.

FIGURE 2.1-7
SCHEMATIC OF PLANT GENERATING SYSTEMS
(COMBINED-CYCLE OSP PLANT)

Two rectangular wet mechanical draft cooling towers would dissipate heat from the circulating and intake cooling water system. These towers are expected to be 378 by 48 by 42.3 feet, and use seven fans. During operation, warm water from the condenser and auxiliary equipment heat exchangers enters the tower distribution system about 28 feet above the tower basin water level. The water is distributed over a matrix of bars or laths that break up the flow. As water cascades through this matrix, heat is removed by direct contact with the ambient air flowing up through the towers. Most of the heat is removed by evaporation; the remainder is removed by heat transfer to the air.

2.1.3.2.4 Fuel System

Gas

The primary fuel proposed is natural gas, which would be supplied to the OSP site via a tie-in to Tennessee Gas Pipeline Company's proposed Rhode Island Extension. The Rhode Island Extension (see Section 2.2 for detailed description) would pass to the east of the plant site, along Douglas Pike. A short (0.4-mile) gas delivery line would be constructed to the site.

Oil

No. 2 fuel oil would be stored onsite in four tanks for emergency use during any period of gas supply or transportation disruptions beyond the control of OSP. These tanks would be constructed on a clay-lined basin surrounded by an impervious earthen berm capable of containing the total capacity of all four tanks (120,000 barrels--approximately 5 million gallons) concurrently with stormwater runoff from the design 10 year-24 hour storm.

2.1.3.2.5 Pollution Control

Air Quality

The proposed OSP facility is subject to two sets of ambient air quality restrictions--National Ambient Air Quality Standards (NAAQS), including PSD, and Rhode Island air quality standards. Given the proximity of the proposed power plant to Massachusetts, its air quality standards have also been considered. However, since the facility will not reside in any part of Massachusetts, nor will it require Massachusetts DEQE permit approval, those standards do not apply to the project.

The operation of the proposed power plant would result in two principal types of emissions to the atmosphere--stack emissions and cooling tower emissions. The stack emissions would consist of products of combustion from the turbines and possibly from the supplemental boilers. Cooling tower emissions would consist primarily of water vapor that may be visible, depending on atmospheric conditions. Operation of the combustion turbines and the supplemental boilers would result in emissions of up to five pollutants--nitrogen oxides (NO_x), total suspended particulates (TSP), carbon monoxide (CO), sulfur dioxide (SO_2), and volatile organic compounds (VOC's)--all of which are regulated by state and Federal agencies. The best available control technologies (BACT) proposed for use at the OSP facility are discussed in Section 4.1.3. VOC emissions from this project are not expected to be significant (i.e., less than the 100-ton/yr threshold for nonattainment areas). No other pollutants are expected to be emitted in significant quantities.

Noise

Primary sources of noise associated with operation of the proposed plant would include the combustion turbines and generators; building ventilation systems; heat recovery steam generators; main steam turbines and generators; miscellaneous pumps, motors, valves, vents, fans, and compressors; main power transformers; and main cooling towers, as well as small heat exchangers. The plant public address/alarm system is anticipated to operate at two levels, a lower unobtrusive level for communication during normal plant operations, and an alarm level for use during emergency conditions. In accordance with a FERC Staff recommendation, OSP has agreed to limit plant noise levels to an L_{dn} of to 55 decibels (dBA) at the nearest residence by incorporating sound attenuation into the equipment design.

Plant Lighting

Outdoor lighting of the plant would include roadway lighting and lighting around equipment where maintenance might be required. Lighting would be shielded, high-pressure sodium fixtures which would be directed toward the areas to be lit. OSP would not perimeter-light the entire project site.

Water

The plant is designed with a zero discharge system whereby the only water loss would result from evaporation into the atmosphere from cooling towers. The plant would use a wet recirculating cooling system and process water for makeup and NO_x control. The zero discharge system collects all effluent from the various plant locations for diversion to a treatment system located in a treatment building onsite. Treated water would be returned for reuse within the plant. Water withdrawals for the plant are considered as true consumptive use since none would be returned to the immediate surface water environment. Stormwater runoff from the plant area would be diverted to two onsite detention basins. Water from up to 48 hours of treatment plant malfunctions would be diverted to a separate holding pond located on the plant perimeter. This water would be recycled back through the treatment system as flows permit. The holding pond will be designed to prevent overflow and will be sealed to prevent groundwater contamination.

The major contributors to the wastewater streams are cooling tower blowdown, boiler blowdown, and ion-exchange regeneration. "Blowdown" is the constant or intermittent discharge of a small portion of boiler water or circulating cooling water in a closed system to prevent a buildup of high concentrations of dissolved solids. These streams are high in dissolved solids. Ion exchange regeneration waste is neutralized in a separate neutralization tank prior to mixing the waste with cooling tower and boiler blowdown. The combined waste would be processed through an electrodialysis reversal (EDR) unit and an evaporator. The EDR process accepts the wastewater stream, which has been pretreated by a manganese sand filter or an oxidizing filter for removal of soluble iron and manganese. Ionized salts and minerals from the wastewater are removed and concentrated in a smaller volume of water by means of direct current electricity. A mechanical vapor recompression (MVR) evaporator/crystallizer system accepts feed from the EDR and concentrates the waste to between 60 and 70 percent solids on a dry weight basis. A deaerator removes carbon dioxide, nitrogen, and oxygen. Almost pure product water is recycled for reuse. The cakes and solids obtained would be stored in secure facilities onsite, then trucked offsite to an approved landfill. The wastewater streams after pretreatment, EDR, and evaporator processing form a zero discharge system.

Information on the proposed zero discharge wastewater treatment system supplied by OSP in its Environmental Impact Assessment (EIA) was reviewed and evaluated to determine if the system is likely to perform as described (Bechtel Eastern Power Corporation, December 1986). Wastewater treatment equipment in general, and especially membrane systems, will go out of service periodically due to routine maintenance and system failures.

Several vendors of electrodialysis treatment systems were contacted to gain their perspective on this application of the technology. The consensus was that the technology could be used successfully, though operational failures are common, at least initially. Three reasons cited for system failures were unskilled operators, instrumentation problems, and influent quality.

Plant systems are designed to assure efficient operation of each element, considering the cost of initial construction, operation and maintenance, and the cost in lost power generation if these systems require maintenance and repair. The EDR wastewater treatment system is considered a critical system to achieve zero discharge which is an important operational and environmental consideration. EDR systems have been in use for several years; however, use in the United States has become more common only in the last two years. It is this limited industry experience and the essential functions that causes concerns about the system and why it is considered critical. On the other hand, EDR systems are used in water treatment systems and have performed well after initial startup shakedown and after operators have received training and experience.

OSP has proposed one EDR for each phase and would therefore have some flexibility of operation if one were to fail and require maintenance or repair. OSP would have the following options if EDR failure occurred:

a) Transfer to the second EDR and hold excess untreated water until the EDR is repaired. If full power generation is occurring and during those climatic conditions when maximum evaporation is occurring in the cooling towers, capacity exists to continue operation for several hours.

b) Allow the solids to build up in the cooling tower. This option would probably be the first one chosen for a EDR shutdown of several hours.

c) Use the EDR for the other unit. It would not be possible to treat all of the water blowdown at full operation; however, plant operations would vary by time of day and time of year as would the cooling requirements. Experienced operators would be able to take advantage of these variations.

Combinations of the above would normally allow sufficient time for EDR repair or change of operations. If EDR remains out of operation, then plant operation would have to be shut down.

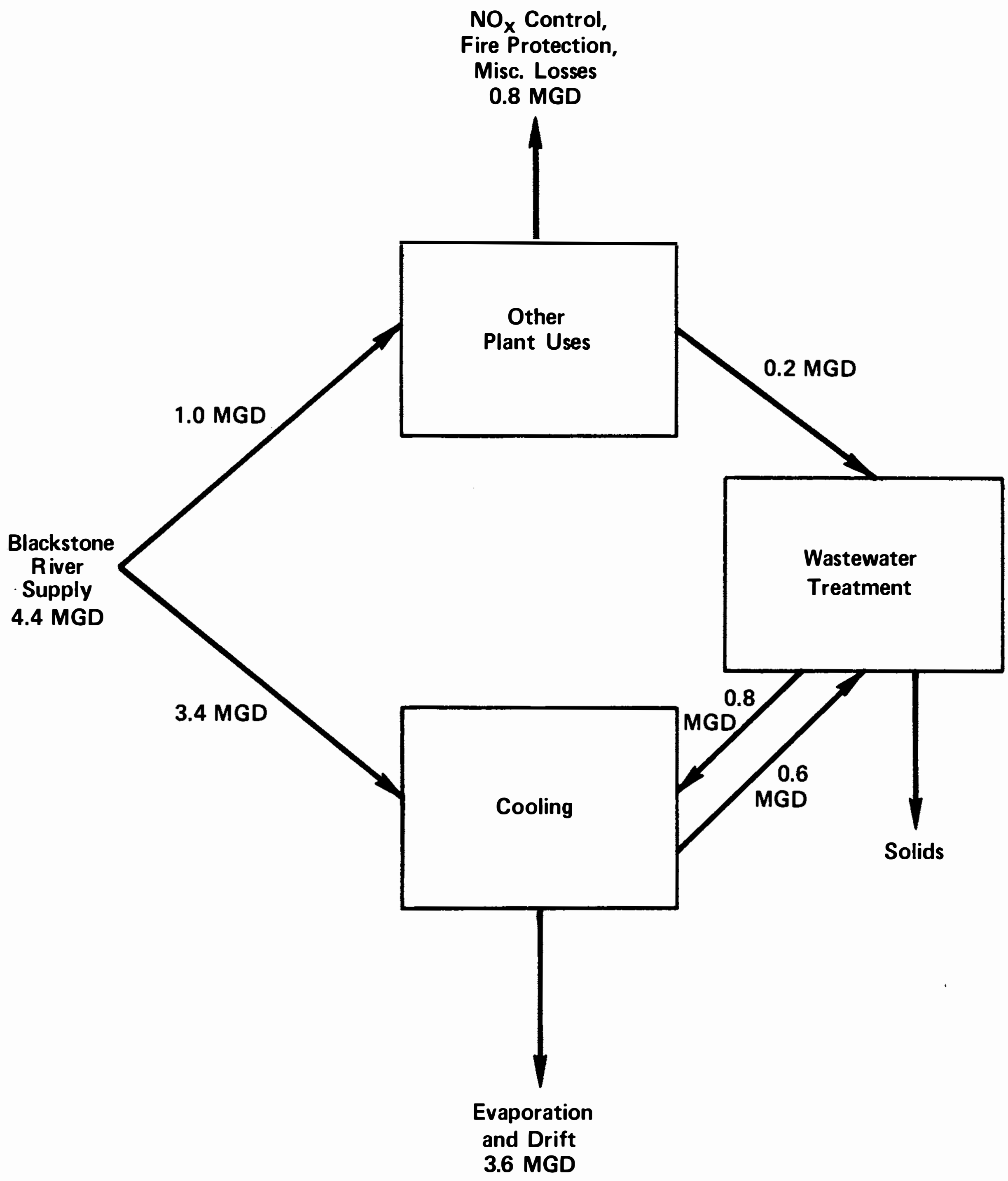
Since a zero discharge system is an integral part of the proposed system, OSP will have ultimate responsibility to assure the effective operation of the treatment system and to assure its operation. A schematic diagram of the zero discharge system is presented in Figure 2.1-8.

In the event of a fire emergency, OSP would provide fire protection by drawing water from the service water tank which is supplied by the Blackstone River.

Solid Waste

The use of natural gas as the primary fuel eliminates the large quantities of fly ash, bottom ash, and flue gas desulfurization waste sludges that are produced by alternative fuels, such as coal. Table 2.1-10 presents the estimated characteristics of solids for landfill disposal generated by the OSP project. These solids are listed on an elemental basis in pounds per day per phase. The U.S. Environmental Protection Agency (EPA) regulates the disposal of hazardous and toxic substances. Any solid waste determined to be hazardous would require a manifest for transport to a RCRA-approved landfill. The nearest such landfill is located in the State of New York. There are no legal impediments to the interstate transfer of hazardous materials to a RCRA-approved landfill. Such transfers constitute free trade and are thus left to the business discretion of the transferring parties. All other solid wastes may be disposed of in a licensed landfill.

A preliminary examination of these substances indicates that chromium and mercury might "fail" the EPA extraction procedure (EP) toxicity test for toxicity of hazardous substances. The FERC Staff therefore recommends that an EPA's EP toxicity test be performed on the wastes before approval is granted to the OSP project, and that OSP demonstrate that a suitable disposal facility is available if these wastes are determined to be hazardous. OSP has reviewed the possibility that some of its waste could be classified as hazardous materials and investigated the disposal options available in the event that such a determination is made (Bechtel Eastern Power Corporation, April 1988). OSP has identified a licensed hazardous waste landfill (owned by SCA Corporation in Model City, New York) that



SOURCE: Bechtel Eastern Power Corporation, January 11, 1988

NOTE: Totals are for both units, under extreme conditions.

FIGURE 2.1-8
SCHEMATIC OF ZERO DISCHARGE
WASTEWATER SYSTEM

TABLE 2.1-10

Solid Wastes to be Produced by Proposed OSP Plant[a]

Assumptions:

Plant Size:	Two phases, at 250 MWe per phase
Waste Streams:	1) Cooling tower blowdown, 199 gpm @ 7 cycles 2) Boiler blowdown, 28 gpm @ 900 psi 3) Ion-exchange regeneration, 21 gpm

Parameter	Weight (as dry solid) (lb/day)[b]	
		Per Phase
Calcium[c]		256.9
Magnesium		42.2
Sodium		1,323.7
Potassium		130.2
Alkalinity		--
Sulfate		2,437.7
Chloride		807.4
Nitrate		20.2
Phosphate[d]		8.6
Fluoride		5.6
Iron		0.125
Silica		88
Boiler Blowdown solids[e]		168.2
Turbidity		47.6
Heavy Metals:		
Cadmium	0.018	
Chromium	0.550	
Copper	0.366	
Lead	0.092	
Nickel	0.918	
Mercury	0.018	
Total Heavy Metals		1.962
Total Solids[f]		5,338

[a]Data based on extreme operating conditions.

[b]Weights are expressed as elements (not, for example, as $CaCO_3$), assuming that:

- Ion exchangers operate 20 hr/day (average) major component.
- Metal-cleaning wastes are infrequent and can be contracted for offsite disposal.

[c]Source of water quality data--USGS Storet Retrieval, 86/07/28, page 35.

[d]Assume 10 mg/l PO_4 (maximum) in internal-water treatment.

[e]Boiler blowdown solids consist of the parameters listed above. The exact breakdown of individual weights depends on actual chemicals used for water treatment. Boiler blowdown is nonhazardous.

[f]Suspended solids + total dissolved solids = total solids.

SOURCE: Bechtel Eastern Power Corporation, January 11, 1988.

is willing and capable of accepting OSP's waste designated as hazardous. Onsite storage of the approximately two tons per day portion of plant solid waste that may be classified as hazardous waste is anticipated to be straightforward in accordance with RCRA regulations.

Storage of Petroleum and Hazardous Chemicals

Facilities that handle or store significant quantities of petroleum products or hazardous chemicals are subject to EPA and state regulations regarding such handling and storage. OSP plans to store onsite, in aboveground tanks, up to 120,000 barrels of No. 2 fuel oil as backup for the plant; an unspecified quantity of diesel fuel; and chemicals for water treatment systems. OSP has prepared a preliminary Spill Prevention Control and Countermeasures (SPCC) Plan for the plant (OSP, November 19, 1987). Table 2.1-11, provided as an attachment to the preliminary SPCC Plan, indicates the types and amounts of chemicals and compounds anticipated to be stored at the site during plant operation.

2.1.3.3 Electricity Distribution

Power generated by the OSP plant would be fed to the NEPOOL grid through the 345-kV transmission line system adjacent to the plant. The existing switching station to the west of the plant would be retrofitted with gas insulated equipment to allow a denser arrangement of equipment on the existing site than provided by conventional switching gear. Thus, power from the OSP plant could be fed into the bulk grid without an expansion of the existing switching station. Power from the plant would be distributed in either a northeast or southeast direction along existing transmission lines.

OSP has indicated that PCB transformers would not be used or stored at either the OSP site, the water intake facility, nor along the associated pipeline route. According to OSP, Blackstone Valley Electric Corporation has further stated that it is not using or storing and would not use or store PCB transformers at the existing substation adjacent to the OSP facility site (OSP, May 6, 1988).

2.1.3.4 Water Supply System

The proposed OSP 500 MWe plant is projected to consume an estimated average of 4 million gallons per day (mgd) of water for cooling, boiler makeup, and other plant uses. Operations under certain operating and climatic conditions

TABLE 2.1-11

Preliminary List of Chemicals and Compounds to be Stored at OSP Plant Site[a]

Chemical	Quantity	Use
93% Sulfuric Acid	5,000 gal[b]	Demineralizer regeneration Cooling tower pH
50% Caustic Soda	5,000 gal[b]	Demineralizer regeneration
40% Ammonia Solution	200 gal	Condensate pH control
35% Hydrazine Solution	20 gal	Feedwater oxygen control
Trisodium Phosphate	200 lb	Boiler water alkalinity control
Aluminum Sulfate	1,000 lb[c]	Coagulation of raw water
Polymer	200 lb[d]	Raw water clarification Inline coagulation ahead of EDR
Polyphosphate	400 lb	Corrosion inhibitor for cooling tower circuit
Polymeric Inhibitor	1,300 lb	Control of deposition in cooling tower circuit
Tolyltriazole	80 lb	Copper corrosion inhibitor for cooling tower circuit
Chlorine	10 tons	Biocide for cooling tower circuit Potable water sterilization
Sodium Hexametaphosphate	60 lb	Prevent scaling in EDR
NALCO 2388	110 gal	Prevent scaling
Lubricating Oil	To be determined	
Hydrogen	4 gas cylinders	
Nitrogen	4 gas cylinders	
Carbon Dioxide	4 gas cylinders	
Natural Gas	No storage	
No. 2 Fuel Oil	120,000 bbls	
Diesel Fuel	To be determined	

[a] All above quantities are based on a 1-month supply under worst operating conditions, unless otherwise noted.

[b] Based on filling bulk storage tanks.

[c] Use to be reviewed.

[d] Selection of polymers to be carried out later.

SOURCE: OSP, November 19, 1987.
Bechtel Eastern Power Corporation, February 1988.

(extreme conditions) would require 4.4 mgd. The proposed source of plant water is the Blackstone River.

Access to this source of water would require an intake structure at the Blackstone River and construction of an approximately 10-mile pipeline from the river at Woonsocket to the site. This point of access was chosen on the basis of minimum and maximum river water levels, dependability of flow, and the availability of space for locating the pumping facilities. The proposed location of the water intake structure is on the right bank of the Blackstone River, just north of the Sayles Street Bridge. The water pipeline would run from the intake structure along the street right-of-way in Woonsocket to Route 146A, and then northwest to Route 102 in North Smithfield. The pipeline would be located in the right-of-way of Route 102 to Nasonville, where it would follow Route 7 (Douglas Pike) to West Ironstone Road. It would then follow the right-of-way along West Ironstone Road to the Blackstone Valley Electric Company transmission line right-of-way into the power plant site. The proposed pipeline route is illustrated in Figure 2.1-9 (Section 2.1.4.5); wetland crossings are listed in Table 2.1-15 (Section 2.1.4.5).

2.1.3.5 Oil Supply System

A fuel oil pipeline would be constructed as a spur off the existing Mobil Oil pipeline, which runs from Providence to Springfield, Massachusetts. The pipeline--6 inches in diameter--would be located in the same trench as the water pipeline from its connection point in North Smithfield to the site. During and following a period of oil use during a gas supply interruption, the fuel oil pipeline would be used to refill the oil storage tanks. As a backup to the pipeline, OSP would install oil unloading stations at the plant delivery of oil. The stations would be fitted with spill retention and collection facilities.

2.1.3.6 Training

General Electric (GE)--OSP's construction engineering contractor--would conduct a training program for the plant's operation and maintenance (O&M) staff. The training program would consist of four stages:

- Power plant basic training--Introduction to the basic concepts and theory of power station equipment and design.
- Power plant site-specific training--Presentation of the theory of operation, design, flow paths, integrated operation, interface,

protective devices, and schemes of the components, equipment, and systems associated with combined-cycle systems and the balance of plant mechanical and electrical systems.

- Startup on-the-job training--Active, hands-on involvement of technical and O&M personnel in all phases of plant startup, commissioning, and testing. Supervision, direction, and instruction of personnel are the responsibility of GE during this phase.

- Initial plant operation--GE responsibility for the management of plant operations and preventive and routine management activities until provisional plant acceptance by OSP.

2.1.3.7 Construction Schedule

Construction of the first phase of the proposed OSP plant is scheduled to begin (pending approvals) on August 15, 1988, and extend over a 2-year period, with commercial operation commencing in August 1990. The second unit schedule is anticipated to lag the first unit schedule by 6 months. The generating units are anticipated to have a 20-year life.

For Unit I, the first 6 to 7 months will be engineering, purchasing, and planning activities by OSP's design/build contractor. Construction at the project site will begin in the sixth month. Initial activities will be clearing of the plant site, rough grading, excavation, and placement of major equipment foundations. These initial activities will extend over approximately 5 months. Following these initial activities, the next 4 months will be primarily focused on installation and erection of the major plant equipment, buildings, and facilities. The subsequent 6 months will involve the installation and the connection of many of the auxiliary systems, and piping and electrical systems that will tie the major pieces of equipment together. The final 4 months will be used to check out and test the plant. Initial start-up of the plant will occur in that final 4-month period.

2.1.4 Alternatives to Proposed Action

2.1.4.1 Energy Conservation/Load Management

Both energy conservation and load management are important elements in New England's present and future electricity consumption. Energy conservation includes a diversity of procedures that reduce the consumption of electricity--from shutting off lights to using special energy-saving equipment (e.g., high-efficiency light bulbs produce the same number of lumens as ordinary light bulbs, but require only a portion of the electricity).

In contrast, load management does not necessarily involve energy conservation (though typically it does), but the time-of-use of energy during the day, month, and year. A common load management technique shifts a consumer's electricity consumption from heavy use periods (such as early afternoon) to lower use periods (such as early evening or night).

NEPOOL projects that the demand for electricity in New England during peak consumption periods will be reduced by 6 percent by the year 2000 using energy conservation and load management techniques. Although energy conservation and load management are critical elements in meeting New England's need for power, these techniques usually take several years to be introduced and implemented and, in some cases, involve large capital commitments.

2.1.4.2 Alternative Generation

The choice of combined-cycle generation using natural gas as the primary fuel and No. 2 fuel oil as the secondary fuel must be evaluated against alternative types of generation to determine if any other generation options would be significantly superior. Four criteria are commonly used to evaluate the selection of a generation technology, as explained below:

- Engineering characteristics--This criterion includes reliability, efficiency, and operating characteristics. Determining whether the need is for base, intermediate (cycling), or peaking power is essential for selecting an appropriate technology. Reliability concerns usually result in utilities and independent producers either choosing a proven technology with a long track record or requesting financial support or assurance from vendors of nonproven technologies.

- Capital and operating costs--Technologies such as nuclear power have high first costs, but relatively low operating expenses. In contrast, gas- and oil-fired turbines tend to have low capital costs, but because of fuel costs have relatively high operating expenses. Capital costs per kilowatt may range from less than $300 to more than $4,000.

- Environmental impact of alternative generating technologies--Siting, water, air, and socioeconomic considerations are primary factors in choosing a given technology.

- Lead time--This is the time required to plan, permit, and construct a generating plant. Lead times can range from 3 to 5 years for technologies such as combined-cycle plants to 10 to 12 years for coal-fired power plants. Because nuclear plants can be assumed to have an indefinite lead time when licensing is considered, nuclear generation is not considered an alternative worth evaluating herein.

The combined-cycle system--the proposed technology for the OSP project--uses gas turbines, with the addition of a combined-cycle or secondary boiler that recovers waste heat from the gas turbines to produce additional electricity generation through an auxiliary turbine generator. The lead time for such units is about 3 to 5 years, of which 2 or 3 years is construction and installation time. The capital cost of combined-cycle units averages $600 per kW ($1986) (New England Governors' Conference, Inc., 1986). The greater thermal efficiency of the combined-cycle plant, combined with its quick-fire startup time, makes this type of technology useful for base, cycling, and peaking dispatch.

Sections 2.1.4.2.1 through 2.1.4.2.5 briefly examine the above four criteria as they apply to pulverized coal with scrubber, fluidized bed combustion, gas turbine, integrated gasification combined-cycle, and renewable resource technologies, respectively.

2.1.4.2.1 Conventional Pulverized Coal With Scrubbers

Coal-fired units ranging in size from 300 to 800 MW are usually base loaded. Some important attributes of these units are their mature technology and high thermal efficiency. They generally require a lead time of 10 to 12 years, according to industry estimates, though vendors (such as Babcock & Wilcox) are researching ways to reduce this long lead time. The units can be built for approximately $1,600 per kW ($1986) (New England Governors' Conference, Inc., 1986). These high capital costs can be somewhat offset by low operating costs. However, low operating costs are dependent on fuel and fuel transportation costs. Coal-fired units have the potential to produce large quantities of pollutants, but this can be minimized by using scrubbers or low sulfur coals, though dust and ash are still major environmental concerns. Coal-fired generation is a major producer of solid wastes, such as boiler slag, scrubber sludge, and ash, which are generally transported offsite to approved landfills. Landfill disposal requires a substantial amount of acreage over the life of a powerplant. Disposal of these sludge also has the potential to contaminate surface and groundwater through leaching. Methods to control or reduce leaching are expensive and currently not regulatory requirements (New England Governors' Conference, Inc., 1986).

Site requirements for a coal-fired unit are greater than for most other types of generation. Most plants maintain a 60- to 90-day supply of coal onsite. Unless the plant is located on navigable waters, coal deliveries will be via rail, averaging one to two deliveries a week (approximately 150 carloads).

There are no obvious environmental advantages of conventional coal with scrubber generation compared to combined-cycle generation; however, there are considerable environmental disadvantages. These disadvantages include greater space requirements, solid waste disposal, and possible leaching into surface and groundwater from solid waste disposal. Reliability of both generation types is proven; however, conventional coal is less efficient to operate compared to combined-cycle. Capital costs are about 2.5 times greater for conventional coal than combined-cycle although operating costs tend to be less due to lower fuel costs. The lead time for conventional coal generation is about 2.5 times longer than combined-cycle generation. Considering the long lead time, environmental concerns, and high capital and operating costs, a coal-fired power plant is not a recommended alternative for the OSP facility.

2.1.4.2.2 Fluidized Bed Combustion

Fluidized Bed Combustion (FBC) is a relatively new technology, with an average size currently around 100 MW. The technology consists of a bed of small inert red-hot particles of sand or ceramic pellets that are suspended by large volumes of combustion gases. Fuel is fed as small particles into the bed.

Limestone can be added to react with the sulfur while it remains in the bed, thereby eliminating the need for scrubbers. The technology is capable of using different fuels for combustion, NO_x and SO_2 emissions are low, and operating efficiency is higher than with conventional coal-fired technology. The capital costs of installing FBC systems are comparable to conventional coal-fired units, averaging $1,750 per kW ($1986) (New England Governors' Conference, Inc., 1986). Lead times average 5 to 7 years.

At present, FBC technology is directed toward units of 100 MW or less. The size considered by Ocean State would require the installation of several units, at almost twice the costs of the proposed plant, or the use of a larger size unit with no operating track record. Environmentally, FBC is comparable to combined-cycle generation. Both have little impact on air and water. However, though the solid waste from FBC is more readily amenable to disposal due to its composition, solid waste generation is much greater than for combined-cycle generation and does require significant landfill area. If sufficient landfill area is available, there should be no real environmental advantage or disadvantage to FBC compared to combined cycle. The primary advantages to combined cycle are its lower capital cost, proven reliability and plant size. Coal storage and layout area for a 500 MW FBC operation would be significant. Only units around 100 MW have any proven track record and may be the most efficient sized plant for this technology. Capital costs are about 3 times greater than for combined-cycle generation while lead times for the two generation types are about the same. Operating cost for FBC should be lower than for combined cycle, assuming coal is less expensive than gas.

FBC is not a superior alternative to combined cycle. Plant size and proven reliability on a large scale combined with higher capital costs make this technology a more expensive alternative for the unit size planned by OSP. In addition, siting requirements would force the use of a larger site.

2.1.4.2.3 Gas Turbines

Gas turbines are most often used by utilities as cycling or peaking units due to their ability to fire quickly and the relatively high cost of natural gas. Fuel efficiency is relatively low, which also encourages their use as peaking rather than base-loaded plants. Turbines can burn either No. 2 oil or natural gas interchangeably, depending on the availability and price of fuel. Lead times for constructing and operating these units are short, usually 3 to 5 years. Typically, these plants have low first costs, $360 per kW ($1986) (New England Governors' Conference, Inc., 1986). Gas turbines are relatively clean burning plants; only minimal environmental problems are associated with their use.

Gas turbines would be used by Ocean State in the combined-cycle system, together with a heat recovery boiler that increases the thermal efficiency of the overall system. This improvement in efficiency is superior to the use of gas turbines alone. There are no environmental advantages or disadvantages of operating gas turbines without the heat recovery boiler. Environmentally, the two generation types should be comparable.

2.1.4.2.4 Integrated Gasification/Combined Cycle

The Integrated Gasification/Combined Cycle (IGCC) system is an extension of combined-cycle technology. A module is added that converts coal into a combustible gas. The advantages of the IGCC system are the potential for meeting strict air emission standards placed on the use of coal and the ability to expand the capability of the system as load grows. The cost of the IGCC system is currently around $1,600 per kW ($1986) which is about 2.5 times that of combined cycle. Operating costs are lower than for combined cycle (New England Governors' Conference, Inc., 1986). Lead time for this technology is about 6 to 8 years which is about twice that of combined cycle. These systems are increasing in popularity because of load growth uncertainty and the concern for environmental problems with coal-fired generation. Several IGCC systems are currently operational in the mid-Atlantic region. IGCC is more efficient than combined cycle.

The IGCC system is not a superior alternative to OSP's choice of combined-cycle technology at this time, though the addition of a coal conversion unit might be technically feasible at a later date. However, cost of transporting coal to an inland site would be high and the environmental disadvantages to coal, such coal storage and solid waste disposal, would need close review.

2.1.4.2.5 Renewable Resources

This category contains such diverse technologies as hydroelectric, biomass, wind, solar, and geothermal power. The feasibility of hydroelectric power depends on the availability of suitable locations--which is the primary limitation for this project. New England has few if any locations that could support a 250- to

500-MW power plant. Wind, solar, and geothermal power are technically limited in the region by climate and geography, particularly for large-scale operations. Hence, these technologies would be less reliable and more inefficient than combined-cycle generation. Biomass is a viable alternative if it includes the incineration of municipal and other wastes for the purpose of generating electricity. However, biomass units have large capital costs and are generally limited in size to 50 MW or smaller. Units of the size under consideration would probably pose significant environmental problems, particularly with respect to storage and air pollutants. Groundwater impacts may be great depending on the biomass source.

2.1.4.2.6 Conclusions on Alternative Generation

Of the five alternative generating technologies discussed above, none are shown to be superior to the combined-cycle technology chosen by OSP for this project. Lead time for combined-cycle plants is shorter than for most alternative technologies. Combined-cycle plants have a strong operating track record and are suited for use as base load plants. Both capital and operating costs tend to be below those for other alternatives examined, though the economics of the plant will depend on the price of natural gas as compared to other fuels. Lastly, the environmental impacts on air and water are considerably less than, or comparable to, the impacts from other alternatives.

2.1.4.3 Cooling Alternatives

2.1.4.3.1 Alternative Surface Water and Groundwater Sources

Several alternative sources for the average 4 million gallons per day (mgd) required for plant makeup water were considered by OSP and others by the FERC Staff. Generally, potential water sources within 25 miles of the preferred site, plus additional sources along the Rhode Island coastal plain, were considered. Thus, the search area included the entire State of Rhode Island and portions of southern Massachusetts and eastern Connecticut. Potential sources included surface water streams and reservoirs, groundwater, public water supplies, and sewage treatment plant effluent. The dry tower cooling alternative was also considered, which would greatly reduce (but not eliminate) water consumption.

Phased Screening

Water source screening was conducted in three phases. The objective of the screening process was to narrow the list of potential water sources to those that meet certain feasibility criteria. The three screening phases are summarized below.

Phase One. Certain categories of water sources were eliminated for the following reasons:

- Saltwater--environmental impacts associated with salt drift and deposition from cooling towers, as well as equipment corrosion problems.
- Upper Blackstone River Basin--low-flow conditions.
- Southern Rhode Island--low-flow conditions.
- Upper Charles River Basin in Massachusetts--low-flow conditions.
- Sources east of the City of Providence--difficulties in transporting water across heavily urbanized areas and major river crossings.

Phase One resulted in narrowing the search area to the northern two-thirds of Rhode Island and eastern Connecticut.

Phase Two. Public water supplies, river basins, and groundwater sources within the remaining search area were screened to eliminate those that could not safely supply 2 mgd--the amount required for one of the two power units, and thus the minimum necessary if only one unit is constructed. Of the 28 public water supplies in the State of Rhode Island, only one was found that could supply 2 mgd (based on City of Providence Water Supply Board estimates of yield and capacity)--the Scituate Reservoir system owned and operated by the City of Providence Water Supply Board. Thirty-six subbasins in the Narragansett Bay and coastal basins were considered; of these, 17 were found that could potentially supply 2 mgd.

Finally, groundwater sources in the site vicinity were considered. Based on a groundwater study of the Branch River Basin conducted by the U.S. Geological Survey (USGS), the geology of the immediate OSP site area (within about a 2-mile radius) is such that only low-yield wells can be developed (Johnston and Dickerman, 1974). For example, USGS found that the average yield of bedrock wells in the Branch River Basin is about 8 gpm, and typical wells founded in glacial till yield 2 gpm or less (Johnston and Dickerman, 1974). At these rates, more than 170 bedrock wells or nearly 700 glacial till wells would be required to supply 2 mgd for a single power plant unit. OSP has stated that this number of wells would be impractical to manage. The FERC Staff further notes that such a large number of wells would have to be located over an area much larger than the plant site and would likely have a significant impact on neighboring groundwater users. Thus, any practical groundwater source for plant cooling would have to be developed offsite.

The most productive groundwater geology in the basin is associated with stratified-drift aquifer formations, located chiefly in river valleys. These formations consist of layers of assorted gravel, sand, silt, and clay with relatively high water transmission capability (Johnston and Dickerman, 1974). Water flows naturally from the stratified-drift formations to the streams, which follow the valleys. However, reversal of the water table gradients by pumping from wells would reduce groundwater runoff to the streams and, if the duration of pumping is sufficient, would cause the water to move from the stream into the aquifer. This phenomenon is known as induced infiltration (Halberg et al., 1961). Stratified-drift aquifer formations in some areas have potentially high groundwater yield because of the possibility of induced infiltration from adjacent streams (Johnston and Dickerman, 1974).

USGS identified two such aquifer formations within the Branch River Basin that could potentially be developed with a safe yield of 2 mgd or more. These areas, referred to as the Slatersville and Oakland Aquifers in the USGS report, were assessed as having potential sustained yields of 5.5 and 3.4 mgd, respectively

(Johnston and Dickerman, 1974). The Slatersville Aquifer is located about 4 miles southeast of the OSP site, while the Oakland Aquifer is located about 4 miles south of the site.

The potentially more productive of the two formations, the Slatersville Aquifer, is situated adjacent to the upper Slatersville Reservoir on the Branch River. The aquifer owes its relatively high potential yield to induced infiltration from the adjacent reservoir. The USGS report states that high rates of groundwater pumping will deplete surface outflow from the Slatersville Reservoir by nearly the same rate as the groundwater withdrawal (Johnston and Dickerman, 1974).

The situation at the Oakland Aquifer is similar. Pumping would cause induced infiltration at the confluence of the Pascoag and Chepachet Rivers where they join to form the Branch River (Johnston and Dickerman, 1974). Therefore, flows on the lower Branch River (and on the Blackstone River) would be reduced by an amount about equal to the groundwater pumping rate in either area, and impacts associated with reduced streamflow rates would be felt on the Branch as well as the Blackstone River. While these aquifers are reportedly being considered for domestic use and would probably not be available for full-time power plant use, they could possibly be developed as a reliable backup source.

Another potential groundwater source more distant from the site was identified--the now-unused City of Lincoln well field evaluated in Phase Three.

Phase Three. The remaining potential water sources were screened further using a numerical rating system based on the following four categories--potential yield, transportation distance, existing and designated use category assigned by the governing regulatory agency, and water quality. Each rating category was given equal weight, and the following numerical rating scales were chosen:

Category	Rating
Record low flow	
>8 mgd	3
4-8 mgd	2
2-4 mgd	1
Transportation distance	
0-15 miles	3
15-25 miles	2
>25 miles	1
Water use designation	
Class C/D/E	3
Class B	2
Class A	1
Water quality classification	
Class A/B	3
Class C/D	2
Class E	1

This rating system was applied to surface water streams and lakes. The following sources received a score of 10 or greater:

- Blackstone River in Rhode Island.
- Branch River Basin (Slatersville Reservoir plus lakes and ponds near the Burrillville site).
- Scituate Reservoir system.

A few other potential sources were considered after the three-phase screening process. These included several groundwater sources and sewage treatment plant effluent.

Detailed Evaluation of Remaining Alternatives

The alternatives remaining after the three-phase screening procedure were evaluated in detail to determine the final selection of primary and secondary choices. This evaluation included detailed water source descriptions; available quantities; source water quality and required pretreatment; and required appurtenant facilities such as wells, intake structures, and pipelines. Surface water sources were evaluated with respect to a withdrawal criterion that plant withdrawals should not exceed 10 percent of the flow of any watercourse. Results of the evaluations are presented below.

Blackstone River. The reach of the Blackstone River in Massachusetts has a drainage area of about 265 square miles, or about 64 percent of the river's drainage area at the USGS gaging station in the City of Woonsocket. Assuming that low flows along the river are proportional to the drainage area, the 7Q10 flow of the Blackstone River in Massachusetts would be 64 percent of 102 cfs or about 65 cfs. A withdrawal of 4.4 mgd (or 6.8 cfs, the estimated maximum plant requirement) would slightly exceed the screening criteria of 10 percent of the 7Q10 flow. This criterion is not a hard and fast rule, but negative impacts associated with this withdrawal would probably be more severe than those further downstream, would extend upstream of the proposed intake site in Woonsocket, and would negatively impact an additional hydroelectric station (Rolling Dam) located near the Rhode Island State line. Downstream reaches of the Blackstone River have adequate flow to service the plant; thus, the intake for the OSP site was sited in Rhode Island, downstream of the confluence of Branch River.

Based on long-term records, flow would always be greater than the plant demand for all river flow conditions (Bechtel Eastern Power Corp., January 1987). Average plant usage from a withdrawal point in Rhode Island would be less than 1 percent of average river flow and about 6 percent of 7-day, 10-year low flow (7Q10). Water quality, though not always meeting State standards, would be suitable for plant use after conventional pretreatment. OSP estimates that cooling tower operation would be limited to seven cycles of concentration. Necessary appurtenant facilities would include a river intake and a 10-mile pipeline to the plant site. Using the Blackstone River would not impinge on available drinking water supplies in the region, since there are no drinking water withdrawals downstream of the proposed intake site in Woonsocket.

Branch River Basin. Evaluation of the Branch River Basin included the possible use of Slatersville Reservoir and the various lakes and ponds in Burrillville near the plant site. Detailed analysis indicates that plant water demand would require as much as 47 percent of the 7Q10 flow of the Branch River, based on gage records at Forestdale, Rhode Island. This would probably cause serious environmental impacts, and a secondary source would thus be necessary for much of the low-flow season. Use of the Slatersville Reservoir, a water body used for recreation, would result in a 2-foot drawdown during dry years. OSP cites potential licensing problems because of the significant recreational use of the reservoir. The quality of water from the Branch River and the Slatersville Reservoir was found to be acceptable for plant use, and the pretreatment system requirements are comparable to those needed to tap the Blackstone River. Appurtenant facilities would include an intake structure and a 4-mile pipeline--less than needed for the Blackstone River alternative.

Seven other lakes and ponds near the site were also evaluated. The drainage areas to these water bodies range from about 2 to 12 square miles. FERC has estimated the region's average unit runoff rate at about 1.2 mgd per square mile (Section 3.1.2.1). Thus, none of these sources could provide the required plant water volumes and stay within the 10 percent limitation.

The Scituate Reservoir System. The Scituate Reservoir system (Figure 2.1-11 in Section 2.1.5.2) comprises a series of six impoundments in the Pawtuxet River Basin about 15 miles south of the proposed plant site. The total drainage area to the system is 92.8 square miles, and the total capacity is about 127,000 acre-feet. The reservoirs provide water supply for domestic, commercial, and industrial use to a large portion of Rhode Island (City of Providence, Water Supply Board, 1982).

The Providence Water Supply Board, the agency responsible for the Scituate Reservoir system, estimates that the average annual yield from the system is about 40 billion gallons (City of Providence, Water Supply Board, 1982). The average daily plant withdrawal of 4 million gallons is about 3.7 percent of the average system yield. Under its most conservative assumptions concerning drought and demand, the Water Supply Board has stated that the reservoir system could supply the entire average plant water needs of 4 mgd and still meet its current and foreseeable commitments through the year 2020 without exceeding the safe yield of the system (City of Providence, Water Supply Board, 1987). However, data provided by the Rhode Island Division of Planning conflict with the information provided by the Water Supply Board; this is discussed in Section 3.1.2.1.3.

The water quality of the reservoir system is good. Prior to use by the proposed plant, however, the water must undergo pretreatment. OSP estimates that the cooling tower could operate at 20 concentration cycles with water from this source. Appurtenant structures would include an intake at the reservoir and a 15-mile pipeline.

Sewage Treatment Plant Effluent. The nearest source of sewage treatment effluent is the City of Woonsocket. The treatment plant is located about 9.4 miles from the plant site, and its average discharge is about 10 mgd. The plant provides conventional secondary treatment and chlorination prior to discharge to the Blackstone River. Because of the effluent's poor quality characteristics compared to river water (Table 2.1-12), OSP maintains that a sophisticated tertiary treatment plant would be required before it could be used for power plant makeup. Another power plant proposal, the Applied Energy Systems Inc., Riverside Cogeneration Facility, plans to use 2.3 mgd of the city's Woonsocket Wastewater Treatment Plant (WWTP) effluent.

OSP has cited the following additional reasons for not using sewage treatment plant effluent:

- Excessive capital and operational costs for pretreatment facilities (Table 2.1-13).
- Additional waste residuals in the amount of 26 tons/day.
- Potential scaling and corrosion.
- The requirement for additional skilled operating personnel.
- Additional plant complexity, which would decrease the plant's reliability.

The FERC Staff has identified other concerns, which include saline, bacterial, and viral constituents of cooling tower drift; potential formation of bacterial slime; worker health hazards; and decreased thermal performance (Dames & Moore, 1986). FERC has also noted that, since the effluent would be diverted from its destination (the Blackstone River), the consumptive use would reduce the flow of the river in much the same way as would the direct use of river water. However, a positive impact to the river would also result due to the prevention of pollutants from entering the river.

Groundwater. Several potential groundwater sources were investigated, including the abandoned Town of Lincoln well field and new groundwater development. A well field would need to have a safe yield of 4.4 mgd or about 3,000 gallons per minute (gpm). These potential sources are discussed below.

The old well field for Lincoln was abandoned in 1979 because of solvent contamination. The source of contamination has apparently been eliminated, but

TABLE 2.1-12

Comparison of Water Quality Parameters[a] for Blackstone River and Typical Municipal WWTP Effluent

	Concentration (mg/l)	
Parameter	Blackstone River[b] (average)	Typical[c] WWTP Effluent
Calcium	14	15-40
Magnesium	2.3	15-40
Sulphate	58	15-30
Silica	4.8	6-15
Suspended Solids	19	30

[a] Parameters important for determination of recirculating water quality limitations.

[b] SOURCE: Bechtel Eastern Power Corporation, January 1987.

[c] SOURCE: Metcalf and Eddy, Inc., 1972

TABLE 2.1-13

Comparison of Costs for Using Water from Blackstone River and WWTP Effluents[a]

Capital Costs	Blackstone River	WWTP Effluents
Pipeline and Appurtenances	7.5	8.5
Pretreatment Facilities	2	6.82
Cooling System	6.5	6.5
Total	16	21.82
Annual Operating Costs		
Water Pretreatment	0.092	0.666
Pumping	0.269	0.290
Waste Disposal	0.053	0.390
Cost of Water	0	0
Cost of Efficiency Loss	0	0
Total	0.414	1.346

[a]Figures are for two 250 MWe Units and are expressed in million dollars.

SOURCE: Bechtel Eastern Power Corporation, January 1987.

the aquifer is still contaminated. The aquifer has been designated part of a Superfund site, and plans are underway to clean up the area (Letto, 1988). The Town of Lincoln now obtains its water from the Scituate Reservoir. The well field consists of three wells, which have a proven yield of 2.25 mgd. The wells are adjacent to the Blackstone River, and recharge to the aquifer is derived from induced infiltration from the river bottom (Halberg et al., 1961). There is direct hydraulic interconnection between the river and the aquifer, and pumping tests results indicate that the river is the primary source of aquifer recharge (Trudeau, 1988). The yield from the well field might be expanded to 4 mgd by the addition of three wells. The FERC Staff believes that such use would have a similar effect to direct withdrawals from the river.

The quality of the groundwater from this well field would be acceptable for power plant use after pretreatment if it were not for the contamination problem. Appurtenant facilities would include additional wells, a collection system and pump station, a pretreatment system, and about 15 miles of pipeline to the plant site. This potential source of water would not be a viable alternative at this time, at least until EPA completes the clean up of the solvent contamination problem.

A new well field could be constructed near Slatersville to provide 4.4 mgd. The wells would likely be in stratified glacial materials and be hydraulically connected to the Branch River surface waters. Water quality data is not widely available but it is anticipated that groundwater could be used for drinking water. Withdrawal of 4.4 mgd on a continuous consumptive use basis may cause "noticeable depletion of streamflow" because of the intimate relationship of groundwater and surface water (Johnson and Dickerman, 1974).

Appurtenant facilities would include construction of wells, a collection system and a pump station, pretreatment system, and about 4 miles of pipeline to the site. It would not appear that a well field near Slatersville would be an adequate full-time source of 4.4 mgd because of the expected impact on the Branch River system during low flow. The source might be suitable as a backup supply.

2.1.4.3.2 Onsite Reservoir

The proposed plan requires that the plant's daily water needs be provided on demand from the Blackstone River. An alternative would be to use an onsite reservoir for equalizing day-to-day pumping requirements, and to provide a backup source of cooling water for use during low streamflow conditions.

Siting a suitably sized reservoir in the immediate area of the proposed plant is limited by the hummocky terrain. Available space is limited to the low area to the east of the plant--bounded on the north by the Algonquin Gas Transmission Company right-of-way, on the east by residential properties along Douglas Pike, and on the south by properties along West Ironstone Road. This land could be recontoured and, with construction of an embankment and saddle dikes, developed into an approximately 30-acre reservoir. The impoundment could be constructed to contain a 30- to 35-day supply of plant feedwater, assuming an average 4-million-gpd plant requirement. Approximately one-quarter of the reservoir described would be in Massachusetts, with the remainder in Rhode Island. Limiting the reservoir to the Rhode Island side of the border would reduce its capacity to a 20- to 25-day supply.

Development of the reservoir would require clearing approximately 30 acres of existing forest, including about 10 acres of wetlands. The impact to wetlands should be considered a significant negative environmental impact. The additional woodland cleared would reduce the buffer area between the power plant and local residences and should be considered a negative impact. This is not considered to be a preferable alternative.

2.1.4.3.3 Dry Cooling Towers

An alternative to the proposed wet cooling system would be to use a closed-circuit dry cooling tower configuration. A dry cooling system would use fan-driven, air-cooled heat exchangers to remove heat from a closed-circuit system, thereby eliminating the need for an outside source of cooling water. The use of a dry cooling system would greatly reduce water requirements at the plant, though water is still required for boiler makeup, water injection to the turbines for NO_x emission control, and other miscellaneous plant uses.

Dry cooling systems are typically used in areas where an adequate supply of water is not available for plant cooling, or where significant adverse environmental effects are associated with the use of a wet cooling system. Hundreds of dry cooling systems are in operation throughout the world. The use of a dry cooling system for the OSP project would result in several advantages over the proposed wet cooling system, as detailed below:

- Dry cooling advantages

  - Complete elimination of the need for cooling water from the Blackstone River and the possible elimination of requirement for a water pipeline to Blackstone River. Plant water could be obtained from other locations, but a pipeline to those sources would still be required.
  - Onsite water treatment requirements would be greatly reduced.
  - No visible plume discharge from the dry cooling towers.
  - Elimination of the potential for plume fogging and icing.
  - No deposition of cooling water drift at any location.
  - Elimination of maintenance problems associated with equipment corrosion and deterioration in a wet environment.

The primary disadvantages of using dry cooling, as compared to the proposed wet cooling system, are summarized below:

- Dry cooling disadvantages

  - Much higher initial capital costs than comparable wet systems. The use of a dry cooling system for the OSP project would require an estimated additional $20.6 million (Bechtel Eastern Power Corporation, January 1987).
  - Annual operating costs approximately 1 percent higher as a result of increased back pressure on the turbines, resulting in an annual operating cost of approximately $3.2 million (Bechtel Eastern Power Corporation, January 1987). During relatively hot weather when electricity (and plant cooling) is needed most, power production can be expected to be reduced by approximately 5 percent due to poor cooling efficiency and a resulting significant increase in turbine back pressure.
  - Dry cooling towers are physically much larger than comparable wet cooling towers. The proposed wet mechanical draft towers are estimated to be approximately 42 feet high, with a total plan area for both phases of approximately 50,000 square feet.

According to one manufacturer, dry cooling towers with an equivalent heat dissipation rate are approximately 65 feet high and occupy a plan area similar in size to the area of the proposed wet towers. It is likely that the height of the dry cooling towers would make them more visible to area residents than the smaller wet cooling towers. (It should be noted, however, that the dry cooling towers need not be oriented in a linear arrangement like the wet towers. It is possible to arrange dry towers in a more compact matrix arrangement.)

- Greater offsite noise effects may occur since the dry cooling system requires more fans than the wet system (i.e., approximately 30 as opposed to 14 for the proposed system). The increased fan noise is expected to be at least partially offset by the elimination of noise associated with falling water in the wet towers.

Of the disadvantages listed above, several cannot be eliminated or mitigated--particularly initial cost, operating cost, and size. Issues such as noise may be minimized with engineering control techniques, though this would add considerably to the capital cost of the system.

The total cost of the wet and dry cooling system can be compared by summing the initial capital cost and the present value (PV) of the annual operating costs for each of these two alternatives. This comparison is presented below:

	Cooling System ($ million)	
	Wet	Dry
Capital cost	$16.0	36.6
PV Operating Costs[a]	3.8	33.0
Total Costs	19.8	69.6

[a]Assumes a 9 percent rate of interest and a 20-year plant life.

The 50-million-dollar increase in capital and operating costs associated with the use of a dry cooling system is significant for a plant with an initial projected cost of 300 million dollars.

It should be pointed out that, though most of the plant's water needs would be eliminated by the use of a dry cooling system, an offsite water supply would probably still be required for boiler makeup, water injection to the combustion turbines for NO_x control, and general plant use. These additional water requirements are estimated to be 0.8 mgd.

The decision to use a dry rather than a wet cooling system should depend on an economic optimization process that takes into account environmental benefits and pitfalls. The primary variables that should be considered in the economic optimization are:

- Capital cost differential.
- Relationship of the system capital cost to the initial temperature difference between the system coolant and the ambient air.
- Relationship of turbine performance to the cooling system initial temperature difference and ambient air temperatures (by season).
- Performance and cost penalties associated with operation of the turbine at higher back pressures (i.e., increased annual operating costs).
- Expected seasonal load distribution pattern.
- Operation and maintenance cost differentials.
- Cooling tower ground area requirements.
- Restricted operations due to low flow conditions.

Once the economic aspects of the dry cooling alternative have been accounted for, the environmental considerations that were previously discussed should also be considered and factored into the decisionmaking process.

The dry cooling alternative presents certain disadvantages for the Sherman Farm Road site, such as more noise and greater visibility of the cooling towers. Dry cooling would be more compatible with a larger site such as Ironstone where increased noise and size may not be significant impacts. Were dry cooling to be used at Sherman Farm Road, the reduced water requirements could be met by the Slatersville aquifer. The Staff's preferred route for the water pipeline would follow alternatives OP-1 and OP-5 from the plant site to the Slatersville Reservoir area.

2.1.4.3.4 Combination Wet/Dry Cooling

An additional alternative approach to plant cooling would be to use a combination wet and dry cooling system. This would be accomplished by using both wet and dry cooling towers, or by using a hybrid tower configuration with wet and dry heat exchanger sections in each tower.

The impact on the Blackstone River as a result of the withdrawal of 4 mgd of water is discussed in Section 4.1.2.1.2. The use of a combination wet/dry cooling system would decrease the demand on the river in proportion to the amount of dry cooling used at the plant. Table 2.1-14 illustrates the effects on river water demand for different wet/dry cooling configurations. The table illustrates that for the 7-day, 10-year low flow (7Q10) of 102 cfs, approximately 6 percent of the total river flow would be withdrawn for the wet cooling system, and approximately 3 percent would be withdrawn for the 50 percent dry cooling system.

The comparative cost and environmental impact of water withdrawal from the Blackstone River cannot be assessed. The configuration of a wet/dry cooling system is an investment and engineering issue which depends on the optimal percentage of wet versus dry cooling.

Use of such a system would permit OSP to retain some of the advantages (and disadvantages) of both systems. It would also allow additional flexibility in that the plant would not become completely inoperable in the event of a decrease in water availability from the Blackstone River. The cost to build and operate a wet/dry system would necessarily depend on the amount of dry cooling used at the plant. A sizeable disadvantage of a combination wet/dry cooling system is that such a combination would be an untested departure from proven systems and standard practice. Further consideration of such a system is thus felt to be inappropriate at this time.

2.1.4.3.5 Once-Through Cooling

The possibility of using a once-through wet cooling system was investigated and found not to be a feasible alternative primarily because of the lack of an available water supply to provide the massive quantities of water required. The proposed wet-cooling arrangement will require approximately 4 mgd. A similarly sized once-through system would require on the order of 200 mgd to avoid excessive thermal shock to the receiving stream or water body. By comparison,

TABLE 2.1-14

Plant Demand of Blackstone River Flow
Wet and Dry Cooling

Flow Condition	River Flow (cfs)[a]	Average Cooling Water Demand (%) 100% Wet Cooling	50% Dry Cooling
95% Exceedence Flow	135	4.6	2.3
7-Day, 10-Year Low	102	6.1	3.1
120-Day, 10-Year Low	161	3.9	2.0
Mean Annual Flow (Period 1929-1983)	765	0.8	0.4
Average Summer Mean Monthly Flow (Period 1951-1970)	274 (July)	2.3	1.4
Lowest Monthly Mean Low Flow (August 1966)	111	5.6	2.8
Minimum Flow of Record (1929-1985)	21	29.5	15.0

[a] Based on Blackstone River at Woonsocket gage, Rhode Island. Drainage area = 416 square miles.

SOURCE: Bechtel Eastern Power Corporation, January 1987.

this represents approximately twice the lowest monthly mean low flow of the Blackstone River.

2.1.4.3.6 Comparison of Environmental Impacts and Economics of Proposed and Alternative Cooling Systems

From an environmental and economic perspective, water withdrawal from the Blackstone River for wet cooling towers would result in acceptable impacts. Withdrawals from the Blackstone River would not significantly affect water quality nor impact the availability of drinking water. Withdrawals from the Branch River and onsite groundwater sources would cause serious environmental impacts due to water availability. Construction of an onsite reservoir would also result in negative environmental impacts, but they would be limited to the proposed OSP site. The availability of water from the Scituate Reservoir is in dispute and should therefore be considered a negative impact until the availability issue is resolved. However, the Scituate Reservoir is a primary source of drinking water, and withdrawals for cooling water would reduce the State's drinking water supply. The use of sewage treatment plant effluent from Woonsocket would be significantly more expensive than the proposed action due to treatment costs.

Air quality and socioeconomic impacts are not expected to be negatively impacted by any of these alternative cooling water sources. Negative impacts to terrestial ecology would occur only under the onsite reservoir alternative. Branch River withdrawals would cause the greatest aquatic impacts, while impacts from Blackstone River withdrawals are predicted to be minor and amenable to mitigation. Negative aquatic impacts should not occur under the other alternatives discussed.

Dry cooling, combination wet/dry cooling and once-through cooling were examined as alternatives to evaporative cooling. Negative environmental impacts would be greatest using once-through cooling due to the significant amount of water required. Dry cooling has both advantages and disadvantages over evaporative cooling, but these must be examined on a site-specific basis. If water is available for cooling and no prohibitive environmental impacts are associated with its use, wet cooling has significant engineering advantages over dry cooling. In addition, the economic cost of wet cooling is significantly less than dry cooling. Combination wet/dry cooling may also be a viable alternative for the OSP project.

The additional flexibility introduced by the combination system may be a significant advantage if a lack of water availability under low flow conditions might disrupt power plant operations. It is difficult to assess the likelihood of power plant shutdowns due to low flow conditions since no limits have been officially placed on OSP withdrawals.

2.1.4.4 Alternative Air Pollution Control Equipment

The emission control equipment proposed for the OSP project was evaluated to ensure that it is representative of best available control technology (BACT), as defined by EPA (Section 4.1.3.1). The BACT analysis was performed in partial fulfillment of PSD regulations. This analysis is summarized in detail in OSP's PSD permit application report (Bechtel Eastern Power Corporation, March 1987a) and in a supporting document (Environmental Research & Technology, 1987).

The BACT evaluation included investigation of the most stringent alternative emissions control technologies available, including flue gas treatment. Based on this evaluation, OSP believes that add-on control systems, such as selective catalytic reduction for NO_x control and catalytic oxidation for CO control, do not represent BACT for the planned project and offer no significant environmental advantage over the proposed action. Rhode Island Department of Environmental Management regulatory review of air emissions from the proposed facility would include a determination of the appropriateness of OSP's proposed control technologies.

2.1.4.5 Alternative Oil and Water Pipeline Routes

The proposed and alternative oil and water pipelines are routed to parallel existing road, railroad, gas, or electric transmission line rights-of-way and are estimated to require a maximum construction width of 75 feet. The preferred routes would minimize construction impacts to wetlands and residences and minimize the length of pipeline required. Table 2.1-15 lists the National Wetland Inventory wetlands (as delineated on USFWS maps) crossed by the proposed and alternative water and oil pipeline routes. Five alternative routes replacing all or portions of the proposed route are described below and shown on Figure 2.1-9. Table 2.1-16 presents a comparison of the proposed and alternative water and oil pipeline routes.

TABLE 2.1-15

Wetlands Affected by Proposed and Alternative Oil and Water Pipeline Routes

Pipeline Section	Wetland Name (Description)	Source		Class	Approximate Distance Crossed (ft)	Approximate Acreage Affected During Construction	Approximate Acreage Affected During Operation
		Fed	State				
Proposed Water Pipeline Route	R2OW (riverine, lower perennial, open water/unknown bottom)	X			100	0.2	0.1
Proposed Combined Water and Oil Pipeline Route	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			250	0.4	0.3
	PF01E/SS (palustrine, forested, broad-leaved deciduous, estuarine-over-scrub/shrub)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			200	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			200	0.3	0.2
Alternative OP-1 (Combined Oil/Water Pipeline Route)	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	PSS1E (palustrine, scrub/shrub, broad-leaved deciduous, seasonal saturated)	X			100	0.2	0.1
	PSS1E (palustrine, scrub/shrub, broad-leaved deciduous, seasonal saturated)	X			200	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			875	1.5	1.0
	PF01 (palustrine, forested, broad-leaved deciduous)	X			225	0.4	0.3
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
Alternative OP-2 (Oil Pipeline Route)	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			150	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			200	0.3	0.2
Alternative OP-3 (Oil Pipeline Route)	PF01 (palustrine, forested, broad-leaved deciduous)	X			400	0.7	0.5

TABLE 2.1-15 (cont'd)

Pipeline Section	Wetland Name (Description)	Source Fed	Source State	Class	Approximate Distance Crossed (ft)	Approximate Acreage Affected During Construction	Approximate Acreage Affected During Operation
Alternative OP-4 (Water Pipeline Route)	PSS1 (palustrine, scrub/shrub, broad-leaved deciduous)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	PSS1/EM (palustrine, scrub/shrub, broad-leaved-over-emergent)	X			150	0.3	0.2
	POW (palustrine, open water/unknown bottom)	X			150	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	POW (palustrine, open water/unknown bottom)	X			150	0.3	0.2
	LIOW (lacustrine, limnetic, open water/unknown bottom)	X			200	0.3	0.2
	POW (palustrine, open water/unknown bottom)	X			200	0.3	0.2
	LIOW (lacustrine, limnetic, open water/unknown bottom)	X			150	0.3	0.2
	LIOW (lacustrine, limnetic, open water/unknown bottom)	X			100	0.2	0.1
Alternative OP-5 (Combined Oil/	PF01 (palustrine, forested, broad-leaved deciduous)	X			50	0.1	0.1
Water Pipeline Route)	PSS1E (palustrine, scrub shrub, broad-leaved deciduous, seasonal saturated)	X			100	0.2	0.1
	PF01E (palustrine, forested, broad-leaved deciduous, seasonal saturated)	X			100	0.2	0.1
	PF01E (palustrine, forested, broad-leaved deciduous, seasonal saturated)	X			100	0.2	0.1
	PF01/4 (palustrine, forested, broad-leaved deciduous-over-needle-leaved evergreen)	X			1040	1.8	1.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1

TABLE 2.1-16

Comparison of Proposed and Alternative Oil and Water Pipeline Routes

	Alternative OP-1 (oil and water pipeline)		Alternative OP-2 (oil pipeline)		Alternative OP-3 (oil pipeline)		Alternative OP-4 (water pipeline)		Alternative OP-5 (oil and water pipeline)	
	Proposed Route	Alternative Route[a]	Proposed Route	Alternative Route[a]	Proposed Route	Alternative Route[a]	Proposed Route	Alternative Route[a]	Proposed Route	Alternative Route[a]
Alignment Length	22,600[b]	21,700[b]	38,000[c]	20,100[c]	38,000[c]	15,300[c]	30,140[d]	25,157[d]	20,850[e]	19,800[e]
Acreage Affected[f]	39	37.4	65.4	34.6	65.4	26.3	52	43.3	35.9	34.1
Wetlands Affected[g] (number/ length (ft.)	5/850	6/1,600	5/850	3/450	5/850	1/400	1/100	10/1,400	5/850	6/1,490

[a] See Figure 2.1-9.

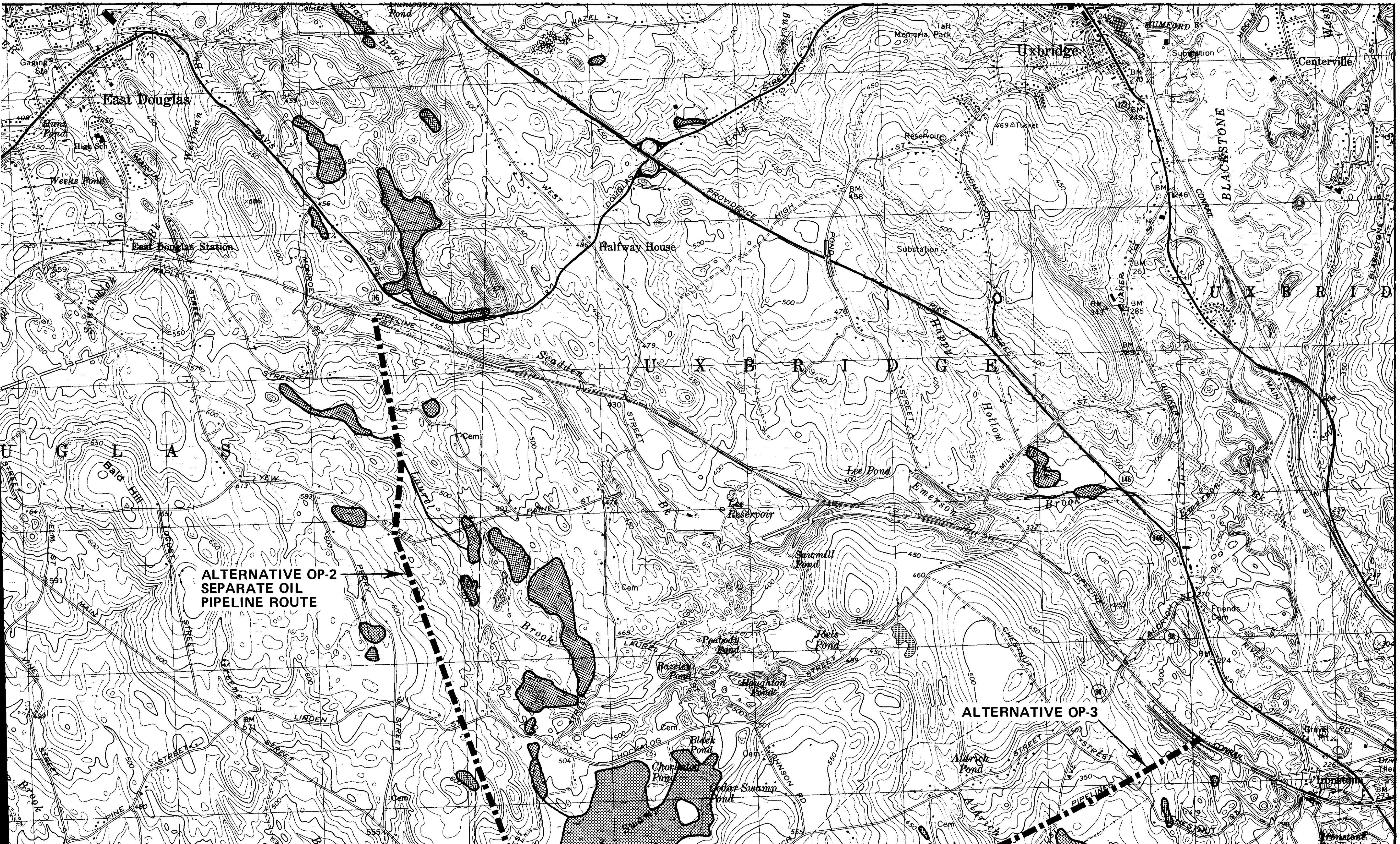
[b] Approximate length from divergence from proposed route at State Route 102 to proposed OSP site.

[c] Approximate length from intersection with Mobil Oil pipeline to proposed OSP site.

[d] Approximate length from Blackstone River intake to the point where OP-4 intersects the proposed route at State Route 102.

[e] Approximate length from divergence from proposed route at State Route 102, to intersection with proposed route at West Ironstone Road.

[f] Assumes a construction right-of-way of 75 feet.



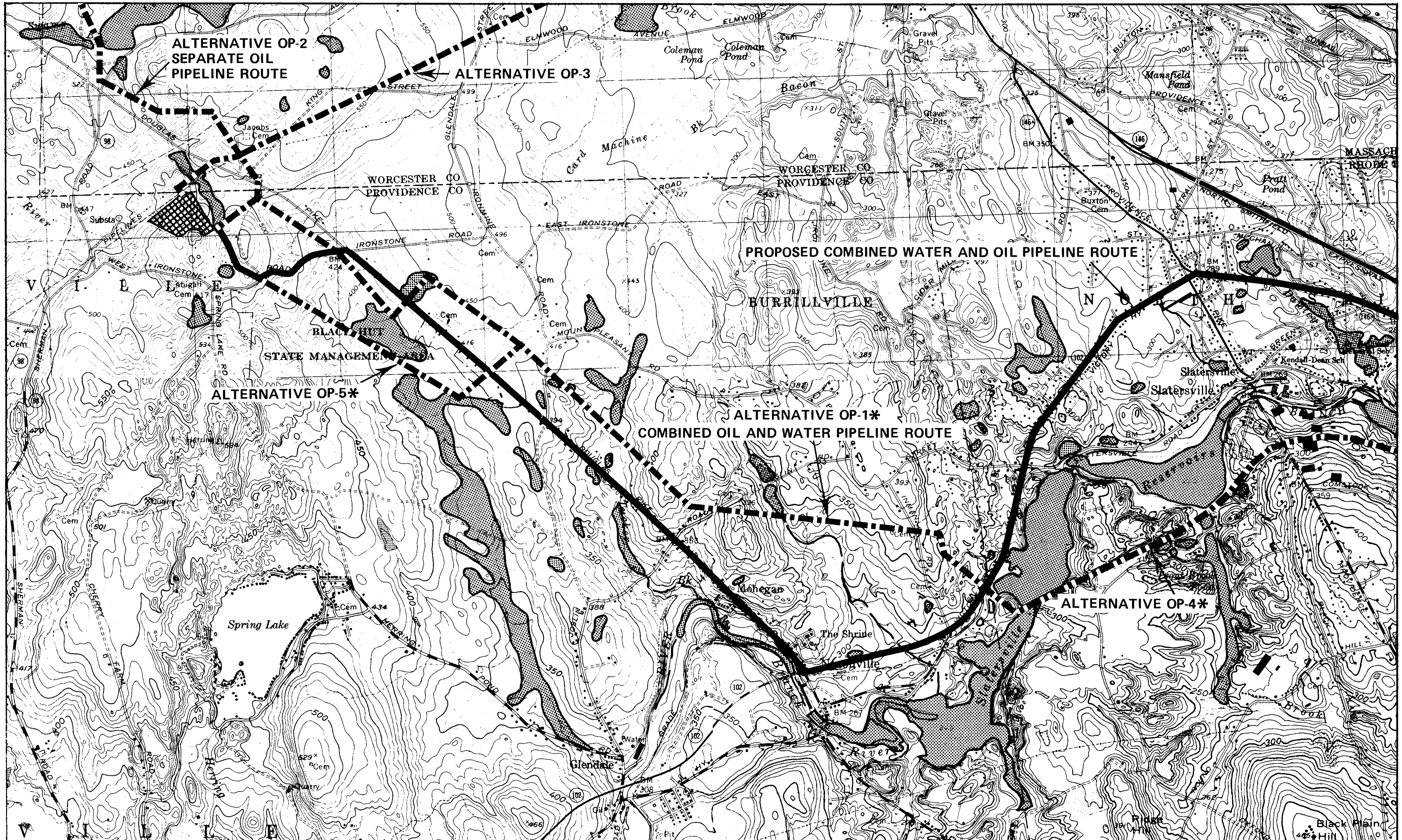
FEDERAL WETLAND

0 ½ 1 Mile

NOTE: A complete understanding of alternative pipeline routings requires using both this graphic representation and the text discussion.

BASE MAP SOURCE: U.S.G.S. 7½′ Quads: Uxbridge, Mass.; Blackstone, Mass.; 1979.

FIGURE 2.1-9
WETLANDS ALONG ALTERNATIVE AND PROPOSED OIL AND WATER PIPELINE ROUTES



Base Map Source: U.S.G.S. 7½′ Quads: Uxbridge, Mass., Blackstone, Mass., R.I., Georgiaville, Mass., R.I., 1979.

FIGURE 2.1-9. Cont'd.
WETLANDS ALONG ALTERNATIVE AND PROPOSED OIL AND WATER PIPELINE ROUTES

0 ½ 1 Mile

Scale (1:25,000)

FEDERAL WETLAND

* Route Preferred by FERC Staff

Base Map Source: U.S.G.S. 7½′ Quads: Blackstone, Mass., R.I., 1979.

FIGURE 2.1-9, Cont'd.
WETLANDS ALONG ALTERNATIVE AND PROPOSED OIL AND WATER PIPELINE ROUTES

An alternative route to the proposed alignment of the water and oil pipelines begins northeast of Nasonville (OP-1). The pipelines would follow the proposed route to the transmission line crossing of Route 102 between Buxton Street and Inman Road. They would then follow the transmission line right-of-way and the proposed route for the Rhode Island Extension continuation, entering the proposed Sherman Farm Road site from the south-southeast after crossing West Ironstone Road. This alternative route would cross one additional wetland, but it avoids placement of the pipelines along Douglas Pike. Residences are close to Douglas Pike to the north, and the land grade drops off sharply to the south. The alternative route also avoids impacts to traffic and eliminates effects on residents along the pike.

Another alternative route (OP-2) would be for the water pipeline to follow the route discussed above, while the oil pipeline would enter the site along the same right-of-way as the proposed Tennessee Gas pipeline. The Mobil Oil pipeline would be tapped at Douglas, Massachusetts at the point where Tennessee's Rhode Island Extension would cross it. The delivery pipeline would follow the proposed gas pipeline route from this point to the Sherman Farm Road site. Connection to the Mobil Oil pipeline in Douglas would require only about 3.8 miles of oil pipeline and may require a new tap and valve station. Metering could occur at the Douglas location or at the Sherman Farm Road site. The advantage of this alternative is that it would require a shorter oil pipeline than the proposed route, would affect two fewer wetlands, and it could possibly be constructed at the same time as the gas pipeline.

A third alternative (OP-3), raised by the Massachusetts Energy Facilities Siting Council staff, would be to tap into the Mobil Oil pipeline at its intersection with Algonquin's pipeline, about 0.6 miles northwest of Ironstone, Massachusetts. The oil delivery pipeline to Sherman Farm Road would then parallel Algonquin's pipeline to the plant site. The advantage of this alternative is that it would parallel an existing right-of-way, would affect four fewer wetlands than the proposed route, and would be only about 2.8 miles long. While the FERC Staff believes that either OP-2 or OP-3 would be preferable alternatives to the proposed oil pipeline route, the Staff is recommending the OP-1/OP-4/OP-5 alternative route discussed below, because of the advantages of constructing both the oil and water pipelines in the same trench.

The Town of North Smithfield, Rhode Island has suggested an alternative water pipeline route (OP-4) that would cross a number of small wetlands adjacent to the railroad bed, but eliminate much of the pipeline construction along city streets that would be required for OSP's proposed route. The route proposed by OSP includes several heavily traveled streets--South Main Street in Woonsocket, Great Road (Route 146A), and Victory Highway (Route 102).

Alternative OP-4 would start at OSP's proposed water intake structure on the Blackstone River, then follow Sayles Street in Woonsocket west to the Providence and Worcester Railroad right-of-way. The rail spur line services industries in the North Smithfield area and the right-of-way is approximately 100 feet in width. The water pipeline would follow the rail spur to its terminus at Route 5 (Providence Pike) in North Smithfield. It would be buried over most of its length and suspended under the railroad bridge at Route 146. Although the right-of-way is about 100 feet, there are numerous encroachments along the route from streets and utility easements; there are terrain problems such as steep slopes and wetlands (see discussion below). A preliminary reconnaissance of the route in May 1988 indicated that locating a water line along the right-of-way should be possible. Most of the route appears to be constructable within the right-of-way; a few private easements may also be needed. Alternative OP-4 and the Blackstone Linear Park will only approximate each other in two places: along the beginning of the route near the intake structure and near Slatersville reservoir. A deviation from the railroad to along local streets would be required to avoid the rock cut at the Route 146A Bridge over the railroad.

West of the Route 5 terminus of the railroad, pipeline alternative OP-4 would generally follow an abandoned railroad right-of-way (not associated with the Providence and Worcester Railroad). This portion of the route would cross the outlet of Trout Brook Pond into Slatersville Reservoir, then continue on the abandoned right-of-way.

The route would then follow the right-of-way westward alongside an existing sand and gravel operation. There appears to be other utility easements in this portion of the right-of-way. An underwater crossing would be required at Slatersville Reservoir as the rail bridge has been removed. At the Slatersville Reservoir crossing, the route intersects a transmission line right-of-way; the pipeline would parallel the transmission line northward. North of Route 102, alternative OP-4 is identical to alternative OP-1 discussed above.

West of Route 5, alternative OP-4 has the advantage that the route would generally follow an existing railroad right-of-way. However, the railroad line has been abandoned for many years and ownership of much of the abandoned right-of-way is unclear.

Overall, OP-4 appears technically feasible and has some advantages over OSP's proposed route. Staff prefers OP-4 over the proposed route and urges OSP to consider using all or part of OP-4 to reduce impacts along local streets and roads.

The fifth alternative (OP-5) diverges from the proposed oil and water pipeline route along State Route 102 to follow the transmission line right-of-way through the Black Hut State Management Area to its intersection with West Ironstone Road. Use of the existing right-of-way is conditionally acceptable to the Rhode Island Department of Environmental Management's Division of Fish and Wildlife (RIDEM, May 4, 1988-attached as Appendix G) rather than cutting a new right-of-way through the area. FERC Staff believes that OP-5 would also be a preferable alternative to the proposed route.

The FERC Staff's preferred alternative for the oil pipeline is OP-3 because it is the shortest route, parallels an existing pipeline right-of-way, and would result in minimal impact on wetlands, road traffic, and residences.

The FERC Staff's preferred alternative for the water pipeline is the route that consists of: OP-4 (between the Blackstone River intake and the Slatersville Reservoir crossing) and OP-1 (from Slatersville Reservoir to the plant site along the power line, OP-5 inclusive). Such a route maximizes the use of existing utility corridors and would minimize impact on road traffic, residences, and areas of historic significance. The Staff's preferred alternative is also about 6,000 feet shorter than the proposed route.

An alternative to using an oil pipeline route would be to truck No. 2 fuel oil to the site. Operation of the power plant at 100 percent load factor would require approximately 20,700 barrels of oil per day. Gas supply interruptions of up to approximately 6 days could be accommodated by the 120,000 barrels of fuel oil stored in 4 onsite tanks. Longer interruptions would require that the onsite supply be replaced at the 20,700 barrels per day rate. Assuming that a tank truck would transport the equivalent of approximately 200 42-gallon barrels, OSP would require over 100 tanker loads per day. This amounts to approximately four trucks per hour over a 24-hour period, or eight trips (to and from the plant) per hour on Sherman Farm Road. Impacts to local residents would include increased traffic congestion, noise, and the possibility of an accident resulting in an oil spill. This truck traffic could be accommodated without significant impact to local residents for only a brief period of time. Construction of an oil pipeline would therefore create significantly fewer and less severe socioeconomic and environmental impacts than transportation of the backup fuel by truck.

2.1.5 Alternative Site Study

The purpose of the alternative site study is to identify sites other than the applicant's and to systematically and without bias evaluate their environmental and economic suitability for location of the subject power plant. A FERC Staff report is available upon request that provides further technical data and support for the evaluation discussed below. The document entitled Staff Report-Alternative Site Analysis is Appendix D to the EIS.

2.1.5.1 Site Identification and Evaluation Process

The site evaluation process starts with the identification of sites. Eighty-two sites were identified by OSP, interested parties, and the FERC Staff. Although some of the sites were examined in more detail than others, each received the same initial review. Sites were examined in Rhode Island and south-central Massachusetts because of the lack of generating capacity near the large power demand in the Providence Metropolitan Area. Additional sites were considered in the Springfield, Massachusetts area. Figure 2.1-10 presents an overview of the evaluation process.

After identification, the sites were submitted to a suitability screen consisting of two parts--a "fatal flaw" analysis and a compatibility analysis:

- The fatal flaw analysis refers to any site characteristic that renders the site unusable. For example, a site in a national park cannot be used. Fatal flaws can refer to a multitude of characteristics, but they are usually regulatory in nature.
- Site compatibility means that a site has at least the amount of land required by the plant, the ability to tie the plant into the regional transmission line system, and the ability to supply the plant with fuel and cooling water at the site.

The suitability screen narrows the number of sites that must be examined. The sites with the fewest number of apparent problems are chosen for further evaluation and are called "possible sites". While any of these possible sites may be suitable for the power plant, they are not equal; on further examination, some will be found to have problems that eliminate them from further consideration.

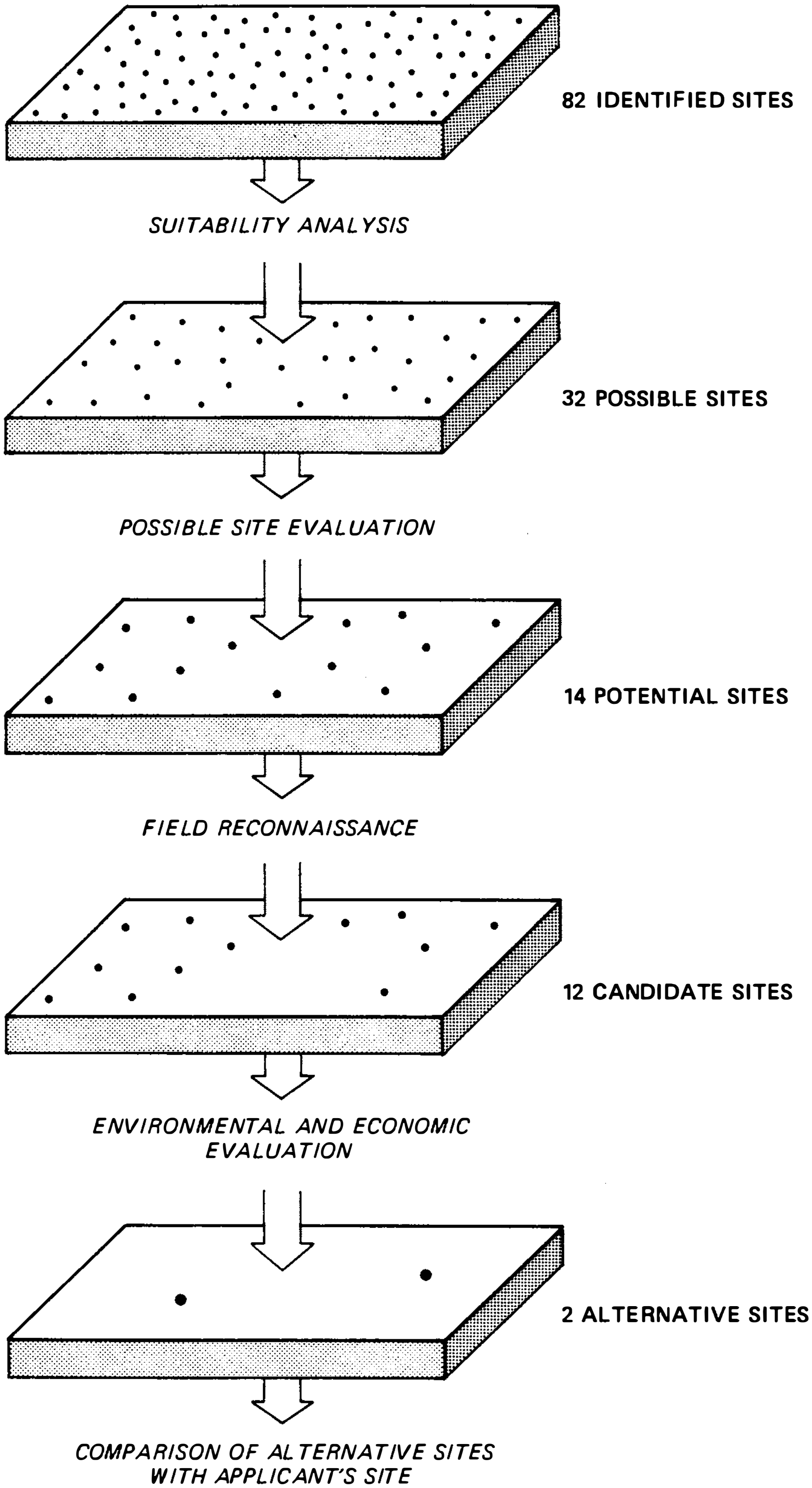


FIGURE 2.1-10
ALTERNATIVE SITE IDENTIFICATION AND EVALUATION PROCESS

The possible sites are screened on the basis of likely environmental effects. The potential environmental effects are grouped into a number of related issues that are evaluated by means of a three-point ordinal scale, with divisions of (+), ( ), and (-).

The (+) rating means that the site has favorable characteristics with respect to environmental effects. This judgment means that there is little likelihood that the plant and its accompanying facilities would have serious negative impacts on the surrounding area; for example, the nearby land use may be industrial, or the ecology of the area may already have been disturbed.

A ( ) rating means that the area is likely to experience some negative effects due to the plant, but that these are not of significant magnitude to constitute damage. For example, the land cover in the area may be very common throughout the region, and its removal at the site would not significantly affect the habitat of species in the region.

A (-) rating means that negative effects of some significance are likely to occur.

The criteria used to establish the ratings of (+), ( ), and (-) must be applicable to all sites and be applied in an even and unbiased manner. This means that the criteria must be based on information that is available for each of the possible sites.

Once the possible site evaluation is complete and the ratings applied, the sites can be compared. Those with the least likelihood of inducing negative effects are chosen for further analysis. These sites are called "potential sites."

Evaluation of the potential site requires a site reconnaissance to collect new data on site characteristics and to confirm information obtained during the evaluation of possible sites. As a result of the analysis following site reconnaissance, some of the potential sites may be dropped from consideration. The remaining sites are referred to as "candidate sites."

Any of the candidate sites could be developed as a power plant site. None should have major environmental limitations. However, this does not mean that the candidate sites are equivalent. They will vary in terms of environmental sensitivity as well as cost. The candidate sites are examined for land use compatibility, cooling water sources, gas pipeline routing, access, and incremental costs. The cost evaluation focuses on the cooling water, gas pipeline, and transmission line costs associated with each specific site.

After evaluation of the candidate sites, alternative sites are selected and compared with the applicant's site. This comparison is made on the same basis as discussed above for candidate sites. Additional information on the applicant's site and the alternative sites is considered in this final evaluation process.

Appendix D provides additional informations on sites evaluated and on the specific application of criteria used to determine site suitability at the potential and candidate site phases.

2.1.5.2 Site Identification

Three separate efforts by three groups--OSP, the FERC Staff, and interested parties--have identified sites for the combined-cycle power plant. Table 2.1-17 lists the names of the identified sites and their general locations, and gives the sources of site identifications. Figure 2.1-11 shows the locations of identified sites.

OSP identified a number of sites in its alternative site study. However, these sites are subject to a major limitation--OSP does not have the power of eminent domain. Since OSP cannot condemn land for a plant, the land must be available through either lease or purchase. This limitation imposes some realistic restrictions on OSP--one is that the sites identified should have a strong likelihood of being available for purchase (i.e., an industrial park or land on which an abandoned facility is located); the other is that the transmission line corridors should be relatively short to minimize land requirements. These two limitations are reflected in the sites identified by OSP, which were chosen in the following ways:

- Review of sites identified in previous studies for OSP member utilities.
- Review of industrial sites in Rhode Island.
- Review of tax assessor maps and zoning for the Towns of Uxbridge and Douglas.

OSP performed site reconnaissances to confirm that the sites identified were vacant and still likely to be available.

TABLE 2.1-17

Identified Sites

Name of Site	Source of Identification	Town/State
AES	IP[a]	Woonsocket, RI
Abbott Run	OSP	Cumberland, RI
Agawam A	OSP	Agawam, MA
Agawam 2	OSP	Agawam, MA
Albion Road	OSP	Cumberland, RI
Auction House	IP	Uxbridge, MA
Bear Hill Road	OSP	Cumberland, RI
Berry Spring	FERC	Pawtucket, RI
Branch River Industrial Park	OSP, IP	North Smithfield, RI
Bronco Highway	FERC	Burrillville, RI
Bryant College	FERC	Smithfield, RI
Buck Hill Road	OSP	Burrillville, RI
Burrillville Industrial Park	OSP, IP	Burrillville, RI
Concord Street	FERC	Pawtucket, RI
Cumberland Industrial Park	FERC	Cumberland, RI
Dart Industries	OSP	North Smithfield, RI
Diamond Hill Road	FERC	Cumberland, RI
Digital Property	FERC	Coventry, RI
Douglas Woods	OSP	Douglas, MA
East Bay Industrial Park	FERC	Bristol, RI
Frenchtown Road 1	FERC	East Greenwich, RI
Frenchtown Road 2	FERC	East Greenwich, RI
Grotto Avenue	FERC	Pawtucket, RI
Halfway House	OSP	Uxbridge, MA
Harkney Hill Road	FERC	Coventry, RI
Haswell Street	FERC	Providence, RI
Hedley Street	FERC	Portsmouth, RI
Highland Industrial Park	FERC	Woonsocket, RI
High Street	FERC	Central Falls, RI
Hopkins Hill	FERC	West Greenwich, RI
Houghton Street	FERC	Providence, RI
Howard Industrial Park	FERC	Cranston, RI
Indian Corner Road	FERC	North Kingstown, RI
I-295 Industrial Park	FERC	Smithfield, RI
Ironstone	OSP, IP	Uxbridge, MA

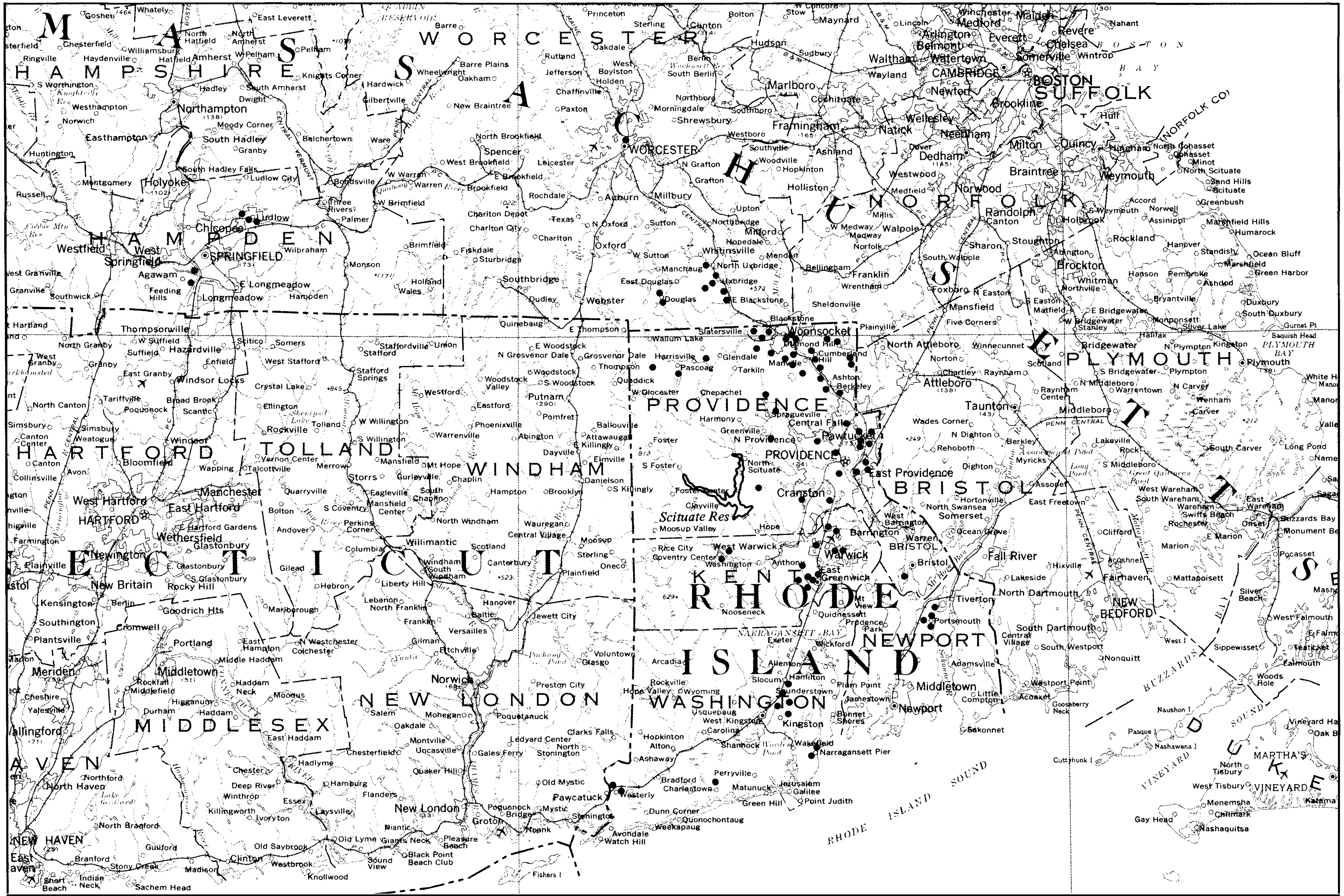
[a]IP = interested party.

TABLE 2.1-17 (cont'd)

Name of Site	Source of Identification	Town/State
Kilvert Street	FERC	Warwick, RI
Kings Factory Road	FERC	Richmond, RI
Knight Street	FERC	Warwick, RI
Lark Industrial Park	FERC	Smithfield, RI
Liberia Street	FERC	Cranston, RI
Ludlow 3	OSP	Ludlow, MA
Ludlow 4	OSP	Ludlow, MA
Metals Processing Facility	IP	East Providence, RI
Metrocenter Boulevard	FERC	Warwick, RI
Middle Road (Rt. 2/Middle Rd.)	FERC	East Greenwich, RI
Monroe Street	OSP	Douglas, MA
Narragansett Park Drive	FERC	Pawtucket, RI
New England Way 1	FERC	Lincoln, RI
New England Way 2	FERC	Lincoln, RI
New London	FERC	West Greenwich, RI
Newport Avenue	FERC	Pawtucket, RI
North Central Industrial Park	FERC	Lincoln, RI
North Smithfield 2	OSP	North Smithfield, RI
North Street	OSP	Douglas, RI
Owens-Corning	OSP, IP	Cumberland, RI
Portsmouth Industrial Park	FERC	Portsmouth, RI
Post Road	FERC	North Kingstown, RI
Quaker Road	IP	Uxbridge, MA
Quonsett Point	FERC	North Kingstown, RI
Rocky Hill (Rt. 116/I-295)	FERC	Smithfield, RI
Route 100/South Main Street	FERC	Burrillville, RI
Route 102/I-95	FERC	West Greenwich, RI
Sacred Heart	OSP	Burrillville, RI
Smithfield Avenue	FERC	Providence, RI
South Ferry Industrial Park	FERC	Narragansett, RI
South Ferry Road	FERC	Narragansett RI
Springham Road	FERC	Portsmouth, RI
Steel Street	FERC	North Smithfield, RI
Stilson Road	FERC	Richmond, RI
Stony Brook	IP	Ludlow, MA

TABLE 2.1-17 (cont'd)

Name of Site	Source of Identification	Town/State
Tracy Hill (Rt. 44/I-295)	FERC	Smithfield, RI
United Nuclear	IP	Charleston, RI
U.S. Steel	IP	Worcester, MA
Uxbridge Substation	IP, OSP	Uxbridge, MA
Valley Falls	OSP	Cumberland, RI
Warren Ave./Rt. 6	FERC	East Providence, RI
Warwick Airport Road	FERC	Warwick, RI
West Cranston Industrial Park	FERC	Cranston, RI
West Main Street/Rt. 144	FERC	Portsmouth, RI
Westerly Airport Road	FERC	Westerly, RI
Westerly Industrial Park	FERC	Westerly, RI
Woonsocket WWTP	OSP	Woonsocket, RI



Base Map Source: U.S.G.S. 1:500,000 Quad, Mass., R.I. & Conn., 1971.

0 10 20 Miles

FIGURE 2.1-11
IDENTIFIED SITES

During the scoping process, interested parties identified a number of alternative sites, many of which were close to the applicant's sites. The FERC Staff investigated all sites identified by interested parties to determine their locations, and these sites were evaluated on the same basis as all others.

The FERC Staff also identified a number of sites using the Rhode Island Department of Economic Development's technical paper for land zoned "industrial" (State of Rhode Island, October 1986). The proximity of cooling water sources and fuel supply pipelines was not considered in FERC's identification of sites. The cooling water pipeline could use existing rights-of-way, and the fuel pipeline could use upgraded, existing pipelines. These factors enter into the screening process.

As a result of the three site identification efforts, 82 sites were identified--17 by OSP, seven by interested parties, and 53 by the FERC Staff. Five sites were identified by more than one party. Although all 82 sites were considered as possible sites, they are not all necessarily suitable.

2.1.5.3 Suitability Analysis

The suitability analysis examines each site to determine the feasibility of building a combined-cycle plant. There are several considerations in deciding whether a site is feasible, including problems of a "fatal flaw" nature and practical limitations.

Fatal flaws, as used in this analysis, are problems with a tract that preclude its use as a plant site--regardless of how attractive it may be from engineering, economic, and environmental perspectives. There is no set definition of fatal flaws; they are considered on a case-by-case basis. Fatal flaws can include characteristics of a site that would prevent the applicant from obtaining the necessary permits, or they might be associated with liability considerations at the property (e.g., land contaminated by hazardous wastes) or government policy (e.g., a state or Federal agency having classified the site as inappropriate for a power plant).

Practical or "reality" limitations refer to the physical or economic restrictions of the site. The power plant requires about 40 acres, including areas for the turbines, ancillary facilities (transformers, transmission line, parking lots, storage buildings), and a buffer zone between the turbine generators and the nearest offsite land uses. Sites with less than 35 acres are not considered--there is simply not enough space for the design flexibility needed to minimize potential effects. Sites with 35 to 40 acres are considered on an individual basis.

The distance to the 345-kV transmission line is an important consideration. A cutoff distance of 10 miles was chosen for two reasons:

- A new transmission line corridor (with a 250-foot-wide right-of-way) for 10 miles affects 300 acres, almost eight times the area required by the plant itself. Each mile beyond 10 adds another 30 acres to the amount of land affected. Further, since many sites are within 10 miles of the 345-kV transmission line grid, it is unnecessary to go beyond this area.
- Problems of obtaining rights-of-way become greater with a longer transmission line corridor, especially since OSP lacks eminent domain.

The transmission line limitation is severe in terms of environmental effects and acquisition difficulty.

2.1.5.4 Possible Site Identification

Table 2.1-18 presents data for each of the 82 identified sites. Of the sites, 32 do not have any problems that would prohibit their use. Most of the eliminated sites are inappropriate because of size (33 sites) or lack of proximity to transmission lines (15 sites). Table 2.1-19 lists sites that must be examined further, and Figure 2.1-12 shows their locations.

The sites listed in Table 2.1-19 are to be considered possible sites. Each can accommodate a combined-cycle power plant, and there are no obvious reasons why any of the sites cannot be used. However, the sites are not the same in terms of environmental sensitivity and some may have undetected problems.

2.1.5.5 Possible Site Evaluation

Evaluation of the possible sites is performed by analyzing environmental issues which include: land use, wetlands, surface water, ecology, air quality, cooling water pipeline, and transmission line effects. For each issue, criteria are prepared to classify the sites into the (+), ( ), and (-) categories discussed in Section 2.1.5.1. The criteria are based on the potential effects of the plant on the surrounding environment. The measures of potential effects used are surrogates; for example, the number of houses within a 0.5-mile radius of the site provides a

TABLE 2.1-18

Suitability Analysis to Determine Possible Sites

Site Name	Available Land (acres)	Within 10 Miles of 345-kV Grid	Possible Site	Evaluation
AES	15-20	yes	--	Not available for plant site
Abbott Run	35-40	yes	X	Marginal area
Agawam A	35-40	yes	X	Marginal area
Agawam 2	40	yes	X	
Albion Road	50	yes	X	
Auction House	25	yes	--	Insufficient area
Bear Hill Road	35-40	yes	X	
Berry Spring	0[a]	yes	--	Industrial park filled
Branch River Industrial Park	55	yes	X	
Bronco Highway	10-15	yes	--	Insufficient area
Bryant College	50	yes	X	
Buck Hill Road	80	yes	X	
Burrillville Industrial Park	50	yes	X	
Concord Street	30-35	yes	--	Insufficient area
Cumberland Industrial Park	30	yes	--	Insufficient area
Dart Industries	35-40	yes	X	Marginal area
Diamond Hill Road	20	yes	--	Insufficient area
Digital Property	135	no	--	Transmission line too distant
Douglas Woods	560	no	--	Transmission line too distant
East Bay Industrial Park	90	yes	X	
Frenchtown Road 1	0[a]	yes	--	Insufficient area
Frenchtown Road 2	0[a]	yes	--	Insufficient area
Grotto Avenue	0[a]	yes	--	Insufficient area
Halfway House	115	yes	X	
Harkney Hill Road	30-35	no	--	Transmission line too distant

TABLE 2.1-18 (cont'd)

Site Name	Available Land (acres)	Within 10 Miles of 345-kV Grid	Possible Site	Evaluation
Haswell Street	0[a]	yes	--	Insufficient area
Hedley Street	40	no	--	Transmission line too distant
Highland Industrial Park	90	yes	X	
High Street	5	yes	--	Insufficient area
Hopkins Hill	0[a]	yes	--	Insufficient area
Houghton Street	20	yes	--	Insufficient area
Howard Industrial Park	165	yes	X	
Indian Corner Road	1,300	yes	X	
I-295 Industrial Park	63	yes	X	
Ironstone	200	yes	X	
Kilvert Street	20	yes	--	Insufficient area
Kings Factory Road	10-15	no	--	Insufficient area; transmission line too distant
Knight Street	0[a]	yes	--	Insufficient area
Lark Industrial Park	15-20	yes	--	Insufficient area
Liberia Street	0[a]	yes	--	Insufficient area
Ludlow 3	50	yes	X	
Ludlow 4	50	yes	X	
Metals Processing Facility	30	no	--	Transmission line too distant
Metrocenter Boulevard	50	yes	X	
Middle Road (Rt. 2/Middle Rd.)	0[a]	yes	--	Insufficient area
Monroe Street	70	yes	X	
Narragansett Park Drive	0[a]	yes	--	Insufficient area
New England Way 1	5	yes	--	Insufficient area
New England Way 2	15	yes	--	Insufficient area
New London	100	no	--	Transmission line too distant
Newport Avenue	45-50	yes	X	
North Central Industrial Park	30	yes	--	Insufficient area
North Smithfield 2	10-15	yes	--	Insufficient area
North Street	95	yes	X	
Owens-Corning	12	yes	--	Superfund site; insufficient area

TABLE 2.1-18 (cont'd)

Site Name	Available Land (acres)	Within 10 Miles of 345-kV Grid	Possible Site	Evaluation
Portsmouth Industrial Park	40	no	--	Transmission line too distant
Post Road	0[a]	yes	--	Insufficient area
Quaker Road	110	yes	X	
Quonsett point	350	yes	X	
Rocky Hill (Rt. 116/I-295)	5	yes	--	Insufficient area
Route 100/South Main Street	25	yes	--	Insufficient area
Route 102/I-95	350	no	--	Transmission line too distant
Sacred Heart	300	yes	X	
Smithfield Avenue	0[a]	yes	--	Insufficient area
South Ferry Industrial Park	70	no	--	Transmission line too distant
South Ferry Road	29	no	--	Insufficient acreage
Springham Road	70	no	--	Transmission line too distant
Steel Street	16	yes	--	Insufficient area
Stilson Road	45	no	--	Transmission line too distant
Stony Brook	470	yes	X	
Tracy Hill (Rt. 44/I-295)	116	yes	X	
United Nuclear	1,100	no	--	Transmission line too distant
U.S. Steel	10-15	yes	--	Insufficient area available
Uxbridge Substation	60	yes	X	
Valley Falls	49	yes	X	
Warren Ave./Rt. 6	25	yes	--	Insufficient area
Warwick Airport Road	54	yes	X	
West Cranston Industrial Park	200		X	
West Main Street/Rt. 144	100	no	--	Transmission line too distant
Westerly Airport Road	41	no	--	Transmission line too distant
Westerly Industrial Park	57	no	--	Transmission line too distant
Woonsocket WWTP	13	yes	--	Insufficient area

[a]Listed with the State of Rhode Island as an industrial site available for development, but as of late 1986 all available acreage had since been developed.

TABLE 2.1-19

Possible Sites

Site	Comments
Abbott Run	Almost identical to Bear Hill Road site; on side of hill--120-foot drop across site; in low point for area.
Agawam A	Level site next to Connecticut River, in flood plain; wetlands onsite.
Agawam 2	Several residential areas in vicinity; relatively level site; near airport; no onsite wetlands; several mountains within 5 miles.
Albion Road	Rugged site; stream traverses center; terrain within 5 miles is relatively rugged; site is in valley, residences nearby; no onsite wetlands.
Bear Hill Road	Almost identical to Abbott Run site; on side of hill--100-foot relief over site; in low point for area, which is relatively rugged.
Branch River Industrial Park	Residences nearby; zoned industrial; near Branch River; wetlands adjacent to site; 80-foot drop across site; region is relatively rugged.
Bryant College	In rolling terrain near Bryant College; few residences around site; near transmission grid; small onsite wetlands, though some nearby; heavily wooded; streams adjacent to site.
Buck Hill Road	Heavily wooded on high ground with rolling hills; adjacent to transmission lines; cooling water relatively distant; very few residences nearby; rural roads provide access; no apparent wetlands.
Burrillville Industrial Park	Site occupied by light industry; most of site wetland in flood zone; heavily wooded; some residences in vicinity; transmission line and cooling water relatively distant.
Dart Industries	Residences in vicinity; heavily wooded; no onsite wetlands; adjacent to Blackstone River; in valley with relatively rugged terrain.

TABLE 2.1-19 (cont'd)

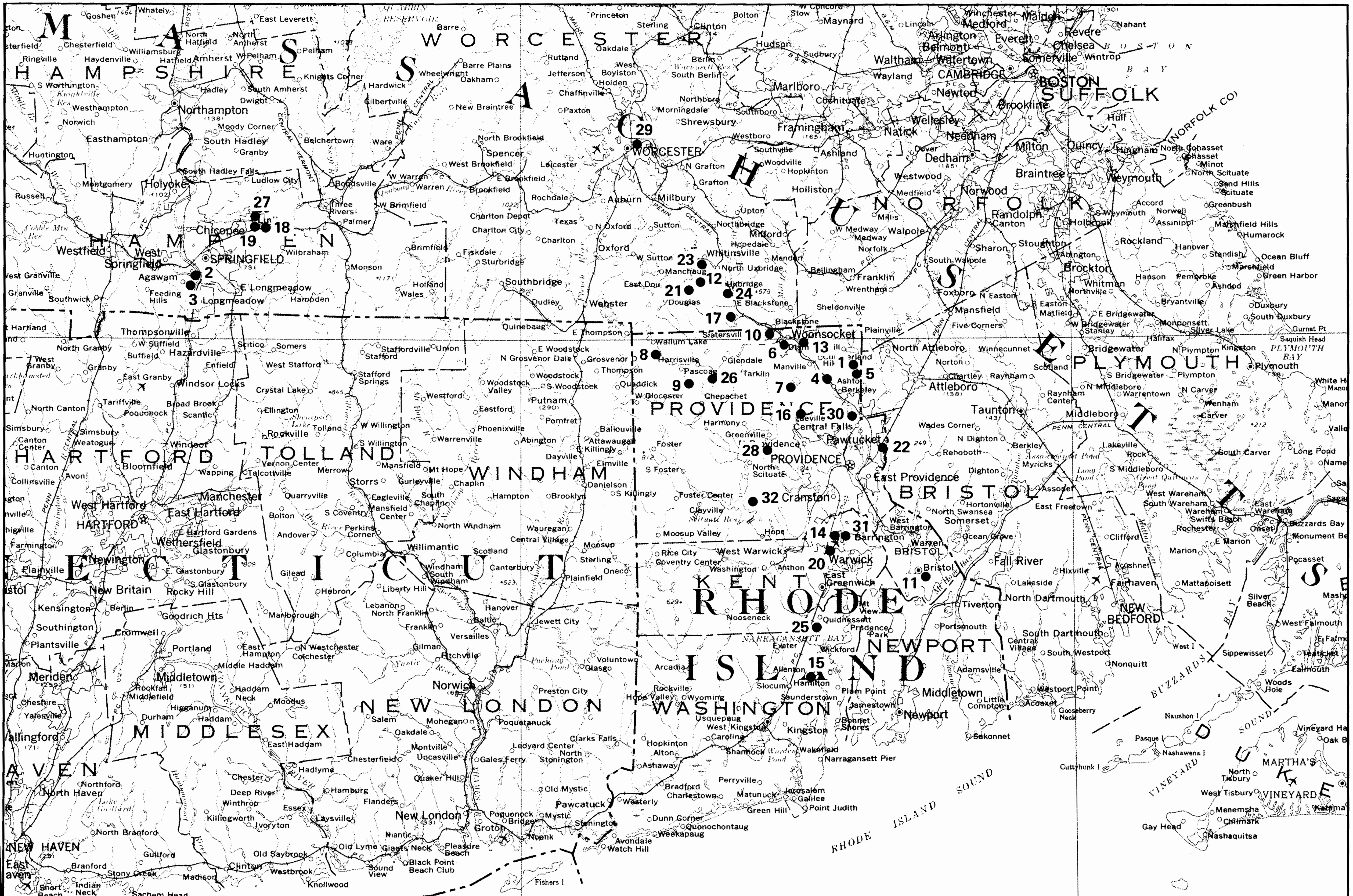
Site	Comments
East Bay Industrial Park	Surrounded by residential areas; area is flat; mostly wooded; no wetlands or streams onsite; site would require saltwater cooling; relatively distant from 345-kV transmission system.
Halfway House	Isolated site with few nearby residences; small wetlands onsite; no streams; outside flood zone; flat terrain; heavily wooded; distant from cooling water.
Highland Industrial Park	Adjacent to Blackstone River and 345-kV transmission line; area around site residential; no onsite wetlands; site is vacant and cleared.
Howard Industrial Park	Water source is Pawtuxet River; relatively level; in industrial area; large State facility near site; cleared; no wetlands onsite; outside flood plain; transmission line must traverse crowded area.
Indian Corner Road	Level site, in crops; sparsely settled area; not in flood plain and no surface water nearby; cooling water from Narragansett Bay; complex transmission line routing.
I-295 Industrial Park	Some development onsite (office park); plant can avoid development; Woonsocket cooling water sources; no onsite wetlands but adjacent to stream; heavily wooded; transmission line and pipeline at the site.
Ironstone	Level area with gently rolling hills; partially wooded; mining operation onsite, whose activities may be avoided; some residences in vicinity; no onsite wetlands or flood plains; some surface water nearby.
Ludlow 3	Partly wooded; new facility onsite; numerous residences in vicinity; no wetlands onsite; in valley adjacent to river.
Ludlow 4	Dense concentration of residences nearby; mostly cleared site; onsite wetlands, streams, and ponds; Chicopee River adjacent in valley; transmission line at site.

TABLE 2.1-19 (cont'd)

Site	Comments
Metrocenter Boulevard	In partially residential area, many residences nearby; onsite wetlands; cleared; in flood zone; rolling to flat terrain; Pawtuxet River is water source
Monroe Street	Site on hill; vacant, mostly wooded site; few houses in vicinity; no wetlands; not in floodplain; small stream adjacent; rolling-to-flat terrain.
Newport Avenue	In urban area, many residences in vicinity; onsite wetlands; about half wooded; in floodplain, with adjacent reservoir; terrain flat-to-gently rolling; transmission line rather distant.
North Street	Heavily wooded, vacant, located in residential area; no onsite wetlands; some evidence of water nearby; gently rolling terrain; cooling water source at Woonsocket.
Quaker Road	Partially cleared, some site grading operations ongoing; no apparent wetlands; zoned for industrial use; existing transmission line close to site; though near a river, the site is on relatively high ground; gently rolling terrain; cooling water available at Woonsocket.
Quonsett Point	Vacant, wooded, level site in vicinity of residential areas; no onsite wetlands; small stream adjacent; Narragansett Bay cooling water source.
Sacred Heart	Appears to be vacant, but with a moderate amount of housing in vicinity; heavily wooded; no onsite wetlands, streams, or ponds; not in flood plain; gently rolling terrain; cooling water source at Woonsocket.
Stony Brook	Vacant, in proximity to existing power plant; partly wooded; onsite wetlands; not in flood plain; no surface water body nearby; level, but vicinity rolling-to-moderately rugged.

TABLE 2.1-19 (cont'd)

Site	Comments
Tracy Hill	Vacant, but with moderate number of homes in vicinity; heavily eroded; no onsite wetlands; hilly and surrounded by steep hills; transmission line adjacent to site.
Uxbridge Substation	In valley, in vacant area near substation; some residential density in vicinity; no onsite wetlands; in flood plain and adjacent to Blackstone River; water available at Woonsocket.
Valley Falls	Vacant, in valley adjacent to Blackstone River; in flood plain, with heavy concentration of wetlands; transmission line will cross heavily urban area.
Warwick Airport Road	Level, at end of main runway for airport; mostly vacant, but close to dense urban area; onsite wetlands.
West Cranston Industrial Park	Vacant, with only scattered houses in vicinity; no onsite wetlands, though some adjacent; heavily wooded; level-to-gently rolling; on a hill; cooling water source from Scituate Reservoir.



1. ABBOTT RUN
2. AGAWAM A
3. AGAWAM 2
4. ALBION ROAD
5. BEAR HILL ROAD
6. BRANCH RIVER INDUSTRIAL PARK
7. BRYANT COLLEGE
8. BUCK HILL ROAD
9. BURRILLVILLE INDUSTRIAL PARK
10. DART INDUSTRIES
11. EASY BAY INDUSTRIAL PARK
12. HALFWAY HOUSE
13. HIGHLAND INDUSTRIAL PARK
14. HOWARD INDUSTRIAL PARK
15. INDIAN CORNER ROAD
16. I-295 INDUSTRIAL PARK
17. IRONSTONE
18. LUDLOW 3
19. LUDLOW 4
20. METROCENTER BOULEVARD
21. MONROE STREET
22. NEWPORT AVENUE
23. NORTH STREET
24. QUAKER ROAD
25. QUONSETT POINT
26. SACRED HEART
27. STONY BROOK
28. TRACY HILL (RT. 44/I-295)
29. UXBRIDGE SUBSTATION
30. VALLEY FALLS
31. WARWICK AIRPORT ROAD
32. WEST CRANSTON INDUSTRIAL PARK

Base Map Source: U.S.G.S. 1:500,000 Quad., Mass., R.I. & Conn., 1971.

0 10 20 Miles

FIGURE 2.1-12
POSSIBLE SITES

rough estimate of the noise, visual, and land use sensitivity of the surrounding area to activities at the plant. The criteria are established for the purpose of comparing sites and are not meant to substitute for an environmental analysis.

The issue criteria are applied evenly to all sites to ensure an unbiased evaluation of each site. This requirement means that the same data sources must be used for each site. Data sources used in the possible site evaluation are aerial photography, U.S. Geological Survey topographic maps, and published information. The aerial photography is as current as is available, which in some cases means that the photography dates to 1981 and 1982. More site-specific data can be introduced when the number of sites is smaller. Individual site classifications are discussed in more detail in the technical staff report (Appendix D to the EIS) available by request from FERC.

The general aspects of each environmental issue are described below.

- Land use--The land use issue primarily focuses on land use at the site and population in the vicinity, with particular emphasis on the sensitivity of land uses around the site to the potential presence of a power plant.

- Wetlands--The wetlands issue is concerned with the presence of onsite wetlands--their size and characteristics and whether they would be affected by site activities. (Wetlands in the plant buffer zone may not be affected by site activities.)

- Ecology--The ecology issue is concerned with the amount of woodlands habitat onsite that would be removed for the plant. Woodlands are considered sensitive because they are more valuable than scrub. Most of the information regarding habitat is available from aerial photography.

- Surface water--This issue focuses on the potential degradation of surface water on or near the site due to plant activities and also considers whether any portion of the site is located in a flood plain.

- Air quality--The air quality issue considers air quality in the site vicinity as well as the capability of the site microclimate to transport the stack plume away from the plant.

- Cooling water pipeline--Since the cooling water pipeline will be placed in available right-of-way--much of which is along public streets or roads--the amount of street disruption in an urban area is key to this issue. Further, the longer the pipeline, the less desirable the site. The dry cooling alternative (Section 2.1.4.3.3) could be used at any site, but a pipeline would still be required. However, since dry cooling systems produce more noise, sites with larger buffer areas or fewer nearby sensitive receptors would be better.

- Transmission line--The transmission line issue deals with the amount of right-of-way required to link the plant to the 345-kV transmission grid. It also considers the number of homes within 0.25 mile of the potential transmission line corridor.

Criteria for each of these seven siting issues were applied to the possible sites (Figure 2.1-12); results of this evaluation are shown in Table 2.1-20.

To apply the criteria for the cooling water pipeline and the transmission line, it is necessary to identify potential corridors for these facilities. In both cases, the shortest route is preferred; however, the routes generally follow existing rights-of-way where available. The cooling water pipeline uses existing rights-of-way along public roads or existing pipeline and transmission line corridors. This approach reduces the number of people and facilities to be affected over the long term, but there would still be a short-term disruption of businesses, traffic, and facilities that use the subject right-of-way.

The transmission line from the plant must interconnect with the regional 345-kV electrical grid system for the generated electricity to be delivered to customers. Although all of the possible sites are within 10 miles of a 345-kV transmission line, a connector line must be constructed from the plant fence to the 345-kV line. The most direct transmission route is preferred because of both cost and the requirement of a 250-foot right-of-way for new corridors. Thus, 1 mile of new transmission line corridor requires about 30 acres of land. Expansion of an existing transmission line corridor, if available, requires about 24 acres/mile. Although the difference in acreage between using a new corridor and expanding an existing corridor is minor, the potential environmental effects vary widely. The existing line has already created the corridor effects associated with a transmission line (e.g., it has become a part of the landscape).

TABLE 2.1-20

Possible Site Evaluation

Name of Site	Plant Site: Land Use	Plant Site: House Density	Plant Site: Wetlands	Plant Site: Ecology	Plant Site: Surface Water	Plant Site: Air Quality	Auxiliary Facilities: Cooling Water Pipeline	Auxiliary Facilities: Transmission Line ROW	Auxiliary Facilities: Transmission Line House	Net Rating
Abbott Run	+	-	+	-	+	-		-	-	-2
Agawam A	+	-	-	+	-	-	+	-	-	-3
Agawam 2	+	-	+	-	+	-		-	-	-2
Albion Road	-	-	-	-	-	-	+		-	-6
Bear Hill Road	+	-	+	+	+	-		-	-	0
Branch River Ind. Park	+	-						+		+1
Bryant College	+	+	+	-	+	+	-	+	+	+5
Buck Hill Road	+			-	+	+	-	+	+	+3
Burrillville Industrial Park	+		-		-	+	-	-	-	-3
Dart Industries	+	-	+			-			-	-1
East Bay Industrial Park	+	-	+	+	+	+	+	-	-	+3
Halfway House	+	+	+	-	+	+	-		-	+2
Highland Industrial Park	+	-	+	+		-	+	+	-	+2
Howard Industrial Park	+	-	+	+		+			-	+2
Indian Corner Road		+	+	+	+	+		-	-	+3
I-295 Industrial Park	+		+	-	+		-	+		+2
Ironstone	+	+	+			+	-	+		+4
Ludlow 3	+	-	+	-		-	+	+	-	0
Ludlow 4	+	-	-	+	-	-	+	+	+	+1
Metrocenter Boulevard	-	-		+	+	+		+	-	+1
Monroe Street	+	+	+	-	+	+	-		-	+2
Newport Avenue	+	-				+		-	-	0
North Street	+			-	+	+	-	-	-	0
Quaker Road		+	+			+	-	+	+	+3
Quonsett Point	+	-	+	-	+	+		-	-	0
Sacred Heart	+	-	+	-	+	+	-	-	-	-1
Stony Brook	+	-	+		+					+2
Tracy Hill (Rt. 44/I-295)	+	-	+	-	+			+	+	+3
Uxbridge Substation	+	-	+	+		-	-		-	-1
Valley Falls	+	-	-	+	-	-	+	-	-	-3
Warwick Airport Road	+	-	-	+	-	+		-	-	-2
West Cranston Industrial Park	+	-	+	-	+	+		+	+	+4

It should be pointed out that a switching station will be required to link the transmission line from the plant to the existing transmission line. The switching station will require about 10 acres, but is not included in this analysis.

2.1.5.6 Results: Possible Site Evaluation

The evaluation of possible sites allows comparison of the sites to reduce the number that will be examined in more detail. The goal is to select sites that are the least likely to experience negative effects. As shown in Table 2.1-20, there are some sites with no net negative evaluations. On the whole, these sites have the best prospects for avoiding severe problems. Further, all sites with a net positive evaluation or "O" net rating may be developed for a power plant site. In some respects, these sites are very similar, and further evaluation is needed to differentiate among them. Fourteen sites (those with a +2 or greater) selected for further evaluation as potential sites are presented in Table 2.1-21 and Figure 2.1-13. Of the 14 potential sites, seven are in the general vicinity of the applicant's site, one is east of Springfield, Massachusetts, and the others are located around Providence.

2.1.5.7 Reconnaissance of Potential Sites

Each of the 14 potential sites was visited to perform a site reconnaissance. The purpose of the reconnaissance was to confirm the data derived from topographic maps and aerial photography, and to investigate access to the site and the presence of nearby facilities that may be sensitive to the site. A facility was considered "nearby" if it was within 0.5 mile of the site. Examples of such sensitive receptors are schools, hospitals, recreation areas (golf courses, parks, etc.), and nursing homes. These facilities may be sensitive to noise generated at the site, associated traffic, or dust produced during construction.

A summary of the site reconnaissance is presented in Table 2.1-22. The analysis shows that only two sites changed appreciably in their eligibility for serving as an alternative site. Both the Highlands Industrial Park and the Howard Industrial Park are fully developed. Because the latest construction is relatively recent, it did not appear on the available topographic maps or aerial photography. The land area needed for a plant is clearly not available.

The site visits also show that Bryant College, I-295 Industrial Park, and Buck Hill Road have sensitive facilities within 0.5 mile of the site. The Bryant College

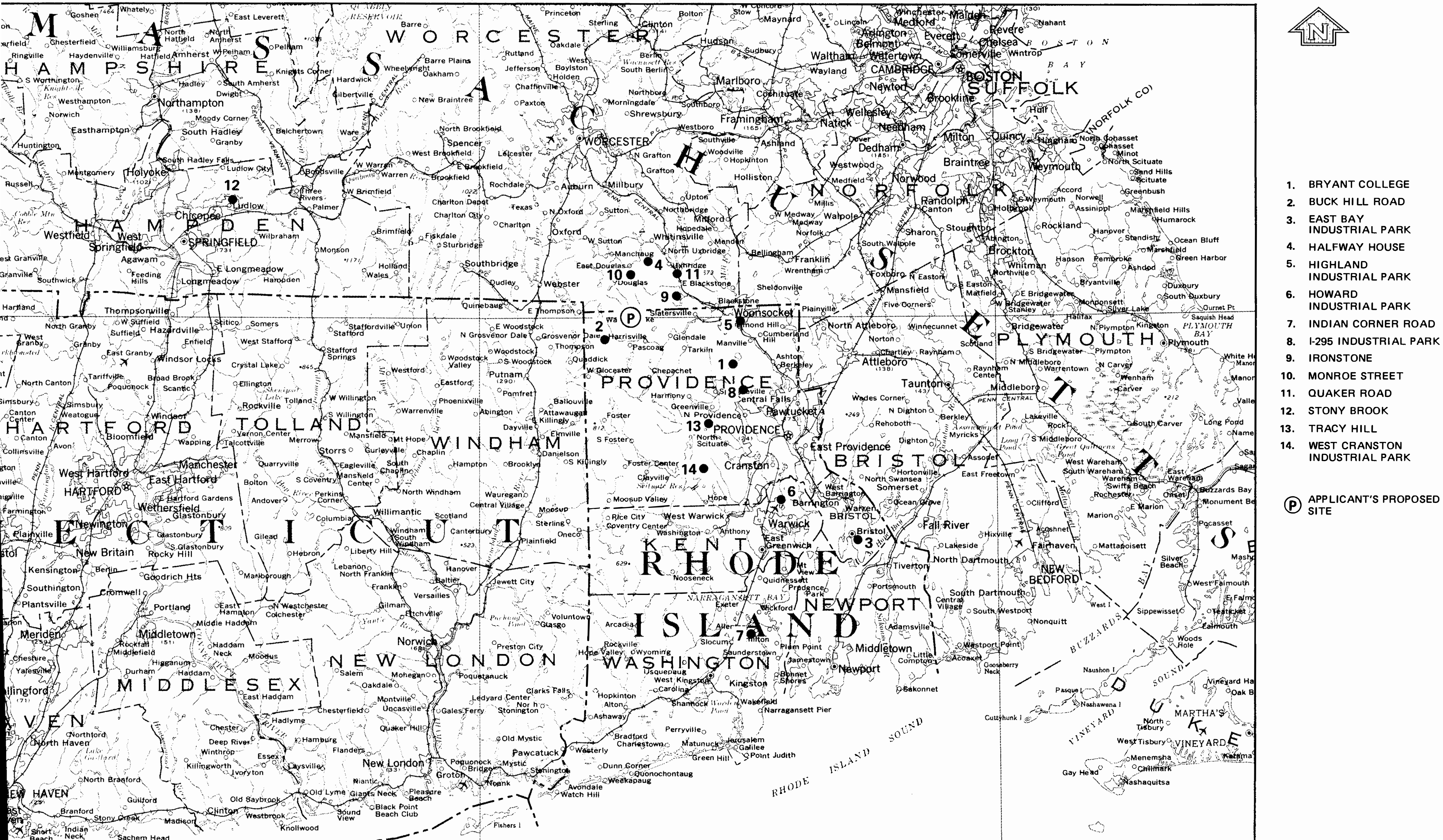
Table 2.1-21

Characteristics of Potential Sites

Site Name	Nature of Site	Cooling Water Source	Transmission Line	Comments
Bryant College	Wooded; flanked by wetlandsand streams.	Blackstone River at Woonsocket; water available but rather distant.	345-kV line at site.	Bryant College within 0.5 mile;vacant on three sides.
Buck Hill Road	Wooded, sparsely settled; rural roads provide access.	Blackstone River at Woonsocket; very long pipeline needed.	345-kV line at site.	Adjacent to Pulaski Wildlife Refuge.
East Bay Industrial Park	In urban area surrounded by concentrated residential areas.	Narragansett Bay; no rivers or fresh water in proximity.	Line nearly 10 miles to the east of the site; must traverse heavily urban area.	No gas pipelines in vicinity; on peninsula.
Halfway House	Wooded, rural, with a number of residences along the roads.	Blackstone River at Woonsocket; very long pipeline necessary.	345-kV line close to site.	Adjacent to major highway (Route 146).
Highland Industrial Park	On river bank; cleared, some evidence of development; residences around site.	Blackstone River adjacent to site, but cooling water source is south of Woonsocket.	345-kV line close to site; route can follow riverbank.	Access by heavily traveled road; very close to Woonsocket.
Howard Industrial Park	Adjacent to Pawtuxet River; in heavily urbanized area; cleared.	Pawtuxet River; availability for power plant use has not been determined.	345-kV line to west; route must cross some urban areas.	Several large State institutions in proximity.
Indian Corner Road	Cleared, in pasture and cropland; residential area abuts the site.	Narragansett Bay; about 2 miles distance.	345-kV line is about 10 miles to north.	No buffer zones between site and surrounding areas; flat.
I-295 Industrial Park	Partially cleared, some development in vicinity.	Blackstone River at Woonsocket; very long cooling water pipeline needed.	345-kV line adjacent.	Interstate 295 adjacent; park being developed.
Ironstone	Part of quarry, has been cleared; some residential development around roads that circle site; very large buffer area.	Blackstone River at Woonsocket.	345-kV line very close.	Multi-lane, limited access road adjacent.
Monroe Street	In rural area; some residences in vicinity; mostly wooded.	Blackstone River at Woonsocket; long cooling water pipeline needed.	345-kV line several miles away.	Rural roads provide access.

Table 2.1-21 (cont'd)

Site Name	Nature of Site	Cooling Water Source	Transmission Line	Comments
Quaker Road	Partially cleared; being developed; vicinity sparsely developed.	Blackstone River at Woonsocket.	345-kV line very close.	Major highway nearby.
Stony Brook	On military base; cleared; area around airport developed.	Chicopee River; availability of water uncertain.	345-kV line to east; must cross some developed area.	In industrialized area; adjacent to existing power plant.
Tracy Hill	Heavily wooded; considerable number of residences in vicinity.	Scituate Reservoir; long pipeline; water availability requires policy decision.	345-kV line adjacent.	Adjacent to Route 44 and Interstate 295.
West Cranston Industrial Park	West of Providence; heavily wooded; residences in vicinity; no wetlands; large area available.	Scituate Reservoir; pipeline of moderate length; water availability requires policy decision.	345-kV line at site.	Site on high ground.



ase Map Source: U.S.G.S. 1:500,000 Quad, Mass., R.I. & Conn., 1971.

0 20 Miles

FIGURE 2.1-13
POTENTIAL SITES

TABLE 2.1-22

Reconnaissance of Potential Sites

Site	Onsite Land Use	Sensitive Receptors	Access	General Character
Bryant College	Woodlands, rolling terrain; relatively rocky; similar in character to Sherman Farm Road site; 100% vacant.	Bryant College located within 0.5 mile of site; no other sensitive receptors within 0.5 to 1 mile of site.	Access from Route 7, Douglas Pike; secondary 2-lane road, moderate-to-heavy traffic; access road from Massachusetts to N. Providence; good quality road.	Very rural, minimal development in area; primarily farming, agriculture, spot residence; area stable, some growth.
Buck Hill Road	Forested; 100% vacant.	Buck Hill Management Area within 0.5 mile, adjacent to property; Zambarano Hospital slightly more than 1 mile from site; Pulaski Memorial Forest also slightly more than 1 mile away.	From Buck Hill Road via Route 100 (Wallum Lake); Buck Hill Road rural, 2-lane road, virtually untravelled; access road into site would be necessary; poor quality road; must pass residences to access site.	Very rural; similar in character to Sherman Farm Road area; stable.
East Bay Industrial Park	Some woodlands; part of site developed for manufacturing; 75% vacant.	Residential and commercial areas surround site; golf course and country club adjacent to site.	Access from Route 114 and/or Route 36. Both are narrow, 2-lane urban roads; heavy traffic.	Area is predominantly urban.
Halfway House	Woodlands, primarily secondary growth; no other activities onsite.	No major sensitive receptors around; picnic area on Hwy 146 adjacent to site; area is rural.	Primary access provided by Hwy. 146; multi-lane, limited-access highway.	Area is predominantly rural.
Highland Industrial Park	Nearly 100% occupied; primarily light manufacturing and warehouses; park relatively new.	No sensitive receptors within 0.5 mile; conservation area, park, high school, vocational school, academy, Woonsocket Hospital within 1 mile.	From Route 122, Mendon Avenue, 2-lane heavily travelled commuter and residential road, the major east-west route through Woonsocket's good quality road; must past commercial, residential area.	Area is old, stable.
Howard Industrial Park	Nearly 100% occupied; primarily light manufacturing and warehouse/office buildings; park is new, less than 5 years; bordered on north by state corrections facility, on south by landfill.	Within 0.25 mile are RI Medical Center and State corrections facility; within 1 mile Glenhill School; Green Airport about 1.25 miles away.	From Pontiac Avenue, 3-lane road connecting to Route 37 (4-lane) and I-95 interchange; Pontiac Avenue relatively heavily trafficked secondary road, mostly commuter traffic; good quality road; access does not pass any residential areas.	Commercial character; relatively new area though just to North of site are older residential commercial areas; the presence of RI Medical center gives it a somewhat old atmosphere, though offset by industrial park.

TABLE 2.1-22 (cont'd)

Site	Onsite Land Use	Sensitive Receptors	Access	General Character
Indian Corner Road	Zoned for industrial use; 90% farmland, 2% small industry, and woodlands.	Site is adjacent to new housing.	Access from Indian Corner Road, a 2-lane winding road that links to 4-lane roads.	Area in transition from rural to suburban; very little buffer between site and nearby residences.
I-295 Industrial Park	New industrial park, last 3 to 5 years; estimate 60% to 70% occupied; undeveloped portion is wooded or recently cleared; rocky terrain.	Still-Water Golf Club within 0.5 mile; Still-Water Pond within 1 mile; North Central Airport 1.5 miles from site.	From Route 7 via Thusher Road; just off I-295, Route 7 interchange; Route 7 is 2-lane secondary road; good quality road; need not pass residences if access from I-295 to Route 7.	Somewhat isolated; surrounding area primarily rural or agricultural; growing commercial/industrial area.
Ironstone	Sand and gravel operation; small reservoir onsite with picnic tables; neatly maintained; 80% unoccupied.	No sensitive receptors within 0.5 to 1 mile.	Good quality road, pass through no residential areas from Route 146A; primary road from Providence to Worcester; 4-lane newly constructed; moderate commuter traffic.	Area fully developed rural; mix of old and new development; new development spurred by Route 146A.
Monroe Street	Primarily woodlands, secondary growth.	No obvious sensitive receptors; some residences in vicinity.	From Route 146, local roads are rural, 2-lane, winding; must past residential area to access site.	Area is predominantly rural; residences along roads.
Quaker Road	Formerly farmland/pasture; will shortly be developed as industrial park; 100% vacant, open field, pasture; site grading underway.	No sensitive receptors within 0.5 to 1 mile; Quaker Motor Lodge (owned by industrial park owners) adjacent to site; Friends Meeting House (circa 1700's) across street.	From Quaker Street, rural local road, minimal traffic; access Quaker Road from Buxton; Providence Street off Route 146A/146; good quality road; must pass several residences to access site.	Agricultural, rural farmland; spot residences; quiet growth anticipated from Route 146A.
Stony Brook	Formerly a weapons storage facility; flat terrain, generally open; to north, site is developed as industrial park, light manufacturing, warehouses; power plant exists on site; approximately 50% or less occupied.	No sensitive receptors within 0.5 mile; runway for Westover AFB within 1 mile.	From Moody Street via Brunett Road; Exit 6 off Mass Turnpike; Moody is rural 2-lane access road; only traffic is to plant; Brunett Road is 2-lane, local traffic; must pass residences to access site.	Isolated, several small commercial offices along access road to plant; area stable.

TABLE 2.1-22 (cont'd)

Site	Onsite Land Use	Sensitive Receptors	Access	General Character
Tracy Hill	Woodlands; 100% vacant.	Site is area close to I-295; residential area is adjacent to site.	Access from Route 44, new road; roads are generally 2-lane and contain heavy traffic.	Surrounding area is predominantly residential, with mixed commercial/industrial bordering in the north; residences are older single-family dwellings.
West Cranston Industrial Park	New industrial park developed within past 2-3 years; consists of light manufacturing, office buildings; site approximately 60% occupied primarily along Comstock Pkwy.; lane behind parkway on either side not yet developed; primarily flat, no trees, pastureland, open field.	No sensitive receptors within 0.5 or 1 mile; (Simmonsville Lower Reservoir within 0.5 to 1 mile).	From Comstock Pkwy. off Route 12 (Scituate Road) and Route 14 (Plainfield Pike); Route 12 is 2+ lane road; Route 14 is also 2-3 lane divided highway; good quality road; must pass residential area to access.	Formerly agricultural farm land. Surrounding area primarily open fields or residential development; some commercial development east on Route 14; area new, expanding.

power plant site, located on a hill, is within 0.5 mile of Bryant College, also on a hilltop; a road runs between the two sites at a lower elevation. The Buck Hill Road site is adjacent to Pulaski State Park; the I-295 Industrial Park site is near a golf course.

Sites with very easy access are Ironstone, Halfway House, Quaker Road, Bryant College, and I-295 Industrial Park. In each case, the site is adjacent to a major four-lane highway, or a road adjacent to the site connects with such a highway and the interconnection is near the site. For Bryant College and the I-295 Industrial Park sites, the four-lane road is an interstate highway. For the Ironstone, Halfway House, and Quaker Road sites, the highway in question is Route 146.

The East Bay Industrial Park site, in contrast, has very poor access. It is surrounded by residential areas. Further, the site is on a peninsula; no major, limited-access roads follow the length of the peninsula. Thus, access to the site is gained along roads with considerable commercial and residential development. In such a case, the traffic generated during construction and operation would result in traffic increases quickly noticed by local residents.

Of the other potential sites, some present possible access problems. The Buck Hill Road site, for example, is adjacent to two-lane rural roads. The roads are narrow and have numerous curves, but fortunately are not heavily used and could support the traffic generated by the plant. However, local residents would be aware of the increased traffic.

As a result of the site reconnaissance, two of the 14 potential sites--Howard Industrial Park and Highland Industrial Park--were dropped from further consideration because of unavailability for development as a power plant site. The remaining 12 sites are candidate sites. Additional data obtained during the site reconnaissance were used to evaluate the candidate sites, as described below.

2.1.5.8 Candidate Site Environmental and Economic Evaluation

Each of the 12 candidate sites could be developed for a power plant. Some sites may require special engineering, such as the use of dry cooling towers, but no overwhelming technical problems would preclude development. However, the sites are not equal in terms of environmental effects or economic attractiveness. Incremental economic differences between the sites are reflected in the price consumers must pay for electricity. However, anything less than a multimillion dollar difference would not have a significant affect on electricity costs.

The evaluation of candidate sites focuses on a refinement of site suitability as well as economic attractiveness. Site suitability consists of evaluating the compatibility of the power plant with surrounding land uses, site access, the ability of the plant to use identified cooling water sources, and the effects of routing the gas transmission pipeline. Economic attractiveness includes the costs of the cooling water pipeline, transmission line, and gas supply pipeline.

Site Suitability

The evaluation of a site's suitability considers land use compatibility, the source and type of cooling water, site access, and right-of-way requirements of the gas supply line. These concerns are not purely environmental, but are closely related.

Land Use Compatibility. The land use compatibility of the site refers to the site's congruence or conflict with surrounding land uses. It is preferable to place the site in an area where it is simply one of many such facilities, or where it is isolated from other land uses. The ideal location for a power plant is in the midst of heavy manufacturing, but such sites are rare and the manufacturing industries may require the same types of resources as the power plant. The next best location for a power plant is an isolated area, where there are no heavily used lands nearby and any human communities are not likely to be affected by the power plant. The least desirable location is one in which noise emissions, traffic, and air emissions are out of character with the surrounding area. The more people influenced, the less desirable the site. Locating a site in a suburban or urban residential area is less desirable than siting in a rural area. While the site may be out of character with the rural area, fewer people are affected.

Of the 12 candidate sites, the one most likely to be incompatible with the surrounding area is the East Bay Industrial Park. This area is heavily residential. The industrial park is primarily light manufacturing, warehousing, and offices--uses that, unlike a power plant, are not incompatible with the concentrated residential areas that surround the site.

The Bryant College site is located near Bryant College, a facility that may be particularly sensitive to the power plant. The Halfway House site is in a rural, sparsely settled residential area; a rest area for Route 146 is adjacent to the site.

The Buck Hill Road site is in a rural area, even more sparsely settled than the area near the Halfway House site. In addition, the site is adjacent to the Pulaski State Park. The power plant may be inconsistent and incompatible with the recreational activities available at the park.

The site that is most compatible with the surrounding area is Stony Brook. Located on part of what was an Air Force base, the site is adjacent to an existing power plant owned by the Massachusetts Municipal Wholesale Electric Cooperative.

The West Cranston Industrial Park site, located in an agricultural area that could be classified as suburbs, is also a compatible site. The park contains light manufacturing, warehouses and industrial offices.

Cooling Water Source. The power plant would compete with other facilities for use of available surface water. For example, it has already been determined that sufficient water exists in the Blackstone River at Woonsocket to supply the water needed for the two-unit facility. A policy decision from the Rhode Island Department of Environmental Management is required to determine any restriction that the State may want to impose on the amount of withdrawals or conditions limiting withdrawals by OSP. Sites that would use this water supply are rated (+) because of the adequate availability of water under average conditions.

Candidate sites that use the Blackstone River at Woonsocket are Bryant College, Buck Hill Road, Halfway House, I-295 Industrial Park, Ironstone, Monroe Street, and Quaker Road--all in the same general area. Although the cooling water source is the same for each site, there are variations in the length and routing of the pipeline from the river.

For sites that would use the Scituate Reservoir, Pawtucket River, or Chicopee River, a policy decision from Rhode Island or Massachusetts environmental agencies on water availability and restrictions on withdrawal would be required. Water availability from the Scituate Reservoir is currently under dispute (see Section 3.1.2.1.3). The Scituate Reservoir is the closest source of water for the Tracy Hill and West Cranston sites and would be the environmentally preferred source if water is available. The Stony Brook site can use one of several sources, though the Chicopee River is the closest source. Sites that use the Scituate Reservoir, Pawtucket River, and Chicopee River are rated (-) because insufficient information exists to determine the basis on which water withdrawal policies would be established.

The use of saltwater for cooling does not pose a supply problem. The Narragansett Bay and its estuaries can supply an almost infinite amount of cooling water. However, because of the adverse environmental effects of using saltwater in cooling towers, the sites dependent on this source received a (-) rating.

Site Access. Site access is governed by existing traffic, the capacity of access roads, and the volume of traffic generated by the plant. Although the most noticeable effects would be during construction, there would be a slight increase in traffic due to actual plant operation. Access to the candidate sites was addressed during the reconnaissance of potential sites (Section 2.1.5.7).

Gas Pipeline Right-of-Way. The last suitability criterion is associated with the gas supply pipeline. Evaluation of the pipeline's environmental suitability requires possible routing of the pipeline. The starting point is the Tennessee Gas pipeline in Massachusetts. Using existing pipeline right-of-way, as well as new right-of-way, a preliminary route was selected and evaluated. As with the transmission line, the land acreage affected is a surrogate for potential environmental effects. It is assumed that a new gas pipeline right-of-way would require 75 feet, while expansion of an existing right-of-way would require an additional 50 feet.

Cost Suitability

The cost of developing a site varies with the cooling water pipeline, transmission line, and gas pipeline distances. The cooling water pipeline is presumed to use existing rights-of-way, such as those available along roads. The most costly pipelines are associated with sites that use the Blackstone River at Woonsocket--Monroe Street, Halfway House, and Buck Hill Road; in some cases, the pipeline must extend as far as 10 miles. The site with the least expensive cooling water pipeline costs is East Bay Industrial Park, less than 2 miles from Narragansett Bay.

Transmission line costs also vary with the length of right-of-way required. The most expensive transmission lines are those for the Indian Corner Road, West Cranston Industrial Park, and East Bay Industrial Park sites. The least costly transmission lines are for sites adjacent to an existing double-circuit 345-kV transmission line--Buck Hill Road, Quaker Road, and Ironstone. Several candidate sites are adjacent to a single-circuit 345-kV transmission line, but construction of a second 345-kV line to the nearest substation is still required.

Gas pipeline costs also increase with distance. Since the Tennessee Gas pipeline is located in Massachusetts, sites near Providence are more expensive than those in northern Rhode Island and southern Massachusetts. The East Bay Industrial Park, Indian Corner Road, and West Cranston Industrial Park sites have the highest gas pipeline costs. The least cost sites are Monroe Street, Halfway House, Quaker Road, and Ironstone.

Table 2.1-23 presents the total costs of ancillary facilities for the 12 candidate sites. The least expensive sites overall are Quaker Road, Ironstone, and Buck Hill Road.

2.1.5.9 Identification of Alternative Sites

The evaluation of candidate sites is presented in Tables 2.1-24 and 2.1-25. Table 2.1-24 summarizes the evaluation of 14 issues in the general categories of plant site, ancillary facilities, suitability, and cost and includes the right-of-way requirements and costs of the gas pipeline to the site. Table 2.1-25 presents the same evaluation, excluding the gas pipeline right-of-way and cost components and assuming that a gas pipeline (the Rhode Island Extension) is constructed to Cranston independent of the proposed power plant requirements. The intent of evaluating the sites with and without gas pipeline considerations is to select the best alternative sites for comparison with the Sherman Farm Road site proposed by OSP. There is no intention of reflecting an opinion on the desirability of a gas pipeline to Cranston.

Four candidate sites are located in south-central Massachusetts within 4 miles of one another. All of these sites are highly ranked; however, Ironstone is the highest ranked and is selected as the alternative site from Massachusetts to be compared to OSP's Sherman Farm Road site. Stony Brook, in western Massachusetts, is addressed in the following discussion (Section 2.1.6.4) of alternative sites for reasons explained therein. Of the remaining seven sites--all located in Rhode Island--Bryant College ranks the highest, as shown on both Tables 2.1-24 and 2.1-25. Its proximity to Woonsocket (5.7 miles), the adjacent 345-kV transmission line (single circuit), and its rural surroundings contribute to the favorable ranking. Hence, the Bryant College site is selected as the alternative site in Rhode Island to be compared to the Sherman Farm Road site.

TABLE 2.1-23

Ancillary Facility Costs for Candidate Sites

Site Name	Cooling Water Pipeline Distance (miles)	Transmission Line: New ROW (250 feet) Distance (miles)	Transmission Line: Expanded ROW (200 feet)[a] Distance (miles)	Transmission Line: Expanded ROW (100 feet)[a] Distance (miles)	Gas Transmission Pipeline Distance (miles)	Total Cost (000 $)[b,c]
Bryant College	5.7	0.0	0.0	4.6	20.6	31,200
Buck Hill Road	9.2	0.0	0.0	0.0	15.4	23,800
East Bay Industrial Park	0.9	3.5	4.0	0.0	31.6	49,300
Halfway House	9.0	0.4	3.0	0.0	7.5	28,400
I-295 Industrial Park	6.9	0.4	0.0	5.7	22.1	35,800
Indian Corner Road	4.1	0.0	11.9	22.9	50.3	110,000
Ironstone	5.0	0.4	0.9	0.0	10.5	21,200
Monroe Street	10.5	1.4	3.0	0.0	7.3	32,100
Quaker Road	6.6	0.0	0.7	0.0	9.7	20,200
Stony Brook	2.4	0.6	2.8	0.0	14.1	27,600
Tracy Hill	3.6	0.0	0.0	9.0	25.0	38,800
West Cranston Industrial Park	4.0	0.0	0.0	15.1	30.9	51,800
Sherman Farm Road	10.0	0.0	0.0	0.0	11.0	14,600
Cost per mile (000$)	(750)	(2,767)	(2,893)	(1,447)	(644)	

[a]Double circuit requires 200 feet additional ROW; single circuit requires 100 feet additional ROW.

[b]The total cost is based on cooling water pipeline cost, transmission line cost, and gas transmission pipeline cost. The transmission line cost consists of right-of-way, structure (i.e., towers, wire, etc.), and switching station costs ($7 million for switching station when required).

[c]Ratings for the <u>cost</u> criteria are on Tables 2.1-24 and 2.1-25--$0 to $25 million (+), $25 to $50 million ( ), over $50 million (-).

Table 2.1-24

Evaluation of Candidate Sites Including Right-of-Way Requirements and Gas Pipeline Costs[a]

	Plant Site						Ancillary Facilities			Suitability					
Site	Land Use	Population Density	Wetlands	Ecology	Surface Water	Air Quality	Cooling Water Pipeline	Transmission Line ROW	Transmission Line Population	Surface Water Source	Gas Pipeline ROW	Access	Land Compatibility	Cost	Net
Bryant College	+	+	+	-	+	+	-	+	+	+	-	+	-		+5
Buck Hill Road	+			-	+	+	-	+	+	+			-	+	+4
East Bay Industrial Park	+	-	+	+	+	+	+	-	-	-	-	-	-		-1
Halfway House	+	+	+	-	+	+	-		-	+		+			+4
Indian Corner Road		+	+	+	+	+		-	-	-	-			-	0
I-295 Industrial Park	+		+	-	+		-	+		+	-	+			+3
Ironstone	+	+	+			+	-	+		+		+		+	+7
Monroe Street	+	+	+	-	+	+	-		-	+		+			+4
Quaker Road		+				+	-	+	+	+		+		+	+6
Stony Brook	+	-	+		+							-	+		+4
Tracy Hill (Rt. 44/I-295)	+	-	+	-	+			+	+	-	-				+1
West Cranston Industrial Park	+	-	+	-	+	+		+	+	-	-		+	-	+2
Sherman Farm Road[b]	+			-	+	+	-	+	+	+				+	+5

[a]Definitions of ratings due to plant impacts:

(+) Area is not likely to experience negative effects
( ) Area is likely to experience negative effects, but not of significant magnitude
(-) Area is likely to experience negative effects of some significance

[b]Included for comparison purposes only.

Table 2.1-25

Evaluation of Candidate Sites Excluding Right-of-Way Requirements and Gas Pipeline Costs[a,b]

	Plant Site						Ancillary Facilities			Suitability				
							Cooling Water	Transmission Line		Surface Water				
Site	Land Use	Population Density	Wetlands	Ecology	Surface Water	Air Quality	Pipeline	ROW	Population	Source	Access	Land Compatibility	Cost	Net
Bryant College	+	+	+	-	+	+	-	+	+	+	+	-	+	+7
Buck Hill Road	+			-	+	+	-	+	+	+		-	+	+4
East Bay Industrial Park	+	-	+	+	+	+	+	-	-	-	-	-		0
Halfway House	+	+	+	-	+	+	-		-	+	+			+4
Indian Corner Road		+	+	+	+	+		-	-	-			-	+1
I-295 Industrial Park	+		+	-	+		-	+		+	+			+4
Ironstone	+	+	+			+	-	+		+	+		+	+7
Monroe Street	+	+	+	-	+	+	-		-	+	+			+4
Quaker Road		+				+	-	+	+	+	+		+	+6
Stony Brook	+	-	+		+						-	+	+	+3
Tracy Hill (Rt. 44/I-295)	+	-	+	-	+			+	+	-				+3
West Cranston Industrial Park	+	-	+	-	+	+		+	+	-		+	-	+3
Sherman Farm Road[c]	+			-	+	+	-	+	+	+			+	+5

[a]Assumes that a gas pipeline (the Rhode Island Extension) will be constructed independent of the proposed power plant requirements.

[b]Definitions of ratings due to plant impacts:

(+) Area is not likely to experience negative effects
( ) Area is likely to experience negative effects, but not of significant magnitude
(-) Area is likely to experience negative effects of some significance

[c]Included for comparison purposes only.

2.1.6 Environmental Comparison of Alternatives and Applicant's Site

2.1.6.1 Purpose and Focus of Comparison

The comparison of OSP's proposed site at Sherman Farm Road in Burrillville, Rhode Island, with the two primary alternative sites, namely the Ironstone site in Uxbridge, Massachusetts, and the Bryant College site in Smithfield, Rhode Island, focuses on significant issues where there are differences in impacts. Significant issues that differ from site to site are referred to as "distinguishing issues." The environmental characteristics of each site are highlighted by these distinguishing issues. Some issues that are important--such as the impact of withdrawing 4.4 mgd of water from the Blackstone River--may be significant, but because water withdrawal for each of these sites is at the same point in Woonsocket, water use is not a distinguishing issue since there are no differences between sites. Other issues not appropriate for this comparison include air quality impacts and construction and operation of the water supply pipeline.

The applicant's preferred site at Sherman Farm Road in Rhode Island was discussed in detail in Section 2.1.3. The purpose of this section is to provide background on the two primary alternative sites (i.e., the Bryant College site, and the Ironstone site) to facilitate a comparison with the Sherman Farm Road site.

2.1.6.2 Bryant College Site

2.1.6.2.1 Location and Description

The alternative Bryant College plant site is located in a wooded area adjacent to Douglas Pike, approximately one mile north of the intersection of Douglas Pike and Highway 116, and opposite the entrance to the Bryant College Campus. The general location of the site is shown in Figure 2.1-14. The site is shown in more detail in Figure 2.1-15.

The use of the Bryant College site would require the clearing and grading of approximately 20 acres at the plant site, 64 additional acres for transmission lines to and from the site, and 170 acres for natural gas pipeline. The available site area is in excess of 50 acres, which is sufficient to allow a wooded buffer zone to be left around the plant and locational flexibility within the site to avoid sensitive areas if necessary. The closest residences are adjacent to the southwest site boundary, approximately 1,200 feet from the center of the site. Access to the plant would be off Douglas Pike.

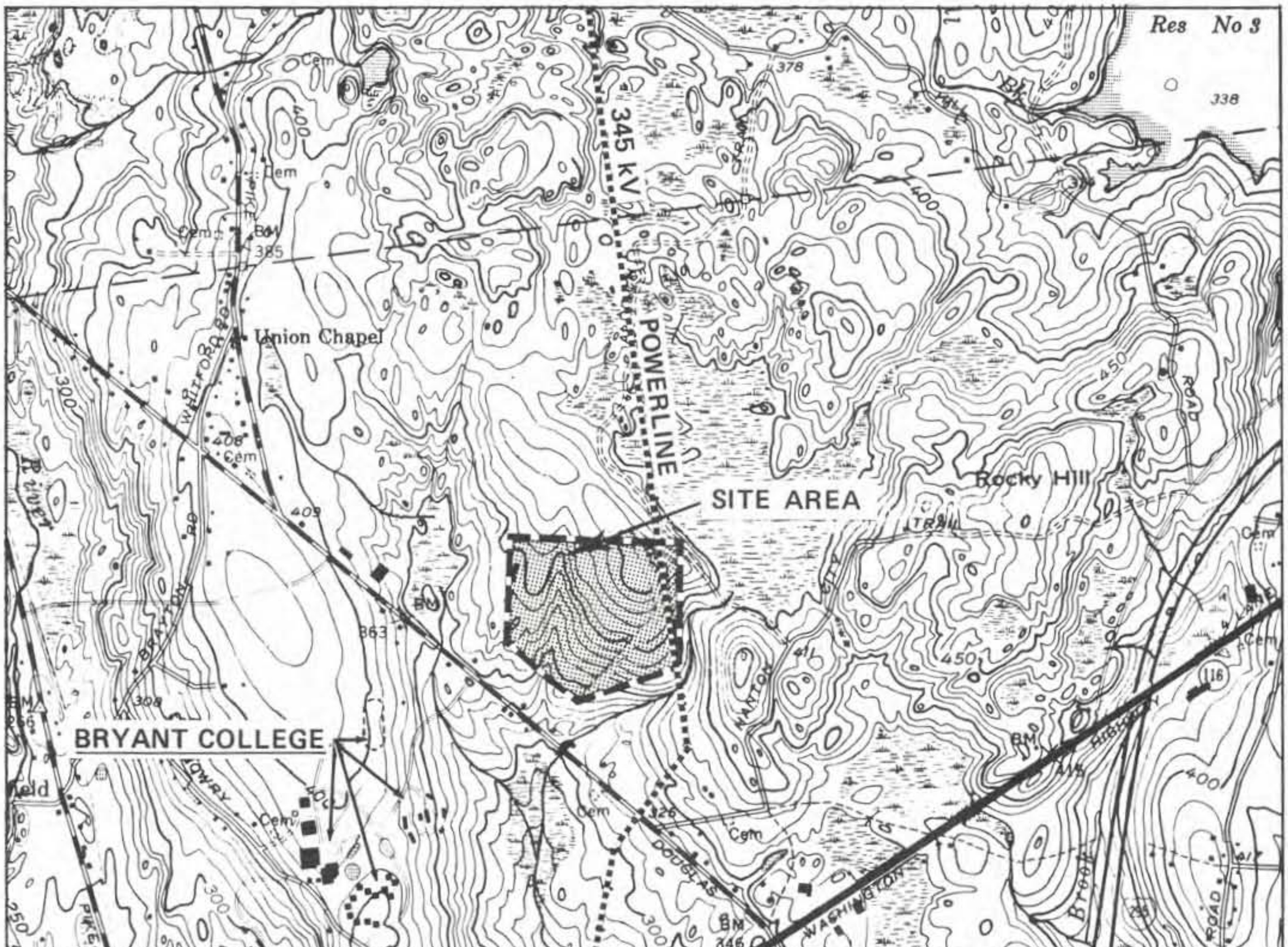


FIGURE 2.1-14
LOCATION OF ALTERNATIVE BRYANT COLLEGE PLANT SITE AREA

2.1.6.2.2 Electricity Distribution

Power generated at the plant would be fed to the NEPOOL grid. There is an existing 345-kV transmission line that traverses the site. However, since this line is not part of the bulk grid, connection to the grid would be made at a new switching station and transmission line junction approximately 4 miles north of the site. This would require some widening of the existing transmission line right-of-way between the site and the switching station. Approximately 66 acres of additional land will be required for the transmission line and the new switching station.

2.1.6.2.3 Water Supply System

The alternative plant configuration does not differ from that proposed by the applicant for the Sherman Farm Road site. Overall plant water requirements of up to 4.4 mgd would be met by constructing a pipeline to the Blackstone River in Woonsocket, Rhode Island, approximately 6 miles north of the site. The pipeline would follow existing roadways from Woonsocket and would enter the west side of the site from Douglas Pike. The water intake structure as proposed by the applicant (i.e., next to the Sayles Street Bridge in Woonsocket) would be utilized. The water pipeline would run from the intake structure along city street rights-of-way in Woonsocket to Route 104, then south to Route 7 (Douglas Pike), then southeast to the site.

2.1.6.2.4 Oil Supply System

A fuel oil pipeline would be constructed to supply oil to the plant in the event of a gas supply interruption. The pipeline will be used to refill the oil storage tanks during and following a period of plant operation using standby oil.

The pipeline would be 6 inches in diameter and would be located in the same trench as the water pipeline from the plant site to Route 146A in Woonsocket where it would connect to the existing Mobil Oil pipeline which runs from Providence, Rhode Island, to Springfield, Massachusetts. The oil line tie-in would be at the same location as proposed for the Sherman Farm Road site (see Figure 2.1-9).

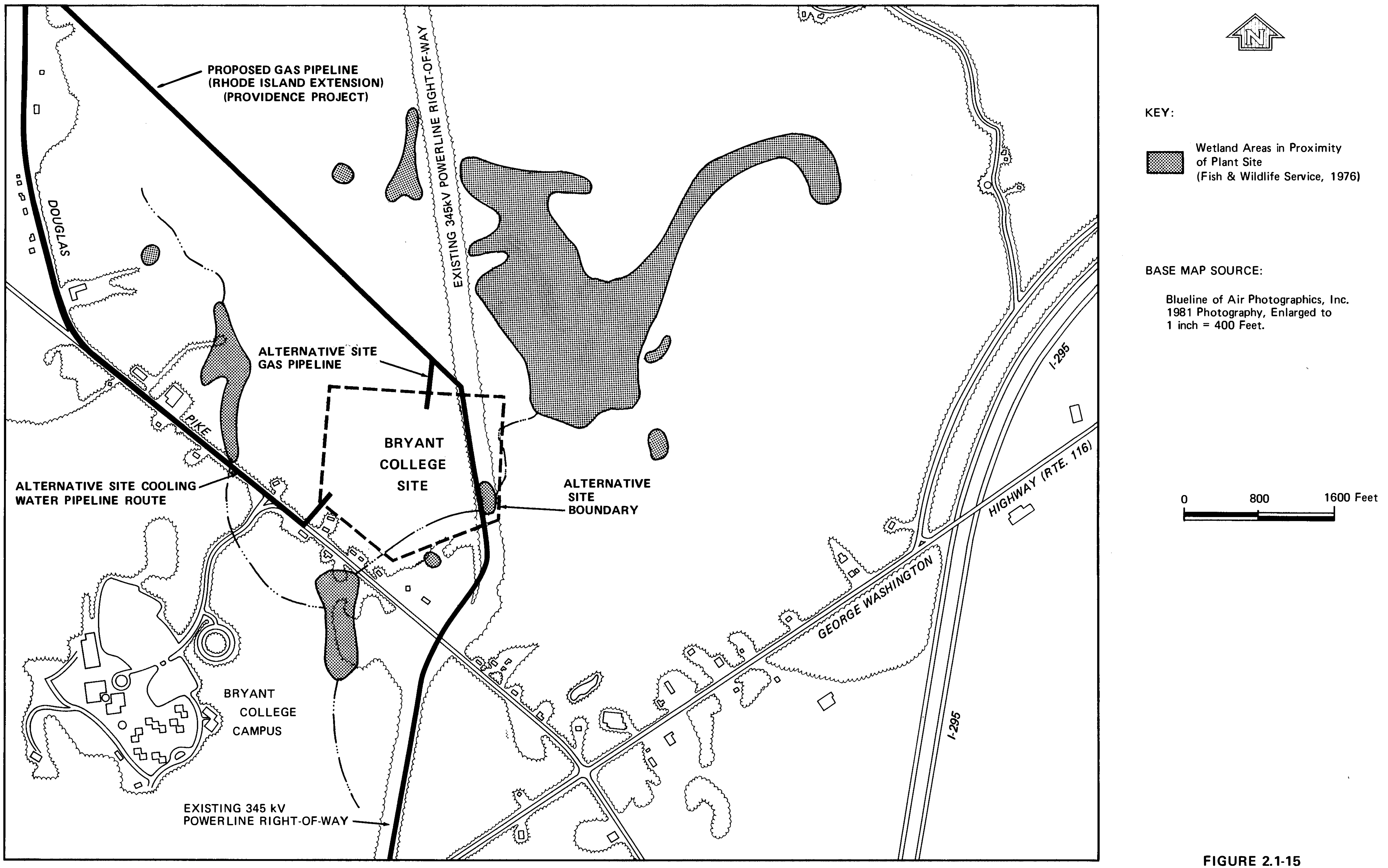


FIGURE 2.1-15
BRYANT COLLEGE SITE VICINITY MAP

2.1.6.2.5 Gas Supply System

Tennessee's proposed Rhode Island Extension route passes directly by the east side of the Bryant College site. To service the site, a 20.6-mile pipeline from Tennessee's Main Line would be constructed, of which the north 11 miles would be identical to the gas delivery line to Sherman Farm Road. No changes to Tennessee's alignment for the Rhode Island Extension would be required.

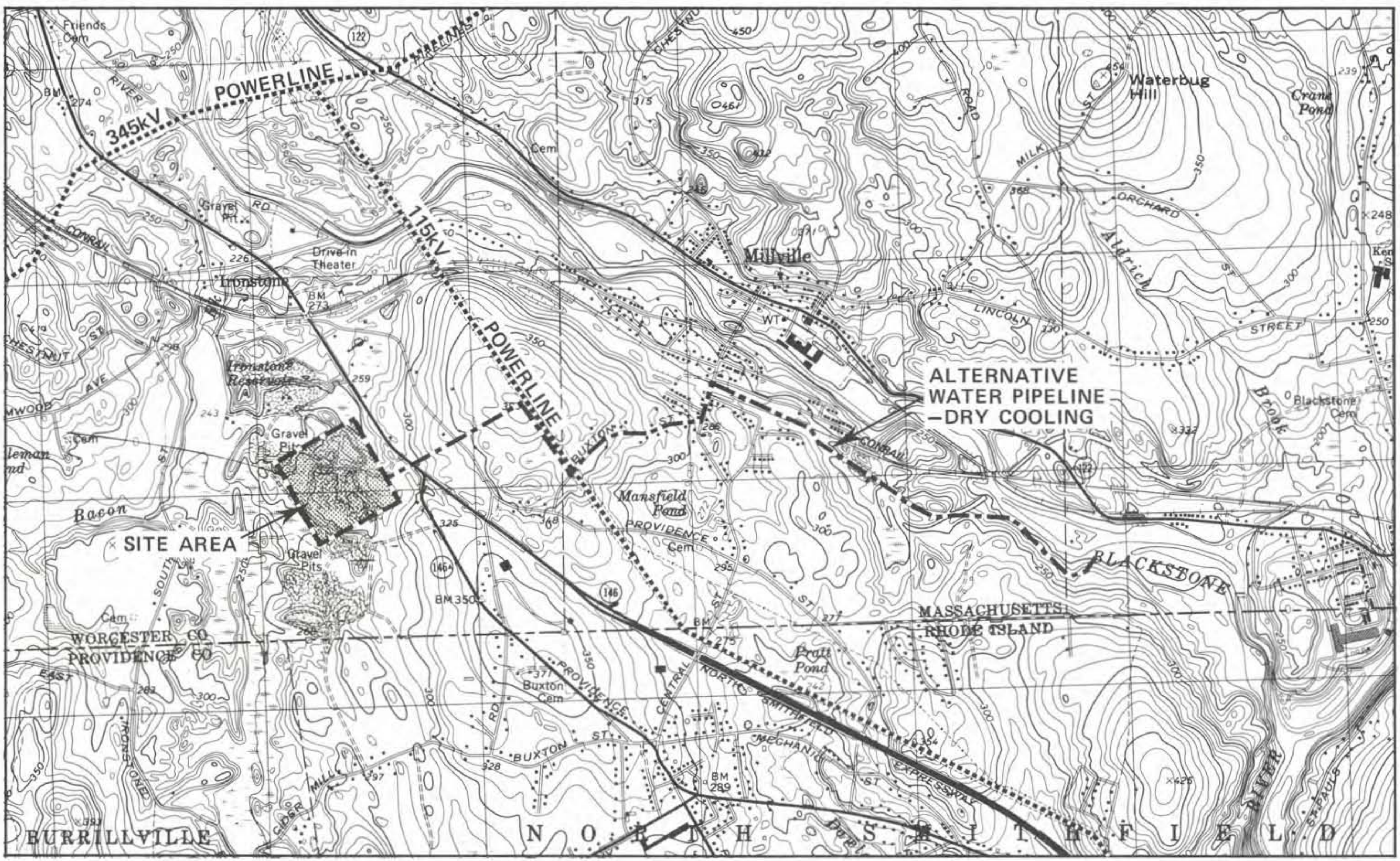
2.1.6.3 Ironstone Site

2.1.6.3.1 Location and Description

The proposed Ironstone plant site is located in previously mined-out portions of a sand and gravel operation adjacent to Route 146A (Quaker Highway) in Massachusetts. There are ongoing sand and gravel operations located immediately adjacent and to the north of the proposed site area. The site is also adjacent to the Ironstone reservoir approximately 1.5 miles west of Millville, Massachusetts. The relative location of the alternative Ironstone plant site is illustrated in Figure 2.1-16. A more detailed site map is shown in Figure 2.1-17.

The area in question is currently zoned for agricultural and business use. However, there is a current proposal to rezone 200 acres to industrial use. The proposed zoning line is shown in Figure 2.1-17. The potential for groundwater contamination from the industrial uses proposed at the site was an issue in the rezoning application. The Town of Uxbridge, Massachusetts, engaged a consultant to evaluate the geohydrological characteristics of the Ironstone site and to provide recommendations regarding the town's land use planning at the site. The consultant concluded that the site could reasonably be rezoned to industrial purposes; however, the report did not specifically evaluate or recommend zoning that would include an electric generating or similar type of facility. The consultant also recommended that the town should impose relatively strict controls on the types of industrial activities that can be approved.

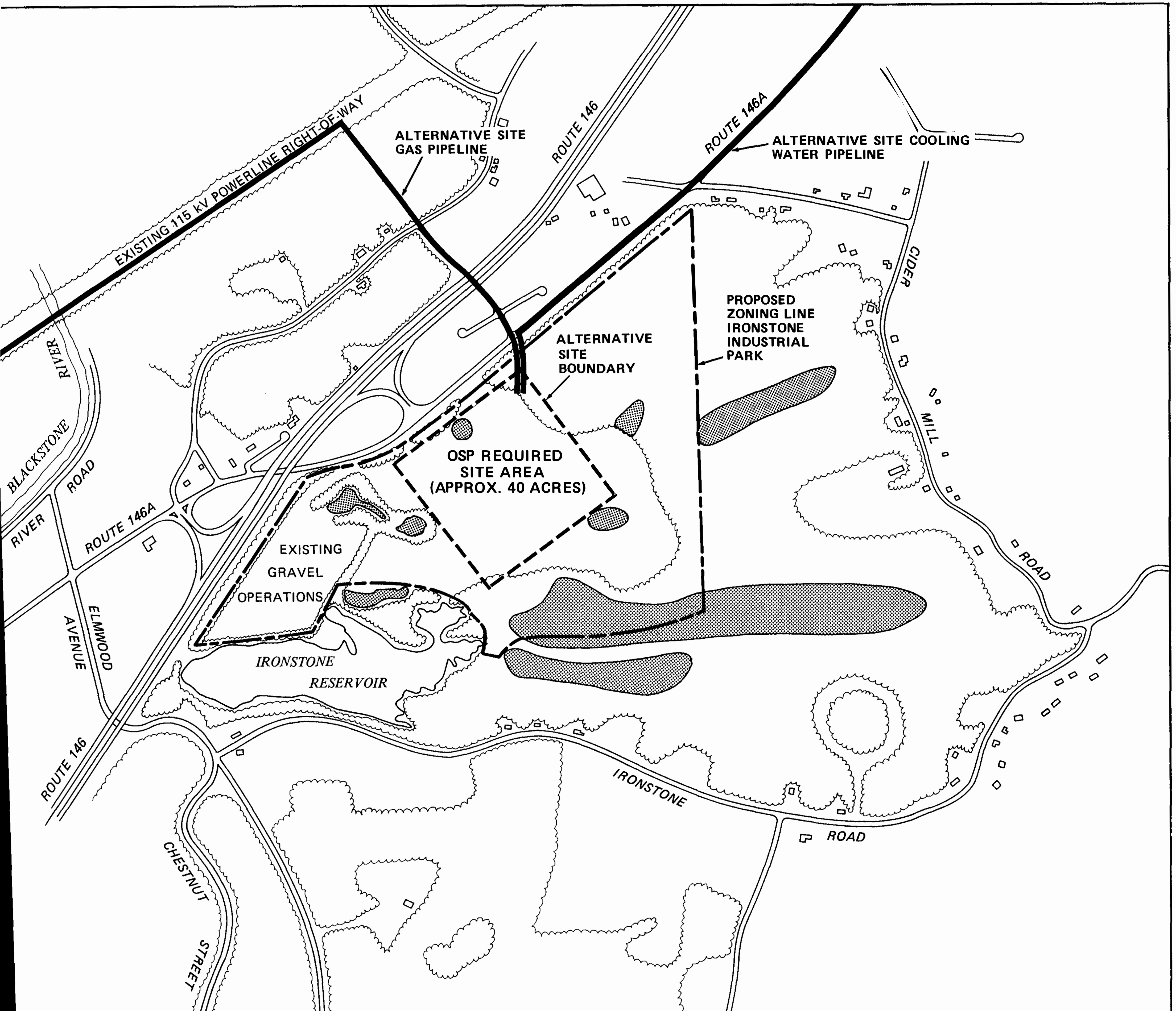
The developable area in the proposed Ironstone Industrial Park exceeds 100 acres which would be more than adequate for OSP's land requirements of approximately 40 to 50 acres. The area in question would not require site clearing, although considerable site preparation would be needed. Since the area has been previously mined out, sand and gravel resources would not be lost. Wetlands would not be impacted at the site but may be by the ancillary facilities (i.e., transmission



SOURCE: U.S.G.S. 7½′ Quad, Blackstone, Mass., R.I., 1979.

FIGURE 2.1-16

ALTERNATIVE IRONSTONE PLANT SITE AREA



KEY:

Wetland Areas in Proximity of Plant Site (Fish & Wildlife Service, 1979 b)

BASE MAP SOURCE:

Blueline of Air Photographics, Inc. 1981 Photography, Enlarged to 1 inch = 400 Feet.

Additional Detail From Map of Proposed Ironstone Industrial Park, Laferriere, April 1988

0 800 1600 Feet

FIGURE 2.1-17
IRONSTONE SITE VICINITY MAP

lines and pipelines). Additional land use requirements would be approximately 44 acres for 1.3 miles of new transmission lines and a new switching station, and 75 acres for gas pipelines. The closest residence to the Ironstone site is located approximately 2,000 feet west of the center of the proposed site location. Access to the plant would be off Route 146A.

2.1.6.3.2 Electricity Distribution

Power generated by the plant would be fed to the NEPOOL grid through a nearby 345-kV transmission line. Connection to the grid would be made at a new switching station and transmission line junction on the bulk grid 1.3 miles north of the site. This would require some right-of-way clearing in a northeasterly direction to an existing power line right-of-way and some additional right-of-way widening up to the new switching station on the bulk grid.

2.1.6.3.3 Water Supply System

Plant water requirements of 4.4 mgd would be met by constructing a pipeline to the proposed water intake structure in Woonsocket approximately 5 miles east of the site. The pipeline would run from the intake structure along city street rights-of-way in Woonsocket to Route 146A, then northwest to the plant site.

Use of dry cooling at the Ironstone site would reduce plant water requirements to about 0.8 mgd. Water could be withdrawn from the Blackstone River, from the pool above the dams in Woonsocket. A possible intake location is shown on Figure 2.1-16. From the intake, the water pipeline would follow the topographic contour along the south bank of the river, then follow an old railroad grade west, intersecting the active Conrail line. The route would then follow the Conrail line to Central Street in Millville, Massachusetts, then along Buxton Street and the power line right-of-way to a point just east of the Ironstone site. It would then follow the common utility corridor into the site.

2.1.6.3.4 Oil Supply System

A fuel oil pipeline would be constructed to supply oil to the plant in the event of a gas supply interruption. The pipeline would be used to refill the oil storage tanks during and following a period of plant operation using standby oil. The pipeline would be 6 inches in diameter and would be a short distance to the north of the site, where it would connect to the existing Mobil Oil pipeline that runs from Providence to Springfield, Massachusetts.

2.1.6.3.5 Gas Supply System

The Ironstone site is approximately 3 miles east of the Sherman Farm Road site and the route of Tennessee's proposed Rhode Island Extension. Were the Ironstone site to be selected, it would be appropriate to reroute the gas pipeline to the east, along the Lackey Pond/Transmission Line Variation (V-4) as shown on Figure 2.2-20 in Section 2.2. The portion of the line north of Lackey Pond would be identical to the Rhode Island Extension. Overall, the line would, at 10.5 miles in length, be 0.5 miles shorter than the proposed gas delivery line to Sherman Farm Road.

2.1.6.3.6 Permits

Massachusetts regulations will need to be complied with if the Ironstone site is selected. Many of the permits and approvals required for the plant site and pipeline facilities are presented in Tables 1.3-1 and 1.3-2. Additional regulatory requirements are (1) the Massachusetts Environmental Policy Act (MEPA)--preparation of draft and final environmental impact reports; (2) the Massachusetts Department of Public Safety--permits for fuel oil storage tanks (Intercontinental Energy Corporation, 1987); and the Massachusetts Energy Facilities Siting Council--approval for construction of proposed energy facilities.

2.1.6.4 Summary Comparison

The applicant's proposed site at Sherman Farm Road and the two alternative sites--Ironstone in Massachusetts, and Bryant College in Rhode Island--have previously been described in detail. The purpose of this section is to summarize and compare the characteristics of each site.

The relative location of each of the three sites with respect to each other is shown in Figure 2.1-18. Also shown are the proposed and alternative routings of transmission lines, gas pipelines, and water pipelines as described in Sections 2.1.3 (Sherman Farm Road), 2.1.6.2 (Bryant College), and 2.1.6.3 (Ironstone). The comparison of these sites focuses on significant issues where there are differences in impacts. Significant issues that differ from site to site are referred to as "distinguishing issues," which serve to highlight the environmental characteristics of each site. Table 2.1-26 summarizes the distinguishing issues of each site for onsite impacts, near-site impacts, plant operations, affected residences, impacts of

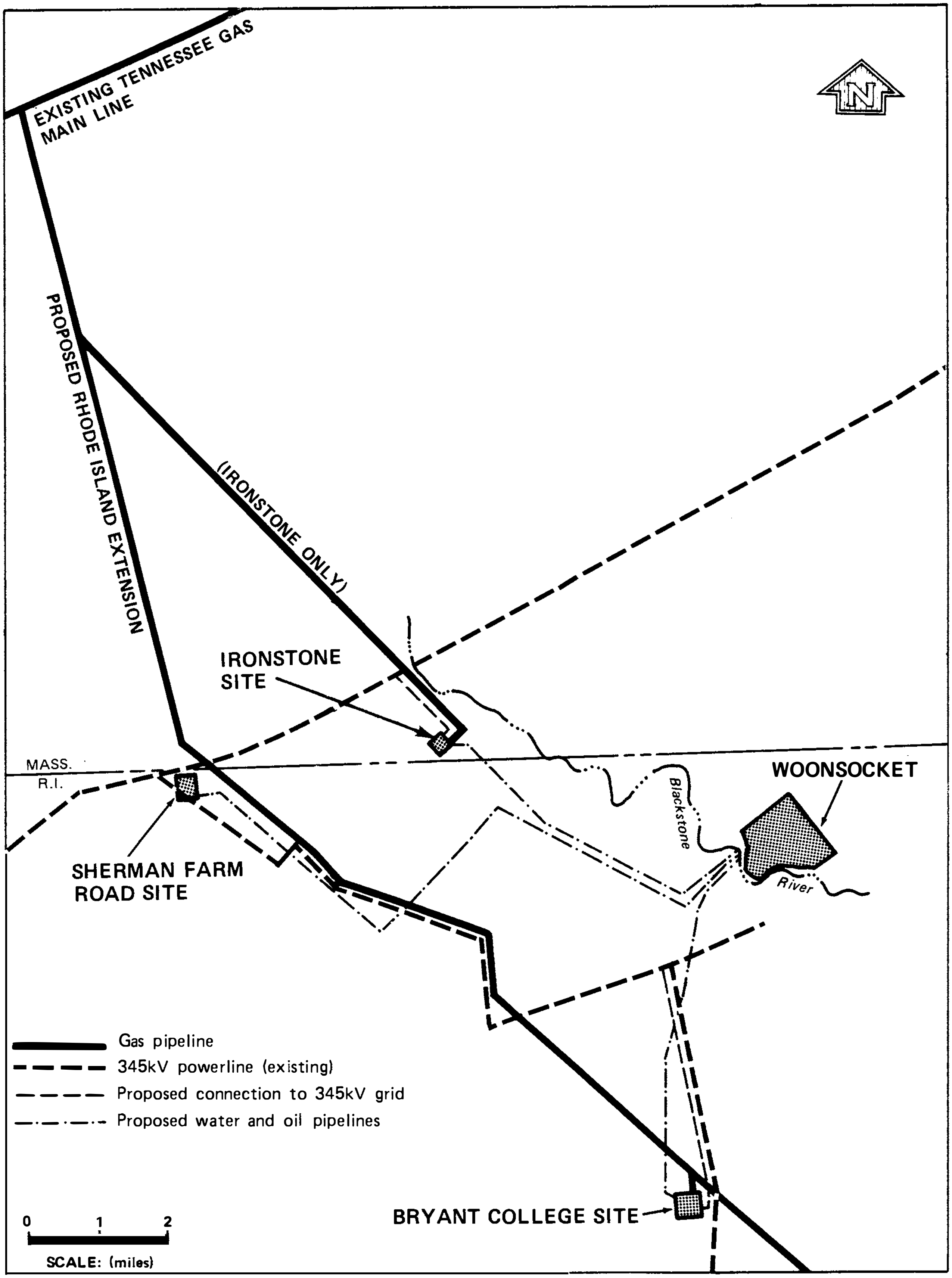


FIGURE 2.1-18
RELATIVE LOCATION OF PROPOSED AND ALTERNATIVE SITES INCLUDING PIPELINE AND TRANSMISSION LINE RIGHT-OF-WAY ROUTINGS

TABLE 2.1-26

Comparative Analysis of Proposed and Alternative Sites

Issue	Sherman Farm Road	Bryant College	Ironstone
Site Development and Construction of Plant			
Onsite Impacts:			
Wetlands Disturbed	0.5 acre	none	none
Woodlands Cleared	16 acres	20 acres	none
Near-Site Impacts:			
Noise	Buffer area large and wooded, thereby reducing noise impacts on surrounding residences; noise would be noticeable at nearest residences. Blasting expected to be noticeable; may impact horse breeding nearby. Would decrease quality of life during construction.	Buffer area is large and wooded, though property is at higher elevation than surrounding noise receptors; noise expected to be noticeable to nearest residents and possibly to the population at nearby Bryant College. May impact quality of life during construction.	Buffer area large with internal cleared area and outside wooded area. Noise impacts expected to be similar to or slightly greater than from existing sand and gravel operations. May impact quality of life for nearest residents during construction.
Traffic	Construction traffic (particularly trucks and equipment) expected to be a significant impact due to existing low volume of traffic and rural nature of the road. Roads are winding, used for walking and biking. Only access is through residential areas. Would negatively impact quality of life during construction period.	Construction traffic expected to be noticeable along Route 7 (Douglas Pike) due to current high volume. Significant impact expected in speed of traffic, number of stops. Access through mixed residential/commercial areas. Would negatively impact quality of life for nearby residents and Bryant College Community during construction period.	Construction traffic not expected to be noticeable considering large number of trucks and equipment already present from sand and gravel operation. No significant impact expected. Access through commercial/industrial areas. No impact on quality of life.
Visibility	Not expected to be significant impact during construction. Large equipment such as cranes should be visible but for short term. Would negatively impact quality of life during construction period.	May be perceived significant by nearest residents along Douglas Pike. Large equipment such as cranes would be visible from Bryant College campus but should not be perceived as a significant impact. May negatively impact quality of life of nearest residents for short periods of time.	May be visible by nearest residents and recreational users of Ironstone Reservoir. May negatively impact quality of life for short periods of time.
Zoning	Zoned F-5, farming, with provision for special exception for an electric generating facility. OSP has applied for and received a special exception for the site.	Zoned industrial, currently undeveloped, with nearby mix of residential, commercial, and industrial facilities.	Zoned agricultural, with zoning change request for industrial park placed by owner.

TABLE 2.1-26 (cont'd)

Issue	Sherman Farm Road	Bryant College	Ironstone
Cultural Resources	No historic or prehistoric sites are on plant site. Two sites of historic interest[a] are within 0.5 mile of the plant site - Burlingame Mitchell Farm and J. Reynolds Farm.	No historic or prehistoric sites are on the plant site. One site of historic interest[a] is within 0.5 mile of the plant - Town Asylum/Farm. The gas and water pipelines and electric transmission lines do not have historic or prehistoric sites adjacent.	One prehistoric site (Uxbridge 332) is partially on the plant site. Little is known about the site which has been disturbed by the rock quarry operations. Adjacent to the site are a farmhouse foundation and a cemetary, both already disturbed by the quarry operation. Within 0.5-mile of the plant site are two National Register sites, Uxbridge 3-1 and 2-6, both occupied dwellings. Within 0.5-mile of the plant site are numerous sites of local historic interest[a]. These sites are in or near the hamlet of Ironstone. Most of these sites are structures or the remains of structures.
Plant Operations			
Noise	Operational noise levels would be noticeable by the closest residents. Noise levels would be below levels determined to protect public health and welfare. Vehicle traffic during plant shift changes would be noticeable and may be perceived as significant by residents. Buffer zone of trees around plant would significantly reduce noise impact during growing months. Would negatively impact quality of life.	Noise impacts not expected to be significant, though may be greater than at Sherman Farm Road due to site elevation. Operational noise may be noticeable on the Bryant College Campus but should not be perceived as significant. Buffer zone of trees should reduce some noise impacts. May decrease quality of life at closest residences.	Noise impacts not expected to be significant during the times that the current sand and gravel facility is operational. Plant noise impact during nighttime quiet hours when sand and gravel facility does not operate are expected to be noticeable by the nearest residents located south and west of the site. When sand and gravel operations shut down, plant operational noise may be noticeable. May negatively impact quality of life in nearest residential areas when sand and gravel facility is not operating.

[a] Sites of historic interest are not National Register sites. Instead, they are sites which have been reported by towns to the State Historic Preservation Officer as being of local historic interest. A National Register site has a set of procedures which must be followed if construction activities will occur nearby.

TABLE 2.1-26 (cont'd)

Issue	Sherman Farm Road	Bryant College	Ironstone
Traffic	Increase in traffic on roads leading to plant should be noticeable by local residents, primarily due to current low volume of traffic. Existing roads capable of increase. May negatively impact quality of life during periods of shift changes at the plant.	May experience some impact due to high volume of traffic, particularly during early morning and late afternoon hours when there may be a conflict with college traffic. May decrease quality of life for residents located along Douglas Pike and the Bryant College community.	No significant impacts expected. Increased volume of traffic should be absorbed without problems. Should not impact quality of life.
Visibility	The two turbine exhaust stacks (150 feet) and the cooling towers (40-50 feet) will be visible from different vantage points around the plant site. The cooling tower plume would be noticeable under certain meteorological conditions (i.e., relatively cool, moist air). Existing trees used as a buffer and visibility mitigation measures to be implemented by the applicant would reduce, but not alleviate, visibility impacts. Pristine nature of night sky would be affected by plume visibility and plant lighting. Would negatively impact quality of life.	Surrounding residences (including Bryant College community) are expected to see stacks and cooling tower plumes. Elevation of site will cause plume to be more noticeable at greater distance from site. Would negatively impact quality of life.	Commuters along Route 146 are expected to see stacks and possibly cooling towers. Plume will be noticeable from Route 146 and possibly from residences south and west of the plant. No significant impacts expected on night viewing. Would negatively impact quality of life for nearby residents.
Property Values	Property values may decline in areas immediately adjacent to the plant.	Property values may decline slightly, though mixed use of surrounding area will tend to restrict decline.	Property values may decline south and west of plant, but the decrease should not be great nor direct.
Number of Residences Within 0.5 Mile	40	20	23
Number of Residences Within 1 Mile	90	unknown	125
<u>Construction and Operation of Ancillary Facilities</u>			
Gas Pipeline	Pipeline follows about 2 miles of power line right-of-way. Primarily rural area. Minimal significant impact expected to local ecology or residences. Impacts would be	Pipeline to be located in rural areas using mostly existing rights-of-way. Minimal significant impact expected to local ecology or residences. See site develop-	Pipeline to be located in rural areas using significantly more power line right-of-way. Minimal significant impact expected to local ecology or residences. See site development section above for

TABLE 2.1-26 (cont'd)

Issue	Sherman Farm Road	Bryant College	Ironstone
Water Pipeline	Requires 10 miles of pipeline from Woonsocket to Burrillville. Would cause temporary disruption in traffic patterns along most of route. Would impact some residences along Douglas Pike. All impacts would be temporary. The water pipeline traverses two historic districts (Mohegan and Nasonville) which are not National Register Districts and two National Register Historic Districts (Union Village and South Main Street). Both Districts are mostly dwelling. Three National Register Sites are adjacent to the pipeline - Peleg Arnold Tavern, Smithfield Meeting House, and the 1761 Milestone.	Requires 5.7 miles of pipeline through mixed rural and urban areas. Temporary impact expected to traffic along pipeline route. All impacts would be temporary. See site development section above for cultural resources.	Requires 5 miles of pipeline primarily through rural area. Around Woonsocket/Smithfield, urban areas would be impacted. Would cause temporary disruption of traffic. All impacts would be temporary.
Transmission Line	No new right-of-way or construction expected. No impacts.	Requires 4.6 miles of new transmission line along existing right-of-way; impact would be temporary. Requires new switching station (10 acres). Approximately 66 acres of new land required. See site development Section above for cultural resources.	Requires 1.3 miles of new transmission line plus new switching station. Approximately 44 acres of new land required. The electric transmission lines do not have historic or prehistoric sites adjacent. The water and oil pipelines, which follow local roads, traverse several areas where there are concentrations of sites of local historic interest, two National Register Historic Districts (Union Village and South Main Street), and Three National Register Sites (Peleg Arnold Tavern, Smithfield Meeting House, and the 1761 Milestone).

ancillary facilities (i.e., pipelines and transmission lines), and impacts on cultural resources[a].

Table 2.1-27 summarizes the natural resources that can be expected to be impacted by the power plant's ancillary facilities associated with each site.

Plant Construction Phase

Access to Sherman Farm Road would generate the perception of a greater impact than the alternatives because of the distance along secondary roads to major arteries, such as Route 146 and I-295. This distance is 4.5 miles for Sherman Farm Road, 0.5 miles for Ironstone, and 1.5 miles for Bryant College. The level of traffic near Sherman Farm Road is very light compared to both alternatives, and increased traffic at the site would not affect highway safety standards.

Construction noise would be most noticeable to the local residents at Sherman Farm Road because of the rural nature of the area and low traffic volumes. Residents near Ironstone are accustomed to trucks and equipment from the sand and gravel operation and high traffic levels along Route 146. The Bryant College site has the least number of nearby (within 0.5 mile) permanent residents; however, student housing is within 0.5 mile of the site and may experience some noise impact.

The Sherman Farm Road and Ironstone sites would require more caution than the Bryant College site in constructing the oil, gas, and water pipelines because of the known historic sites adjacent to the pipelines. These pipelines traverse several National Register historic districts and are adjacent to several National Register sites. Since the proposed pipelines would be using existing road right-of-way, the historic sites should not be adversely affected; however, special action may have to be taken during construction to make sure adverse effects are avoided. The Bryant College site does not have such characteristics.

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[a]Cultural resources were not examined previously in the alternative site study. Except for the plant site, facilities such as pipelines either have the flexibility to avoid cultural resources or are located in existing roads or rights-of-way and are less likely to affect historic or prehistoric sites. An analysis of cultural resources, identified to date from site file checks or actual project surveys, was performed for the summary comparison to enable an evaluation of the likelihood of encountering such resources and/or the difficulty of their avoidance.

TABLE 2.1-27

Natural Resources Impacted by Alternative Site Ancillary Facilities

	Number and Percent Wetlands Crossed[a,b]	Number Streams Crossed[c,d]	Number and Percent Sand & Gravel Operations Impacted[a,b]	Parks and Management Areas[c]	Number and Percent Agricultural Land Crossed[b]
Bryant College					
Water	6; 14%	3	1; 6%	none	2; 15%
Oil	17; 38%	3	1; 1%	none	2; 10%
Transmission	9; 57%	1	none	none	none
Gas	35; 24%	20	5; 8%	none	7; 4%
Ironstone					
Water	6; 10%	3	none	none	none
Oil	9; 20%	3	2; 9%	none	1; 5%
Transmission	7; 18%	4	1; 3%	none	3; 12%
Gas	13; 15%	7	2; 4%	none	6; 22%
Sherman Farm Road					
Water	11; 16%	7	2; 7%	none	4; 4%
Oil	5; 8%	4	none	none	1; 2%
Alternative Oil	4; 6%	4	none	none	1; 6%
Transmission	--	--	--	--	--
Gas	12; 19%	5	4; 14%	none	1; 1%

[a]Based on National High Altitude Program (NHAP) 1985 false-color infrared aerial photographs, interpreted stereoscopically.

[b]Percents are the portion of the total line length crossing a feature, divided by the total line length times 100.

[c]Based on 7.5-minute topographic quadrangles.

[d]Includes water bodies.

Operational Impacts

After startup, the distinguishing issues would be noise, visibility, and potential impact on property values. While the noise sources would be different, the receptors are those described in the previous paragraphs on construction. The presence of a power plant--including generator buildings, cooling tower, and stacks--would be visible at all three sites. In addition, during cool, humid weather conditions, a plume would be observed from the cooling towers. At Sherman Farm Road, existing woodlands beyond the cleared plant site would provide a partial visual buffer (which would be least effective in the winter); however, the site has about twice as many residences within 0.5 mile. A plant at Ironstone would be highly visible to traffic along Route 146. At the Bryant College site, since both the college and the site are on topographic high points, the plant would have high visibility.

Property values may be adversely affected by construction of a power plant, but the significance is difficult to determine. Assuming that the greatest impact would be on residential properties, effects could be most significant at the Sherman Farm Road site, which has the highest number of nearby residences. At Ironstone and Bryant College, there would be some impact on property values, but there would also likely be more potential benefits to the few local restaurants and other commercial activities. There are no commercial establishments adjacent to Sherman Farm Road.

Plumes from cooling towers occasionally create localized fogging and icing conditions at ground level. Although these events are expected to be rare, Sherman Farm Road is the least likely to be a safety problem, while Route 146 adjacent to Ironstone is of the most concern.

Other Issues

Water for a plant at any of the three sites is presumed to come from Woonsocket, Rhode Island. The transfer of water from the Blackstone River in Woonsocket, Rhode Island, to the Ironstone site would require OSP submitting a written petition to the Rhode Island Water Resources Board requesting permission to transport water out of the state (Rhode Island Water Resources Board, GL § 46-15.9), where upon the Board would either grant or deny the petition. Petition approval would depend on accompanying documentation and presumably a policy decision on the benefits and costs of the transfer to the State of Rhode Island. An adequate supply of water (0.8 mgd) could probably be withdrawn from the Blackstone River within Massachusetts to implement the dry cooling alternative at the Ironstone site.

Stony Brook

The existing Stony Brook Energy Center in Ludlow, Massachusetts, east of Springfield, provides an opportunity to add power generating capacity alongside an existing gas-fired power plant. Using the site evaluation process shown in Figure 2.1-10 and discussed in Section 2.1.5, several environmental issues tended to downgrade Stony Brook. In part, this is the result of not considering the acceptability of a very large facility at one location compared with two smaller facilities at separate sites. Construction and operation of a plant similar to the one proposed by OSP is possible and perhaps desirable at some time. However, it should be realized that numerous environmental impacts would have to be considered.

If the requirements for power described in Section 2.1.1 are considered, there is a clear imbalance between generating capacity and electrical demand in Rhode Island. Additionally, the overall demand in New England would require the development of several other plants in the next few years. Construction of a plant at Stony Brook would not address the need for generating capacity in northern Rhode Island/southern Massachusetts.

Conclusion

While gas-fired power plants of the type proposed by OSP are relatively good neighbors, there are both construction and operating impacts that would vary from site to site. OSP's proposed Sherman Farm Road site and the two identified alternative sites--Bryant College and Ironstone--are all considered to be feasible for the development of the proposed power plant and ancillary facilities. That is, all three sites appear to be capable of supporting the proposed power plant configuration with acceptable impacts on and around each site.

In terms of impacts on nearby residents, the Sherman Farm Road site has the greatest number of nearby residences (i.e., 40 within 0.5 mile of the plant compared with 20 and 23 for Bryant College and Ironstone, respectively) where residents could experience adverse impacts due to plant construction and operation. The greatest environmental impact would be experienced at the Bryant College site, primarily because of transmission line right-of-way requirements. The Bryant College and Ironstone sites would require 66 and 44 acres, respectively, of additional right-of-way for transmission lines, while the Sherman Farm Road site will not require any. However, use of the Ironstone site would not require site clearing, and onsite wetlands could easily be avoided. Based on these and other considerations summarized in Table 2.1-26, the most favorable site is considered to be the Ironstone site, followed by the Sherman Farm Road site and the Bryant College site. Of the alternatives considered, the FERC Staff believes that the Ironstone site with a dry cooling system would result in the least overall environmental impact. The estimated cost differential is 40 to 50 million dollars greater for the Staff's preferred alternative, or about 15 percent of the present estimated capital cost for the plant.

2.2 GAS PIPELINE IMPROVEMENTS

Section 2.2 includes the following discussions related to gas pipeline improvements:

- Section 2.2.1--Need for Proposed Action.
- Section 2.2.2--No Action or Postponed Action.
- Section 2.2.3--Proposed Action.
- Section 2.2.4--Alternatives Considered.
- Section 2.2.5--Comparison of Impacts of Proposed Action and Alternatives.

2.2.1 Need for Proposed Action

As discussed in Section 2.1.1, there is a demonstrated need for the electric power that would be produced by the OSP power plant. The pipeline looping and increases in compression on the Tennessee Gas Pipeline Company system are those necessary to supply the OSP plant with natural gas from the 200 Main Line system as currently proposed by Tennessee.

2.2.2 No Action or Postponed Action

FERC has three alternative courses of action in processing a certificate application--it may grant the application (with or without conditions), deny the application, or postpone action pending further study. The guiding principle in choosing among these alternatives is the question of which would best serve public convenience, necessity, and welfare. Postponement of action may not be appropriate as a reasonable alternative because Commission policy mandates that the public interest is best served by acting on complete applications in a timely manner. Postponement could also create delays in startup and operation of the proposed OSP plant.

If the Commission denies the application and thereby prevents delivery of Tennessee's natural gas to the OSP plant, OSP would be required to secure gas supplies from other sources to offset the projected supply deficiencies, to secure alternative sources of fuel, or to abandon the project. Assuming that the need for power has been demonstrated, abandoning the project would not be in the public's best interest. Similarly, it has been demonstrated that natural gas is an environmentally "clean" fuel; therefore, using alternative fuels that may not be as "clean" would not be in the public's best interest. Securing gas supplies from other sources may have effects similar to postponing action because delivery to the OSP plant will require significant upgrading and expansion of delivery facilities regardless of which source is selected.

FERC action is based on a thorough analysis of concerns related to public convenience and necessity, including consideration of the environmental impact of the proposal as required by NEPA.

2.2.3 Proposed Action

2.2.3.1 Description of Action

In Docket No. CP87-75-000, Tennessee Gas Pipeline Company is seeking authorization to sell up to 30,000 Mcfd (thousand cubic feet per day) to Providence Gas Company (Providence Gas). To provide the proposed firm sales service to Providence Gas, Tennessee proposes to construct five sections of 30-inch-diameter pipeline loop on its No. 200 Main Line and Niagara Spur in New York and Massachusetts. Tennessee also proposes therein to construct a new delivery lateral (the "Rhode Island Extension"), consisting of 11 miles of 20-inch-diameter pipeline from its Main Line system in the Town of Sutton, Massachusetts, to the site of the proposed OSP plant in Burrillville, Rhode Island. This line is sized to provide service to both phases of the two-unit OSP plant, however, other elements of Tennessee's proposal are sized for only Unit 1 at OSP. The line would continue southward to a new delivery point for Providence Gas in Cranston, Rhode Island.

Considering the relationship between the "Providence project" (CP87-75-000) and the facilities proposed in Docket Nos. CP87-131-001 (Niagara Spur expansion) and CP87-132-001 (OSP project), the Providence project appears to be independent of the other two projects. The only connection among the projects is the coincidence of the 11 miles of 20-inch-diameter pipeline between Tennessee's Main Line and the proposed OSP plant site (Table 2.2-1). The Providence project is the subject of a separate environmental assessment currently under preparation, and the facilities proposed in Docket Nos. CP87-131-001 and CP87-132-001--including the 11 miles of 20-inch-diameter pipeline to the OSP site--are considered in this FEIS. There is a direct relationship between Tennessee's Niagara Spur expansion and its OSP project, in that development of the latter is dependent on completion of at least portions of the Niagara Spur.

In Docket No. CP87-131-001, Tennessee proposes to construct and operate the facilities necessary to expand its Niagara Spur line to handle transport of a total of 292,000 Mcfd from Canada and to provide firm transport of 50,000 Mcfd for OSP (see Figures 2.2-1 through 2.2-12). To increase the capacity of the Niagara Spur to receive 292,000 Mcfd at the Niagara receipt point, Tennessee proposes the following:

TABLE 2.2-1

Proposed Pipeline Facilities

Docket No. and Project Name	Proposed Facilities	Pipe Diameter (inches)	Length (miles)	Location State	Location County	Location Mileposts[a]
CP87-75-000 Providence	Rhode Island Extension	20 20 16	10.6[b] 0.1[b] 25.3	MA RI RI	Worcester Providence Providence	New Pipeline
	M-1 Loop	30	1.1	NY	Onondaga	MP 239+8.8 to 239+9.9
	M-2 Loop	30	2.0	NY	Madison	MP 242+9.3 to MLV 243
	M-3 Loop	30	2.7	MA	Hampden	MP 259+4.2 to 259+6.9
	M-4 Loop	30	1.2	MA	Hampden	MLV 261 to 261+1.2
	M-5 Loop	30	1.4	MA	Hampden	MLV 262 to 262+1.4
	New Providence Meter Station	--	--	RI	Providence	New Facility
CP87-131-001 Niagara Spur	Expand Lewiston Meter Station	--	(b)	NY	Niagara	MP 230B-107
	Station 233 Permanent operation of 3,500-hp compression authorized in CP86-251	--	(b)	NY	Livingston	MP 232+14.5 (MLV 233)
	Station 230B Permanent operation of 1,000-hp compression authorized in CP86-251 Additional 1,200-hp compression	--	(b)	NY	Erie	MP 230+8.14
	Construct new 4,500-hp compressor station 230C	--	(b)	NY	Niagara	MP 230B-105+0.5
CP87-132-001 Ocean State Power	Loop 1	30	11.2[b]	NY	Niagara	MP 230B-105+5.0 to MLV 230B-107
	Loop 4	30	2.3[b]	NY	Onondaga	MP 239+9.9 to MLV 240
	Loop 5	30	3.7[b]	NY	Madison	MP 242+5.6 to 242+9.3
	Loop 6	30	3.9[b]	NY	Rensselaer	MLV 253 to 253+3.9
	Loop 7	30	4.4[b]	MA	Hampden	MP 259+6.9 to MLV 260
	Station 230B Additional 1,000-hp compression	--	(b)	NY	Erie	MP 230+8.14
	Station 233 Additional 3,500-hp compression	--	(b)	NY	Livingston	MLV 233
	Station 264 Additional 2,000-hp compression	--	(b)	MA	Worcester	MP 263+11.44 (MLV 264)
	New Sherman Road Meter Station	--	(b)	RI	Providence	New Facility

[a] Pipeline milepost (MP) locations are based on the distance from Main Line valve stations (MLV), with values increasing toward the north and east.

[b] Proposed gas pipeline facilities to be considered in EIS.

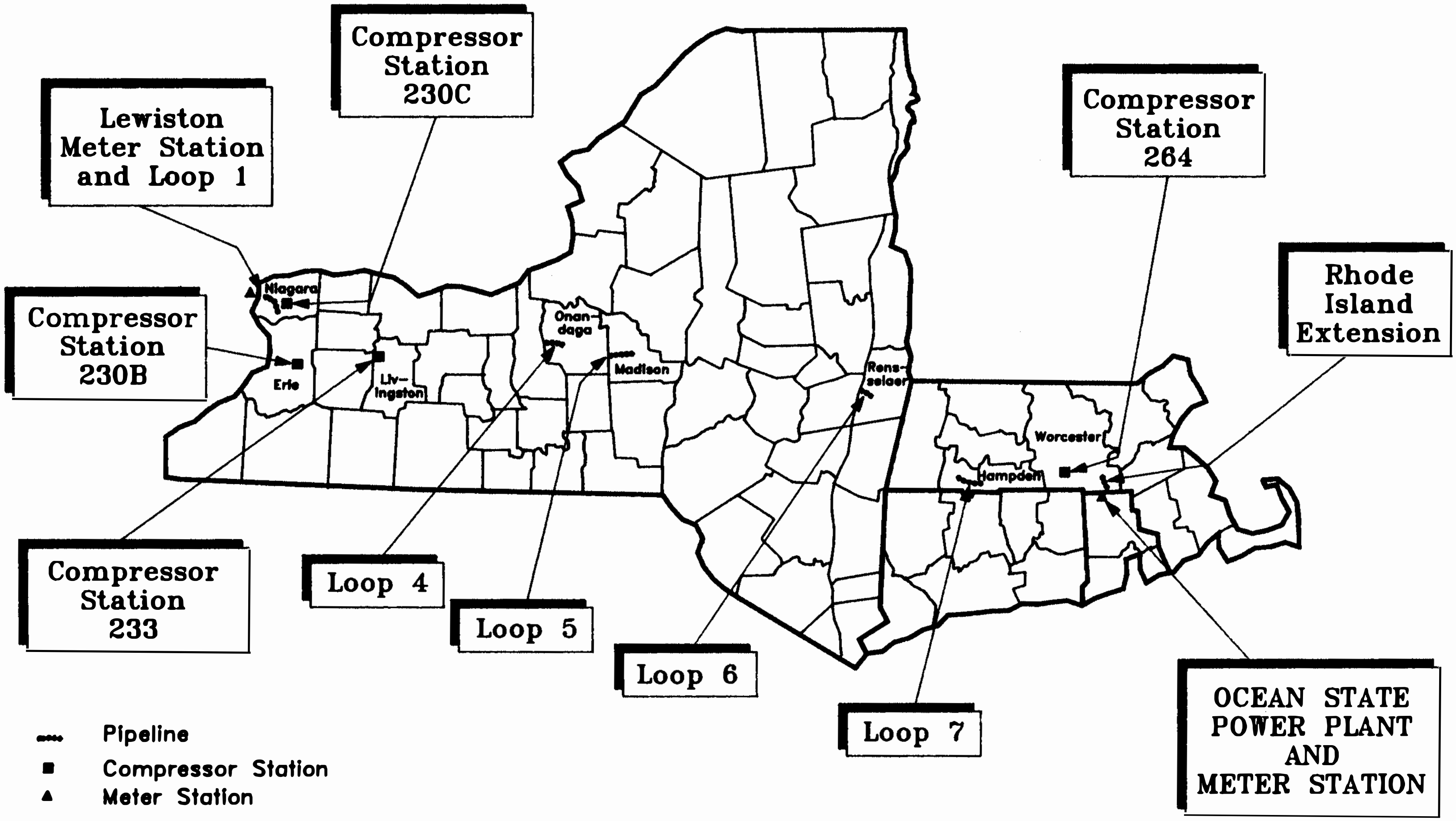
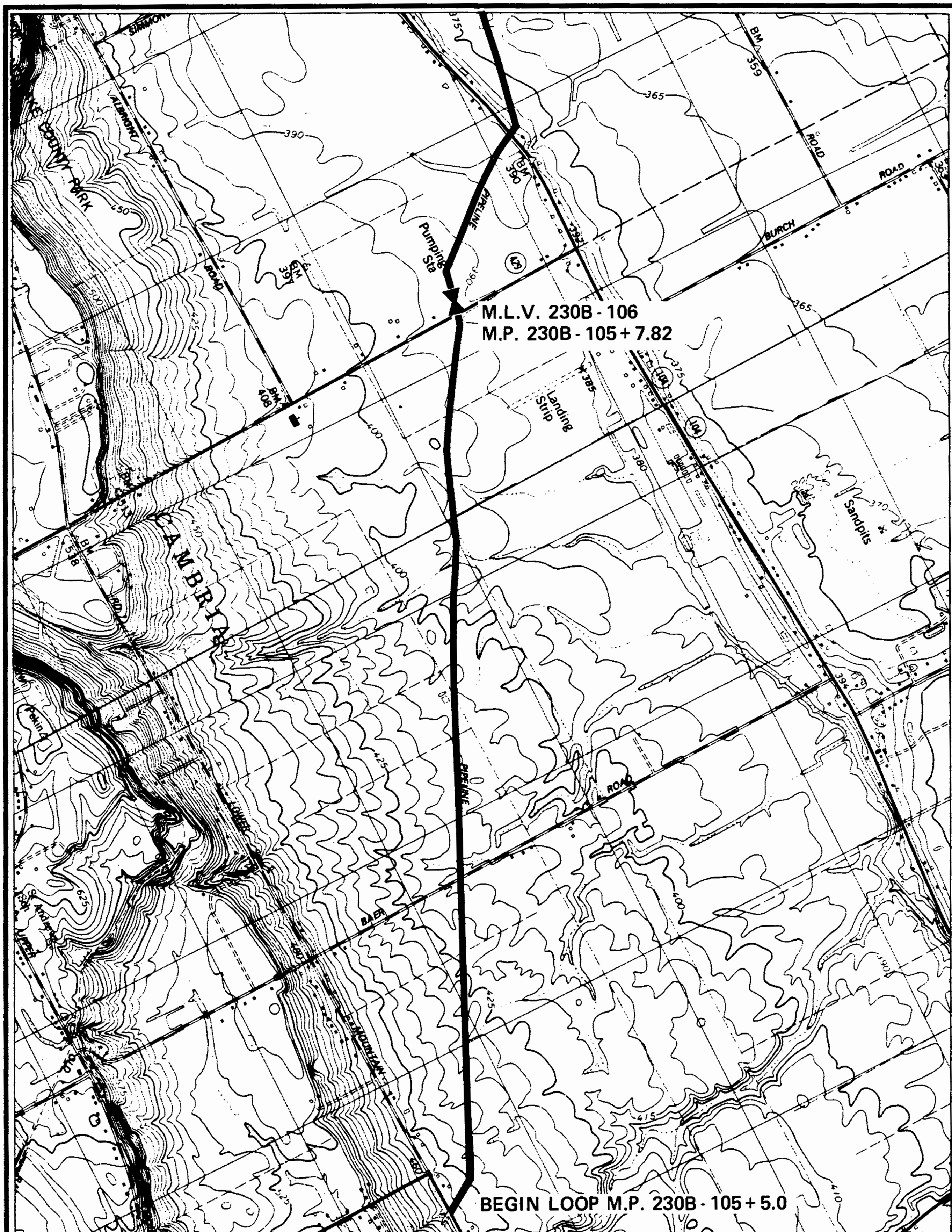


FIGURE 2.2-1
LOCATIONS OF PROPOSED FACILITIES



0 2000 Feet

FIGURE 2.2-2
LOOP 1
NIAGARA COUNTY, NEW YORK

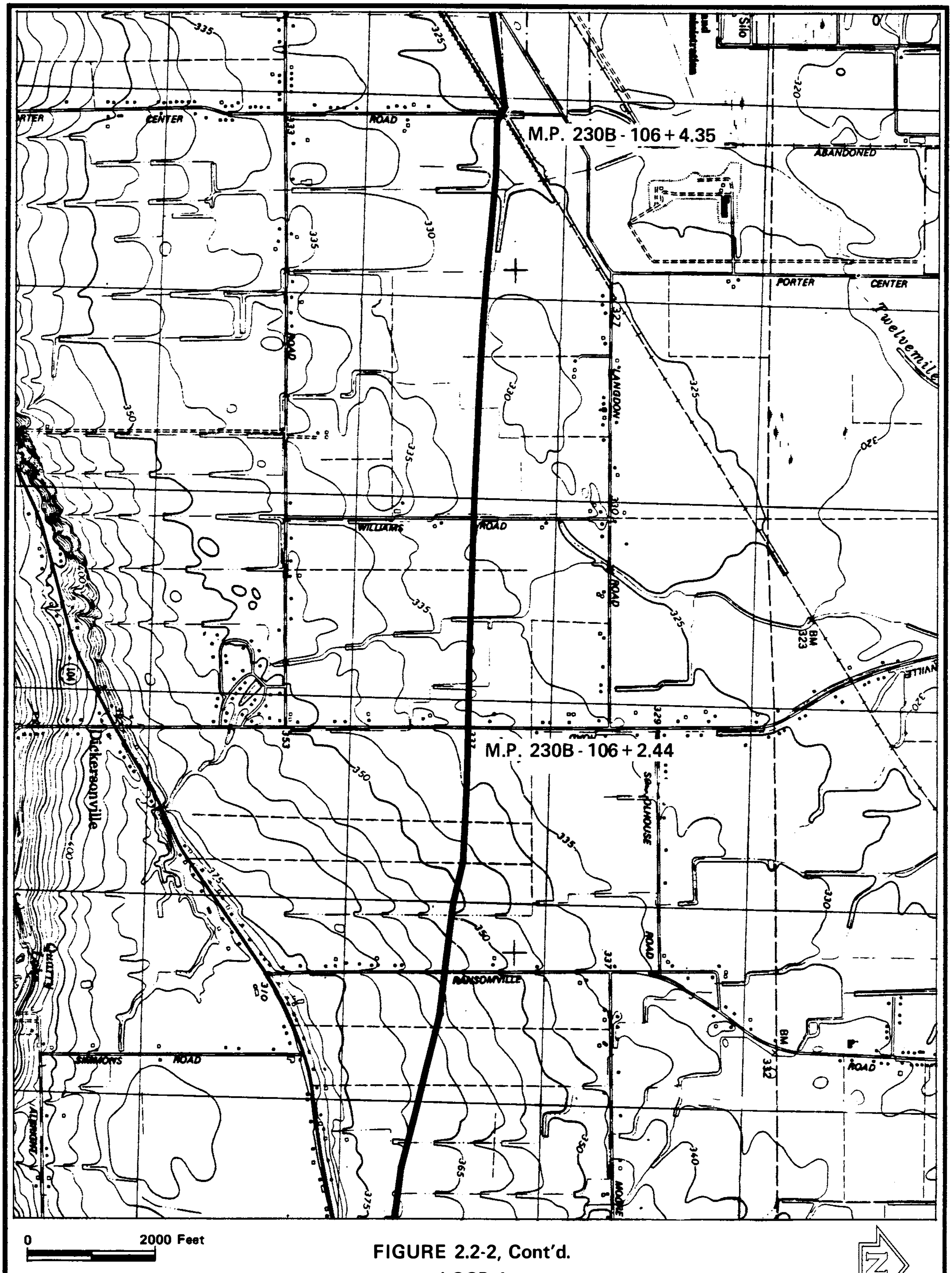
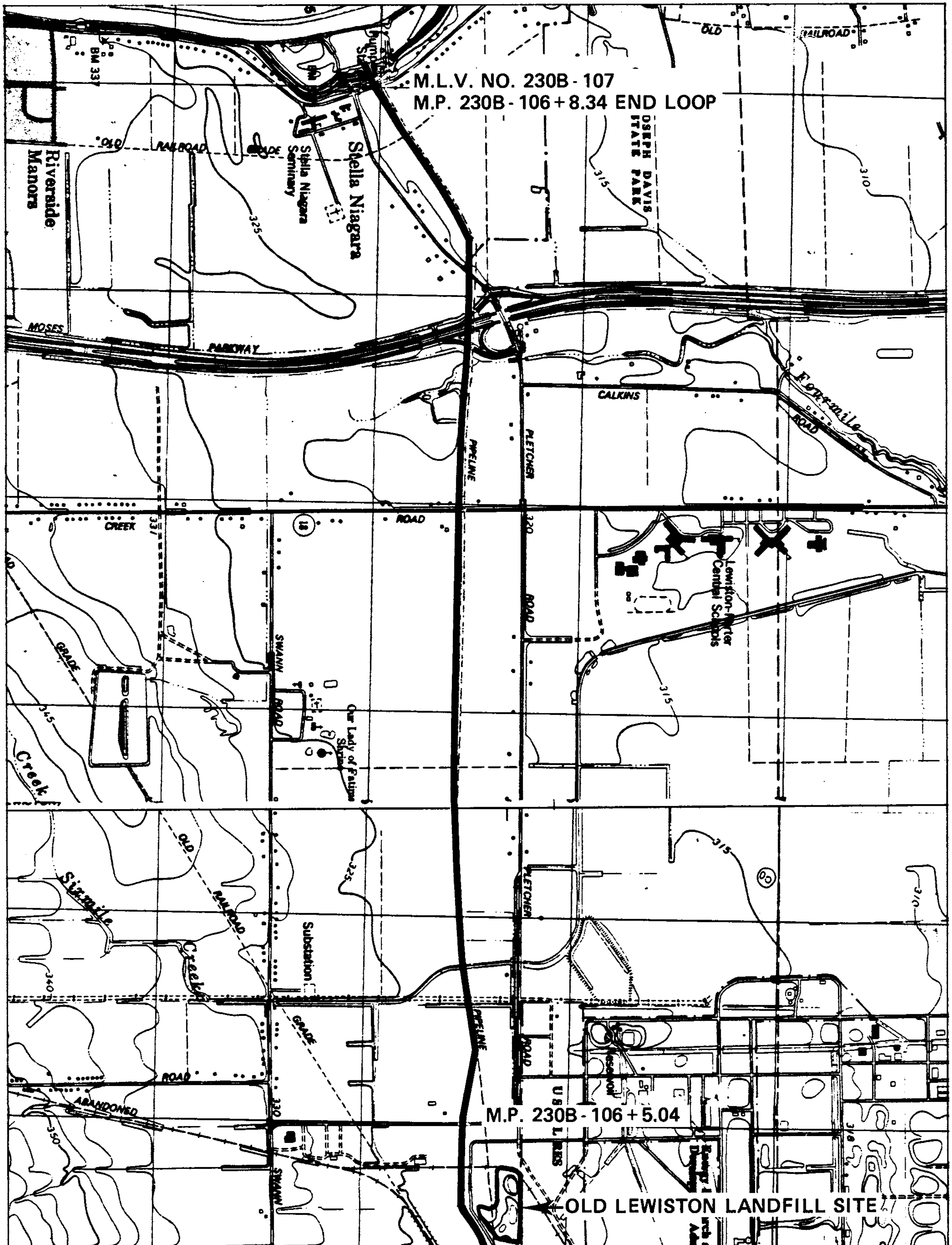


FIGURE 2.2-2, Cont'd.

LOOP 1

NIAGARA COUNTY, NEW YORK



0 2000 Feet

FIGURE 2.2-2, Cont'd.
LOOP 1
NIAGARA COUNTY, NEW YORK

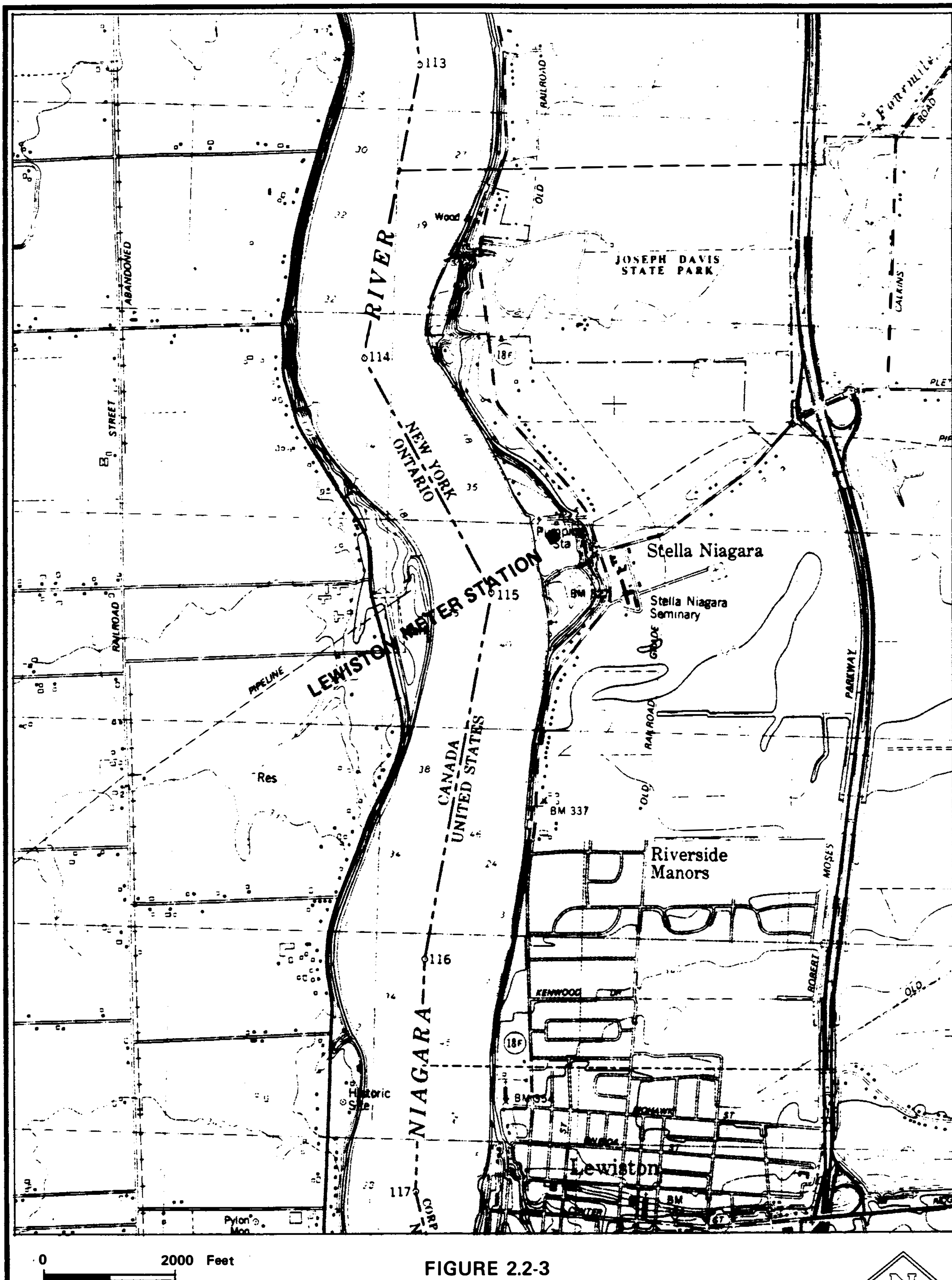


FIGURE 2.2-3
LEWISTON METER STATION
NIAGARA COUNTY, NEW YORK

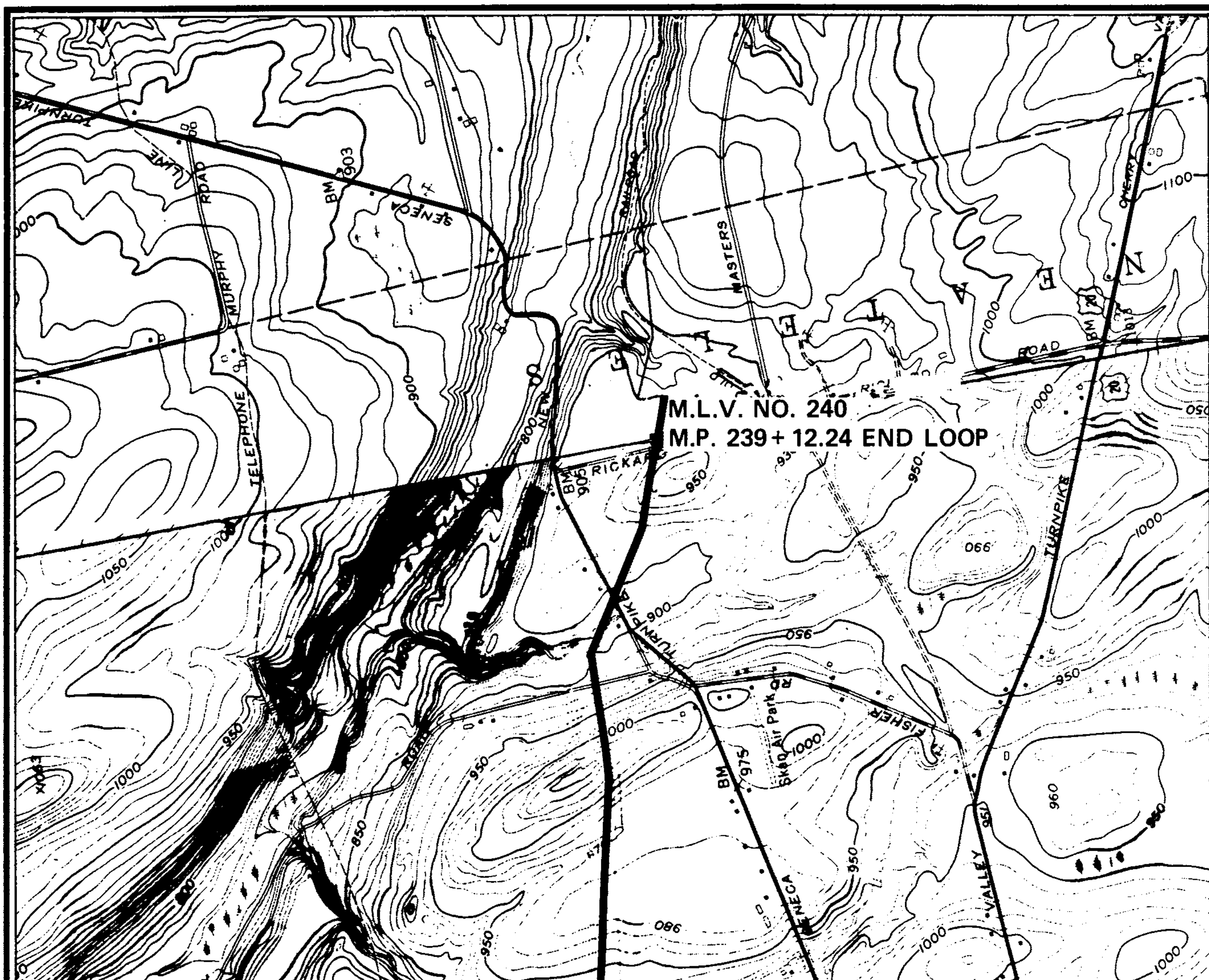


FIGURE 2.2-4
LOOP 4
ONONDAGA COUNTY , NEW YORK

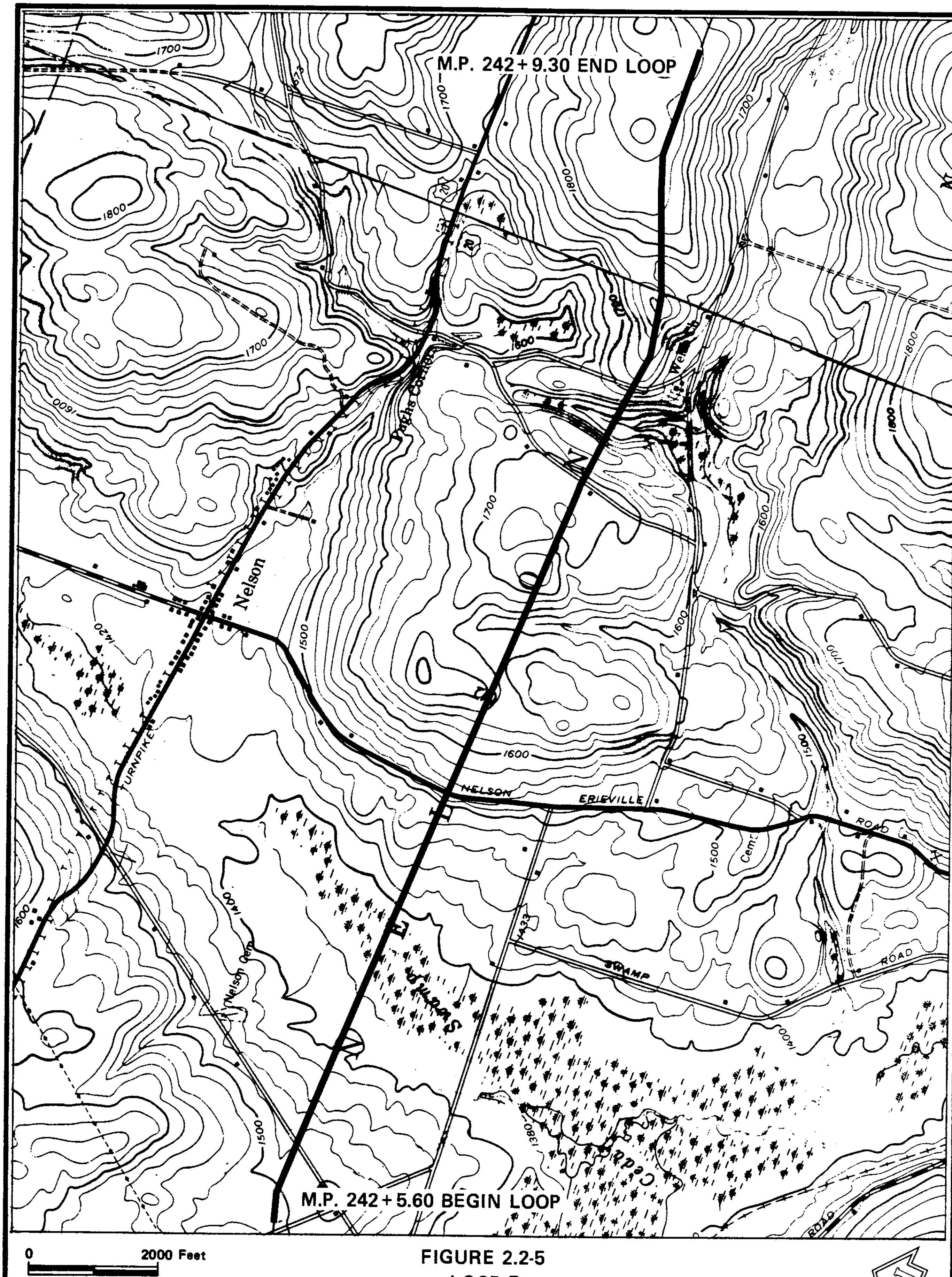
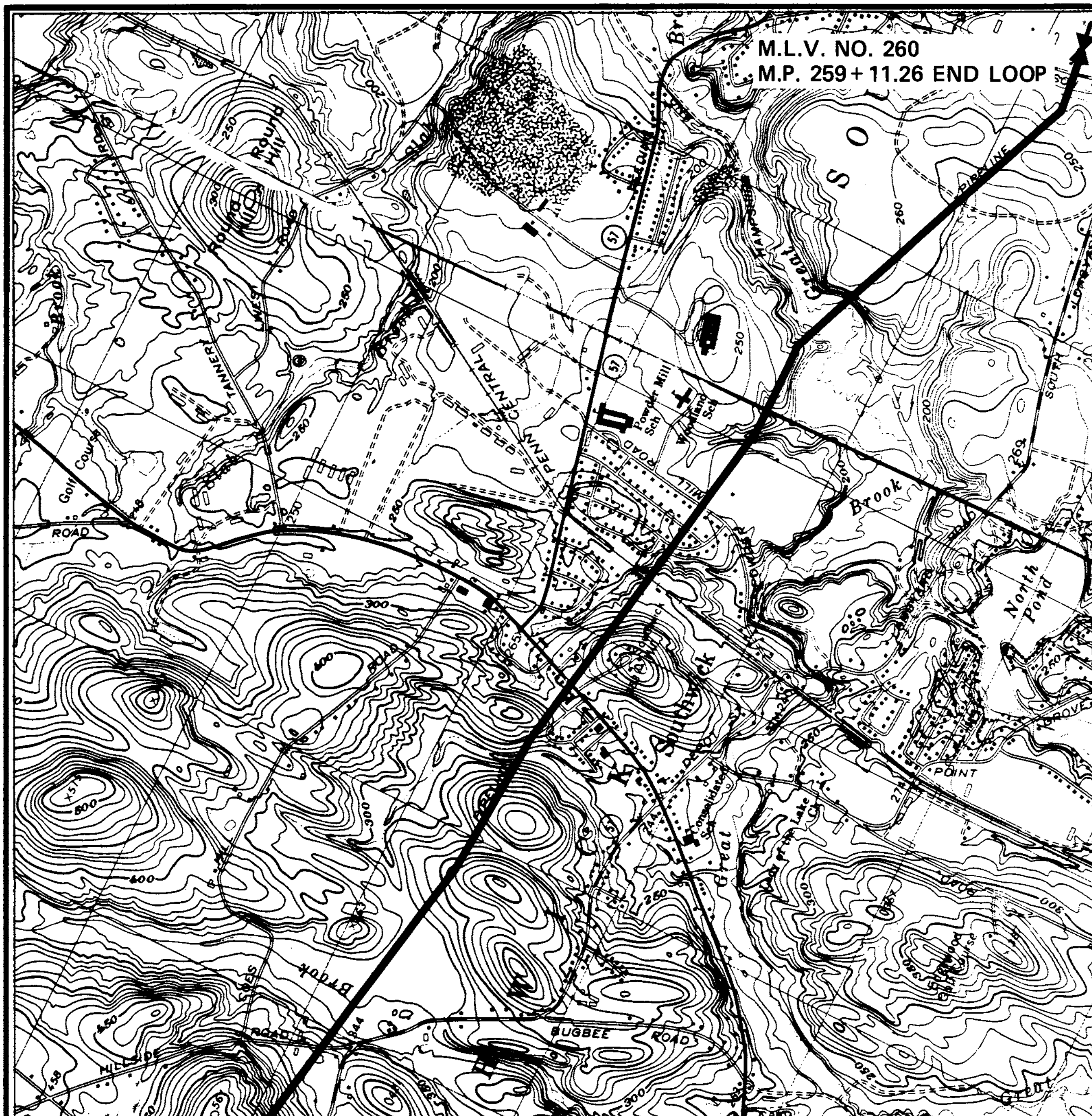


FIGURE 2.2-5
LOOP 5
MADISON COUNTY, NEW YORK

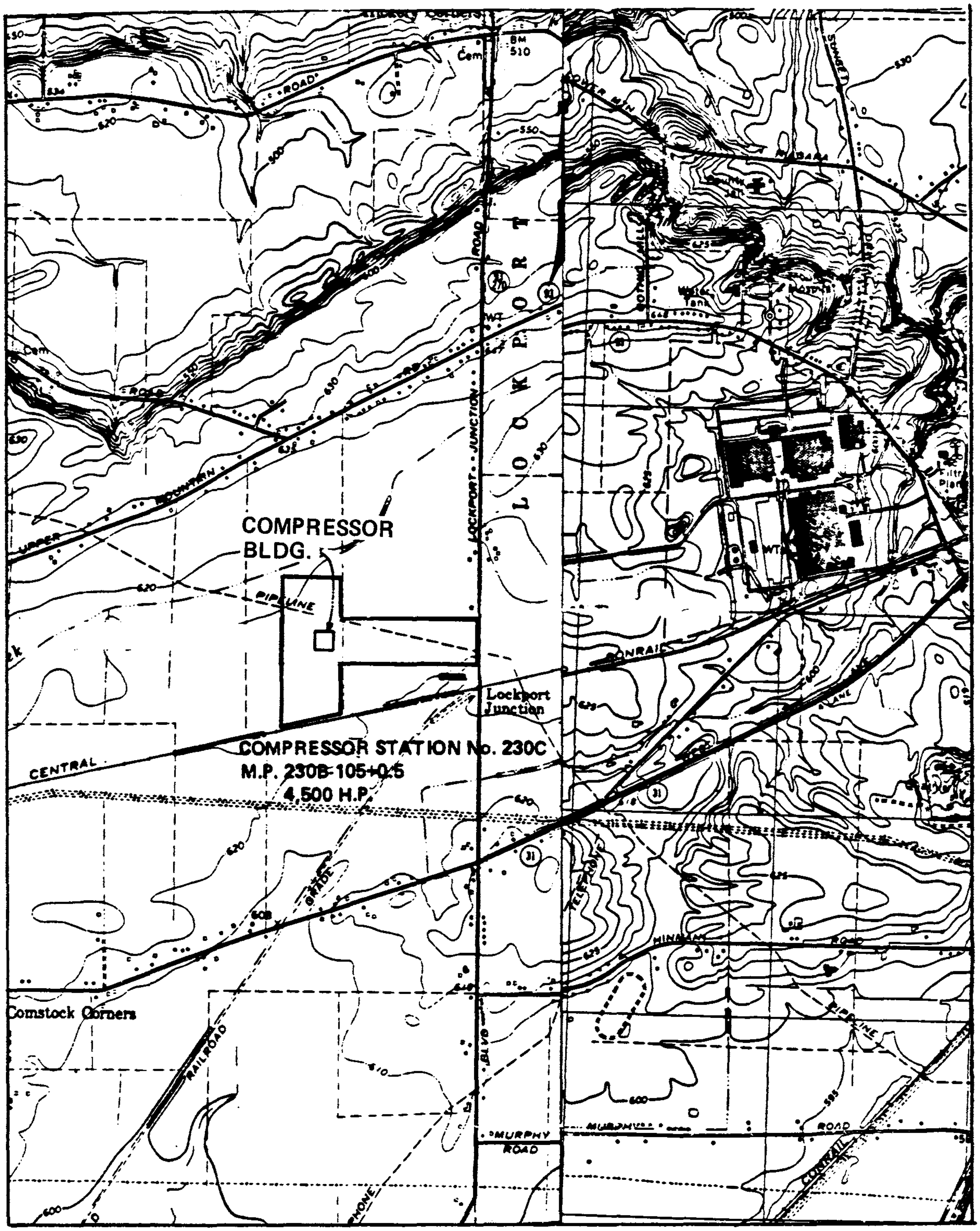
FIGURE 2.2-6
LOOP 6
RENSSELAER COUNTY, NEW YORK



0 2083 Feet

FIGURE 2.2-7
LOOP 7
HAMPDEN COUNTY, MASSACHUSETTS

FIGURE 2.2-8
COMPRESSOR STATION 230B
ERIE COUNTY, NEW YORK



SOURCE: TENNESSEE GAS PIPELINE, MAY 13. 1988

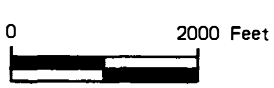


FIGURE 2.2-9
COMPRESSOR STATION 230C SITE
NIAGARA COUNTY, NEW YORK

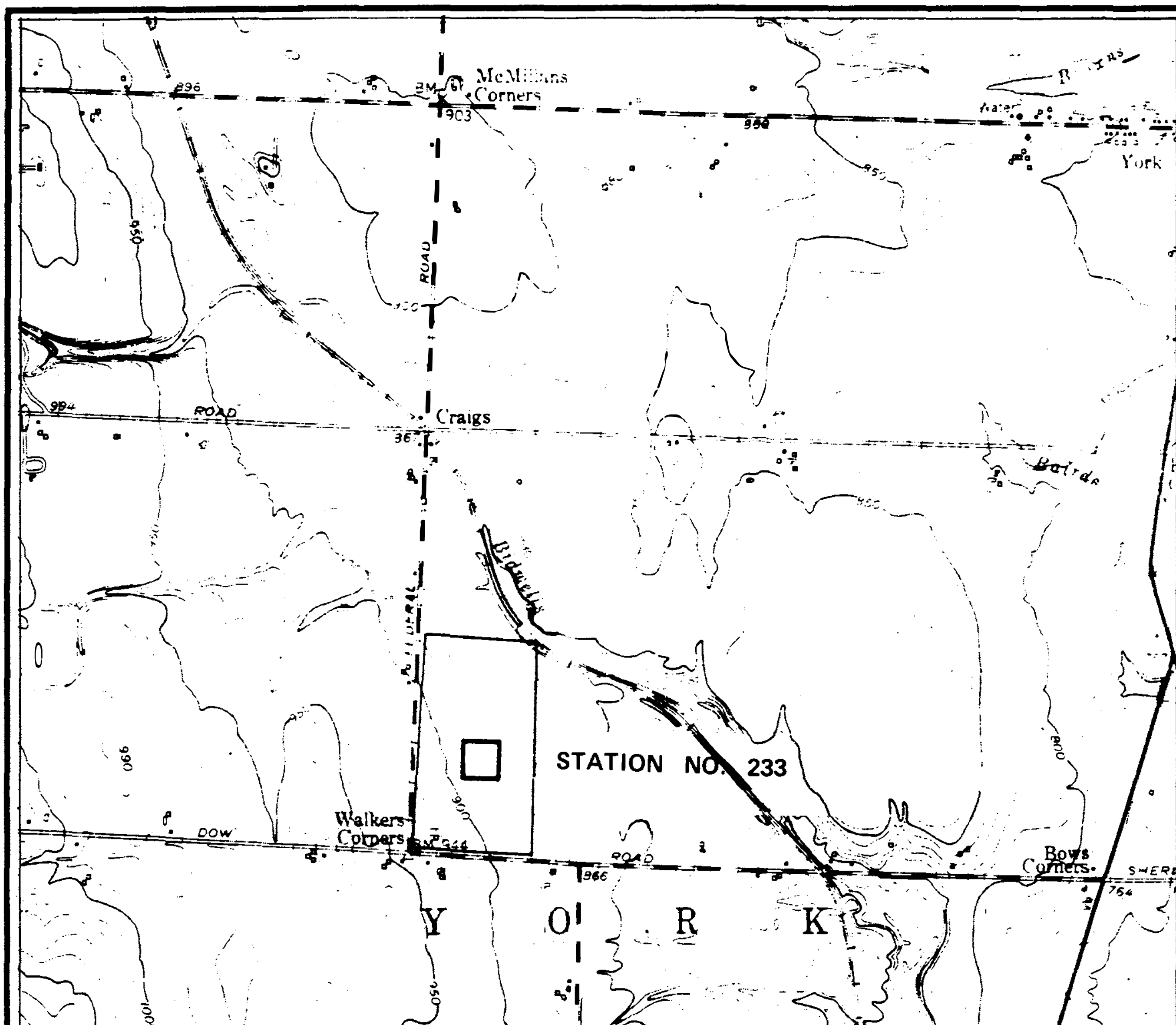


FIGURE 2.2-10
COMPRESSOR STATION 233
LIVINGSTON COUNTY, NEW YORK

FIGURE 2.2-11
COMPRESSOR STATION 264
WORCESTER COUNTY, MASSACHUSETTS

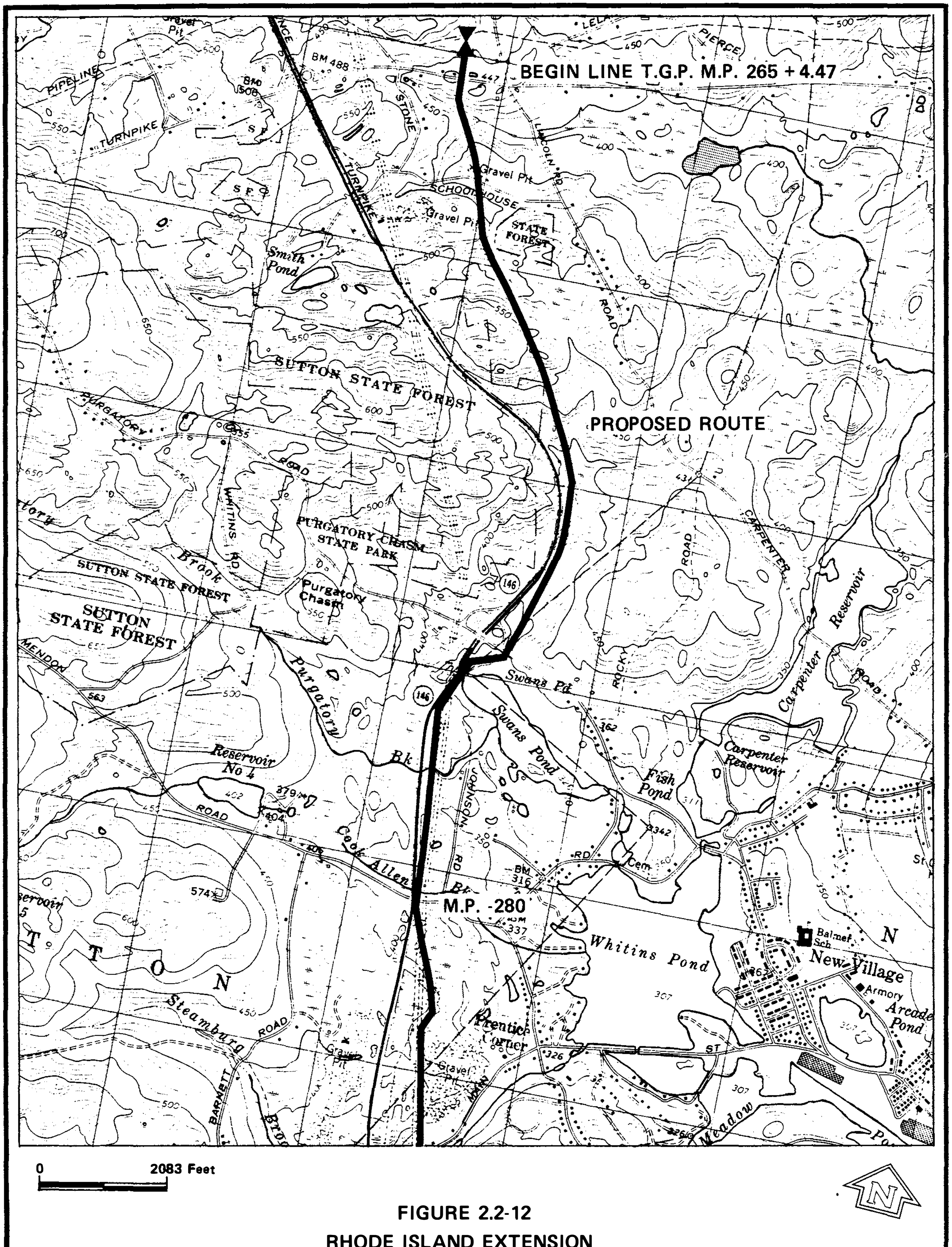


FIGURE 2.2-12
RHODE ISLAND EXTENSION
WORCESTER COUNTY, MASSACHUSETTS

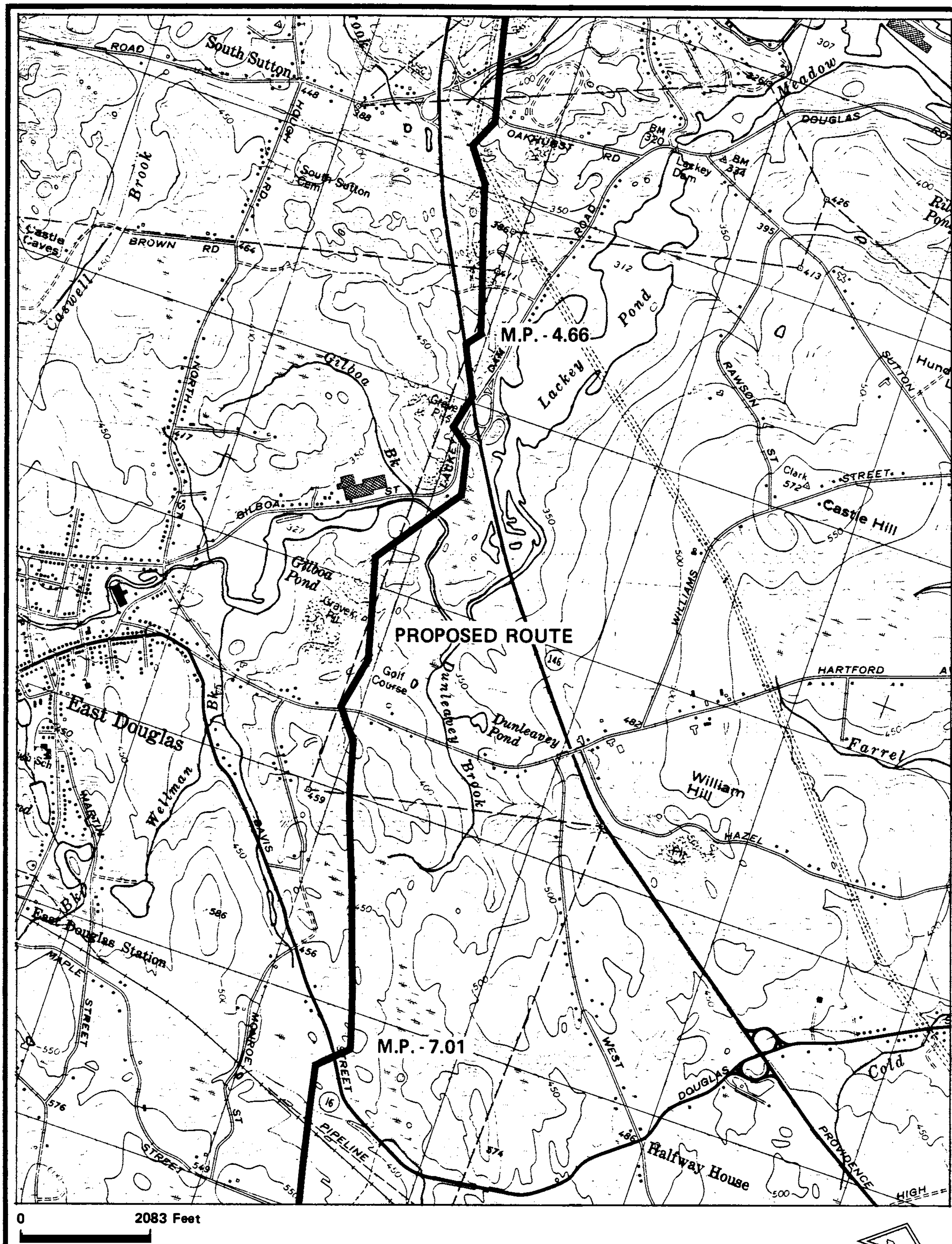


FIGURE 2.2-12, Cont'd.
RHODE ISLAND EXTENSION
WORCESTER COUNTY, MASSACHUSETTS

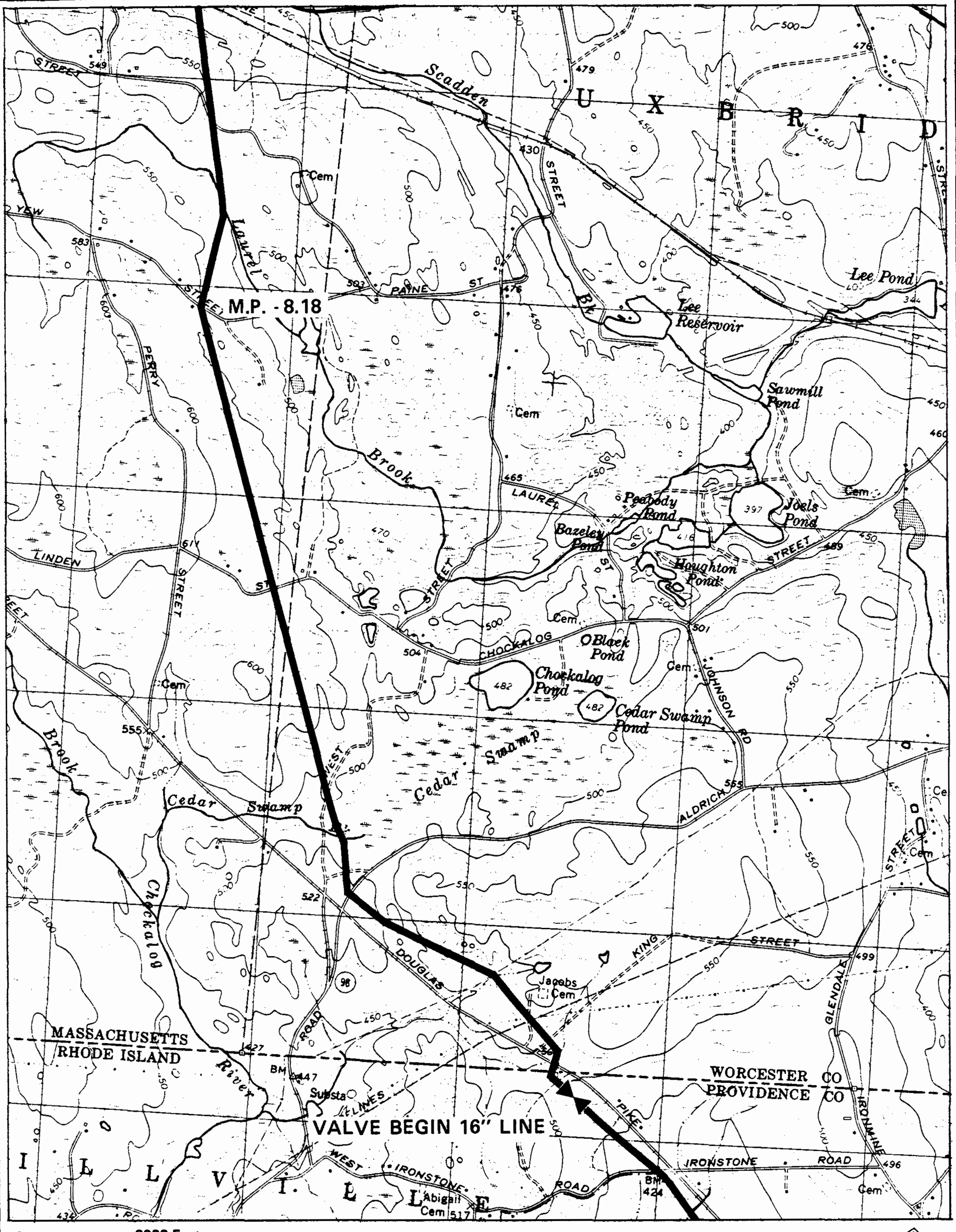


FIGURE 2.2-12, Cont'd.
RHODE ISLAND EXTENSION
WORCESTER COUNTY, MASSACHUSETTS & PROVIDENCE COUNTY, RHODE ISLAND

- Installation of measurement and odorization facilities for approximately 300,000 Dt/d at the Lewiston Meter Station in Niagara County, New York.

- Permanent operation of the 3,500-horsepower compressor facilities at Station 233 in Livingston County, New York, authorized for interim service under FERC Docket Nos. CP86-251-000 and CP86-251-001 (the INGS pipeline project).

- Permanent operation of the 1,000-horsepower compressor facilities at Station 230B in Erie County, New York, also authorized for interim service under FERC Docket Nos. CP86-251-000 and CP86-251-001, and an additional 1,200 horsepower of compression at Station 230B.

- Construction and operation of a new 4,500-horsepower compressor station, to be designated Station 230C, in Niagara County, New York, near Lockport.

The total estimated cost of the Niagara Spur expansion is $22,783,000.

In Docket No. CP87-132-001, Tennessee proposes:

- Transport, on a firm basis, up to 50,000 Mcfd of natural gas from the Niagara receipt point to Unit I of a proposed two-unit (500 MW total) combined-cycle electric power generating plant in Burrillville, Rhode Island.

- Construct and operate five sections of 30-inch-diameter pipeline loop, totaling 25.5 miles, on its No. 200 Main Line in New York and Massachusetts and on the Niagara Spur.

- Install an additional 3,500 horsepower of compression at Station 233 in Livingston County, New York (in addition to the facilities proposed in CP87-131-001).

- Install an additional 1,000 horsepower of compression at Station 230B in Erie County, New York.

- Install an additional 2,000 horsepower of compression at Station 264 in Worcester County, Massachusetts.

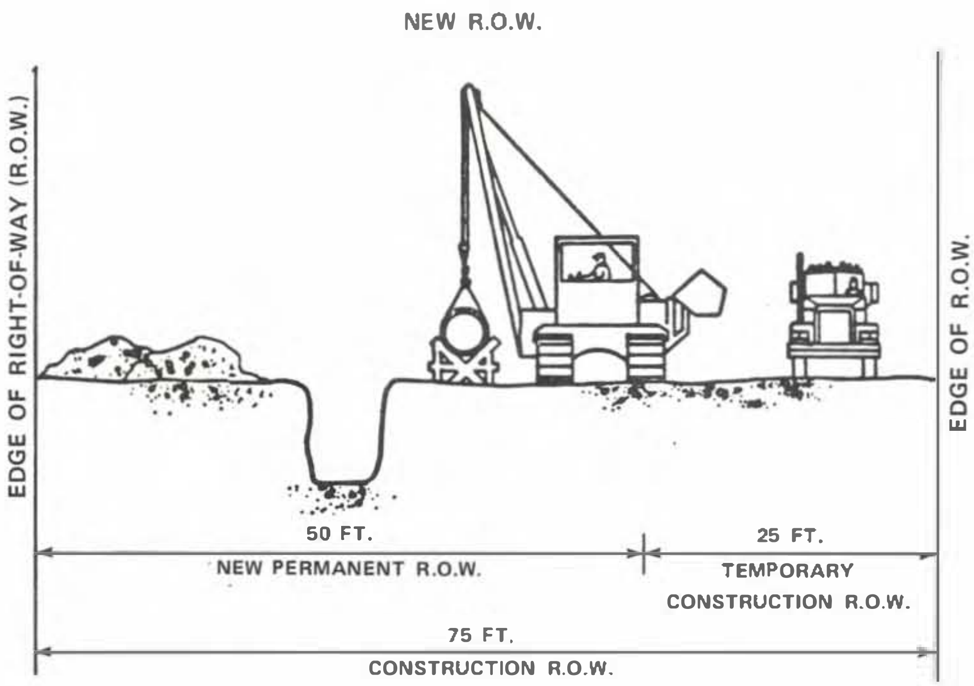
- Construct a meter station (Sherman Road Station) adjacent to the OSP plant in Burrillville.

Furthermore, Tennessee specifically requests that, if the Providence project is not approved by FERC, authorization be given under Docket No. CP87-132-001 for construction of that portion of the Rhode Island Extension that would allow service to OSP (i.e., 11 miles of 20-inch-diameter pipeline). The total estimated cost of the OSP project gas facilities is $44,904,000, excluding the Rhode Island Extension. The estimated cost of the 11 miles of 20-inch-diameter pipeline is $6,892,000.

Tennessee proposes to use a 75-foot-wide construction right-of-way for installation of the proposed gas pipeline. In general, loop lines would be installed 25 feet from the existing lines (using 25 feet of the existing right-of-way), and an additional 50 feet would be used during construction. After loop construction is complete, the outside 25 feet of right-of-way width would revert to its former use, and the 25 feet adjacent to the existing right-of-way would become part of the permanent right-of-way. Figure 2.2-13 presents the right-of-way requirements for new pipeline corridors and pipeline construction that parallels an existing pipeline corridor. Minor exceptions would occur as dictated by terrain features or the need for special construction techniques. In areas where a new pipeline corridor is established, a 50-foot-wide permanent right-of-way would be retained. In areas where the proposed pipeline would be parallel to an existing powerline, the pipeline would generally be placed at the edge of, or 5 to 10 feet inside, the powerline right-of-way.

Along each segment of pipeline, some additional land would be required adjacent to the right-of-way in areas such as major road crossings (25 by 100 feet) and stream and wide wetland crossings (50 by 150 feet) to accommodate special construction techniques. Approximately 0.5 acre at the end of each loop section and the Rhode Island Extension would be needed temporarily for field offices, pipe storage, and equipment mobilization and demobilization. Tennessee states that it would instruct its contractors to clear only land that is needed for construction.

The total estimated land requirement for construction of the pipeline facilities associated with the OSP project is 360 acres--of which approximately 140 would be retained as permanent right-of-way, while the remainder would revert to



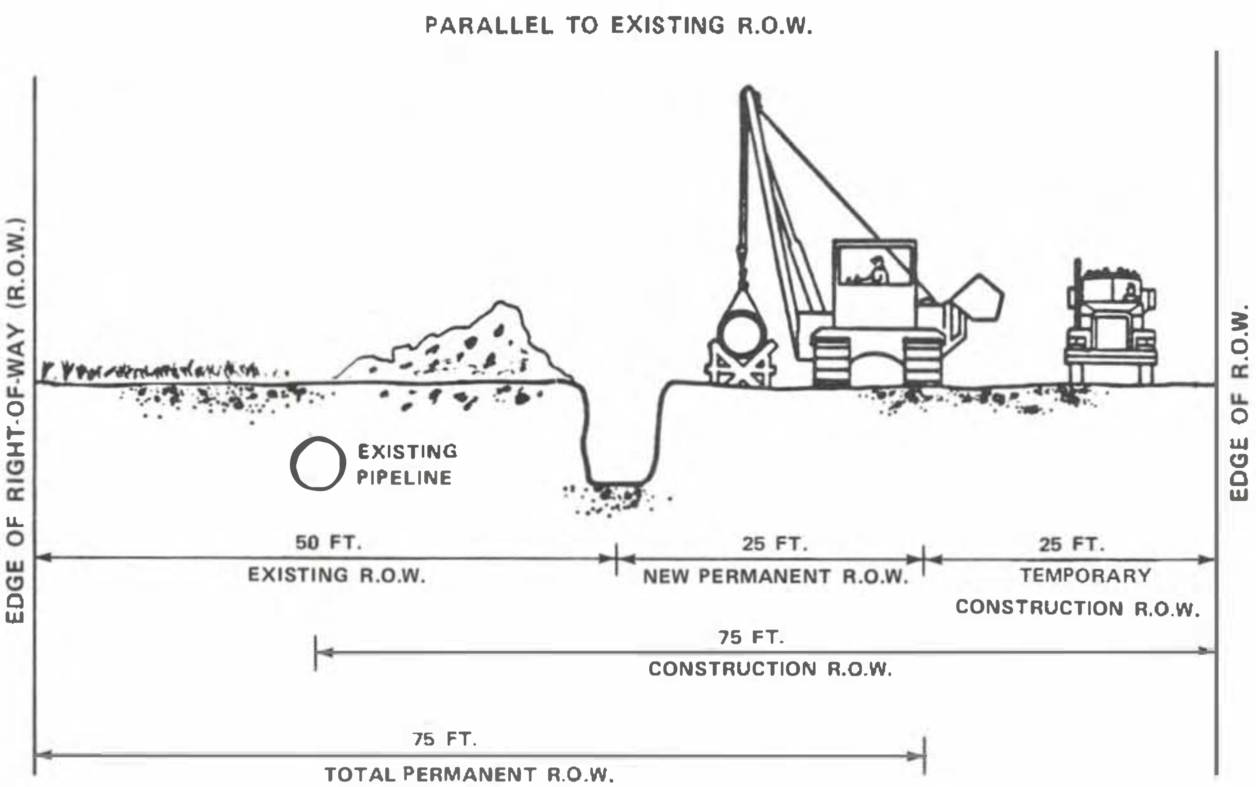


FIGURE 2.2-13

RIGHT-OF-WAY REQUIREMENTS FOR
GAS PIPELINE CONSTRUCTION

their former use and control. Aboveground facilities proposed in the Niagara Spur expansion would be located entirely within existing compressor or meter station property owned by Tennessee, except for the new Compressor Station 230C, which would occupy a 58-acre site adjacent to the Niagara Spur near Lockport, New York.

Wetlands and perennial streams located along the proposed routes of the various sections of the pipeline were identified by New York State agencies, the National Wetlands Inventory (U.S. Department of the Interior, Fish and Wildlife Service), and local entities. Tables 2.2-2 and 2.2-3 list the wetlands and perennial streams identified by State and Federal sources. (See Section 2.2.4 for figures depicting wetlands along the proposed and alternative pipeline routes.) The state wetland class designations shown on Table 2.2-2 are defined by New York Environmental Conservation Law (Part 664.5) as follows:

Class I--has any of the following characteristics:

- Is a class 2 kettlehole bog.
- Is a resident habitat of an endangered or threatened animal species.
- Contains an endangered or threatened plant species.
- Supports an animal species in abundance or diversity unusual for the state or region.
- Is a tributary to a body of water which could subject a substantially developed area to significant damage from flooding, or from additional flooding should the wetland be modified, filled or drained.
- Is adjacent or contiguous to a reservoir or other body of water that is used primarily for public water supply, or is hydraulically connected to an aquifer which is used for public water supply.
- Contains four or more distinct Class II characteristics.

Class II--has any of the following characteristics:

- Is an emergent marsh in which purple loosestrife and/or reed (phragmites) constitutes less than two-thirds of the cover type.
- Contains two or more wetland structural groups.

TABLE 2.2-2

Wetland Crossings

Pipeline Section	Wetland Name (Description)	Source Fed	Source State	Class	Approximate Distance Crossed (ft)	Approximate Acreage Affected During Construction	Approximate Acreage Affected During Operation
Loop 1	POWKZx (palustrine, open water, artificial, intermittently exposed/permanent excavated)	X			150	0.3	0.1
	LE-19		X	II	4,595	8.0	2.6
	PF01Ad (palustrine, forested, broad-leaved deciduous, temporary, partially drained/ditched)	X			625 (included in LE-19)	1.0	0.4
	PSS1A (palustrine, scrub/shrub, broad-leaved deciduous, temporary)	X			200	0.3	0.1
	PF01A (palustrine, forested, broad-leaved deciduous, temporary)	X					
	RV10		X	III	600	1.0	0.3
	POWZh (palustrine, open water, intermittently exposed/permanent, diked/impounded)	X			200	0.3	0.1
	PF01A (palustrine, forested, broad-leaved deciduous, temporary)	X					
	PEMSA (palustrine, emergent, narrow-leaved persistent, temporary)	X			150	0.3	0.1
	P SS1/EMS A (palustrine, shrub/scrub, broad-leaved deciduous-over-emergent, narrow-leaved persistent, temporary)	X			300	0.5	0.2
Loop 4	SKA-13		X	II	1,000	1.7	0.6
	SKA-14		X	III	750	1.3	0.4
Loop 5	CA-5 (Nelson Swamp)		X	I	1,150	2.0	0.7
Loop 5 Alternative	CA-18		X	II	400	0.7	0.5
Loop 6	EG-1 (Papscanee Marsh and Creek)		X	I	425	0.8	0.2
Loop 7	P SS1/EM (palustrine, scrub/shrub, broad-leaved deciduous-over-emergent)	X			200	0.3	0.1
	PFO/SS1 (palustrine, forested-over-scrub/shrub, broad-leaved deciduous)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			200	0.3	0.1
Loop 7 Alternative	PF01 (palustrine, forested, broad-leaved deciduous)	X			500	0.9	0.6

TABLE 2.2-2 (cont'd)

Pipeline Section	Wetland Name (Description)	Source		Class	Approximate Distance Crossed (ft)	Approximate Acreage Affected During Construction	Approximate Acreage Affected During Operation
		Fed	State				
Rhode Island Extension	PF01 (palustrine, forested, broad-leaved deciduous)	X			450	0.8	0.5
	PF01 (palustrine, forested, broad-leaved deciduous)	X			225	0.4	0.3
	PF01 (palustrine, forested, broad-leaved deciduous)	X			650	1.1	0.7
	PF01 (palustrine, forested, broad-leaved deciduous)	X			300	0.5	0.3
	LIOW (lacustrine limnetic, open water/unknown bottom)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	PSS1/EM (palustrine, scrub/shrub, broad-leaved deciduous-over-emergent)	X			300	0.5	0.3
	PSS3a (palustrine, scrub/shrub, broad-leaved evergreen, acid)	X			300	0.5	0.3
	PSS1 (palustrine, scrub/shrub, broad-leaved deciduous)	X			550	0.9	0.6
	PF01 (palustrine, forested, broad-leaved deciduous)	X			550	0.9	0.6
	PF01 (palustrine, forested, broad-leaved deciduous)	X			350	0.6	0.4
	PEM (palustrine, emergent)	X			150	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			300	0.5	0.3
	PF01 (palustrine, forested, broad-leaved deciduous)	X			575	1.0	0.7
	PF01 (palustrine, forested, broad-leaved deciduous)	X			200	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
Sutton Forest Power Line Variation (V-1)	PF01 (palustrine, forested, broad-leaved deciduous)	X			300	0.5	0.3
	PSS1 (palustrine, scrub/shrub, broad-leaved deciduous)	X			150	0.3	0.2
	PEM (palustrine, emergent)	X			100	0.2	0.1
V-1 Modification (V-1M)	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			425	0.7	0.5

TABLE 2.2-2 (cont'd)

Pipeline Section	Wetland Name (Description)	Source Fed	Source State	Class	Approximate Distance Crossed (ft)	Approximate Acreage Affected During Construction	Approximate Acreage Affected During Operation
Swans Pond Variation (V-2)	PF01 (palustrine, forested, broad-leaved deciduous)	X			250	0.4	0.3
	PEM (palustrine, emergent)	X			100	0.2	0.1
Lackey Pond/Town Line Variation (V-3)	PF01/4 (palustrine, forested, broad-leaved deciduous-over-needle-leaved evergreen)	X			125	0.2	0.1
	PEM/OW (palustrine, emergent-over-water/unknown bottom)	X			100	0.2	0.1
Lackey Pond/Transmission Line Variation (V-4)	LIOW (lacustrine, limnetic, open water/unknown bottom)	X			500	0.9	0.6
	PF01/SS (palustrine, forested, broad-leaved deciduous-over-scrub/shrub	X			225	0.4	0.3
	LIOW (lacustrine, limnetic, open water/unknown bottom)	X			725	1.2	0.8
	PEM (palustrine, emergent)	X			200	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
Seaver Variation (V-5)	No wetlands affected						
Tennessee Variation (V-6)	No wetlands affected						
Boston Edison Variation (V-7)	PF01 (palustrine, forested, broad-leaved deciduous)	X			400	0.7	0.5
Algonquin Alternative (A-1) (Loop M.P. 266A - 102 + 4.76)	PF01 (palustrine, forested, broad-leaved deciduous)	X			200	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			175	0.3	0.2
	PF01 (palustrine, forested, broad-leaved deciduous)	X			300	0.5	0.3
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
Algonquin Alternative (A-1) (Loop M.P. 264 + 9.00)	PSS1/EM (palustrine, scrub/shrub, broad-leaved deciduous-over-emergent)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1
	PF01 (palustrine, forested, broad-leaved deciduous)	X			300	0.5	0.3
	PF01 (palustrine, forested, broad-leaved deciduous)	X			100	0.2	0.1

TABLE 2.2-3

Perennial Stream Crossings[a]

Pipeline Section	Perennial Stream Name	Stream Classification	Fishery[b]
Loop 4	Tributary to Ninemile Cr. Trib. #1	D	Warm
	Tributary to Ninemile Cr. Trib. #2	D	Warm
Loop 5	Chittenango Creek	C	Cold
	Cedar Swamp Brook Trib.	C	Cold
Loop 6	Vierda Kill	C	Cold
	Moordener Kill	C	Cold
Loop 7	Tuttle Brook	B	Cold
	Great Brook	B	Cold
	Great Brook Trib.	B	Cold
Rhode Island Extension	Purgatory Brook	B	Cold
	Swan's Pond	B	Cold
	Cook Allen Brook	B	Cold
	Steamburg Brook	B	Cold
	Mumford River	B	Warm
	Laurel Brook	B	Cold
	Cedar Swamp Brook (Tributary to Chockalog River)	B	Cold

[a]Perennial streams shown are those identified on USGS 7.5 minute quadrangle maps.

[b]Warm = warmwater fishery; Cold = coldwater fishery.

- Is contiguous to a tidal wetland.
- Is associated with permanent open water outside the wetland.
- Is adjacent or contiguous to streams classified C or higher under Article 15 of the Environmental Conservation Law.
- Is a traditional migration habitat of an endangered or threatened animal species.
- Is a resident habitat of an animal species vulnerable in the State.
- Contains a plant species vulnerable in the State.
- Supports an animal species in abundance or diversity unusual for the county in which it is found.
- Has demonstrable archeological or paleontological significance as a wetland.
- Is associated with an unusual geological feature which is an excellent representation of its type.
- Is a tributary to a body of water which could subject a lightly developed area, an area used for growing crops for harvest, or an area planned for development by a local planning authority, to significant damage from flooding should the wetland be modified, filled, or drained.
- Is hydraulically connected to an aquifer which has been identified by a government agency as a potentially useful water supply.
- Acts in a tertiary treatment capacity for a sewage disposal system.
- Is within an urbanized area.
- Is one of the three largest wetlands within a city, town, or New York City borough.
- Is within a publicly owned recreation area.

Class III--has any of the following characteristics:

- Is an emergent marsh in which purple loosestrife and/or reed (phragmites) constitutes two-thirds or more of the cover type.
- Is a deciduous swamp.

- Is a shrub swamp.
- Consists of floating and/or submergent vegetation.
- Consists of wetland open water.
- Contains an island with an area or height above the wetland adequate to provide nesting habitat, refuge, visual variety, and/or recreational and educational activities.
- Has a total alkalinity of at least 50 parts per million.
- Is adjacent to fertile upland.
- Is a resident or migration habitat for an animal species vulnerable in the State or region.
- Contains a vulnerable plant species.
- Is part of a surface water system with permanent open water and receives significant pollution of a type amenable to amelioration by wetlands.
- Is visable from an interstate highway, a parkway, a designated scenic highway or a passenger railroad, and serves a valuable aesthetic or open space function.
- Is one of the three largest wetlands of the same cover type within a town.
- Is in a town in which wetland acreage is less than 1 percent of the total acreage.
- Is on publicly owned land that is open to the public.

The surface water classifications (B, C & D) shown in Table 2.2-3 are defined by the States of New York (C&D--Loops 1-6) and Massachusetts (B--Loop 7 and Rhode Island Exension) as follows:

- Class B--Designated for protection and propagation of fish; other aquatic life and wildlife; and for primary and secondary contact recreation.
- Class C--Suitable for fishing and all other uses except as a source of water supply for drinking, culinary, or food processing purposes and primary contact recreation.

- Class D--Suitable for secondary contact recreation, but due to such natural conditions as intermittent flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support the propagation of fish.

2.2.3.2 Construction Procedures

Overland Construction

The Rhode Island Extension and the Main Line loops would be installed using conventional overland buried pipeline construction techniques. Generally, a route that will result in the minimum amount of land disturbance is selected. The terrain is considered when determining the route in order to avoid extreme slopes, side hill construction, and wetlands, whenever practical. As noted in Section 2.2.3.1, Tennessee proposes to utilize a 75-foot-wide right-of-way along the Rhode Island Extension route during construction and to retain a 50-foot-wide right-of-way after the pipeline is installed, allowing the remaining 25 feet to revert to its previous uses and control. In some areas, where the Rhode Island Extension follows an existing power line right-of-way, a small portion of the power line right-of-way would be used so that the full 50-foot width of new permanent right-of-way would not be needed.

Along the proposed loop lines, 25 feet of the existing pipeline right-of-way would be used; an additional 50 feet would be used during construction, of which 25 feet would be allowed to revert to preconstruction conditions and uses. In general, the new loop line would be laid 25 feet from the existing line (see Figure 2.2-13). Minor exceptions would occur where the new loop lines must deviate from the existing right-of-way to avoid obstructions and to minimize the potential for structural damage in areas where blasting is necessary. In areas where the existing pipeline passes close to houses or other structures and no reasonable alternative route is available, the new loop may be laid within 10 feet of the existing line to reduce the amount of land disturbance.

Tennessee's right-of-way supervisors work extensively with local landowners to ensure that construction proceeds in a manner as consistent as possible with current land uses and the landowners' management objectives. Tennessee also employs a staff of environmental scientists assigned to various regions to oversee construction operations and ensure that all operations are in compliance with Federal, state, and local environmental permits and regulations.

Before construction begins and once Tennessee has obtained all the necessary permits and easements, the right-of-way would be surveyed and staked. Other utility lines are located and marked to prevent accidental damage during pipeline construction. These are later carefully excavated using a backhoe and hand tools. Construction then proceeds as follows: clearing and grading the right-of-way, ditching/excavating the trench, hauling and stringing the pipe sections, bending the pipe, laying and welding the pipe, applying its protective coating, lowering it into and backfilling the trench, then testing the pipe, and finally cleanup and restoration of the right-of-way. Figure 2.2-14 presents this typical pipeline construction sequence.

The overland pipeline construction "spread" operates as a moving assembly line performing these procedures in an efficient planned sequence. Each spread, consisting of 100 to 300 construction workers, may progress at a rate of 1,000 to 1,500 feet per day in rocky terrain. Special construction crews would be employed to install and alter fences, to bore under major roads and railroads, to install any necessary stream and wetland crossings that would not be done by conventional overland techniques, and to construct valve stations and meter and regulator stations.

Clearing and grading consists of removal of trees, crops, and other obstructions and leveling the right-of-way sufficiently to allow safe passage of construction vehicles and trucks. Permission would be obtained from landowners for use of access roads across their properties and for cutting trees and erecting temporary gates where necessary. Topsoil would be segregated from the trench spoil in all cropland, and farmers would be paid fair market value for any crop losses. Marketable timber cut from the right-of-way would be purchased for fair market value or cut, limbed, and stacked for use by the landowner. In accordance with local regulations and the terms of the applicable permit or easement agreements, unmarketable timber would either be: piled on the low side (or both sides) of the right-of-way to provide a filter strip and wildlife habitat; burned; buried; or chipped and spread over the right-of-way as mulch. Leveling the right-of-way may entail a considerable amount of rock blasting in certain areas. Disposal of excess rock would also be in accordance with the terms of any applicable permit or easement agreement. It should be noted that landowners are not required to provide waste disposal areas.

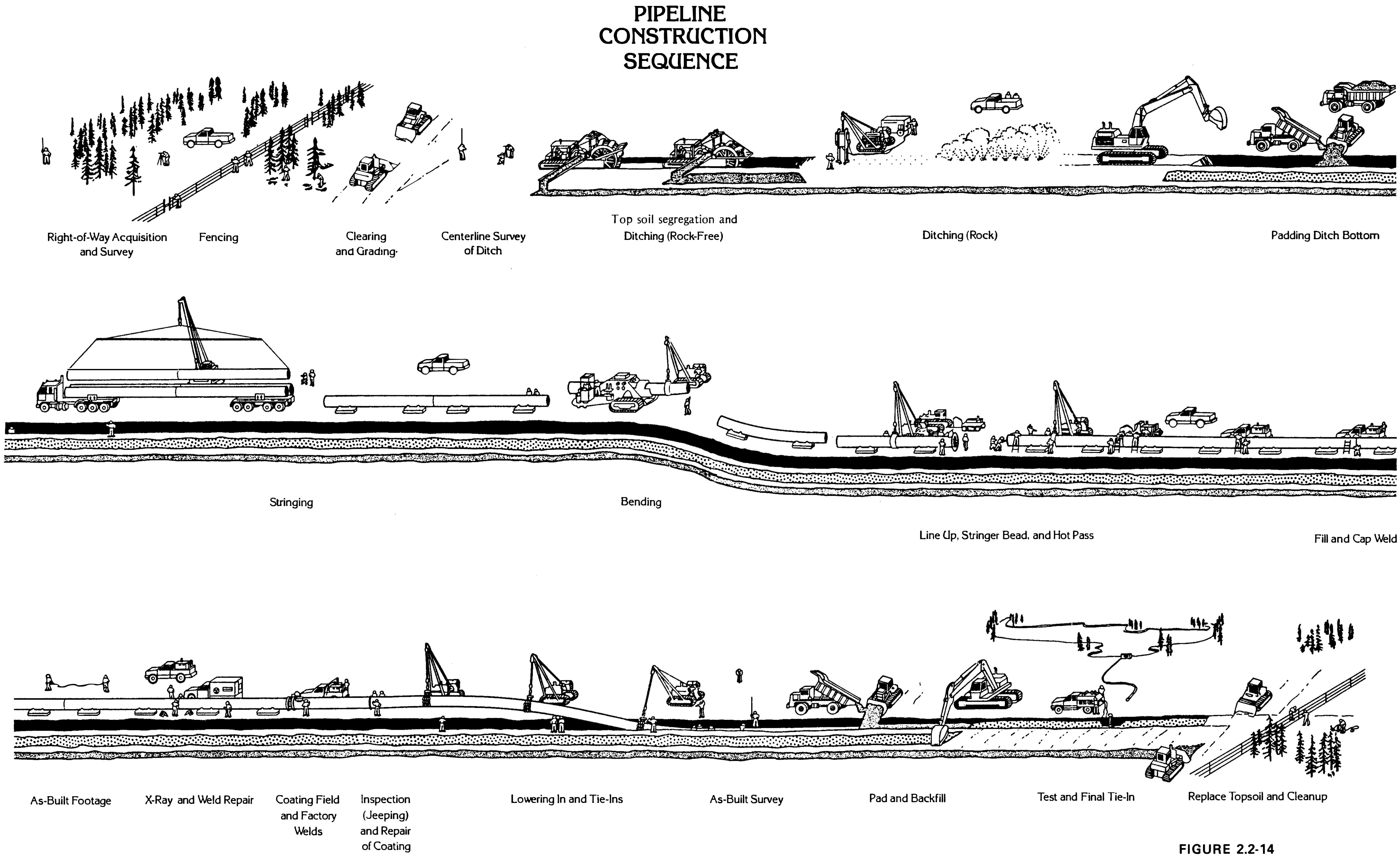


FIGURE 2.2-14
PROFILE OF A PIPELINE SPREAD

Clearing and grading would normally be restricted to the 75-foot-wide construction right-of-way; however, some additional land would be needed at major roads and stream crossings to accommodate special construction crews, equipment, and spoil material. One-half acre of land would be needed at the ends of each pipeline segment for equipment mobilization and demobilization. Also, an area of approximately 3 acres would be needed along the Rhode Island Extension and each loop segment for the contractor's field office and for pipe storage. No new access roads would be constructed.

Wherever water flowing off the right-of-way enters flowing streams, ponds, or lakes, hay bale filters or silt screens would be installed to trap sediments. Silt barriers also may be installed on the downstream side of drains or ditches that cross the right-of-way.

Once the right-of-way is prepared, the ditch centerline would be surveyed and staked. Topsoil would then be stripped and segregated and a trench would be cut using a rotary wheel-type ditching machine, backhoe, or other special equipment. The trench is cut to a depth that would meet the U.S. Department of Transportation minimum requirement of 30 to 36 inches of cover over the pipeline in areas with a soft substrate, 18 to 24 inches in consolidated rock, and 48 inches under navigable streams. Tennessee may use deeper burials. During construction, excavated material is stored along one side of the trench while the other side is used as a work area.

A significant portion of the proposed pipeline construction would require blasting to excavate the trench. Tennessee applies comprehensive specifications for blasting operations including: the use of matting in congested areas or near structures that could be damaged by fly-rock; posting of warning signals, flags, and barricades; and procedures for the safe storage, handling, loading, firing, and disposal of explosive materials. In all cases, Tennessee's specifications would meet or exceed any applicable Federal, state, or local requirements covering the use of explosives. Excessive vibration would be controlled through limitations on the size of explosive charges and use of charge delays. If blasting is required close to buildings, Tennessee would hire an independent contractor to perform pre-blast and post-blast structural inspections. Seismographic monitoring would be done where appropriate. Also, at the request of the landowner, water wells in proximity to blasting operations would be sampled before and after blasting is done to monitor changes in water quality and quantity. If any water wells are damaged by the blasting, Tennessee would either compensate the owner or arrange for the drilling of a new well.

After the trench is excavated, pipe sections are delivered from the storage yard to the construction site by truck and strung along the trench. Where the supply, schedule, and location permit, the pipe would be transported directly from the rail car to the right-of-way. The pipe will be placed along the right-of-way at the side of the trench. Certain pipe sections are then bent as necessary to conform to changes in slope and bearing of the trench; then one by one, pipe sections are aligned, welded together, and placed on temporary supports next to the trench. After the welds are complete, nondestructive testing would be conducted to check their adequacy and integrity in accordance with Federal regulations. The welding process is then completed and the pipeline is wrapped or coated with protective corrosion-resistant material.

Padding material would be used in areas where the trench bottom was irregularly shaped because of consolidated rock or where the excavated spoil material was unacceptable for backfilling around the pipe. Pipeline padding consisting of a six-inch layer of sand or gravel, crushed rock, or screened trench spoil would be placed on the trench floor to protect the coating and support the pipe. Topsoil from the right-of-way would not be used as padding.

Prior to backfilling the trench, any drain tiles that cross the working side of the right-of-way would be cleaned out with a snake to ensure that they have not been crushed or otherwise damaged by construction equipment. Damaged tiles would be replaced. Also, ditchline breakers, usually composed of sandbags or foamed concrete sprayed in place, would be installed on steep slopes to prevent excessive water flow down to ditchline and consequent erosion of the backfill. Ditch plugs, usually composed of compacted earth or other suitable low-permeability material, would be used on gentler slopes and wet areas to minimize channeling of ground water along the ditchline.

The trench is then backfilled with the excavated subsoil and compacted by multiple passes of heavy tracked equipment. The right-of-way would be regraded to its original contour or to a new contour that is considered an improvement with regard to surface drainage or soil stabilization. Topsoil is then respread over the right-of-way in areas where it had been segregated prior to trenching.

The pipeline would then be hydrostatically tested to ensure its integrity. This procedure consists of filling a sealed-off segment of pipeline with water to a predetermined pressure for a specified period of time (typically 8 hours), then discharging the water. Any sections of pipe that rupture or leak are replaced and tested again. Test water would be aerated and dispersed by discharging against a splash plate. The runoff would either be directed across a well-vegetated area; filtered through hay bales or a silt screen; or, where allowable and practical, discharged directly into a receiving water body. State or USEPA approval would be needed for test water discharges.

When backfilling and testing are completed, the disturbed right-of-way would be restored to a neat and stable condition. Chisel plows and disking would be used to rehabilitate compacted soils. All stone fences disturbed by construction would be restored to their preconstruction condition. Large rocks and other debris would be buried or removed and disposed of in appropriate landfills. Water bars would be constructed across the right-of-way to divert runoff away from disturbed areas, and additional erosion control devices would be installed where necessary. Disturbed areas would then be limed, fertilized, and seeded. Revegetation would be done in cooperation with the landowner or in accordance with any FERC staff recommendation that the Commission may impose. All slopes in excess of 8 percent would be mulched to minimize erosion. Hay mulch or equivalent would be applied at the rate of 1.5 tons per acre. Tennessee would attempt to keep lean up operations within 2 miles of the backfilling operation.

Unless the landowner requests otherwise, Tennessee would seed disturbed areas with a mixture of grasses and legumes. A crown vetch mix may be used on steep slopes.

If final cleanup cannot begin within three weeks of the completion of construction, Tennessee would establish a temporary cover. Prior to October 31, the disturbed areas would be seeded with quick-germinating grasses such as winter rye. After October 31, mulching would be employed rather than seeding, and a permanent seed mixture would be applied early in the following seeding season.

Tennessee would periodically inspect the right-of-way as part of its standard operating procedures. All areas experiencing potentially damaging erosion would be stabilized and revegetated.

Additional information concerning construction mitigation measures is contained in Tennessee's "Sediment and Erosion Control Plan" that has been supplemented through responses to data requests by the FERC Staff. FERC Staff believes that Tennessee's proposed plan, as supplemented by FERC Staff recommendations, would be adequate to prevent significant environmental impact.

Special Construction Techniques

Railway crossings and major roadway crossings require special construction techniques such as boring or tunneling. These crossings are normally constructed independently by separate crews and later tied into the pipeline. Casing would be installed where required by the permitting authority.

Although the above-described construction procedures apply throughout most of the proposed loop sections, site-specific installation methods would be used in residentially congested areas to minimize impact on and disturbance to local residents. These include trench excavation by backhoe and fabrication of three or four pipe sections outside the tight area to minimize the amount of work adjacent to houses. These sections would then be carried in by sideboom tractors, placed in the trench, and welded together. Tennessee would also reduce the width of the right-of-way, place the new Loop 10 to 15 feet from the existing line, and backfill the trench immediately after installation in congested areas. Driveways would be rebuilt and repaved, and trees, bushes, and lawns would be replaced by a local landscape contractor as agreed upon with the landowner.

Areas that would be constructed in this manner include: the Manor Heights Subdivision on Loop 4, the Fernwood Subdivision on Loop 7, and the Amberwood Hills Subdivision, also on Loop 7.

Stream and Wetland Construction

Pipeline construction procedures for stream and wetland crossing would vary somewhat with the characteristics of each location. General procedures to be used are contained within Tennessee's "Wetland and Water Crossing Plan," summarized below. Site-specific procedures would be developed for each crossing that requires a separate Federal, state, or local permit.

Small intermittent streams that are dry during construction would be crossed using conventional overland construction procedures. For any small streams flowing at the time of construction, flume pipe culverts with clean rock fill or portable bridges would be installed to carry construction vehicles across while allowing the water to flow unimpeded. All fill material would be removed after pipeline installation.

Prior to installation of the pipeline across a stream, the right-of-way would be prepared on both sides of the crossing. Stream banks are left plugged to prevent runoff from flowing directly into the stream. Trenching across the stream bed is done with a backhoe operating either from the stream bank or directly straddling the trenchline where the width of the stream prohibits excavation solely from the banks. If water depth prohibits the use of a backhoe, a dragline working from the banks would be used for excavation.

Spoil removed from the streambed would be piled behind the banks in a manner that would prevent it from washing back into the stream. Straw or hay bales would be used to filter any runoff from the spoil piles.

Pipelines to be installed at small stream crossings would be welded together on one side of the stream, coated with concrete or other suitable weights or anchors to overcome buoyant forces where necessary, then either carried or dragged into the prepared trench.

For deep or wide water crossings, a work area is prepared on dry ground adjacent to the water body. The pipe section is welded together, coated or weighted, and pushed or pulled across the waterway with floats attached. Once in position over the ditch, the floats are removed and the pipe section settles into place. Sand, gravel, or soil padding is placed around the pipe with a dragline or clamshell, and the spoil excavated during ditching is used to backfill the trench to its original level. Surplus spoil would be diposed of at a suitable upland location.

Cleanup operations remove all debris from the stream bed and banks and restore the area as nearly as possible to its original contour. Under no circumstances would tracked equipment be allowed to clean tracks or cleats in the stream.

Jute thatching or other suitable erosion control/filter fabric would be installed in surface drains of urban areas and on the banks of small streams. Riprap would be emplaced on the banks of streams subject to erosion. Rock riprap would be of field or quarry stone and would be sized to preclude movement by stream currents.

Techniques used for wetland crossings vary according to the width of the wetland and water level. For narrow wetland crossings (i.e., less than 200 feet), timber and brush are cleared approximately 75 feet wide, with the stumps cut at ground level and left in place. Logs and brush are laid on the ground to form a workpad about 15 feet wide. The trench is excavated using a backhoe or a dragline working off the timber mats or "mudboards" (constructed of several large timbers or railroad ties connected with steel cable) that are leap-frogged as the ditching progresses. The pipeline installation proceeds in much the same manner as on dry land.

For wide wetland crossings or ones with a high water level, the right-of-way and trench are prepared the same as for narrow wetlands; however, the pipe section is fabricated on stable ground adjacent to the wetland, and the push/pull or flotation method is used to move the pipe section into place. Backfilling is done using a dragline or clamshell working off the timber mat or mudboards, and the wetland is restored to its original contour. Activity within the wetland is thus held to a minimum. Construction machinery would be moved around the wetland using existing roads or access roads. No new access roads would be built and no permanent fill material would be left in any wetland.

All necessary Federal, state, and local permits for construction in wetlands would be obtained prior to construction.

Trout Streams. Six trout propagation streams were identified by state personnel along the project route--Moordener Kill (Loop 6), Great Brook (Loop 7), and Steamburg, Purgatory, Cook Allen, and Laurel Brooks (Rhode Island Extension). Tennessee has agreed to maintain a 50-foot distance between staging areas and trout propagation streams, where topographic conditions allow, and to avoid construction across trout propagation streams during spawning and spring hatchout periods.

Nelson Swamp. Tennessee has indicated that it proposes to use a reduced clearing width across Nelson Swamp along Loop 5 to minimize construction impacts. Rather than clearing an additional 50 feet for construction purposes, Tennessee proposes to clear only 35 to 40 feet. Of this total, 25 feet will be kept permanently cleared, while the remainder will be allowed to revegetate. This new clearing would be parallel to the existing right-of-way.

Papscanee Marsh/Creek. In addition to the special measures indicated above for the crossing of Nelson Swamp, Tennessee proposes (as described in its Wetland and Water Crossing Plan) to use push/pull installation techniques to lay sections of Loop 6 that cross the wide wet areas within Papscanee Marsh and Creek.

Aboveground Facilities

Aboveground facilities proposed in the project include compressor, meter, and valve stations at various points along the pipeline sections.

Valve sites typically require about 200 square feet or less, may be surrounded by chain link fencing to deter vandalism, and would be contained entirely within the pipeline right-of-way.

Construction of the compressor and meter stations would be typical of procedures employed in construction of small industrial facilities. During the initial phase of construction, the site would be cleared and graded. A field office, storage facilities, and a welding/fabrication shop would be installed. Next, the building foundation and pipe support piers would be installed, followed by installation of equipment, piping and erection of a permanent building. Once the service lines, pipe tie-ins, other necessary facilities, and testing are completed, painting, road surfacing and landscaping would be done.

2.2.3.3 Operation and Maintenance

Tennessee would use its present personnel primarily to operate and maintain the proposed facilities and right-of-way. Likewise, existing maintenance bases and communication systems would be used.

Maintenance would include regularly scheduled gas leak surveys using methane gas detectors and the corrections necessary to repair any potentially hazardous leaks. All valves would be inspected and greased.

Tennessee's maintenance activities also include monitoring for PCB's, which Tennessee performs quarterly in accordance with EPA requirements. PCB's have been found in the pipeline liquids from gas transmission systems, including Tennessee's, although no PCB's have been found in Tennessee's gas stream.

Periodic aerial inspections of the pipeline would be conducted; population density and activity along the right-of-way (i.e., nearby construction and possible encroachment) would determine the actual patrol scheduling, as well as the need to make periodic adjustments in class location. Aerial surveillances would also provide information on possible leaks, construction activities, erosion, exposed pipe, and any potential problem that could affect the safety and operation of the pipeline.

Other maintenance functions would include periodically mowing or running a bushog along the right-of-way to remove woody vegetation; replacing backfill and repairing drain tiles and terraces; periodically inspecting water crossings; and maintaining an emergency supply of pipe, leak repair clamps, sleeves, etc., for repairs.

Existing roads and the right-of-way would provide access to inspect and maintain the proposed pipeline facilities. No trees or deep-rooted shrubs that could damage the pipeline's protective coating or prevent periodic surveillance would be allowed within the permanent right-of-way. Tennessee has indicated that no herbicides would be used to maintain the right-of-way in Massachusetts and Rhode Island. Tennessee is currently evaluating vegetation management programs in New York that could involve select use of herbicides and regrowth inhibitors following brush-cutting activities.

Metering equipment would be maintained on a regular schedule and would operate in accordance with applicable regulations.

2.2.3.4 Safety Controls

In addition to corrosion inhibitor coating outside the pipe, cathodic protection would be applied to the pipe to minimize corrosion and prevent a possible pipeline failure. This would be done by impressing an electrical current through a controlled electrical path and discharging it back to the source. If a pipe segment was exposed because of repair or maintenance, it would be visibly checked for corrosion.

The pipeline would be clearly marked at line-of-sight intervals at crossing of public roads, railroad, and other key points. The markers would identify the company and give a telephone number where a representative could be reached at any time. In agricultural areas, pipeline markers would be located near fence lines.

2.2.3.5 Abandonment

There are currently no plans to abandon the proposed facilities. If necessary at some time in the future, these facilities would be abandoned in accordance with U.S. Department of Transportation regulations and other applicable state and Federal codes. The applicant also must obtain authorization from the FERC under Section 7(b) of the Natural Gas Act to abandon any facilities. The FERC could place conditions upon the abandonment, if necessary. Upon abandonment, all lands would revert to their natural state.

2.2.3.6 Permits and Approvals

In addition to the FERC certificate, several other Federal, state, and local government regulatory agencies have permit or approval authority over portions of the proposed project (see Table 1.3-1).

As previously indicated, the ERA has authorized the proposed importation of gas by OSP conditioned upon its review of this FEIS.

The U.S. Army Corps of Engineers (COE) Nationwide Permit for discharge of dredge and fill material into U.S. waters would apply to all or most of the proposed stream crossings. The COE would determine if any individual permits would be required under section 404 of the Clean Water Act. Individual permits under Section 10 of the River and Harbor Act may be required for crossing various bodies of water.

USEPA Regions I and II would determine if any National Pollutant Discharge Elimination System (NPDES) permits would be needed for discharge of hydrostatic test water. The New York Department of Environmental Conservation (NYDEC) would have to issue a Letter of Approval for test water discharges, and the Massachusetts Department of Environmental Quality Engineering (MADEQE) and the Rhode Island Department of Environmental Management (RIDEM) would have to issue Water Quality Certifications. Additional approvals for stream and wetland crossings must be issued by the New York Department of Environmental Conservation, Massachusetts Department of Environmental Quality Engineering, and Rhode Island Department of Environmental Management. The New York Department of Environmental Conservation and Massachusetts Department of Environmental Quality Engineering must also issue permits for compressor engine air emissions.

Several other permits from state and local agencies would be needed for road and highway crossings, building construction, and individual septic systems at compressor stations.

2.2.4 Alternatives Considered

FERC Staff believes that, generally, construction of pipeline loops parallel with, and adjacent to, existing pipelines is environmentally preferable. Parallel construction takes advantage of available cleared right-of-way during construction of the loop. This prevents the establishment of new pipeline corridors and minimizes the amount of required clearing. Preferable alternatives to paralleling an existing pipeline route must have significant environmental advantages over a parallel route, must be practicable to construct from an economic and engineering standpoint, and should pose no long-term operation or maintenance problems.

Where a parallel route would cross environmentally sensitive locations such as critical habitats of protected species, water supply reservoirs and watersheds, significant cultural resources, or high-density residential areas, alternative alignments may be desirable.

The staff has considered adding compression at existing stations as an alternative to construction of Loops 5 and 6 (i.e., to avoid construction through Nelson Swamp and Papscanee Marsh, respectively). In both cases the necessary compression would cause an exceedance of the maximum allowable operating pressure of the existing pipeline. Additional compression is therefore not a reasonable alternative.

2.2.4.1 Loop 1

The existing Niagara Spur pipeline, which Loop 1 would parallel for 11.2 miles, crosses a Class II wetland and the adjacent area of a Class III wetland, as designated by the State of New York. Loop 1 also crosses eight wetlands identified by the National Wetlands Inventory as various palustrine wetlands (Table 2.2-2 and Figure 2.2-15).

FERC Staff reviewed various alignments for Loop 1 which would avoid all wetlands. These variations from the proposed route would have added an additional 6,720 feet to the proposed length of Loop 1, at an additional cost of $1,484,545. Therefore, FERC Staff did not consider the variations practicable, and they have not been delineated in this FEIS. Furthermore, in a letter to Tennessee, the U.S. Army Corps of Engineers determined that all Loop 1 wetland crossings would be authorized under the Nationwide Permit Program (COE, January 21, 1988).

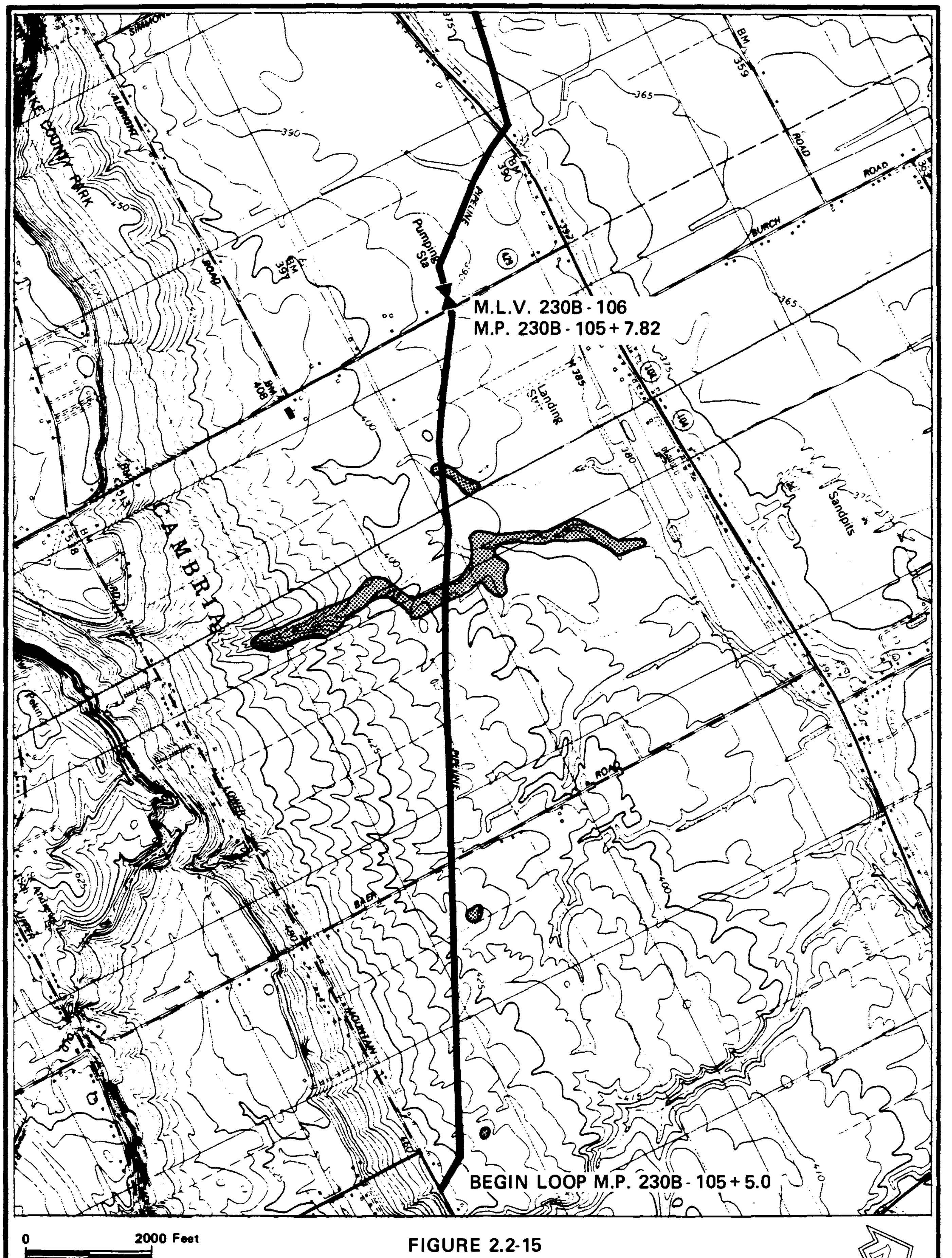


FIGURE 2.2-15
LOOP 1 WETLANDS
NIAGARA COUNTY, NEW YORK

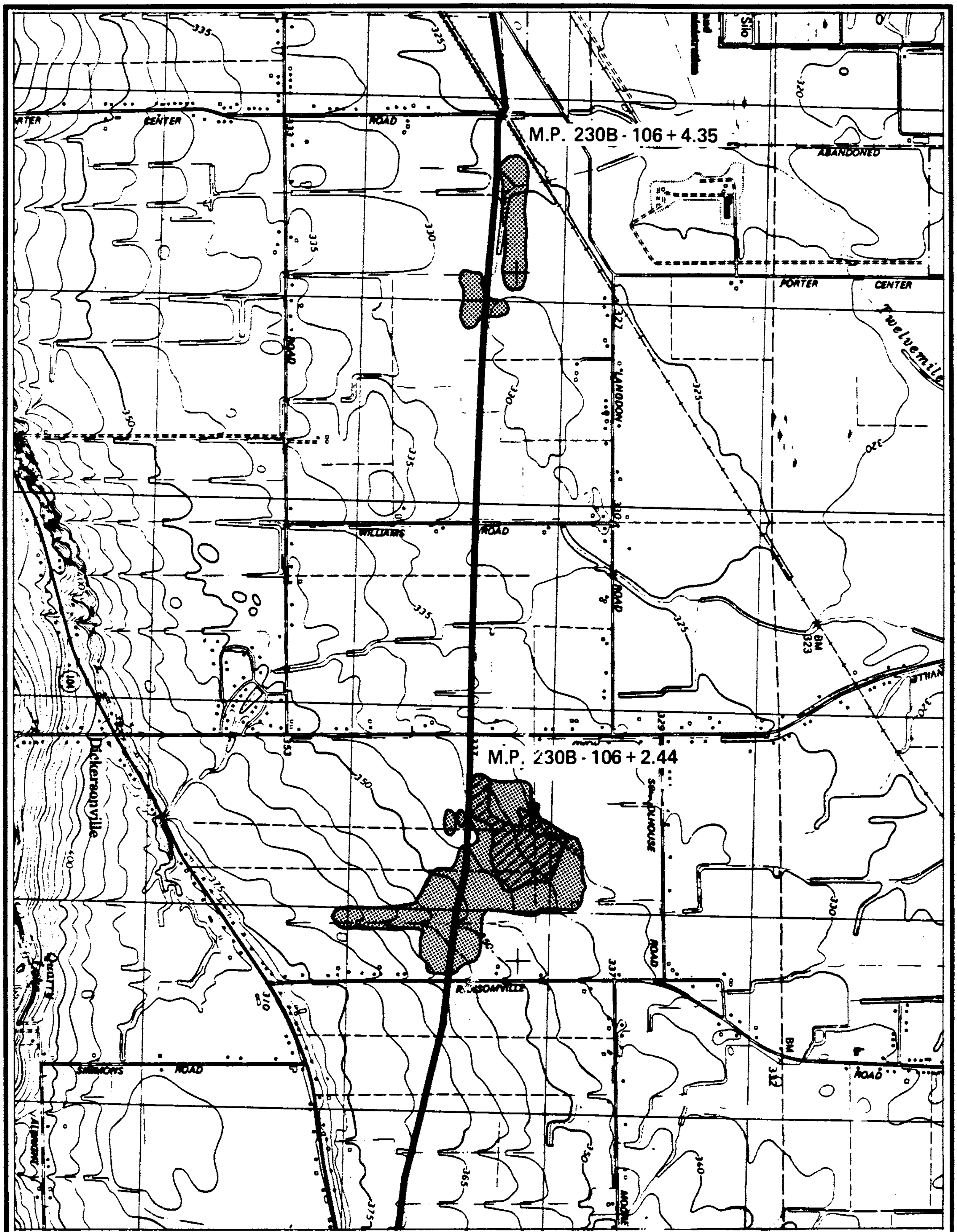


FIGURE 2.2-15, Cont'd.
LOOP 1 WETLANDS
NIAGARA COUNTY, NEW YORK

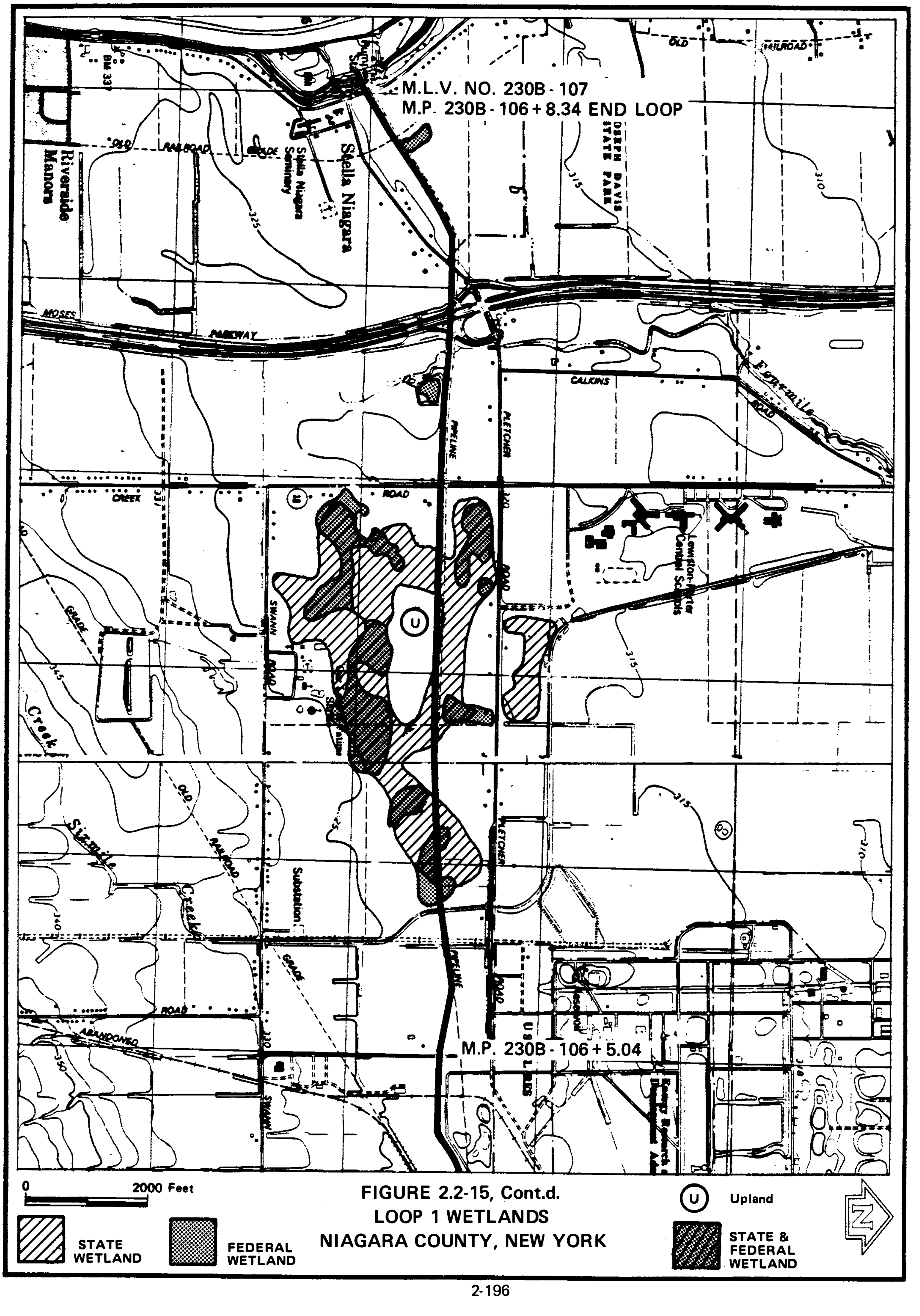


FIGURE 2.2-15, Cont.d.
LOOP 1 WETLANDS
NIAGARA COUNTY, NEW YORK

Tennessee's Wetland and Water Crossing Plan includes a description of construction techniques and methods to minimize adverse impacts during wetland and water crossings (Tennessee Gas Pipeline Company, 1986). Implementation of these techniques and methods, with the FERC Staff's additional recommended mitigating measures, would obviate the need to reroute around the wetlands mentioned above.

FERC Staff believes that parallel pipeline construction of loops through wetlands poses no long-term adverse environmental impacts. The original contour of wetlands is restored immediately following construction, and, with the exception of large woody vegetation that may damage pipelines or their cathodic protection, wetland vegetation is allowed to reestablish itself within the pipeline right-of-way.

Tennessee has proposed a minor deviation from its existing pipeline route near MP 230B-106+5.04 to avoid the Old Lewiston Landfill. See Section 3.2.5.1.3 for further discussion.

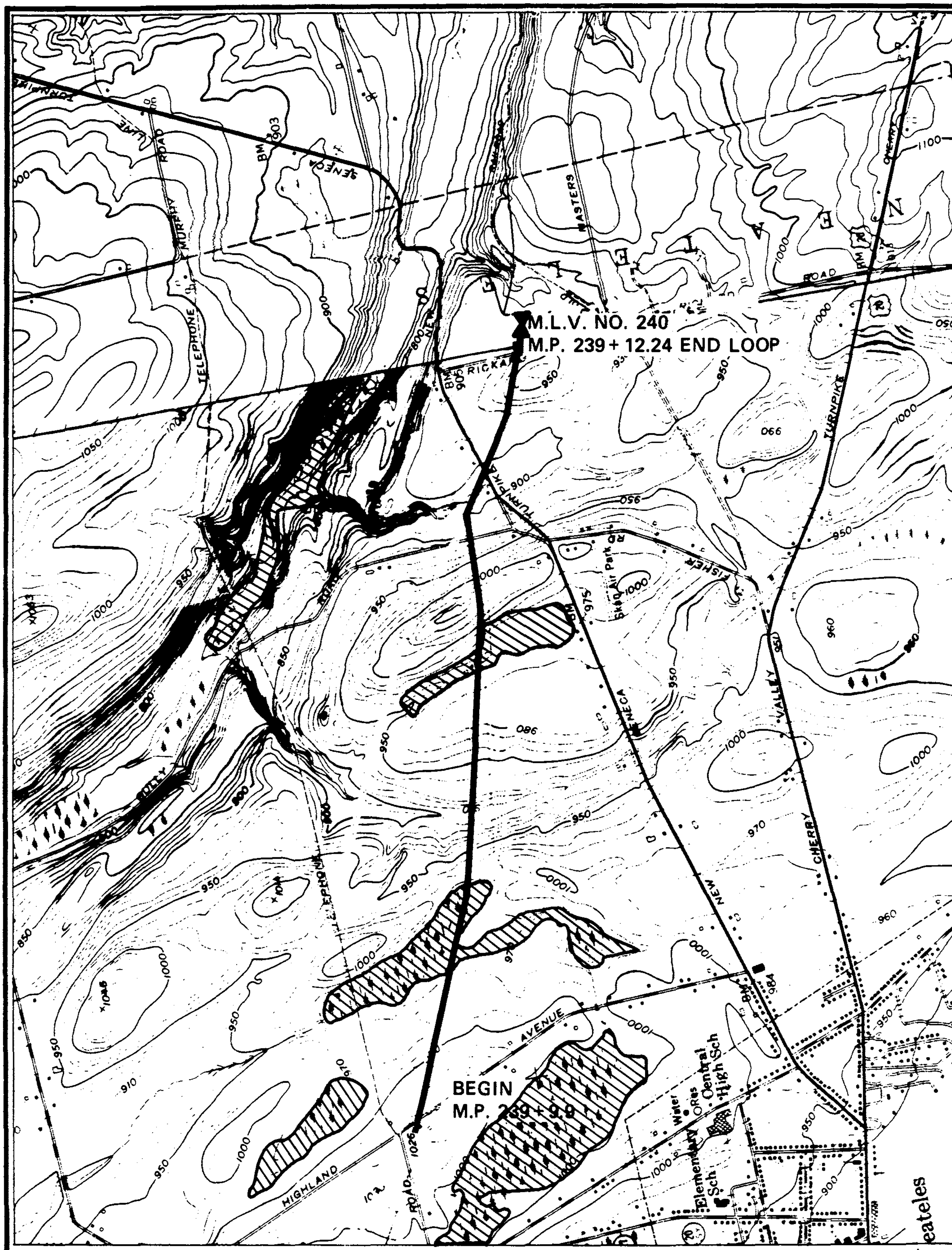
2.2.4.2 Loop 4

Loop 4 crosses two State-designated wetlands between Highland Avenue and Gully Road. The first, SKA-13, is a Class II wetland located approximately 2,000 feet east of Highland Avenue. The second, SKA-14, is a Class III wetland located approximately 1,800 feet west of Gully Road (Figure 2.2-16).

FERC Staff reviewed an alignment of Loop 4 that would avoid all wetlands. The alternative alignment would add an additional 1,000 feet through agricultural lands to the proposed length of Loop 4, at an additional cost of $220,914. Staff did not determine that the alternative was practicable because, as noted above, adherence to Tennessee's proposed Wetland and Water Crossing Plan with the Staff's additional recommendations would obviate the need for extensive rerouting to avoid these wetlands. Furthermore, in a letter to Tennessee, the U.S. Army Corps of Engineers determined that the Loop 4 wetland crossings would be authorized under the Nationwide Permit Program (COE, January 27, 1988).

2.2.4.3 Loop 5

The one wetland crossed by Loop 5 is located between Thomas and Nelson Erieville Roads (Figure 2.2-17). Nelson Swamp (CA-5) is a State-designated Class I wetland. An alternative route for Loop 5 has been proposed (Figure 2.2-17) to



0 2000 Feet

STATE WETLAND

FIGURE 2.2-16
LOOP 4 WETLANDS
ONONDAGA COUNTY , NEW YORK

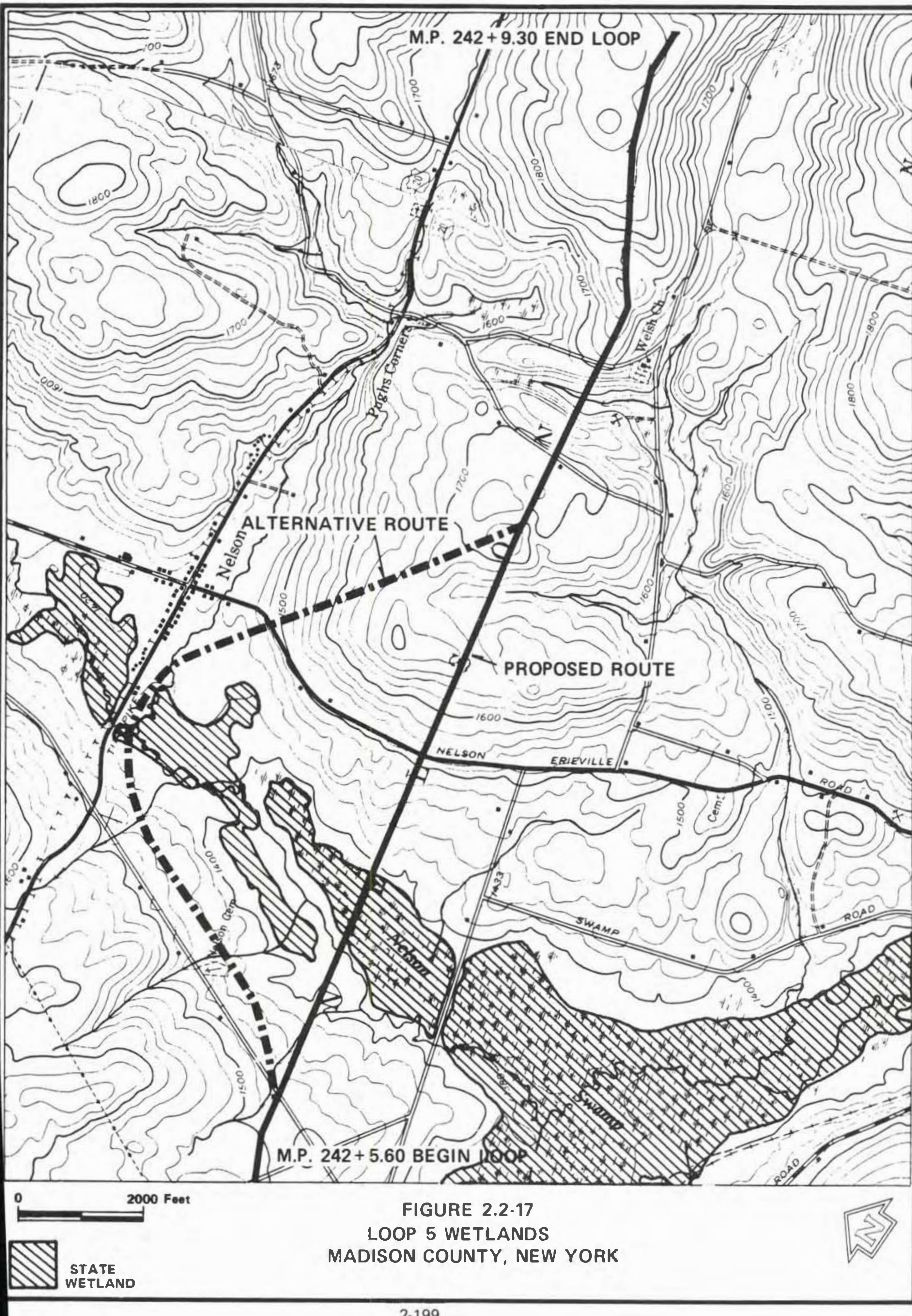


FIGURE 2.2-17
LOOP 5 WETLANDS
MADISON COUNTY, NEW YORK

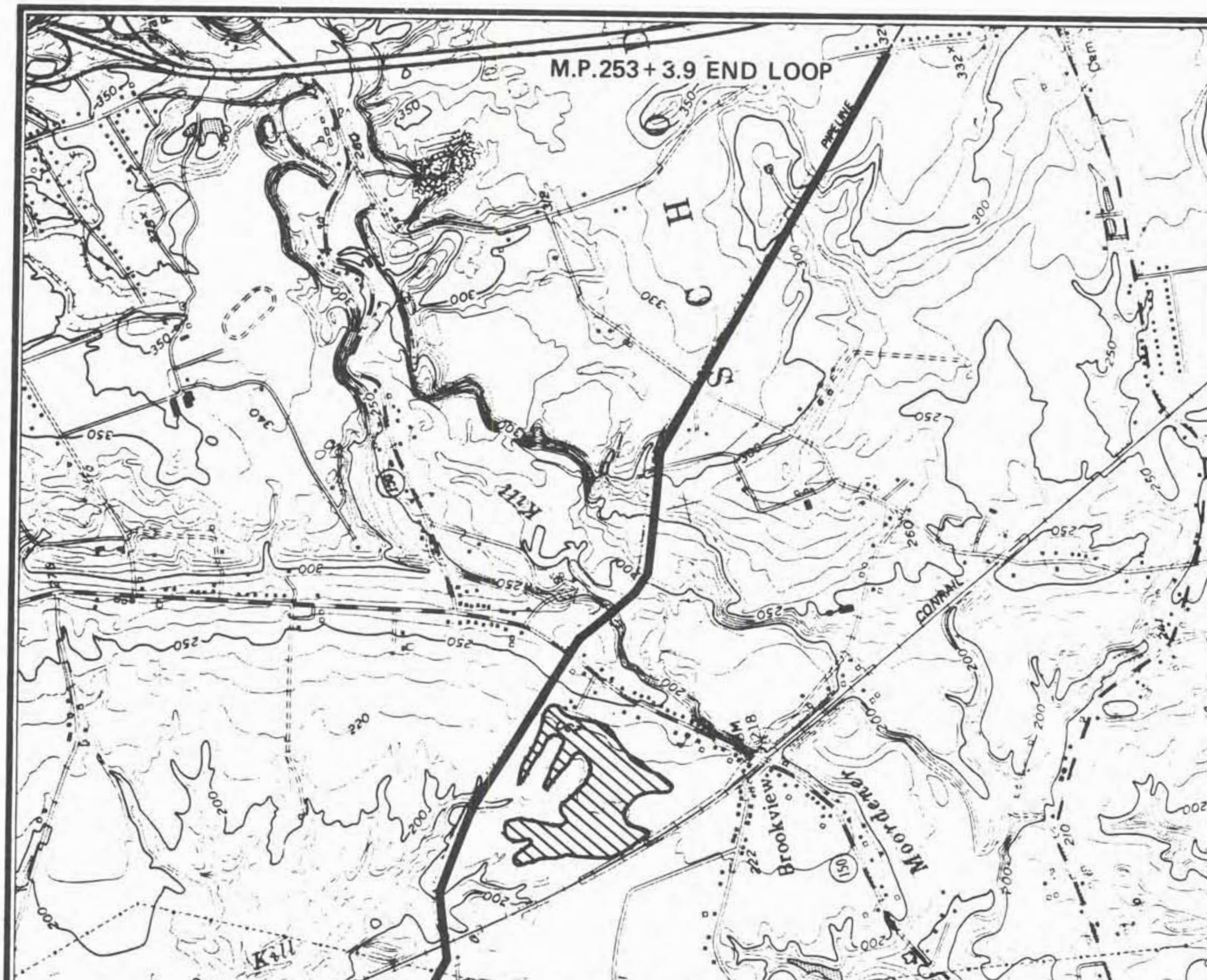
avoid Nelson Swamp. It involves rerouting the loop around the northern end of Nelson Swamp, which would add approximately 4,000 feet at a cost of $883,675, to Loop 5 and would cross State-designated wetland CA-18, a Class II wetland of lower quality than CA-5, for approximately 400 feet (see Section 2.2.5.1 for additional discussion of the alternative route). In a letter to Tennesee, the U.S. Army Corps of Engineers determined that the proposed wetland crossing would be authorized under the Nationwide Permit Program (COE, January 20, 1988).

2.2.4.4 Loop 6

The proposed route of Loop 6 crosses one wetland (Figure 2.2-18). Papscanee Marsh and Creek (EG-1)--noted by the State of New York as one of the major wetland areas of the northern Hudson River and a suspected breeding site for the least bittern, a state-listed "special concern species," is crossed by Loop 6 near its western terminus. The designated wetland areas of the marsh include many long slender strips, as well as the riparian land adjacent to Papscanee Creek that runs parallel to the Hudson River and forms the eastern boundary of Campbell and Papscanee Islands. The configuration of the various strips of wetlands leaves few alternative routes available that would have less impact than the proposed route. No alternative routes could completely avoid all wetlands along Papscanee Creek, thus, Staff has not proposed any wetland avoidance routes.

Staff of the New York State Department of Environmental Conservation (NYDEC) performed a visit in June 1987. In his summary memorandum, Nathan Tripp, Senior Wildlife Biologist, DEC Region 4, indicated that no significant impact should result from crossing Papscanee Creek if appropriate measures are taken, nor should there be any adverse impact to the small cottonwood and reed wetland described by DEC staff as "low quality," between the railroad and Papscanee Creek (NYDEC, 1987). To minimize impacts, the New York State Department of Environmental Conservation recommended that the loop cross the wetland on the north side of the existing Main Line. Since Tennessee already proposes to construct Loop 6 on the north side, this suggestion is not considered an alternative.

The New York Department of State has determined that the proposed crossing of Papscanee Marsh would be consistent with the New York Coastal Zone Management program (Staford, 1988).



0 2000 Feet

STATE WETLAND

FIGURE 2.2-18
LOOP 6 WETLANDS
RENSSELAER COUNTY, NEW YORK

2.2.4.5 Loop 7

Three wetland areas identified on National Wetlands Inventory maps would be crossed by Loop 7 (Figure 2.2-19). The three areas include land adjacent to Tuttle Brook, the tributary of Great Brook approximately 1,200 feet west of U.S. 202, and Great Brook. FERC Staff reviewed an alternative alignment for Loop 7 to avoid all wetlands. The alternative alignment required adding 5,040 feet to the length of the proposed route, at an additional cost of $1,113,408. Staff did not consider this alternative practicable because adverse environmental impacts should be minimized by using Tennessee's Wetland and Water Crossing Plan during construction in these areas.

The proposed route of Loop 7 also passes through densely developed commercial and residential areas between U.S. Route 202 and Powder Mill Road. To avoid this area, the FERC Staff has identified an alternative route that passes north of the main Southwick business district and the Fernwood subdivision (Figure 2.2-19). The alternative route would add approximately 1,300 feet to Loop 7 at a cost of $287,188 (see Section 2.2.5.2 for an additional discussion of this alternative).

2.2.4.6 Rhode Island Extension

The proposed Rhode Island Extension passes through or immediately adjacent to 16 wetlands identified on the National Wetlands Inventory maps. Eleven of these areas are designated palustrine, forested, broad-leaved deciduous; four are variations of the palustrine ecological system; and one is a lacustrine system. The alternative routings for the Extension are illustrated in Figure 2.2-20. Figure 2.2-21 illustrates wetlands along the proposed route of the Extension and the variations and alternatives. Tables comparing the impacted resources accompany the description of each variation to the Extension (Section 2.2.5).

Most of the wetlands encountered along the proposed route are fairly small--less than 10 acres--and would be affected only near their edges. However, at least two wetlands larger than 10 acres would be traversed by the proposed route. Near the northern end of the Extension, the proposed route crosses an approximately 20-acre wetland bounded by Lincoln, Stone, and Schoolhouse Roads. Another large wetland of approximately 15 acres is crossed by the proposed route, south of Lackey Dam Road and west of Route 146. The proposed route crosses the northwest corner of the wetland adjacent to Dunleavey Brook and a tributary to Gilboa Pond.

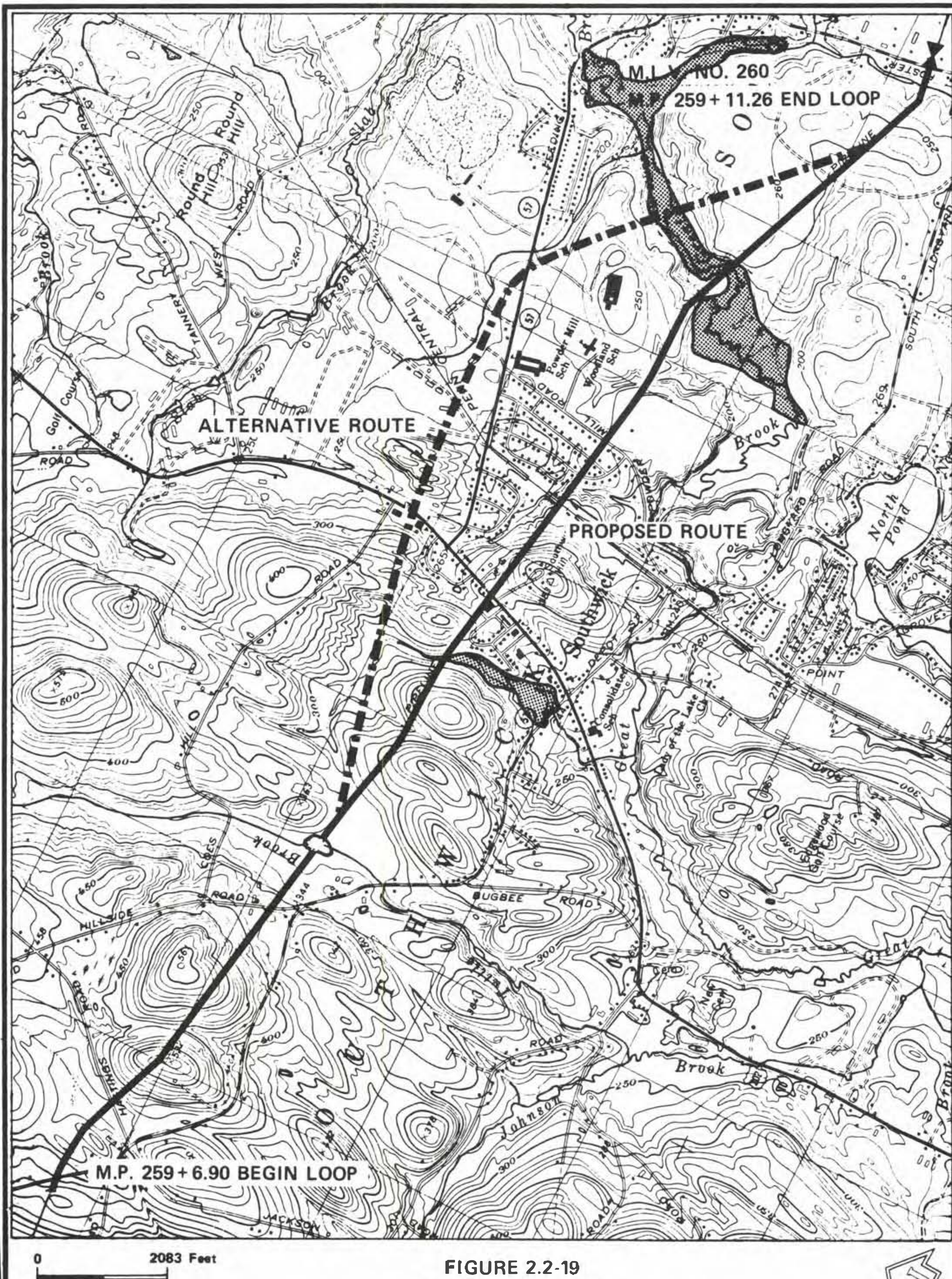


FIGURE 2.2-19
LOOP 7 WETLANDS
HAMPDEN COUNTY, MASSACHUSETTS

0 ½ 1 Mile

* Route Preferred by FERC Staff.

Base Map Source: U.S.G.S. 7½' Quads; Grafton, MA, 1979; Milford, MA, 1979; Uxbridge, MA/RI, 1979; Blackstone, MA/RI, 1979.

NOTE: A complete understanding of alternative pipeline routings requires using both this graphic representation and the text discussion.

FIGURE 2.2-20
RHODE ISLAND EXTENSION ALTERNATIVES AND VARIATIONS

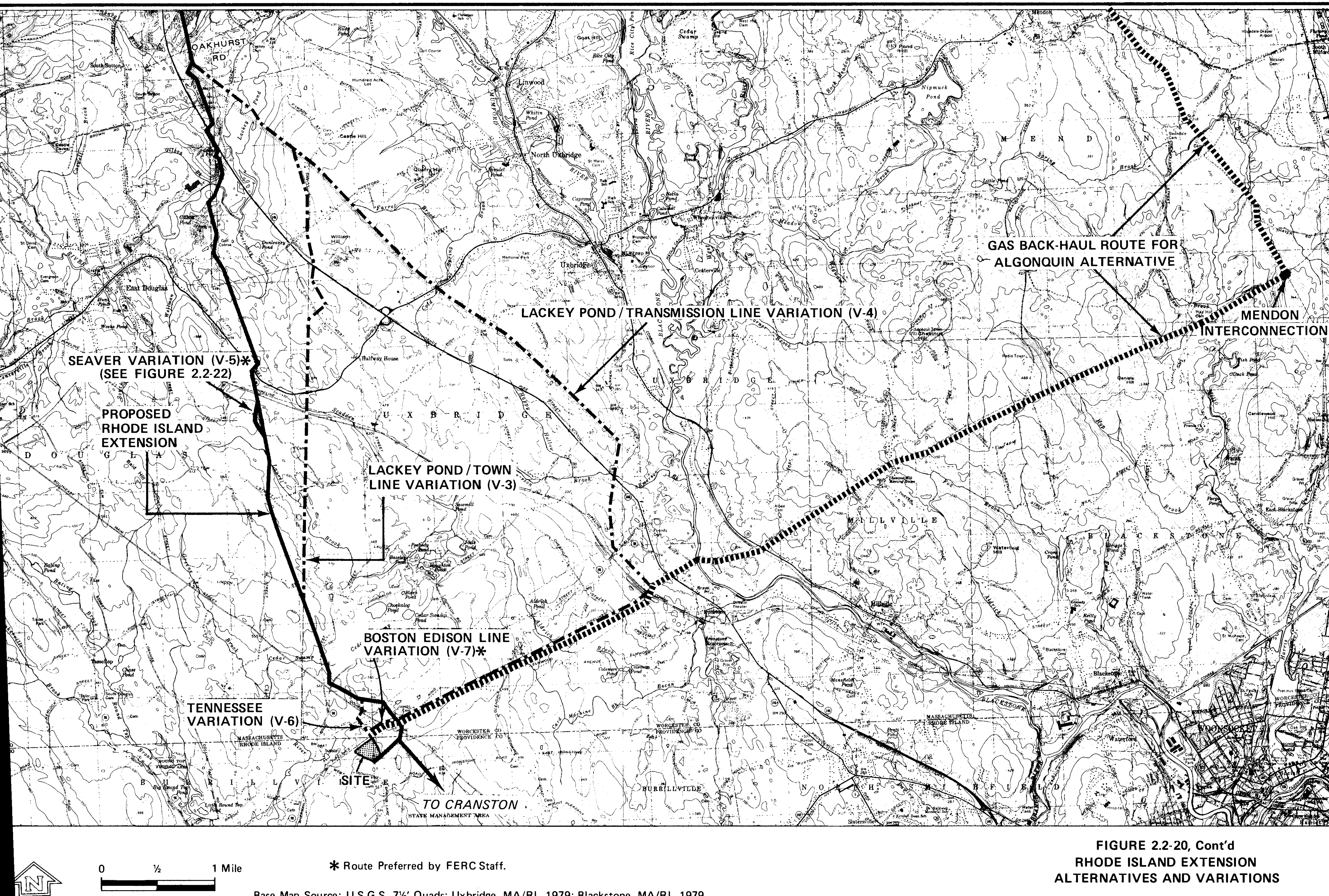
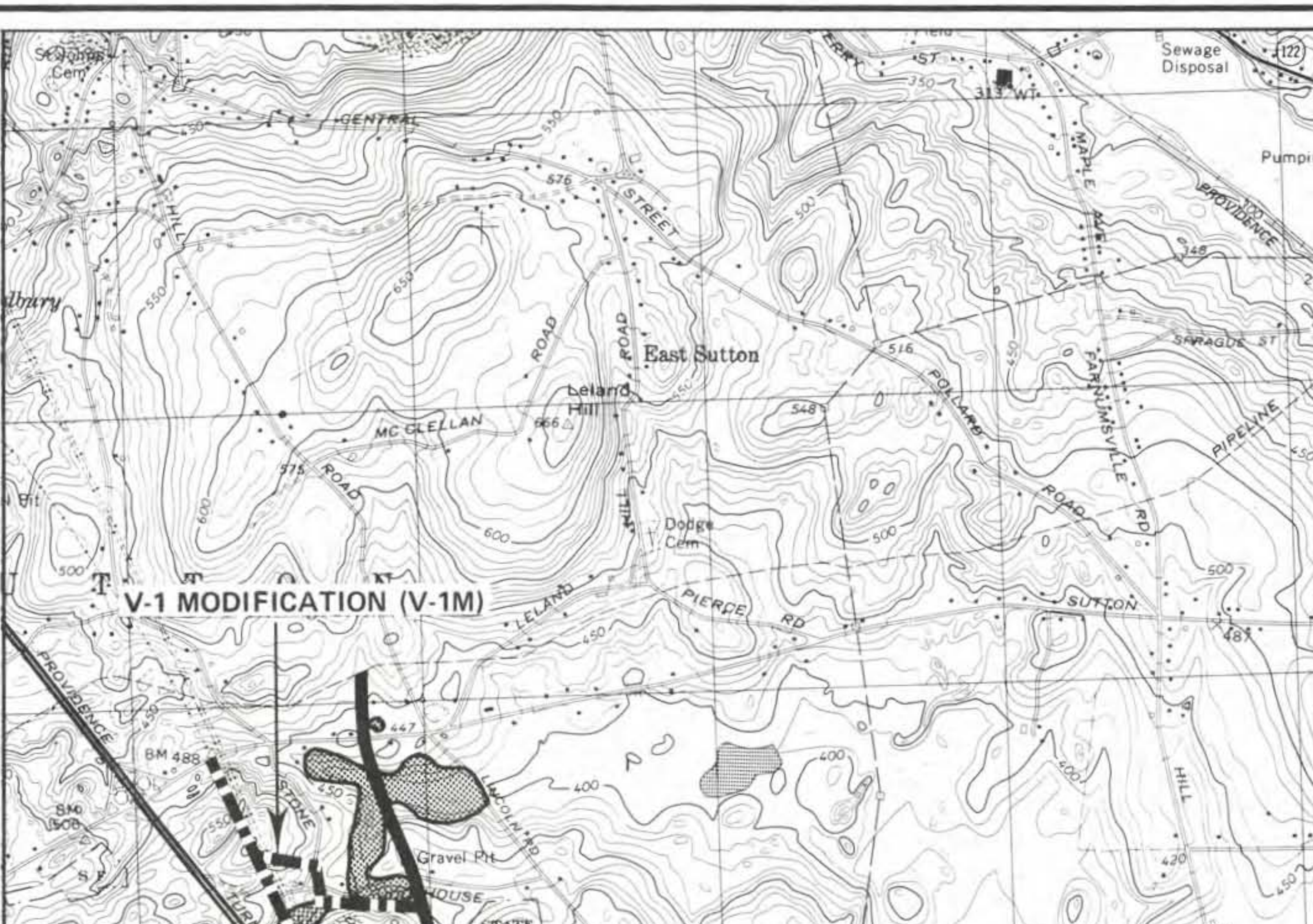


FIGURE 2.2-20, Cont'd
RHODE ISLAND EXTENSION
ALTERNATIVES AND VARIATIONS



Base Map Source: U.S.G.S. 7½' Quad; Grafton, Mass., 1979.

NOTE: A complete understanding of alternative pipeline routings requires using both this graphic representation and the text discussion.

0 ½ 1 Mile

Scale: (1:25,000)

FEDERAL WETLAND

FIGURE 2.2-21
WETLANDS ALONG ALTERNATIVE AND PROPOSED GAS PIPELINE ROUTES

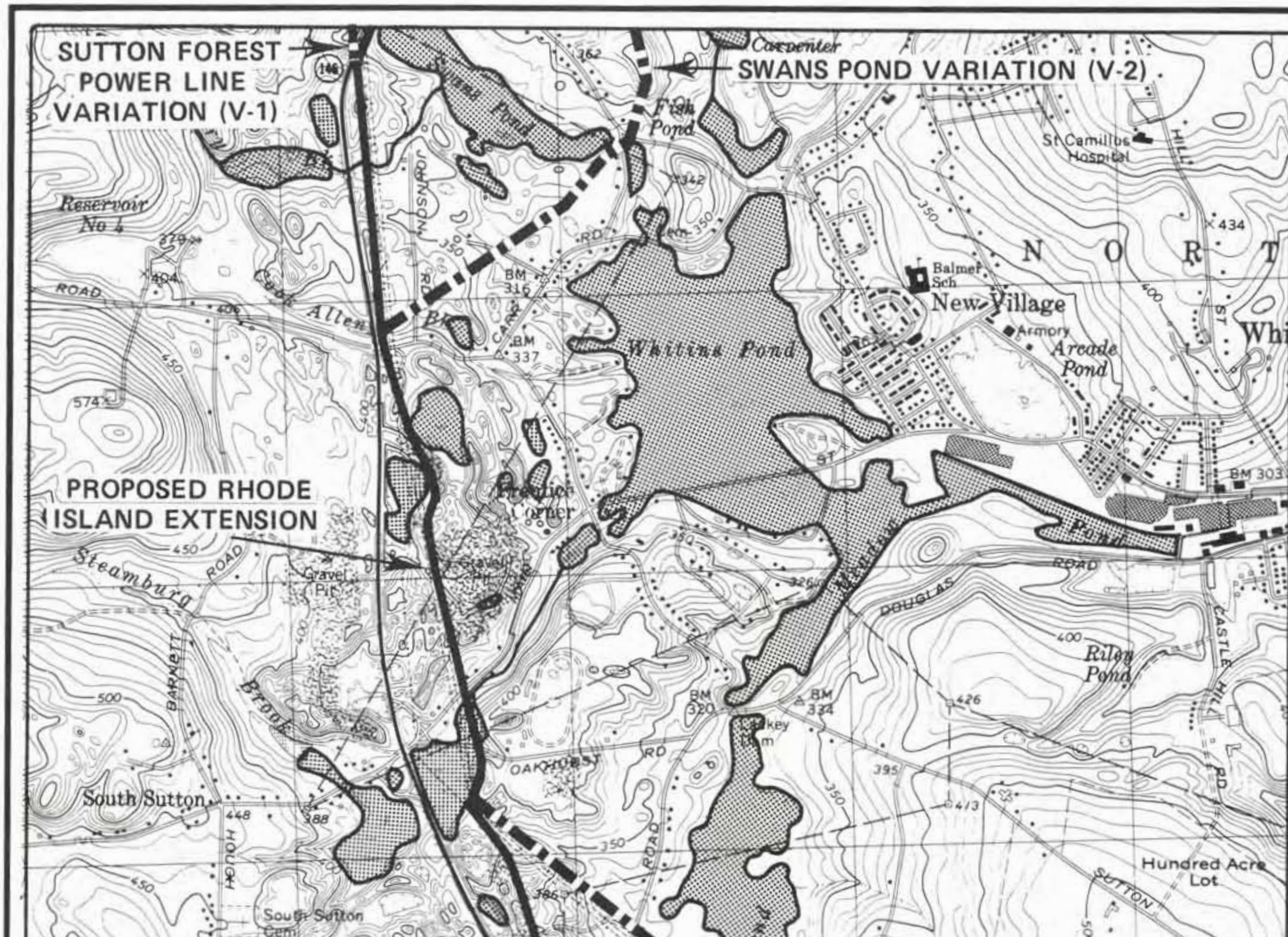
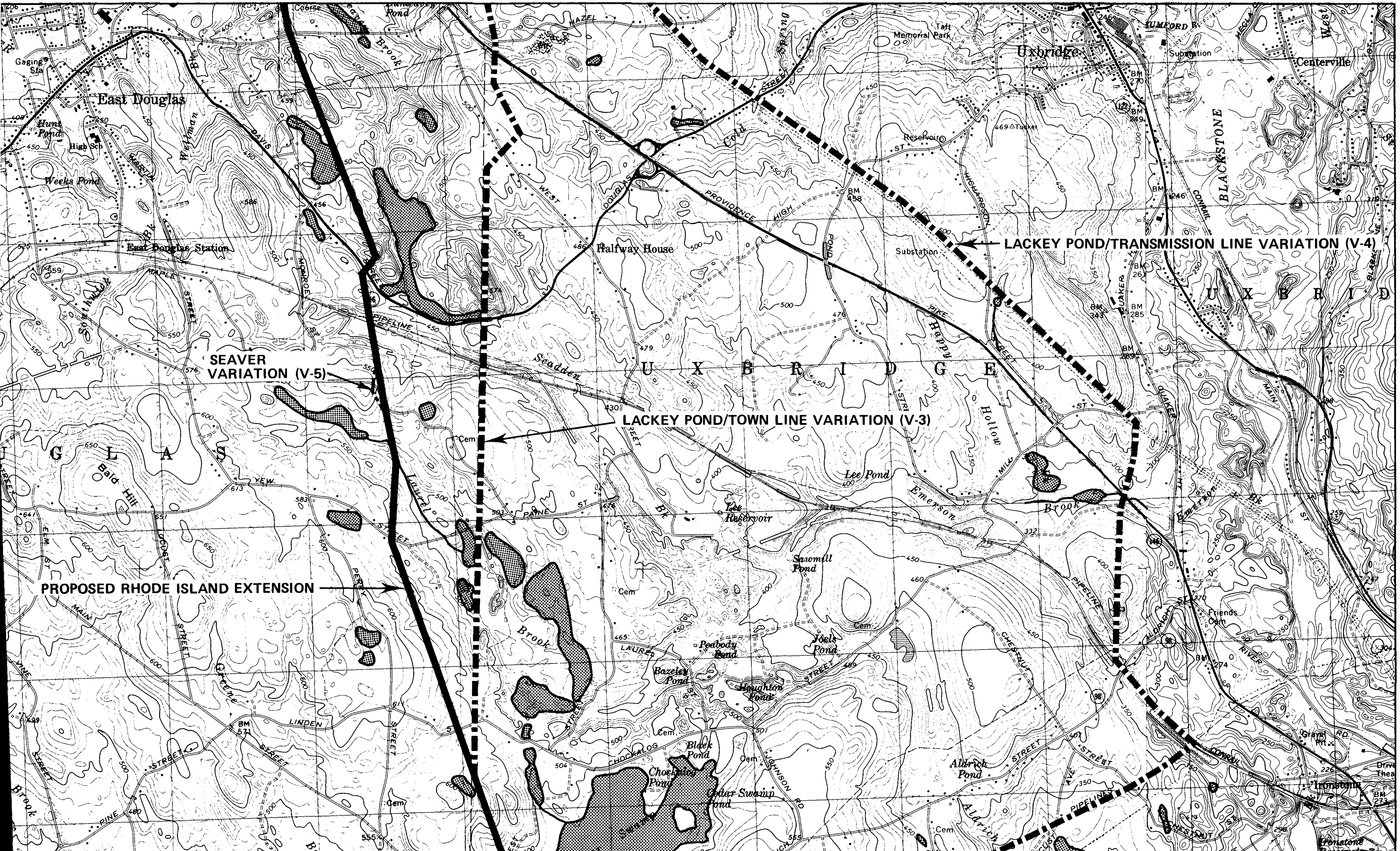
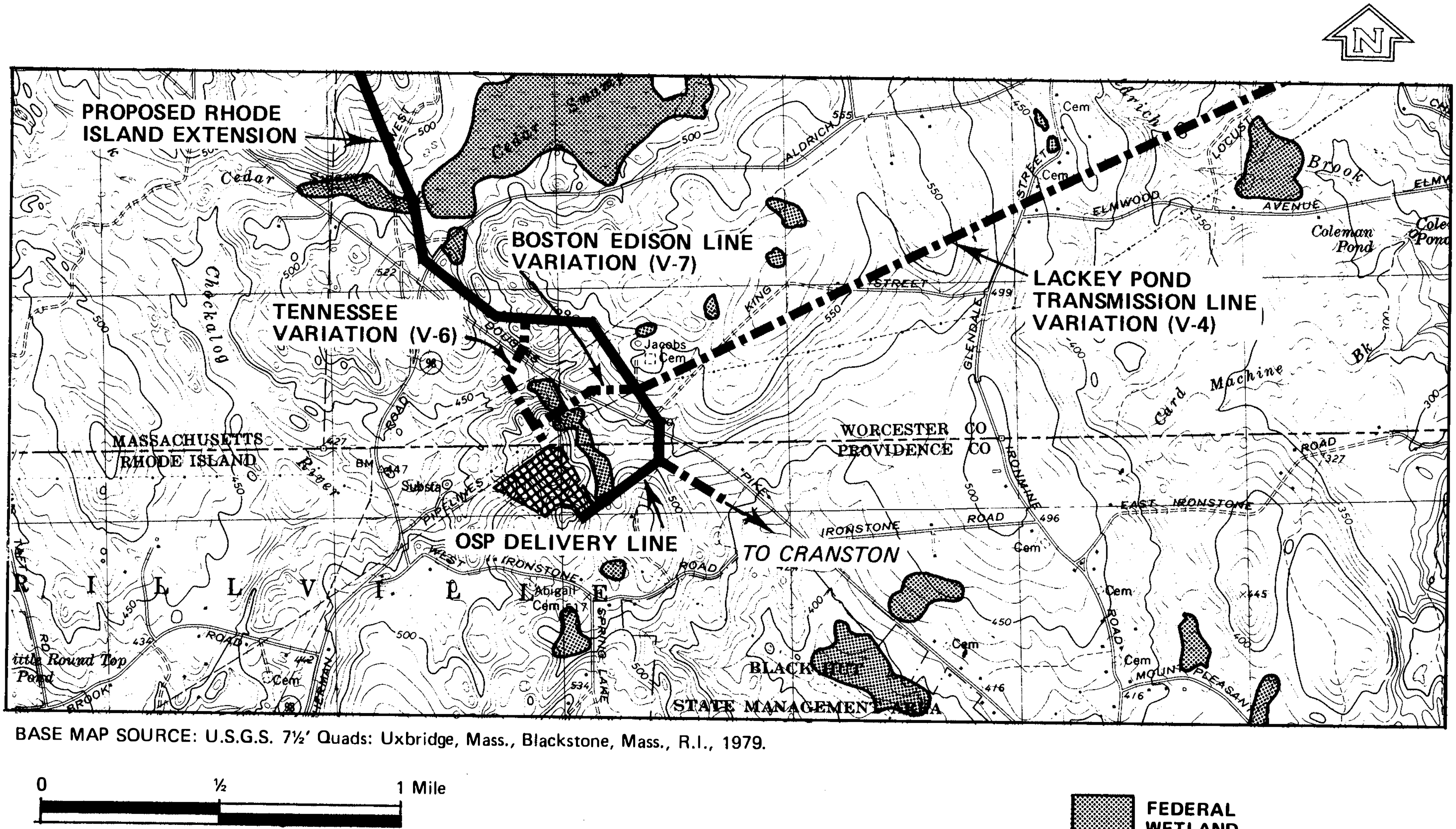


FIGURE 2.2-21.Cont.d.
WETLANDS ALONG ALTERNATIVE AND PROPOSED GAS PIPELINE ROUTES



Base Map Source: U.S.G.S. 7½′ Quads: Uxbridge, Mass., Blackstone, Mass., 17 1979.

FIGURE 2.2-21, Cont'd.
WETLANDS ALONG ALTERNATIVE AND PROPOSED GAS PIPELINE ROUTES



BASE MAP SOURCE: U.S.G.S. 7½′ Quads: Uxbridge, Mass., Blackstone, Mass., R.I., 1979.

FIGURE 2.2-21, Cont'd.
WETLANDS ALONG ALTERNATIVE AND PROPOSED GAS PIPELINE ROUTES

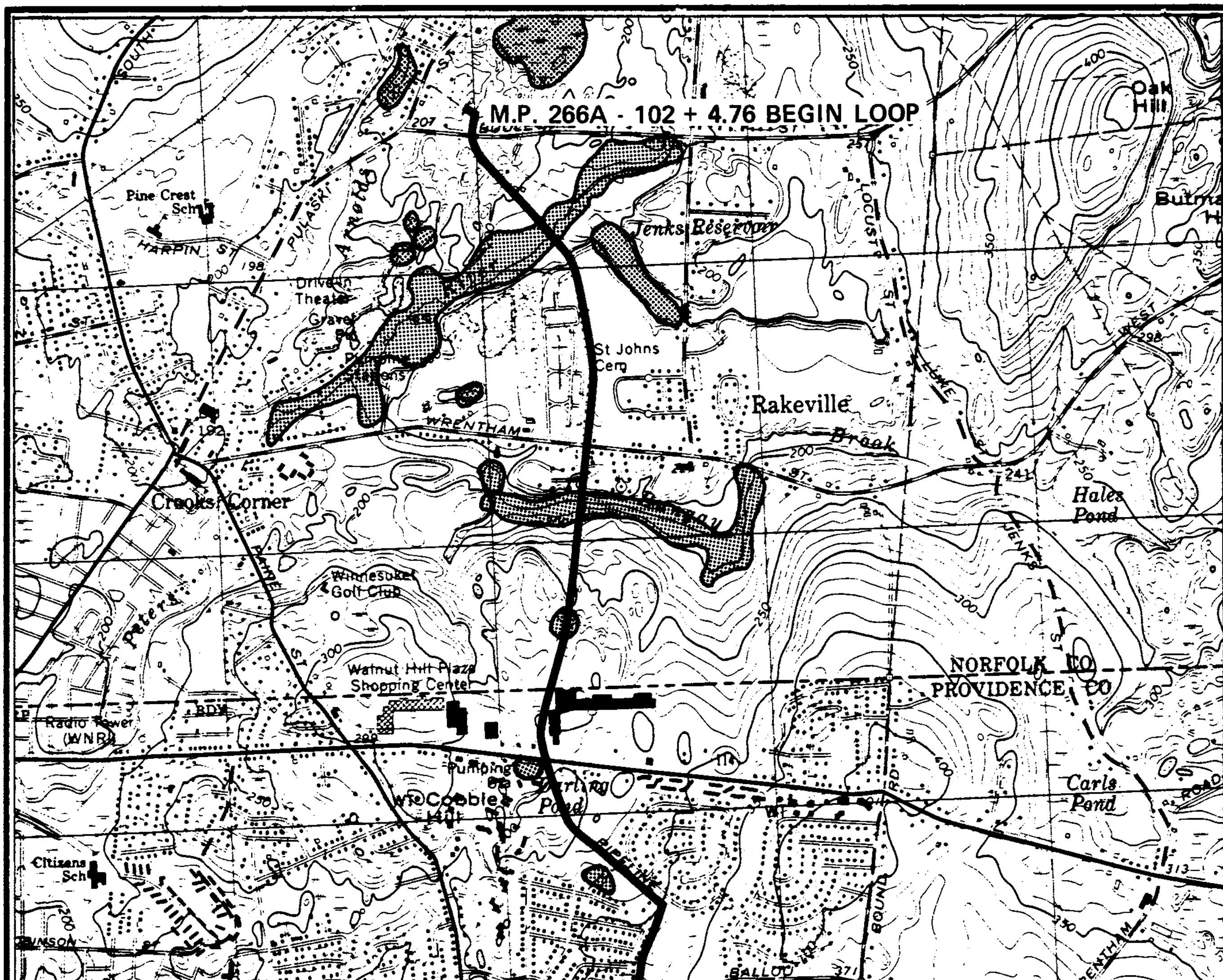


FIGURE 2.2-21, Cont.d.
WETLANDS ALONG ALTERNATIVE AND PROPOSED GAS PIPELINE ROUTES

(ALGONQUIN ALTERNATIVE (A-1)
BLACKSTONE VALLEY LINE IMPACT AREA WETLANDS)

FEDERAL WETLAND

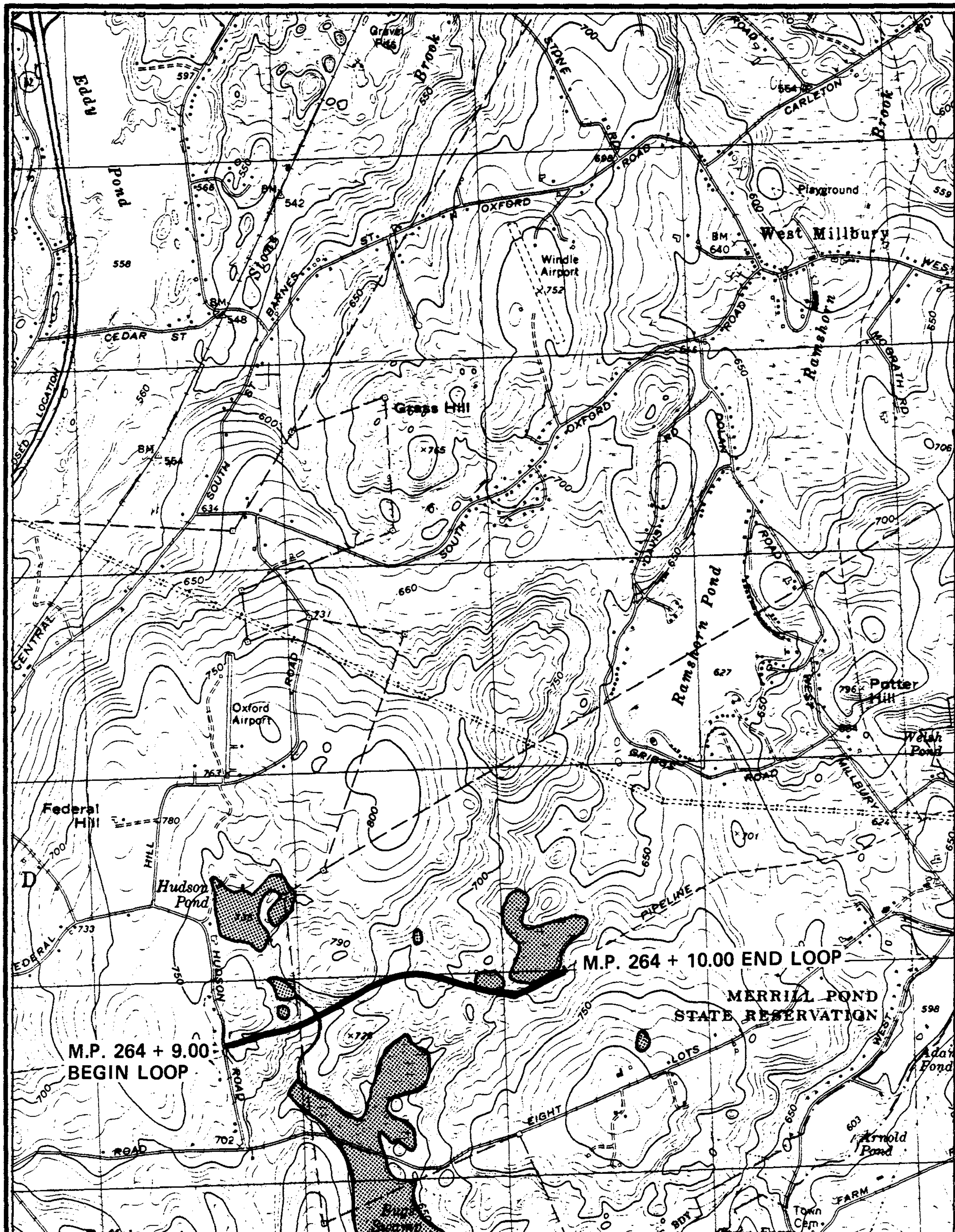


FIGURE 2.2-21, Cont'd.
WETLANDS ALONG ALTERNATIVE AND PROPOSED GAS PIPELINE ROUTES
(ALGONQUIN ALTERNATIVE (A-1)
MAINLINE LOOP IMPACT AREA WETLANDS)

The proposed route of the Extension also crosses the extreme western end of Swans Pond, an approximately 35-acre lacustrine, limnetic, open-water wetland just south of Purgatory Road and east of Route 146.

There are large deposits of sand and gravel at various locations along the proposed route. Many of these deposits have significant economic value because of their size, quality, and location.

Several variations to the proposed route that would avoid major wetlands and valuable sand and gravel resources have been suggested. Other variations and alternatives have been suggested that would avoid impinging on the development potential of certain property and minimize the amount of virgin right-of-way needed for the pipeline.

The Sutton Forest power line variation (V-1), identified by FERC Staff, begins at Tennessee's 200 Main Line in the transmission line corridor approximately 1,500 feet east of Route 146 (Figure 2.2-21). V-1 follows the transmission line south for approximately 11,000 feet to where the transmission line corridor intersects the proposed route of the Extension. This variation minimizes the required amount of virgin right-of-way by using the existing transmission line corridor to avoid the 20-acre wetland at the end of the Rhode Island Extension. V-1 is approximately 700 feet shorter than the proposed route.

A modification of V-1 (V-1M) begins at the same point and follows the same route as V-1 for approximately 1,800 feet. V-1M then leaves the power line corridor in a roughly southeasterly direction, crosses Stone Road, turns south, crosses Schoolhouse Road, and then proceeds generally southeast until intersecting the proposed route approximately 3,100 feet south of its proposed beginning. V-1M adds approximately 700 feet to the proposed route.

The Swans Pond variation (Figure 2.2-21), identified by Tennessee, avoids the physical limitations of constructing the extension in the narrow strip of upland between the west end of Swans Pond and the Route 146 northbound exit ramp. This variation (V-2) deviates from the proposed route in a south-southeasterly direction approximately 2,500 feet north of Purgatory Road, passes around the east end of Swans Pond, and then heads southwest to rejoin the proposed route approximately 200 feet north of Mendon Road.

The Lackey Pond/Town Line variation (V-3), also identified by Tennessee, bypasses major sand and gravel deposits. V-3 (Figure 2.2-21) begins just north of the existing power line right-of-way, approximately 700 feet south of Oakhurst Road. V-3 runs southeast roughly parallel to the existing power line right-of-way, crosses Lackey Pond at its narrowest point, runs parallel and adjacent to the east side of the power line to approximately 800 feet north of Williams Street, turns south and runs roughly parallel to Williams Street--crossing Hartford Avenue, Hazel Street, Route 146, and West Street--and runs parallel and adjacent to the Douglas town line (while crossing Douglas, Maple, Yew, and Chockalog Streets), before joining the proposed extension route approximately 4,300 feet north of Aldrich Street. This variation avoids the large wetland adjacent to Dunleavey Brook, but adds approximately 1,500 feet to the proposed pipeline.

The Lackey Pond/Transmission Line variation (V-4), a modification of a route suggested by a local resident (W. Saravara), minimizes the amount of virgin right-of-way required for the proposed extension and avoids the large wetland adjacent to Dunleavey Brook. V-4 begins at the same point and follows the same route as V-3 (Figure 2.2-21) until approximately 800 feet from Williams Street, where V-3 crosses V-4 heading south. V-4 continues along the transmission line corridor to approximately 200 feet below Mill Street, where it turns due south approximately 5,500 feet to its intersection with the abandoned railroad tracks just north of Aldrich Street. V-4 follows the abandoned railroad tracks southeast for approximately 2,500 feet to where they intersect the Algonquin Gas transmission line, at which point Tennessee would follow the Algonquin line west to the proposed OSP site at Burrillville.

Figure 2.2-22 shows the proposed route of the Rhode Island Extension in the vicinity of Maple Street in Douglas, Massachusetts. On the north side of Maple Street, the proposed route bisects two small parcels of undeveloped residential property (owned by Seaver and Olson). Mr. Seaver has expressed a concern that approval of the proposed route would severely limit and constrain the use of his property for its intended use as a homesite. The Staff agrees and recommends that Tennessee deviate from the proposed route and follow the Seaver variation as shown on Figure 2.2-22 to maximize the use of existing property lines for the gas pipeline. The pipeline should be built within the road or as close to the road as possible. This modification would be about 250 feet longer than the proposed route, but would not significantly affect the project.

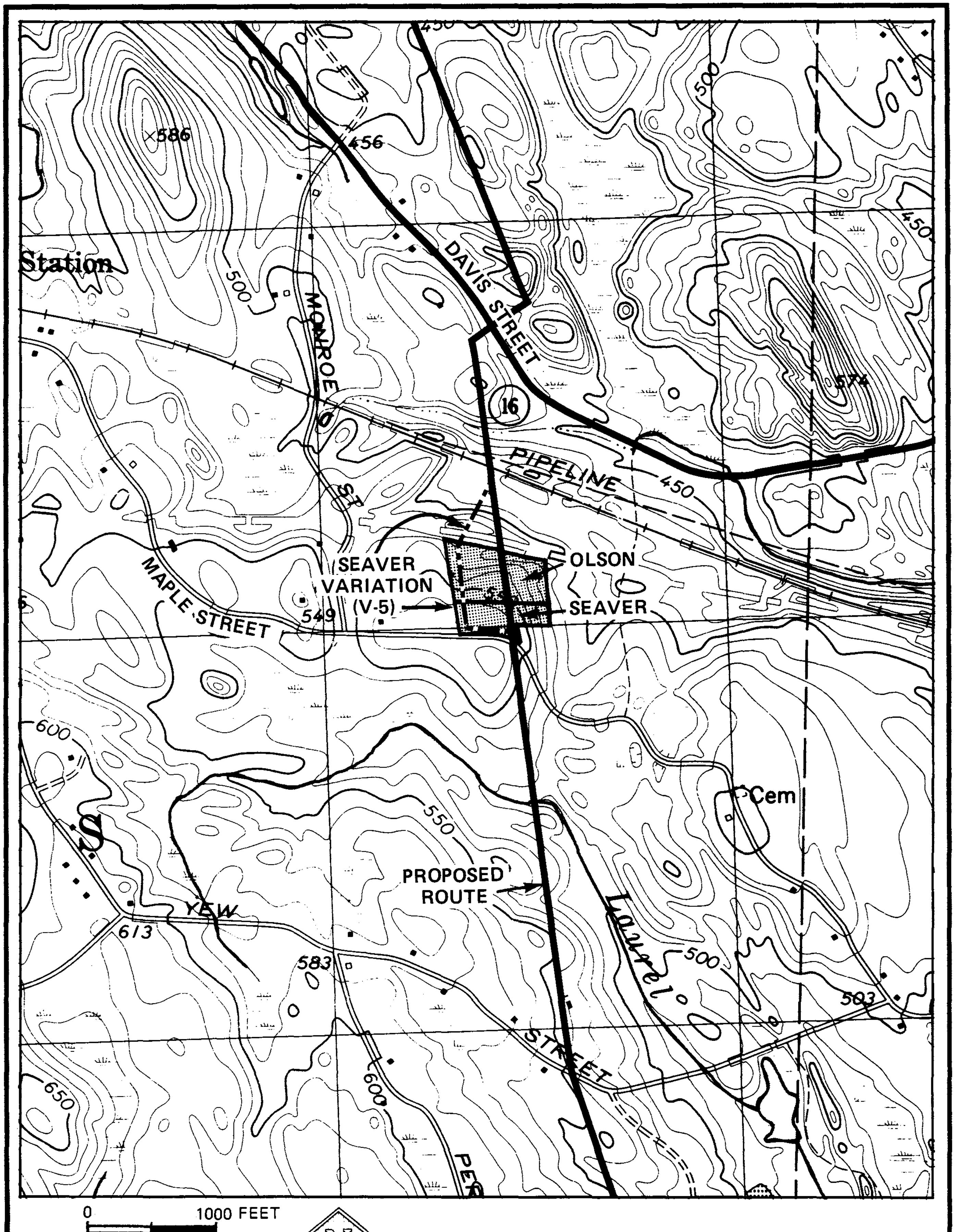


FIGURE 2.2-22
SEAVER VARIATION (V-5)

The Tennessee Variation (V-6) (see detailed drawing Figure 2.1-6) begins approximately 1,200 feet east of Aldrich Street. V-6 would modify the proposed route of the Rhode Island Extension just prior to reaching the proposed Sherman Farm Road plant site. V-6 was suggested by Tennessee Gas as a shorter route to the plant site than the proposed route. After diverging from the proposed route east of Aldrich Street, V-6 would run generally south crossing Douglas Pike then across the AT&T, Boston Edison, and Algonquin Gas rights-of-way, and terminating in the northeast corner of the proposed plant site at the alternative location of the gas meter station.

A second variation of the proposed Rhode Island Extension just prior to reaching the proposed Sherman Farm Road plant site is identified as the Boston Edison Line variation (V-7) (see detailed drawing, Figure 2.1-6). V-7 is a route suggested by FERC Staff in response to the concerns of local citizens regarding cutting a new right-of-way corridor through the area. V-7 would diverge from the proposed route of the Rhode Island Extension approximately 800 feet north of Douglas Pike, at the north side of the existing Boston Edison right-of-way. V-7 would then parallel the existing right-of-way for approximately 1,600 feet, at which point V-7 would turn southeast, pass under the Boston Edison electric and the Algonquin gas transmission lines, and terminate in the northeast corner of the proposed Sherman Farm Road plant site at the alternative site for the gas meter station. Should the gas meter station be constructed in the northwest corner of the proposed plant site, V-7 could be extended approximately 700 feet down the Boston Edison line before crossing under the transmission lines, without significant additional environmental impact.

Staff raises the possibility of constructing the gas meter station in the northwest corner of the proposed site so the FERC may consider V-7 in terms of Tennessee's proposed Providence Project, which would extend the Rhode Island Extension into the Providence, Rhode Island area. These extended gas transportation facilities could take advantage of the existing electric transmission line right-of-way that runs along the southwest side of the proposed Sherman Farm Road site. From a meter station in the northwest corner of the proposed plant site, the transmission line corridor would be immediately accessible for the Extension to parallel through the area including the Black Hut State Management Area and beyond. By following the existing transmission line right-of-way, the cutting of a new right-of-way corridor could be avoided.

An alternative to construction of the extension was proposed by Algonquin Gas Transmission Company (Figure 2.2-20). The Algonquin Gas alternative (A-1) suggests using existing Tennessee transmission facilities to deliver the required quantity of gas for the OSP power plant to Algonquin's transmission facilities. Algonquin would then redeliver the gas to the OSP site.

A-1 involves routing the required gas from Tennessee's Main Line to a point approximately 4 miles east of the extension's proposed point of origin. The gas would then be transported south approximately 9 miles through Tennessee's Blackstone Valley delivery line and delivered to Algonquin's transmission line at Mendon, Massachusetts. Algonquin would then deliver equivalent volumes of gas to OSP through its Main Line, which passes adjacent to the proposed power plant site at Burrillville. Algonquin states that this "back-haul" arrangement would obviate the need for construction of the 11 miles of the Rhode Island Extension.

2.2.5 Comparison of Impacts of Proposed Action and Alternatives

No alternatives have been proposed for Loops 1, 4, and 6. Impacts for alternatives/variations to Loops 5, 7, and the Rhode Island Extension are discussed below. The following discussion focuses on areas where direct comparisons can be made.

The analysis of air quality effects associated with the alternatives to the proposed pipeline extensions and modifications (Section 4.2.3) indicates that the only air quality impacts are temporary construction-related fugitive dust and vehicle emissions, unless the alternative involves permanent stationary sources of emissions such as additional compression.

Excavation and other construction activities will result in temporary air quality effects along the length of new pipeline. The extent of these impacts is dependent on the level and duration of construction activity; if additional pipeline length is needed, impacts will be proportionately greater. With the use of proper dust suppression techniques, crews can avoid creating nuisances for nearby residents. The emissions from workers' vehicles and construction equipment should not have significant effects on air quality. However, under certain weather conditions, high concentrations of pollutants might exist in the vicinity of construction sites.

Sound quality analysis for the proposed alternatives to the pipeline extensions and modifications (Section 4.2.4) indicates that there would be impacts from temporary construction noise only. Vehicular traffic and construction activities would contribute to noise levels during pipeline construction. If the alternative route is longer than the proposed route, it would proportionately increase the duration of noise associated with construction. Tennessee has indicated that construction activities may begin as early as 6 or 7 a.m. It is possible that the early morning construction traffic could present a particular nuisance to residents immediately adjacent to construction sites.

The human health effects associated with construction of the alternatives to the proposed pipeline extensions and modifications would be generally comparable to those associated with the proposed pipeline construction. Where greater lengths of pipeline are required to implement alternative routes, these impacts would be proportionately greater. The most significant effects directly attributable to construction activities would be the result of fugitive dust, vehicle emissions, and blasting. Individuals with respiratory maladies such as asthma may be particularly sensitive to the temporarily increased levels of exhaust emissions from construction vehicles and the fugitive dust generated around construction sites. Precautions may be necessary to protect individuals who are sensitive to these conditions.

2.2.5.1 Loop 5

Table 2.2-4 presents a comparison of the proposed route and alternative routing for Loop 5 from the points where the alternative diverges and converges with the proposed route. Rerouting Loop 5 to avoid construction through Nelson Swamp (CA-5), a State-designated class I wetland, would require temporarily disturbing an additional 7 acres of agricultural, wetland, and upland soils during pipeline construction. Following the proposed route for Loop 5 would expose approximately 2 acres of soil during construction within the swamp. Topography along the alternative route slopes toward Nelson Swamp and several drainage courses on the north and west side of Nelson Swamp. This side-hill construction, combined with the total increase in acreage affected during construction, would increase the potential for erosion along the alternative route. During periods of high surface runoff, areas within Nelson Swamp and adjacent drainage could receive a greater amount of silt and sediment from the alternative route than from the proposed route.

The primary ecological impacts of concern along Loop 5 are those associated with crossing Nelson Swamp. The proposed crossing of this swamp would disturb approximately 2 acres of land, of which 0.8 acre would be retained as new permanent right-of-way. Plant species within the 25-foot-wide new right-of-way would be temporarily displaced, but woody species would be permanently displaced. The ground within the existing right-of-way and adjacent land in Nelson swamp is moist but free from standing water for most of the year, as was the case during site visits in September and November 1987. The ground will support wheeled vehicles such as those used for periodic mowing of the right-of-way to inhibit the growth of woody vegetation. The cedar forest that dominates the swamp is dense, and provides excellent cover for various species of fauna, the most evident of which being game species such as whitetail deer and cottontail rabbits. These species move freely between the cedar forest and surrounding agricultural lands,

TABLE 2.2-4

Loop 5 - Nelson Swamp Bypass Alternative Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	10,000	14,000
New ROW/Existing ROW (feet)	0/10,000	14,000/0
Acreage Affected (construction/permanent)[c]	16.9/5.4	24.1/16.1
Wetlands Affected (number/length (feet))	1/1400	1/400
Perennial Stream Crossings	2	5
Road Crossing	1	1
Estimated Cost (@ $917,000/mi.)[d]	$1,742,300	$2,430,050

[a]See Figure 2.2-17.

[b]Approximate length from tie-ins of alternative route.

[c]Temporary construction easement is 75 feet wide, 65 feet wide for 1,400 feet through designated wetland (CA-5); permanent easement is: 50 feet wide for new ROW; 25 feet wide when parallel to existing easement.

[d]SOURCE: Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-132-001), 1987.

some of which are in production (mainly corn) and others fallow. These surrounding agricultural lands, through which the alternative around Nelson Swamp must pass, are a significant source of food for animal populations in and around the swamp. At any given time, animal populations in these surrounding lands may equal those within Nelson Swamp. Therefore, following the alternative route around Nelson Swamp and thereby affecting a larger acreage, could potentially displace more animal populations than following the proposed route through Nelson Swamp.

Two rare plant species are known to occur in the vicinity of the proposed Loop 5 pipeline. Spreading globeflower (Trollius laxus) and striped coralroot (Corallorhiza striata) are identified by the New York Nature Conservancy as rare species found in the area. Prior to any construction activities within Nelson Swamp, the FERC Staff recommends that Tennessee conduct a thorough survey of the proposed construction route to identify these rare plant species. If any are found, Tennessee should consult with New York State Department of Environmental Conservation on appropriate mitigating measures such as transplanting or avoidance.

The proposed alternative around the north end of Nelson Swamp would affect approximately 24 acres of land during construction, including 400 feet of State-designated wetland (CA-18). The alternative would require establishing a second pipeline corridor in previously undisturbed areas that are in various stages of succession, with the exception of upland areas currently under agricultural production. The amount of vegetation and the potential number of animals that would be disturbed by clearing a new right-of-way to avoid crossing Nelson Swamp may be greater than those disturbed by following the proposed route through the swamp.

Additionally, to minimize the impact on wetland CA-18 which is immediately north of Nelson Swamp (CA-5), the alternative would have to be routed as close as possible to US Route 20. This would involve passing directly behind several businesses and residences and would create a variety of temporary construction-related nuisances such as noise, dust, exhaust emissions, vibration, and traffic congestion.

Considering the proposed and recommended mitigating measures, the FERC Staff does not believe that this alternative is significantly superior to the proposed route.

2.2.5.2 Loop 7

The alternative route identified by the FERC Staff for Loop 7 bypasses the highest concentration of commercial and residential development in the Town of Southwick, Massachusetts--specifically the major business district along U.S. Route 202 and the Fernwood subdivision. Table 2.2-5 presents a comparison of the proposed and alternative routes for Loop 7 from the points where the alternative diverges and converges with the proposed route. Approximately 9 acres of additional land would be disturbed during construction by following the alternative route, some of which crosses agricultural land under production. A decrease in soil productivity could result from construction activities that compact, clot, and rut the soil. Section 2.2.3.2 describes mitigation measures that would be used by Tennessee to prevent significant impacts from construction.

Construction of Loop 7 along the alternative route would result in the establishment of a second Tennessee pipeline right-of-way within the Town of Southwick that would include a new and longer cleared right-of-way across the stream and wetland associated with Great Brook. The permanent right-of-way requirement for the Loop 7 alternative would affect approximately five times as much wetland as the proposed route in the vicinity of the Great Brook crossing.

While there would be some unavoidable nuisance to Fernwood Subdivision residents during construction, Tennessee does not propose to increase the width of its existing right-of-way through the area, and therefore no significant impact on residential land uses would occur. FERC Staff notes that Tennessee has demonstrated through recent pipeline installation projects that--with proper attention to detail and mitigation measures--the proposed pipeline could be installed with minimal impacts. The added length and route of the alternative may affect the development potential of areas crossed by the route in addition to disturbing a greater amount of agricultural land than the proposed route. Therefore, considering the proposed and recommended mitigating measures, the FERC Staff does not believe that this alternative is significantly superior to the proposed route.

2.2.5.3 Rhode Island Extension

Variations to the proposed route of the Rhode Island Extension and an alternative route are intended to avoid wetlands and sand and gravel resources, to

TABLE 2.2-5

Loop 7 - Southwick Variation Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	13,000	14,300
New ROW/Existing ROW (feet)	0/13,000	14,300/0
Acreage Affected (construction/permanent)[c]	22.4/7.5	24.6/16.4
Wetlands Affected (number/length (feet))	1/200	1/500
Perennial Stream Crossings	1/(trout propagation)	1/(trout propagation)
Road Crossings	5	2
Estimated Cost (@ $917,000/mi.)[d]	$2,257,770	$2,483,540

[a]See Figure 2.2-19.

[b]Approximate length from point where alternative route departs from proposed route, about 600 feet east of Tuttle Brook, extending east to point on proposed route, about 1,500 feet west of Foster Road.

[c]Temporary construction easement is 75 feet wide; permanent easement is: 50 feet wide for new ROW; 25 feet wide when parallel to existing easement.

[d]SOURCE: Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-132-001), 1987.

prevent impinging on a landowner's ability to develop his or her property, and to limit the amount of virgin land used for the pipeline right-of-way.

Table 2.2-6 presents a comparison of the proposed route for the Rhode Island Extension and the Sutton Forest Power Line variation (V-1). V-1 adds two major road crossings (Route 146), with one that would require setting up road boring equipment in very moist wetland soils. Large areas of solid rock also exist along this variation. Considerable blasting and ripping would be required to construct the pipeline on this alignment including, in all probability, two 300-foot rock tunnels below Route 146. Approximately 4,800 feet of V-1 is within the Sutton State Forest and adjacent to Purgatory Chasm State Park. Construction activities within the forest would temporarily affect the aesthetic qualities associated with the forest and adjacent state park. Additionally, the first boring of Route 146 may increase sedimentation of a small pond on the south side of Route 146 and any surface water associated with the wetlands on either side of Route 146. The FERC Staff does not believe V-1 to be a superior alternative to the proposed route, but the modification to V-1 (V-1M) is believed to be a superior alternative because it avoids a major wetland, takes advantage of power line right-of-way, does not cross Route 146, and does not significantly add to the length of the proposed route. Table 2.2-7 presents a comparison of V-1M and the proposed route of the Extension.

The Swans Pond variation (V-2), which avoids the wetlands and physical constraints of construction associated with crossing the western end of Swans Pond just south of Purgatory Road and east of Route 146, would increase the amount of area disturbed during construction by approximately 2 acres. V-2 would require three more road crossings than the proposed route, two of which would be close (within approximately 100 feet) to residential structures. The increase in the amount of soil exposed during construction of V-2 would increase the potential for erosion. Topography in the vicinity of V-2 slopes generally toward Swans Pond and tributaries to Whitins Pond, a public drinking water supply. A high rate of surface runoff could increase silt and sediment flowing into Whitins Pond which may affect water quality and the treatment required for drinking water. Table 2.2-8 presents a comparison of V-2 with the proposed route of the Extension. Because of the increased land requirements, additional length and cost of pipeline, potential nuisance to residential areas, and potential impact on the water quality of Whitins Pond, FERC Staff does not believe V-2 is superior to the proposed route of the Extension that passes the western end of Swans Pond.

TABLE 2.2-6

Rhode Island Extension - Sutton Forest Power Line
Variation (V-1) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	11,700	11,000
New ROW/Existing ROW (feet)	11,700/0	0/11,000
Acreage Affected (construction/permanent)[c]	20.2/13.4	18.9/6.3
Wetlands Affected (number/length (feet))	5/1400	3/1000
Perennial Stream Crossings	0	0
Road Crossings	3	5
Estimated Cost (@ $644,112/mi.)[d]	$1,427,294	$2,841,900[e]

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[a]See Figure 2.2-21.

[b]Approximate length from point on Tennessee's 200 Main Line about 1,500 feet east of Route 146, and extending south to where transmission line corridor intersects the proposed route of the Extension.

[c]Temporary construction easement is 75 feet wide; permanent easement is: 50 feet wide for new ROW; 25 feet wide when parallel to existing easement.

[d]SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

[e]Includes $1.5 million for two additional highway crossings in solid rock (SOURCE: Tennessee Gas Pipeline Company, Response to FERC Data Request, June 3, 1987).

TABLE 2.2-7

Rhode Island Extension - V-1 Modification (V-1M) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	3,100	3,800
New ROW/Existing ROW (feet)	3,100/0	2,000/1,800
Acreage Affected (construction/permanent)[c]	5.3/3.6	6.5/3.3
Wetlands Affected (number/length (feet))	1/200	0
Perennial Stream Crossings	0	0
Road Crossing	2	3
Estimated Cost (@ $644,112/mi.)[d]	$378,172	$463,566

[a] See Figure 2.2-21.

[b] Approximate length from beginning point of V-1, running south about 1,800 feet, then southeast until it intersects the proposed route, approximately 3,100 feet from its beginning.

[c] Temporary construction easement is: 75 feet wide; permanent easement is: 50 feet wide for new ROW; 25 feet wide when parallel to existing easement.

[d] SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

TABLE 2.2-8

Rhode Island Extension - Swans Pond Variation (V-2) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	7,200	8,500
New ROW/Existing ROW (feet)	3,800/3,400	8,500/0
Acreage Affected (construction/permanent)[c]	12.4/6.3	14.6/9.8
Wetlands Affected (number/length (feet))	1/200	1/100
Perennial Stream Crossings	1 (trout propagation)	1
Road Crossing	1	4
Estimated Cost (@ $644,112/mi.)[d]	$878,335	$1,036,923

[a]See Figure 2.2-21.

[b]Approximate length from point of departure from proposed route, about 2,500 feet north of Purgatory Road, rejoining the proposed Extension route approximately 200 feet north of Mendon Road.

[c]Temporary construction easement is 75 feet wide; permanent easement is: 50 feet wide for new ROW; 25 feet wide when parallel to existing easement.

[d]SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

To avoid sand and gravel resources located south of Oakhurst Road, the Lackey Pond/Town Line variation (V-3), moves the proposed Extension eastward, disturbing approximately 3 more acres of land than the proposed route during construction. Table 2.2-9 presents a comparison of V-3 and the proposed route of the Extension. V-3 would cross primarily sandy and rocky Canton and Charlton soils, which have severe limitations with regard to shallow excavations. The proposed route crosses similar soils to those crossed by V-3, and would not necessarily permanently interfere with sand and gravel excavations. V-3 increases the length of the Extension by approximately 1,500 feet, which would increase the cost of construction by approximately $193,000. One additional perennial stream and two additional roads would also need to be crossed by V-3. For these reasons, the FERC Staff does not believe that V-3 offers a superior alternative to the proposed route.

The Lackey Pond/Transmission Line variation (V-4) is intended to minimize the amount of virgin right-of-way used for the pipeline. Table 2.2-10 presents a comparison of V-4 and that portion of the proposed route it would replace. V-4 exposes approximately 25.4 more acres of land area to construction activities than the proposed route. Clearing and grading activities along V-4 may be minimized, however, because of previous activities associated with power line installation (clearing and grading). In general V-4 would pass through more developable/accessible land than the proposed route, and would require four more road crossings. The potential for soil erosion would be similar along V-4 and the proposed route because various similar soil types are encountered, though V-4 encounters slightly more rock than the proposed route. V-4 would cross twice as many perennial streams (6) as the proposed route and at least 4 intermittent streams. The potential for increasing sediment in these streams is important given that two of the six perennial streams have the potential for trout propagation. Increasing silt loads in trout propagation areas may reduce spawning areas by covering up gravel bed material used by trout for securing eggs to the stream bed. Siltation may also smother eggs during spawning season, thereby reducing trout populations.

While V-4 would make substantially greater use of an existing utility corridor, the actual difference in permanent right-of-way required is marginal. V-4 would be about 3 miles longer and would cost about 30 percent more to build than the proposed route. The FERC Staff does not believe that V-4 is significantly

TABLE 2.2-9

Rhode Island Extension - Lackey Pond - Town Line
Variation (V-3) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (miles)	5.1	5.4
New ROW/Existing ROW (miles)	5.1/0	5.0/0.4
Acreage Affected (construction/permanent)[c]	46.3/30.9	49.1/31.5
Wetlands Affected (number/length (feet))	5/1,500	4/1,350
Perennial Stream Crossings	2 (1 trout propagation)	3 (1 trout propagation)
Road Crossings	7	9
Estimated Cost (@ $644,112/mi.)[d]	$3,284,972	$3,478,206

[a]See Figure 2.2-21.

[b]Approximate length from point of departure from proposed route approximately 700 feet south of Oakhurst Road to intersection with the proposed route, approximately 900 feet south of Linden Street.

[c]Temporary construction easement is 75 feet wide; permanent easement is: 50 feet wide for new ROW; 25 feet wide when parallel to existing easement.

[d]SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

TABLE 2.2-10

Rhode Island Extension - Lackey Pond -
Transmission Line Variation (V-4) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (miles)	6.4	9.2
New ROW/Existing ROW (miles)	5.9/0.5	1.1/8.1
Acreage Affected (construction/permanent)[c]	58.2/37.3	83.6/31.1
Wetlands Affected (number/length (feet))	6/1,660	4/1,000
Perennial Stream Crossings	3 (1 trout propagation)	6 (2 trout propagation)
Road Crossing	7	11
Estimated Cost (@ $644,112/mi.)[d]	$4,122,318	$5,925,832

[a]See Figure 2.2-21.

[b]Approximate length from point of departure from proposed route about 700 feet south of Oakhurst Road to intersection with the proposed route at Algonquin's Main Line on north side of Douglas Pike.

[c]Temporary construction easement is 75 feet wide; permanent easement is: 50 feet wide for new ROW; 25 feet wide when parallel to existing easement.

[d]SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

superior to the proposed route. However, if the Ironstone Industrial Park in Uxbridge, Massachusetts, is selected as the location for the OSP power plant, FERC Staff believes that V-4--with appropriate modifications--would be the preferred pipeline route.

The Seaver Variation (V-5) (Figure 2.2-22) represents a minor shift in the proposed route of the Extension between Maple and Davis Streets. Table 2.2-11 presents a comparison between the proposed route and V-5. V-5 does not increase the number of wetlands, streams, or roads crossed, and only marginally increases the length and cost of the Extension. V-5 would significantly reduce the loss of development potential and aesthetic quality that would occur from bisecting the property with the proposed pipeline. For these reasons, FERC Staff believes V-5 to be a superior alternative to the proposed route.

As indicated in Table 2.2-12, V-6 would shorten the route to the proposed Sherman Farm Road site by approximately 2,200 feet and would not affect any wetlands identified by the USFWS National Wetland Inventory.

FERC Staff does not find V-6 unacceptable, but recognizes that this variation would require cutting a new right-of-way corridor through the area, an option local residents do not favor.

As indicated in Table 2.2-13, V-7 would be approximately 700 feet shorter than the proposed route and take advantage of approximately 1,200 feet of existing right-of-way, which would reduce the required amount of clearing during pipeline construction. One wetland identified by the USFWS National Wetland Inventory would be temporarily affected by the construction of V-7. Following V-7 would significantly reduce the amount of new right-of-way corridor cut in the vicinity of the Sherman Farm Road site. Staff believes the environmental advantages of V-7 are significant and finds it a preferable route.

Staff notes that another route was considered that would parallel V-7, but run between the Boston Edison lines and the Algonquin Gas pipeline. The primary problem with constructing such a route is the lack of safe working space. Heavy construction equipment would be required to work over high-pressure natural gas pipelines or under high-tension electric transmission lines. Extraordinary construction techniques would be required to protect the pipelines and power tower supports. Ditching near the power towers could require the relocation of tower

TABLE 2.2-11

Rhode Island Extension - Seaver Variation (V-5) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	1,250	1,500
New ROW/Existing ROW (feet)	1,250/0	1,500/0
Acreage Affected (construction/permanent)[c]	2.1/1.4	2.6/1.7
Wetlands Affected (number/length (feet))	0	0
Perennial Stream Crossings	0	0
Road Crossings	1	1
Estimated Cost (@ $644,112/mi.)[d]	$152,489	$182,986

[a]See Figure 2.2-22.

[b]Approximate length from point of departure from proposed route approximately 50 feet south of Maple Street to approximately 1,350 feet south of Davis Street.

[c]Temporary construction easement is 75 feet wide; permanent easement is 50 feet wide.

[d]SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

TABLE 2.2-12

Rhode Island Extension - Tennessee Variation (V-6) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	4,600	2,400
New ROW/Existing ROW (feet)	4,600/0	2,400/0
Acreage Affected (construction/permanent)[c]	7.9/5.3	4.1/2.8
Wetlands Affected (number/length (feet))	1/100	0
Perennial Stream Crossings	0	1
Road Crossings	2	1
Estimated Cost (@ $644,112/mi.)[d]	$561,158	$292,778

[a]See Figure 2.2-21.

[b]Beginning at divergence from the proposed route of the Rhode Island Extension approximately 1,200 feet east of Aldrich Street, to the proposed Sherman Farm Road plant site.

[c]Temporary construction easement is 75 feet wide; permanent easement is 50 feet wide.

[d]SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

TABLE 2.2-13

Rhode Island Extension - Boston Edison Line Variation (V-7) Comparison

	Proposed Route	Alternative[a]
Alignment Length[b] (feet)	2,600	1,900
New ROW/Existing ROW (feet)	2,600	700/1,200
Acreage Affected (construction/permanent)[c]	4.5/3.0	3.3/1.5
Wetlands Affected (number/length (feet))	1/100	1/400
Perennial Stream Crossings	0	0
Road Crossings	2	1
Estimated Cost (@ $644,112/mi.)[d]	$317,176	$231,782

[a]See Figure 2.2-21.

[b]Beginning at divergence from the proposed route of the Rhode Island Extension approximately 800 feet north of Douglas Pike.

[c]Temporary construction easement is 75 feet wide; permanent easement is 50 feet wide for new right-of-way; 25 feet wide when parallel to existing easement.

[d]SOURCE: Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

ground beds that provide electrical protection for the power lines. These engineering problems and associated worker safety concerns, as well as the problems with Tennessee's acquiring an easement agreement with Boston Edison, precluded serious consideration of such a route.

The Algonquin Gas Transmission Company has proposed an alternative way (A-1) to deliver 50,000 Mcfd to the OSP plant. Algonquin maintains that rerouting gas through its existing transmission pipelines, which pass adjacent to the proposed plant site, would obviate the need for construction of the 11 miles of the Rhode Island Extension. To deliver the proposed volumes of gas initially required to fuel the OSP plant, Tennessee has indicated that it would have to construct the following facilities in lieu of 11 miles of new 20-inch-diameter pipeline:

- 1 mile of 30-inch Main Line loop.
- 3.4 miles of 12-inch loop on its Blackstone Valley delivery line.
- A new 2,000-horsepower compressor station at the interconnection of the Algonquin and Tennessee systems near Mendon, Massachusetts.

No reduction in the proposed Main Line looping or compression in New York and Massachusetts would be required. The Algonquin alternative, therefore, represents a significant reduction in necessary pipeline construction, but involves additional compression facilities. Table 2.1-14 presents a comparison of A-1 with the proposed Rhode Island Extension.

Tennessee has indicated, in a response to the Staff's October 14, 1987 data request, that the 3.4 miles of 12-inch diameter loop which it would have to construct to implement the Algonquin alternative (A-1) would be installed on its Blackstone Valley Line south of Mendon. The affected section of pipeline passes through a densely developed residential section in the eastern part of Woonsocket, Rhode Island. The 1 mile of Main Line looping required for A-1 would be constructed along Tennessee's Main Line in Sutton, Massachusetts, beginning just east of Hudson Road and continuing east for approximately 1 mile (see Figure 2.2-21). In its comments on the DEIS, which the Staff notes were filed substantially out of time, Algonquin argues that its alternative is not a "trade-off," as the FERC Staff has stated, but involves a substantial reduction in facilities and is therefore "superior in terms of efficiency and environmental consequence." Algonquin further argues that Tennessee may not need to construct the 3.4 miles of

TABLE 2.2-14

Rhode Island Extension - Algonquin Alternative (A-1) Comparison

	Proposed Route	Alternative[a]
Alignment Length (miles)	11	4.4[b]
New ROW/Existing ROW (miles)	9.3/1.7	0/4.4
Acreage Affected (construction/permanent)[c]	100/61.5	40/13.3
Wetlands Affected (number/length (feet))	16/5,200	8/1,375
Perennial Stream Crossings	7	5
Road Crossings	15	6
Estimated Costs (30" pipe/mi @ $1,032,929) (20" pipe/mi @ $644,112) (12" pipe/mi @ $417,208)[d]	$7,085,232	$8,335,436[e]

[a]See Figure 2.2-21.

[b]Total length as indicated by Tennessee Gas, includes 1 mile of 30-inch Main Line loop, and 3.4 miles of 12-inch looping along the Blackstone Valley Line south of Mendon.

[c]Temporary construction easement is 75 feet wide; permanent easement is 50 feet wide for new ROW; 25 feet wide when parallel to existing ROW.

[d]Average and estimated costs per Revised Exhibit K, Tennessee Gas Pipeline Company (FERC Docket No. CP87-75-000), 1988.

[e]Includes estimated cost ($5,884,000) of 2,000-HP compressor facility at Mendon.

SOURCE: Exhibit K (compressor 264), Tennessee Gas Pipeline Company (FERC Docket No. CP87-132), 1987.

12-inch diameter loop that Tennessee has indicated would be necessary to implement the Algonquin alternative. Also, Algonquin states that the 2,000-horsepower compressor station that Tennessee has said would be required duplicates the 1,000-horsepower compressor station that Algonquin says would be needed at Mendon. Tennessee, however, maintains that winter operating conditions on its system would indeed dictate a need for 2,000 horsepower at Mendon to provide firm service into Algonquin's pipeline.

While Algonquin may be correct in asserting that Tennessee would not need the 3.4 miles of 12-inch diameter loop on the Blackstone Valley delivery line, the Staff has determined that as much as 2.48 miles of additional 30-inch diameter Main Line loop would be required in lieu thereof, including a crossing of the Connecticut River.

Indeed, there may be several combinations of looping and compression facilities that could perform the proposed service. Tennessee has proposed certain facilities in its application and has indicated, in response to a Staff data request, the facilities it would construct to implement Algonquin's alternative based upon its operating philosophy. The Staff has not found these to be unreasonable.

Nevertheless, the Staff must agree that, absent all other considerations, the Algonquin alternative (including the facility requirements identified by Tennessee) would be environmentally preferable to the proposed Rhode Island Extension for providing the currently proposed service to OSP.

However, the FERC may wish to consider the ramifications of the Algonquin alternative as it relates to (1) Tennessee's proposed Providence Project; (2) gas supply for OSP's Unit 2; and (3) gas transportation rates (which are outside the scope of this EIS).

The Providence Project proposed construction of the Rhode Island Extension in its entirety (i.e., from Tennessee's Main Line in Sutton, Massachusetts, through the proposed OSP site, and continuing southward to the Providence area). If the FERC approves Tennessee's Providence Project, then transporting the OSP Unit 1 gas (50,000 Mcfd) by way of alternative A-1 would result in unnecessary duplication of facilities.

With respect to the issue of fuel for OSP Unit 2, which is currently a subject of negotiation and preliminary design work by Tennessee, the Rhode Island

Extension would be sized to transport the total volume (i.e., 100,000 Mcfd, eventually, for OSP Units 1 and 2, and 30,000 Mcfd for Providence Gas) without additional looping. While if the Algonquin alternative were implemented at this time (i.e., to provide 50,000 Mcfd for OSP Unit 1), the Staff's analysis predicts a need for approximately 14.7 miles of additional 30-inch and 12-inch diameter looping on Tennessee's Main Line east of New York and its Blackstone Valley delivery line, plus an additional 3,620-horsepower compression at three compressor stations (520 horsepower at Station 261; 2,000 horsepower at Station 264; 1,110 horsepower at Mendon).

When these considerations are taken into account, there appears to be no environmental advantage to alternative A-1.

SECTION THREE

AFFECTED ENVIRONMENT

3.1 OCEAN STATE POWER PLANT

Section 3.1 discusses the following aspects of the affected environment:

- Section 3.1.1--Geology and Soils
- Section 3.1.2--Water Resources
- Section 3.1.3--Air Quality
- Section 3.1.4--Sound Quality
- Section 3.1.5--Ecology
- Section 3.1.6--Sociocultural Resources.

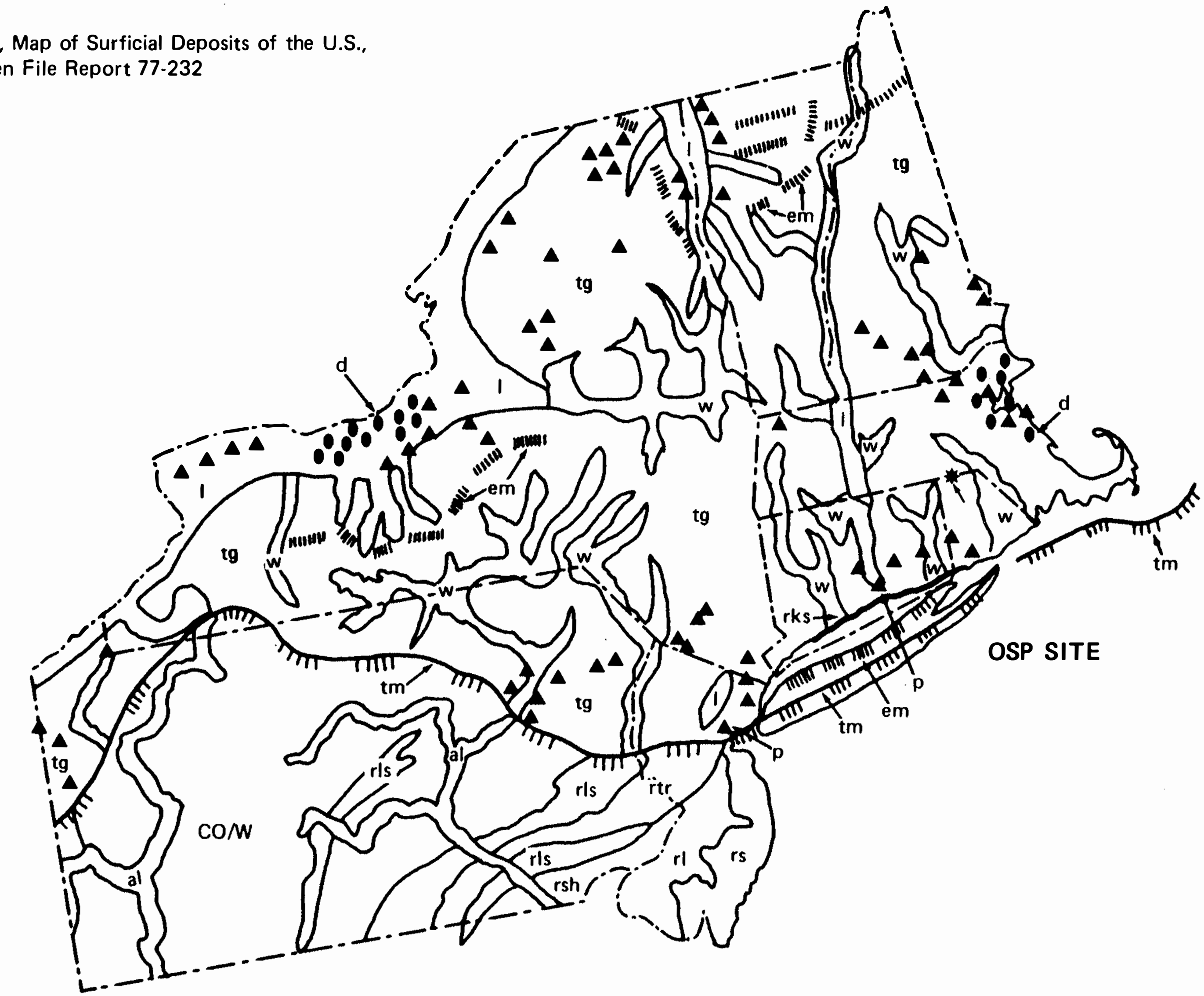
3.1.1 Geology and Soils

3.1.1.1 Physiography

The plant site and oil/water pipeline route are located within the New England upland section of the New England physiographic province. This area is within the northern Appalachian Mountain system and has gone through a long and complex sequence of geologic events involving geosynclinal sedimentation and volcanism, folding, thrust faulting, metamorphism, plutonism, uplift, and erosion. As a result, rocks within the upland section are jointed and fractured. The province is characterized by a maturely eroded surface that has been uplifted and occasional residual hills or mountains dissected by narrow valleys.

During the Pleistocene epoch, which began 2.5 to 3 million years ago, all of what is now Rhode Island was covered by glacial ice sheets several thousand feet thick. As the glacier moved south, it scoured and picked up older glacial deposits, bedrock, and soil. The final deposition of glacial material occurred during the Wisconsin glaciation 10,000 to 12,000 years ago. As the glacier melted and receded, it deposited a blanket of unsorted glacial till and beds of meltwater-sorted sand, gravel, and silt. Glacial till is the most extensive of these deposits. The meltwater and the eroded material it carried caused a landscape of kames, eskers, terraces, and outwash plains, all of which contain stratified outwash and fluvial deposits (U.S. Department of Agriculture, Soil Conservation Service (SCS), 1981). The surficial geology of Rhode Island and nearby states in the project area is shown on Figure 3.1-1. A description of the map code terms is presented in Table 3.1-1.

Source: C.B. Hunt, Map of Surficial Deposits of the U.S., USGS Open File Report 77-232



See Table 3.1-1 for Explanation for Codes

FIGURE 3.1-1
SURFICIAL GEOLOGY OF THE PROJECT AREA

TABLE 3.1-1

Surficial Geology of the Project Area

Glacial, Interglacial, and Post-Glacial Deposits	
tg	Ice-laid bouldery and sandy deposits (till or ground moraine). Poorly sorted Wisconsinan gravel and sand. Numerous glacial erratics. Mostly on hilltops and hillsides and less than 25 feet thick except locally; weathering slight; abundant glacially scratched (striated) stones and bedrock exposure. Subsoil acid.
tm	Hummocky ridge of poorly sorted, slightly weathered gravel and sand. Terminal moraine, commonly 25 to 50 feet high, marking the southern limit of the Wisconsinan ice and northern limit of most saprolite. Moraine low or lacking along about one-quarter of the length of the ice front. Subsoil acid east of Mississippi River.
em	Other hummocky ridges of poorly sorted, slightly weathered gravel and sand. End moraines, deposited at front of the Wisconsinan ice during stillstands that interrupted the general northward retreat. Similar to tm. Some ridges built of outwash off the front of the ice; others of materials scooped into ridges by slight readvances of the lobes.
w	Gravel, sand, silt, and clay deposited by glacial streams adjacent to or downstream from temporary ice fronts; include small areas of lake deposits. Shown only in hilly Wisconsinan glaciated areas, but these deposits become the alluvium that extends down valley from glaciated areas. Thickness commonly 50 feet and locally much more, especially in New England.
d	Drumlins, elongate mounds of glacially deposited sand and gravel; may or may not have bedrock core; generally occur in clusters. Heights commonly 50 to 100 feet. Weathering slight, subsoil acid.
l	Lake deposits. Mostly clay and silt grading shoreward to sand and gravel. Deposits associated with midcontinental glacial deposits are mostly fertile farmland. Clays may be sensitive (i.e., loss of shear strength upon remolding).
al	Flood plain and alluvium gravel terraces. Well bedded gravel, sand, and silt; lenticular bedding. Individual fills generally 10 to 25 feet thick, but the several fills in many valleys may aggregate more than 100 feet. Considerable groundwater; subject to pollution. Ground acid in eastern and central United States. These deposits form much of the best farmland. Age mostly late Pleistocene and Holocene.
rks	Bayhead and bayside sand bars separated by rocky headlands.
P	Peat deposits; occur in the area covered by the latest (Wisconsinan) glaciers. Highly compressible and corrosive.

TABLE 3.1-1 (cont'd)

	Colluvium
co/w	Mixed colluvium, derived from sandstone, shale, and limestone; fresh rock commonly mixed with weathered materals; thickness generally less than 25 feet but thickens at foot of hillsides; boulder fields common.
	Thick, Deeply Weatered Residual Deposits or Saprolite
rls	Red clay: massive clay that is generally kaolinitic.
rtr	Residuum on Triassic formations; depths less than most other saprolite, reddish color, largely inherited from parent rock.
rsh	Micaceous residuum without much quartz; clay, mostly kaolinite.
rl	Loam; texture variable, ranging from sand to clay which is mostly the nonswelling clay mineral kaolinite; generally less than 10 feet thick.
rs	Sandy residuum, derived by intensive weathering of sandstone formations. Sand locally is in dunes.

The upland till plains found at the Sherman Farm Road site are the most extensive examples of glacial till in Rhode Island. The till is derived mostly from granite, schist, and gneiss rock. Glacial stones and boulders are scattered on the surface of these plains, and bedrock outcrops are common. Much of the till is relatively loose and unconsolidated. The plant site area topography is characterized by large smooth hills and low-lying swampy wetlands.

3.1.1.2 Geology

The bedrock formations of Rhode Island represent four main groups. From oldest to youngest, the groups are:

- The Blackstone series of metamorphic (recrystallized) rock along the Blackstone Valley, in areas chiefly in the western part of the State, and along the southern border of the State.
- Older granite rock of considerable variety and possibly of several ages.
- Pennsylvanian (coal-age) sedimentary rock of the Narragansett Basin in eastern Rhode Island.
- Younger granite rock exposed at Narragansett and extending west to Westerly.

Not included in these four groups are a few trap dikes and quartz veins.

The bedrock beneath the plant site and the portion of the pipeline route therein and along West Ironstone Road is part of the Ponaganset Gneiss (part of the older granite rock described above), believed to have been emplaced during the Paleozoic era 225 to 600 million years ago. A variety of gneissic and granitic rocks is included in this formation. The different rock types are arranged chiefly in north-trending lenses and layers. The rock is dense, hard, and mostly medium-to-coarse grained. All rocks have a distinctly gneissic or foliated texture, and most are also lineated. In most places, the gneissic structure is steeply dipping and trends northward; the lineation also plunges northward. A second foliation is present at a few places, trending westward and dipping gently northward.

The bedrock geology along the oil/water pipeline route south of West Ironstone Road is similar to that described previously. Most, if not all, of the rock exhibits a foliated texture, striking generally northward and dipping steeply. While the geologic structural history of the area is complex, no major faults are shown on the published geologic maps. Bedrock may be encountered within trenching depths, particularly along the route north of Nasonville.

3.1.1.3 Soils

The soils in the plant site and along the the northern portion of the oil/water pipeline route are glacial outwash deposits underlain by till or bedrock. The outwash deposits consist of unconsolidated medium-to-coarse sand and gravel, interbedded with fine sand, silt, and clay. Locally, these deposits reach thicknesses of 50 to 100 feet. The thickest deposits are typically found along river valleys. The till consists of boulders, gravel, sand, silt, and clay, which generally form a discontinuous mantle over the bedrock. Till thicknesses can range from a few feet in the highlands to 100 feet along river valleys.

The site soils that would be disturbed by plant construction are described as Canton and Charlton fine sandy loams, are very rocky, and occur on 3 to 15 percent slopes. The surficial erodibility factor (K) is between 0.17 and 0.24, making the soil moderately erodible. As defined by the U.S. Soil Conservation Service, both soils are included within the B group hydrologic soil classification, which indicates that they have moderate infiltration rates when thoroughly wetted and consist chiefly of moderately deep-to-deep, moderately well-to-well drained soils with moderately fine-to-moderately coarse textures. Such soils have a moderate rate of water transmission (SCS, 1981). The oil and water pipelines would be almost entirely in previously placed road fill materials supporting existing roadways.

A preliminary subsurface investigation of the Sherman Farm Road site, performed in early 1987 (Goldberg-Zoino & Associates, Inc., 1987), included 12 boreholes ranging in depth from 14.5 to 38.6 feet. Soil thicknesses (over bedrock) in the plant area ranged from 2.5 to 18.6 feet at the locations investigated. While four of the borings did not encounter groundwater to the depths explored, it was encountered at depths of from 1 to 4 feet in the other borings.

3.1.1.4 Seismicity

The site and oil/water pipeline route are located within the Southeastern New England Platform tectonic province. Significant seismic events have occurred at Ossippee, New Hampshire, and Cape Ann, Massachusetts. The largest earthquake in New England was an epicentral intensity VIII (MMI) event, which occurred on November 18, 1755, and is associated with the Cape Ann plutonic structure, located about 100 miles from the site. The Uniform Building Code places the site in seismic zone 2, which implies a moderate damage potential for structures in general. Algermissen (1982) estimates that for a given 50-year period, there is a 90 percent probability that horizontal ground accelerations would not exceed 13 percent of gravity (0.13g) for the region surrounding the OSP site.

The Massachusetts Institute of Technology (MIT) operates a small seismic station at a residence on Sherman Farm Road.

3.1.2 Water Resources

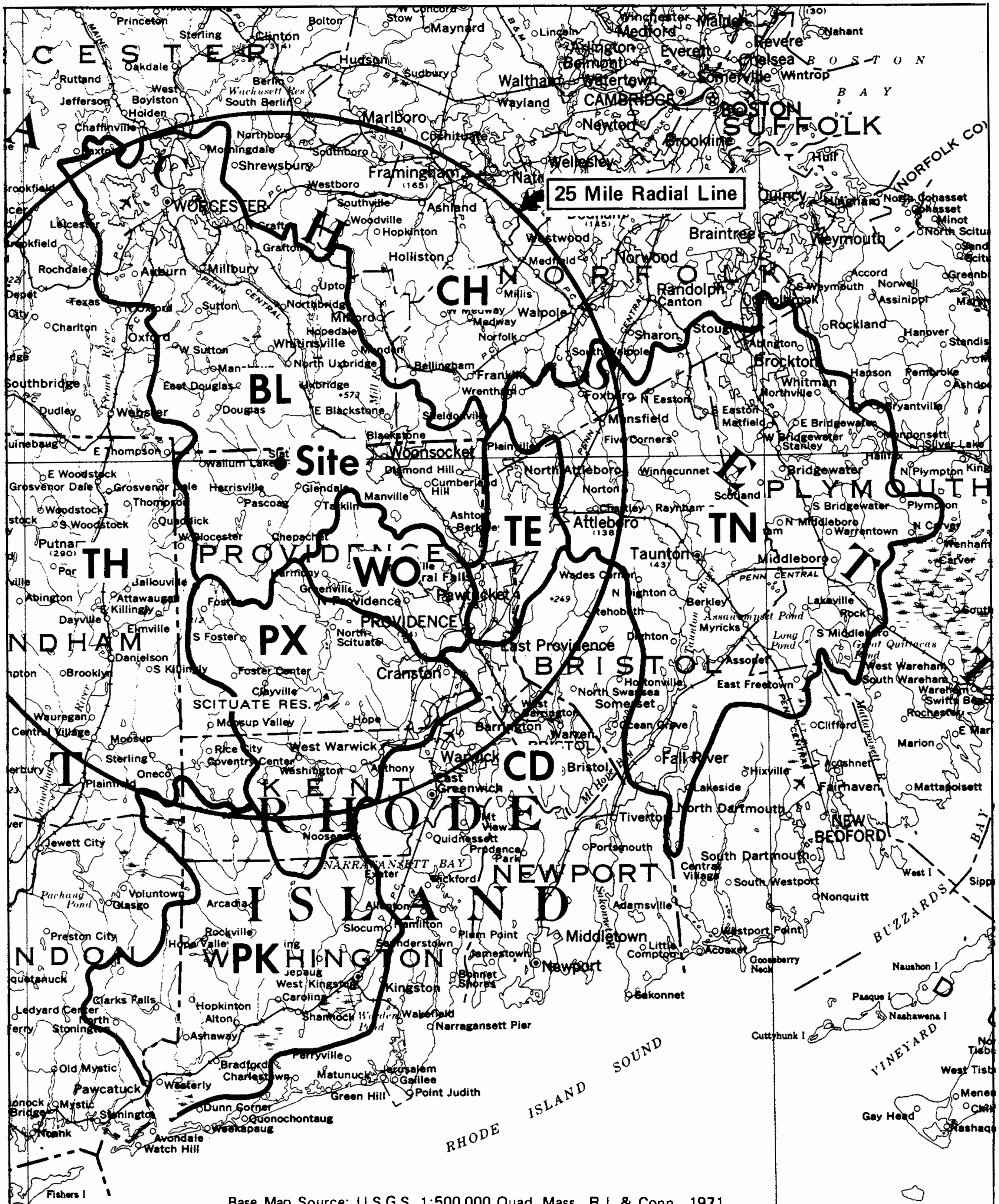
3.1.2.1 Surface Water

The following sections describe the surface water environment, focusing on water bodies that would be affected by construction and operation of the proposed OSP plant. Water resource elements that would not be affected, though important to the plant region, are included in the general discussion below.

3.1.2.1.1 General Region

The surface water resources region under consideration includes most of Rhode Island, south-central Massachusetts, and eastern Connecticut. The region comprises the following major river basins--those that drain into Narragansett Bay, including the Blackstone, Pawtuxet, Moshassuck, Woonasquatucket, Taunton, and Hunt River Basins; the Thames River Basin in eastern Connecticut; the Charles River Basin in Massachusetts; and the Pawcatuck River Basin and coastal basins of Rhode Island (Figure 3.1-2). Most of these river basins are within 25 miles of the plant site (Bechtel Eastern Power Corporation, January 1987).

The Narragansett Bay Basin includes the system of major and minor waterways that discharge into the Atlantic Ocean from south-central Massachusetts and northern Rhode Island. The basin area is 1,850 square miles--56 percent is in Rhode Island and 44 percent in Massachusetts (Bechtel Eastern Power Corporation, January 1987). With respect to the OSP project, the Blackstone River is the most important stream in the Narragansett Bay Basin for two reasons--the proposed plant site lies within the Blackstone Basin, and OSP proposes to withdraw plant makeup water from the Blackstone River. Another important basin is the Pawtuxet, which lies south of the site. This basin contains the Scituate Reservoir system, which has been identified as an alternative source for plant water.



- - - - State Line
—— Respective Basin Limits

PX	Pawtuxet River Basin
TN	Taunton River Basin
PK	Pawcatuck River Basin
WO	Woonasquatucket-Moshassuck-Providence Rivers Basin
BL	Blackstone River Basin
TE	Tenmile-Seekonk River Basin
TH	Thames River Basin
CH	Charles River Basin
CD	Coastal Drainage

0 10 Miles

FIGURE 3.1-2
STUDY AREA BASIN MAP

Other drainage basins within 25 miles of the site include portions of the Thames River and Charles River Basins. The Thames River Basin includes all the streams--from Robbins Brook in Burrillville to Roaring Brook in Coventry--that flow west into Connecticut and eventually into the Thames River. The western portion of the Charles River Basin rises in western Wrentham Town, Massachusetts, about 10 miles east of the site, and flows northeasterly toward Boston. Both basins contain numerous small streams and ponds that were considered as possible plant water sources.

Other watersheds considered in the assessment include the Pawcatuck River and the Rhode Island coastal basins lying south and east of a 25-mile radius circle around the plant. The Pawcatuck River Basin rises in the southwestern corner of the town of Coventry, about 24 miles from the plant site, and flows south through Washington County toward Little Narragansett Bay at the extreme southwestern corner of the State. The Rhode Island coastal basins cover the area from Watch Hill Point in the Town of Westerly to Point Judith in the Town of Narragansett; many of Rhode Island's saltwater ponds are in this area.

3.1.2.1.2 Blackstone River Basin

The Blackstone River Basin is generally elongated in shape, with its long axis oriented northwest-southeast, a length of about 44 miles, and an average width of 12 miles. It drains a total area of 476 square miles in south-central Massachusetts and northern Rhode Island. The topography is generally hilly, with its higher elevations in excess of 1,300 feet NGVD. The river originates at the confluence of the Middle River and Mill Brook, in the southern part of Worcester, Massachusetts. It flows in a generally southeasterly direction to its mouth in Pawtucket, Rhode Island, where it discharges to the Seekonk River, a tidal estuary extending southward 7 miles to the Providence River, and thence to Narragansett Bay. The river falls a total of 440 feet from its source to sea level (U.S. Department of the Army, Corps of Engineers, 1981).

Power Dams

During the nineteenth century, several small dams were constructed across the Blackstone River to develop water power and supply sources for industrial plants. In recent years, a number of these plants have been abandoned, but the dams remain to create pool habitats spaced along the otherwise riffle-pool water course. The dams have greatly modified the natural flow regime of the river.

Two dams in the vicinity of the proposed OSP intake structure site in Woonsocket are still operated for electric power generation. The Thundermist Dam, located about 500 feet downstream of the intake site, is owned and operated by the City of Woonsocket. The pool formed by the dam would provide water depth for the proposed OSP intake. The second power dam, known as Rolling Dam, is located 3.4 miles upstream of the intake structure site. The Rolling Dam hydroelectric station is owned by the Tupperware Corporation and is licensed by the FERC as a run-of-the-river facility (Camara, 1988). This means that the Rolling Dam Station is not allowed to regulate flows on the river.

Basin Hydrology

Mean annual precipitation over the Blackstone River Basin--based on 112 and 74 years of meteorological records at Worcester, Massachusetts, and Providence, Rhode Island, respectively--is 42.1 inches, or about 3.5 inches per month. On the average, precipitation is distributed evenly over the year (Table 3.1-2). However, extreme monthly precipitation ranges from 0.04 to 18.58 inches (U.S. Department of the Army, Corps of Engineers, 1981).

The USGS gaging station that is most useful in this assessment is in the City of Woonsocket, about 1.3 miles downstream of the proposed OSP intake site. The drainage area at the gage is 416 square miles. Based on 56 years of record (1929-1985), the average discharge is 765 cubic feet per second (cfs). Flow in the Blackstone River is generally highest in late winter and early spring and lowest in summer and fall. Extreme flows in the record include a maximum discharge of 32,900 cfs in August 1955, which included discharges caused by the failure of an upstream dam. The minimum daily flow during the period was 21 cfs, recorded in August 1934. At the time of this minimum flow, some water was bypassing the gage through a canal, so the total river flow was greater than shown in the record (White, 1987).

Using the above data, the average basin runoff for a 56-year period ending in 1985 was computed to be 25 in./yr--nearly 60 percent of the mean annual precipitation. This amount of runoff is equivalent to 1.19 mgd per square mile of drainage area. USGS estimates the 7Q10 flow of the Blackstone River at 102 cfs (White, 1987). A flow duration curve for the river at the Woonsocket gage is given in Figure 3.1-3, and low-flow frequency-duration curves are shown in Figure 3.1-4.

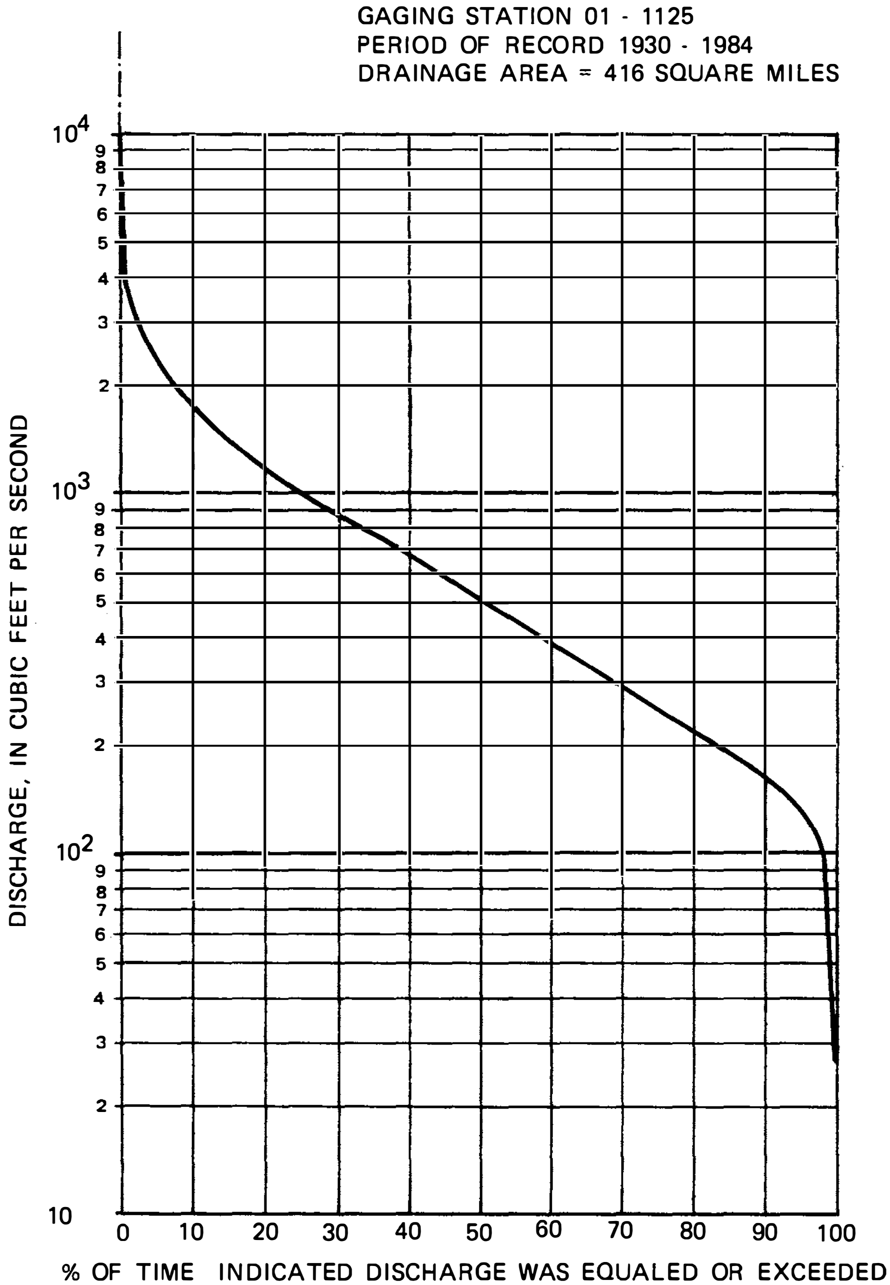
TABLE 3.1-2

Mean Monthly Precipitation in Project Area

Month	Worcester, Massachusetts[a] 112 Years of Record (elevation 628 feet msl)			Providence, Rhode Island[a] 74 Years of Record (elevation 51 feet msl)		
	Mean	Maximum	Minimum	Mean	Maximum	Minimum
January	3.63	11.16	0.70	3.63	7.12	0.50
February	3.20	8.09	0.67	3.29	5.80	1.18
March	3.85	11.13	0.04	3.70	8.31	0.07
April	3.60	10.77	0.35	3.54	7.32	0.72
May	3.74	8.84	0.76	3.13	9.25	0.57
June	3.36	9.25	0.66	2.97	7.21	0.04
July	3.62	11.41	0.62	2.43	8.08	0.24
August	3.96	18.58	0.35	3.61	12.24	0.78
September	3.67	13.13	0.20	3.35	9.79	0.48
October	3.65	11.67	0.36	3.09	11.89	0.15
November	3.84	10.40	0.56	3.69	8.50	0.31
December	3.64	9.83	0.78	3.86	10.75	1.05
Annual	43.92	71.66	27.92	40.29	65.06	25.44

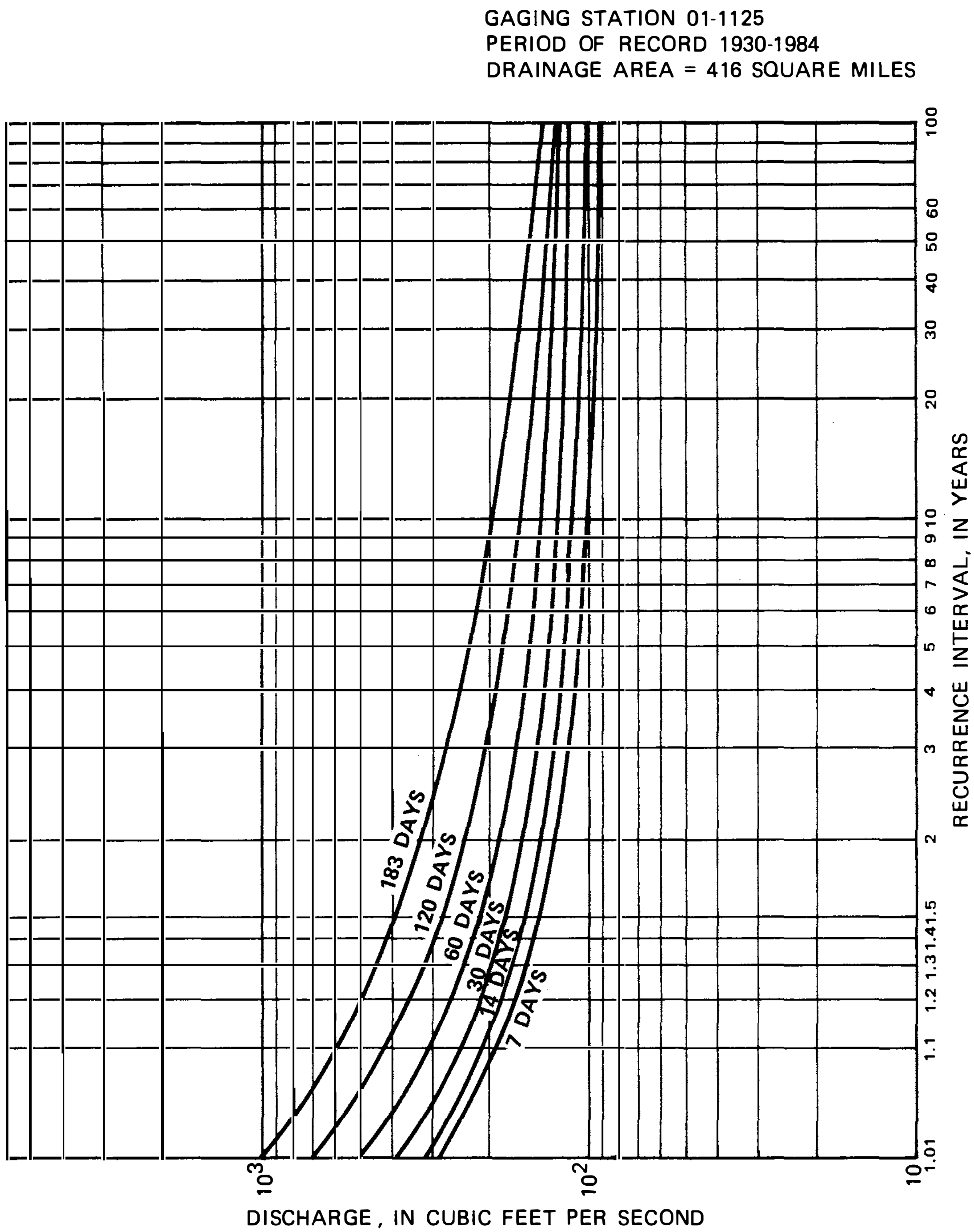
[a] Average annual precipitation at both stations = 42.1 inches.

Source: Bechtel Eastern Power Corporation, January 1987.



Source: Bechtel Eastern Power Corporation, January 1987

FIGURE 3.1-3
BLACKSTONE RIVER FLOW DURATION CURVE



Source: Bechtel Eastern Power Corporation, January 1987

FIGURE 3.1-4
BLACKSTONE RIVER LOW FLOW FREQUENCY CURVE

Existing Water Quality

The water quality of the Blackstone River is influenced by innumerable industrial and municipal wastewater discharges in Massachusetts and Rhode Island. Summary results of water quality sampling in Massachusetts (1984) and Rhode Island (1985 and 1987) are given in Table 3.1-3. Several of the constituents measured failed to meet Rhode Island water quality standards.

3.1.2.1.3 Scituate Reservoir

The Scituate Reservoir system, an alternative cooling water source for the OSP plant, is owned and operated by the City of Providence Water Supply Board. The system comprises a series of six impoundments in the Pawtuxet River Basin, about 15 miles south of the OSP plant site (Figure 3.1-2). The total drainage area to the reservoirs is 92.8 square miles, and their total capacity is about 127,000 acre-feet (41.3 billion gallons). The reservoirs provide water supply for domestic, commercial, and industrial uses to a large portion of Rhode Island. Pertinent data concerning yield, consumption, and future commitments of the system--not including the OSP plant--are summarized in Table 3.1-4.

Table 3.1-4 presents capacity and yield estimates from the State of Rhode Island, Division of Planning, as well as the Providence Water Supply Board. These estimates conflict in that the Providence Water Supply Board estimates a safe yield 5.3 mgd greater than the Division of Planning, and the Division of Planning estimates include contract commitments to Johnson and Kent Counties of 3.16 mgd, which are not included in the Providence Water Supply Board estimates. (These contracts are signed, but water has not yet been supplied under them.) The result of these discrepancies is significant, since Providence estimates a total excess over safe yield of 7.3 mgd, which is sufficient to supply water to the OSP project. The Division of Planning, however, estimates a deficiency of 4.16 mgd in the Scituate Reservoir system water supply. These discrepancies can only be resolved by coordination between the Providence Water Supply Board and the Division of Planning. The FERC Staff recommends that the State of Rhode Island request backup information on these estimates so that a decision can be reached on the viability of using the Scituate Reservoir as an alternative water supply for the OSP project.

The mean annual runoff from the Pawtuxet River Basin above the reservoirs averaged 24.9 inches for the 66-year period from 1916 to 1982, while the average

Summary of Selected Water Quality Data for Blackstone and Branch Rivers

Parameter	Location/Source of Data[a]						
	Millville MA[b]	Branch River	Blackstone MA	Blackstone MA[c]	Rt. 122 Woonsocket	Manville Dam	R.I. Water Quality Standard[d]
Suspended Solids (mg/l)	--	2.66±0.69	6.88±2.31	4.5	6.64±1.69	8.25±1.67	--
Hydrocarbons (mg/l)	--	11.9±3.58	156±132	--	48.1±20.4	79.2±24.9	--
Total PAH (ug/l)	--	0.12±0.02	0.37±0.04	--	0.27±0.13	0.34±0.09	1,950
Phthalates (ug/l)	--	3.17±1.13	6.91±5.81	--	4.96±5.88	6.13±5.88	2,605
Coprostanol (ug/l)	--	0.11±0.05	0.41±0.28	--	0.28±0.29	0.37±0.12	--
PCB (ug/l)	100	6.21±2.66	37.3±16.5	--	26.7±17.4	22.5±6.95	0.014
Total Cadmium (ug/l)	3.5	0.21±0.09	1.14±0.32	--	0.95±0.39	0.95±0.38	e
Total Chromium (ug/l)	20	1.73±0.62	18.8±16.5	--	9.58±6.7	8.18±5.19	21
Total Copper (ug/l)	20.5	3.64±1.12	14.0±2.51	--	11.5±1.87	11.7±1.81	e
Total Lead (ug/l)	6.5	1.79±0.60	4.82±2.56	--	4.8±3.01	4.91±3.18	e
Total Nickel (ug/l)	33	5.42±1.96	31.7±6.89	--	24.8±4.72	24.1±2.56	e
Total Silver (ug/l)	1	0.29	0.38	--	0.37	0.38	e
Dissolved Oxygen[f] (mg/l)	3.8-9.7	6.9-8.3	8.0-9.6	--	7.0-9.9	3.4-9.5	5.0 (min.)
BOD_5 (mg/l)	2.0±1.26	--	---	3.2	--	--	

SOURCES: [a] Except as specified, all data from Quinn et al., 1986, and Wright, 1987.

[b] Water Resource Data for Massachusetts and Rhode Island, Water Year 1984 (USGS, 1986a).

[c] Blackstone River Basin 1983-1985 Wastewater Discharge Survey Data (MADEQE, 1986).

[d] Environmental Reporter, State Water Laws (Undated).

[e] Depends on total hardness.

[f] Ecology & Environment, July 1987.

TABLE 3.1-4

Scituate Reservoir Capacity and Yield

	Quantity (mgd)		
	Providence Water Supply Board		RI Div. Planning
Estimated safe yield based on the drought of the early 1960's		89.3	84.0
Average yield based on the total water in and out since 1940		110.1	NA[a]
Average consumption			
	Minimum	Maximum	
Current delivery to the system	66.0	66.0	66.0
Legal requirements to Pawtucket River	0	9.0	12.0
SUBTOTAL	66.0	75.0	78.0
Commitments			
Bristol County (maximum, year 2020)	4.0	7.0	7.0
Johnson and Kent Counties	--	--	3.16
SUBTOTAL	4.0	7.0	10.16
Total delivery and commitments	70.0	82.0	88.16
Safe yield over delivery and commitments	19.3 (21.6%)	7.3 (8.2%)	-4.16 (-4.7%)
Average yield over delivery and commitments	40.1 (44.9%)	28.1 (31.5%)	NA[a]

[a]NA = not available.

SOURCE: City of Providence, Water Supply Board, 1982
State of Rhode Island, Division of Planning, 1987.

annual precipitation was 49.16 inches (City of Providence, Water Supply Board, 1982). Thus, runoff was about 51 percent of precipitation. This amount of runoff is equivalent to 1.18 mgd per square mile of drainage area, which closely agrees with the unit runoff data for the Blackstone River.

3.1.2.1.4 Surface Water at the Plant Site

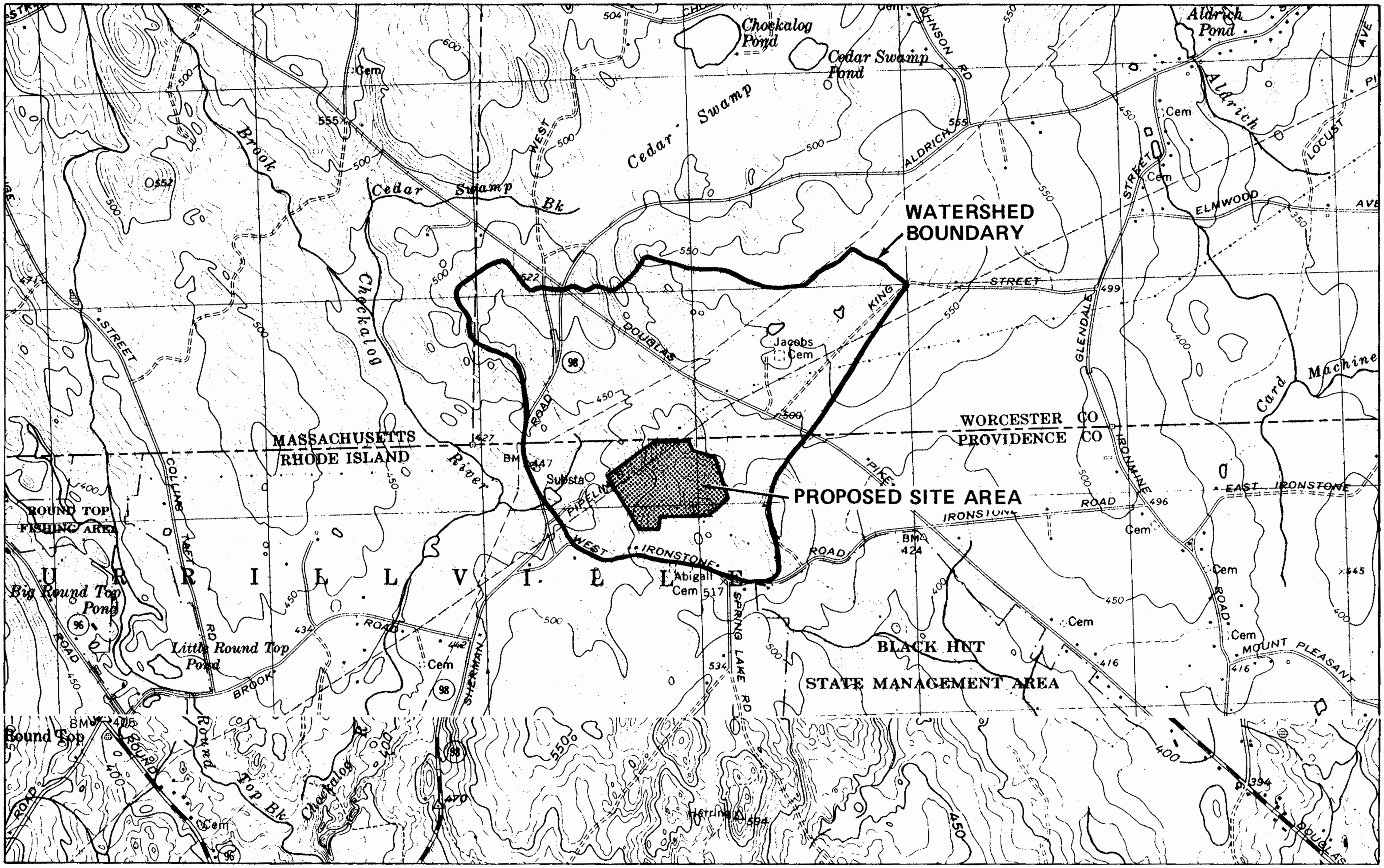
The OSP plant site is located in an upland area, with very little drainage from offsite areas crossing the property (Figure 3.1-5). A drainage divide crosses the site in a generally north-south direction. Drainage east of the divide is toward a small onsite wetland area that drains toward the north into a small unnamed stream. This stream continues north, leaves the plant property at the Rhode Island-Massachusetts border, turns west, then southwest, and empties into the Chockalog River about 0.3 mile west of the plant site. Drainage west of the divide flows west toward the Chockalog River.

The Chockalog River flows in a southerly direction and empties into the Nipmuc River about 1.4 miles southwest of the site. The Nipmuc flows into the Clear River about 2.5 miles south of the site. The Clear River joins the Branch River about 3.8 miles south-southeast of the site. The mouth of the Branch River is on the Blackstone River, in the City of Woonsocket, Rhode Island.

3.1.2.2 Groundwater

The Sherman Farm Road site area is located within the boundaries of the Branch River Basin in northwestern Rhode Island (Figure 3.1-6). The Branch River Basin comprises an area of 79 square miles. Groundwater within the basin occurs in three hydraulically interconnected aquifers--bedrock, till, and stratified glacial drift. Most wells constructed in the till and bedrock yield small quantities of water sufficient for domestic needs. Larger quantities of water are supplied by withdrawal from stratified glacial deposits. Because groundwater resources within the site area are relatively undeveloped, there are insufficient data to describe the hydraulic properties of the aquifer.

The water-bearing units beneath the Burrillville site are deposits of glacial till underlain by bedrock. The till is generally a poor water-bearing material--typically a very poorly sorted, nonstratified, dominantly sand deposit composed of varying proportions of clay, silt, sand, gravel, and boulders.



Base Map Source: U.S.G.S. 7½′ Quads; Uxbridge, MA/RI, 1969, Photorevised 1979;
Chepachet, RI, Photorevised 1970 and 1975.

0 2000 4000 Feet

FIGURE 3.1-5
SHERMAN FARM FOAD SITE AREA WATERSHED

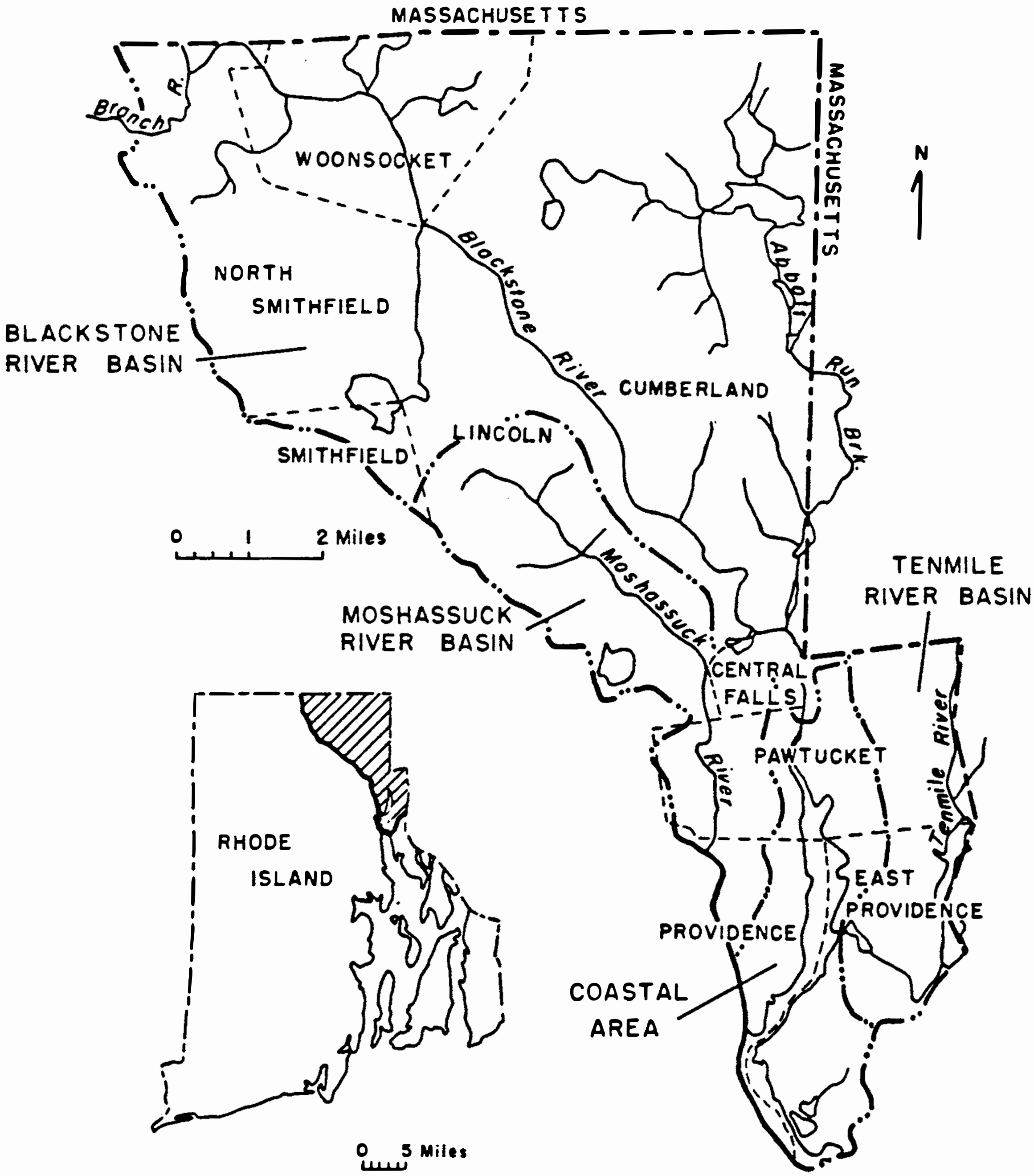


FIGURE 3.1-6
GENERALIZED DRAINAGE MAP OF THE BLACKSTONE RIVER AREA

Recharge to the till is primarily from precipitation. Much of this recharge is discharged as groundwater flow to bedrock or adjacent stratified drift deposits or as runoff to nearby streams. Bedrock beneath the site area consists of igneous and metamorphic rocks. Groundwater withdrawal from the bedrock aquifer is almost exclusively from openings along bedding and joint planes and irregularly spaced fractures. The median yield of bedrock wells within the Branch River Basin is 8 gpm (indicating that the transmitting capacity of the bedrock is low). Higher yields may be expected to occur where discontinuities in the rock (i.e., fractures, faults, and bedding plane separations) are hydraulically connected to bodies of surface water or to adjacent materials of higher transmissivity.

3.1.3 Air Quality

3.1.3.1 Climate and Meteorology

The proposed OSP site is located in the far northwest corner of Rhode Island. The proximity of this area to the Atlantic Ocean and Narragansett Bay affects its climate, as does its proximity to the Berkshire Hills of Massachusetts. The climate of Rhode Island is characterized by an equitable distribution of precipitation among the seasons, a large range in daily and annual temperature variations, and considerable diversity in weather over short periods of time. In general, winters are cold and summers are warm, with summers influenced greatly by the moderating effect of the Atlantic Ocean.

The region exhibits rapid weather changes in winter, when storms move up the East Coast after development through wave action off the Carolina coast. Most of these storms track to the south and east of the area, resulting in northeast and easterly winds carrying rain, snow, or fog. Conversely, other winter storms that develop in the Texas/Oklahoma area generally pass to the west of the region as they travel north into the St. Lawrence River Valley. These tend to deposit little precipitation, but generally result in an influx of warm air to the region. Rapidly falling temperatures or cold waves, generally associated with Canadian high pressure systems, normally follow cold front passages. However, a tempering of the cold temperatures associated with these air masses usually occurs before the full impact of the high reaches the area.

Thunderstorms are the dominant weather feature during the summer months. Although sea breezes (onshore) and fog are dominant moderating summertime phenomena along coastal Rhode Island, their influence rarely extends far enough inland to affect the OSP site. In early fall, severe coastal storms of tropical origin may bring destructive winds into the area.

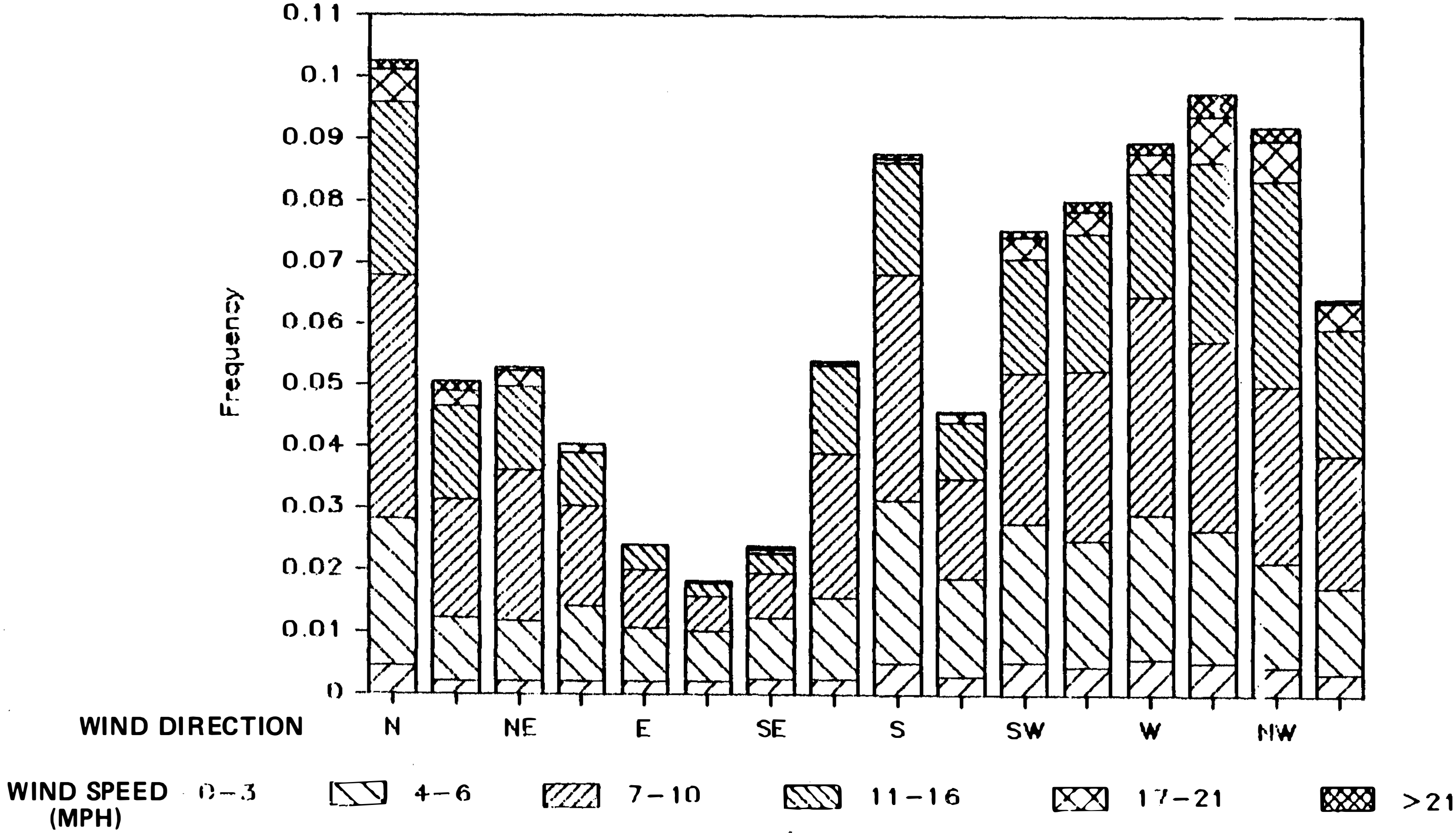
In general, air masses affecting the area belong to three types--cold, dry air from subarctic North America; warm, moist air from the Gulf of Mexico and adjacent waters; and cool, damp air from the North Atlantic. Processions of contrasting air masses and a relatively frequent passage of low pressure systems generally bring about a twice-weekly change from fair to cloudy or stormy weather. This is usually attended by abrupt changes in temperature, the advent of moisture or sunshine, and frequent variations in wind direction and speed. There is no regular or persistent rhythm to this sequence, and it may sometimes be interrupted by periods of several days, or a few weeks, with the same weather pattern.

The highest mean monthly temperature, around 70°F, occurs in July. The three coldest months--December, January, and February--have an average temperature approximating 25°F. The highest temperature on record is 102°F and the lowest is -24°F. Temperatures below freezing can be expected to occur approximately 200 days/yr. Month-to-month variations in Rhode Island's precipitation are sometimes extreme--ranging from less than 1 inch to more than 8 inches--and may occur in any season of the year. Annual figures range from 42 to 46 inches, with 45 percent of precipitation falling from April to September. Average seasonal snowfall is 36 inches. In general, about 19 days a year have at least 1 inch of snow on the ground.

Although the terrain in the site vicinity is rolling-to-hilly, it does not include narrow valleys or pronounced ridges that might encourage stagnation, inversion formation, or diurnal recirculation. Average wind speeds peak in the winter and are minimal in summer, with the average annual wind speed in excess of 10 mph. Consequently, the site can be considered to be in a region with advantageous dispersive qualities. A joint frequency distribution of wind speed and wind direction for the nearest representative meteorological observation station (Providence, Rhode Island) is provided in Figure 3.1-7.

3.1.3.2 Ambient Air Quality

The proposed facility is in a relatively remote area that is generally free from the impacts of other point and area sources. Existing regional air quality data can be used to characterize the background air quality for the area. Based on guidance received from the Rhode Island Department of Environmental Management, background air quality for the area has been established for SO_2, PM, CO, and NO_x on the basis of regional air quality data from the East Providence Monitoring Station (SO_2, O_3), the Woonsocket City Hall (TSP), and the Providence (Brown University) monitoring station (CO, NO_x). These three stations are operated and maintained by the Rhode Island Air Pollution Laboratory/Health Department, and the results are published annually. Both Rhode Island and Massachusetts are classified as nonattainment for ozone (O_3). This requires special consideration for VOC emissions, which are precursor emissions for ozone (O_3). Monitoring data was unavailable for ambient VOC.



SOURCE: BECHTEL EASTERN POWER CORPORATION, DECEMBER 1986.

FIGURE 3.1-7
WIND FREQUENCY DISTRIBUTION FOR PROVIDENCE, RHODE ISLAND

The selected background levels of SO_2, PM, NO_x, CO, and O_3 were derived from the most recent 3 years of monitoring data (1983-1985) collected at the stations indicated above. These levels are summarized in Table 3.1-5. Since the proposed site is located in a rural area, it is realistic to expect air quality in the immediate vicinity to be better than what is indicated by the monitoring results summarized in the tables.

According to EPA determinations, the preferred and alternative plant sites are located in an area where PM, SO_2, CO, and NO_2 levels either "cannot be classified" or are "better than national standards." O_3 levels are classified as not meeting primary standards in Rhode Island and Massachusetts.

3.1.3.3 Applicable Air Quality Standards and Classifications

Two sets of ambient air quality restrictions are considered applicable to the proposed OSP project--Federal primary and secondary ambient air quality standards (NAAQS), including PSD standards; and Rhode Island standards. Given the proximity of the proposed site to the Commonwealth of Massachusetts, its air quality standards are also addressed. The only pollutants expected to be of concern are NO_x, CO, SO_2, and PM.

3.1.3.3.1 Federal Standards

NAAQS are summarized in Table 3.1-6 for the pollutants of primary interest. These standards are independent of any particular source of emissions and prescribe levels that are not to be exceeded as a result of all contributing emission sources combined. Additionally, federally enforced regulations governing PSD specify allowed incremental increases in SO_2 and particulate levels for specified sources. A summary of the PSD allowable increments is also contained in Table 3.1-6 for Class I and Class II areas. The closest Class I area to the proposed site is the Lye Brook Wilderness Area, located over 180 kilometers (110 miles) to the northwest and will not be affected by this project. The project site and all surrounding areas are classified as a Class II area for PSD.

The Federal new source performance standards (NSPS) (40 CFR Part 60 Subpart GG) limit emissions of NO_x and SO_2 for electric utility/stationary gas turbines with a heat input greater than 10.7 gigajoules/hr (10 MMBtu/hr). Emissions are limited as follows:

TABLE 3.1-5

Background Criteria Pollutant Concentrations
($\mu g/m^3$)

Pollutant and Averaging Time	Year 1983	1984	1985
SO_2			
3-hour[a]	179	203	157
24-hour[a]	83	104	83
Annual	15	21	26
PM			
24-hour[a]	107	90	112
Annual	NA[b]	39	38
NO_2			
1-hour[a]	237	167	164
Annual	45	47	49
CO			
1-hour[a]	10,200	11,400	10,200
8-hour	7,700	6,300	3,900
O_3			
1-hour[c]	257	335	366

[a] Second highest concentration.

[b] NA = not available.

[c] Highest concentration.

SOURCE: Rhode Island Department of Environmental Management, Air Quality Data Summaries for 1983, 1984, and 1985.

TABLE 3.1-6

Applicable Ambient Air Quality Limits and Significant Impact Levels (concentrations in $\mu g/m^3$)

Pollutant and Averaging Period	NAAQS Primary	NAAQS Secondary	PSD Increments Class II	PSD Increments Class I	Significant Impact Levels
SO_2					
3-hour	--	1,300[a]	512[a]	25[a]	25
24-hour	365[a]	--	91[a]	5[a]	5
Annual	80	--	20	2	1
NO_2					
Annual	100	100	(b)	(b)	1
1-hour	320[c]	--	(b)	(b)	--
CO					
1-hour	40,000[a]	--	(b)	(b)	2,000
8-hour	10,000[a]	--	(b)	(b)	500
PM[d]					
24-hour	--	--	37[a]	10[a]	5
Annual	--	--	19	5	1
PM10[e]					
24-hour	150	150	--	--	--
Annual	50	50	--	--	--
O_3					
1-hour[f]	235	235	--	--	--

[a] Concentrations not to be exceeded more than once a year.

[b] No increments applicable.

[c] Massachusetts NO_2 air quality standard.

[d] Total suspended particulates.

[e] Recently promulgated PM standard replaces previous PM standard (52 FR 24634, July 1, 1987); includes only particulates less than 10 micrometers in diameter.

[f] Not to be exceeded.

NO_x limit	=	0.0075 (14.4)/Y + F (percent by volume at 15 percent O_2 on a dry basis)
	=	0.0136 percent
where: Y	=	Manufacturer's rated fuel rate at rated load (8.46 kilojoules per watt-hour for OSP)
F	=	NO_x emissions allowance for fuel bound nitrogen (assumed to be zero for OSP)
SO_2 limit	=	0.015 percent by volume at 15 percent O_2 on a dry basis. (Sulfur in fuel (gas or oil) is also limited to 0.8 percent by weight.)

Federal NSPS are also applicable to supplementary fired heat recovery steam generators (HRSG) with a heat input greater than 100 MMBtu/hr. The proposed natural gas-fired duct burners of each steam generator will have a maximum supplementary firing rate of 126 MMBtu/hr. These units will be subject to the regulations of 40 CFR Part 60, Subpart Db--Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units (51FR42788, November 25, 1986). Under Subpart Db, the duct burners must comply with a NO_x emission limitation of 0.2 lb/MMBtu heat input.

No other Federal emission limitation standards are applicable to this facility.

In addition to the NSPS, PSD regulations require a BACT demonstration to ensure that emissions from the facility will be at least as restrictive as the NSPS.

3.1.3.3.2 Rhode Island Standards

The AAQS enforced by the State of Rhode Island are identical to the NAAQS for all pollutants, as summarized in Table 3.1-6. The State has also adopted the Federal PSD regulations, with the additional stipulation that no source or modification will be allowed to consume more than 75 percent of the remaining 24-hour increment, or 25 percent of the remaining annual increment, as specified in Rhode Island Air Pollution Control Regulation 9.15.1(a).

Rhode Island has adopted the Federal NSPS for gas turbines; the emission limitations are therefore the same as those described in Section 3.1.3.3.1.

Prior to the construction of any facility, an application to construct and operate that facility must be made to the Rhode Island Department of

Environmental Management. If the facility is subject to the regulations governing PSD (based on annual emissions), a PSD permit application report must also be submitted. The PSD report is intended to demonstrate compliance with State and Federal ambient standards; use of BACT on emission sources; and protection of visibility, soils, and vegetation. The proposed OSP project is subject to the regulations governing PSD for NO_x, CO, VOC, and PM. It should be noted, however, that the entire State of Rhode Island is considered to be in attainment with State and Federal standards for all pollutants except O_3. This situation requires that all proposed new sources in Rhode Island that expect to emit VOC's in excess of 100 tons/yr undergo a nonattainment review process. However, VOC emissions from the proposed OSP project are not expected to exceed this limit.

3.1.3.3.3 Massachusetts Standards

The Massachusetts AAQS are identical to the Federal NAAQS listed in Table 3.1-6, with the exception of a 1-hour ambient NO_2 standard of 320 ug/m^3. The Massachusetts Department of Environmental Quality Engineering has also adopted the Federal regulations governing PSD (see Table 3.1-6), with no additional stipulations.

Since the proposed project is located in Rhode Island, regulations governing emission limitations in Massachusetts are not applicable. However, compliance with both Rhode Island and Massachusetts standards is discussed in Section 4.1.3.4.

3.1.4 Sound Quality

Sound quality data representative of the existing environment were obtained by conducting in-field noise surveys in the immediate vicinity of the proposed OSP site, as well as in the vicinity of the proposed cooling water intake structure to be located on the west side of the Blackstone River in Woonsocket, Rhode Island. A summary of existing noise levels for each of these two areas is given below. A general discussion of noise and its associated terminology is included as Appendix E of this document.

3.1.4.1 Existing Noise Levels

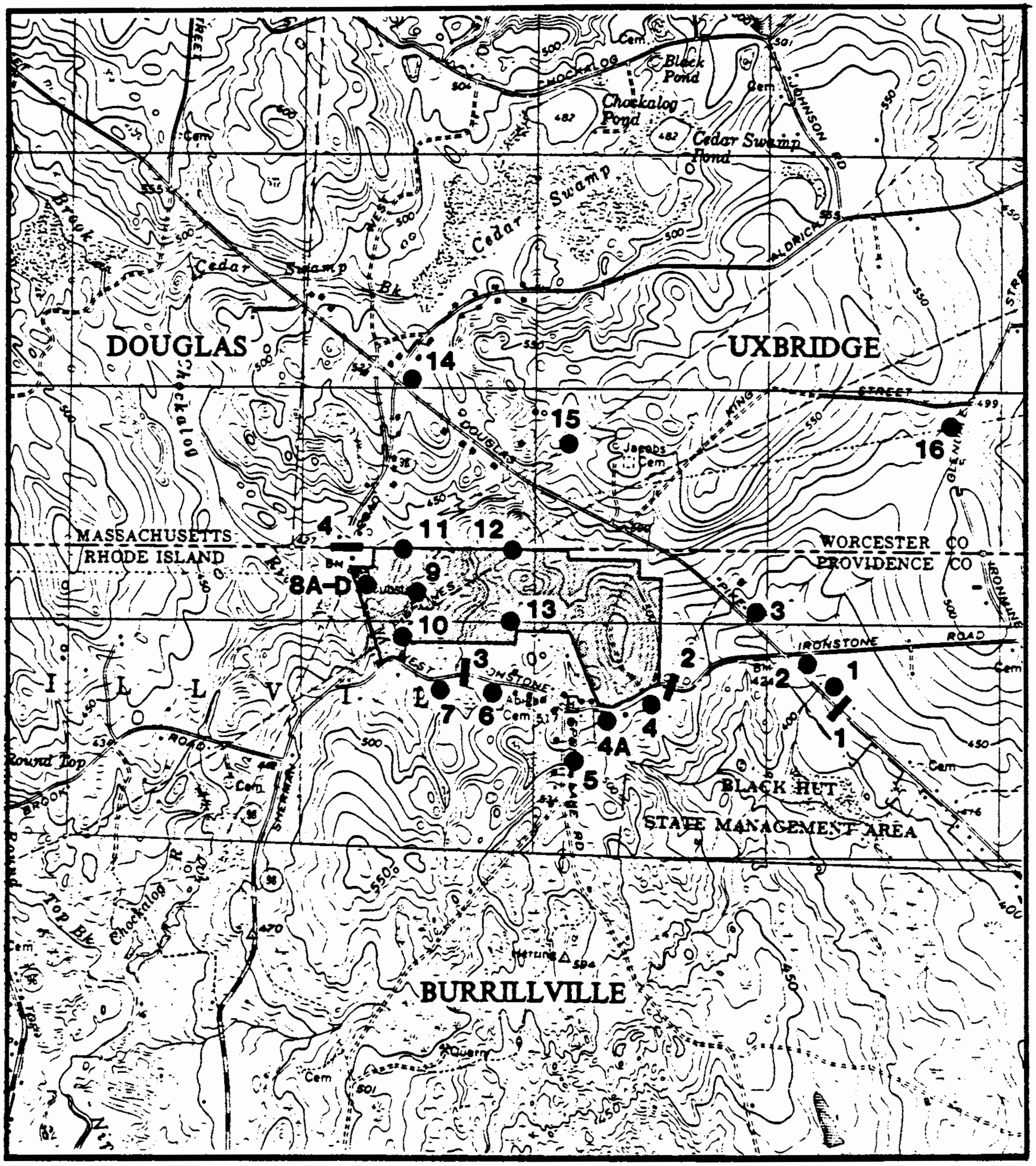
3.1.4.1.1 Plant Site

Existing noise levels in the vicinity of the proposed site have been characterized by two noise monitoring surveys. The first study (Vanasse Hangen Brustlin, Inc., 1987) consisted of both long- and short-term noise measurements in the vicinity of the site. The second study (BBN Laboratories, Inc., November 1987) was conducted to provide additional information and clarification as a result of inadequacies in the original survey results. The results of these programs are summarized here to provide insight into the existing sound quality/noise levels at the OSP site.

The initial monitoring program reported in the Vanasse Hangen Brustlin, Inc., 1987 report (i.e., the VHB report) consisted of recording existing noise levels at selected locations (stations) in the vicinity of the site for both long and short time periods. Long-term readings were taken over an approximate 44-hour period at eight stations. Short-term readings were taken during 10-minute time periods at the eight long-term stations plus 13 additional locations. The locations of these stations are illustrated in Figure 3.1-8.

The long-term measurements were made in late November 1986 when vegetation was at a minimum and there was no snow cover. All eight long-term stations were surveyed simultaneously using eight identical instruments. Although approximately 2 days of data were obtained, passing rain showers caused inaccurate readings for part of the time. One day of data (Sunday, November 23, 1986) was not affected.

The results of the long-term measurements suggest that noise levels are fairly uniform throughout the study area. This is attributable to similarities in traffic volumes and landscape characteristics. Only Stations 1 and 8 were found to



SOURCE: VANASSE HANGEN BRUSTLIN, 1987

Vanasse/Hangen
Consulting Engineers & Planners
605 Broadway, Providence, RI 02909

Legend

- ● Noise Monitoring Station
- ▌ Traffic Count Station

Scale: 1"=2000'

FIGURE 3.1-8
NOISE MONITORING STATIONS, VICINITY OSP's
SHERMAN FARM ROAD SITE

exhibit higher noise levels than the other stations, due to a combination of higher traffic volumes and speed on adjacent roads. Stations 3 through 7 and Station 9 were all observed to have similar noise levels, with maximum equivalent (L_{eq}) noise levels during the day of 51 to 54 dBA. Night levels were recorded as 43 or 44 dBA, which was the threshold of noise detection for the equipment. The implication of these data is that nighttime noise levels are at or below the threshold, although how much less cannot be determined from the data.

Short-term ambient noise level readings were later obtained to supplement the long-term data and to provide insight into quiet-hour noise levels around the site. This program consisted of monitoring at each of the project stations for a 10-minute period with instantaneous readings every 10 seconds. The instrumentation used in the short-term survey was capable of measuring noise levels well below 43 dBA. Short-term weekday readings were taken at various times on December 4, 1986; February 6, 1987; and February 10, 1987. Weekend measurements were made on December 6, 1986, and February 7, 1987. The entire site was covered with snow during the February 6, 7, and 10 measurements.

Table 3.1-7 summarizes the results of all onsite short-term noise surveys, listing the minimum, maximum, and average noise levels for all onsite stations. The lowest noise level observed during the short-term noise surveys was 25 dBA (on a weekend), while the highest level was 64 dBA (on a weekday). On average, weekend noise levels were observed to be lower than weekday levels by 3 to 4 dBA. On a typical weekday, onsite L_{eq} (equivalent) noise levels were observed to vary from 42 to 46 dBA, with an average of 40-44 dBA. L_{90} noise levels were observed to range from a low of 29 dBA on a weekend, to a high of 49 dBA on a weekday, with an average of 36 dBA on the weekend and 41 dBA on a weekday. It should be noted that the short- and long-term monitoring programs reported in the VHB report were conducted when vegetation was at a minimum.

Additionally, some of the short-term noise measurements in the VHB report were made in the presence of snow cover (i.e., on February 6, 7, and 10 of 1987), with the expected result being lower noise levels. In fact, the lowest recorded

TABLE 3.1-7

Summary of Short-Term Noise Monitoring for
Sherman Farm Road Site
(Onsite Stations)

Statistical Indicator	Weekday Readings			Weekend Readings		
	Minimum	Maximum	Average	Minimum	Maximum	Average
Minimum dBA	31	36	32	25	31	28
L_{90} dBA[a]	33	49	41	29	43	36
L_{50} dBA	39	43	40	33	39	37
L_{eq} dBA	42	46	44	37	42	40
L_{10} dBA	47	53	49	41	49	46
Maximum dBA	57	64	61	51	60	57

[a]Derived from data sheets attached to Vanasse Hangen Brustlin report.

SOURCE: Vanasse Hangen Brustlin, Inc. (1987).

instantaneous noise level of 25 dBA occurred in the presence of snow cover on February 7, 1987. The lowest recorded noise level without snow cover was 31 dBA.

The noise survey performed by BBN Laboratories consisted of long-term equivalent noise level measurements (for 44 hours) at locations immediately north and south of the OSP project site. The results of these measurements were reasonably consistent with the measurements reported in the VHB report. Daytime L_{eq} noise levels were in the range of 44-47 dBA; nighttime L_{eq} levels were 40-42 dBA. Calculated day-night sound levels (L_{dn}) were approximately 48 dBA.

3.1.4.1.2 Cooling Water Intake Structure

Existing noise levels in the vicinity of the proposed cooling water intake structure were characterized by performing an in-field noise measurement survey. The results of this survey have been documented in a report (BBN Laboratories Incorporated, December, 1987) and are summarized to provide insight into existing noise levels near the proposed water intake structure and pumphouse in Woonsocket. The purpose of the measurement program was to characterize the existing acoustic environment in the immediate vicinity of the site and to provide an initial design baseline for the intake structure facility.

Noise measurements were obtained during the afternoon of December 11, 1987, and during the late night to early morning of December 12 and 13, 1987, at three locations immediately adjacent to the site. The results of the measurements are summarized below:

Monitoring Site No.	Direction From Site	Equivalent Sound Levels (L_{eq}) (dBA)		Day-Night Sound Levels L_{dn}(dBA)
		Afternoon	Night	
1	NW	53	46	54
2	NE	54	46	55
3	SW	56	46	56

During the afternoon measurements, the equivalent L_{eq} sound levels range from 53 to 56 dBA. With diminished traffic volumes, the L_{eq} declines to a consistent 46 dBA. The calculated day-night sound levels range from 54-56 dBA.

3.1.4.2 Applicable Noise Standards

At present, there are no noise standards or guidelines that will apply to the proposed OSP project. The State of Rhode Island does not have noise standards applicable to this project. Although not applicable to this project for jurisdictional reasons, the Commonwealth of Massachusetts has an enforced noise guideline that limits property line noise levels generated by an industrial/commercial facility to 10 dBA above existing noise levels. Existing noise levels are defined as the L_{90} measured during the quiet hour of the day. Due to the proximity of the OSP facility of the Massachusetts border, those guidelines will be addressed.

3.1.5 Ecology

Ecological data for preparation of this EIS were obtained through literature review, contact with appropriate State and Federal agencies, and onsite environmental studies. Field studies are detailed below and baseline conditions are described for terrestrial ecology, aquatic ecology, and the presence of protected species.

The Staff reviewed National Wetland Inventory maps to assess potential impacts from development of the site and associated oil and water pipelines. Construction of pipelines across streams and wetlands would result in short-term construction impacts including increased turbidity and sedimentation. After construction, the natural grade will be reestablished and hydrological conditions will be restored in all affected wetlands except for the 0.52-acre wetland on the plant site. Figure 2.1-9 illustrates wetlands along proposed and alternative routes. Wetlands on the plant site are illustrated in Figure 3.1-9. The two screened areas represent the jurisdictional and non-jurisdictional wetlands.

The proposed site was evaluated for existing ecological conditions during field reconnaissance visits in spring and fall 1986, and spring and late summer 1987. During a May 1987 survey, onsite wetlands were delineated and marked with survey tape. The oil and water pipeline route was examined in the field during surveys in June and November 1986 and again in March 1987. A field evaluation was conducted at the proposed cooling water intake on the Blackstone River, and documentation in support of the Rhode Island "Application to Alter a Wetland" was prepared in May 1987. Aquatic biological surveys were conducted in the river near the intake location during spring, summer, and fall 1987.

3.1.5.1 Terrestrial Ecology

3.1.5.1.1 Plant Site

The proposed site is primarily oak-hickory forest typical of second growth vegetation following clear cutting from forestry or agricultural use. In addition to a variety of deciduous trees and shrubs, some species of conifers are interspersed, primarily as saplings in the intermediate canopy level and as shrubs. Laurel, blueberry, and huckleberry are most common at ground level. Species typical of this forest system on upland areas of the northeastern United States are listed in Table 3.1-8. The 345-kV transmission line right-of-way that traverses the site supports a variety of shrubs and forbs.

TABLE 3.1-8
Characteristic Upland Vegetation Species of the Burrillville Area

Fern Allies

Lycopodium complanatum	Running Pine
Sphagnum sp.	Sphagnum Moss - 2 species
Lycopodium clavatum	Staghorn Clubmoss*
Lycopodium obscurum	Tree Clubmoss

Ferns

Polystichum acrostichoides	Christmas Fern
Osmunda cinnamomea	Cinnamon Fern*
Dennstaedtia punctilobula	Hay Scented Fern
Osmunda claytoniana	Interrupted Fern*
Athyrium felix-femina var michauxi	Lady Fern*
Thelypteris palustris var pubescens	Marsh Fern
Thelypteris noveboracensis	New York Fern
Pteridium aquilinum var latiusculum	Bracken Fern

Flowering Plant

Sanicula marilandica	Black Snakeroot
Maianthemum canadense	Canada Mayflower
Erigeron annus	Daisy Fleabane
Potentilla canadensis	Early cinquefoil
Smilacina racemosa	False Solomon's Seal
Prenanthes serpentaria	Gall-of-the-Earth
Solidago graminifolia	Grass-leaved Goldenrod
Polygonatum pubescens	Hairy Solomon's Seal
Amphicarpa bracteata	Hog Peanut
Erigeron canadensis	Horseweed
Medeola virginiana	Indian Cucumber - Root
Monotropa uniflora	Indian-pipes
Arisaema triphyllum	Jack-in-the-Pulpit
Galium lanceolatum	Lance-leaved Wild Licorice
Aster macrophyllus	Large-leaved Aster
Epilobium glandulosum var adenocaulon	Northern Willow-Herb
Helianthus strumosus	Pale-leaved Sunflower
Erechites hieracifolia	Pilewort
Cypripedium acaule	Pink Lady's Slipper Orchid
Phytolacca americana	Pokeweed
Ambrosia artemisiifolia var elatior	Ragweed
Prenanthes trifoliolata	Rattlesnake Root
Solidago aspera	Rough Stemmed Goldenrod
Potentilla norvegica	Rough-fruited cinquefoil
Trientalis borealis	Star Flower
Urtica dioica	Stinging Nettle
Agrimonia gryposepala	Tall Hairy Agrimony
Thalictrum polygamum	Tall Meadow-Rue
Prenanthes altissima	Tall White Lettuce
Lilium superbum	Turk's Cap Lily
Aster undulatus	Wavy-leaved Aster
Actaea pachypoda	White Baneberry
Aster divaricatus	White Wood Aster
Aster acuminatus	Whorled Aster
Geranium maculatum	Wild Germanium
Uvularia sessilifolia	Wild Oats
Aralia nudicaulis	Wild sarsaparilla
Anemone quinquefolia	Wood Anemone

Shrubs

Corunus alternifolia	Alternate-leaved Dogwood
Gaylussacia baccata	Black Huckleberry
Rubus allegheniensis	Blackberry
Smilax herbacea	Carrion Flower*
Gaylussacia frondosa	Dangleberry*
Vaccinium vacillans	Early Sweet Blueberry
Corylus americana	Hazelnut
Kalmia angustifolia	Lambkill*
Vaccinium angustifolium	Low Sweet Blueberry
Kalmia latifolia	Mountain Laurel
Mitchella repens	Partridgeberry
Rhus radicans var rydbergii	Poison Ivy*
Sassafras albidum	Sassafras
Rhus glabra	Smooth Sumac
Chimaphila maculata	Spotted Wintergreen
Spiraea latifolia	Wide-leaved Spiraea
Gaultheria procumbens	Wintergreen
Hamamelis virginiana	Witch Hazel

Trees

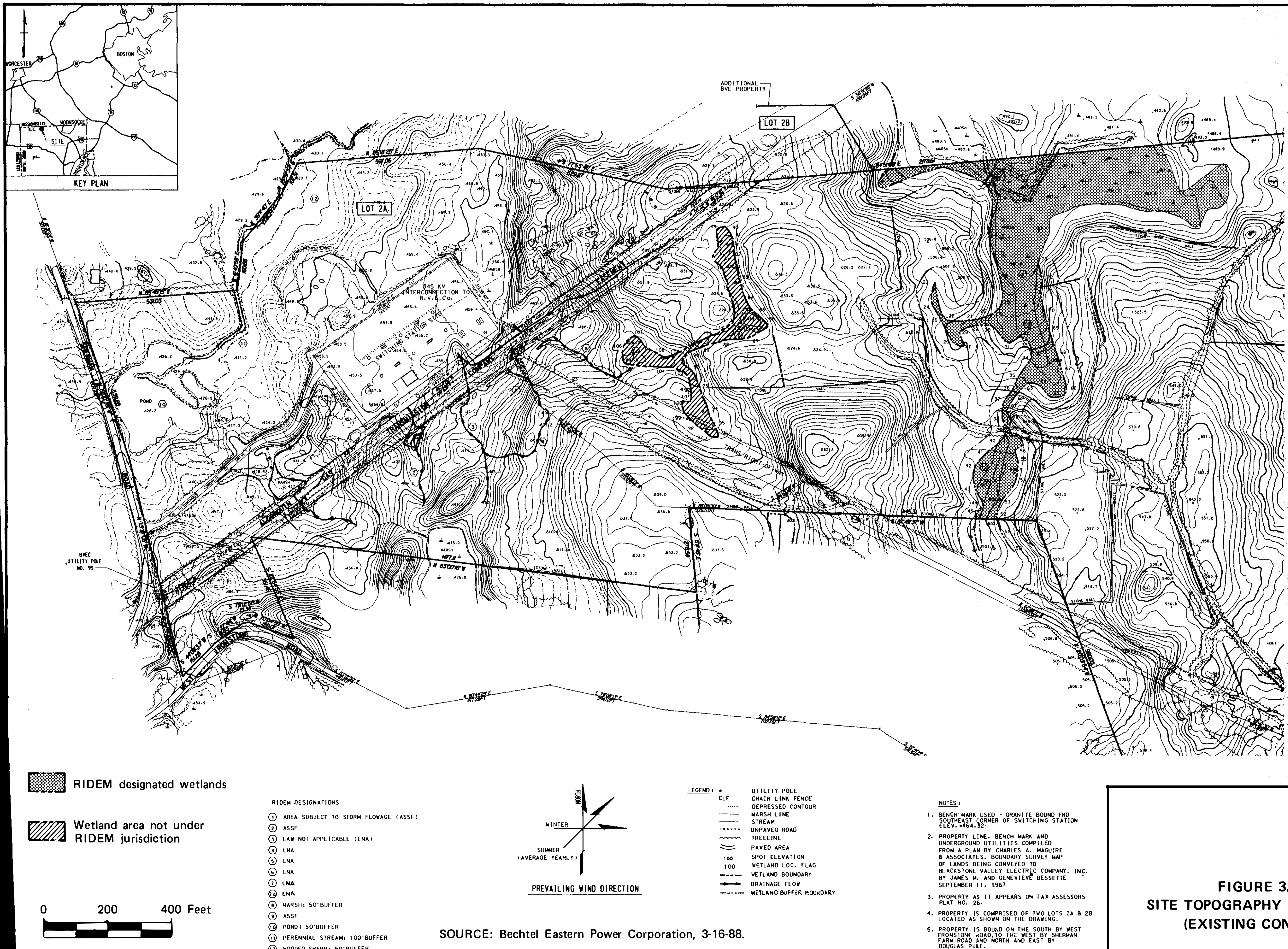
Betula lenta	Black Birch
Castanea dentata	Chestnut
Betula populifolia	Gray Birch*
Tsuga canadensis	Hemlock
Carpinus caroliniana	Hornbeam, Muscle-wood
Carya tomentosa	Mockernut Hickory
Carya cordiformis	Pignut
Acer rubrum	Red Maple*
Quercus rubra	Red Oak
Quercus coccinea	Scarlet Oak
Carya ovata	Shagbark Hickory
Nyssa sylvatica	Tupelo Gum*
Betula papyrifolia	White Birch
Quercus alba	White Oak
Pinus strobus	White pine
Betula alleghaniensis	Yellow Birch*

Vines

Vitis labrusca	Fox Grape
Smilax rotundifolia	Greenbriar*
Rhus radicans	Poison Ivy*
Smilax glauca var leurophylla	Sawbrier
Parthenocissus quinquefolia	Virginia Creeper

SOURCE: Audubon Society of Rhode Island, 1987.

*Facultative species, which can also be found in wetlands



SOURCE: Bechtel Eastern Power Corporation, 3-16-88.

FIGURE 3.1-9
SITE TOPOGRAPHY AND WETLANDS
(EXISTING CONDITIONS)

The Black Hut Management Area lies directly across West Ironstone Road at the southeastern edge of the property. Upland vegetation there is similar in species composition to the deciduous forest onsite.

Two wetlands present on the site were delineated according to surface hydrology and vegetation (Figure 3.1-9), as described by the Rhode Island Fresh Water Wetland Act. The act defines wetlands according to the presence of plant communities consisting of 50 percent or more wetland plant families, genera, and species. A botanical inventory of observed dominant wetland trees, shrubs, herbs, and vines is shown in Table 3.1-9.

One wetland, located just to the northeast of the site, is bounded by Douglas Pike on the northeast, the gas/power line easement to the northwest, and West Ironstone Road to the southeast. This low-lying wetland of approximately 10 acres includes standing water almost entirely covered with sedges, rushes, and sphagnum moss. Cattails, ferns, and shrubs grow along the edge of this bog. It is fed from surface water drainage of one intermittent and one perennial stream, flowing from areas south and southwest of the standing water body. A second smaller wetland, located in the center of the site, includes two levels, approximately 20 feet different in elevation, connected by a short intermittent stream with an indistinct channel lacking wetland plants along its course. This wetland system is isolated with no inlet or outlet and may have developed due to a perched water table or very slow rate of surface water infiltration into clay-rich subsurface soils (Bechtel Eastern Power Corporation, November 1987). The smaller wetland system with a total area of approximately one-half acre would be the only wetland filled for facility construction.

Wildlife at the site is typical of rural wooded areas found in the region and in the northeast United States in general. Mammals potentially inhabiting the site include various shrews, bats, the Eastern and New England cottontail rabbit, eastern chipmunk, house mouse, deer mouse, white-footed mouse, star-nosed mole, gray squirrel, red squirrel, southern flying squirrel, meadow vole, Norway rat, red fox, gray fox, raccoon, striped skunk, and white tailed deer. During an autumn 1987 field reconnaissance, few tracks and animal signs were observed.

TABLE 3.1-9
Characteristic Wetland Vegetation
Species of the Burrillville Area

Fern Allies	
Lycopodium lucidulum	Shining Clubmoss**
Lycopodium clavatum	Staghorn Clubmoss*
Ferns	
Osmunda cinnamomea	Cinnamon Fern*
Dryopteris cristata	Crested Fern*
Dryopteris spinulosa var intermedia	Evergreen Woodfern*
Osmunda claytoniana	Interrupted Fern*
Athyrium felix-femina var michauxi	Lady Fern*
Osmunda regalis var. spectabilis	Royal Fern**
Onoclea sensibilis	Sensitive Fern**
Dryopteris spinulosa	Spinulose Woodfern*
Flowering Plant	
Iris versicolor	Blue Flag
Eupatorium perfoliatum	Boneset**
Aster lateriflorus	Calico Aster**
Eupatorium dubium	Eastern Joe-pye Weed**
Boehmeria cylindrica	False Nettle**
Aster umbellatus	Flat Topped Aster**
Senico aureus var intercursus	Golden Ragwort**
Apios americana	Groundnut**
Viola cucullata	Marsh Blue Violet**
Polygonum hydropiperoides	Mild Water Pepper
Symplocarpus foetidus	Skunk Cabbage
Bidens frondosa	Stick-tight**
Viola pallens	Sweet White Violet
Impatiens capensis	Touch-me-not**
Chelone glabra	Turtlehead
Cicuta maculata	Water Hemlock
Lycopus americanus	Water Horehound
Lysimachia quadrifolia	Whorled Loosestrife**
Shrubs	
Smilax herbacea	Carrion Flower*
Gaylussacia frondosa	Dangleberry*
Sambucus canadensis	Elderberry**
Vaccinium corymbosum	Highbush Blueberry**
Kalmia angustifolia	Lambkill*
Lyonia ligustrina	Maleberry**
Spiraea alba	Narrow-leaved Spiraea**
Viburnum recognitum	Northern Arrow-wood**
Rhus radicans var rydbergii	Poison Ivy*
Cornus stolonifera	Red Osier Dogwood**
Lindera benzoin	Spicebush**
Rhododendron viscosum	Swamp Azalea
Rubus hispidus	Swamp Dewberry**
Clethra alnifolia	Sweet Pepperbush*
Ilex verticillata	Winterberry**
Trees	
Betula populifolia	Gray Birch*
Acer rubrum	Red Maple*
Quercus bicolor	Swamp White Oak**
Nyssa sylvatica	Tupelo Gum*
Betula alleghaniensis	Yellow Birch*
Vines	
Smilax rotundifolia	Greenbriar*
Rhus radicans	Poison Ivy*

*Facultative species, which can also be found outside of wetlands

**Facultative wetland species, which usually are found in wetlands but may occur elsewhere

SOURCE: Audubon Society of Rhode Island, 1987.

The proposed site provides suitable habitat in the upland woods, wetland and small stream for a variety of reptiles and amphibians. The eastern box turtle may inhabit the second-growth woodland while the northern brown snake, northern ringneck snake and eastern garter snake likely find shelter in old rock walls still standing in the woods. Amphibians typical of bog and stream habitats are the red-spotted newt, four-toed salamander and northern spring peepers. The American toad and northern leopard frog are also likely inhabitants of the proposed site.

Bird species are also typical of second-growth woodland in the northeast oak-hickory forest regions. They include a variety of perching and tree-clinging species, such as warblers, thrush, chickadee, woodpecker, nuthatch, and the common crow. Various upland ground species may occur on the site, such as ruffed grouse, bobwhite, and ring-necked pheasant. Various species of hawk and owl may also occur although no hawk nests or owl pellets were found during field reconnaissance. The presence onsite of the cleared transmission line right-of-way provides shrub and grassland habitat for sparrows, cardinals, and other seed-eating birds as well.

3.1.5.1.2 Water and Oil Pipelines

The water and oil pipelines associated with the proposed facility would lie within existing street, roadway, and electric transmission line rights-of-way. Several streams, brooks, the Branch River, and other small wetlands are located along the water pipeline route. There are approximately 25 crossings of these water courses. Initially, depending on the specific route chosen within the City of Woonsocket, the line may or may not cross Cherry Brook. Where the route parallels Route 146A, it must cross the Branch River. After crossing Route 146, the line still following Route 146A will cross Dawley Brook near Slatersville. The next crossing is over an unnamed tributary running along the Slatersville Reservoir. After turning northwest on Douglas Pike, the route will cross Tucker Brook, several small bogs, and an unnamed intermittent stream before intersecting with West Ironstone Road. Along West Ironstone Road and the Blackstone Valley Electric Company transmission line right-of-way, several small bogs are crossed prior to reaching the site. The classification of each stream mentioned above and available data on its fishery are presented in Section 2.2.3.

Because the pipelines will be in existing rights-of-way, affected wetlands are generally limited to small areas of vegetation adjacent to stream crossings. The Rhode Island Department of Environmental Management maintains approval authority over wetland crossings under the Fresh Water Wetlands Act. An application to alter a wetland has been prepared for the water and oil pipeline route.

Of the swampy wetlands found, the majority are dominated by red maple, which forms a canopy 30 to 40 feet high, together with a few white pines. Shrub growth below the maple is usually dense and includes high-bush blueberry, azalea, ferns, and dogwood. Generally, ponds are covered with pondlily or pondweed over much of their surface. Bogs, characterized by reduced drainage and accumulated decaying vegetation, are typically vegetated with sphagnum moss, grasses, and smaller shrubs.

Most streams and rivers are wooded to their edges, though several small streams flow through pasture grasslands. Most stream crossings are less than 10 feet in distance and follow existing road rights-of-way. Several streams are confined to drainage ditches close to the road and may be intermittent, flowing only as a result of recent rains. The pipeline route terminates at the Sherman Farm Road site. A single stream surrounds the plant site and flows through and below several bog areas. One of the bogs is crossed by the pipeline route south of the site.

In addition to the wetlands surveyed directly adjacent to the proposed route, the Rhode Island Department of Environmental Management has jurisdiction within 50 feet of any legal wetland, within 100 feet of streams less than 10 feet wide, and within 200 feet of streams 10 feet or wider. According to U.S. Fish and Wildlife Service National Wetlands Inventory maps, approximately four additional wetlands back from the route may be involved in approvals associated with the proposed pipeline route.

Where the water pipeline crosses urban areas, no wildlife is anticipated. Oil and water pipelines within existing rights-of-way would cross wildlife habitat typical of adjacent vegetation communities.

A water intake structure is proposed to be located on the right bank of the Blackstone River, just upstream of the Sayles Street bridge within the City of

Woonsocket, Rhode Island. An application has been prepared for permission to alter a fresh water wetland (i.e., an approximately 1,500-square-foot area on the bank of the Blackstone River) to construct and operate the proposed water intake structure. Existing vegetation is a mixture of shrubs and grasses on the moderately steep riverbank.

3.1.5.2 Aquatic Ecology

3.1.5.2.1 Plant Site

The proposed Burrillville site includes no large water bodies. A small pond lies at the northwest corner of the property adjacent to Sherman Farm Road. The pond would provide suitable habitat and may be stocked with bluegill, catfish and bass. An unnamed tributary to the Chockalog River carries seasonal water flow from a bog area on the eastern portion of the site, exits north, and then flows through the northwest part of the property into the small pond mentioned above. Similar small tributaries in the area support creek chub, sculpins and darters in the faster moving creeks. The northern dusky salamanders and northern two-lined salamander are typically found on stream edges in this region. The sphagnum bog would provide suitable habitat for the four-toed salamander.

3.1.5.2.2 Water and Oil Pipelines

Streams to be crossed by the pipeline route include the Branch River and several brooks. Running from Woonsocket toward the plant site they are classified as follows by the Rhode Island Department of Environmental Management:

- Cherry Brook--C
- Branch River--C
- Dawley Brook--B
- Unnamed tributary of Slatersville Reservoir--B
- Tucker Brook--B
- Unnamed intermittent stream--B.

Of these streams, only the Branch River is given its own water quality classification. The other water courses are listed with the classification of the streams into which they flow. Class B allows for public water supply with appropriate treatment and for agricultural uses, bathing, other primary contact recreational activities, and fish and wildlife habitat. Class C allows for boating, other secondary contact recreational activities, fish and wildlife habitat, industrial process water, and cooling water.

To the FERC Staff's knowledge, no fisheries data--other than on the presence or absence of wild trout--are available for these streams. None have been found to have a wild trout population. The Branch River was sampled in a previous survey, and no wild trout were found. The Rhode Island Department of Environmental Management does not stock any of the streams in question (Demaine and Guthrie, 1979).

3.1.5.2.3 **Cooling Water Withdrawals**

The proposed project would require an average withdrawal of 4 mgd from the Blackstone River at Woonsocket for plant process and cooling water. There would be no discharge of effluent back to the river. Data on the fishery resources in the Blackstone River in Rhode Island were gathered from a survey conducted by the Rhode Island Department of Environmental Management in summer 1975 (Demaine and Guthrie, 1979) and from surveys conducted for this project in late May, late July, and late August/early September 1987 in the vicinity of the proposed intake structures (Ecology and Environment, Inc., October 1987c). The Blackstone River Basin is described in detail in Section 3.1.2.1.2.

The report of the 1975 fishery survey notes that historically (since the late 1600's) the Blackstone River and many of its tributaries have been a source of power for industry, and a carrier for sewage and industrial waste. In the distant past, two anadromous species, the American shad (Alosa sapidissima) and the alewife (Alosa pseudoharengus) annually ascended the river on spring spawning runs. These runs were eliminated with the building of dams long before 1975 (as discussed in Section 3.1.2.1.2). Largemouth bass (Micropterus salmoides) and bluegill sunfish (Lepomis macrochirus) were among other species introduced into the river during the early 1900's.

Sampling in 1975 was conducted on the Blackstone River 450 feet upstream of River Street Bridge in Woonsocket. Water was ponded at this sampling station due to downstream dams. The bottom type was mud (30 percent), rubble (25 percent), gravel (20 percent), silt (15 percent), and sand (10 percent). Water quality indicated pollution. The following four species were collected, with the number of individuals noted:

- White sucker (Catostomus commersoni)--14
- Brown bullhead (Ictalurus nebulosus)--8
- Bluegill (Lepomis macrochirus)--6
- Fallfish (Semotilus corporalis)--30.

Water quality is believed to have improved over the past 12 years; consequently, sampling was conducted in spring, summer, and fall 1987. Survey stations were established at the proposed site of the water intake structure (Station A), which is 500 feet upstream of the Thundermist hydroelectric facility; 0.75 mile upstream of the intake (Station B); 500 feet downstream of the Thundermist Dam (Station C); and 1.5 miles downstream of the proposed water intake structure. Sampling methods included electroshocking, gill netting, seining, and plankton sampling. In shallow waters, electrofishing was conducted while wading through the station. In deeper waters, electrofishing was performed from a boat to sample stream bank habitats and the upper portion of more open waters. Seining was conducted in wadable pools and riffles to collect smaller fish and any benthic species. Deep pools inaccessible to seining and electrofishing were sampled using a 100 foot experimental gill net with a stationary bottom set. This net consisted of four, 25 foot panels of 0.5, 1.0, 1.5, and 2.0 inch mesh. The very turbid waters of the Blackstone River were particularly suitable for the use of gill nets in deeper waters.

Results of the 1987 survey appear to confirm the general observations of State personnel that water quality and fishery resources in the Blackstone River are improving. The survey by the Rhode Island Department of Environmental Management (Demaine and Guthrie, 1979) indicated that the fishery resources present were generally typical of warm water habitats and included only species capable of surviving in poor quality waters. The results of the 1987 survey indicate that, while the fishery is still characteristic of warm water habitats, there is a greater number of species present. Some of the species--such as largemouth bass, pickerel, and yellow perch--are more typical of better water quality conditions and may provide recreational fishing opportunities.

Eleven species of fish were collected during the May, July, and September 1987 surveys (Table 3.1-10). Minnows, including the golden shiner, fallfish, and common shiner, comprised 24.1 percent of the total catch for all stations. Minnows, often the most numerous fishes in relatively undisturbed streams occupy

TABLE 3.1-10

Summary of Fish Survey Results:
Total Numbers Captured During May, July, and September 1987

Station	Method	White Sucker	Pumpkinseed	Bluegill	Golden Shiner	Chain Pickerel	Fallfish	Largemouth Bass	Yellow Bullhead	Johnny Darter	Yellow Perch	Common Shiner	Total
A	Electroshocking	4	5	2	--	--	--	9	1	--	--	--	21
	Gill Netting	3	--	--	8	2	2	--	--	--	--	--	15
	Bucket and dip net sample[a]	18[b]	--	--	--	--	--	1	--	--	--	--	19
B	Electroshocking	4	13	7	--	--	--	20	4	--	--	--	48
	Gill Netting	6	--	--	--	--	--	--	--	--	--	--	6
C	Electroshocking	10	3	4	11	--	54	12	3	17	1	1	116
	Seining	15[b]	--	--	--	--	--	--	--	--	--	--	15
D	Electroshocking	3	22	11	--	--	6	26	--	7	1	--	76
	Seining	25[b]	--	--	--	--	--	--	--	--	--	--	25
	TOTAL (% of total)	88 (25.8)	43 (12.6)	24 (7.0)	19 (5.6)	2 (0.6)	62 (18.2)	68 (19.9)	8 (2.3)	24 (7.0)	2 (0.6)	1 (0.3)	341

[a]No seining was done at A; too deep, banks too steep.

[b]Larval fish.

SOURCE: Ecology and Environment, Inc., October 1987c.

a wide range of habitats from riffles to the midwaters and surface waters of pools. Both electrofishing and seining were used to sample these habitats. Small benthic species, such as darters and sculpins, most commonly inhabit the cleaner substrates of riffles and moderately flowing waters rather than the silty or mucky substrates typical of deeper pools. These riffle and run habitats were extensively sampled by electrofishing and seining at Stations C and D. Stations A and B were predominantly pool habitat. In contrast, the State survey in 1975 reported only four species.

The species of fish collected during the 1987 survey, in order of their abundance, included:

- White sucker (26 percent of total)
- Largemouth bass (20 percent)
- Fallfish (18 percent)
- Pumpkinseed (13 percent)
- Bluegill (7 percent)
- Johnny darter (7 percent)
- Golden shiner (6 percent)
- Yellow bullhead (2 percent)
- Chain pickerel, common shiner, and yellow perch (approximately 1 percent each).

In contrast to the eleven species collected during 1987 sampling, the 1979 RIDEM survey reported only four species. The State also found white sucker to be the most abundant species (comprising 83 percent of the total biomass) in the Blackstone River in the vicinity of Woonsocket. Also reported were brown bullheads (which were not collected in 1987), fallfish, and bluegills.

The results of the biological surveys, in particular the results of the July and September sampling, indicate that the fishery resources of the Blackstone River in the vicinity of Woonsocket have improved since the 1975 survey by the Rhode Island Department of Environmental Management. Overall, there is a greater species richness, and the species present include several that have value for recreational use (i.e., largemouth bass, yellow perch, chain pickerel, bluegill, and pumpkinseed). Although different sampling methods were used during the two surveys--making direct comparisons of the overall abundance of fish populations difficult--it appears that in addition to species diversity, the overall abundance of fish populations has increased. The presence of large numbers of juveniles of some species (whitesucker, Table 3.1-10) indicates that shallow water and areas along the edges of the Blackstone River provide a suitable spawning habitat.

3.1.5.3 Threatened or Endangered Species and Unique or Critical Habitats

The primary law governing the protection of threatened or endangered species and their critical habitat is the Endangered Species Act of 1973 as amended. The act provides "... a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved ..."

In a letter to FERC Staff dated June 18, 1987 (USFWS, 1987), the U.S. Fish and Wildlife Service (USFWS) indicated that: "Except for occasional transient individuals, no Federally listed or proposed threatened or endangered species under our jurisdiction are known to exist in the project impact area. No Biological Assessment or further consultation are required with us under Section 7 of the Endangered Species Act." This determination was reconfirmed on June 23, 1988, with USFWS staff.

The Rhode Island Natural Heritage Program has provided information on State threatened or endangered species in the site area and along the proposed water and oil pipeline route, and no State endangered or threatened species of flora or fauna are known to exist on the proposed site (RIDEM, Natural Heritage Program, July 22, 1987).

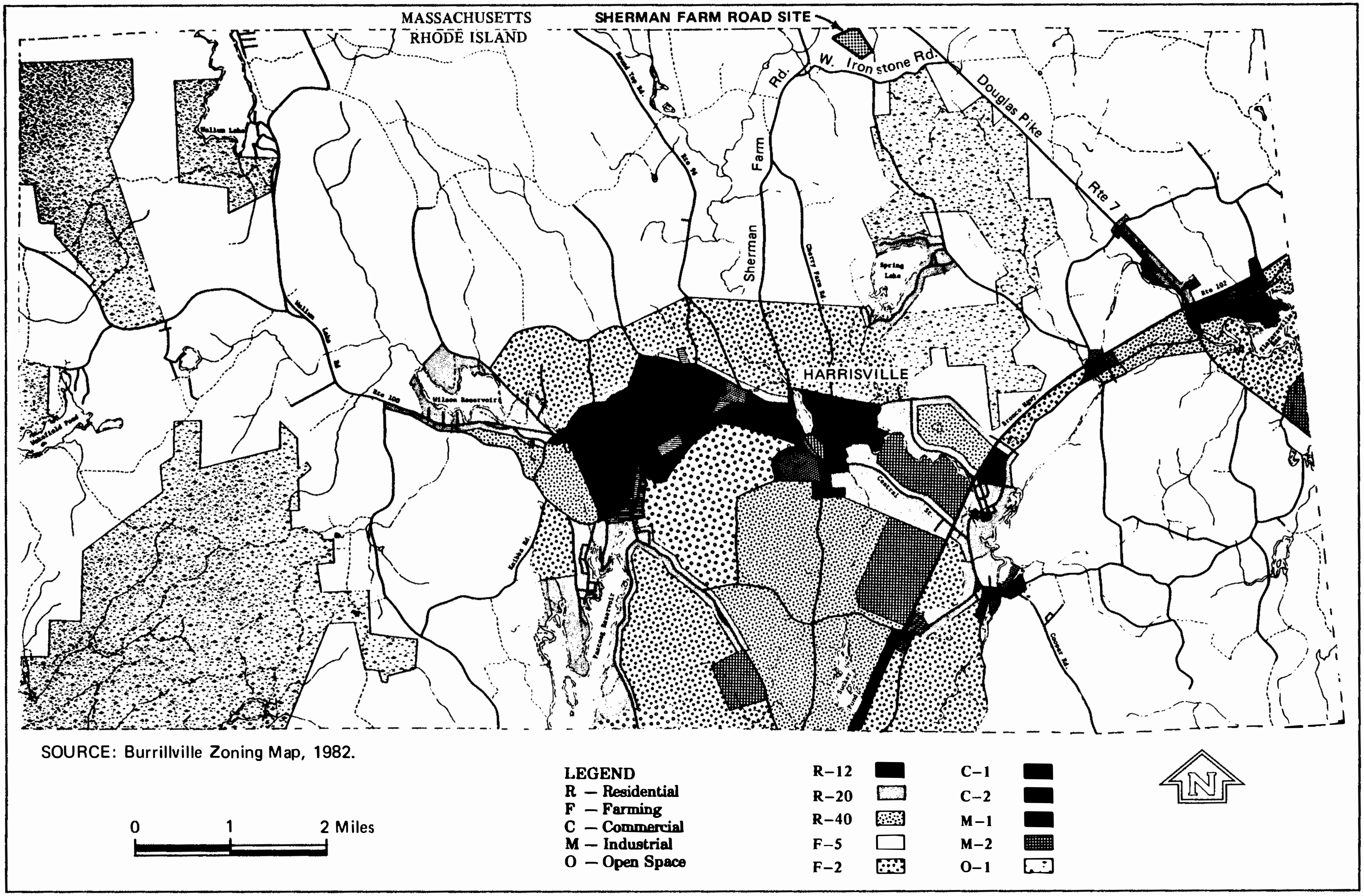
3.1.6 Sociocultural Resources

3.1.6.1 Land Use

Land use in the site area is primarily deciduous and mixed forest land interspersed with residential properties along the roads. The site is approximately triangular, with Douglas Pike running northwest to southeast, West Ironstone Road east to west, and Sherman Farm Road north to south. Although there were no homes on the site as of August 1987, residences abut the site along the three roads and across these roads. Seven homes are located near the site along Sherman Farm Road; however, they are to the west of the 345-kV transmission line and are not adjacent to the OSP property. Nine existing homes and one under construction along West Ironstone Road abut the OSP property. There are two new homes on Douglas Pike adjacent to the site. Also located on these roads but not sharing a boundary with the site are four homes on Aldrich Street, eleven homes on West Ironstone Road, and six homes on Douglas Pike. Since August 1987, new construction has begun and been completed on several houses on West Ironstone Road and Douglas Pike.

Currently, the site and the surrounding area are zoned F-5, Farming (Figure 3.1-10). Although much of the land in Burrillville is zoned farming, very little is cultivated. There is some agricultural use in the surrounding area, primarily in the form of pasture. This lack of agriculture is easily correlated to the area's environment. Of the 36,000 acres in Burrillville, nearly 42 percent is of the Canton/Charlton soils series, which is too rocky for cultivation. Because of the poor soil, economic growth in Burrillville has centered around industry. Many of the town's villages (e.g., Harrisville) developed around mill activities; these village centers still exist, though many of the mills have closed.

The closest population centers to the site are the Villages of Harrisville and Pascoag--the former 3 miles south of the site and the latter adjacent and to the west of Harrisville. Both are central to Burrillville and consist of dense residential patterns typical of a town structure. Immediately southeast of the site is the Black Hut State Management Area, a large State forest zoned and maintained as conservation and open space. Buck Hill and George Washington Management Areas are also located in the Town of Burrillville. The Rhode Island



SOURCE: Burrillville Zoning Map, 1982.

FIGURE 3.1-10
BURRILLVILLE ZONING MAP

Audubon Society owns the Fayette Bartlett Woodland, approximately 50 to 60 acres of preserved upland woodlands and wetlands located at the northeast quadrant of the intersection of Douglas Pike and West Ironstone Road. Approximately 20 lakes, ponds, and reservoirs are located in Burrillville--including Pascoag Reservoir, Wallum Lake, and Spring Lake--all of which provide boating, fishing, and swimming.

The Black Hut State Management Area is a 1,300-acre tract located generally south and east of the Sherman Farm Road site. Access to the management area is from Spring Lake Road. It is managed primarily for hunting (Rhode Island Department of Energy Management, 1970). The value of the land for producing abundant game species is apparently limited by poor habitat conditions, especially in the northern section; residential development on the management area boundaries; and the presence of domestic dogs that chase away deer and game birds.

The primary vegetation type in the northern section of the Black Hut Management Area is pole-scrub oak. Ecological succession since a major fire in 1953 has apparently been slow. Most crops are probably minimized by the small size and scrubby nature of the oak. The understory contains dense deciduous growth. The habitat is not suitable for producing many individuals of desired game species, and hunting use is probably concentrated along roads and trails because of difficult access.

The southern section is primarily a mature oak, maple, and ash forest. The oak trees in this section are likely to produce abundant crops of acorns, and the habitat is suitable for game species like the gray squirrel. In accordance with the management plan, this portion of the area is capable of supporting timber harvest to increase habitat diversity.

Management of open fields to provide food and cover for wildlife has evidently been successful. Food crops of cereal grains are well-established within the fields, and shrub and conifer plantings for cover are established around field borders. Although habitat in the area is presently not optimum for game species, it is suitable for a variety of nongame species of songbirds, raptors, and small mammals. These species contribute to the value of the area for uses other than hunting. No State or federally protected plant or animal species are known to exist in the management area.

The density of the vegetation at Black Hut prevents other recreational uses such as bird watching or nature hikes. The future development of recreational uses will depend on the priority given to Black Hut by State planners. However, it should be noted that Black Hut is valued by local residents as a wildlife management area and as a buffer to further development in the area. This value translates into an increase in property values and an improvement in the quality of life to local residents.

The Blackstone River and Valley has national significance as the birthplace of the American Industrial Revolution and the Rhode Island system of manufacturing. It has been designated by Congress as a National Heritage Corridor (RIDEM, Division of Planning and Development, 1986). After almost twenty years of discussion on the viability of a park along the Blackstone River and Canal, the park's development has now been undertaken. In Massachusetts, a Blackstone Heritage Park is being established. The first phase of this project is centered in Uxbridge. In Rhode Island, a three-mile stretch of the towpath and canal has been given priority in creating a park.

The Rhode Island portion of the Blackstone Linear Park will consist of some road and urban restructuring between the Sayles and Bernon Street bridges to maximize enjoyment of the river. Beginning at Island Park just west of Bernon Street Bridge, a loop trail is planned between Bernon and South Main Street bridges. Recreational and conservation features planned are canoeing (limited access) and a waterfront park, primarily for passive sports. The major cultural features include the Thundermist dam and a few remaining mill buildings that are currently in disrepair. In addition, a bikeway from Providence to the Massachusetts border, primarily along the banks of the Blackstone River, has been proposed and is intented to complement the Linear Park (RIDEM, Division of Planning and Development, 1987).

3.1.6.2 Socioeconomics

The proposed OSP site is located in the Town of Burrillville, Providence County, Rhode Island. Burrillville is located in the northwest corner of the State, about 20 miles northwest of Providence. It is bounded by Massachusetts on the north, by Connecticut on the west, by the Town of Glocester on the south, and by the Town of North Smithfield on the east. Burrillville comprises several villages;

its administrative center is the Village of Harrisville. The villages have become primarily rural residential communities for individuals working locally and in the nearby employment centers, such as Providence, Woonsocket, and in some cases Boston.

Infrastructure in Burrillville is typically rural but well established. The Burrillville Fire Department is volunteer and is located in six areas of the town--Pascoag (which serves the OSP site), Bridgeton, Harrisville, Oakland-Mapleville, Glendale, and Nasonville. Along with regular hook-and-ladder combinations, pumpers, and tank trucks, three companies have rescue trucks complete with inhalators and first-aid equipment and forest fire units. One company has a boat equipped for underwater rescue operations. Emergency medical services are provided by the town fire department. Hospital and emergency treatment centers are run by Northwest Community Nursing and Health Services and are available in and around nearby Providence and Woonsocket. The Burrillville Police Department has 15 employees, including the chief, deputy chief, sergeants, and patrolmen. Trash removal is not provided by the Town of Burrillville; all residents are required to dump rubbish at the town landfill. Burrillville has five public schools, which had an average daily membership of 2,545 in the 1983-1984 school year. Parochial and independent schools are available.

Recreation facilities consists of three large wildlife management areas, the Harrisville and Pascoag athletic fields, the Pascoag Reservoir, Wallum Lake, and Spring Lake, and the Casimir Pulaski Memorial Park. The State has converted the 134-acre Round Top area into a fish and game site.

The population of Burrillville was 13,164 in 1980 and 10,087 in 1970. The average population density in 1980 was 236 inhabitants per square mile. In 1980, the median age resident was 30.3 years old. According to census figures, 30.5 percent of Burrillville's inhabitants were under 18 years of age, 55.8 percent were between 18 and 64, and 13.7 percent were 65 and over. Current population projections, made in 1979, show an increase to 14,744 by the year 2000 and an increase to 15,007 persons by 2020. According to the 1980 census, there were a total of 4,602 housing units in Burrillville--an increase of 45.3 percent over 1970. Approximately 72.2 percent of occupied housing units were owner-occupied. The median value of owner-occupied housing, excluding condominiums, was $45,200. According to the 1980 census, Burrillville had a total civilian labor force of 6,077--

an increase of 48.5 percent since 1970. Table 3.1-11 describes the industry attachment, occupation, and class of employed workers 16 years of age and older residing in Burrillville.

The State of Rhode Island's population increased by 28,000 in the period 1980 to 1986, according to the U.S. Bureau of the Census. The Census estimates a population of 975,000 in July 1986.

Rhode Island has experienced a shift in the age composition of its population. Approximately 374,000 persons, or 39 percent of the population, are between the ages of 18 and 44. In addition, 203,000 are ages 45 to 64. In the period 1970 to 1980, the population under 5 years of age decreased by 25 percent, and the population 5 to 17 years decreased by 17 percent.

County trends in Rhode Island show percentage gains from 1970 to 1980 in Washington County (8.9 percent), Kent County (8.3 percent), and Bristol County (2.2 percent). As a result of withdrawal of Navy personnel, losses occurred in Newport County (13.6 percent) and Providence County, including Burrillville (1.7 percent).

Among Rhode Island communities, the greatest numerical gains were in the Towns of Narragansett, North Providence, Coventry, and South Kingston, and in the Cities of Warwick and Smithfield. The greatest percentage gains were for Narragansett, Charlestown, Richmond, West Greenwich, Glocester, and Jamestown.

Housing units in Rhode Island as of April 1, 1980, numbered 372,672--an increase of 54,983 or 17.3 percent over 1970. Of the total units in 1980, 10,039 were reported as seasonal, principally summer cottages.

New residential construction has shown the greatest volume in suburban communities throughout the State, but particularly to the south of Providence. The greatest numerical increases in new housing units in the decade ending in 1980 occurred in Warwick, Cranston, East Providence, and North Providence. The largest percentage increases occurred in Exeter, Glocester, Richmond, Charlestown, North Providence, and Burrillville.

A pronounced trend toward suburban growth, accompanied by a decline in population in some older and more densely populated cities, is in evidence

TABLE 3.1-11

Burrillville Labor Force Characteristics, 1980

INDUSTRY ATTACHMENT OF EMPLOYED PERSONS	
Agriculture, Forestry, Fishing, and Mining	76
Construction	330
Nondurable Manufacturing	819
Durable Manufacturing	1,126
Transportation	144
Communications and Utilities	97
Wholesale Trade	209
Retail Trade	637
Finance, Insurance, and Real Estate	181
Business Services	124
Personal Services	163
Health Services	1,040
Educational Services	367
Other Professional Services	113
Public Administration	274
OCCUPATION OF EMPLOYED PERSONS	
Executive, Administrative, and Managerial	363
Professional, Technical, Sales, and Administrative Support	583
Technicians and Support Occupations	219
Sales Occupations	384
Administrative Support and Clerical	742
Private Household	7
Protective Services	65
Service Occupations	969
Farming, Forestry and Fishing	73
Precision Production and Craft	854
Machine Operators and Assemblers	1,015
Transportation and Material Movers	236
Handlers, Equipment Cleaners, Laborers	190
CLASS OF EMPLOYED WORKERS	
Private Wage and Salary	4,252
Federal Government	153
State Government	704
Local Government	334
Self Employed	244
Unpaid Family Worker	13

SOURCE: 1980 U.S. Census.

throughout the country, particularly in major metropolitan areas. In the City of Providence, the major population declines appeared in densely populated lower income areas.

The Rhode Island economy showed strong advances between 1986 and 1987, setting record highs in employment and average monthly wage and salary employment. Average total employment increased from 429,500 in 1985 to 442,100 in 1986. Manufacturing employment increased by 300 in 1984, to 119,400; nonmanufacturing employment increased by 12,600. Average hourly earnings for production workers in manufacturing increased to $7.91, up 4.2 percent from 1985; production workers' weekly wages increased by 5 percent and averaged $320.36.

The Rhode Island unemployment rate for 1986 averaged 4.1 percent, compared to a national average of 7 percent. The unemployment rate continued to decline in 1987. The Rhode Island civilian labor force has added 7,300 workers per year.

The Town of Uxbridge in Worcester County, Massachusetts, will also receive impacts if the proposed OSP power plant is located on the Sherman Farm Road site. In 1980, Uxbridge's population was estimated at 8,374; growth in Uxbridge--5.9 percent between 1970 and 1980--has been slower than in other towns in Worcester County. Population statewide increased approximately 8 percent between 1970 and 1980.

Housing units in Uxbridge increased 16 percent between 1970 and 1980, with approximately 3,056 year-round housing units in 1980. Growth in housing units has increased significantly since 1980; approximately 721 building permits were issued in Uxbridge between 1980 and 1985. The total valuation of real property in the Town of Uxbridge was $180 million in 1986. Property is valued at 100 percent of current market value.

Uxbridge is part of the Worcester Metropolitan Statistical Area, and the Southern Worcester Delivery Area, as delineated by the Massachusetts Division of Employment Security. Between 1985 and 1986, the Southern Worcester Delivery Area experienced area job gains in all sectors except manufacturing. The greatest percentage gain was in construction, which grew at 17.7 percent. The area's employment growth rate was 3.1 percent, exceeding the State's growth rate of 1.9 percent. The construction sector is expected to continue to grow at a record pace.

Table 3.1-12 presents employment by industry group for the Uxbridge labor force. Uxbridge's overall unemployment rate is 5.4 percent, higher than the Southern Worcester Delivery Area and State averages of 3.8 percent.

Information on Burrillville's recent history (population, economy and finance, land use, facilities) can be found in the Burrillville Comprehensive Community Plan (Rhode Island Development Council Planning Division, 1966).

3.1.6.3 Transportation

Burrillville is traversed by a few two-lane highways and several smaller rural roads. No major highways run through Burrillville. Route 7, the Douglas Pike, enters Burrillville near Oak Valley, travels northwest, and exits at the Massachusetts State line northwest of the Sherman Farm Road site. This road is a two-lane highway through Nasonville, a two-lane road to Mohegan, and a rural road to the State line. Douglas Pike, generally running south to northwest, provides access to the site from Providence via I-295.

Route 98 is Sherman Farm Road to the north of Harrisville and Steere Farm Road to the south. It runs north from its intersection with Route 100 north of Chepachet to the Masschusetts State line. The entrance to the OSP site will be on Sherman Farm Road.

Route 100 runs diagonally from south-central Burrillville to the Massachusetts border. It services the site as part of a route comprising Sherman Farm Road, Route 100, Route 44 (out of Providence through Greenville to Slatersville), and Route 107, an east-west connector from Pascoag through Harrisville to Route 102 and the Victory Highway. Other small rural roads complete the arterial pattern in Burrillville.

Eleven airlines provide over 160 scheduled flights daily at T. F. Green Airport in Providence. Four major airlines (American, Piedmont, United, and U.S. Air) operate more than 100 scheduled flights daily, with service to more than 20 eastern cities. In addition, several regional airlines provide frequent scheduled service to New York, Boston, Baltimore, Philadephia, and Washington, among other cities.

In addition to the T.F. Green Airport, the Rhode Island Department of Transportation operates five general aviation airports, each with private plane and charter facilities. These airports are Westerly State Airport in Westerly, at the

TABLE 3.1-12

Employment by Trade in Uxbridge, 1985

Sector	Persons Employed
Wholesale and Retail Trade	668
Manufacturing	555
Government	328
Transportation, Communications, and Public Utilities	167
Services	129
Contract Construction	116
Mining	0
Agriculture, Forestry, Fishing	34

SOURCE: OSP, October 1987.

border with Connecticut; Block Island Airport; Newport State Airport; Quonsett State Airport in North Kingstown near Wickford; and the North Central State Airport in Smithfield, which is closest to the site.

There is no rail service to the site area, though the Providence and Worcester Railway connects to other Rhode Island industrial sites. This rail network allows access to the entire United States and Canadian rail system through east-west routes via Central Vermont/Canadian National System, Conrail, and the Boston and Maine Railroad.

The Providence and Worcester Railway offers piggy-back service to and from Rhode Island. The railroad supplies freight cars, trailers, and containers, and will also provide the services of a custom house broker, shipping agent, and foreign freight forwarder.

Narragansett Bay is a deep-water ocean port with access to the Atlantic Ocean. General, bulk, and containerized cargos are handled by facilities located in Providence, East Providence, North Kingstown, Portsmouth, Middletown, Newport, and Tiverton. The Port of Providence is a major distribution center for petroleum products and automobiles in southern New England. Other important cargo handled through Providence includes scrap iron, lumber, chemicals, cement, asphalt, and steel. The Port of Providence is a port of destination for containerized cargo. Strategically located between the major commercial centers of Boston and New York, it is a full-service port accessed by a 40-foot (12-meter) channel. There are 10.5 miles of commercial waterfront, with 27 wharves and piers to accommodate deep and medium draft vessels. The City of Providence Municipal Wharf has 4,750 feet of berthing space, with a 40-foot mean low water depth. Two 750-ton container cranes are located at Berth No. 6. The wharf is serviced by adjacent railroad tracks and 265,000 square feet of transit and storage shed space, as well as 45 acres of open storage area.

In addition to facilities at the head of Narragansett Bay, former U.S. Navy bases in Portsmouth, Middletown, and North Kingstown provide excellent piers for handling bulk and general cargo. These facilities are operated by the Rhode Island Port Authority.

3.1.6.4 Visual and Aesthetic Factors

Existing visual resources surrounding the Sherman Farm Road site are typical of similar surroundings in Massachusetts and Rhode Island. The area is heavily forested, with residences interspersed throughout. Houses are single-family dwellings, typically wood frame structures on wooded lots. Lot sizes in this part of Burrillville tend to be in the range of 2 to 5 acres. The Black Hut State Management Area, located south and southeast of the site, is densely forested.

The pristine character of the area is broken by several transmission line, gas pipeline, and AT&T cable rights-of-way. These linear clearings are a significant visual factor in the area.

There are no unique scenic resources in the vicinity of the Sherman Farm Road site. There are few potential viewers in the area since both residential density and traffic demand on area roadways are low.

3.1.6.5 Historic and Archeological Resources

3.1.6.5.1 Plant Site

A literature search of Federal Register Annual Listings of Historic Properties did not identify any listed properties on the plant site. However, two properties of potential historic significance are located on the south side of West Ironstone Road:

- Burlingame Mitchell Farm--a mid-nineteenth century farm complex with a 1.5-story Greek Revival farmhouse, a shed, and a large, vertical-board-sided barn set back from the road and fronted by a stone wall.
- J. Reynolds Farm--a mid-nineteenth century farm complex with a small farmhouse and several outbuildings.

There are no significant aboveground resources on the site itself.

A review of the proposed OSP project by the Rhode Island Historic Preservation Commission (RIHPC) indicated that further study was necessary to quantify any potential below ground resources at the Sherman Farm Road site. The Rhode Island Historic Preservation Commission recommended that a Phase I cultural resources survey be conducted to identify and assess any archeological resources that may exist in the project area. The recommended survey was performed by the Public Archeology Laboratory, Inc. (PAL), an approved consultant in accordance with Rhode Island Historic Preservation Commission guidelines (RIHPC, 1982).

Public Archeology Laboratory, Inc. examined Rhode Island Historic Preservation Commission files to gain background information on known prehistoric and historic sites in the Burrillville area. Published and unpublished reports of previous research in the vicinity of the project site were reviewed (Thorbahn and Cox, 1983; Solomon and Depaoli, 1981). Town histories and old maps were studied to determine if historic sites were located on or near the project site (Wallings, 1855; Beers, 1870; Everts and Richards, 1895). The consultant also reviewed geological studies and soil surveys of Rhode Island (Quinn, 1971; USDA, 1981).

A "walkover" survey and close visual inspection of the site were conducted to locate any surface indications of prehistoric or historic sites, as well as to plan the subsurface exploration. Remnant stone foundations of a barn or stable were the only surface indications of past settlement discovered in this examination. They were judged to have little historic significance. Areas within the 120-acre project site with the highest potential to contain historic or archeological sites were chosen for transects (cross sections) during this survey. A total of 24 transects were delineated, and 175 test units (pits) were excavated at intervals along these transects. Each test pit was a 30-by-30-centimeter square excavated in 10-centimeter increments. All material removed from the test units was passed through a 0.25-inch screen to recover all possible cultural materials. Where such cultural material was identified, additional test units were excavated to further investigate the deposit.

Lithic flakes and shatter--possible remnants of stone-tool fabrication--were the only cultural materials recovered from the test pits. A concentration of these materials was found in one unit, which was then opened up to a 1- by 1-meter pit. Several small pieces of charcoal, three core fragments, and 50 pieces of quartz chipping debris were recovered from this excavation. Located outside the proposed project construction area, it was designated the Crow Hollow site. An intensive survey would be required to determine if the Crow Hollow site is eligible for the National Register of Historic Places. Since no archeological remains of potential significance were discovered within the proposed construction area, the consultant recommended that no further investigations were justified. The Rhode Island Historic Preservation Commission concurs with this recommendation (PAL, 1987a) as does the FERC Staff.

A family cemetery is located near the Sherman Farm Road site. The plant facilities closest to the cemetery would be approximately 250 feet away. The cemetery likely dates between the late eighteenth and early nineteenth centuries, based on data derived from field inspection and archival research (PAL, 1988b). It is not maintained and has been overgrown for many years. In consultation with the Rhode Island Historic Preservation Commission, OSP has realigned the layout of the proposed plant to provide a sufficient buffer between the historic cemetery and the area to be disturbed for plant construction.

3.1.6.5.2 Water and Oil Pipelines

Cultural resources investigations are in progress for the water and oil pipelines. Sensitivity for cultural resources at these locations was addressed by the Rhode Island Historic Preservation Commission. According to Rhode Island Historic Preservation Commission, diverse upland environmental settings in the region were highly sensitive to both prehistoric and historic archeological resources. Moreover, Rhode Island Historic Preservation Commission indicated that eight cultural resources listed on the National Register of Historic Places (NRHP) occurred in the proposed area of the water and oil pipelines.

FERC Staff conducted a site file check and cultural resources overview at the Rhode Island Historic Preservation Commission to identify National Register of Historic Places-listed sites that would be affected. Two historic districts (the Union Village District in North Smithfield and the South Main Street Historic District in Woonsocket) would be crossed by the proposed pipelines. Three cultural resources listed in the NRHP (the 1761 Milestone, the Smithfield Monthly Meeting of Friends Meeting House, and the Peleg Arnold Tavern in North Smithfield) are adjacent to the proposed pipeline route. Three other sites (the Parsonage and Cemetery in Woonsocket, and the Slatersville Historic District in North Smithfield) would be avoided.

In coordination with OSP, the Rhode Island Historic Preservation Commission has indicated to the FERC Staff that Rhode Island Historic Preservation Commission field visits are in progress to assess the integrity of cultural resources in unspoiled areas and presently disturbed areas along the proposed pipeline routes. Based on its field inspections, the Rhode Island Historic Preservation Commission will make recommendations on the amount and level of cultural resource surveys, if necessary, to identify cultural resources. Based on the results of any surveys, the FERC Staff, in consultation with the Rhode Island Historic Preservation Commission, will determine if any other identified cultural resources are eligible for the National Register of Historic Places. If any eligible sites cannot be avoided, the FERC Staff, in consultation with the Rhode Island Historic Preservation Commission, will assess the effect of the pipelines on these significant cultural resources (as well as the National Register of Historic Places-listed cultural resources) and provide the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on the merits of the project and any proposed mitigation plans.

3.2 GAS PIPELINES

Section 3.2 describes the affected environment for the gas pipelines, as listed below:

- Section 3.2.1--Geology and Soils
- Section 3.2.2--Water Resouces
- Section 3.2.3--Air Quality
- Section 3.2.4--Sound Quality
- Section 3.2.5--Ecology
- Section 3.2.6--Sociocultural Resources.

3.2.1 Geology and Soils

The proposed pipeline loops, extension, and meter and compressor facilities lie within the Appalachian Highlands physiographic region, which includes all of the mountain and plateau areas of the eastern United States. Loops 1 and 4, the Lewiston Meter Station, and Compressor Stations 230B, 230C, and 233 lie within the Central Lowlands Province. Loop 5 lies within the Appalachian Plateau Province, while Loop 6 is found within the Ridge and Valley Province. Loop 7, compressor station 264, and the Rhode Island Extension pipeline lie within the New England Province.

Most of the soils upon which the proposed loops, compressor and meter stations, and Rhode Island Extension would be sited developed from deposits laid during the last glacial period, which ended approximately 12,000 years ago. As the glaciers of this period advanced and retreated, preglacial soil and bedrock were crushed, ground, and mixed into a heterogeneous mass of rock, gravel, sand, silt, and clay called glacial till. The manner in which the glacial till was deposited has an important bearing on the characteristics of the soils today. Coarse materials (e.g., rock, gravel, and sand) settled out at the headwaters of glacial rivers. Glacial outwash of the finer silt and clay particles was carried to the valleys. Glacial lakes left lacustrine deposits that are the parent materials of many of the poorly drained, fined-textured soils in the project area. Glacial till that was not carried off by water remained to form ground moraine, the most common parent material in the project area, which is found from the mountainous uplands to the level, arable plains.

The soils in this area fall into five main groups--deep, rocky, wet, sandy, and organic. Each group presents unique concerns with regard to pipeline construction techniques and revegetative efforts.

Wet soils predominate along the proposed Main Line and Rhode Island Extension pipeline routes. A total of 19.21 miles or 53 percent of the total pipeline length would traverse soils that have high water tables 0 to 2 feet. Most of these soils are farmed or wooded. Soils that are farmed generally require the use of drainage tiles. These soils usually dry out slowly in the spring making early planting and machinery operation difficult.

Approximately 7.3 miles or 20 percent of the proposed pipeline consists of deep soils with a depth to bedrock generally greater than 5 feet. Most of those soils are farmed but do not require the use of drainage tiles.

Rocky soils comprise 15 percent or 5.4 miles of the proposed gas pipeline route. Generally, these soils form on the upper slopes of hills and have slopes ranging from 0 to 35 percent. Most of these soils are extremely stony; rock outcrops are common throughout the area. Most of the soils in this group are forested or pastured as their stonieness makes them unsuitable for farming. The erosion hazard is severe on the steeper slopes of this group.

Sandy soils lie along 3.5 miles or 9.6 percent of the route. These soils are mainly farmed or used for urban development. Because these soils are well drained droughtiness and low nutrient contents limits farming. Wind erosion is a problem where excavated areas are left bare.

The least prevalent group of soils crossed by the proposed gas pipeline are the organic soils. Only 2 percent or 0.6 miles of the proposed gas pipeline would cross these soils. This group of soils, by virtue of their high organic content and high water table (0.0-1.0 foot) consist exclusively of wetland habitat. These organic soils have slopes of less than 2 percent.

Table 3.2-1 groups soils in the project area by category and lists all soil subgroups that comprise each of these categories.

TABLE 3.2-1

Soil Groups Along Gas Pipelines

Soil Group/Soil Classification	Mileage	Percent of Total
PIPELINE LOOPS		
Wet Soils	18.25	72
Aquic Udorthents Aeric Ochraqualfs Mollic Ochraqualfs Glossoboric Hapludalfs Aeric Haplaquepts Aquic Udipsamments Typic Psammaquents Mollic Haplaquepts Glossaquic Hapludalfs Typic Fragiochrepts Aeric Fragiaquepts Typic Fragiaquepts		
Deep Soils	5.88	23
Typic Udorthents Glossoboric Hapludalfs Dystric Eutrochrepts Typic Dystrochrepts		
Sandy Soils	0.77	3
Aquic Udipsamments Typic Udipsamments		
Organic Soils	0.60	2
Typic Medisaprists Terric Medisaprists		
TOTAL	25.50	100
RHODE ISLAND EXTENSION		
Rocky Soils	5.40	51
Typic Dystrochrepts Lithic Dystrochrepts		
Sandy Soils	2.70	26
Typic Dystrochrepts Typic Udipsamments		
Deep Soils	1.44	14
Typic Fragiochrepts		
Wet Soils	0.96	9
Typic Fragiochrepts		
TOTAL	10.50	100

3.2.2 Water Resources

3.2.2.1 Surface Water

3.2.2.1.1 Hydrology

The proposed loops and the Rhode Island Extension would cross one river, numerous perennial and intermittent streams, one small pond, and several freshwater wetlands. A list of the perennial stream crossings organized by loop is presented in Table 2.2-3.

The proposed loops and the Rhode Island Extension would traverse three major river basins--Eastern Great Lakes-St. Lawrence, Delaware-Hudson, and New England River.

The Eastern Great Lakes-St. Lawrence Basin drains approximately 47,000 square miles in New Hampshire, New York, Pennsylvania, Ohio, Indiana, and Michigan, discharging 40 billion gpd into Lake Erie, Lake Ontario, and the St. Lawrence River. Located in this basin are Loops 1, 4, and 5; the Lewiston Meter Station; and Compressor Stations 230B, 230C, and 233. The following subbasins will be affected by the proposed facilities:

- Niagara subbasin (Lewiston Meter Station).
- Niagara and Oak Orchard-Twelve Mile subbasins (Loop 1).
- Oak Orchard-Twelve Mile subbasin (Compressor Station 230C).
- Seneca subbasin (Loop 4).
- Buffalo-Eighteen Mile subbasin (Compressor Station 230B).
- Genesee River subbasin (Compressor Station 233).
- Oneida subbasin (Loop 5).

The Delaware-Hudson River Basin drains approximately 31,000 square miles in Delaware, New Jersey, Pennsylvania, New York, and New Hampshire, discharging 32 billion gpd into Delaware Bay and Long Island Sound. The Middle Hudson River subbasin would be affected by construction of Loop 6.

The New England River Basin drains approximately 59,000 square miles in Maine, Massachusetts, New Hampshire, Vermont, Connecticut, Rhode Island, and New York, discharging 67 billion gpd into the Atlantic Ocean. This basin is divided into numerous subbasins, each of which consists of a relatively short river emptying directly into the Atlantic Ocean. The Westfield River subbasin will be affected by the proposed construction of Loop 7, the Quinebaug River subbasin by modifications at Compressor Station 264, and the Blackstone River subbasin by construction of the Rhode Island Extension.

In an average year, the New England states receive approximately 40 inches of precipitation, which includes an average 60 or more inches of snowfall. In colder mountainous areas, much of this snowfall does not melt until the spring thaw. The region's watercourses can experience extremely heavy flows in March and April due to spring thaws and heavy precipitation in the same season. Large ice jams may also cause flooding. The lowest flow conditions usually occur in late summer or early fall (August and September). Surface water runoff varies greatly throughout the affected area, but ranges between 15 and 30 inches annually.

Continental glaciation caused some unique geological formations in the project area. Massive glaciers carved out huge depressions in the rock, which later filled with water, forming lakes. Loop 4 of the proposed project is in the northeastern section of the Finger Lake region of New York. Some of these lakes are very deep, have excellent water quality, and are famous for trout production. The shallower lakes are generally too warm for trout, but nonetheless have excellent water quality and support large fish populations.

Wetland areas have formed in shallow glacial scours. These wetlands vary in size, and many have been filled over the years for development. Most of the wetlands that remain are protected by state law; special permits must be issued to authorize encroachments.

3.2.2.1.2 Water Quality

Surface water quality in the rivers, streams, ponds, and wetlands along the proposed route of the loops and Rhode Island Extension, and at the meter and compressor stations, varies widely. While small mountain streams may be cool, clear, and pristine, major rivers--having suffered decades of degradation from urban and industrial activities--show signs of serious anthropogenic contamination.

The Niagara River, at the Lewiston Meter Station and western end of Loop 1, has experienced serious water quality problems from urban and industrial activities along its banks. Riverbed sediments are likely to contain various organic and inorganic contaminants. Most of the small, intermittent streams along Loop 1 are tributaries of Fourmile, Twelvemile, and East Branch Twelvemile Creeks. Many of these small streams have been channelized to facilitate drainage and agricultural activities. As a result, high nutrient levels and concentrations of agrochemicals are common due to surface runoff and direct drain tile discharge. These conditions have significantly reduced water quality. Standing water in wetlands along Loop 1 and at Compressor Station 230B may also vary in quality. Natural processes that facilitate nutrient uptake in wetlands will generally tend to have a cleansing effect on their quality.

The small streams to be crossed by proposed Loops 4 and 5 generally have been left in their natural conditions. Like those along Loop 1, these streams receive agricultural surface runoff from adjacent farms. However, the nutrient and agrochemical concentrations reaching these streams may be mitigated somewhat by buffer zones of natural vegetation that line certain sections of the stream channel. The large cedar swamp (Nelson Swamp) wetland along Loop 5 contains standing water during parts of the year. This water is of generally good quality and supports a variety of swamp vegetation, though pH levels may be very low (acidic).

The western end of Loop 6 is within the flood plain of the Hudson River. Like the Niagara, the Hudson has experienced years of degradation from urban and industrial activities. In recent years, Federal and State efforts have been directed at mitigating activities that provide sources of contamination, and as a result the quality of the Hudson in the vicinity of Loop 6 may be improving.

Two streams in the vicinity of Loop 6--Vierda Kill and Moordener Kill--are protected by the State of New York for their high quality. Moordener Kill, which would be crossed by Loop 6, was observed during a site visit in September 1987 to be a clear, cool stream of apparent high quality.

Streams along Loop 7 in Southwick, Massachusetts, vary significantly in quality. Small intermittent streams at the western end of the loop are subject to agricultural runoff from crops and livestock operations. At the eastern end of Loop 7 is Great Brook, a tributary to Westfield River noted for its high quality. During a site visit in September 1987, Great Brook was observed to be clear and cool with areas of rock and gravel streambed--characteristics of streams capable of supporting high quality, cold water fisheries.

Surface waters in the streams, ponds, and wetlands crossed by the proposed Rhode Island Extension are generally of high quality. The rural, sometimes remote, character of these water bodies is a significant factor in maintaining this quality. Swans Pond, near the northern end of the extension, is fed by a relatively small drainage area containing one small brook of a quality considered sufficiently high to support a cold water fishery. The pond receives some agricultural runoff and contains enough nutrients to support a large population of floral species that were observed (during a site visit in September 1987) across the entire pond. The Extension would be crossed by several streams similar to the small feeder entering Swans Pond.

In general, these streams arise in rocky, sparsely populated areas with steep slopes. Their general quality is considered high enough to support cold water fisheries, particularly trout populations. Seasonal fluctuations in water quality in these small streams may occur in response to corresponding fluctuations in stream discharges. Many of these small streams feed wetlands along the route of the extension. These high quality inflows generally support high quality wetlands, which, in turn, support a variety of plant species that remove nutrients in solution and enhance the quality of streamflows passing through the wetlands.

3.2.2.2 Groundwater

Readily available groundwater and recharge areas in New York are largely in unconsolidated sand and gravel. Bedrock formations generally yield small-to-moderate supplies of water, though there are exceptions. The productive unconsolidated deposits include primarily glacial outwash sand and gravel in upstate valleys. The most productive of these are glacial outwashes that underlie large floodplains and terraces; the largest can yield several hundred gallons per minute. The quality of water from these Upper Devonian rocks and Pleistocene outwash deposits is generally suitable for domestic consumption and farm use.

The principal aquifers in Massachusetts are in stratified glacial drift, found primarily in flood plains, terraces, and lowlands. Many of the aquifers found in these deposits are thin and unconfined, with most having hydraulic connections to watercourses. Underlying much of the upland area of Massachusetts are crystalline bedrock formations that yield enough water for domestic use. Generally, the quality of groundwater in these areas is good.

3.2.3 Air Quality

3.2.3.1 Climate and Meteorology

The proposed modifications to the Tennessee Gas Company pipeline and its associated compressor facilities will be performed at various locations along the pipeline route. The affected route extends approximately 400 miles from Niagara Falls in western New York, across central New York State, through southern Massachusetts, and into extreme northwestern Rhode Island to the site of OSP's proposed electric generating station near Burrillville.

The climate over the entire pipeline route is relatively similar and typical of the Northeast. Considerably varied temperature conditions exist over the project area, with an average annual mean temperature range of 40° to 50°F. Summer temperatures range from the upper 70's to the mid 80's. In winter, the temperatures average between the upper teens and the mid 20's. Precipitation is distributed fairly evenly throughout the year, with annual average precipitation totals of approximately 45 to 50 inches. Snowfall varies with elevation and distance from coastal waters, with seasonal totals ranging from 35 to more than 70 inches. Thunderstorms occur on the average of about 30 days/year. Tornadoes, hurricanes, and tropical storms are uncommon.

3.2.3.2 Ambient Air Quality

The affected pipeline facilities will cross a number of EPA-designated air quality control regions in New York, Massachusetts, and Rhode Island. EPA publishes determinations (40 CFR 81) as to whether air quality control regions attain national standards for five pollutants--PM, SO_2, CO, nitrogen dioxide (NO_2), and O_3.

According to EPA determinations, the affected pipeline sections and Compressor Stations 230B, 230C, 233, and 264 are all currently located in areas where PM, SO_2, CO, and NO_2 levels either "cannot be classified" or are "better than national standards." O_3 levels are classified as not meeting primary standards in Massachusetts and Rhode Island and are either unclassifiable or better than national standards in New York.

3.2.4 Sound Quality

The proposed modifications to the Tennessee Gas pipeline and its associated compression facilities would result in increases in ambient sound levels at various locations along the affected pipeline route. The sound levels at these locations would be affected by both construction and permanent operation of the proposed gas pipeline. Aside from some temporary noise associated with construction, the pipeline itself is not expected to generate any significant permanent noise. The only source of permanent noise would result from operation of Compressor Stations 230B, 230C, and 233 in western New York and 264 in southern Massachusetts. The description of existing environmental sound quality is therefore limited to the four affected compressor station site locations.

Two commonly used statistical measures for relating the time-varying quality of environmental noise with the known effects on people are the 24-hour equivalent sound level ($L_{eq\ (24)}$) and the day/night sound level (L_{dn}). The $L_{eq\ (24)}$ is the sound level equivalent to the actual time-varying sound energy averaged over a 24-hour period. The L_{dn} is the $L_{eq\ (24)}$ with a 10-dB weighting on the A-weighted scale (dBA) applied to the nighttime sound level (10 p.m. to 7 a.m.) to account for the difference in annoyance between daytime and nighttime noise. A 10-dBA drop in noise levels from day to night is typical of quiet areas. Other statistical measures of environmental noise are L_{90}, the noise level that is exceeded 90 percent of the time; and L_{10}, the noise level exceeded 10 percent of the time. L_{90} is often used to describe the residual noise levels in rural areas--the background noise that persists in the absence of intrusive noise such as cars, airplanes, and other intermittent activities.

There are presently no noise regulations for the State of New York; however, the New York Public Service Commission recommends that compressors be designed to an L_{eq} of 40 dBA at the nearest residences in areas where the existing L_{90} is less than 40 dBA. If the existing L_{90} exceeds 40 dBA, the compressors should be designed to increase the L_{90} at the nearest residence by no more than 10 dBA (excluding impact noises such as blasting). The Commonwealth of Massachusetts also has no regulations limiting noise; however, an "enforced guideline" limits noise impacts to 10 dBA above the existing background levels, where background is defined as ambient L_{90} levels during the quiet hours of the day. This guideline excludes impact noises such as blasting.

3.2.4.1 Compressor Station 230B

Compressor Station 230B is located in Erie County near East Aurora, New York. The area surrounding the site is predominantly rural and agricultural, with a trailer park and several farmhouses located to the west and south (see Figure 3.2-1). It is also bordered on the east side by Hunters Creek County Park. The nearest noise-sensitive areas to the compressor building are three residences (located 2,100 feet west, 1,950 feet southwest, and 2,100 feet south) and the trailer park (located 1,800 feet west). Hunters Creek County Park is also a noise-sensitive area that could be affected by compressor operation. Current uses of the park include outdoor activities such as hiking and cross-country skiing, primarily on weekends. Existing noise sources in the immediate vicinity of the site include Reiter Road and the East Aurora sales meter station on Reiter Road.

A noise survey was conducted in December 1982 at two locations on the property--points A and B, shown in Figure 3.2-1. These are the two closest property boundaries to any residences. Sound levels were recorded (FERC, 1986) for over 23 hours at location A, the southwest corner; and for over 44 hours at location B, the west property line. The results of this survey yielded an L_{dn} of 50.7 and 57.7 dBA, and an L_{90} of 39.2 and 38.7 dBA at locations A and B, respectively.

The orientation of the site is such that the compressor building is located on the west side of an approximate 60-foot hill that acts as a natural noise barrier for Hunters Creek Park. The area between the trailer park and the compressor site is wooded.

3.2.4.2 Compressor Station 230C

The proposed Compressor Station 230C site is a 58-acre tract on Lockport Junction road, approximately 2 miles west of Lockport, New York, in Niagara County (Figure 3.2-2). The compressor building will be located approximately 2,000 feet from the roadway. A Conrail line and NY Route 31 are located approximately 1,000 feet and 3,500 feet south of the compressor, respectively. A Harrison Radiator manufacturing facility is approximately 8,000 feet east, and a large warehouse is located approximately 1,500 feet southeast of the proposed compressor building. A salvage yard and a large bus garage are located approximately 500 to 1,000 feet south of the site along Lockport Junction Road.

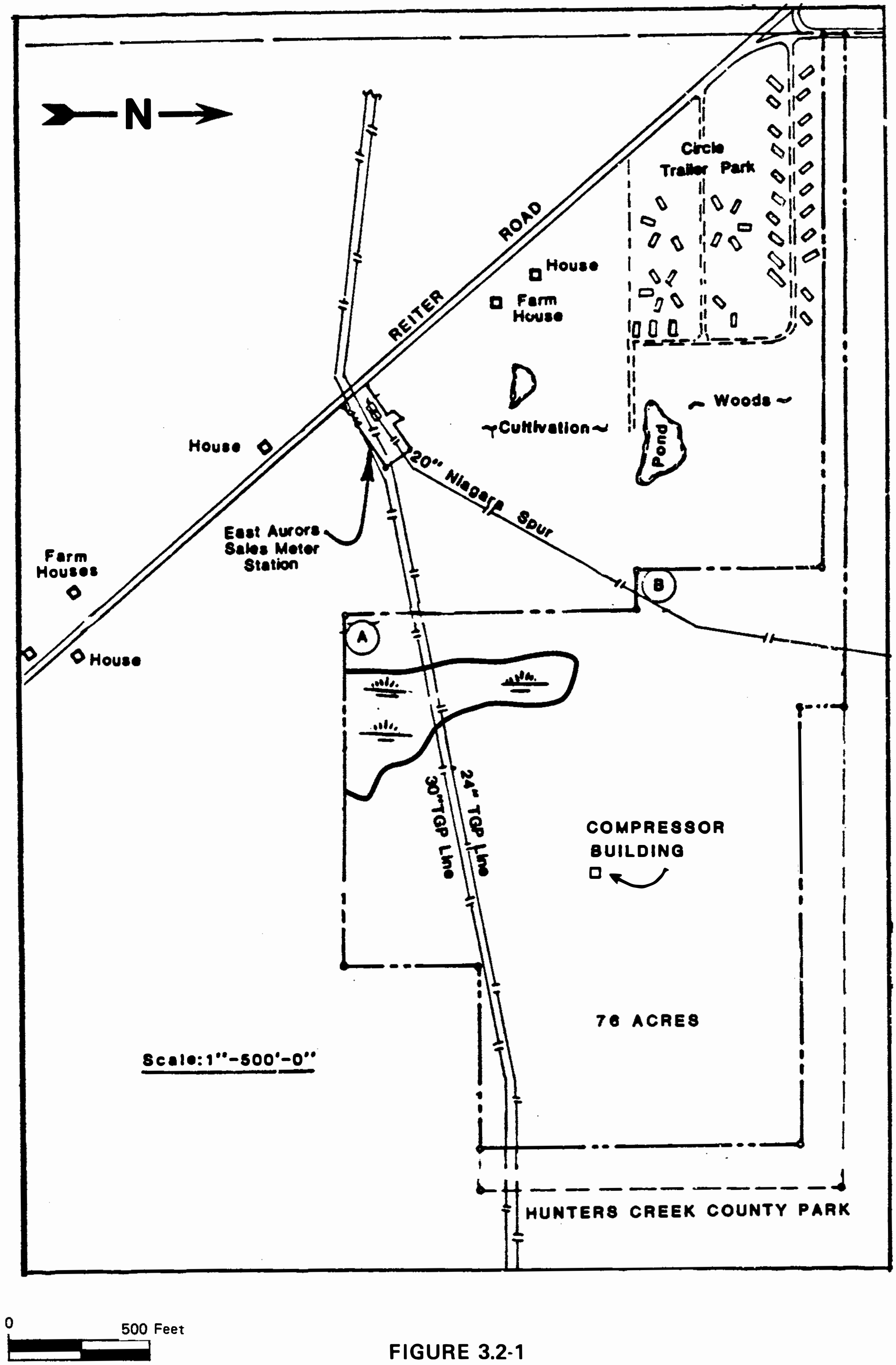
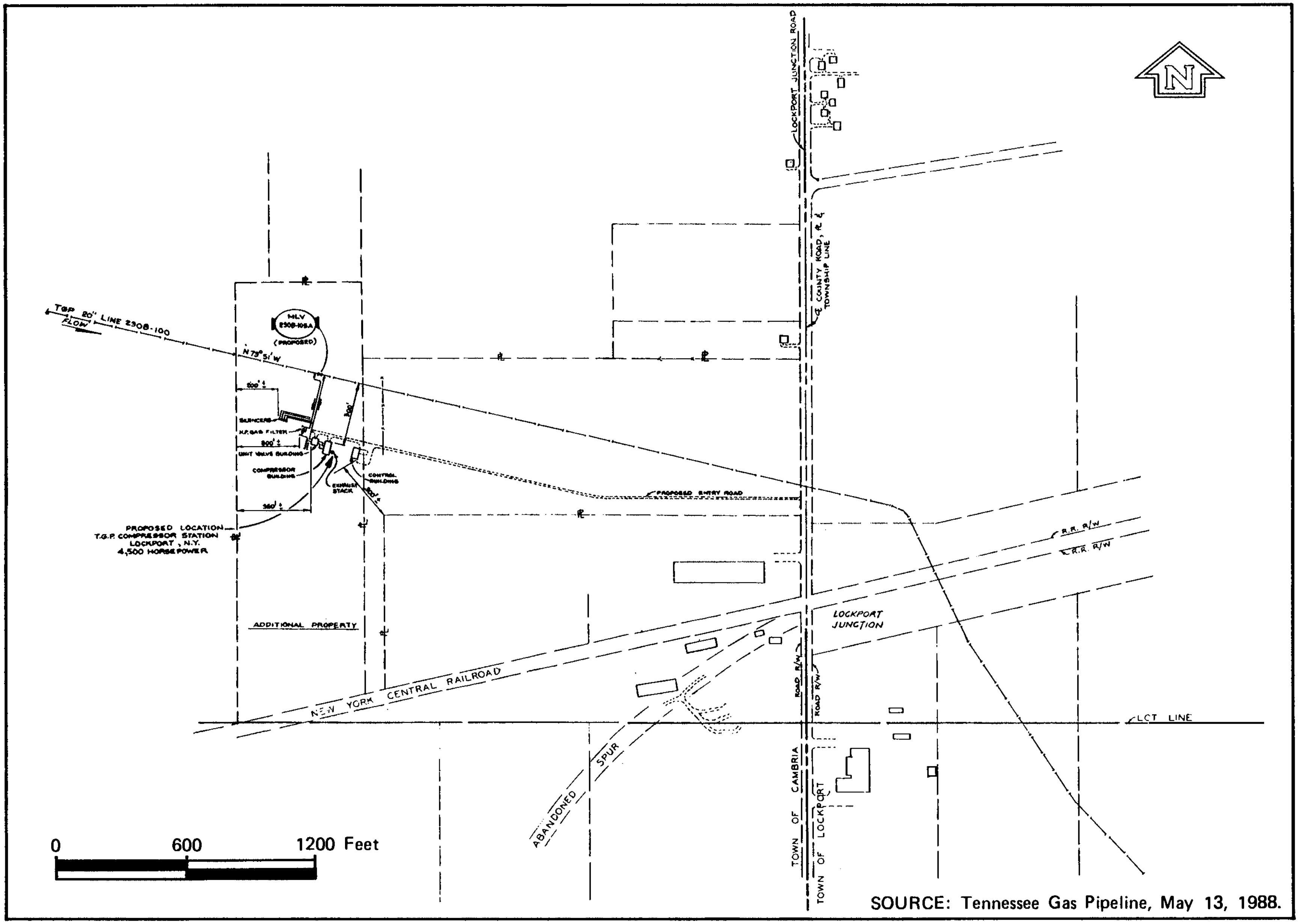


FIGURE 3.2-1
COMPRESSOR STATION 230B SITE
ERIE COUNTY, NEW YORK

SOURCE: FERC (1986)



SOURCE: Tennessee Gas Pipeline, May 13, 1988.

FIGURE 3.2-2
COMPRESSOR STATION 230C SITE
NIAGARA COUNTY, NEW YORK

The nearest residence is approximately 2,100 feet east of the proposed compressor building. The site is immediately surrounded on the north, east, and west by idle and cultivated land.

Ambient sound levels were measured around the proposed site (Tennessee Gas Pipeline Company, September 25, 1987) at the location of the nearest noise-sensitive receptor. The results of this survey were an L_{dn} of 62.8 dBA and an L_{90} of 46.3 dBA. The high noise levels were primarily due to traffic.

3.2.4.3 Compressor Station 233

The 80-acre site for Compressor Station 233 is located near York, New York, in Livingston County. The site is an agricultural area with scattered houses to the west and south. The nearest noise-sensitive areas are the residences located 800 feet south and 1,180 feet northwest of the compressor building location, as shown in Figure 3.2-3.

Existing noise sources in the immediate vicinity of the site include Dow Road at the south property line and Federal Road on the west property line. Background ambient noise levels were measured by Tennessee Gas Pipeline Company in October 1982 (FERC, 1986) at locations A and B, as shown in Figure 3.2-3. Sound levels were recorded for 94 hours at location A and 143 hours at location B. The results of the survey yielded an L_{dn} of 52.1 and 55.5 dBA and an L_{90} of 40.3 and 37.6 dBA at locations A and B, respectively.

3.2.4.4 Compressor Station 264

Compressor Station 264 is located in Massachusetts in a rural agricultural area of southern Worcester County. The area is relatively remote; only a few residences are in the vicinity of the site. The closest noise-sensitive locations to the compressor building are residences located 1,000 feet north, 700 feet east-southeast, 700 feet east-northeast, and 1,100 feet south-southeast.

A noise level survey for Compressor Station 264 was performed on February 2, 1987 (Tennessee Gas Pipeline Company, February 1987). The data were obtained while the station was operating at full load and at several locations around the facility, as shown in Figure 3.2-4. The results of this survey indicate that the highest L_{eq} recorded in the vicinity of any residence is 58 dBA (house 4). The L_{eq} values recorded at the other nearest houses (1 & 2 and 4) are 51 and 58 dBA, which correspond to an L_{dn} of 57.4 and 64.4 dBA.

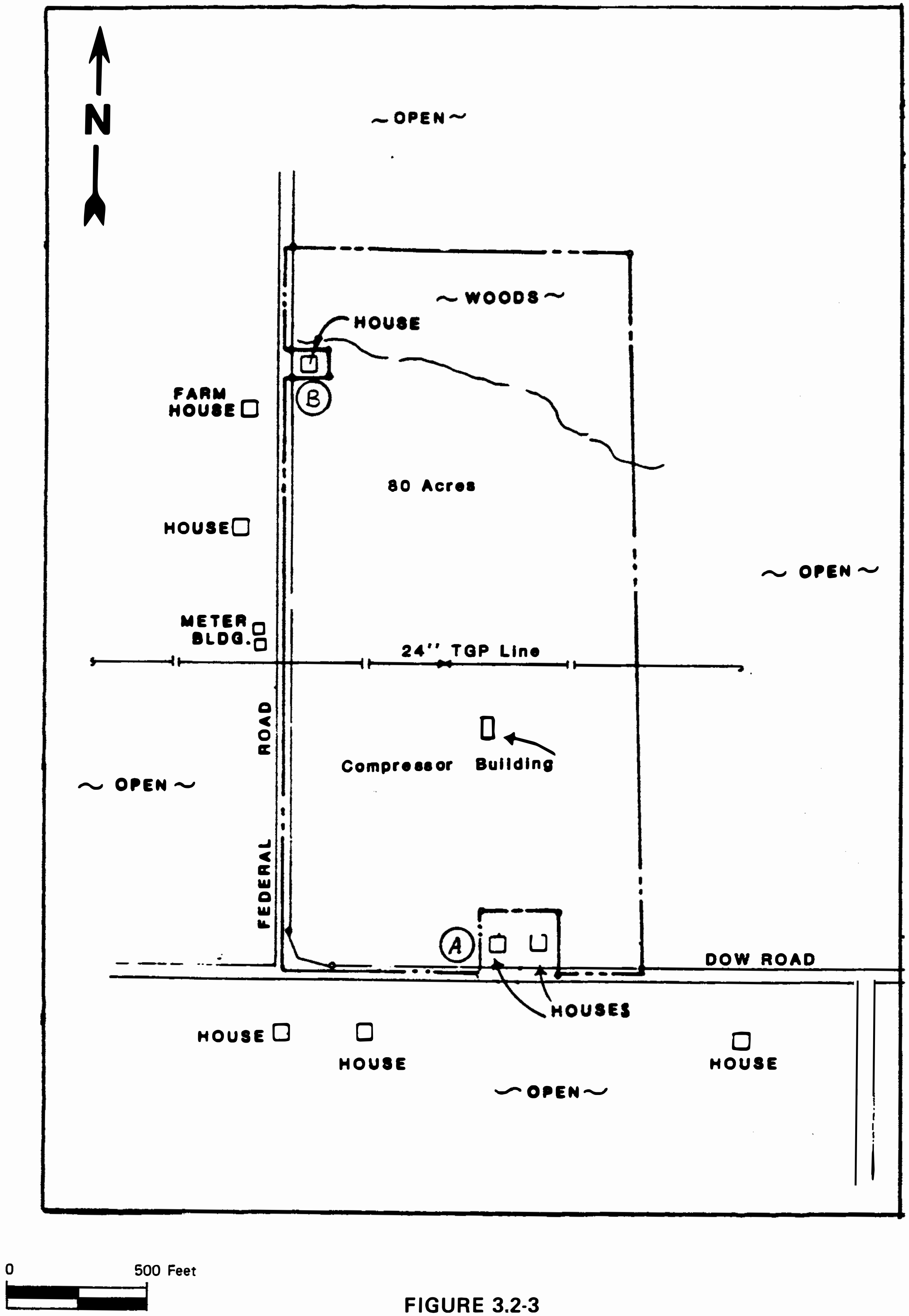
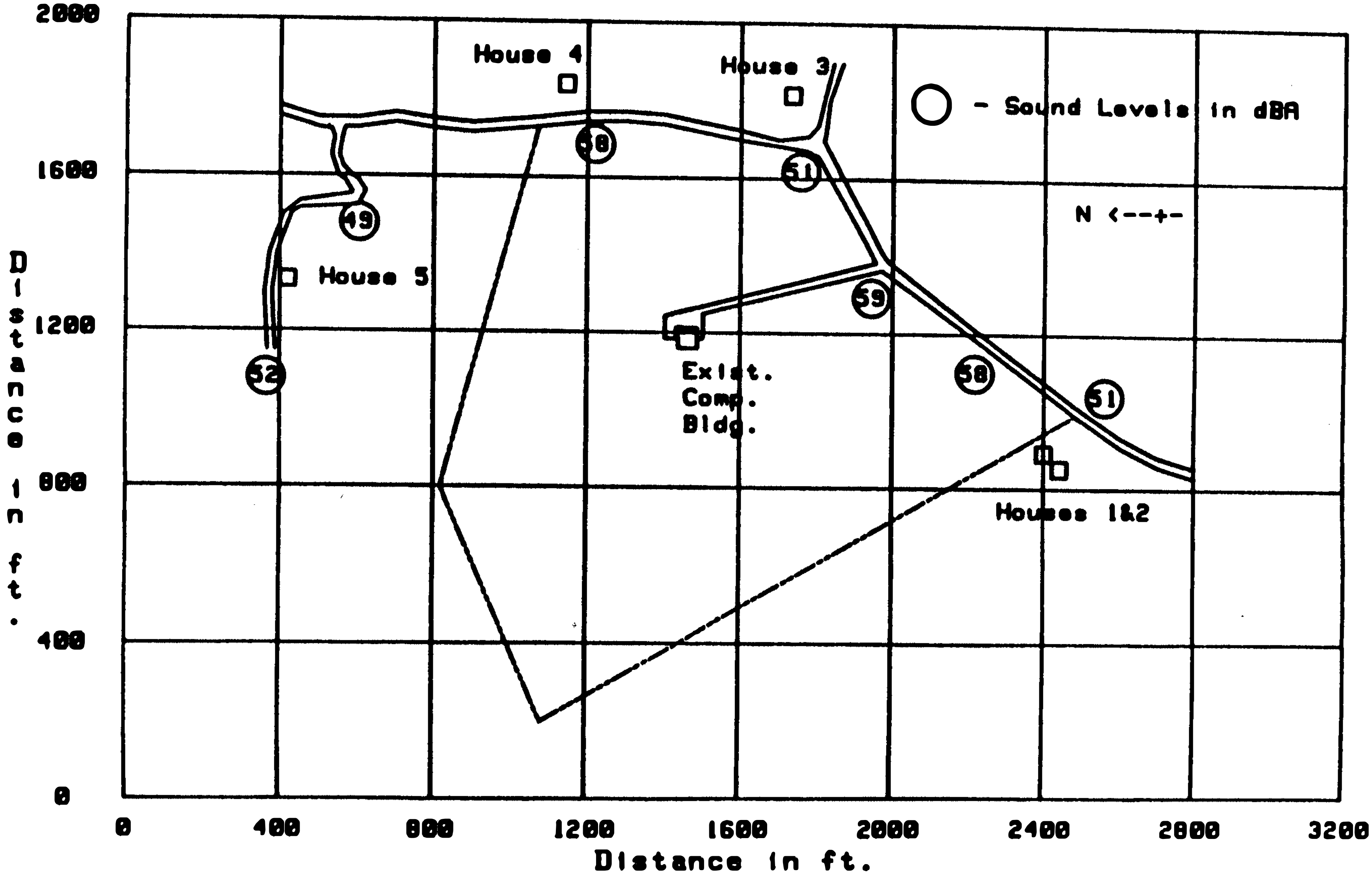


FIGURE 3.2-3
COMPRESSOR STATION 233 SITE
LIVINGSTON COUNTY, NEW YORK

SOURCE: FERC (1986)



SOURCE: TENNESSEE GAS PIPELINE COMPANY (FEBRUARY 1987)

FIGURE 3.2-4
EXISTING NOISE LEVELS AT NEARBY
HOUSES FOR COMPRESSOR STATION 264

3.2.4.5 Applicable Noise Standards

There are no state or local noise standards that would affect the compressor stations proposed for New York State. However, the New York Public Service Commission (NYPSC) recommends that compressors be designed to an L_{eq} of 40 dBA at the nearest residences in areas where the existing L_{90} is less than 40 dBA. If the L_{90} exceeds 40 dBA, the compressors should be designed to increase the L_{90} at the nearest residences by no more than 10 dBA.

For stations located in Massachusetts, the State has an enforced guideline that limits property line noise levels generated by an industrial/commercial facility to 10 dBA above existing quiet hour L_{90} noise levels.

3.2.5 Ecology

Existing environmental conditions along the proposed gas pipeline route were evaluated from review of maps, data received from appropriate agencies, responses to citizen comments, and field reconnaissance. Pipeline routes are described below for the northern 11-mile portion of the Rhode Island Extension (Tennessee Gas Docket No. CP87-75-000), compressor enlargements and a new compressor station for the Niagara Spur (CP87-131-000), and pipeline loops and a new compressor station for the OSP project (CP87-132-001).

The Staff reviewed National Wetland Inventory maps and state wetland maps (where available) to assess potential wetland impacts from the construction of gas pipelines and compressor stations. Construction of pipelines across streams and wetlands would result in short-term construction impacts including increased turbidity and sedimentation. Long-term impacts would be limited to the removal of woody vegetation along the permanent right-of-way. After construction, the natural grade will be reestablished and hydrological conditions will be restored for all affected wetlands. Pipeline crossings would qualify for the U.S. Army Corps of Engineers under a nationwide permit as described in 33 CFR 330.5(a)(12), (13), and (14). Wetlands are illustrated on pipeline routes in Figures 2.2-15 through 2.2-21.

3.2.5.1 Terrestrial Ecology

3.2.5.1.1 Rhode Island Extension

The Rhode Island Extension, as it relates to this project, includes 11 miles of 20-inch pipe in Worcester County, Massachusetts, and Providence County, Rhode Island.

The proposed route traverses predominantly forested land, though some portions of the route have been cleared and used for agriculture and gravel quarries. The forest is in the Appalachian Oak Forest region, with almost entirely deciduous trees--including a variety of oaks, hickory, basswood, red maple, elm, poplar, and walnut. There is a prominent understory of dogwood, witch hazel, blueberry, mountain laurel, and hackberry. The herbaceous layer is characterized by ferns and wildflowers.

Principal water and wetland crossings include the northwestern edge of Swans Pond, Purgatory Brook, Cook Allen Brook, Steamburg Brook, Mumford River, Laurel Brook, and Cedar Swamp (which includes a tributary of the Chockalog River). Wetlands were found at the edge of Swans Pond and immediately adjacent to streams. Wetland and stream classifications for these crossings are tabulated in Section 2.2.3.

Mammals typical of this region are whitetailed deer, squirrel, raccoon, cottontail rabbit, and red fox. Birds present in the project area include the ruffed grouse, bobwhite quail, various woodpeckers, and pheasant, various thrushes and warblers, American goldfinch, Eastern wood pewee, cardinal, and red-eyed vireo. Ducks, geese, and herons may be found in or near wetland habitats. Various species of reptiles and amphibians are also found in the area.

3.2.5.1.2 Compressor Stations

The proposed project would require the construction of new or modification of existing gas compressor stations in New York and Massachusetts.

Compressor Station 230B--located in the Township of Wales, Erie County, New York--is proposed for an additional 2,200 horsepower required by the gas transportation arrangement. The construction site would be adjacent to the existing 1,000-horsepower turbine, in a 9.5-acre site located in the center of a 76-acre tract of land owned in fee by Tennessee. The tract is bordered on the east by a county nature preserve (Hunters Creek County Park), but the construction site is west of a 60-foot-high hill that would shield the compressor facilities from park visitors. North of the tract are fields, brush, and woodland. The tract includes a small wetland designated by the New York Department of Environmental Conservation as a Protected Wetland (HO-2). There would be no construction within a 100-foot buffer zone of this wetland.

Compressor Station 230C would be located on a 58-acre site in Niagara County, New York, near the Town of Lockport. It would have facilities for generating 4,500 horsepower of compression. The land immediately surrounding the site on the north, east, and west is under cultivation or idle. No significant impacts on flora and fauna are expected to occur as a result of compressor station construction activities.

Compressor Station 233, in Livingston County, New York, would require facilities for an additional 3,500 horsepower of compression. The Salt Creek deer winter concentration area is located approximately 2.6 miles north of Station 233.

Compressor Station 264, in Worcester County, Massachusetts, also would require an additional 2,000 horsepower. All of these modifications would occur within existing compressor station property.

Facilities would be required on the proposed plant site at Sherman Farm Road, Providence County, Rhode Island, for measuring 50 MMcfd of natural gas. Construction of this proposed meter station would require approximately 1 to 2 acres, including an access road. The existing terrestrial habitat is the same as described for nonwetland areas of the plant site (Section 3.1.5.1).

The existing Lewiston Meter Station, in Niagara County, New York, would require facility modifications to accommodate an additional 50 MMcfd. No additional buildings would be erected, and work would be confined to Tennessee's existing fee property. Aquatic and terrestrial ecological impacts are not anticipated with this action, since no additional structures are proposed by Tennessee. Tennessee must obtain a letter of consistency from the New York State Coastal Zone Management Program for the proposed modifications to the Lewiston Meter Station.

3.2.5.1.3 OSP Pipeline Loops

A total of 25.5 miles of 30-inch gas pipeline looping would be required for the proposed project. Loop 1 parallels 11.2 miles of existing pipeline right-of-way in Niagara County, New York. This loop begins south of Route 425, at an elevation of approximately 460 feet, and follows Tennessee's existing 20-inch Niagara Spur over a gradual elevation drop to approximately 320 feet, terminating just east of the Niagara River. Most of this loop traverses nearly level-to-gently sloping land that is primarily open or under cultivation. Areas of woods and brush are scattered throughout.

Two wetlands were observed during field reconnaissance in September 1987. One was adjacent to the KOA campground off Pletcher Road and appeared to be of good quality. This is State-designated wetland LE-19, a Class II wetland of 240 acres. According to the New York State Freshwater Wetlands Act (Environmental Conservation Law 3-0301 and 24-1301, Section 664.5), wetlands with any one of 17 cover type, ecological association, special feature, hydrologic, or distribution characteristics are designated Class II (see Section 2.2.3.1 for a complete classification description). The proposed pipeline route traverses the northern quarter of this wetland. A second wetland of lesser apparent quality was observed near Ransomville Road. This is State-designated wetland RV-10, a Class III wetland of 27 acres. A Class III wetland is defined by the State Freshwater Wetland Act as having any one of 15 characteristics in the above-named categories. The proposed route of Loop 1 passes along the southern edge of RV-10.

Between approximately MP 230B-106+4.35 and 230B-106+504 (Porter-Center Road to Harold Road), Loop 1 is diverted 400 feet south of the Niagara Spur line to bypass the Old Lewiston Landfill. The Town of Lewiston used the property adjacent to a 400-foot segment of the Niagara Spur as a landfill site for municipal refuse between 1964 and 1972. The New York State Department of Environmental Conservation, Division of Solid and Hazardous Waste has classified the entire town parcel containing the former refuse site as an inactive hazardous waste disposal site.

Following review of a site characterization study performed for Tennessee Gas in May 1987 to define soil and groundwater conditions at the site, the New York State Department of Environmental Conservation office in Buffalo, New York, determined that the "Tennessee Gas easement does not appear to contain significant contamination," (NYDEC, August 4, 1987). The New York State Department of Environmental Conservation had no objections to the proposed route of Loop 1 (400 feet south of the Niagara Spur line) but noted that because the entire town parcel, through which the proposed route would pass, was classified as an inactive hazardous waste disposal site, it would be necessary for Tennessee to comply with Part 375.9(a) of the 6 NYOCRR, Inactive Hazardous Waste Disposal Sites, Article 27, Title 13, Section 27-1315 of the Environmental Conservation Law, which requires 60-day notice to the New York State Department of Environmental Conservation of any substantial change of use at the site (Tennessee Gas Pipeline Co., May 3, 1988).

The selection of the proposed route around the old landfill was made in consultation with adjacent landowners and the Town of Lewiston. The proposed route parallels the existing line as closely as possible to minimize the encumbrance on adjacent properties.

Loop 4 crosses 2.3 miles in Onondaga County, New York. This loop begins east of Highland Road and follows Tennessee's existing 24-inch Main Line, terminating just east of Rickard Road. The terrain ranges from nearly level-to-rolling with locally steep segments. With the exception of some residences, the land along the proposed pipeline is primarily under cultivation. Wildlife typically found in fields and cultivated lands in this region are raccoon, cottontail rabbit, squirrel, and red fox. Ruffed grouse, bobwhite quail, and pheasant use open areas for feeding and brush along hedgerows for cover. A variety of songbirds, owls, hawks, and woodpeckers is characteristic of this habitat.

Three State-protected wetlands, located northeast of Skaneateles, New York, are on or adjacent to the proposed route of Loop 4. The New York State Department of Environmental Conservation identifies Skaneateles Swamp (SKA-12) for its potential as an outdoor conservation education site for local school use. The proposed pipeline route begins several hundred feet east of, and does not cross, this area; consequently, no wetland vegetation or wildlife would be affected. East of SKA-12, the route crosses a narrow arm on the southern portion of SKA-13, a State-designated Class II wetland. The route then passes through SKA-14, a Class II wetland also under State protection.

The regional New York State Department of Environmental Conservation office in Cortland, New York, has stated that the proposed Loop 4 route would not affect any known deer over-wintering areas.

Upland vegetation in the region that includes proposed Loops 1, 4, 5, and 6 is part of the Northern Hardwood forest type. Where woodlands are not cleared, sugar maple, yellow birch, beech, and hemlock are the dominant species. There is also a prominent understory of striped maple, mountain maple, eastern hornbeam, American hornbeam, and black cherry. Herbaceous vegetation is particularly diverse in these forests, especially on upper slopes or in young stands where more moisture and sunlight are available. Mature trees in this region, 150 to 200 years old, may reach heights of 120 feet under optimal growing conditions. Much of this region has been clear-cut for agricultural and residential use; where stands of hardwood remain, the timber is harvested periodically. The farmland that has been created, especially in New York, is excellent for farming because the soil is well drained and tillable.

Loop 5 traverses 3.7 miles in Madison County, New York, running parallel to Tennessee's existing 24-inch Main Line. The terrain is gently rolling, with elevations ranging from 1,600 to 1,830 feet. The proposed pipeline loop crosses a cedar swamp, known as Nelson Swamp, a State-designated (wetland CA-5) Class I wetland. This northern white cedar swamp is recognized by the State of New York as a rare natural community. Although cropland encroaches on this wetland system from the east and west and the existing pipeline right-of-way is visible, Nelson Swamp is a complex, mature wetland. During field reconnaissance, white cedar, balsam, larch, spruce, and hemlock were observed as dominant species, with yellow birch, maple, and alder scattered throughout. Root buttressing and very moist, soft soils were common; no standing water was found during the mid-September 1987 visit. The New York Natural Heritage Program indicated that two rare and one unusual plant species occur in the vicinity of the proposed pipeline.

A deer winter browsing area is located 0.5 mile south of MP 242+5.60. In addition to whitetail deer, squirrel, rabbit, fox, ruffed grouse, bobwhite quail, and songbirds are wildlife characteristic of this area.

Loop 6 crosses 3.9 miles of Rensselaer County, New York. This proposed loop begins just east of the Hudson River and follows Tennessee's existing 24-inch Main Line through woodlands, cultivated fields, and an orchard. Elevation of the route varies from 10 feet near the Hudson River to about 330 feet over nearly level-to-gently rolling terrain. Local areas of sharp relief occur.

Typical upland vegetation is the same as described previously. Papscanee Marsh and Creek, a State-designated wetland (EG-1), lies adjacent to the Hudson River. The proposed pipeline would run through the marsh and cross the creek. This general area is one of the major wetland areas of the northern Hudson River. It is described by the New York State Department of Environmental Conservation as of major importance as a contributor to the food chain for fish and wildlife in the northern section of the Hudson Valley. It is a suspected breeding site for least bittern--a State-listed, special concern species. This area has been nominated for designation by the U.S. Department of State as "Significant Coastal Fish and Wildlife Habitat" under the Waterfront Revitalization and Coastal Resources Act. Tennessee must obtain a letter of consistency from the New York State Coastal Zone Management Program prior to construction, indicating that the proposed project is consistent with the State's approved Coastal Zone Management Plan.

The proposed route of Loop 7 crosses 4.4 miles of land in Hampton County, Massachusetts. It lies in varied terrain from nearly level-to-hilly, varying in elevation from 170 to 530 feet. The area is a patchwork of woods, fields, open land, and residential development. Upland vegetation is primarily deciduous, with a variety of oak species, hickory, red maple, elm, and poplar. Understory is typically dogwood, blueberry, and mountain laurel with ferns in the herbaceous layer. Although Massachusetts does not prepare wetland maps, wetlands were identified by the National Wetlands Inventory (see Table 2.2-2 and subsection 2.2.4.5).

3.2.5.2 Aquatic Ecology

The proposed new right-of-way for the Rhode Island Extension crosses the edge of Swans Pond and several small brooks. A variety of warm-water and cold-water fishes may be expected to occur in the streams and impoundments crossed by the proposed route. Cold-water species include smallmouth bass and brook trout. Warm-water species include largemouth bass, bluegill, and yellow perch. The golden shiner, white sucker, and other bottom feeding fish may be found in area ponds and reservoirs.

Upgrading of existing compressor stations and construction of new compressor facilities are not expected to affect the aquatic environment since no streams are affected. For the pipeline loops, each perennial stream crossed, its classification and fishery potential are presented in Section 2.2.3.

Loop 1, the proposed 11.2-mile pipeline that traverses Niagara County, New York, would cross intermittent tributaries to Fourmile Creek, Twelvemile Creek, and East Branch Twelvemile Creek. These waterways drain northward into Lake Ontario. The western end of Loop 1 drains to the Niagara River.

The proposed route of Loop 4 through Onondaga County, New York, is drained by tributaries of Ninemile Creek, which flows into Onondaga Lake and then to the Seneca River. This 2.3-mile route crosses two warm water perennial streams.

Loop 5--a 3.7-mile proposed route in Madison County, New York--crosses tributaries to Cedar Swamp Brook and Electric Light Stream. Cedar Swamp drains to Chittenango Creek, which flows north into Oneida Lake and eventually to Lake Ontario. Electric Light Stream flows into the Chenango River, which drains southward to the Susquehanna River.

The proposed route of Loop 6 crosses 3.9 miles in Rensselaer County, New York. The area is drained by the Hudson River and by Vierda Kill and Moordener Kill, which also flow to the Hudson. The proposed pipeline route runs between two streams, Veirda Kill and a second unnamed stream to the south, both of which flow to the Hudson. Vierda Kill is listed by the State as a protected stream. The unnamed stream to the south is not State protected. The pipeline then extends southeast, crossing the upper portion of Veirda Kill, where it appears to originate from wetland P241a. At this second crossing, Vierda Kill is not protected. Further southeast, the proposed route crosses Moordener Kill, a State-protected stream. During a field reconnaissance of Moordener Kill in September 1987, the streambed was observed to be bedrock, with many rock outcrops, and appeared to have the potential for trout propagation.

The proposed 4.4-mile route of Loop 7 in Hampton County, Massachusetts, crosses Tuttle Brook, tributaries of Great Brook, and Great Brook (which drains to the Westfield River in the Connecticut River system). Great Brook appeared to be a good quality stream when observed during a field visit in fall 1987.

3.2.5.3 Threatened or Endangered Species and Unique or Critical Habitats

The USFWS New England area office reviewed the proposed project and indicated that, except for occasional transient individuals, no federally listed or proposed threatened or endangered species are known to exist in the project area. The Massachusetts Natural Heritage Program, Division of Fisheries and Wildlife, also stated that it is not aware of any rare plants or animals or significant natural communities in the proposed project area within Massachusetts.

The proposed route of Loop 5 in Madison County, New York, crosses Nelson Swamp. In the vicinity of the proposed pipeline, two plant species that are rare in New York State have been reported. The spreading globeflower (Trollius laxus ssp. laxus) is designated by the Natural Heritage Program (NHP) as a State "imperiled" species. "Imperiled" means that six to 20 occurrences of the species have been reported in the State, or that there are few individual plants or acres remaining. The Nature Conservancy reports that this particular subspecies is known from fewer than 100 sites in all of North America.

Nelson Swamp is the only known site in New York State for the striped coralroot (Corallorhiza striata). This species is listed by the Natural Heritage

Program as "critically imperiled," meaning that five or fewer occurrences are known, or that there are very few individuals or acres remaining.

Nelson Swamp is considered to represent one of the best remaining examples of a northern white cedar swamp in the State. It is listed as a "rare natural community" by the Natural Heritage Program.

A deer winter concentration area (Significant Habitat #DC27-119) is reported by State wildlife biologists at a site 0.5 mile south of the western end of Loop 5, at MP 242+5.60.

3.2.6 Sociocultural Resources

The land use, socioeconomic, visual, and aesthetic characteristics of the environment as well as historic and archeologic resources affected by the proposed pipeline facilities are examined below.

Phase I cultural resource investigations, including surveys, for the proposed gas pipelines in New York were conducted by the Public Archeology Facility, Inc. (PAF) of the State University of New York at Binghamton. Those facilities include Loops 1, 4, 5, and 6. The Phase I investigations were in compliance with established standards of the New York State Historic Preservation Office (SHPO). The research strategy employed the following: an architectural survey of standing structures, a pedestrian survey for archeological sites where visibility was good, and a systematic subsurface sampling of archeological deposits where visibility was poor.

PAF (1988) indicated that significant cultural resources might be discovered from field surveys based on background research as follows: historical documentation, interviews with informants, environmental factors, and recorded Indian sites including small camps and stockaded villages, and early historic settlements in the project vicinity.

3.2.6.1 Niagara Spur

Changes to the Niagara Spur include an upgrade to the Lewiston Meter Station to increase metering capability, the addition of Compressor Station 230C, and the addition of Loop 1.

The Lewiston Meter Station is located approximately 300 feet east of the Niagara River, near Stella Niagara, New York. The immediate area is predominantly residential, especially along Lower River Road, but agriculture predominates to the east. The Stella Niagara Seminary is located approximately 1,200 feet southeast of the meter station, and the Town of Lewiston wastewater treatment plant is located approximately 1,500 feet northeast.

Loop 1 begins south of Lower Mountain Road (Route 425), and follows Tennessee's existing 20-inch Niagara Spur for 11.2 miles, terminating just east of the Niagara River. The majority of land is open or under cultivation, with some woods and brush. In consultation with the New York Office of Parks, Recreation and Historic Preservation, the FERC Staff has determined that there would be no effect on cultural resources. This determination is based on negative findings of cultural resource surveys (PAF, 1988).

Compressor Station 230C would be located in Lockport, New York on a 58-acre site along Lockport Junction Road, at MP 230B - 105 + 5. The site is on the west side of Lockport Junction Road and is owned by Armstrong Pumps. The site is zoned partially industrial and partially agricultural.

A cultural resource investigation is in progress to identify any significant historic or archeological resources that may be affected by the construction of Compressor Station 230C.

3.2.6.2 Main Line

Changes to the Main Line consist of adding four loops and compressors at three compressor stations.

Compressor Station 230B is located in Erie County, New York, on a 76-acre tract owned in fee by Tennessee. The property is located within the Township of Wales, approximately 2 miles east of East Aurora, New York. The site is bordered on the east by a county nature preserve (Hunters Creek County Park). The proposed compressor facilities would be located on the west side of an approximately 60-foot hill, which would shield them from park users. Fields, brush, and woodlands lie to the north of Tennessee's property. A trailer park of approximately 45 units is located to the west between Reiter Road and Tennessee's property. Although Tennessee's access lies along the northern edge of the trailer park, the main property boundary is approximately 900 feet from it. The center of the recently constructed compressor facilities is approximately 1,800 feet from the eastern edge of the trailer park. Several farmhouses are to the southwest and south along Reiter Road; the closest of these is approximately 1,900 feet from the center of the existing compressor facilities. Tennessee's property lies within the Wales Agricultural District, but is not considered prime farmland and is not in cultivation. The additional compressor facilities would be constructed on an approximately 9.5-acre industrial-zoned portion adjacent to existing facilities in the center of the site.

In consultation with the New York State Historic Preservation Office, the FERC Staff has determined that the proposed Compressor Station 230B addition would have no effect on cultural resources (New York Office of Parks, Recreation and Historic Preservation, 1986). This determination is based on negative findings of cultural resource investigations, including surveys (PAF, 1986a).

Compressor Station 233--located in Livingston County, New York, on property belonging to Tennessee Gas--is dedicated to natural gas transmission. It is located within the Township of York, approximately 2 miles southwest of the Village of York. The surrounding area is overwhelmingly agricultural. Tennessee's property is considered prime farmland, and a portion of it is presently leased for cultivation. The proposed compressor facilities are within an approximately 20-acre industrial-zoned site. There is a cluster of farmhouses on Federal Road near the northwest corner of the property, and there are several houses along Dow Road. Two of the houses on Dow Road (north side) are the only residences within 1,000 feet of the proposed compressor facilities, which would be located approximately 800 feet from the closest of them.

In consultation with the New York State Historic Preservation Office, the FERC Staff has determined that the proposed Compressor Station 233 addition would have no effect on cultural resources (New York Office of Parks, Recreation and Historic Preservation, 1986). This determination is based on negative findings of cultural resource investigations, including surveys (PAF, 1986b).

Phase I cultural resource surveys of Compressor Station 230B and 233 sites--which each included background research, a walkover survey, and subsurface testing--revealed that no significant cultural resources were present (PAF, July 1986a and July 1986b). In consultation with the New York State Historic Preservation Office, the FERC Staff has reviewed the results and concurred with the archeological consultant's findings.

Compressor Station 264 is located on Carpenter Hill Road in Worcester County, Massachusetts. The facility is dedicated to the transmission of natural gas. The station is located on a hill rising at a fairly steep grade. The nearest residences are approximately 700 feet from the existing compressor station buildings. The surrounding area is primarily pasture and cropland. The existing compressor station property would be extended to the north a sufficient distance to allow installation of the new building, thus reducing the size of the buffer area separating the station from the farm directly north of the site. No significant cultural resources would be affected.

Loop 4 begins east of Highland Avenue in Skaneateles, New York, and follows Tennessee's existing 24-inch Main Line for 2.3 miles, terminating just east of Rickard Road. The route crosses three roads--Gully Road, New Seneca Turnpike/US 20, and Rickard Road--and also two tributaries. West of Gully Road, the route passes through the Manor Heights subdivision. The front yards of three homes would be affected by construction. With the exception of some residences along Highland Avenue and in the Manor Heights subdivision, the land along the pipeline right-of-way is primarily under cultivation.

Public Archeology Facilty, Inc. (1988) located no significant archeological sites; a cut nail and a transfer print pearlware ceramic shard were recovered from subsurface testing along Loop 4. The FERC Staff, in consultation with the New York State Historic Preservation Office, supports Public Archeology Facilty, Inc.'s findings that there would be an effect on archeological resources. The FERC Staff and the New York State Historic Preservation Office have determined that an early 19th-century clapboard house with associated outbuildings meets the criteria of NRHP eligibility, but it will not be affected by the project action at Loop 4.

Loop 5 begins at MP 242 + 5.6 and follows Tennessee's existing 24-inch Main Line for 3.7 miles, terminating at MP 242 + 9.3. The loop crosses several minor roads and the Nelson Erieville Road. The line also crosses a portion of the Nelson Swamp and two perennial streams.

Public Archeology Facilty, Inc. (1988) located no significant archeological sites. An isolated occurrence of a square cut nail was the only archeological find on Loop 5. In consultation with the New York State Historic Preservation Office, the FERC Staff supports Public Archeology Facilty, Inc.'s findings that there would be no effect on archeological resources. It has also been determined that the Welsh Church located in the general vicinity of Loop 5, meets the criteria of National Register of Historic Places eligibility, but it would not be affected by construction of Loop 5.

Loop 6 begins just east of the Hudson River and follows Tennessee's existing 24-inch Main Line for 3.9 miles. The route crosses Conrail tracks in two locations, as well as River Road (NY Route 9J), NY Route 150, and several minor roads. The pipeline loop crosses three streams: Papscanee Creek, a tributary of Vierda Kill, and Moordener Kill. The route would cross woodlands and cultivated lands; and, east of Moordener Kill, an orchard. Residential development is scattered, except for homes along NY Route 150 and Old New York Post Road. West of Old New York Post Road, the route passes a cemetery and skirts a portion of the property reserved for future burials. Tennessee would probably purchase a few of the plots to prevent encroachment on the pipeline right-of-way.

Public Archeology Facilty, Inc. (1988) located no significant archeological sites, although aboriginal village sites were recorded in the project vicinity. Several porcelain and pearlware ceramic shards were found, but no significant historic sites were found. The FERC Staff, in consultation with the New York State Historic Preservation Office, has determined that Loop 6 would have no effect on archeological sites. The FERC Staff and the New York State Historic Preservation Office have determined that a mid-19th century vernacular house structure meets the criteria of NRHP eligibility, but it will not be affected by the project action at Loop 6.

Loop 7 begins on the east side of MA Route 57 and follows Tennessee's existing 24-inch Main Line across Hastings Road, Hillside Road, MA Route 10/U.S.-202, and the Penn Central Railroad tracks. The route passes through the Fernwood subdivision, crosses Powder Mill Road, runs down the edge of a private road, and then continues eastward to just beyond Foster Road. Several streams are crossed, including Shurtleff Brook and one of its tributaries, Tuttle Brook, Great Brook, and three of its tributaries. West of Foster Road, the route passes through a new subdivision under construction. The route also passes near businesses along MA Route 10/U.S.-202, near homes in the Southwick Hill subdivision to the east, and along Foster Road. The surrounding land is a patchwork of woods, fields, open land, and residential development.

The FERC Staff has determined that construction of the proposed facilities on Loop 7 would have no effect on cultural resources. This determination is based on the Staff's review of the negative results from previous cultural resource investigations (Massachusetts State Historic Preservation Office, January 26, 1987) and on comments of the Massachusetts State Historic Preservation Offices (Stokes, 1988).

3.2.6.3 Rhode Island Extension

The proposed Rhode Island Extension, as it relates to this project, runs from Sutton, Massachusetts, to the Sherman Farm Road site, in Burrillville, Rhode Island. The pipeline would require new right-of-way along its entire route. However, about 2.25 miles of the 11-mile segment of the proposed route would be parallel and adjacent to existing electric transmission line and road rights-of-way.

The proposed alignment currently passes along the western edge of Swans Pond and through several active and inactive sand and gravel operations.

The proposed route crosses Route 146; no other highways are expected to be affected.

Cultural resource surveys are in progress by Public Archeology Laboratory, Inc. to identify significant historic and archeological resources that may be affected by the Rhode Island Extension. From phase 1 background research, Public Archeology Laboratory, Inc. (October 1987) identified thirty-six historic sites and sixty-four prehistoric sites in the project vicinity. According to Public Archeology Laboratory, Inc.'s research design for the prehistoric period, three distinct physiographic zones would be crossed by the Rhode Island Extension, which include the interior upland, the near interior, and the Connecticut River Valley. Each of these zones is characterized by the availability of specific resources and unique topographic features that have interesting implications for our understanding of prehistoric land use.

From the historical research conducted, Public Archeology Laboratory, Inc. (October 1987) has analyzed the social, economic, and political processes that influenced land use patterns in Massachusetts and Rhode Island from colonial times to the present day. Cultural resource surveys presently being undertaken on the Rhode Island Extension have the potential to reveal information concerning the following: early settlement from 1650 to 1775; industrial beginnings from 1775 to 1830; industrial expansion from 1830 to 1870; and community stabilization and modernization from 1870 to present.

SECTION FOUR

ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

4.1 OCEAN STATE POWER PLANT

The environmental consequences of construction and operation of the proposed OSP facility are discussed in the following sections:

- Section 4.1.1--Geology and Soils
- Section 4.1.2--Water Resources
- Section 4.1.3--Air Quality
- Section 4.1.4--Sound Quality
- Section 4.1.5--Ecology
- Section 4.1.6--Sociocultural Resources.

4.1.1 Geology and Soils

Development and operation of the OSP project would have negligible effects on local and regional geology. Construction activities would require the clearing and grading of about 17 acres at the plant and the clearing or grading of natural soils along the northern 2 to 3 miles of the oil and water pipeline routes. The remainder of the pipeline routes would be in previously placed roadfill along existing roadways. The natural soil types at the plant site and along the pipeline route are derived from glacial till and outwash deposits, described in Section 3.1.1.3.

Plant site soils are Canton and Charlton fine sandy loams (symbol CeC) with moderate soil erodibility. Soil erosion potential is relatively uniform across the site. Sediment and erosion control measures would be applied to prevent the movement of sediments downslope into the stream valleys bordering the plant site (Bechtel Eastern Power Corporation, October 1987). With the proposed controls, effects on soils and surrounding areas are anticipated to be minor.

The Town of Burrillville has adopted an "Erosion and Sediment Control" ordinance pursuant to Rhode Island Law Title 45, Chapters 45-46. OSP would be required to submit to the town for approval a copy of its plans regarding temporary and permanent erosion control measures to be implemented. Burrillville retains the technical services of the Northern Rhode Island Conservation District, an extension of the University of Rhode Island, for assistance in reviewing such plans (Coutu, 1988).

The potential for soil erosion along the oil/water pipeline route is considered to be low due to the short duration of open excavation and the restoration of natural ground and roadways to their original or improved conditions following backfilling operations.

Construction blasting at the plant site and along the pipeline route will not affect area seismicity, and anticipated effects on local features such as slope stability of loose, saturated sands are also expected to be negligible. Minor ground vibrations may be experienced at nearby residences; however, they are expected to be small and controllable by blasting practices.

MIT maintains a seismograph station on the property of David Laferriere in Uxbridge, Massachusetts. The station is located about 2,000 feet northwest of the electric switching station adjacent to the Sherman Farm Road site. Ground vibrations produced by the construction and operation of the power plant, particularly the required blasting for site development, could compromise the validity of data from the station. As a result, OSP and MIT have agreed to relocate the seismic station at OSP's expense. The relocation will involve locating a new site, conducting extensive testing, and installing new telephone lines to feed data back to MIT.

4.1.2 Water Resources

4.1.2.1 Surface Water Impacts

4.1.2.1.1 Construction Impacts

Impacts on surface water resources during construction of the OSP project would involve three project phases--the power plant itself, the oil and water pipelines, and the intake structure on the Blackstone River. These impacts would involve potential erosion and sedimentation due to disturbance of soil and other natural onsite materials. The implications of these effects on aquatic ecology are discussed in Section 4.1.5.2.

An Erosion and Sedimentation Control Plan has been submitted to the Rhode Island Department of Environmental Management that outlines management strategies, vegetative practices, and structural erosion and sediment control practices. Some aspects of this plan are illustrated in Figure 2.1-5. Major elements of this plan involve specific management strategies, vegetative practices and structural practices. Management strategies include:

- A schedule of installation to expose the minimum areas.
- Excavated areas will not be exposed to construction traffic.
- Locate all roads and parking areas on the contour.
- Construction traffic shall be limited to access roads and areas to be graded. Traffic is prohibited from entering runoff waterways or brooks unless absolutely necessary.
- Protection measures will be implemented to prevent transport into any stream, wetland area or drainage course.
- Stockpiling of excavated material will be away from the wetland areas and surrounded by a silt fence.
- The construction superintendent shall have overall responsibility for plan implementation. He shall also be responsible for seeing that appropriate construction workers and subcontractors are aware of the provisions of the plan.

Vegetative practices include:

- Stockpiling of topsoil for later use.
- Temporary seeding of all rough graded areas.
- Placement of jute mesh or other degradable channel lining material as an aid to grass growth.

Structural practices include:

- Construction of sediment traps.
- Use of hay bale barriers, silt fences, or diversion dikes.
- Use of a gravelled temporary construction entrance to minimize offsite transport of soil to Sherman Farm Road.

OSP has stated that these measures would be maintained in accordance with Rhode Island Conservation District standards and specifications. As OSP's plan incorporates state-of-the-art techniques to minimize erosion impacts, and the proposed construction is not extraordinary or unusual in nature, any impacts would be temporary and construction activities would not be expected to have a significant effect on the environment.

Power Plant Site

Construction of the plant would disturb approximately 17 acres of upland terrain located at the highest elevations of the site property. This land is not located on State or Federal property and is not identified as prime farmland by the SCS. Temporary construction-related impacts would be limited to those associated with the clearing of vegetation from the plant site and construction laydown areas and the erosion and transportation of exposed site soils.

A detailed Erosion and Sedimentation Control Plan would be developed and submitted to the Rhode Island Department of Environmental Management, and all Rhode Island rules and regulations for minimizing construction-related erosion and sedimentation impacts would be observed (Bechtel Eastern Power Corporation, December 1986). Therefore, the proposed construction activities related to the release of eroded materials into offsite waterways are expected to result in an insignificant environmental impact.

Water Supply and Oil Pipelines

The proposed pipelines would be constructed entirely within existing rights-of-way for city streets, State highways, and power transmission lines, and would cross roadways and several streams. The associated construction activities would temporarily increase erosion along the pipeline rights-of-way due to removal of surface cover and soil disturbances. OSP has stated that these impacts would be minimized through conventional mitigation techniques, as specified in the Erosion and Sedimentation Control Plan. OSP would abide by all Rhode Island rules and regulations for minimizing construction-related erosion and sedimentation impacts (Bechtel Eastern Power Corporation, December 1986).

In addition, OSP has filed an application with the U.S. Army Corps of Engineers for including the pipeline (and intake structure) under the nationwide permit program. The application outlines proposed mitigation actions to minimize construction impacts to streams crossed by the pipeline. The proposed construction activities are not expected to result in significant environmental impacts related to the release of eroded materials into waterways along the construction routes.

Blackstone River Water Intake Structure

Construction of the intake structure would require the disturbance of riverbank, terrace, and river bottom contained within an area of less than 5,000 square feet. Primary construction activities would include excavation for the shoreline structure and a trench in the river bottom, construction of the shoreline structure, assembly and placement of the intake, placement of a riprap cover over the intake pipe, backfill around the shoreline structure, and reconstruction of the existing riprap riverbank protection. Approximately 2,200 cubic yards would be excavated, 200 of which will come from the river bottom trench (Bechtel Eastern Power Corporation, April 1987a). These activities would cause temporary discharges of sediment-laden runoff from land areas and the resuspension of river bottom sediments.

The quality characteristics of the river bottom sediments are unknown. However, OSP has commited to the use of appropriate erosion and sediment control measures, management strategies vegetative practices, and structural erosion and sediment control in accordance with Rhode Island Conservation District standards and specifications. Specific measures to be employed include:

- scheduling construction to minimize exposure
- stockpiling soils away from the river
- river bank stabilization
- seeding of exposed soils
- use of sheet pile or cofferdams
- use of hay bale barriers
- use of sediment traps at inlets
- use of riprap on river bank.

4.1.2.1.2 Operational Impacts

Power Plant Water Use

OSP estimates that the plant would consume an average 4 mgd for cooling, boiler makeup, and other plant uses. During warm months, under full power, a maximum 4.4 mgd will be consumed. Since the plant is designed with a zero-discharge system, the ultimate fate of water used would be evaporation to the atmosphere. Thus, water withdrawals for the plant can be considered as true consumptive use, since only a small amount of cooling tower drift would be returned to the immediate surface water environment (Section 4.1.3.5.3).

Consumptive Loss Impacts. The consumptive loss of 4 mgd from the surface water resources of the plant region has been identified as a potentially significant impact. Based on long-term average runoff data, each square mile of local watersheds yields about 1.2 mgd (Section 3.1.2.1). The proposed plant, therefore, will consume water equivalent to the average runoff from about 3.4 square miles--which is about 0.3 percent of the land area of the State of Rhode Island. In these terms, the plant's consumptive water use does not appear to be a significant impact. However, during low-flows on the Blackstone River, the removal of up to 4.4 mgd of water would reduce river flows by significant percentages as indicated in the following section.

Water Quality Impacts on Blackstone River. The proposed source of plant water is the Blackstone River. During warm months, which usually coincide with low-flow conditions, the withdrawal of up to 4.4 mgd would potentially impact the river from the point of withdrawal in the City of Woonsocket to the point where the river empties into the Seekonk Estuary, a distance of about 14.5 miles. These impacts will include a reduction in discharge and potentially a change in the concentration of water quality parameters.

The withdrawal of a 4 mgd average (4.4 mgd maximum) from the river is compared to various river flow conditions in Table 4.1-1. The percentage decrease in flow under average conditions appears to be insignificant. For example, withdrawal represents less than 1 percent of the average river flow and less than 1.2 percent of the river flow during 50 percent of the time. However, the percent decrease during extreme low-flow conditions may be significant. For example, under a worst case scenario, the maximum water withdrawal would be nearly 7 percent of the 7Q10 river flow, and over 32 percent of the minimum daily flow recorded over a 56-year period at the Woonsocket gage. Such reduction in river flow would have no impact at the point of withdrawal since water is pooled above the hydroelectric dam. However, the reduced flow would alter aquatic habitats below the dam. The extent of habitat impact would vary with the bottom configuration of the river channel. Where steep banks cut to the river bottom, a decrease in the quantity of water would have little impact. Where shallow pools and riffles are present, the surface area of this habitat would be reduced especially during seasonal low-flow conditions. Nevertheless, the proposed maximum anticipated withdrawal of 6.8 cfs represents less than 1 percent of the total river flow during the months of April through September when spawning activity and downstream movement of juveniles would likely occur.

Metals Concentrations

Potential impacts to river water quality were investigated by Applied Science Associates (ASA), a consultant to OSP (Swanson et. al., 1988). ASA found that metals concentrations in the river are relatively high due to high concentrations in the river flow from Massachusetts. ASA examined the potential impacts of OSP water withdrawal using a mathematical water quality model and referring to aquatic toxicity studies. The computer model used to make estimates of the impacts, known as PAWTOXIC, was previously developed and applied to the Blackstone River by Professor R. M. Wright of the University of Rhode Island Department of Civil and Environmental Engineering. Professor Wright calibrated and verified the model using existing data for five metals: cadmium, chromium, copper, lead, and nickel. For the OSP study, ASA also examined silver and zinc concentrations. ASA found that these seven metals are currently at concentrations near or above Rhode Island and Federal water quality criteria. Variation in metals concentrations at upstream river boundaries are given in Table 4.1-2; these

TABLE 4.1-1

OSP Plant Demand of Blackstone River Flow at Woonsocket, Rhode Island[a]

Flow Condition	River Flow (cfs)	Average Plant Demand (% of river flow)	Maximum Plant Demand (% of river flow)
95% Exceedence Flow	135	4.6	5.0
7-Day 10-Year Low	102	6.1	6.7
120-Day 10-Year Low	161	3.8	4.2
Mean Annual Flow (Period 1929-1985)	765	0.8	0.9
Average July Mean Monthly Flow (Period 1951-1970)	274	2.3	2.5
Lowest Monthly Mean Low Flow (August 1966)	111	5.6	6.1
Minimum Flow of Record (1929-1985)	21	29.5	32.4

[a]Based on stream flow records for the Blackstone River at Woonsocket, Rhode Island (drainage area = 416 square miles).

SOURCE: Bechtel Eastern Power Corporation, January 1987

TABLE 4.1-2

Variation in Metals Concentrations at
Upstream River Boundaries

Metal	Concentration (μg/l) Minimum	Mean	Maximum	Number of Samples	Standard Deviation
Blackstone River					
Cadmium	1.	3.8	10.	15	2.6
Chromium	0.	18.2	40.0	17	11.9
Copper	15.	24.8	39.	16	7.6
Lead	4.	16.9	51.	17	11.7
Nickel	0.	39.7	130.	16	33.1
Silver	0.	0.1	1.0	20	0.3
Zinc	40.	98.2	200.	17	6.9
Branch River					
Cadmium	0.	0.6	2.0	7	0.8
Chromium	0.	10.0	20.0	9	8.7
Copper	3.	13.	30.	8	9.5
Lead	1.	8.2	31.	9	9.7
Nickel	2.	7.6	26.	9	7.7
Silver	0.	0.	0.	7	0.
Zinc	10.	53.3	120.	9	33.9

SOURCE: Swanson, et al., 1988.

concentrations can be compared to chronic and acute criteria as determined by Rhode Island and the USEPA (Table 4.1-3).

ASA studied two flow regimes, the 7Q10 and the 1Q10. The 7Q10, the lowest 7-day flow in 10 years, was assumed to be the basis for evaluation of chronic toxicity impacts. The 1Q10, the lowest daily flow in 10 years, was assumed to be the basis for evaluating acute toxicity. ASA used existing metals concentration data for the following waste dischargers to the Blackstone River downstream of the proposed OSP intake location: the Woonsocket Waste Water Treatment Plant (WWTP), SAB Nife Company, Okonite Corporation, and GTE. Maximum observed source concentrations were employed in the acute toxicity evaluations.

The PAWTOXIC model evaluation results are given in Table 4.1-4. The table indicates the maximum changes in Blackstone River metals concentrations caused by an OSP withdrawal of 4.4 mgd under 7Q10 and 1Q10 flow conditions. The computed results for five of the seven metals showed improvement for all cases. In some cases, concentrations of copper and silver increased slightly; the greatest increase was 3.9 percent for silver under 7Q10 (chronic) conditions. The proposed OSP withdrawal will actually reduce the concentrations of cadmium, chromium, lead, nickel, and zinc, thus improving water quality with respect to these toxic metals. These changes, both plus and minus, would occur downstream of the points of discharge of the Woonsocket WWTP and several other wastewater discharges that add to the river estimated amounts of the metals under study. Since the proposed OSP plant withdrawal would remove heavy metals from the river at ambient concentrations, there would be no changes in concentrations immediately downstream, but changes would occur downstream of the other discharges. The resultant decrease or increase in the concentration of a given pollutant depends on the relative ambient concentration of the pollutant in the river at the point of withdrawal compared to the concentration in the downstream effluent streams. For cases where the effluent concentrations are greater tham ambient, an increase in concentration would result in the river; if the effluent concentrations are less than ambient, a decrease in concentration in the river would result downstream. In any case, the PAWTOXIC model study has concluded that the calculated changes would be minor, less than 4 percent.

In order to understand the potential impacts of toxic metals on aquatic life of the river, a laboratory toxicological evaluation of the Blackstone River was

TABLE 4.1-3

State (RIDEM) and Federal (USEPA) Water Quality
Criteria for Various Metals

	Concentration (g/l)			
	RIDEM		USEPA	
Metal	Chronic	Acute	Chronic	Acute
Cadmium	0.009	1.09	0.528	1.309
Chromium	33.5	1,640.	93.3	783.
Copper	5.6	8.89	5.15	7.09
Lead	0.389	52.5	0.922	23.7
Nickel	45.6	880.	69.2	665.
Silver	0.017	0.762	0.12	0.762
Zinc	47.	143.	47.	143.

Note: A mean hardness of 37.8 mg/l was used to calculate concentrations in those criteria that included dependency on hardness.

SOURCE: Swanson et al., 1988.

TABLE 4.1-4

Maximum Changes in Blackstone River Metals Concentrations Caused by OSP Withdrawal

	Maximum Percent Change in Concentration			
	7Q10 (Chronic)		1Q10 (Acute)	
Metal	Increase	Decrease	Increase	Decrease
Cadmium	0.0	-4.5	0.0	-5.1
Chromium	0.0	-6.4	0.0	-7.9
Copper	1.7	-0.6	1.5	-0.7
Lead	0.0	-6.0	0.0	-7.2
Nickel	0.0	-1.7	0.0	-2.8
Silver	3.9	0.0	1.3	-0.8
Zinc	0.0	-6.0	0.0	-6.8

SOURCE: Swanson et al., 1988.

undertaken by ASA. (Swanson et. al., 1988). Tests were conducted with the water flea and fathead minnow. Both species were exposed to river water; river water spiked with copper, lead, and silver at twice the Rhode Island Department of Energy Management's chronic criteria levels; and laboratory culture water. The toxicity tests indicated that increases of copper, lead, or silver at twice the Rhode Island Department of Energy Management's chronic criteria levels would have no impact on mortality, reproduction, or growth of the test species. From these results, ASA concluded that, since these metal additions were higher than the changes predicted by the PAWTOXIC model study, no effect of the proposed OSP withdrawal on aquatic toxicity would be expected.

Dissolved Oxygen Concentrations

The potential changes in downstream dissolved oxygen (DO) concentrations were assessed by Ecology and Environment, Inc. (E&E) using the EPA water quality model QUAL2E (Ecology and Environment, February 1988). The QUAL2E model was calibrated to match field data collected by E&E during September 1987 and was verified using field data collected by the Rhode Island Department of Energy Management in August 1987. The model was then used to simulate DO levels in the Blackstone River during 7Q10 flow conditions. E&E found that withdrawal of cooling water for the OSP facility will result in a reduction in the amount of river flow available for dilution of effluent from the downstream Woonsocket WWTP. Under 7Q10 flow conditions, the withdrawal of 4.4 mgd would slightly lower DO concentrations through an approximate 10-mile reach downstream of the WWTP. The maximum decrease in DO levels would occur in the pool formed by the Manville Dam, which is located about 5 miles downstream of the proposed intake site. The computed minimum DO without the withdrawal was computed to be 4.95 mg/l compared to a minimum of 4.74 mg/l with the withdrawal. The length of river that would be below the state water quality criteria of 5.0 mg/l would be 0.4 miles and 0.8 miles, respectively, for the cases without the withdrawal and with the withdrawal. Thus, the length of river that would fail to meet the state criteria would be lengthened from 0.4 to 0.8 miles. Through this reach, the maximum lowering of dissolved oxygen would be about 0.3 mg/l.

The applicant has stated that any lowering of the DO level downstream due to plant withdrawals would be mitigated by one or more of the following measures:

1. Increasing DO in the effluent of the WWTP by 1.0 mg/l,
2. Increasing flow over the Thundermist Dam to 100 percent, and
3. Decreasing BOD in the WWTP effluent from 24 mg/l to 20 mg/l.

E&E has stated that utilizing all of these measures would result in a DO that would alleviate impacts due to OSP withdrawal and would also meet the minimum criterion of 5.0 mg/l downstream (Ecology & Environment, February 1988). The applicant has committed to utilizing whatever measures are specified by the Rhode Island Department of Energy Management.

Conclusions

Although the studies thus far indicate that only minor water quality impacts will result from the withdrawal of plant makeup water, the issue is not insignificant from a regulatory standpoint. Concentrations of the heavy metals and DO do not presently meet water quality standards; any adverse changes, albeit minor, would violate Rhode Island's nondegradation policy. The above modeling predicts potential water quality impacts if 4.4 mgd were withdrawn during a period when the Blackstone River flow in 7Q10. This withdrawal is 6.7 percent of the 7Q10 river flow. If the Rhode Island Department of Environmental Management applies conditions on OSP to limit withdrawal to periods with 7Q10 flow or greater, water quality impacts would be expected as described above.

USFWS recommends that OSP be required to maintain a minimum flow regime of 0.5 cubic feet per second for each square mile of drainage basin upstream of the intake (i.e., 208 cfs compared to 102 cfs for 7Q10). The effect of such a limitation would be that OSP's withdrawals from the Blackstone River would be prohibited approximately 18 percent of the time.

Impacts on Downstream Hydropower Facilities. Withdrawal of 4 mgd (6.2 cfs) would reduce the amount of water available for hydropower production at the City of Woonsocket Thundermist plant. OSP has stated that, as part of the proposed agreement with the city to locate the intake structure on city property, they would make financial compensation to the city for any reduction in hydropower production.

Wastewater Discharges

There would be no discharge of power plant wastewater effluent to the environment.

Stormwater Management

The replacement of existing forest vegetation at the OSP plant site with grass cover, paved areas, and rooftops would result in an increased rate and volume of stormwater runoff. OSP has stated in the storm water management plan that the increased rate of runoff would be mitigated by the construction of detention ponds. A system of diversion dikes, ditches, and swales would divert runoff from the developed areas to the detention ponds, which would also be designed to remove sediments (Bechtel Eastern Power Corporation, February 1987).

OSP has made calculations to estimate the increase in runoff volume from the entire plant site. Using the SCS rainfall-runoff methodology (SCS, August 1972), the computed increased runoff volumes from the proposed 17-acre disturbed area would be as follows (Bechtel Eastern Power Corporation, February 1987):

Values are reported in acre-feet.

	Natural Conditions	Developed Conditions	Percent Change
Mean annual precipitation	41.1	70.0	70
10-year, 24-hour storm	4.6	7.8	70

The proposed development area is part of a small subwatershed of Chockalog River, the nearest named offsite stream. Although the percentage increase in runoff volume from the site itself is significant, the relative impact to the subwatershed is not as pronounced, since the proposed developed area (17 acres) is small in comparison to the whole subwatershed (480 acres). Calculated runoff volume from the subwatershed would be increased by about 7.5 percent (Bechtel Eastern Power Corporation, February 1987).

The peak runoff rate from the developed area would also increase over natural or existing conditions. However, OSP has stated that detention ponds would be used to mitigate these increases, thereby preventing negative impacts to downstream receiving water.

Water and Oil Pipelines

After excavation, pipe placement, backfill operations, and revegetation, the pipeline will not be exposed to external conditions. Therefore, no adverse environmental impacts are expected during operation.

4.1.2.2 Groundwater Impacts

Groundwater from one or more onsite wells would be used as the source of potable water for the OSP plant, while surface water sources would be used for plant process and cooling water. Groundwater withdrawal for potable uses is expected to be small. Assuming a plant operating staff of about 30 and three work shifts per day, consumption would probably average about 6 gpm. This withdrawal should have minimal effects on groundwater resources in the site area.

Recharge to groundwater would be affected in the 17-acre area to be converted from existing forested land to plant facilities, and the area would become more impervious. Some water would recharge from the storm water runoff basin. Overall effects on groundwater should be minimal.

Sanitary wastes are proposed to be sent to a package-type secondary treatment plant, located within the plant area, and the effluent would be reused in the plant. There would be no effect on groundwater from sanitary waste.

4.1.3 Air Quality

The operation of the proposed power plant would result in two principal types of emissions to the atmosphere--stack emissions and cooling tower emissions. There may also be a relatively minor amount of fugitive emissions from sources such as standby fuel oil storage tanks. The stack emissions would consist of products of combustion from the combustion turbines and possibly from the supplementary fired heat recovery boilers. Cooling tower emissions would consist primarily of water vapor that may be visible, depending on atmospheric conditions.

4.1.3.1 Stack Emissions

The stack emissions from the proposed facility are expected to be fairly constant, since the plant is expected to operate at or near full load on a continuous basis. The primary fuel to be burned in the combustion turbines would be natural gas. The gas would be supplied to the OSP facility via a tie-in to the proposed Tennessee Gas Pipeline Company Rhode Island Extension, which would traverse the plant site. A typical fuel analysis is included in Table 4.1-5. No. 2 fuel oil would be stored onsite in tanks for emergency use when natural gas is not available to OSP. The fuel oil used for this purpose would have a maximum sulfur-in-fuel content of 0.5 percent.

Operation of the combustion turbines and the supplementary fired heat recovery boilers would result in emissions of up to five pollutants--NO_x, PM, CO, SO_2, and VOC--all of which are regulated by State and Federal agencies. OSP's generating station would have the potential to emit NO_x, PM, CO, SO_2, and VOC in quantities that would trigger a PSD review by the Rhode Island Department of Environmental Management. The State of Rhode Island is, however, classified as nonattainment for O_3. Since the OSP facility's VOC emissions (a precursor to O_3) are expected to be less than 100 tons/yr, O_3 is exempt from the nonattainment review process. An integral part of the PSD review process would be a BACT demonstration for all sources of emission at the plant. BACT is defined under Rhode Island Regulation No. 9 as follows:

> Best available control technology means an emission limitation (including a visible emissions standard) based on the maximum degree of reduction for each regulated air pollutant which would be emitted from any proposed major stationary source or major modification which the Director, on a case-by-case basis, taking into account energy, environmental and economic impacts and other costs, determines is achievable for such source or modification

TABLE 4.1-5

Fuel Analysis

Analysis	Mole (%)
Nitrogen	0.67
Carbon dioxide	0.71
Methane	95.61
Ethane	2.37
Propane	0.36
Iso-butane	0.08
Normal-butane	0.08
Iso-pentane	0.02
Normal-pentane	0.02
Hexanes plus	0.06
Total 100.00	
Specific gravity:	0.5848
Saturated Btu @ 14.73:	1014
Dry Btu @ 14.73:	1032

Station Name: Granite-Agawam Mass.

Sample date: 10/15/86.

SOURCE: Tennessee Gas Pipeline Company, Gas Analysis Report.

through application of production processes or available methods, systems and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by an applicable standard under 40 CFR Parts 60 and 61.

A comprehensive BACT analysis was performed for the OSP project as part of the requirements of the PSD review process (Environmental Research and Technology, July 1987). This analysis augmented a previous BACT analysis provided in OSP's PSD permit application (Bechtel Eastern Power Corporation, March 1987a). The earlier demonstration involved evaluating several alternative NO_x control technologies, including water and steam injection and selective catalytic reduction. The purpose of this analysis is to demonstrate that the proposed emission control measures represent BACT for NO_x, CO, SO_2, and PM emissions. The BACT requirements of the PSD review process are intended to ensure that the control systems incorporated into the design of the proposed facility reflect the latest in demonstrated control technology, in keeping with local air quality, energy, economic, and other environmental considerations. It should be noted that the demonstration of BACT for a particular project is in addition to Federal NSPS, which establish the minimum acceptable requirements for a BACT determination. The NSPS applicable to this project are discussed in Section 3.1.3.3.

Table 4.1-6 presents a summary of projected emissions from the OSP generating station for gas- and standby oil-fired operation. The emissions shown in the table are representative of the ultimate configuration of the facility (i.e., 500 MW), and reflect the control technology determined to represent BACT for the proposed facility.

The control technologies proposed for use as BACT at the OSP facility are as follows:

- For NO_x--water injection and turbine combustion design.
- For CO--natural gas as primary fuel, full load operation.
- For SO_2--natural gas as primary fuel with negligible content, low sulfur fuel oil (less than 0.5 percent sulfur) as backup fuel.
- For PM--use of natural gas as primary fuel and No. 2 oil as backup fuel.

TABLE 4.1-6

Maximum Projected Emission Rates for the Proposed 500 MW OSP Generating Station (Both Phases)

	Gas Firing[a]			Oil Firing (standby)[b]		
Pollutant	(lb/MMBtu)	(lb/hr)	(ton/yr)[c]	(lb/MMBtu)	(lb/hr)	(ton/yr)[d]
NO_x	0.164	698	3,057	0.18	761	--
CO	0.0506	187	819	0.08	327	--
VOC[e]	0.0052	19	83	0.01	41	--
SO_2	0	0	0	0.54	2,331	--
PM	0.01	46	201	0.01	46	--

[a]Based on a heat input of 2,116.8 MMBtu/hr per phase (gas firing only) and 1,846.3 MMBtu/hr per phase (natural gas with supplemental firing). Two phases, 250 MW ea.

[b]Based on a heat input of 2,172.8 MMBtu/hr per phase. Two phases, 250 MW ea

[c]Based on 100 percent operation.

[d]Annual emission rate not estimated. Oil firing will occur only in the unlikely event that gas is not available from Tennessee Gas Pipeline Company.

[e]Nonmethane hydrocarbons.

SOURCE: Bechtel Eastern Power Corporation, September 1987.

4.1.3.2 Dispersion Modeling Results

To meet the preconstruction review requirements of this project under State PSD regulations, a PSD permit application was prepared and submitted to the Rhode Island Department of Environmental Management (Bechtel Eastern Power Corporation, March 1987a, March 1987b, September 1987). This application contains the results of a comprehensive dispersion modeling analysis for four criteria pollutants--SO_2, PM, CO, and NO_x--which the facility is expected to emit in significant amounts (as defined by EPA in 40 CFR 52.21 (b)(23)(i)). The NO_x and CO would be emitted during normal operation utilizing natural gas. The emergency use of fuel oil would add limited amounts of PM and SO_2 to the emissions. The State of Rhode Island is currently designated as nonattainment for O_3; however, a nonattainment review is not necessary since VOC emissions from this facility (VOC's are precursors to O_3) would be less than 100 tons/yr.

The dispersion modeling analysis performed for the proposed facility, as submitted in support of OSP's PSD permit application, was based on a modeling protocol that was reviewed and approved by the Rhode Island Department of Environmental Management and EPA Region 1 (Bechtel Eastern Power Corporation, 1986). The final analyses included SO_2 and PM increment consumption analyses and a demonstration of NAAQS compliance (as given in Section 3.1.3.3) for those criteria pollutants to be emitted in potentially significant amounts (i.e., SO_2, PM, NO_x, and CO).

The modeling was based on EPA's Industrial Source Complex Short Term Model, Version 6. The analysis was designed to predict the combined and individual air quality impacts from operation of the proposed OSP facility and any other existing or proposed sources of emission that might interact with the plant emissions. The modeling use 5 years of meteorological data from Providence, Rhode Island (surface observations), and Chatham, Massachusetts (upper air data), as input for the period 1979 to 1983. This long-term 5-year data base is considered by the State and EPA Region I to account for any year-to-year variability in meteorological measurements.

The analysis of both PSD increment consumption and NAAQS compliance was performed for both the natural gas- and oil-fired cases. Modeling for both cases was based on a worst case or maximum load 500-MW operating scenario for the

OSP facility. The pollutant emissions and stack parameters associated with full load operation are shown in Table 4.1-7.

The modeling analysis of the OSP facility at full load operation indicates that its maximum radius of significant impact (as defined by EPA) would not exceed 20 kilometers. The analysis of interactions with other sources in the area was limited to sources with emissions greater than 100 tons/yr within 10 kilometers of the OSP site and all sources with emissions greater than 500 tons/yr located between 10 and 20 kilometers from the site. Two sources were identified as meeting this criteria:

- The existing Cranston Print Works in Webster, Massachusetts (SO_2 and VOC emissions), approximately 12.5 miles west of the Sherman Farm Road site.
- A proposed cogeneration facility in Bellingham, Massachusetts (SO_2, NO_x, PM, and CO emissions), approximately 10 miles northeast of the OSP site, to be operated by Northeast Energy Associates. This is a 280-MW generating facility; Northeast Energy has recently applied for an exemption from the Powerplant and Industrial Fuel Use Act (52 FR 8506, March 18, 1987). The petition was supported by an environmental impact analysis that included an analysis and summary of the impacts of the proposed facility (Intercontinental Energy corporation, 1987).

Dispersion modeling analyses were performed for the proposed OSP facility to determine the air quality impacts with respect to State and Federal limits and regulations set to protect health and welfare. A discussion of air quality limits and regulations is contained in Section 3.1.3.3. The two primary air quality constraints with which this project must comply are the PSD increments for SO_2 and PM, and the State AAQS and NAAQS for SO_2, PM, NO_x, and CO.

4.1.3.3 PSD Increment Consumption

There are no existing PSD increment consuming sources within 12.5 miles of the proposed OSP site. The only potential increment consuming source in the area other than the proposed OSP facility is the proposed Northeast Energy Associates cogeneration facility described above. The environmental impact analysis performed for that project indicates that the maximum concentrations of SO_2 and PM will in fact be less than the EPA-defined levels of significant impact for all averaging periods. No significant interactive effects between the Northeast

TABLE 4.1-7

Stack Parameters and Pollutant Emissions for the Proposed OSP Facility[a]

LOCATION

Burrillville, Rhode Island
Phase I--279033 meters East/4654200 meters North
Phase II--279159 meters East/4654132 meters North

Stack Parameters

Stack height (m) (2 stacks)	45.7 (GEP stack height)
Base of stack elevation (m)	158.5
Stack exit temperature (K)	371 (natural gas) 413 (oil)
Stack exit velocity (mps)	19.39 (no supplemental firing) 15.79 (supplemental firing) 19.69 (fuel oil)
Stack exit diameter (m)	4.80

Emissions (Total for Both Phases)[b]
(grams per second)

	Natural Gas[c]	Natural Gas[d] (supplemental firing)	Fuel Oil[e] (standby)
SO_2	(f)	(f)	294.00
PM	5.80	4.40	5.80
NO_x	88.0	74.00	96.00
CO	12.0	23.60	41.20
VOC	1.12	2.40	5.20

[a]All parameters and emission rates based on full load operation.

[b]Total power generation of 500 MW.

[c]Based on a heat input of 2,116.8 x 10^6 Btu/hr per phase.

[d]Based on a heat input of 1,846.3 x 10^6 Btu/hr per phase.

[e]Based on a heat input of 2,172.8 x 10^6 Btu/hr per phase.

[f]Negligible emissions.

SOURCE: Bechtel Eastern Power Corporation, September 1987.

Energy and OSP facilities are expected at any location. PSD increment consumption in the area surrounding the OSP facility is, therefore, expected to be attributable only to the operation of the OSP plant.

A summary of OSP's predicted SO_2 and PM ambient impacts and a comparison with the corresponding PSD increments is shown in Table 4.1-8. The values shown represent the maximum predicted offsite SO_2 and PM impacts for the ultimate plant buildout scenario (500 MW). As can be seen, the maximum concentrations are well below the available increment for both gas- and oil-fired operating scenarios, with the maximum percent increment consumption for SO_2 and PM at 15.4 and 1.1 percent, respectively. Gas-fired emissions are seen to result in a less than significant impact for all locations when compared to EPA significance levels. These values are also well below Rhode Island's additional limitation that no new source can consume more than 75 percent of the available increment at any location (Section 3.1.3.3).

4.1.3.4 Compliance With Ambient Air Quality Standards

Compliance with State AAQS was addressed by considering the combined impacts of the proposed OSP facility, the existing Cranston Print Works, and the existing background concentrations, and comparing results with the applicable AAQS. The AAQS for Rhode Island and Massachusetts are identical to the NAAQS, except that Massachusetts also has a 1-hour ambient standard for NO_2. Table 4.1-9 presents the results of this analysis, summarizing the maximum predicted concentrations (using 5 years of meteorological data) for the proposed OSP facility alone (gas-fired and oil-fired configurations), the Cranston Print Works alone, and the maximum concentration from all sources (i.e., the maximum predicted concentration with all sources modeled simultaneously plus the ambient background concentration); NAAQS are shown for comparison purposes.

All predicted concentrations are well below the ambient standards, and there is no reason to expect that any standard would be threatened or exceeded at any location as a result of the operation of the OSP facility. The maximum percent consumption of any standard by the OSP project is 16 percent for the gas-fired configuration and 13 percent for the oil-fired configuration, both for the Massachusetts 1-hour NO_2 standard. For Federal and Rhode Island air quality standards applicable to the OSP project, the maximum consumption of any standard

TABLE 4.1-8

Maximum Predicted PSD Increment Consumption in the Vicinity of the Proposed OSP Generating Facility[a] (concentrations in $\mu g/m^3$)

Pollutant and Averaging Time[b]	Gas-Fired		Oil-Fired (standby)		EPA Significant Impact Level	Available Increment
	Maximum Predicted Concentration	Increment Consumption (%)	Maximum Predicted Concentration	Increment Consumption (%)		
SO_2 3-hour	0	0	67.9	13.3	25	512
24-hour	0	0	14.4	15.4	5	91
Annual	0	0	1.3	6.5	1	20
PM[c] 24-hour	0.40	1.1	0.3	0.8	5	37
Annual	0.04	0.2	0.03	0.2	1	19

[a]Results obtained using 5 years of meteorological data (see text).

[b]3-hour and 24-hour concentrations represent the highest second-highest concentrations. Annual concentrations represent the highest value obtained.

[c]Values shown in the table for PM represent total suspended particulates.

SOURCE: Bechtel Eastern Power Corporation, September 1987.

TABLE 4.1-9

Maximum Predicted Ground Level Concentrations of SO_2, PM, NO_2, and CO in the Vicinity of the Proposed OSP Facility[a]
(concentrations in mg/m^3)

Pollutant and Averaging Time	Ocean State Power[b]		Cranston Print Works	Ambient Background Concentration	Maximum Predicted Concentration From All Sources[c]		NAAQS
	Gas-Fired	Oil-Fired			Gas-Fired	Oil-Fired	
SO_2							
3-hour	0	67.9	130.1	203	333.1	333.1	1,300
24-hour	0	14.4	32.8	104	136.8	136.8	365
Annual	0	1.3	4.2	26	30.2	30.3	80
PM[d]							
24-hour	0.4	0.3	2.5	112	114.5	114.5	150
Annual	0.1	0.1	0.3	39	39.3	39.3	50
NO_2							
1-hour	52.0	42.0	40.6	237	289.0	279.0	320[e]
Annual	0.6	0.4	0.7	49	49.7	49.7	100
CO							
1-hour	16.6	18.4	3.5	11,400	11,416.6	11,418.4	40,000
8-hour	4.9	4.5	0.9	7,700	7,704.9	7,704.5	10,000

[a]Within OSP's predicted radius of significant impact.

[b]Assumes full load operation of the total plant (500 MW).

[c]Maximum predicted concentration with all sources modeled simultaneously plus background.

[d]NAAQS for particulate matter is the recently promulgated PM10 standard (52 FR 24634, July 1, 1987); see Section 3.1.3. All predicted values are for total suspended particulates.

[e]Massachusetts Air Quality Standard.

SOURCE: Bechtel Eastern Power Corporation, September 1987.

is only 5.2 percent of oil-fired operation, and less than 1 percent for gas-fired operation.

4.1.3.5 Cooling Tower Effects

The mechanical draft cooling towers proposed for the plant as a heat dissipation system would emit moisture in the atmosphere as visible and invisible water vapor. The emissions of water and water vapor from the cooling towers are based on vendor estimates of cooling tower performance. Table 4.1-10 summarizes this information for the proposed cooling tower design.

The operation of the plant and its cooling towers may have the following potential effects on the nearby environment:

- Elevated visible plumes affecting air traffic.
- Ground-level fog affecting roadway visibility.
- Icing conditions on nearby roads associated with freezing of water vapor and cooling tower drift.
- Deposition of cooling tower drift (small water droplets) downwind of the plant.

4.1.3.5.1 Visible Plumes

The cooling towers would produce a visible plume of various lengths depending on prevailing meteorological conditions and the operating load of the plant. In the absence of downwash and wake effects, the warm moist air would rise until it loses its initial momentum and excess heat. The occurrence of a long, visible plume is expected to be relatively infrequent, and would occur primarily during the winter months. An analysis of the frequency of occurrence of visible plume lengths was performed (C.T. Main, 1988) using 5 years of data from Providence, Rhode Island. The plumes would be expected to extend 800 meters (about one-half mile) downwind of the cooling towers about 5 percent of the time. Plume lengths of 200 meters (about 650 feet) would occur about 25 percent of the time. Visible plume height would be expected to reach 90 meters (295 feet) 16 percent of the time; 50 percent of the time the plume would be less than 70 meters (230 feet) in height.

TABLE 4.1-10

Summary of Cooling Tower
Characteristics and Performance

Tower Type	Linear mechanical draft
Number of Fans per phase	7
Dimensions (ft(m)) per phase	
Length	378 (115.2)
Width	48 (14.3)
Height	42.3 (12.9)
Effective Outlet Diameter (ft (m))	84.7 (24.82)
Heat Dissipation Rate (MW)	197.7
Total Air Flow Rate (cfm)	8,494,514
Drift Loss Rate	
(gpm/tower)	1.63
(gpm total both phases)	3.26
Cooling Water Salt Concentration[a] (grams salt per gram solution)	.0027

Drift Droplet Spectra

Diam. (μm)	Mass Freq. (%)
0-10	0.4
10-20	5.0
20-25	14.0
25-60	41.0
60-150	35.0
150-240	4.4
240-350	0.09
350-500	0.01

SOURCE: C.T. Main, 1987.

Note: The cooling water salt concentration equals the mean total solids minus suspended solids times 20 concentrations (cycles):

(145 mg/l - 11 mg/l) x 20 = 2,680 mg/l
At 1,000 grams H_2O/l = .0027 gm solids/gm H_2O

Since the OSP station will normally operate at 7 cycles, the calculated cooling water salt concentration of .0027 gm solids/gm H_2O at 20 cycles is conservative.

Calculations are based on USGS Water Resources 1984 Data for the Blackstone River (Table 2-2, Environmental Impact Assessment for the OSP Burrillville, RI, Electric Generating Station - Bechtel Eastern Power Corporation, December 1986).

Visibility on nearby roadways is not expected to be degraded by the presence of elevated visible plumes. The nearest airport--Hopedale-Druper--is 10.5 miles away. At that distance, the visible plume is not expected to hinder the safe operation of aircraft during takeoff and landing operations. Away from the airport, aircraft should typically be operated at much higher altitudes than the estimated plume height.

4.1.3.5.2 Ground Level Fogging and Icing

In the event of relatively severe downwash and wake effects, it is possible that the cooling tower plume could reach the ground. Should this occur, ground-level fogging could result in a degradation of visibility in the vicinity of the plant site. Furthermore, during subfreezing atmospheric conditions, icing could occur where the plume contacts the ground and in locations where there is any drift deposition.

An analysis of fogging and icing potential on nearby roads was reported in the EIA for this project (Bechtel Eastern Power Corporation, December 1986). The analysis was based on a conservative modeling approach that is believed to yield a greater frequency of fogging and icing than would actually be expected to occur. The results of this analysis indicate that fogging may occur up to:

- 136 hr/yr on West Ironstone Road (approximately 1,300 feet south of the proposed cooling tower locations).
- 240 hr/yr on Douglas Pike in Massachusetts (approximately 900 feet north of the cooling towers).
- 94 hr/yr on Douglas Pike in Rhode Island (approximately 1,200 feet northeast of the cooling towers).
- 31 hr/yr on Sherman Farm Road in Massachusetts (2,100 feet west of the towers).

Icing due to ground level plume impingement was predicted to occur up to 63 hr/yr on Douglas Pike in Massachusetts and as little as 5 hr/yr on Sherman Farm Road, also in Massachusetts. Icing as a result of drift deposition along these roads was predicted to occur as much as 300 hr/yr on West Ironstone Road, 120 hr/yr on Douglas Pike in Rhode Island, and in negligible amounts along Douglas Pike in Massachusetts, on Sherman Farm Road, and in the surrounding area.

Some additional analyses were performed after the study conducted for the EIA, primarily in response to questions about the reported results (C.T. Main, 1988). This followup study used the Seasonal/Annual Cooling Tower Plume and Drift Impaction Prediction Model (SACTI) developed by Argonne National Laboratory for the Electric Power Research Institute. This model--based on an evaluation of the theory and performance of over 30 cooling tower plume and drift models--is considered by the scientific community to represent an improvement over previous modeling theories and is expected to provide a more realistic estimate of fogging and icing potential than the conservative model used in the previous analysis.

On the basis of 5 years of meteorological data, the SACTI model was used to estimate the maximum number of hours of potential fogging and icing effects on nearby roads. The analysis predicted that maximum fogging and icing impacts of the cooling towers would be expected to occur on plant property. Maximum expected roadway fogging and icing potential was estimated at 4.8 and 0.82 hr/yr, respectively, on West Ironstone Road in Rhode Island. Fogging and icing potential on other roads in the area was estimated at less than 1 hr/yr. It should be noted that many of the predicted instances of icing and fogging could occur in conjunction with naturally occurring phenomena of a similar type, making it difficult to distinguish between the two.

4.1.3.5.3 Cooling Tower Drift

The deposition of a small amount of cooling tower drift (small water droplets) can be expected to occur in the vicinity of the plant, to some extent, on a year-round basis. The amount of drift deposition is expected to be relatively small, however, since the maximum expected total drift loss from the towers is estimated at only 3.2 gpm. Estimates of the distribution of cooling tower drift around the plant were made for the cooling tower design parameters described in Table 4.1-10 (C.T. Main, 1988). Total annual plume water deposition estimates show that the deposition can be expected within approximately 3,000 meters north and south of the cooling towers. However, the maximum deposition rate of 1,900 $kg/km^2/mo$ for both towers is predicted to occur less than 200 meters from the towers. This is an expected result, since the larger mass carrying droplets tend to fall out closer to the source. Most of the deposition can be expected to occur onsite and in the immediate vicinity of the towers. The pattern of plume water deposition for the cooling towers are shown in Figure 4.1-1.

Base Map Source: U.S.G.S. 7½' Quad.; Chepachet, R.I., 1975 and Uxbridge, Mass., 1979.

Contours = kg/km^2/mo
Multiply by 0.00894 to get lbs./acre/mo.

0 4000 8000 Feet

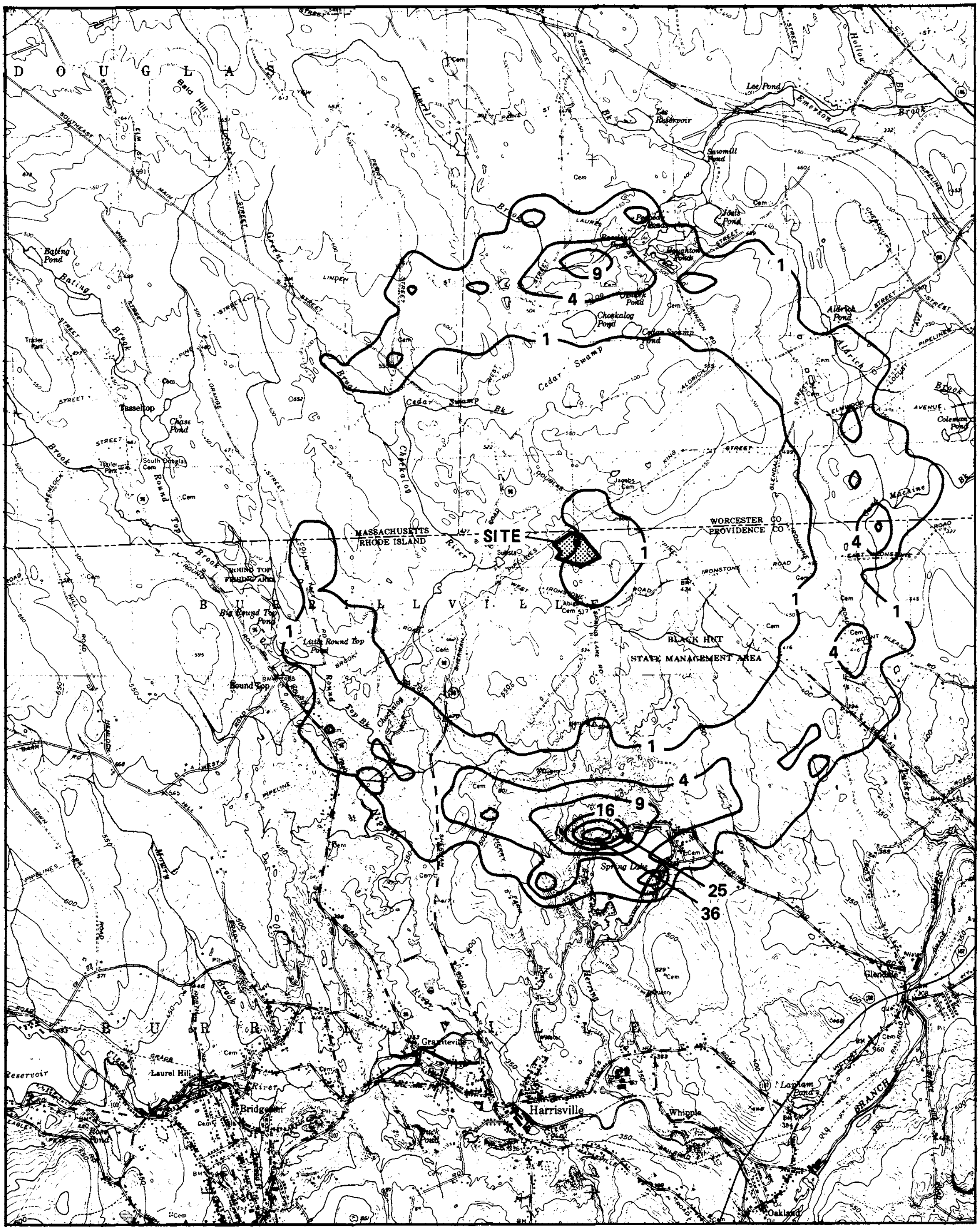
FIGURE 4.1-1
PLUME WATER DEPOSITION

A component of the total drift loss from the cooling towers is dissolved salts, which could have an impact on local vegetation and wildlife. An estimate of the maximum annual plume salt deposition was made (C.T. Main, 1988). The maximum annual salt deposition rate was predicted to be 39 $kg/km^2/mo$ at approximately 2.6 km south of the towers (at a location within the 36 $kg/km^2/mo$ contour shown on Figure 4.1-2).

The difference in the deposition patterns shown in Figure 4.1-1 (water) and 4.1-2 (salt) is a direct result of fundamental differences in the behavior of water droplets of different sizes. Plume water deposition is predicted to occur relatively close to the plant site since the larger mass carrying droplets tends to fall out of the plume within a short distance. Salt deposition is predicted to occur at larger distances because the smaller diameter salt particles are carried farther downwind within smaller, slowly evaporating water droplets. The smaller the size of the droplet carrying the salt particle, the farther downwind the particle will be carried and eventually deposited. The predicted annual average water and salt deposition shown in the figures should be regarded as an approximate representation of what might occur. The most important point that these figures demonstrate is that the area of maximum impact is relatively small. The predicted direction of the impact should not be considered precise.

It should be noted that the isopleths of plume water and plume salt deposition shown in Figures 4.1-1 and 4.1-2 are conservatively estimated patterns of ground-level water and salt deposition that may occur once the facility becomes operational. Except for areas immediately adjacent to the cooling towers (i.e., within a few hundred feet), plume water and salt deposition should not be perceptible. It should also be noted that the term 'salts' does not refer to ordinary table salt, but rather any of numerous compounds that may be present in the river that are ionic or crystalline in nature.

A biocide would be used to control biofouling in the condensers and other components of the water cooling system. It is anticipated that gaseous chlorine with an injection rate of 1 to 10 mg/l, would be used. An analysis of the proposed biocide injection system (Bechtel Eastern Power Corporation, June 1987) predicted the concentration of chlorine compounds in the cooling tower plumes would be no more than 0.00033 ppm. This is a conservative concentration based on 20 cycles rather than the proposed 7 cycles. At such low concentrations, resulting ground-



Base Map Source: U.S.G.S. 7½' Quad.; Chepachet, R.I., 1975 and Uxbridge, Mass., 1979.

Contours = kg/km²/mo
Multiply by 0.00894 to get lbs./acre/mo.

0 4000 8000 Feet

N

FIGURE 4.1-2
PREDICTED ANNUAL AVERAGE COOLING TOWER PLUME SALT DEPOSITION

level concentrations of chlorine are expected to be negligible. These findings are consistent with those of the Electric Power Research Institute (1986) which has reported negligible environmental effects from atmospheric VOC emissions when chlorine is used as a biocide.

4.1.3.5.4 Other Emissions

Aside from the emissions of water, water vapor, and dissolved salts discussed above, no significant emissions of any other pollutants are expected. Comments received by FERC regarding this project have suggested that the cooling towers might be a source of VOC's. Since chlorine and NALCO 2388 would be the only chemicals added to the cooling water (as a biocide and antifouling agent), the only source of VOC's in the cooling water would be the Blackstone River--the proposed source of cooling water. No data are available that document VOC content in the Blackstone River. Conversations with personnel from the Rhode Island Department of Environmental Management and EPA Regions I and IV indicate that, on the basis of past experience, they are not aware of the potential for significant VOC emissions from cooling towers used in this type of application (RIDEM, 1987; EPA Region I, 1987; EPA Region IV, 1987).

4.1.3.6 Visibility Effects

Visibility impairment can occur as either a general regional reduction in visual range (haze) or the presence of a visible plume. Haze can generally be attributed to primary (e.g., carbon) and secondary (e.g., sulfate) particulates, which can build up during relatively stagnant conditions. In urban areas, photochemical smog (NO_2) causes the brownish coloration of the sky. In rural areas, such as the area surrounding the OSP site, haze is more likely to occur as a result of emissions of SO_2, which subsequently transform to fine sulfate particulates. Plume visibility is most prevalent during stable dispersion conditions, when the effluents from a stack can travel significant distances with very little dilution. NO_2 and primary particulates are the major contributors to plume visibility.

Operation of the OSP generating facility would result in two types of plumes--a stack plume consisting of products of combustion from the combustion turbines and a cooling tower plume. The cooling tower plume and its potential impacts, discussed in detail in Section 4.1.3.5, are expected to be limited to a relatively small area surrounding the plant. The stack plume is not expected to result in a significant degradation of visibility at any location. Particulate emissions for both gas- and oil-fired (standby) operating conditions are expected to be relatively small--at 46 lb/hr. As a result, the plume is expected to be nearly invisible immediately upon exiting the stack. Futhermore, the opacity of the plume is limited to 20 percent by Rhode Island Air Pollution Control Regulation No. 1.

Long-range plume visibility effects were estimated using EPA's Level 1 visibility screening test (EPA, July 1980). Test results indicate that there should be no significant long-range visibility impairment at any location as a result of operation of the OSP facility.

4.1.3.7 Construction Effects

Some temporary and localized reduction of air quality would be associated with construction of the OSP generating station. This would occur primarily as a result of construction traffic and fugitive dust from earthmoving operations.

The extent of the fugitive dust generated would depend on the level of construction activity and on soil composition and dryness. If proper dust supression techniques are not maintained, a combination of dry soil and windy weather could result in localized dusty conditions. The construction permit for this project is subject to OSP's compliance with the Rhode Island Air Pollution Control Regulation No. 5, which limits fugitive dust emissions during construction activities.

The emissions from workers' vehicles and construction equipment should have an insignificant impact on regional air quality. However, there may be some very localized and isolated short-term occurrences of elevated pollutant concentrations, primarily of a nuisance nature.

4.1.3.8 Odors

The only potential sources of odor at the proposed OSP facility are the following:

- Combustion gases emitted from the stacks, for both gas and emergency oil firing.
- Temporary natural gas leaks.
- Onsite fuel oil storage.
- Cooling tower biocide (chlorine).

Any odors from the potential sources listed above are expected to be temporary and associated with rare, upset conditions or atypical operating scenarios.

The combination of both natural gas and emergency backup fuel oil in the combustion turbines is expected to be relatively clean and efficient. Under normal operating conditions, no odors are expected.

Comments received by FERC regarding this project have suggested that there might be a noticeable natural gas smell in the vicinity of the plant. The only way this could occur would be through an abnormal leak in the gas delivery or distribution systems within the plant. An unpleasant odor is added to natural gas for the purpose of leak detection. If any natural gas odors are detected at the plant, the situation would be promptly corrected.

Any odors associated with the storage of light fuel oil on the plant property are expected to be minimal and extremely localized (i.e., within 100 feet of the fuel oil storage facilities).

The use of chlorine in the cooling towers to control biofouling may from time to time result in a very localized chlorine smell. The quantity of chlorine to be used in the cooling towers is expected to be small, in the range of 1 to 10 mg/l of water. The resulting concentration of chlorine gas leaving the towers is estimated at 0.00033 ppm (Bechtel Eastern Power Corporation, June 1987). This is approximately three orders of magnitude less than the published odor threshold for chlorine--0.314 ppm (Billings and Jonas, 1981). The 0.00033 ppm estimate is conservatively based on 20 cycles of concentration rather than the proposed 7 cycles.

4.1.4 Sound Quality

Construction and operation of the proposed OSP generating station will result in both temporary and permanent increases in ambient sound levels in the vicinity of both the primary project site and the proposed cooling water intake structure and pumphouse facility site in Woonsocket. An assessment of the noise impacts of this project were addressed in two environmental noise impact studies (BBN Laboratories Incorporated, November 1987 and December 1987).

4.1.4.1 Construction-Related Noise

Noise associated with construction of the proposed plant would be produced primarily by diesel engine-powered equipment, such as cranes, dozers, scrapers, and trucks. Noise would also be produced by material cutting, grinding, and welding operations, and the site public address system. There may also be a limited amount of blasting activities during the early stages of construction. Some noise would be generated away from the main site during material deliveries and during installation of the new pipeline to the site. At the end of the construction period, main steam line blowout procedures during plant testing would also be a source of noise.

The plant construction schedule has been subdivided into three phases of activity to project and describe offsite noise:

- Phase 1--site clearing, rough grading, excavation, and placement of major foundations.
- Phase 2--structural steel erection, equipment erection and installation, plant siding and systems installation, system testing, plant startup, final grading, and site finishing.
- Phase 3--steam line blowout.

Construction activities associated with Phase 1 would take place for approximately 8 months. Phase 2 would last approximately 14 months; Phase 3 would probably occur intermittently during two 1-week periods near the end of Phase 2. The projected offsite noise levels during plant construction are listed in Table 4.1-11 for various locations representative of the nearest residential neighbors. During Phase 1 and Phase 2 construction, offsite 8-hour equivalent noise levels (L_{eq}) can be expected to range from 57 to 62 dBA at the closest

TABLE 4.1-11

Projected Noise Levels During Plant Construction and Operation (dBA)

Construction[a]

Distance from Site Center (feet)	Noise Level During Construction Phase 1	2	3
1,200	62	57	77
2,000	57	52	70
3,000	51	46	65
Duration (months)	8	14	0.5

Operation

Distance From Plant Center (Feet)	Location	Noise Parameter	Existing Noise Levels[b] Minimum	Existing Noise Levels[b] Average	Projected Plant Noise Level[c]	Projected Total Operating Noise Level[d] Minimum	Projected Total Operating Noise Level[d] Average
700	Nearest Property Line	L_{eq}	37-42	40-44	53	53	53
		L_{dn}	43-48	46-50	60	60	60
		L_{90}	29-33	36-41	53	53	53
1,200	Nearest Residence (Rhode Island)	L_{eq}	37-42	40-44	49	50	50
		L_{dn}	43-48	46-50	55	56	56
		L_{90}	29-33	36-41	49	49	49-50
2,000	Nearest Residence (Massachusetts)	L_{eq}	37-42	40-44	44	45-46	45-47
		L_{dn}	43-48	46-50	51	52-53	52-54
		L_{90}	29-33	36-41	44	44	45-46
3,000	--	L_{eq}	37-42	40-44	40	42-44	43-45
		L_{dn}	43-48	46-50	47	48-51	50-52
		L_{90}	29-33	36-41	40	40-41	41-44

[a] 8-hour weekday equivalent L_{eq} sound level in dBA based on 8- to 10-hour workdays, with little or no intensive construction work during nighttimes or weekends (BBN Laboratories, November 1987).

[b] Refer to Table 3.1-7.

[c] Based on a FERC Staff recommended project noise limitation of 55 dBA at the nearest noise sensitive area (i.e., residence).

[d] Combination of projected plant noise and existing noise levels.

residence in Rhode Island (i.e., 1,200 feet from the center of the plant). At the closest residence in Massachusetts (2,000 feet), the 8-hour L_{eq} is expected to be in the range of 52-57 dBA. Eight-hour L_{eq} noise levels during Phase 3 would range from approximately 65 to 77 dBA at the nearby homes.

The majority of construction work would take place during weekday daytime hours. Evening and weekend work required to avoid schedule delays would be limited to relatively low-noise activities such as mechanical and electrical systems installation within the main buildings after the exterior siding has been installed. Any other night or weekend work would occur only as a result of a specialized need such as a continuous concrete pour.

Noise associated with the construction of the water intake structure and pumphouse facility in Woonsocket would be produced primarily by medium-and light-duty diesel powered construction equipment such as bulldozers, backhoes, and trucks. The level of noise is expected to be typical of light commercial construction and fairly short-lived (i.e., on the order of 3 to 6 months). Noise levels near the work area could reach a maximum of about 90 dBA, but are expected to drop to approximately 60 dBA within a short distance of the site. During the peak of construction, noise from construction may occur from as early as 6 or 7 a.m. to as late as 6 or 7 p.m., 5 to 6 days per week.

4.1.4.2 Permanent Operation Noise

Primary sources of noise associated with operation of the proposed plant would include the combustion turbines and generators; heat recovery steam generators; main steam turbines and generators; building ventilation systems; miscellaneous pumps, motors, valves, vents, fans, and compressors; main power transformers; main cooling towers; and various smaller heat exchangers. The total overall noise from the entire plant would include the composite noise from each of the individual noise sources operating together. This total composite noise was estimated for offsite locations from the plant property line to residential areas as far as 3,000 feet from the center of the site (BBN Laboratories, November 1987).

Projected day-night noise levels (L_{dn}) for the plant itself will be limited by design to 55 dBA at the nearest residence--approximately 1,200 feet south of the center of the power block. At the nearest existing homes, between 1,200 and 3,000 feet from the center of the site, the L_{eq} attributable to the operation of the plant itself is predicted to be in the range of 40 to 49 dBA. Day-night noise levels L_{dn} attributable to the plant alone are expected to range from 47 to 55 dBA at the nearest homes within 3,000 feet of the center of the site.

Once the plant becomes operational, its noise impacts would combine with observed background levels for the area. The short-term average noise levels recorded at the plant site are summarized in Section 3.1.4.1. The observed average weekday L_{eq} was 44 dBA, and the average weekend L_{eq} was 40 dBA.

The combined operational noise levels are calculated and summarized in Table 4.1-10. The table contains observed and projected noise levels at the nearest OSP property line, and at 1,200, 2,000 and 3,000 feet from the center of the plant (i.e., the nearest 45 to 50 residences are located between 1,200 and 3,000 feet from the center of the site). The projections are based on OSP's commitment to an offsite L_{dn} noise limitation of 55 dBA and the observed existing noise levels. The offsite noise limitation of 55 dBA follows from the FERC Staff recommendation that L_{dn} noise levels not exceed 55 dBA. The FERC Staff recommends that the L_{dn} at the nearest residence be limited to 55 dBA. Additionally, EPA recommends that L_{eq} noise levels in areas where people spend limited amounts of time (i.e., homes, playgrounds, eth.) be limited to 55 dBA (EPA, 1978). The projected total operating noise levels presented in the table demonstrate that the facility would comply with both the FERC and EPA recommended operational guidelines.

As discussed in Section 3.1.4.2, there are no noise standards or regulations that will limit noise from this project. Rhode Island does not have an applicable noise standard and the Massachusetts guidelines do not apply for jurisdictional reasons. Due to the proximity of the OSP project to the state border, the Massachusetts guidelines have, however, been addressed. The Massachusetts noise guideline, which is not a regulation but a policy followed by the Massachusetts DEQE for new or modified facilities obtaining permits in Massachusetts, limits noise impacts to 10 dBA above existing background ambient noise levels. Ambient background noise is defined by the DEQE as the L_{90} measured during the quietest hour of the day. For the OSP project site area, the background L_{90} noise levels (Table 4.1-11) were observed to range as low as 29-33 dBA, with average L_{90} levels of 36-41 dBA. When compared with the Massachusetts guideline, OSP property line noise level of 53 dBA well exceeds the lowest ambient L_{90} by 20-23 dBA, or approximately 10 dBA above the guideline. At the nearest residence in

Massachusetts (2,000 feet to the north northwest), the projected plant noise level of 44 dBA would nearly meet the guideline during quiet hours (i.e., plant noise would exceed the existing minimum L_{90} levels by 11-15 dBA) and would comply with the guideline during all other periods. At the nearest Rhode Island residence (1,200 feet to the south southwest), the projected plant noise level of 49 dBA would exceed the Massachusetts guideline by 6-10 dBA.

On the basis of the observed noise levels at the nearest noise sensitive area (i.e., a daytime L_{eq} range of 40-44 dBA and calculated existing L_{dn} levels of 46-50 dBA), the maximum predicted L_{dn} level after the facility becomes operational would be 56 dBA or an increase of approximately 6-10 dBA.

The acoustic design goal of an L_{dn} of 55 dBA at the nearest residence would be achieved through the use of noise abatement treatments incorporated into the original design of the plant for each of the major noise sources.

Noise abatement features for the combustion turbine generators would include heavy-duty parallel-baffle air inlet mufflers, as well as complete machinery enclosures with sound absorptive lining to reduce casing-radiated noise. In addition, the generators would be located within an insulated metal building designed to further contain and reduce noise radiated by the compartment housings.

The heat recovery steam generators would include sound absorptive insulation and metal lagging to reduce noise radiation from the side walls. Enclosure walls spaced out from the generators would also be provided, if necessary. The heat recovery steam generators would also serve to muffle the combustion turbine exhaust noise.

Cooling towers would be equipped with wide-chord low-speed fans to reduce the level of fan noise radiated from the tower exhaust and inlet. Water splash noise from cooling towers would be reduced by the baffles located at the cooling tower inlets.

Noise generated by the power transformers would be controlled through the use of sound enclosures and low noise coolers. The main steam turbines and generators and most auxiliary equipment would be located within insulated metal buildings designed to contain and reduce equipment noise. In addition, this equipment would be purchased with low noise specifications to achieve reasonable in-plant noise levels and employee noise exposures.

The only source of noise during permanent operation of the cooling water, pipeline facilities would be the pumphouse located at the water intake structure in Woonsocket. The effect of increased noise on nearby noise-sensitive areas may be evaluated by comparing the available data on background levels (Section 3.1.4) with projected noise levels resulting from pump operation. Existing daytime L_{eq} noise levels in the vicinity of the proposed pumphouse were observed to be in the range of 53-56 dBA. Nighttime L_{eq} levels were observed to be 46 dBA, with calculated L_{dn} levels of 54-56 dBA.

Unfortunately, estimates of noise impacts cannot be made at this time because final equipment selections have not yet been made. OSP has, however, agreed to a FERC Staff recommendation that the pumphouse facility would not itself produce an L_{dn} of more than 55 dBA at the nearest noise sensitive receptor (i.e., residence). The noise from the pumphouse would of course be superimposed on the existing background noise for the area. When combined with background noise levels in the area, the operation of the pumphouse can be expected to result in an increase in noise levels of less than 3 dBA (see Appendix E). This small increase in noise should not significantly impact any nearby noise sensitive areas, including the proposed Blackstone Linear Park and River Bikeway.

4.1.5 Ecology

4.1.5.1 Terrestrial Ecology

4.1.5.1.1 Construction

Construction of the power plant would require clearing approximately 17 acres of upland vegetation from the site. This loss of upland vegetation would preclude the use of trees that would have produced acorns and nuts for squirrel and deer, and provided nest sites for birds. Loss of ground cover used by foxes, rodents, bobwhite quail, and ruffed grouse could possibly reduce their populations.

The cleared area is located on the plant site such that only a small portion of the bog wetland would be temporarily altered by construction. According to the OSP Site Plan (see Figure 2.1-5), the approximately 10-acre bog wetland east of the cooling towers would be outside the fenced plant area, yet bordering the limit of disturbance. In addition, the State has jurisdiction within 50 feet of any legal wetland; this area would also be outside the fenced plant area, yet within the area of disturbance. Potential impacts to adjacent wetlands through erosion due to land clearing would be kept to a minimum through implementation of the Erosion and Sediment Control Plan.

The smaller perched wetland area of 0.52 acre located in the center of the plant site would be filled. The area includes two levels, approximately 20 feet different in elevation, connected by a short intermittent stream with an indistinct channel lacking wetland plants along its course. Because this wetland is not hydrologically connected to any larger wetland or stream system, it is the less ecologically valuable of the two large wetlands onsite. This wetland area is too small to fall under the Rhode Island Department of Environmental Management's jurisdiction (RIDEM, June 22, 1988).

It is not anticipated that vegetation and wildlife in the Black Hut State Management Area, located south of West Ironstone Road, would be significantly affected by construction or operation of the proposed facility.

The proposed project includes a 10-mile-long water pipeline to the Blackstone River and a 7.5-mile-long fuel line to be placed in the same trench. Because the pipeline route runs along existing roadways, impacts are expected to be minimal. In the 0.5-mile-long section of pipeline on the plant site that runs along the existing transmission line right-of-way, disturbance to vegetation and wildlife would be temporary.

Wetlands adjacent to streams and brooks crossed by the proposed water and oil pipelines would be affected by construction activities. Potential impacts to streams and wetland vegetation growing on streambanks, as well as mitigation techniques for limiting impacts, are described in Section 4.1.5.2.

It is proposed that the water intake structure be located on the west bank of the Blackstone River in Woonsocket, Rhode Island, upstream of the Sayles Street Bridge. A conventional braced excavation technique, such as a circular steel sheet pile cofferdam, would provide a temporary watertight enclosure around the area of shoreline construction activities to prevent transport of bank sediment into the river. Excavation would be down to the level of adequate foundation material. After backfilling, all riverbanks and shoreline areas would be established and restored prior to removal of the watertight enclosure. Surface contours on the shoreline would be restored, the embankment lined with riprap to retard erosion, and the terrace seeded for stabilization (Bechtel Eastern Power Corporation, April, 1987a).

4.1.5.1.2 Operation

Cooling Tower Emissions

Potential impacts of cooling tower emissions on vegetation may include direct injury from salts or other contaminants in the cooling tower drift, as well as indirect damage from climatological changes, primarily humidity that may result in ice forming on vegetation during winter. Potential effects on wildlife would be indirect, as a result of changes in the abundance and species composition of the vegetation that provides food and cover for wildlife. Beneficial impacts could also result from cooling tower operation. Because of the increase in air moisture immediately downwind of the cooling towers, existing vegetation may become more lush during the growing season, and mosses may become more abundant on tree trunks and in the understory vegetation. Ferns would also grow well with a slight increase in humidity. No significant changes in plant community composition is anticipated.

Potential contaminants present in cooling tower drift from the OSP plant include chlorine (used to prevent biofouling) and NALCO 2388 (used in the towers to control scale). Salts and metals would be present in the influent cooling water from the Blackstone River. The potential effects of these drift constituents on vegetation are summarized below (Ecology and Environment, Inc., October 1987a).

Chlorine. Chlorine emissions from the OSP cooling towers are estimated to be approximately 0.00033 ppm (Bechtel Eastern Power Corporation, June 1987). Damage to vegetation from chlorine is reported to occur at concentrations greater than 0.1 ppm (Jacobsen and Hill, 1970). Consequently, the discharge of chlorine will not adversely affect vegetation.

Salt Deposition. Cooling tower drift may have relatively high concentrations of salt (Bloom et al., 1978) that can build up in the soil and be deposited on leaf surfaces (Taylor, et al., 1976). Salt concentrations in soil solution that exceed 2,600 ppm can inhibit the growth of sensitive plants and retard microbial activity (EPA, 1980). However, there is little potential that the OSP cooling tower emissions will raise salt concentrations in the soil to levels that would damage vegetation. The maximum total annual deposition of salt from the proposed OSP plant would be 468 $kg/km^2/yr$ (Ecology and Environment, October 1987a). When diluted with the normal annual precipitation of 1.07×10^9 $kg/km^2/yr$, the maximum salt concentration in the soil around the OSP plant would be 0.4 ppm--without taking into account any loss of salt from the soil through leaching. For comparison, typical agricultural irrigation practices may result in annual salt applications of 4×10^6 $kg/km^2/yr$ (4 million $kg/km^2/yr$).

Generally, salt deposition of 1 kg/hectare (ha)/week (52/kg/ha/yr) would result in damage to vegetation (Mulchi, 1987). The maximum weekly deposition of salt from OSP would be 0.008 kg/ha/week (0.468 kg/ha/yr), which is more than two orders of magnitude (100 times) less than the levels reported to cause injury to plants. Some minor damage to plants could occur during unusually long periods of dry weather (Mulchi, 1987).

Ice. The potential effects of ice formation on vegetation are expected to be minor. Based on modeling predictions (C.T. Main, Inc., 1988), the maximum predicted frequency of icing is only 0.82 hr/yr. The maximum impact is expected to occur approximately 160 meters south of the towers, which is within the project area.

Metals. Trace amounts of heavy metals would be emitted from the cooling towers because of the presence of metals in the cooling water influent from the Blackstone River. The primary heavy metals involved are cadmium, chromium, copper, lead, mercury, nickel, and zinc. There is no potential for acute toxicity to vegetation or wildlife at the low concentrations predicted in the emissions from the OSP cooling towers, even given the ability of plants and animals to bioaccumulate some heavy metals. Long-term deposition rates were estimated, but concentrations are not likely to be high enough to produce any effects on biota (Ecology and Environment, October 1987a). Therefore, no impacts at the Pitts horse breeding farm are expected from bioaccumulation of heavy metals.

This conclusion is based on an evaluation of potential effects of metal deposition on humans, which indicated that the potential levels of heavy metals deposited in cooling drift would be five to six orders of magnitude less than levels reported to have any effects (Ecology and Environment, October 1987a).

The primary destination of heavy metals deposited from the cooling towers would be the soil and organic litter. The deposition rates for seven metals potentially present in the influent cooling water were calculated to determine whether operation of the plant would pose any risk to plants or wildlife from metal accumulation in the soil. Concentrations of heavy metals in the Blackstone River (Gadboury et al., 1986) were used to determine the maximum annual deposition rates. These rates were used to calculate a maximum hypothetical concentration of heavy metals (ppm) in the soil after 1 year of operation (Table 4.1-12). It was assumed that all of the deposition is retained by a layer of soil 10 cm in depth; none of the element is lost from the volume of soil by leaching, runoff, or erosion; and the deposited element is equally distributed throughout the assumed soil volume.

The estimated concentations of all trace elements deposited in the soil as a result of plant operation would be several orders of magnitude lower than the concentrations that have been found to impact plants (4 ppm for cadmium to 400 ppm for lead to produce a reduction in crop yield or phototoxicity). Concentrations of metals are low enough that they would not build up to toxic levels for plants or animals even over the 20-year project life (Ecology and Environment, October 1987a).

TABLE 4.1-12

Maximum Annual Deposition Rate of Metals From the OSP Plant and Estimated Accumulation After 1 Year of Operation

Metal	Metal Concentration in Emissions ($\mu g/l$)[a]	Annual Deposition (g/m^2)[b]	Maximum Concentration in Soil (ppm)[c]
Cadmium	40	9.2×10^{-7}	3.04×10^{-6}
Chromium	600	1.4×10^{-5}	4.6×10^{-5}
Copper	600	1.4×10^{-5}	4.4×10^{-5}
Lead	200	4.6×10^{-6}	1.5×10^{-5}
Mercury	2	4.6×10^{-8}	1.5×10^{-7}
Nickel	1,000	2.3×10^{-5}	7.6×10^{-5}
Zinc	1,200	2.8×10^{-5}	9.3×10^{-5}

[a]Conservatively assumes 20 cycles of concentration; actual concentration expected to be 7 cycles.

[b]Assumes maximum water deposition of 1900 kg/km^2/month = 23 g/m^2/yr.

[c]Assumes soil weighs 302 kg/m^2 to a depth of 10 centimeters.

SOURCE: Ecology and Environment, October 1987a.

4.1.5.2 Aquatic Ecology

A small tributary to the Chockalog River drains from a bog on the northwest portion of the site, flowing northward. Since sediment control techniques would be implemented during clearing of the upland area, no impacts would be anticipated to aquatic systems onsite.

Streams affected by OSP construction are associated with the oil/water pipeline routes. A Wetland and Water Crossing Plan has been prepared and would be implemented prior to initiation of work. Potential impacts to streams and adjacent vegetation would be further evaluated during the State wetlands permit review process. Because the pipeline runs along existing road rights-of-way, streams would already have been altered in the past and some may flow through culverts. No known significant impacts to downstream wetlands are expected.

The following general methods would be implemented to reduce aquatic impacts:

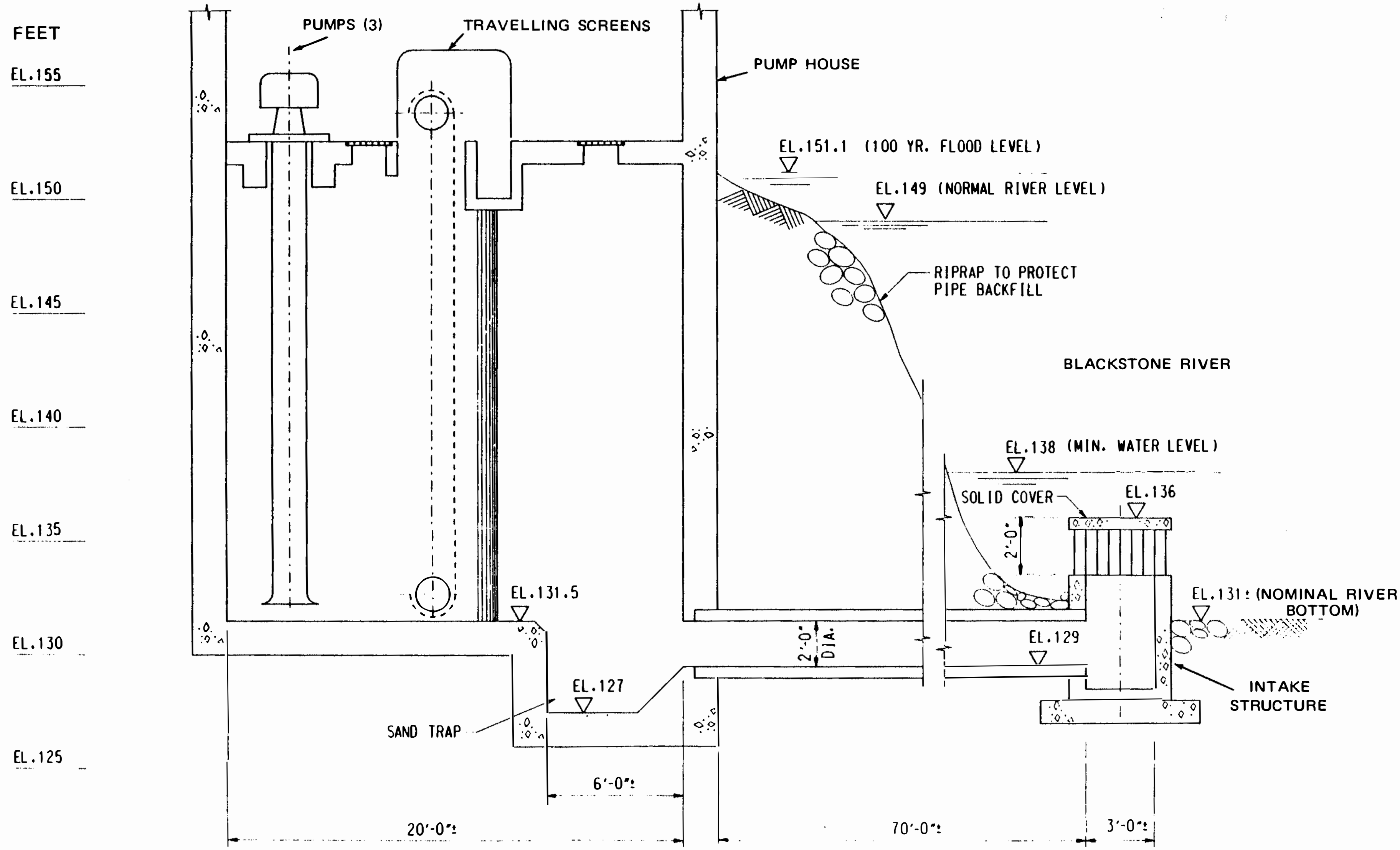
- Siltation and turbidity would be minimized by bank stabilization techniques such as compaction of soil on the banks, installation of mats, and riprap fabricated onsite.
- Prior to grading the right-of-way, silt traps or barriers would be constructed near small creeks and wetlands when protection is not provided by existing vegetation or natural barriers.
- As many trees as possible would be preserved on streambanks.
- If grading is necessary, soil would be pushed away from the stream so that it would not wash into the waterway.
- Tracked equipment would not enter the stream to clean tracks and cleats.
- The natural grade would be restored during backfill and cleanup operations .
- If mats are used to support equipment in the streambed, they would be removed and excess spoil and timber riprap would be disposed of in an acceptable manner.

With careful construction techniques, impacts to streams should be temporary, and benthic invertebrates should recolonize the disturbed streambed. Fish populations should return to normal in the affected area within 1 year. Backfilling to the original bottom surface level should facilitate recovery of the aquatic plant community. Rooted aquatic plants adjacent to the construction area should grow to invade the cleared right-of-way and stabilize soils in the streambed.

Construction of the water intake structure on the bank of the Blackstone River in Woonsocket would potentially cause short-term impacts from siltation. All exposed portions of onshore structures would be placed above the 100-year flood level. The offshore intake includes a velocity cap to minimize fish entrapment and trashracks with a design approach velocity of less than 0.25 feet per second (fps). The bottom of the trashracks is located 3 to 4 feet above river bottom to minimize sediment transport into the intake during flood events. The pipe from the intake would be approximately 2 feet in diameter and would be buried in a trench about 3 feet below the river bottom. The offshore intake would be prefabricated and placed in a prepared trench excavated in the riverbed. Backfill will be protected with a riprap cover sufficient to resist movement by river flow velocity during the 100-year flood (about 9 fps). The intake structure is illustrated in Figure 4.1-3.

Construction and operation of the proposed OSP project are expected to have only minor, temporary impacts to fishery resources--which would include short-term impacts due to disturbance to aquatic habitat in the immediate vicinity of the proposed intake structure, as well as short-term increases in suspended sediments and downstream siltation during construction. Construction-related impacts would be minimized by using conventional braced excavation techniques around the area of shoreline construction, and by implementing standard erosion and sedimentation control techniques such as hay bale barriers and temporary sediment traps (Bechtel Eastern Power Corporation, April 1987a). In addition, construction activities would be performed during normal low flow months (late July through September), and the duration of in-stream construction would be minimized to the extent practicable.

A reduction in flow volume of 6.8 cfs for cooling water requirements will result in very slight reductions in water depths downstream from the intake structure ranging from 2.1 percent to 2.9 percent, with a maximum reduction in



NOTE: ALL DIMENSIONS ARE APPROX. PENDING EQUIPMENT & STRUCTURAL REQUIREMENTS

Source: Bechtel Eastern Power Corporation,(Undated)

FIGURE 4.1-3
COOLING WATER INTAKE ON BLACKSTONE RIVER

depth of 3.4 inches. This maximum reduction occurs in the area in the immediate vicinity of the intake structure. In other downstream reaches, the reduction in depth does not exceed 1.2 inches. Similarly, the reductions in river width due to withdrawal of cooling water are very minor, ranging from 0.1 percent to 0.6 percent. The maximum reduction in width occurs in the reach immediately below the Thundermist Dam, where river widths are expected to decrease 3.7 inches.

These minor reductions in water depth and river width are not expected to have any substantial effect on the availability of aquatic habitats or to affect the presence of wetland vegetation.

Potential long-term impacts to fishery resources include a minor reduction in downstream habitat resulting from the withdrawal of cooling water, as well as removal of fish and fish eggs with the cooling water. Reduction in habitat due to loss of cooling water is expected to be minor. The 6.2 cfs required for cooling water represents less than 1 percent of the annual average flow in the Blackstone River, and approximately 7 percent of the mean annual 10-year, 7-day low flow. These small reductions in flow are expected to have only minor adverse impacts on the availability of downstream habitats. The frequency of withdrawals causing the pool to fall below the upstream side of the dam can not be estimated.

Operation of the proposed water intake would also have potential, minor long-term impacts on fishery resources resulting from the mortality of fish and their eggs due to entrainment in the intake structure. These impacts are expected to be minor because the design and location of the intake structure, as well as the characteristics of fish populations present at the intake site would minimize the likelihood of entrainment. The proposed intake structure would be located in mid-channel, where water depth at normal pool elevation is approximately 18 feet. The top of the intake structure would be approximately 13 feet below normal pool elevation (Figure 4.1-3). This structure would incorporate a velocity cap to minimize vertical flow patterns, and the design approach velocity would be 0.25 fps, which is less than the maximum approach velocity of 0.5 to 1.0 fps recommended by the American Society of Civil Engineers (1982) for the protection of fishery resources.

Based on the results of the 1987 fish survey, the relative abundance of recreational species (e.g., largemouth bass and sunfish) is lowest in the vicinity of the proposed intake location, as indicated by gill netting captures. The numbers of fish captured in the immediate vicinity of the intake represented 27 percent of the total catch and included white sucker, golden shiner, chain pickerel, and fallfish. Most of the eight species captured at this station inhabit nearshore areas, where cover is most abundant. While adults of all species present may occasionally occupy waters in the immediate vicinity of the intake, or may be attracted to the cover provided by the raised structure, their vulnerability to entrainment or impingement is expected to be low due to the low approach velocity of 0.25 fps.

Fish eggs, larvae, and juveniles would be particularly vulnerable to entrainment mortality; however, losses are expected to be minimal due to the location and design of the intake in relation to the spawning and rearing habitats of important species. The largemouth bass, pumpkinseed, bluegill, and yellow bullhead all typically spawn in nearshore areas of pools where they fan out nests in firm substrates and guard their eggs until they hatch. Both the fallfish and white sucker require spawning substrata of gravel, which occur in riffles and moderately flowing pools. The chain pickerel deposits its eggs over submerged vegetation which is usually most abundant along the margins of streams. The golden shiner has the most generalized spawning habit, broadcasting adhesive eggs over filamentous algae, submerged vegetation, and occasionally nests of largemouth bass. Filamentous algae was abundant in plankton tows made in the Blackstone River during the spring survey and was found at all depths. Thus, the eggs and young of the golden shiner, which is an important forage species for bass and pickerel, would be most susceptible to entrainment. However, such losses would be minor relative to the high fecundity of this species. No fish eggs or larvae were collected in plankton tows from the vicinity of the proposed intake location.

The evaluation of potential impacts of the proposed intake structure must also consider long-term trends in improving water quality in the Blackstone River, and the potential for restoration of anadromous fish populations. Although improving water quality should result in higher populations of recreationally important species, the impacts to those resources should remain minor because of the fish protection features incorporated into the intake structure design, and because of the location of the intake structure in the deeper midchannel section (which is not the preferred habitat for the recreationally important species).

The Blackstone River is under consideration for restoration of anadromous fish populations, particularly American shad and alewife. Because of the numerous barriers to fish migration, these restoration efforts will not be possible for many years. However, should anadromous fish runs be reestablished, the proposed intake structure is expected to have little effect on these populations. The proposed withdrawal of 6.2 cfs for cooling water represents less than 1 percent of the total river flow during the months of April through September, when spawning activity and downstream movement of juveniles would likely occur. Losses of anadromous fish would be minimized because of the low volume of withdrawal, the siting of the intake structure in a deep mid-channel location, and design features such as a low intake approach velocity and velocity cap. In summary, the construction and operation of the proposed water intake structure for the OSP project is expected to result in only minor impacts to fishery resources.

4.1.5.3 Threatened or Endangered Species and Unique or Critical Habitats

The USFWS, in a letter to FERC Staff (June 18, 1987), stated that "... except for occasional transient individuals, no Federally listed or proposed threatened or endangered species under our jurisdiction are known to exist in the project impact area." Rhode Island Natural Heritage personnel report that no State-designated threatened or endangered species are known to exist in the project area (RIDEM, Natural Heritage Program, July 22, 1987).

4.1.6 Sociocultural Resources

4.1.6.1 Land Use

The OSP site is part of a larger parcel of land owned by Eastern Utilities Associates, an electric utility holding company. An electric switching station is adjacent to the plant site. The property is traversed by two existing electric transmission lines owned by Boston Edison and a natural gas pipeline owned by Algonquin Gas. The site is undeveloped and is buffered by existing woodlands and vegetation from adjacent properties. Although the site is currently zoned F-5, Farming, it has not been used recently for cultivation. However, F-5 zoning was intended by Burrillville planners as a "catch all" category designed to slow growth in the area. F-5 zoning allows, by special exception, such uses as a sewerage plant, incinerator, or solid waste disposal facility. The Burrillville Town Council recently amended the town's zoning regulations to include an electric generating facility in the above list. OSP has subsequently requested and has been granted a special exception for a generating facility at the Sherman Farm Road site. Since the Burrillville Town Council has approved a special exception for the generating facility, approval of the pipeline by the FERC would not be inconsistent with the Burrillville Community Plan (Council on Environmental Quality, 1987).

The proposed plant construction would disturb approximately 17 acres of upland habitat at the highest point on the site property. Temporary construction-related land use impacts would be limited to those associated with clearing of the plant site and construction of the laydown area, erosion and sediment flow of site soils while uncovered during construction, fugitive dust and noise from construction, and soil mounding.

Potential impacts from cooling tower drift were evaluated to predict whether an increase in fog, ice, or deposition of salts might affect recreational values in the Black Hut State Management Area. Predicted concentrations of trace elements in the cooling towers (to prevent scale and biofouling) were far below concentrations reported to cause any adverse impacts to vegetation or human health, even after 20 years of power plant operation. Because of the very small increase in humidity and low concentrations of salt in cooling tower drift, no significant impacts on vegetation or wildlife are anticipated from power plant operation.

4.1.6.2 Socioeconomics

The location of sensitive receptors is a concern expressed by commentors during the public scoping phase. The proposed power plant would be located on the east and north sides of the existing 345-kV transmission lines. The location of the plant on the site is important in assessing the impacts on sensitive receptors--in this case, homes along Sherman Farm Road, West Ironstone Road, and Douglas Pike.

Increased traffic and traffic noise would negatively affect the quality of life for residents during the construction phase of the proposed project. These impacts are expected to be insignificant once the proposed plant becomes operational.

The proposed plant would employ approximately 200 persons during construction. These employees would draw on locally supplied services such as recreation, transportation, police, medical, and local government. The impacts are not expected to be significant, and the population of Burrillville should assimilate them without adverse effect. The operating phase would require 75 permanent employees, approximately 25 to 30 persons per shift. These employees should not have a significant impact on the community's resources, particularly if they can be drawn from the community.

Table 3.1-11 presents a listing of the Burrillville labor force composition. Generally, construction employees are willing to travel 75 miles for employment over a short duration, while permanent employees are willing to travel a distance of 30 miles on a regular basis. Providence and Worcester and other Rhode Island and Massachusetts communities offer a variety of skilled labor sufficient to provide for construction as well as operation of the proposed plant. In addition, the Boston metropolitan area and other New England communities are within commuting distance of the OSP site and have a diversity of trades sufficient to provide other skills not available locally.

The proposed project would have a positive socioeconomic benefit by supplying Rhode Island and New England with needed electric power on an economic basis. In addition, the proposed facility is expected to add approximately \$60 to \$70 million to the Burrillville tax base. In 1984, Burrillville's total taxable valuation was \$224 million.

OSP would contribute a total of more than $4 million over a 20-year period to the Town of Uxbridge and the Town of Burrillville provided the plant is constructed in Burrillville. These funds are ear-marked for student scholarships and community projects. Uxbridge and Burrillville each would receive $35,000 and $15,000 for scholarships and community projects, respectively, during 1988. In 1989, each town would receive $50,000 for student scholarships and $25,000 for community projects. Each year thereafter, for 20 years, each town would receive $100,000--divided 50, 30, and 20 percent--for scholarships, community projects, and scholarship endowments, respectively. After the 20 years, scholarship endowments will equal approximately $1 million. Uxbridge and Burrillville would appoint committees to administer the two programs. These contributions are dependent on developing the plant at the Sherman Farm Road site (OSP, undated).

OSP has also developed a compensation plan to address citizens' concerns about property value impacts. Donations of $200,000 and $100,000 would be made by OSP to Burrillville, Rhode Island, and Uxbridge, Massachusetts, respectively, to address the needs of those residents living in the immediate vicinity of the plant. The monies would be administered by a civic contribution committee in each town.

Compensation plans are not widely used and are controversial because of their precedent-setting nature. Nevertheless, such plans can be appropriate mitigation for property value and quality-of-life concerns. A property value protection plan proposed for the AES Riverside plant (described in Appendix F) represents another energy company's approach. FERC Staff considers this plan to be exemplary.

Water Supply Constraints on Industrial and Park Development

Withdrawal rights for Blackstone River water are under the jurisdiction of the Rhode Island Department of Environmental Management. Assuming that the State issues a withdrawal permit to OSP, less water would be available from the Blackstone River for future allocations to industrial developments. However, whether OSP's withdrawal permit would constrain industrial development along the Blackstone River cannot be assessed, since no one knows the type and number of new industries that might locate along the river, much less the amounts of water they may require. Therefore, the impact of OSP on future industrial development in the Blackstone River Basin cannot be assessed in this FEIS.

As described in Section 3.1.6.1, the U.S. Congress has designated the Blackstone Valley as a National Heritage Corridor. Both Rhode Island and Massachusetts are currently in the planning stages for developing a Blackstone Linear Park along portions of the Blackstone River. The only impacts the proposed OSP project would have on the park's development and use would be the visibility of the proposed cooling water intake structure at the Sayles Bridge from the proposed Waterfront park between South Main Street and Bernon Street bridges. The proposed intake structure would be upstream from the visitor's center of the proposed park. Should the proposed OSP developers adopt a dry cooling system, reduced impacts would be expected from the project's development on the Blackstone Linear Park. The plant's water withdrawal should not be perceivable by park users except during low flow periods, and even the effect will be minor. Withdrawal under low flow conditions could slightly impact canoeing and the aesthetics of viewing the river.

Water and Oil Pipelines

The primary socioeconomic impacts from water and oil pipelines would occur during the construction phase. At the water intake structures, primary construction activities would include:

- Excavation and fabrication of the shoreline structure
- Backfill around the structure
- Reconstruction of the existing riprap riverbank protection.

Several residences are located directly across the street from the proposed intake structure location. These homes can be expected to be affected by increased traffic (primarily heavy construction equipment), noise, and the visual and other inconveniences of construction activities.

Residences along the city streets of Woonsocket and along Douglas Pike are expected to bear the greatest adverse socioeconomic impacts from pipeline construction. Most residences are located within 50 to 75 feet of the city streets. Those along the route would be affected by traffic impediments, noise, and visual impacts of construction. Rerouting the pipeline to follow the railroad right-of-way or transmission line right-of-way at Route 102 would avoid the expected negative impacts along Douglas Pike. OSP has asserted that every attempt would be made to mitigate inconvenience to residents by using accepted techniques for pipeline construction along residential streets. Impacts from construction along the remainder of the route are expected to be minimal.

Horse Breeding

There is potential for construction noise to affect the breeding of quarter horses at Wild Oak Farm, located on Sherman Farm Road approximately 0.5 mile from the proposed site. The natural horse breeding season is June through August; the season is extended from March through late September by the practice of providing artificial lighting in breeding barns to lengthen the daylight period.

Although nervousness in horses can reduce reproductive ability and suppress appetite, a study published in Colorado notes that stress from hauling horses from 10 to 100 miles after breeding did not affect the rate of spontaneous abortions compared to mares that were not subjected to such stress. Experience with treating horses at stables located next to an airfield indicates that there was no evidence of increased health problems, though the animals were subjected to the noise of jets taking off and landing several times each day (Pugh, 1987).

No qualitative studies are known concerning the specific impact of noise on horse breeding. However, noise from construction activities and blasting in particular may cause nearby horses to become more nervous and possibly result in a short-term reduction in reproductive ability. During power plant operation, low-level noise would probably be inconsequential for horse breeding in the vicinity.

No adverse impacts to horses eating vegetation and drinking water in areas adjacent to the plant site are expected. Water from the cooling tower drift would not be expected to contain contaminants (metals and pathogens) at concentrations sufficient to affect humans or animals (Section 4.1.6.6).

4.1.6.3 Transportation

Construction activity for the proposed plant would produce temporary impacts on the flow of, and noise produced by, road traffic. Approximately 200 persons would be required during construction. The movement of construction-related personnel would cause an increase in local traffic. Residents along Sherman Farm Road would bear the greatest impact from construction activity since access to the site would be from Sherman Farm Road. During construction, it is anticipated that movement of construction equipment would produce the most significant impacts, primarily from noise and slower traffic. Any required upgrades to the road system should be funded by OSP or utilize the Burrillville tax revenues generated by the OSP plant.

Few transportation impacts are expected along Douglas Pike, a rural road that is inadequate for most construction equipment. Although the majority of construction traffic is expected to use Sherman Farm Road for access to the site, traffic from the east could use West Ironstone Road, which is bordered on the north by residences and woodlands and on the south by the Black Hut State Management Area and a few residences. The road is two-lane, with an asphalt and stone surface; children were observed playing in and just beside the road. The character and safety of West Ironstone Road would be adversely impacted by any construction activity along the road.

The 25 to 30 operating personnel per unit expected on the day shift would not have a significant impact on traffic. No road upgradings would be required, and any increased traffic levels would hardly be noticed by residents.

Access to the Black Hut State Management Area is not expected to be impacted by construction and operating traffic travelling to the site. Spring Lake Road is the primary access road to Black Hut. The road connects to West Ironstone Road on the north and Route 102 to the south. The majority of traffic to Black Hut would enter Spring Hill from the south. In either case, however, recreational use of the management area is currently constrained due to dense vegetation. Hunting is the primary form of receational use and is limited to hunting season. Therefore, no potential traffic impacts are expected.

4.1.6.4 Visual and Aesthetic Factors

The primary visual impact from the proposed OSP plant would be the major structures, particularly the exhaust stack (150 feet in height), the power block building (60 feet), and facilities such as the switchyard and cooling towers.

Visual impacts from the facility would also include emissions from the cooling tower array. Under certain meteorological conditions, the cooling tower emissions may produce a visible plume consisting primarily of water vapor. Maximum visible impacts could be expected on cold, humid days during the winter. Since the proposed OSP site and buffer areas are large, the visible plume is not expected to adversely affect area residents, recreational users, or travellers along the adjoining roadways. The plume would also be visible from various locations up to several miles away.

Figure 2.1-4 illustrates the proposed OSP plant. Direct views of the facility are mostly obscured by intervening vegetation, which consists primarily of deciduous hardwood trees averaging 40 to 60 feet in height. The facility would be more evident during the late fall, winter, and early spring. Only from abutting stretches of roadway along Sherman Farm Road, West Ironstone Road, and Douglas Pike would the plant be visible, though most viewers in the area would be able to see the exhaust stack.

4.1.6.5 Historic and Archeological Resources

4.1.6.5.1 Plant Site

A survey to identify potential historic and prehistoric resources at the proposed Sherman Farm Road site was conducted in accordance with specifications of the Rhode Island Historical Preservation Commission (PAL, 1987). The archeological consultant's concluding recommendations were that no significant aboveground or belowground resources existed within the site area. As noted in Section 3.1.6.5, the Crow Hollow site may be eligible for inclusion on the National Register of Historic Places (NRHP). Although the archeological site would not be affected by power plant construction, an intensive archeological survey of the site would be necessary if a change in project plans necessitates disturbance in the vicinity.

The FERC Staff has reviewed the recommendations of the archeological consultants and the comments of the Rhode Island Historical Preservation Commission and has determined that no significant cultural resources would be affected at the proposed plant site.

A family cemetery is located on the plant property. The closest structure to the cemetery would be the switchyard, approximately 250 feet away. The cemetery would not be affected because a sufficient buffer area would be left between the cemetary and the plant facilities. The FERC Staff, in consultation with the Rhode Island Historical Preservation Commission and OSP has made a determination of no effect on the historic cemetery based on the proposed buffer measure.

The OSP power plant project as proposed has thus been determined to have no adverse impacts on historic and archeological resources. Should evidence of such resources be uncovered during site preparation or construction, appropriate action would be taken to characterize and preserve any artifacts found, and to record the scientific information associated with their location and placement.

4.1.6.5.2 Water and Oil Pipelines

As identified in Section 3.1.6.5.2, two historic districts listed on the National Register of Historic Places would be affected by the proposed water and oil pipelines. Also identified in Section 3.1.6.5.2, three historic cultural resources listed on the National Register of Historic Places are adjacent to the proposed water and oil pipelines. It is unlikely that the proposed water and oil pipelines would have an adverse effect on these National Register of Historic Places-listed cultural resources because the facilities would be buried in roadways and other areas of modern disturbance. There would be no long-term visual, physical, or other types of impacts on these listed National Register of Historic Places cultural resources. Short-term visual impacts would be associated with the installation of the facilities, but there would be no physical destruction to these aboveground cultural resources. No new elements would be introduced by emplacement of the water and oil pipelines, which would diminish the integrity of these National Register of Historic Places-listed cultural resources. Prior to construction of these facilities, the FERC would consult with the Rhode Island Historic Preservation Commission and the Advisory Council on Historic Preservation on the effect of the proposed facility construction on these National Register of Historic Places-listed cultural resources.

Field inspections are in progress to assess the effects of the proposed facilities on both aboveground and belowground cultural resources. Archeological surveys would be conducted in certain locations of the proposed water and oil pipelines, particularly where installation of these facilities would cause new disturbance to potentially significant archeological resources. The FERC Staff would review all cultural resource survey results in accordance with Section 106 of the National Historic Preservation Act (NHPA) to determine the eligibility of any cultural resources identified for the National Register of Historic Places. For the most part, it is expected that most of the proposed facilities would be installed in areas of existing modern disturbance and there would be no effects on cultural resources. Due to the minimal ground disturbance resulting from the proposed facilities, it is recommended that significant archeological sites discovered either be avoided by rerouting the facilities or that appropriate data recovery be implemented on unavoidable archeological resources to avoid any adverse effects. Any data recovery performed on cultural resources determined eligible for the National Register of Historic Places would be evaluated by the FERC Staff in consultation with the Rhode Island Historic Preservation Commission and the Advisory Council on Historic Preservation in accordance with Section 106 of the National Historic Preservation Act.

4.1.6.6 Health Effects

Cooling Tower Emissions

Study data from an assessment of potential human health risks associated with release of metals and pathogens from cooling tower drift are summarized below (Ecology and Environment, Inc., October 1987b).

Metals. The evaluation of potential health risk due to exposure to metals in cooling water drift is based on various conservative assumptions and input data concerning operation of the OSP cooling towers. It is assumed that heavy metals potentially present in the cooling tower drift are the same contaminants present in the influent cooling water, and that the concentrations in the drift are approximately 7 times those of the influent water as a result of 7 cycles of concentration in the normal operation of the plant. Concentrations of metals expected to be present in the cooling tower drift are shown in Table 4.1-13.

Since the concentration of salt in the tower drift after 27 cycles of concentration is estimated to be 0.0027 kg/kg of water, the maximum deposition of salt represents a one-hundred fold concentration over that at the tower. Similarly, each metal is assumed to be 100 times more concentrated at the point of human exposure than at the tower outlet.

Finally, it is necessary to predict the maximum ground-level concentration of cooling tower drift from which the various metals exposure can be determined. Using the Industrial Source Complex--Short Term (Version 86170) atmospheric dispersion model, it is estimated that the peak annual average air concentration of drift water will be 119 mg/m^3. This maximum concentration is estimated to occur approximately 400 meters north of the OSP towers (Ecology and Environment, October 1987b). Based on the assumptions discussed above, the maximum concentration of each metal in the breathing zone was determined, as presented in Table 4.1-13.

Table 4.1-13 also summarizes chronic daily intakes for the seven metals of concern. These range from 6.8×10^{-9} mg/kg/day for mercury to 4.1×10^{-6} mg/kg/day for zinc. Also shown in Table 4.1-13 are the safety level reference doses for these metals (EPA, 1986). As can be seen, these doses--which are reflective of minimum health effect levels established by EPA--are generally 1,000 to 100,000 times higher than any chronic daily intakes anticipated to result from operation of the OSP plant. Thus, with the multiple conservative assumptions in this assessment, the use of water from the Blackstone River for OSP cooling water can be seen to present no adverse human health effects due to the presence of metals.

Pathogens. Microorganisms found in any ambient air cooling system include naturally occurring fungi, algae, and bacteria. Most of these organisms are nonpathogenic, and there is no evidence that viruses or fungi in cooling tower emissions present any potential human health hazard. The bacterial pathogens occurring in cooling tower water include certain enterics (e.g., coliforms, Serratia and Klebsiella species), Legionella species (including L. pneumophia (LP)), and some Pseudomonas species that can act as pathogens under opportunistic conditions (e.g., a human with a dysfunctional immune system).

LP, which causes Legionnaire's disease and Pontiac fever, has been the subject of extensive research. It is a naturally occurring bacteria found in fresh water, which is generally ubiquitous in its distribution. When fresh water is used for cooling water, LP can be found in the cooling towers and can be isolated from the drift. However, no correlation has been found between the presence of LP in cooling towers and the occurrence of Legionnaire's disease (Redd, 1987). Although LP is known to occur in cooling tower water, it is also widely distributed in both natural and manmade environments, including humidifiers (Zuravleff et al., 1983), soil excavation sites (Thaker et al., 1978), and respiratory therapy equipment (Arno et al., 1982). In addition, LP is found in shower heads and hot water faucets (Bollin et al., 1985); the aerosols created by these devices are capable of mobilizing LP and the aerosol particles are small enough to penetrate to the lower human respiratory system. However, an actual link between these sources and the occurrence of Legionnaire's disease has not been established.

TABLE 4.1-13

Estimated Chronic Daily Intakes of Metals and
Reference Doses for Hypothetical Residents
Potentially Exposed to Cooling Tower Drift

Metal	Maximum Concentration in Influent Water (μg/l)	Concentration in Emissions at Tower (g/g)[a]	Concentration in Drift at Point of Exposure (g/g)[b]	Reference Dose (mg/kg/day)[c]	Estimated Chronic Daily Intake (mg/kg/day)[d]
Cadmium	2	40×10^{-9}	40×10^{-7}	2.9×10^{-4}	1.4×10^{-7}
Chromium	30	600×10^{-9}	600×10^{-7}	5.0×10^{-3}	2.0×10^{-6}
Copper	30	600×10^{-9}	600×10^{-7}	3.7×10^{-2}	2.0×10^{-6}
Lead	10	200×10^{-9}	200×10^{-7}	1.4×10^{-3}	6.8×10^{-7}
Mercury	0.1	2×10^{-9}	2×10^{-7}	3.0×10^{-4}	6.8×10^{-9}
Nickel	50	$1{,}000 \times 10^{-9}$	$1{,}000 \times 10^{-7}$	1.0×10^{-2}	3.4×10^{-6}
Zinc	60	$1{,}200 \times 10^{-9}$	$1{,}200 \times 10^{-7}$	2.1×10^{-1}	4.1×10^{-6}

[a]Conservatively based on 20 cycles of concentration; actual concentration expected to be 7 cycles.

[b]Assuming one-hundred fold concentration between tower and point of exposure.

[c]Reference doses are chronic daily intakes that result in no adverse health effects over a normal lifetime.

[d]Chronic daily intake = $\dfrac{\text{Breathing zone concentration (mg/m}^3\text{)} \times 20\ \text{m}^3\text{/day}}{70\ \text{kg}}$

SOURCE: Ecology and Environment, Inc., October 1987b.

Because of this lack of correlation between the occurrence of LP in cooling towers and outbreaks of the disease, the Centers for Disease Control does not recommend routine screening of cooling towers for LP. It does point out that any potential for a bacteria-related health hazard will be minimized if cooling towers are properly operated and maintained on a regular basis, (Addis, 1987; Barbaree, 1987).

OSP would employ state-of-the-art procedures in the operation and maintenance of the cooling towers to minimize any potential health risks, as recommended by the American Society of Heating, Refrigeration and Air Conditioning Engineers and the Cooling Tower Institute. These procedures include effective treatment of the circulating water for control of microorganisms, scale, and corrosion; regular inspections; periodic drainage and cleaning; and systematic documentation of operating and maintenance functions.

Transmission Line

Health effects from high voltage transmission lines have become an issue in New England and New York as both regions seek to meet their need for power by importing electricity from Canada and other electric regions. Although the proposed OSP project at the Sherman Farm Road site will use existing 345-kV transmission lines, the possible use of an alternative site where additional transmission lines may have to be constructed warrants a brief discussion of the health effects issue.

In recent research conducted by the New York State Power Lines Project (1987), the scientific literature was reviewed to characterize the health hazards of electric and magnetic fields. Electric fields beneath transmission lines (765 or 345 kV) are at least an order of magnitude greater than the fields experienced by the general population in the home or workplace. Electric field strengths beneath distribution lines (69 kV) are similar to those found in the home near appliances.

Most research studies have reported no health effects of concern; no effects on reproduction, growth, or development have been identified. Several studies showed no effects that might lead to inherited problems, and no tendency to cause cancer. Some studies have shown changes in behavior and brain function that result from changes in body rhythms and might interfere with normal sleep patterns. Changes have been found in pain response and in the ability of rats to learn.

The most disturbing study result suggests that children with leukemia and brain cancer are more likely to live in homes where there are elevated 60-Hz magnetic field levels (e.g., transmission and distribution lines). No assessment of the risks involved in such exposure could be made since only four studies were conducted--two of which were from the same geographic region. However, the results indicate that more research is needed in this area.

4.2 GAS PIPELINES

Section 4.2 discusses the environmental consequences of construction and operation of the gas pipelines, as follows:

- Section 4.2.1--Geology and Soils
- Section 4.2.2--Water Resources
- Section 4.2.3--Air Quality
- Section 4.2.4--Sound Quality
- Section 4.2.5--Ecology
- Section 4.2.6--Sociocultural Resources.

4.2.1 Geology and Soils

4.2.1.1 Blasting and Ripping

During normal pipeline construction and installation, the physical environment may undergo various adverse changes. In areas where rock formations are at or near the surface, blasting or ripping will be necessary to excavate the pipeline trench. Blasting under controlled conditions may have no significant adverse effects, though rippers are preferred to minimize the safety and logistical problems associated with the use of explosives.

Of particular concern is the effect of blasting on groundwater supplies used for drinking water or groundwater of ecological importance. If blasting occurs below the confining bed of an aquifer (aquifers perched above bedrock formations), new fissures in the rock may increase the rate of water transport through the confining bed. This may reduce the productivity of wells in the overlying aquifer. Blasting over rock formations that form the upper confining bed of an aquifer may open fissures in the rock and allow surface contaminants direct access to the aquifer below. The effects of blasting will be of particular concern in areas where rock formations are being disturbed for the first time, such as within the new right-of-way for the proposed Rhode Island Extension and where there are shallow wells in immediate proximity to the route.

Tennessee has indicated that the following areas along the Extension will require significant blasting:

- MP 0.0 to MP 3.0
- MP 5.7 to MP 7.4
- MP 9.9 to MP 11.2

Tennessee also anticipates that spot blasting would be likely along the entire extension due to numerous rock outcrops in the area.

Tennessee has indicated that all blasting would be done by a certified blaster. Undue vibration and fly-rock would be controlled through limitations on charge size, use of charge delays, and appropriate blasting mats. For blasting in proximity to buildings, Tennessee would hire an independent contractor to perform preblast and postblast inspections.

To mitigate the potential for significant adverse impact to groundwater supplies, Tennessee has indicated that, at the landowner's request, it would take well water samples from groundwater wells of neighboring landowners within 200 feet of the construction site before and after blasting to monitor changes in water quality. Seismograph tests would be used to monitor the vibration from blasting activities. Tennessee would evaluate any individual complaint of well damage resulting from construction activity. If there are any adverse impacts to water wells from blasting, Tennessee would provide drinking water and either compensate the owner for damages or arrange for the drilling of a new well.

4.2.1.2 Landslide and Subsidence Potential

No significant landslide or subsidence hazards exist in the vicinity of the proposed facilities.

4.2.1.3 Seismicity

Large earthquakes may also be a hazard to the proposed pipeline system. However, newly constructed welded steel pipelines generally have adequate resistance to seismic shaking. Other earthquake phenomena that may be a hazard to pipelines and associated aboveground facilities include large displacements on active faults that the pipeline might cross and seismically induced ground failures, such as landslides and soil liquefaction. The potential for significant earthquake damage is considered remote.

The northeastern United States does not lie in a major seismically active belt, but earthquakes have been recorded in the region since the first European settlers arrived. The distribution of earthquakes across the region is very uneven. Large earthquakes (Modified Mercalli Intensity (MMI) VIII and higher, which cause considerable damage) have occurred in only a few scattered areas in the northeast.

So far, no earthquake in the northeastern United States is known to have been accompanied by surficial fault displacement, and no faults have yet been proven to be active on the basis of the surficial displacement criterion.

The only identifiable seismic zones of pertinence to the proposed pipelines are the Northeast Massachusetts Thrust Fault Complex, where a 1755 earthquake of estimated Modified Mercalli Intensity (MMI) VIII occurred off Cape Ann; and the Clarendon-Linden Seismotectonic Structure, where a 1929 MMI VIII event was centered near Attica, New York. A reoccurrence of either of these events would probably place a portion of the proposed pipeline within the zone of maximum intensity.

In a quantitative analysis of the earthquake hazard, Algermissen (1982) estimated that for a given 50-year period, there is a 90 percent probability that horizontal ground accelerations would not exceed the values shown on Figure 4.2-1.

The FERC Staff does not believe that there is a significant likelihood of earthquake damage to the pipeline facilities within their anticipated lifetimes.

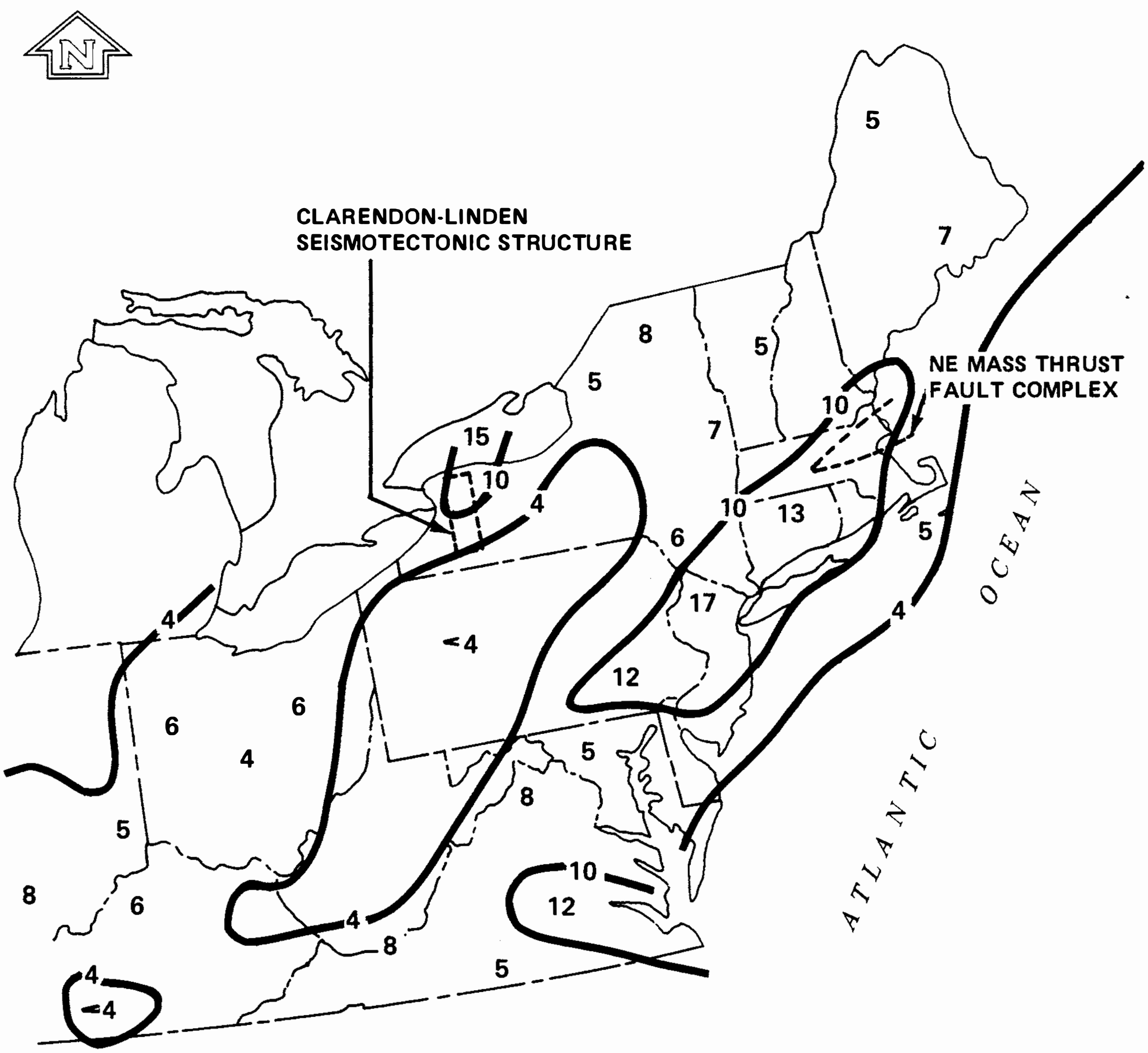
4.2.1.4 Soils

Erosion and compaction from excavating the pipeline trench would be the principal effects of pipeline construction on soil. The total area of construction right-of-way required for the proposed loops and the Rhode Island Extension is approximately 342 acres. The potential for significant soil-related problems exists, and necessitates the conscientious employment of mitigation measures.

4.2.1.4.1 Drainage Tiles

One potential problem area exists where the proposed pipelines cross cultivated cropland. Many farms improve subsurface drainage by using drainage tile. Tile drains consist of ceramic or plastic pipe segments, of various diameters, installed 1.5 to 3 feet below the surface to facilitate the removal of excess water. In well-drained fields, these tiles are placed along depressions that accumulate water. In level fields where internal drainage is uniformly poor, a more extensive system is installed using a main tile with numerous branching lateral tiles.

If pipeline construction occurred in an area with drainage tiles when the soil was saturated, the soil's weight-bearing capacity might not be adequate to support heavy construction equipment, leading to the possibility that tile could be crushed or deformed. (Construction in wet soil would also damage the soil structure, leaving the soil in a clodded, rutty condition; this is discussed later in this section.)



NOTE: Preliminary Map of Horizontal Acceleration (Expressed as Percent of Gravity) in Rock with 90 Percent Probability of not being Exceeded in 50 Years.

Adapted from S.T. Algermissen, U.S. Geological Survey
Open File Report 82-1033, Plate 2.

FIGURE 4.2-1

PROBABILISTIC ESTIMATE OF EARTHQUAKE GROUND MOTION ALONG THE PROPOSED LOOPING

Even if only one tile segment is damaged, the entire drainage system may become inoperative or less effective.

Tennessee has acknowledged drain tile damage as a potential problem during construction activities, and has proposed measures to detect and repair damaged tile. Tennessee proposes cleaning out drain tiles across the working side of the right-of-way with a "snake" to ensure that they have not been crushed or otherwise damaged by construction equipment. Damaged tile that is detected can then be repaired. Tennessee proposes to replace tile cut by trenching with tile supported by a steel trough inserted into the soil on each side of the trench. The trough would resist subsidence of the trench fill.

4.2.1.4.2 Soil Structure

Much of the cultivated farmland crossed by the pipeline has a gravelly subsoil and a topsoil relatively free of gravel. Pipeline trenching and backfilling operations would mix these layers, lowering the soil's water-holding capacity in the root zone and impeding the use of farm implements. Also, mixing permeable topsoil with less permeable subsoil beneath it may form a partial barrier to downslope internal drainage, causing temporary ponding above the pipeline. In certain areas where bedrock is overlain by a shallow soil layer, blasting and ripping could mix rock fragments with topsoil that could lower soil fertility. These problems can be avoided if topsoil is conserved during trenching and replaced during backfilling. Tennessee has stated that it would conserve topsoil during construction in cultivated cropland.

Heavy pipeline construction vehicles, such as sideboom tractors and pipeline stringing trucks, can cause deep rutting in wet soil. Depending on the depth and extent of rutting, this can cause a temporary but significant loss of soil fertility and usefulness. The most obvious effect of rutting is the soil's hard, clodded condition when dry, which makes it difficult to prepare a seedbed. More notably, the soil's physical characteristics--such as water movement, aeration, heat transfer, bulk density, and porosity--can be adversely affected, thereby reducing the germination and growth of plants. The degree of damage depends on how wet the soil is when disturbed. When the soil is fully saturated throughout the profile, its weight bearing capacity is lowest and it is most susceptible to deep rutting. If only the surface is saturated, ruts will extend only to the bottom of the saturated zone. The physical degradation caused by disturbing wet soil is the principal reason why farmers plow only when soil is dry.

The New York Department of Agriculture and Markets recommends that construction in farmland be curtailed whenever the soil is too wet. While this is desirable, it is too disruptive to the progress of construction, especially if construction occurs during an unusually wet year. However, the FERC Staff believes that Tennessee could plan to avoid operating heavy construction vehicles in cropland between April 1 and May 15, when the soil in most of the project area is most likely to be saturated throughout the soil profile and thus be most susceptible to severe damage. Although periodic rains occurring after May 15 may saturate the surface, damage to the soil structure could be minimized by segregating topsoil. Below the plow layer, subsoil compaction from construction vehicles could be rehabilitated by plowing before the topsoil is replaced. Construction activities that would not cause deep rutting, such as surveying or seeding, would not be affected by this recommendation.

4.2.1.4.3 Erosion and Revegetation

Erosion and sedimentation problems may lead to environmental impacts on both soil and surface water resources. Erosion is discussed below; sedimentation is discussed in Section 4.2.2.1.1.

In its application and responses to the FERC Staff's data requests, Tennessee has filed its planned measures for controlling erosion during construction and for revegetating the pipeline right-of-way. These measures include the use of sediment filters, matting and netting, terraces, ditchline breakers, sediment basins, broad-based dips, and rip-rap. The plan also outlines standards for the use of mulch or temporary vegetation for erosion control should construction be completed before permanent vegetation can be planted. Tennessee's plan is basically adequate but lacks information regarding the planned seeding mixes, seeding rates, and seeding dates. The selection of seed species and the timing of seeding is critical to the success of right-of-way restoration. The use of poorly adapted species, or improper seeding practices, can result in poor revegetation and unnecessary soil erosion.

In its March 27, 1987 data request, the FERC Staff requested that Tennessee develop this information for review to ensure proper planning. Tennessee declined, stating that it would contact the Soil Conservation Service (SCS) and follow its recommendations after the certificate is issued. The SCS is an agency of the

U.S. Department of Agriculture that provides locally relevant agronomic information. The FERC Staff believes that SCS should be consulted when developing seeding plans. However, because SCS is not a regulatory agency, such consultation should be conducted prior to certification.

There are a number of grass and legume species that can be used for seeding construction sites in the northeast. For pipeline projects, these species are normally combined in a selected mix of grasses and legumes to provide for reasonable establishment over a wide variety of conditions, thus allowing seeding operations to proceed with a minimum of down-time for changing seed mixes or seeding practices. Approximately 28 of the proposed 36 miles of new pipeline would cross soils with some limiting factors for species adaptation. This includes 19 miles of poorly drained soil, 5.4 miles of stony, infertile soils, and 3.5 miles of acidic, sandy soils. Only 7 miles of the total pipeline would cross fertile and well-drained soils with few limitations for seeding. Thus, a seed mix is needed that contains species that are adapted to wet soils, infertile medium-textured soils, and acid, sandy soils, and that would also do well under favorable conditions.

The Staff contacted several offices of the SCS in New York and Massachusetts to determine the best seed mix for the project. Except for several sites with extreme limitations caused by too much or too little moisture, the best overall seed mix would include birdsfoot trefoil, a legume, and four conservation grasses--creeping red fescue, tall fescue, redtop, and perennial rye grass. Birdsfoot trefoil has a wide range of adaptation and seeding seasons. It tolerates poorly drained soils better than most other legumes and it can be seeded both in spring and fall. Other common legumes, such as flatpea or crown vetch, should only be seeded in the spring. Each of the four grasses has a different range of adaptation, providing a mix that would produce a stand of at least one grass in site conditions ranging from moderately wet to moderately dry, acid to neutral, and from shade to full sun. The combined mix should provide an adapted vegetative cover for most of the project area.

According to Mr. Willim Fry, SCS soil conservationist for Hampden County, Massachusetts, portions of Loop 7 would cross soils where the general seed mix should not be used. There is a one-half mile segment east of Hillside Road where the soils are too wet for the mix. Mr. Fry recommends that for this area the seed mix should include reed canarygrass, a water tolerant grass, and two other water tolerant species, red top and birdsfoot trefoil. Perennial rye grass, a quick-germinating grass has been added to this mix. Mr. Fry also noted that Loop 7 would cross a broad glacial outwash plain between the Penn Central Railroad and the eastern end of the loop at Main Line Valve 260 where the soil is sandy and extremely acid. For this site SCS recommends the use of an acid- and drought-tolerant grass called Tioga deertongue, and birdsfoot trefoil (caution should be exercised when selecting a seed source for Tioga deertongue because the seed does not germinate well if it is less than a year old, or if it has not undergone at least one period of cold). On the basis of its experience and additional consultations with SCS personnel, Tennessee has suggested an alternative seed mix that excludes Tioga deertongue and includes tall fescue and red top. The Staff has incorporated this mix (with the addition of birdsfoot trefoil) in Table 4.2-1. This mix should also be used for seeding gravelly and sandy soils encountered along portions of the Rhode Island Extension. The Staff suggests that Tioga deertongue be seeded in acid soils where the above mix fails to produce an acceptable stand.

An alternative seed mix is available for use in well-drained, moderately acid, and infertile areas that has shown excellent ability to suppress woody growth. The mix includes a legume called Lathco flatpea, which is primarily responsible for woody growth suppression, and two compatible grasses, tall fescue and redtop. This mix is highly desirable for pipeline use because it reduces the need for mowing. However, it does not take well to fall seedings, and it cannot be used in soils with extended periods of wetness. Also, seedbed preparation is more critical to establishment because the flatpea is large and needs to be buried for germination.

Using the proper seeding practices for the time of year is as important as seeding the correct species. In general, seeding can be done at any time in the project area with reasonable success, but special provisions must be made when seeding during mid-summer or late fall. For the best results, seeding during mid-summer should be avoided because the available moisture is often inadequate to ensure successful establishment of emerging seedlings. Late fall should be avoided because of the possibility of frost occurring too soon after germination. However, if construction is completed during these times, it is more economical to seed while the right-of-way is being cleaned up than to wait for the best seeding season. To protect the seedbed from adverse conditions experienced during the summer and late fall, all seeded areas must be mulched with a least 2 tons per acre of straw or hay, and the mulch must be anchored by mechanical or chemical means. Mulch reduces moisture loss by evaporation, thereby increasing the chances for successful summer seeding. Mulch also moderates soil temperature, helping to overcome brief periods of frost experienced during late fall. During winter, dormant seeding may be done as long as the site is mulched to protect the seedbed until germination in the spring. Spring and early fall are the best times for seeding most species, and mulch is only necessary on steep slopes to prevent erosion. The SCS-recommended seed mixes and mulching practices by project area are summarized in Table 4.2-1. The FERC Staff recommends that Tennessee be required to follow this table for revegetating the project area, except where the landowner or land-managing agency has specific seeding requirements.

4.2.1.4.4 Aboveground Facilities

The construction of compressor stations requires a signficant amount of earthwork. Trenches are excavated for pipe; foundations are laid for compressor units, ancillary equipment buildings, and the communications tower; dikes are constructed around glycol and lubricating oil tanks; and site access roads and parking lots are paved. In wet or unstable soils, fill is often used under foundations and roads. The soil degradation resulting from construction and long-term use of these facilities is essentially permanent.

Approximately 5 acres of existing and potential farmland would be permanently disturbed by construction of each of the compressor stations--230B, 230C, and 233 (Compressor Stations 230B and 233 are currently under construction). The land on which Compressor Station 233 is being constructed is considered prime farmland. However, this property is also the site of an existing compressor station owned by Tennessee. Tennessee leases the adjacent land not required for compressor facilities for agricultural uses.

Construction of the Lewiston Meter Station would not affect prime farmland and should not significantly affect a greater amount of soil than that which was disturbed during Main Line maintenance activities immediately adjacent to the existing Niagara River meter facility during summer and fall 1987.

TABLE 4.2-1

Recommended Seeding Mixes, Rates, and Dates

Species Mix	lbs/acre	Optimum Seeding Dates[a]	Use
Birdsfoot trefoil	6	NY: 8/15 - 10/15	General seedings except as specified below
Creeping red fescue	20	Spring thaw - 6/15	
Tall fescue	20	MA: 8/1 - 9/15	
Red top	2	Spring thaw - 5/15	
Perennial ryegrass	5		
Birdsfoot trefoil	6	8/1 - 9/15	Loop 7 from Hillside Road eastward for 2,400 ft.
Reed Canarygrass	20	Spring thaw - 5/15	
Red top	2		
Perennial ryegrass	5		
Birdsfoot trefoil	6	8/1 - 9/15	Loop 7 from Penn Central Railroad to MLV 260 and sand and gravel deposits and pits along Rhode Island Extension.
Tall fescue	30	Spring thaw - 5/15	
Red top	5		
Lathco flatpea[b]	30	NY: Spring thaw - 6/15	Alternate general seed mix for well-drained sites only
Tall fescue	20	MA: Spring thaw - 5/15	Suppresses woody growth
Red top	2		
Perennial ryegrass	5		

[a]During optimum seeding periods mulch is only required on slopes. During all other times 2 tons per acre of hay or straw must be applied on all seeded areas.

[b]Lathco flatpea should not be seeded between June 15 and November 1.

4.2.2 Water Resources

4.2.2.1 Surface Water

4.2.2.1.1 Erosion and Sedimentation

The proposed upgrade to the pipeline would require crossings of several rivers and streams. Subsequent environmental effects would include increased turbidity, the production of silt loads from instream construction, and potential increases in erosion from the streambanks due to the clearing of vegetation.

Stream discharge, turbulence, streambank composition, sediment particle size, and the method, duration, and season of construction will determine the downstream effects of instream excavation of soil materials. Organic matter introduced into a stream by disturbance of the stream bottom may increase biochemical oxygen demand (BOD) and decrease the photosynthetic activity of algal communities by reducing light penetration. Both processes will decrease DO concentrations in the water. With proper construction procedures and adherence to the FERC Staff's recommended mitigating measures, these impacts should be temporary and not significant.

Clearing of rights-of-way in the vicinities of rivers and streams will increase storm runoff and cause erosion of the bared areas. The effects of the erosion-related sedimentation, unlike instream construction, will continue until complete revegetation of the rights-of-way. The FERC Staff's recommended restoration measures would help minimize these impacts.

To minimize the effects of sediment loading and erosion, Tennessee would employ procedures outlined in its Sediment and Erosion Control Plan and Wetland and Water Crossing Plan. These measures are summarized in previous sections of this FEIS. The FERC Staff recommends certain additional right-of-way restoration measures as discussed in the previous section.

In addition, flume pipe culverts with clean rock fill or portable bridges would be used to cross all perennial streams so as not to disturb the stream bottom. Riprap may be used along streambanks that are subject to erosion. Spoils will be placed where they will not enter streams.

4.2.2.1.2 Hydrostatic Testing

Hydrostatic testing of the loops would begin shortly after the pipelines are completed. Water would be drawn from the sources listed in Table 4.2-2. Test water would thus contain any pollutants present in the source water and may contain some iron dust and soil left the pipe after construction. After hydrostatic testing, the water would be discharged at either the withdrawal site source or another location. The test water would be discharged against a splash plate or through a 45-degree elbow to restore the DO concentration that may be depleted by hydrostatic testing. The test water may also be discharged through hay bales to filter out various matter or allowed to infiltrate through the soil. The discharge of test water would require approval from the appropriate permitting authorities. Tennessee would perform any discharge monitoring or treatment required by the federal or state authorities to meet Pollution Discharge Elimination System requirements or water quality standards.

4.2.2.2 Groundwater

Groundwater in the vicinity of the proposed loops would sustain relatively little damage. Most of the aquifers in the area are well below the depth to which the trench would be dug. Groundwater around streams and wetlands may be affected by construction activities, but should return to its natural state after construction ends. Damage to groundwater would be minimal and may be considered negligible.

TABLE 4.2-2

Pipeline Hydrostatic Testing Water Sources

Loop 1	Locally treated potable water from the Town of Lockport
Loop 4	Public water supply
Loop 5	Creek (MP 242 +6.25)
Loop 6	Hudson River
Loop 7	Unnamed creek at MP 259+3.96
Rhode Island Extension	Potential sources include Swan's Pond and Mumford River

SOURCE: Tennessee Gas Pipeline Company, April 1987.

4.2.3 Air Quality

Proposed modifications and additions to the Tennessee Gas Pipeline and its associated metering and compression facilities between Niagara Falls, New York, and the OSP site would result in atmospheric emissions of some pollutants during the construction phase as well as during permanent operation. The emissions associated with construction activities are expected to be fugitive in nature. During permanent operation, the only emissions expected would be those from the compressor station exhaust stacks.

4.2.3.1 Construction-Related Emissions

During the construction phase of the project, there may be some temporary atmospheric emissions from fugitive dust as well as exhaust from construction vehicles. The extent of dust generated would depend on the level of construction activity and on soil composition and dryness. Windblown emissions can be held to a minimum by the use of mitigative dust suppression techniques.

Some temporary, localized reductions of air quality may be associated with construction of the pipeline loops and the compressor stations. These are expected to result in little more than local and temporary nuisances to nearby residents, not unlike other construction activities of this scale. It is anticipated that emissions associated with pipeline construction would last no longer than a few weeks at a given location. Compressor station construction is estimated to last approximately 3 to 5 months.

4.2.3.2 Compressor Station Exhaust Emissions

A summary of emissions for the compressor stations affected by the proposed action is contained in Table 4.2-3. The emission estimates are based on manufacturers' estimates for compressors of the size proposed for this project. For comparison purposes, the EPA-defined "significant emission rates" for NO_x, CO, and VOC are 40, 100, and 40 tons/yr, respectively. The only emission rates believed to exceed these significant levels are the NO_x emissions for Compressor Stations 230B, 230C, 233, and 264. All other emissions would not be considered to be significant by EPA.

Since the NO_x emissions do not exceed 250 tons per year at any affected compressor station, no facility would be considered a major source of air pollution

TABLE 4.2-3

Summary of Estimated Compressor Station Emissions

Station No.	Location	Compressor Size (horsepower)	Status	Estimated Emissions (ton/yr)				
				NO_x	CO	VOC[a]	SO_2[b]	PM[b]
230B	East Aurora, New York	1,000	Convert to Permanent Operation	28	22	13	0	0
230B	East Aurora, New York	1,200	Add to Existing Facility	30	23	14	0	0
230B	East Aurora, New York	1,000	Add to Existing Facility	28	22	13	0	0
230C	Lockport, New York	4,500	New Facility	90	24	11	0	0
233	Livingston Co., New York	3,500	Convert to Permanent Operation	79	19	13	0	0
233	Livingston Co., New York	3,500	Add to Existing Facility	79	19	13	0	0
264	Worcester Co., Mass.	2,000	Add to Existing Facility	51	51	29	0	0

[a]Unburned VOC's.

[b]Emissions for SO_2 and PM considered negligible.

SOURCE: Tennessee Gas Pipeline Company, October 5, 1987.

or require a permit for prevention of significant air quality deterioration (PSD). However, the designated state air quality agencies would require permits to allow Tennessee to install and operate the proposed compressor units. Therefore, none of the four compressor stations involved in this action would be considered a major source of air pollution and the impact on ambient air quality would not be significant.

4.2.4 Sound Quality

The proposed modifications and additions to the Tennessee Gas pipeline and gas compression facilities associated with the OSP project would result in increases in ambient sound levels at various locations along the affected pipeline route. The sound levels at these locations would be affected by two aspects of the proposed action--construction and permanent operation. Aside from some temporary noise due to construction activities, the pipeline itself is not expected to generate any significant permanent noise. The four compressor stations discussed above would be the only sources of permanent noise.

4.2.4.1 Construction-Related Noise

The construction phase of the proposed project would result in some temporary increases in noise levels in the immediate vicinity of the construction activities. Construction of the affected pipeline loops is expected to proceed at a rate of 0.3 to 0.4 mile/day. As a result, individuals living in the vicinity of the pipeline sections under construction may experience some short-term annoyances. Construction of the compressor station facilities is expected to take 3 to 5 months.

Construction noise would result primarily from the operation of heavy equipment. Where blasting is required, noise levels would be reduced by using blasting mats or by placing additional soil over the blasting area. Noise levels near the work area could reach a maximum of about 90 dBA, but are realistically expected to drop to about 60 dBA at a distance of 1,000 feet. Construction activities may occur from as early as 6 or 7 a.m. to as late as 6 or 7 p.m., 5 to 6 days/wk. No construction would occur at night.

4.2.4.2 Permanent Operation Noise

The only source of noise during permanent operation of the pipeline facilities associated with the proposed action would be the four compressor stations discussed above. Their operation may result in an annoyance to nearby residents. The effect of increased noise on nearby noise-sensitive areas can be evaluated by comparing the available data on background levels with the projected noise levels due to compressor operation. However, projections of noise levels cannot be accurately made at this time because final equipment selections have not yet been made.

Tennessee has agreed to a FERC Staff recommendation that its proposed compressor additions would not produce an L_{dn} of more than 55 dBA at the nearest noise-sensitive receptor, such as a residence or hospital. This can be achieved by installing mufflers, barriers, and other noise-suppression devices on the compressors. The compression facility noise would, of course, be superimposed on the existing background noise for each particular station.

Table 4.2-4 summarizes the existing and predicted noise levels for Compressor Stations 230B, 230C, 233, and 264. The existing noise levels were measured and documented by Tennessee at or near the nearest noise-sensitive area (NSA) (i.e., house) in the vicinity of the compressor stations. The predicted noise levels were based on noise measurements made by Solar Turbine, Inc. The noise generated by the additional compression at each station was superimposed on the existing noise levels to determine the total predicted noise level at the nearest NSA for each station.

It should be noted that since sound levels are measured on a logarithmic scale, two separate sounds are not directly (arithmetically) additive. For example, if a sound of 55 dBA is added to another sound of 55 dBA, there will be a 3-dBA increase (i.e., 58 dBA)--not a doubling to 110 dBA. Furthermore, the greater the difference in two sound levels, the smaller the increase from the combination. If the difference is 10 dB or greater, there will be less than a 0.5 dBA increase above the higher sound level when the two sound sources are combined (i.e., 55 dBA + 65 dBA = 65.41 dBA).

Based on a comparison of the predicted total operational noise level at the nearest NSA and the existing noise levels near those stations (Table 4.2-4), the maximum increase in noise level expected to result from the proposed compression additions is determined to range from 0.0 to 1.6 dBA. It should be noted that a 3-decibel increase is the human ear's threshold of a noticeable difference. These predicted noise level increases are well within the guidelines/recommendations set by New York and Massachusetts (see Section 3.2.4.5). The predicted noise levels of the proposed compressors are also considerably below the FERC Staff recommendation of an L_{dn} of 55 dBA at the nearest NSA.

TABLE 4.2-4

Summary of Existing and Predicted Noise Levels at Noise-Sensitive Areas (NSA) Nearest to Compressor Stations

Compressor Station	Location	Existing Compression (hp)	Distance to NSA (ft)	Existing Noise Level (dBA)		Proposed Compression (hp)	Predicted Noise Level of Proposed Units at NSA[a] (L_{dn})	Total Predicted Noise Levels at NSA (L_{dn})	Maximum Noise Increase (dBA)
				L_{dn}	L_{90}				
230B	Erie Co., NY	1,000	1,900	50.7[b]	39.2[b]	2,200	44.8	51.7	1.0
230C	Niagara Co., NY	0	2,000	62.8[c]	46.3[c]	4,500	41.4	63.0	0.0
233	Livingston Co., NY	3,500	770	52.1[b]	40.3[b]	3,500	45.7	53.7	1.6
264	Worcester Co., MA	3,165	700	57.4[d]	N/A[d]	2,000	48.5	57.9	0.5

[a]Based on Solar Turbine, Inc., Compressor Noise Tests (Tennessee Gas Pipeline Company, April 20, 1987, June 3, 1987, September 18, 1987, October 5, 1987).

[b]FERC, 1986.

[c]Tennessee Gas Pipeline Company, October 5, 1987.

[d]Tennessee Gas Pipeline Company, April 20, 1987 (Response No. 37).

N/A = Not available.

4.2.5 Ecology

4.2.5.1 Terrestrial Ecology

4.2.5.1.1 Rhode Island Extension

The Rhode Island Extension would impact approximately 100 acres of terrestrial habitat because it requires new right-of-way across most of its 11 miles in Massachusetts and Rhode Island. A 50-foot-wide permanent right-of-way is proposed, with a 75-foot-wide construction easement over most of the length of the line. Where blasting is required and at significant water crossings, a 100-foot easement may be necessary.

Short-term construction impacts include increases in dust and noise levels, and possible increases in soil erosion before reseeded vegetation takes root to hold the previously exposed soil. Tennessee's Sediment and Erosion Control Plan would be implemented to minimize soil loss.

Because permanently cleared rights-of-way will be required in wooded areas and at river and stream crossings, there may be some long-term effects on the vegetation and associated fauna in these areas, as described below.

Trees cleared along the permanent right-of-way would be replaced with herbaceous cover for the operating life of the pipeline. Tennessee has also stated that no herbicides would be used for right-of-way maintenance in Massachusetts and Rhode Island. Where croplands are crossed, the affected area would be taken out of production during construction and that season's crop along the right-of-way would be lost. Agricultural activities can resume after the line is in place. Where portions of the pipeline cross gravel deposit areas, arrangements must be made with those landowners to minimize environmental (erosion and soil stability) and safety concerns. The Massachusetts Siting Council recommends that vegetative screening or fencing be provided at all road crossings, contingent upon approval by landowners, to discourage the use of the right-of-way by off-road vehicles. Vegetative screening should also reduce the aesthetic impacts on pedestrian and vehicle traffic.

The larger animals in the area would temporarily leave the construction sites, moving to other suitable habitat, and are likely to return when construction is complete. Some small mammals, reptiles, and amphibians may be lost as a direct result of construction; others may be lost due to destruction of suitable habitat. However, the populations of affected species should return to normal levels shortly after construction is complete.

The removal of established or potential nesting trees would result in long term impacts to affected bird species. In addition, some birds and nests may be destroyed by construction acitivities. However, the potential loss of individual birds and their nests should not result in any long term impact to any affected population.

4.2.5.1.2 Compressor Stations

No additional land is required for increasing the horsepower at Compressor Station 233 in Livingston County, New York. Compressor Station 264 in Worcester County, Massachusetts would require clearing an additional one or two acres north of the existing facility. Consequently, no long-term impacts are anticipated; construction impacts would be mitigated through erosion control measures.

No significant long-term impacts to terrestrial flora or fauna are anticipated from construction of Compressor Station 230C, or from the proposed increase in horsepower at Compressor Station 230B in Erie County, New York. Short-term construction impacts would be alleviated by first cleaning up old yard piping, valves, and fittings, and then grading, seeding, and mulching the disturbed area to prevent erosion.

Compressor Station 230B improvements would be contained within approximately 9.5 acres of land, which is zoned industrial and is already owned by Tennessee Gas. Erosion control measures and reseeding would be implemented. There would be no construction within a 100-foot buffer zone around New York protected wetland HO-2.

4.2.5.1.3 OSP Pipeline Loops

Loop 1 and Loops 4 through 7 would require a total of 25.5 miles of gas pipeline to parallel existing pipeline rights-of-way. Construction of the proposed loops would require approximately 242 acres. The existing right-of-way is about 77 acres, an additional 77 acres would be retained for a total of 154 acres in permanent right-of-way.

Loop 1 crosses 11.2 miles in Niagara County, New York. The proposed route would transect the northern quarter of State-designated wetland LE-19, a Class II wetland of 240 acres. The route would not cross through RV-10, a smaller (27-acre) Class III wetland, but would run along its southern edge.

Impacts from wetland crossings include removal of wetland vegetation within the approximately 75-foot-wide construction easement, increases in siltation during construction, and disruption of wetland invertebrate and vertebrate fauna.

Construction Techniques

The following construction techniques would be used to minimize these impacts, as outlined in Tennessee's Wetland and Water Crossing Plan.

On narrow wetlands crossings (less than 200 feet), timber and brush would be cleared in a path approximately 75 feet wide, with the stumps cut at ground level and left in place. Logs and brush would be placed on top of stumps to form a work pad approximately 15 feet wide. Where natural vegetation is not available, Tennessee should import material for this purpose, removing it after construction is complete. The ditchline would be excavated to obtain a minimum 36-inch cover by using either a backhoe or a dragline--these machines work from timber mats that are "leap frogged" as ditching progresses. Pipeline construction would proceed in much the same manner as on dry land.

Backfilling would be accomplished using either a drag or clamshell bucket, also operating from the work pad.

Where practical, logs and brush would be removed and disposed of during cleanup, and the wetland would be restored to its natural grade.

On wide wetland crossings and wetlands with a high water table, the right-of-way would be cleared for a width of approximately 75 feet, with stumps cut at ground level. Logs would be skidded out and the brush disposed of.

The ditch would be excavated using either a dragline or backhoe from wooden mats or timber and brush pads, to obtain a minimum 36-inch earth cover over the line.

During actual pipe laying, a work area would be prepared on sufficiently stable ground near the wetland area for fabrication of pipe sections. The work area generally requires an additional easement similar to a stream crossing, approximately 50 x 100 feet, to set up and complete stringing operations. This additional land is required only during construction and would be allowed to revert back to its present use and condition after construction. Pipeline construction machinery would be moved via existing roads or access roads. No access roads would be built on wetlands. The pipeline would be fabricated into sections on one side of the wetland and pushed or pulled across using the float method to minimize activity in the wetland.

The pipeline trench would be backfilled using either a drag or clamshell bucket working from timber mats, and the wetland would be restored to its original contour. All mats would be removed, and excess spoil and timber riprap would be disposed of in a manner acceptable to the landowner or land management agency.

All necessary environmental and engineering specifications must accompany the construction permit applications submitted to local, state, and Federal agencies.

In addition to the foregoing, the FERC Staff recommends that Tennessee segregate topsoil in all wetlands crossed by the proposed facilities unless the appropriate state or local permitting authority specifically grants Tennessee relief from this requirement. Wetland soils contain seeds, root stock, and rhizomes of plants which are uniquely adapted to the wetland environment. Since Tennessee does not propose to seed disturbed wetland areas with their characteristic vegetation types, topsoil segregation would provide the greatest potential for successful right-of-way restoration.

Also, the FERC Staff believes that it would be inappropriate to cut trees outside the proposed construction right-of-way for the sole purpose of obtaining timber for workmats in wetland areas. The FERC Staff therefore recommends that prefabricated workmats be used in wetland areas where not enough timber is available from the cleared right-of-way. Furthermore, all material introduced into wetland areas, including timber workmats, should be removed upon completion of construction and the area restored to its original condition to the maximum extent practical.

Potential Impacts

The original route of Loop 1 passed through the abandoned Town of Lewiston landfill, which has been placed on the State of New York Superfund list. The portion of Loop 1 near the landfill was rerouted to avoid the potential adverse ecological impacts associated with disturbing contaminated soils.

Loop 4, in its proposed route, crosses 2.3 miles of primarily agricultural land in Onondaga, New York. One season's crop may be lost in the 75-foot-wide easement during construction and until new growth takes place. Of the three State-protected wetlands in the pipeline vicinity, only SKA-13 and SKA-14 would be crossed by the proposed route. Impacts on vegetation and fauna should be short-term.

The proposed route of Loop 5 parallels the existing pipeline for 3.7 miles in Madison County, New York. The route crosses the northeastern arm of Nelson Swamp (CA-5), a Class I wetland recognized by the State of New York as a rare natural community. Within the swamp are two State-designated rare plant species. A survey of the proposed pipeline route should be conducted to verify that those species are not found in the construction zone. The removal of trees along the permanent right-of-way would be a long-term impact lasting for the life of the pipeline.

Loop 6 parallels the existing pipeline along 3.9 miles in Rensselaer County, New York. Near the Hudson River, the proposed route crosses the edge of wetland EG-1 between an existing railroad and Papscanee Creek. The State wildlife biologist observed the route and suggested that the least impact would occur if the new pipe was placed on the north side of the existing line (Tennessee's proposed location). To ensure that the Papscanee Marsh crossing would not adversely affect the least bittern, a state-listed species of concern, the Staff has recommended that Tennessee either avoid construction within the marsh during breeding season or conduct a pre-construction nesting survey to assess any potential impact to the bird. Tennessee would coordinate the survey with NYDEC biologists and report the results to the FERC Staff for a determination on whether additional mitigating measures are necessary.

The proposed route of Loop 7 traverses 4.4 miles in Hampden County, Massachusetts. Although Massachusetts does not prepare maps of State-protected wetlands, several wetlands occur along this loop. Wetlands east of Southwick are of indeterminant quality, while those associated with Great Brook appear to be good quality. Construction impacts would be short-term.

Tennessee has stated that no herbicides would be used for right-of-way maintenance in Massachusetts and Rhode Island, but that herbicides and growth retardents might be used in New York.

4.2.5.2 Aquatic Ecology

4.2.5.2.1 Rhode Island Extension

The proposed route of this 11-mile-long section of new pipeline crosses the edge of Swan's Pond and several perennial streams in Massachusetts. Streams would experience the following short-term temporary effects from construction activities:

- Increases in turbidity and silt loads due to mechanical disturbances
- Changes in the physical configurations of bottom surfaces
- Disruptions to faunal movement
- Removal of associated vegetation.

In addition to the specific construction practices used and mitigative measures, the degree of potential impact depends on the physical characteristics of each stream, resident biota, and type of use. Tennessee has developed a Wetland and Water Crossing Plan (summarized below) to minimize aquatic impacts.

Some increases in turbidity would result from right-of-way clearing, trenching activities, and subsequent runoff. The extent of downstream disturbance would be dependent on current velocities, existing sediment loads, and particle size distribution.

Increased silt loads and turbidity could cause downstream sediment deposition, which may result in smothering and the loss or disruption of some benthic organisms; this, in turn, would affect fish populations that feed on invertebrates. Fishes may also be directly impacted, temporarily, if suspended sediment concentrations are sufficient to interfere with gas exchange across the gills. Fish eggs may also be smothered by increased silt loads. After construction, the benthos would recolonize these areas by the normal biological processes of stream drift and migration. Fishes would recolonize by swimming back into the impacted areas.

Sedimentation and turbidity are believed to reduce algal populations by chemical action, by smothering, or by reducing light penetration. A reduction in available algae population may be accompanied by a corresponding loss in the biomass of herbivorous animals, which may influence the well-being of higher trophic organisms, including fish.

Backfilling to the original bottom surface level would facilitate recovery (i.e., outward growth of rooted aquatic plants adjacent to the construction area) of the aquatic plant community. Recovery time would be dependent on rainfall, maintenance of water levels, and plant reproduction rates.

The movement of vertebrate animals, such as muskrat and waterfowl, may deviate from normal patterns during construction. Movement of these faunal species would return to normal when construction activities are complete.

The impacts described would be minimized through implementation of the erosion control techniques of Tennessee's Wetland and Water Crossing Plan. The following general guidelines would be used for stream crossings:

- Construction perpendicular to stream flow.
- Placement where width, depth, and bottom characteristics will minimize in-stream construction time.
- Construction along relatively straight reaches where water shear forces are minimal.
- Location at gently sloping banks wherever possible.

To avoid impacts on trout spawning and spring hatch out, the Staff recommends that construction activities should be avoided in the following streams during the period September 15 through June 1:

- Purgatory Brook
- Steamburg Brook
- Cook Allen Brook
- Laurel Brook
- Branch of Chockalog River.

4.2.5.2.2 Pipeline Loops

The proposed route of Loop 1 in New York State crosses intermittent and perennial tributaries to Fourmile Creek, Twelvemile Creek, and East Branch Twelvemile Creek. Construction activities would result in short-term degradation of the streams. No long-term impacts are anticipated after restoration of stream bottoms and regrowth of streambank and aquatic vegetation.

Two small streams are crossed by the proposed route of Loop 4; no adverse environmental effects on aquatic systems should occur if Tennessee employs measures outlined in its Wetland and Water Crossing Plan.

Loop 5 crosses two systems--tributaries to Cedar Swamp Brook and Electric Light Stream. Construction impacts would be minimized through the application of erosion control techniques. Care must be taken to restore hydrologic connections, particularly of shallow tributaries that feed or drain Nelson Swamp. Any long-term disruption of these streams could change the hydrologic character of Nelson Swamp, having lasting environmental impacts on associated wetland vegetation.

The proposed route of Loop 6 crosses two streams in Rensselaer County, New York--a tributary to Vierda Kill and Moordener Kill (a State-protected stream). During field reconnaissance, the streambed of Moordener Kill appeared to include bedrock with other areas of rock outcrop. If blasting is required to prepare the pipeline ditch, construction impacts beyond those already discussed are anticipated. Construction should be carried out to avoid the fall through early spring spawning period when fish are most sensitive to increases in stream turbidity. State agency personnel recommend that no construction be carried out in Moordener Kill between October 1 and June 1 to avoid the fish spawning period.

In Massachusetts, the proposed route of Loop 7 crosses several streams, including Tuttle Brook and Great Brook. To avoid impacts during the fish spawning period, it is recommended that no construction be initiated between September 15 and June 1 on Great Brook.

4.2.5.3 Threatened or Endangered Species and Unique or Critical Habitats

The USFWS, in a letter to FERC Staff (June 18, 1987), indicated that "... except for occasional transient individuals, no Federally listed or proposed threatened and endangered species under our jurisdiction are known to exist in the project impact area. No Biological Assessment or further consultation is required with us under Section 7 of the Endangered Species Act." Massachusetts and Rhode Island Natural Heritage personnel report that no state-protected threatened or endangered species are known to occur in the areas that would be disturbed by construction of the Rhode Island Extension, proposed compressor station facilities, and pipeline loops. Consequently, no impacts to protected species are anticipated. This determination was reconfirmed on June 23, 1988 with USFWS staff.

Loop 5 crosses Nelson Swamp in Madison County, New York. Because of the complexity of vegetation and the unusual feature of a white cedar swamp in this region, Nelson Swamp is recognized by the State as a rare natural community

(Significant Habitat #SP27-008). In addition, the New York Natural Heritage Program has indicated that two plant species that are rare in the State--spreading globeflower (Trollius laxus ssp. laxus) and striped coralroot (Corallorhiza striata)--are known to occur in Nelson Swamp. The FERC Staff recommends that Tennessee conduct a survey for these species within the area that would be disturbed to determine the need for additional mitigating measures. The survey botanist will consult with appropriate state conservation organizations prior to walking the proposed right-of-way.

Loop 6 crosses Papscanee Marsh in Rensselaer County, New York. Papscanee Marsh has been identified by the New York Natural Heritage Program as a "suspected breeding site for least bittern, a state listed special concern species." The FERC Staff recommends that Tennessee perform a nesting survey prior to construction, if construction through the marsh would take place prior to June 30.

4.2.6 Sociocultural Resources

The land use, infrastructure, socioeconomic, visual, aesthetic, and cultural resource impacts from construction and operation of the proposed pipeline facilities are discussed below.

4.2.6.1 General Impacts

Construction through agricultural areas may result in minor crop or pasture loss for the growing season in which it occurs. Tennessee plans to reimburse landowners for the resulting lost revenues. After construction is complete, these areas would be allowed to revert to present land uses.

The aesthetic impact of construction would be primarily in forested areas, where timber would be replaced by a clear-cut, revegetated, or second-growth right-of-way.

The proposed action would cross local, state, and interstate highways. Associated construction activities would temporarily add to the normal traffic volume. The movement of construction equipment may disrupt traffic at several road crossings, as discussed earlier.

Leisure activities of the construction workforce could place demands on existing regional recreational facilities, such as parks, picnic areas, and recreational fields. Some increases in hunting and fishing might be expected during this time from construction workers.

The principal socioeconomic impacts of construction are expected to be effects on the local economy, housing, community services, and social life. These effects would be transient.

Accommodating the temporary influx of construction workers may place some stress on area community facilities and services. However, the number of individuals expected to relocate is small compared to the population of the communities to which they may move. Typically, construction workers prefer to commute up to 2 hr/day rather than relocate closer to the work area. Thus, the diffuse pattern of relocation expected would further minimize any impact on local community services.

The movement of heavy equipment and supplies and commuting workers would add to traffic congestion in the vicinity of construction, possibly causing some minor short-term inconvenience and additional travel time for those living in or passing through the area. Highways and most public roads would be crossed by boring, resulting in less traffic disruption than would be caused directly by construction.

An additional consideration is construction workers' cash availability. Increased demand on local suppliers of food, clothing, and entertainment, as well as other services such as restaurants and banks, would temporarily create additional income and sales tax receipts. Purchases of miscellaneous construction supplies (concrete, lumber, sand) would further benefit the local economy. Local jurisdictions would experience an expansion of the local tax base and an increase in ad valorem or property tax revenues.

Tennessee would use contractors for construction and current personnel for construction inspection and operation of the pipeline facilities.

The impact on human resources would be minimal. Construction would produce temporary increases in traffic, noise, and dust.

Extensive cultural resource investigations conducted to date for the majority of the gas pipelines provided evidence that there would be no effect on cultural resources. The FERC Staff, in consultation with the appropriate State Historic Preservation Offices, has concurred with the finding of no effect from these investigations. Although cultural resource surveys have not been completed for the proposed site of Compressor Station 230C and the Rhode Island Extension, based on the background research conducted and research designs developed (see Section 3.2.6.3) for the majority of these proposed facilities, any cultural resources identified that are determined eligible for the NRHP and are unavoidable would be assessed in the best possible manner so that any effects would not be adverse.

4.2.6.2 Niagara Spur

The impacts from modifying the Lewiston Meter Station are anticipated to be minimal. One residence abuts the site, but it should not be significantly impacted by the proposed facilities. Traffic impacts from construction vehicles are anticipated to be minimal.

Loop 1 is routed through a KOA campground, which has only one access, Pletcher Road. The pipeline and right-of-way have the potential to significantly affect access to the southern end of the campground and disrupt about half of the campground's facilities. Mitigation measures are recommended to minimize the impact to the campground if construction occurs during the peak camping season.

Loop 1 has been rerouted around the former Lewiston landfill. The proposed route passes through an area south of the old landfill known as Area Q, which was part of the Lake Ontario Ordnance Works. Tennessee has identified low-level radioactive waste on this site near the former warehouse. Access to an active landfill north of the old Lewiston landfill is from Harold Road, which would be crossed by the proposed pipeline route. Truck traffic going to the landfill is heavy; construction traffic and activity are expected to add to the congestion along this access road. Loop 1 terminates at Lower Mountain Road (Route 425). The pipeline would run directly behind a farmers' market (Hahn's Farm)--about 100 feet from the market building. The market is expected to be impacted by construction noise and possibly construction traffic. Some grape vines would be removed from the vineyard adjacent to Hahn's Farm Market. There would be no effect on cultural resources.

Proposed Compressor Station 230C would be located near a residential and industrial area. Although construction traffic is expected to add to the traffic commuting to the nearby General Motors plant on Lockport Road, the impacts are expected to be minimal.

Cultural resouce investigations are in progress at the proposed Compressor Station 230C to identify archeological resources. No effect on significant cultural resources would result if the project could be modified to avoid any discovered. If unavoidable, National Register of Historic Places-eligible archeological resources are identified, appropriate data recovery programs would need to be designed and implemented so that the effect of the project action would not be adverse. Any proposed data recovery would be evaluated by the FERC Staff in consultation with the New York State Historic Preservation Office and the Advisory Council on Historic Preservation prior to implementation.

4.2.6.3 Main Line

Compressor Station 230B is located in a rural residential area. The station is bordered on one side by a local park. However, a 60-foot hill between the park and site will shield the park from the compressor station. A trailer park also abuts the site. Access to the compressor station is along the road next to the trailer park.

Traffic noise is expected to impact the park as equipment is moved in and out of the site. There would be no effect on cultural resources.

Compressor Station 233 would have only minimal impacts from construction and operation. One residence along Dow Road may be impacted by construction equipment traffic and noise, although these impacts are anticipated to be minimal. There would be no effect on cultural resources.

Loop 4 is routed through a portion of the Manor Heights subdivision. The amount of clearing proposed through this subdivision is limited; total pipeline distance across the subdivision is approximately 1,300 feet. Three homes along Sharon Drives would be affected by the proposed pipeline loop. Tennessee proposes to complete all construction within 5 days to minimize the impact on these residences. Pipe sections would be fabricated offsite and moved to the site to minimize the area needed for construction. All work would be restricted to within the 50-foot permanent and 10-foot temporary easement. If trenches through driveways are left open overnight, a metal or similar cover would be placed over the area. Open trenches would be protected by snow fences. Backfilling and cleanup would immediately follow construction to restore the pipeline trench to its original state. These measures should minimize impacts on residents of the subdivision. There would be no effect on cultural resources.

No significant impacts are anticipated on residences along Loop 5. However, Nelson Swamp would be affected by construction of Loop 5, as discussed in Sections 4.2.5.1.3 and 4.2.5.2.2. There would be no effect on cultural resources.

Loop 6 is expected to affect several residences along the pipeline right-of-way. Along the east side of Old Post Road are two homes located about 100 feet from the pipeline. On the west side of Broad View Station Road and south of the existing pipeline, the proposed pipeline would be located 50 feet from a house and would cross the driveways of two homes. Construction noise and some traffic are anticipated to impact these residences; however, direct impact should be minimal because the loop would be placed to the north. At the Route 150 crossing, a house and garage are located approximately 100 feet to the south of the existing pipeline right-of-way. The proposed loop would be placed on the north side so direct impacts would be minimal. Construction traffic is expected to cause some traffic congestion, possibly increasing the danger along the access. There would be no effect on cultural resources.

Construction impacts similar to those of Loop 6 are anticipated along the proposed Loop 7 route. Along Route 57, a home is located approximately 100 feet south of the pipeline right-of-way. Increasing the right-of-way would necessitate the cutting of mature trees between adjacent residences and the right-of-way and may affect the aesthetics of certain homes in the area. Tennessee can minimize the impact to residences by minimizing the number of trees removed during construction and permanent clearing of the right-of-way, or by placing the pipeline on the side of the existing pipeline which would cause less disturbance. Along Hillside Road, a home is located 72 feet from the existing pipeline. Similarly, the new loop would be placed on the opposite side of the existing pipeline so direct impact would be minimal. There would be no effect on cultural resources

The proposed pipeline is routed through Southwick, Massachusetts. At Route 202/20, it passes directly through the shared parking lot of a small shopping center and gas station. A restaurant across the street uses the existing right-of-way for a picnic area. In this area, Tennessee proposes to install the proposed loop on the north side of the existing pipeline with a 15 foot separation. No existing building would be affected. Construction along the Route 202/20 easement is nevertheless expected to cause some loss of revenue to the businesses affected by the construction activity (i.e., particularly effects due to increased levels of noise and traffic). Continuing eastward, the pipeline would cross the yards of two houses located between downtown Southwick and the Fernwood subdivision; these houses are expected to incur some inconvenience associated with construction equipment, landscaping, and traffic.

The pipeline crosses the Fernwood subdivision, passing directly between two houses approximately 75 to 100 feet apart. Across the street, the pipeline passes between two houses no more than 60 feet apart. A total of nine homes would be directly affected by pipeline construction. The subdivision is mature, with large trees growing on the right-of-way as part of the homeowner's landscaping. Presumably, some trees would be cut to allow for the laying of pipe. Tennessee has proposed construction and restoration techniques for Fernwood similar to those proposed at Manor Heights. The new loop would be placed 10 feet to the north of the existing pipeline in this area. One or two aboveground swimming pools would have to be moved.

The next area that would be impacted is the Amberwood subdivision, currently under construction. As of Fall 1987, no homes have been constructed on the lots crossed by the pipeline. The easement would require the developer to locate the new homes close to existing lot lines.

Compressor Station 264 is an existing station. Some additional tree clearing would occur as the new compressor building would be placed in a currently wooded area to the north of the existing compressor building. This would make the station more visible from the home to the north.

4.2.6.4 Rhode Island Extension

The socioeconomic impacts of constructing and operating the Rhode Island Extension are expected to be minimal. Traffic impacts are expected during construction at Swans Pond. Several sand and gravel operations may be impacted by pipeline construction. At the pit being excavated by Pyne Stone and Gravel, the pipeline may affect access to the mining operation. An alternative access may have to be constructed by Tennessee. No impacts are anticipated on the sand and gravel operation at Route 146 and Lackey Dam Road.

The proposed route would bisect a small parcel of undeveloped residential property on the north side of Maple Street in Douglas. The FERC Staff recommends a minor route deviation (Seaver variation) which would more closely parallel property lines and thus minimize impact on the development potential of the affected property.

At Douglas Pike, the proposed pipeline route runs directly through the property of one resident, Mr. Saravara, whose property is also crossed by the AT&T cable, the Algonquin pipeline, and the Boston Edison transmission line. Mr. Saravara believes that no new corridors should be cut across Douglas Pike. The FERC Staff recommends that the Tennessee pipeline into the OSP plant site follow the route variation identified as V-7, parallel to the Boston Edison power line. Staff believes the route is environmentally preferable to the proposed route because it would not involve cutting a new right-of-way corridor through the area, and could take advantage of the existing Boston Edison line right-of-way to minimize the required amount of clearing during pipeline construction. The FERC Staff further recommends that Tennessee install visual barriers at the proposed crossing of Douglas Pike to help restore and maintain the wooded character of the area which would be most heavily impacted by the proposed power plant.

Archeological surveys are in progress to identify cultural resources. As discussed in Section 3.2.6.3, the Rhode Island Extension is located in an area sensitive to both significant prehistoric and historic cultural resources which are poorly understood at present. Any cultural resources discovered have the potential to answer significant research questions as addressed in Section 3.2.6.3.

4.3 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

FERC is required to include in this FEIS a detailed statement on any adverse environmental effects that cannot be avoided if Tennessee receives authorization to transport natural gas and to construct interstate gas pipeline facilities, and if the OSP project is implemented as proposed. This requirement is contained in NEPA Section 102(2)(C)(ii). These unavoidable adverse impacts are summarized below; more detailed descriptions are provided in the earlier sections of this chapter.

4.3.1 Geology and Soils

Construction of the OSP project will require significant filling, excavation, blasting, and regrading. These activities will occur at the plant site, along the oil/water pipeline route, and where natural gas pipeline improvements are built. From a regional perspective, however, no major changes in terrain are associated with the project.

Construction and operation of the OSP project will have no adverse impacts on geological resources. In the period of initial project planning, there was a potential for segments of the pipeline upgrade to prevent the exploitation of sand and gravel deposits. These sections of pipeline have been realigned to avoid this problem.

4.3.2 Water Resources

Construction of the OSP power plant may result in short-term, temporary degradation of surface water quality in the Nipmuc and Blackstone River Basins. Construction of the gas pipeline improvements may have negative effects on three major river basins in New York, Massachusetts, and Rhode Island. All applicable construction practices will be observed to minimize erosion and runoff at these sites.

Since the power plant is designed for zero discharge of process and cooling waters, there should be no adverse impacts of plant effluent on surface water or groundwater. Operation of the upgraded gas pipeline should also have no permanent effects on surface water or groundwater, except possibly through increased runoff from approximately 185 acres of previously forested land that would be cleared for pipeline construction.

Operation of the OSP power plant would require makeup cooling water--an average withdrawal of 4 mgd and a maximum of 4.4 mgd during the summer peak of power demand. As detailed in Section 4.1.2.1, while the impact of these river withdrawals alone may not be significant, even during exceptionally low flows, the effect of reducing water quality in a stream which does not currently meet water quality standards could be viewed as significant. If the withdrawal limits or precludes use of Blackstone River water for other purposes or imposes restrictions on currently permitted uses, this too may be viewed as significant.

4.3.3 Air Quality

Construction of the OSP power plant and the gas pipeline improvements would have minor, temporary effects on air quality in the vicinity of each site. This would be due to fugitive dust emissions from earthwork and other site activities. Standard construction practices would be followed to minimize these impacts.

Power plant operation would have several effects on air quality in the site vicinity. There would be stack emissions to the atmosphere, principally of NO_x and CO (unless fuel oil is used during an emergency). As noted in Section 4.1.3.1, these emissions should not violate the NAAQS.

The mechanical draft cooling towers planned for the project would emit both visible and invisible moisture plumes into the atmosphere. The major adverse impact of these plumes would be an increased potential for fog and ice formation on roads near the plant site--which may present a driving hazard for local residents. The maximum potential for this impact is predicted to be on West Ironstone Road, approximately 1,300 feet south of the proposed cooling towers in Rhode Island. The worst effects are predicted to amount to 4.8 hr/yr of fogging and 0.82 hr/yr of icing. Fogging potential on other roads in the vicinity is predicted at less than 1 hr/yr. No increased icing potential as a result of the cooling towers is predicted for any roads other than West Ironstone Road. The cooling tower plume will also create an aesthetic impact due to its visibility from the surrounding neighborhood.

Both the stack emissions and the cooling tower vapor plumes could reduce visibility under certain conditions. The cooling towers' effects would be limited to an area immediately adjacent to the plant. The stack plumes are not expected to result in significant degradation of visibility at any location. With stack emissions limited to 46 lb/hr, the plume should be nearly invisible as it exits the stack. Modeling of long-range plume visibility effects indicates that there should be no impairment of visibility at any location as a result of operating the OSP facility.

Power plant operation would require the generation of heat, which will be discharged into the atmosphere. This modification of climate in the immediate plant vicinity is not expected to have any significant adverse environmental effects.

4.3.4 Sound Quality

Construction of the OSP power plant would have the effect of temporarily increasing sound levels in the site vicinity. The nearest receptor residence is approximately 1,200 feet from the center of the plant site. The temporary noise levels associated with daytime construction activities would be similar to other major construction projects--audible and occasionally disruptive noise extending over periods of several months. Operation of the power plant would result in increased levels of sound in the immediate vicinity of the plant but would meet an L_{dn} of 55 dBA at the nearest residence.

Pipeline construction work would vary considerably in distance from receptors. Persons living close to the pipeline route would find the construction noise to be intrusive or disruptive, but of brief (5 to 10 days) duration. Operation of the upgraded pipeline is not expected to create any increase in noise levels, except in the vicinities of the proposed compressor station facilities. Pending final equipment selection, Tennessee Gas Pipeline Company would construct the compressor additions such that noise emissions would not exceed an L_{dn} of 55 dBA at the nearest noise-sensitive receptor. Based on an analysis of manufacturers' far-field sound level data, the FERC Staff believes that this limitation can be met.

FERC Staff recommends that Tennessee and OSP conduct post-construction noise surveys at each noise-emitting facility to verify that the performance goal of 55 dBA has been achieved. Both Tennessee and OSP should be required to undertake remedial measures if necessary.

4.3.5 Ecology

Construction of the OSP power plant, with the associated water and oil supply pipelines, is expected to permanently remove 90 acres of upland habitat from the terrestrial ecosystem The pipeline improvements associated with the project are expected to require the clearing of 185 acres of wooded habitat for pipeline right-of-way and compressor station sites. An additional 180 acres of open land would be affected during construction of the pipeline and compressor facilities. The disruption of about 30 acres of wetlands is expected as a consequence of the project, with about 0.5 acre of wetlands permanently removed from present use for the plant area.

The temporary adverse effects on surface water quality caused by construction of the OSP power plant and the associated gas pipeline improvements would have environmental effects on the aquatic ecosystem of various water bodies. Construction of the plant itself would affect the Nipmuc River. The associated water and oil supply pipelines would require crossings of one reservoir, three rivers, and 21 streams and the construction of water intakes, which would affect the Blackstone River. The natural gas pipeline improvements would require crossings of one river, several perennial streams, and numerous intermittent streams; this could affect three major river basins in New York, Massachusetts, and Rhode Island.

The major permanent adverse aquatic ecosystem impacts from operation of the OSP project would result from the withdrawal of up to 4.4 mgd from the Blackstone River. Peak water needs for the project would probably coincide with low-flow periods in the river. From a comparison of the project's water needs with the quantities of water available in the river, it can be concluded that there should be no significant effects on aquatic ecosystems from cooling water withdrawals.

Because the OSP plant is planned to operate with zero water discharge, there should be no adverse effects on aquatic ecosystems as a result of wastewater or cooling water disposal.

The construction and operation of the OSP project, including associated improvements in natural gas pipelines, are not expected to have adverse effects on any critical or endangered species of plant or animal. No critical or unique habitats are expected to be used for any components of the project.

4.3.6 Sociocultural Resources

The construction and operation of the power plant facility are expected to change the land use of 17 acres from residential zoning to industrial. An additional

24 acres would serve as a buffer zone within the plant perimeter. The oil/water supply pipelines are expected to convert approximately 60 acres to serve as pipeline right-of-way. The modifications to the natural gas pipeline facilities are expected to require approximately 60 acres for new or expanded compressor facilities and 140 acres for pipeline right-of-way.

Adverse socioeconomic effects of the project are not believed to be significant. The major problem with these effects is that they would be concentrated in relatively small areas in the vicinity of the plant site and the oil, water, and natural gas pipeline corridors. The compensating beneficial economic effects of the project would be distributed over a much larger area.

Adverse impacts on transportation would be most severe during construction of the project, and primarily in the vicinity of the plant site and the oil, water, and natural gas pipeline corridors. The increased traffic caused by workers and material and equipment suppliers is believed to be well within the capacity of the road network in the plant vicinity. Most of the pipeline construction and upgrading would occur in rural areas, so that few individuals would be affected by traffic disruptions.

Because of the design for pipeline delivery of natural gas, cooling water, and oil to the OSP facility, plant operation should have minimal adverse effects on transportation. The 30 permanent employees of the plant are not expected to have a significant adverse effect on the road infrastructure in the plant vicinity.

The OSP project may have adverse visual and aesthetic impacts in three areas--the plant vicinity, the natural gas pipeline corridor, and the oil/water pipeline corridor.

The major visual impact at the proposed plant and the only elements visible from off site would be the cooling towers, tower emissions, and exhaust stacks, with the towers by far the more visible.

Most of the improvements to the natural gas pipeline facilities would take place in or adjacent to existing gas pipeline corridors. Therefore, the visual/aesthetic impacts would be minor incremental increases of existing effects. Most of the area involved is rural so that the adverse effects are believed to be insignificant.

No significant historical or archeological resources were identified that would be affected by the OSP power plant. Surveys carried out for this purpose and protective measures to be implemented indicate that no cultural resources would be affected by project implementation at the Sherman Farm Road plant site and at the sites of Compressor Stations 230B and 233, and gas pipeline Loops 1,4,5,6, and 7. Surveys are underway to determine if the proposed action would affect cultural resources at the following locations: Compressor Station 230C, the Rhode Island Extension, and the water and oil pipelines associated with the power plant. No adverse effects would likely result on cultural resources that are on or determined to be eligible for the National Register of Historic Places if approved data recovery of restorative measures are implemented.

No significant effects on human health other than variable levels of anxiety to local residents are expected from construction or operation of any aspect of the OSP project.

4.4 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

As part of this EIS, it is necessary to present a detailed statement as to the occurrence of any irreversible and irretrievable commitments of resources should FERC authorize the interstate shipment of natural gas and the construction of interstate gas pipeline facilities for the OSP project (NEPA Section 102(2)(C)(v)).

Irreversibly committed resources cannot be altered at some later time to restore their original value. Such irretrievable commitments consume resources that are not recoverable for subsequent use.

The types of resources affected by the OSP project can be described as:

- Material resources--renewable and nonrenewable resources consumed in construction and operation.
- Natural resources--the environment prior to the proposed action, including any recognized beneficial uses of the environment.

The resources that may be irreversibly committed include plants and animals destroyed or driven away from the plant site and pipeline corridors, construction materials and energy that cannot be recovered or recycled, materials and fuels consumed or reduced to waste products, and land areas removed from present uses. The resource commitments required for the OSP project, as presently proposed, are described below.

4.4.1 Land

Proposed development of the Burrillville site would require the removal of 40 acres from their present or possible alternative uses. This includes 17 acres graded and excavated for construction of plant facilities. In addition to these land commitments at the power plant site, significant land is required for construction of the oil/water pipelines and for the natural gas pipeline improvements.

The oil/water pipeline corridor from the plant site to the Blackstone River would require the dedication of approximately 60 acres as pipeline right-of-way.

Improvements to the natural gas pipeline system would require clearance of approximately 9.5 acres of woodland for compressor station construction and enlargement, with clearance of an additional 342 acres for new pipeline right-of-way. Some 110 acres adjacent to the pipeline corridors would be cleared during construction, but would revert to present uses after completion of the pipeline work. The land commitments for this part of the proposed action are minimized because much of this work would be carried out on or adjacent to land that is already dedicated to natural gas pipeline corridors and appurtenant structures. Implementation of the proposed action would result in the conversion of Compressor Stations 230B and 233 from temporary to permanent facilities. These sites would be dedicated to natural gas compression for the life of the project.

4.4.2 Water

Construction of the OSP project is estimated to require the consumption of 4 mgd largely for cooling tower makeup water, with a maximum consumption of 4.4 mgd. The annual water consumption for normal operation of the project is projected to be 1,460 million gallons, or 29,200 million gallons over the expected 20-year life of the project. A potable water supply well would be constructed at the plant site; it is expected to require not more than 6 gpm.

4.4.3 Species and Ecosystems

Construction of the OSP power plant, the oil/water pipelines and the improvements to the natural gas pipelines would result in habitat alterations. During construction, there would be temporary displacement or loss of plants and animals from the plant site area and the pipeline right-of-way. Further effects on organisms and ecosystems during operation of the project would be minimal. As noted above, 110 acres of land that would be disturbed during pipeline work would revert to existing habitat after construction.

At the Sherman Farm Road site, 17 acres of forest within the perimeter fence would be cleared for permanent structures. Most of the cleared land on the site would lose its value as wildlife habitat. Some 60 acres of land would be committed to pipeline right-of-way for the oil/water pipeline. Improvements to the natural gas pipeline systems would require the commitment of approximately 60 acres for compressor facilities and 140 acres approximately for permanent pipeline right-of-way.

No endangered, threatened, or unique wildlife or vegetation are likely to be affected by the proposed construction of the OSP power plant, the associated oil and water pipelines, or the proposed natural gas facilities. Section 4.2.5.3 includes a discussion of mitigating measures that would be used to ensure that Loops 5 and 6 do not adversely impact species considered by New York State to be unique floral species associated with Loop 5 of the proposed gas pipeline.

4.4.4 Materials

Most of the concrete, steel, and other construction materials to be used in building the OSP project may be physically, though not economically, retrievable. Since valid estimates of their salvage value cannot be made, these materials must be considered irretrievably committed resources.

4.4.5 Energy

Construction of the OSP project--including the power plant, oil/water pipelines, and natural gas pipeline improvements--would require the irretrievable commitment of fossil fuel and electrical energy.

The central purpose of the OSP facility is to burn natural gas to provide a dependable source of base-load electric power in an area where such power would soon be needed. As now configured, the project's first phase would consume 50,000 Mcfd of gas, beginning in 1990. The second phase would come online shortly thereafter, and from that point the plant would burn an additional 50,000 Mcfd of natural gas, for a projected life of 20 years (until 2010). In 1982, Canada estimated about 70 trillion cubic feet of know gas reserves. This figure has been growing steadily as new gas fields in the Artic area are discovered.

If there is a period when the natural gas supply to the plant is interrupted, or where natural gas supplies are in great demand, the plant could operate using No. 2 fuel oil instead of natural gas. Operating on fuel oil at full capacity, the plant would consume about 18,000 barrels of fuel per day, or 6.6 million barrels per year. It is highly unlikely that the plant would operate on oil for an extended period, except under emergency conditions. Under routine conditions, OSP's air quality permit would limit oil use to a maximum of 1500 hours per year.

All energy resources burned in the plant would be irreversibly and irretrievably committed. However, they would not be lost since they would have been converted to electricity. When both phases of the plant are operating, the project should be producing approximately 4.1×10^9 kWh of electric energy per year, or 8.2×10^{10} kWh over the life of the project.

4.4.6 Labor

Both construction and operation of the OSP project would require the commitment of large amounts of labor. The construction phase is estimated to involve up to approximately 200 people onsite over a period of 2 years. A large temporary work force would also be required for construction of the gas, oil, and water pipelines.

Operation and maintenance of the plant after completion of the second phase is projected to require 60 full-time employees. Over the assumed 20-year operational lifetime of the plant, 1,200 labor-years would thus be required. Operation and maintenance of the associated natural gas pipeline would also require the commitment of a portion of Tennessee's maintenance force.

4.4.7 Capital

The costs of constructing and operating the OSP project represent commitments of capital for land, labor, materials, and equipment that are essentially irretrievable. The magnitude of these commitments must be evaluated with respect to the capital requirements of any of the alternative means by which the required electric power generating capacity could be brought online and operated during the same time period.

The capital costs are estimated at approximately $300 million for the power plant and ancillary facilities and $52 million for the natural gas pipeline construction.

4.4.8 Solid Waste Disposal Capacity

As presently proposed, the OSP project should produce no liquid waste discharges. Because it is designed to burn natural gas, with fuel oil as an alternative during periods of supply interruption, there should be no solid waste combustion byproducts. However, the zero liquid discharge technology requires the commitment of disposal capacity in an approved landfill for solid wastes produced by the MVR evaporator/crystallizer system. This process accepts ionized salts and minerals from the EDR process and concentrates them until they are 60 to 70 percent solids (dry weight basis). A slurry centrifuge extracts these wastes in a cake or solid form.

During plant operation after completion of the second phase, it would be necessary to dispose of 5.4 cubic yards of this material daily, or about 39,400 tons over the projected life of the power plant. Landfill space used for this purpose would be irreversibly committed.

4.5 RELATIONSHIP BETWEEN SHORT-TERM USE OF THE ENVIRONMENT AND MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

4.5.1 Short-Term Uses of the Environment

The immediate short-term effect of the proposed action would be widespread minor degradations in environmental quality. Existing habitats would be altered and new ones may be created. The productivity of adaptable species may be enhanced, while in small areas other species may decline in numbers. Temporary increases in turbidity and sediment loads--which may have temporary deleterious effects on aquatic habitats--can be expected in rivers and streams near the power plant site and along the natural gas, oil, and water pipelines.

In areas where agricultural lands are directly affected by the proposed action, one year of agricutural production would be lost. There is the further possibility that the effects of construction equipment on farm soils would depress their yields for at least one additional growing season.

The sites of the new compressor stations and the OSP power plant itself would become dedicated to gas compression and electricity production for the life of the project, preempting possible noncompatible uses. At the expanded compressor stations, short-term uses would not change, but what had been considered a temporary use will become permanent.

While the most immediate effects of the proposed action would be somewhat negative, benefits from this use of the environment would be realized in a relatively short time for a major energy project. Approximately 2 years after construction begins, the OSP power plant would begin producing base-load electric power for the NEPOOL grid. Most of the alternative means for producing this electricity would require more signficant environmental impacts than the proposed relatively clean gas-turbine combined-cycle generation.

4.5.2 Long-Term Productivity

The proposed action should have no effect on long-term productivity. At the end of the project life, all facilities could be abandoned (with FERC approval for the natural gas facilities) and their sites allowed to revert to previous uses if structures are removed. Alternatively, some parts of the proposed action--power plant and compressor buildings and oil, water, and gas pipelines--could be made available to house other activities and possibly to transport other materials.

SECTION FIVE

CONCLUSIONS

The conclusions and recommendations presented herein are those of the staffs of the Federal Energy Regulatory Commission (FERC or Commission) and the Rhode Island Office of Intergovernmental Relations (OIR). "FERC Staff" as used herein and throughout this document also refers to OIR Staff.

Information provided by the applicants and further developed from field investigations, literature research, alternatives analysis, and contacts with Federal, state, and local agencies indicates that the proposed construction of the OSP project would have a limited adverse environmental impact and would be an environmentally acceptable major action. Additional mitigative measures are recommended to further reduce the environmental impacts. Similarly, the proposed additions and modifications to the Tennessee Gas pipeline to serve the OSP project would have a limited adverse environmental impact and would be environmentally acceptable. Additional mitigative measures are recommended to further reduce the environmental impacts. Inasmuch as the project consists of distinct components by two separate applicants, the conclusions and recommendations regarding the proposed power plant and gas pipelines are discussed individually below.

The FERC's responsibility in this proceeding is to certificate the natural gas pipeline facilities which would be the primary source of fuel for the proposed power plant. Final decisions must be made by the Rhode Island Energy Facility Siting Board (EFSB) and the Economic Regulatory Administration (ERA) of the U.S. Department of Energy with respect to the construction and operation of the power plant. Air quality clearance, and permitting of the proposed cooling water withdrawal are the responsibility of the Rhode Island Department of Environmental Management (RIDEM). The FERC and OIR Staffs have developed and recommended additional mitigating measures which they believe to be appropriate and reasonable for the construction and operation of the power plant and the natural gas pipeline facilities. With respect to the measures for the natural gas pipeline, the FERC Staff is recommending that these measures be attached as conditions to any certificate issued by the FERC. With respect to the measures for the power plant, the FERC Staff believes that the EFSB has the principal authority and responsibility to impose these mitigating measures and conditions upon OSP's license. From the Federal standpoint, the ERA would have more direct authority than the FERC to impose these mitigating measures through its granting OSP an exemption under the Powerplant and Industrial Fuel Use Act. Should the above actions not occur, the Staff recommends that the FERC require OSP to implement appropriate mitigating measures, not imposed by others, through its authorization of the Tennessee pipeline facilities. Recommendation No. 1 for Tennessee would achieve this goal, but it is recommended that EFSB and/or ERA attach the conditions for the power plant to each or both of their specific authorizations.

5.1 OCEAN STATE POWER PLANT

5.1.1 Significant Environmental Impacts of the Proposed Action

Construction of the proposed power plant at the Sherman Farm Road site preferred by OSP would have significant effects on water use and local land use, and would affect protected wetlands. Other resources--such as air quality, terrestrial and aquatic ecology, and cultural resources--would be affected to a lesser extent.

Withdrawal of the plant's water needs of 4 million gallons per day from the Blackstone River would not by itself be a significant consumptive loss; however, this use may preempt other potential uses of the water. Effects of water withdrawals on water quality in the Blackstone River also would not by themselves be significant. Since the Blackstone does not presently meet water quality standards for heavy metals and dissolved oxygen, any further degradation of the river's quality would have regulatory significance. OSP and the Rhode Island Department of Environmental Management (RIDEM) have agreed to mitigation measures to ensure acceptable dissolved oxygen levels in the river during low flow periods.

A power plant at the Sherman Farm Road site would be convenient and economical for OSP's owners, since electric transmission lines and a switching station are currently present onsite. Significant effects would occur within the surrounding rural residential neighborhood during construction due to noise and traffic. Analyses of operational effects from noise, night lighting, and cooling tower fogging and icing have shown that these would not be severe, but would be perceived as significant by local residents. Construction and operation of plant facilities would result in the loss of approximately 17 acres of woodlands.

Wetlands would be affected at the plant site, at the water intake, and along pipeline routes. While the total acreage of affected wetlands would not be great, the effects would be important due to their sensitive nature and protected status. Approximately 0.5 acre of wetland would be lost and several acres temporarily altered as a result of the project's development. A small tributary to the Chockalog River drains from a bog onsite, but it should not be significantly impacted by the proposed action. Six streams would be crossed by the proposed oil/water pipeline route, but no significant impacts are expected.

Residents in the immediate vicinity of the proposed site could suffer a loss in property values. Some of the loss may be offset by a reduction in property tax due to the infusion of tax revenues from the OSP facility. Residents outside the immediate vicinity would benefit from the tax revenues, but would bear none of the burden in lost property values.

Adverse impacts would occur to the aesthetic qualities of the area because the project would place a heavy industrial facility in the midst of what is largely a rural residential area.

5.1.2 Alternatives With Less Severe Environmental Impacts and Actions Preferred by the FERC Staff

In its analysis of the proposed site (Sherman Farm Road), the FERC Staff performed an independent siting evaluation. The evaluation reexamined the sites investigated and criteria used by OSP, added several new sites suggested by interested parties and others identified by FERC Staff, and developed the criteria used to perform site evaluations. The FERC Staff's siting analysis disclosed that the site preferred by OSP, while not clearly superior environmentally to other sites identified, is an environmentally acceptable site.

The Ironstone Industrial Park site, located along Route 146 approximately 3 miles east of the Sherman Farm Road site, is considered by the FERC Staff to be an environmentally preferred alternative. Ironstone is a large site that is already affected by an ongoing sand and gravel operation, and there is a larger buffer area between it and residential neighbors. The sand and gravel operation will reportedly soon close; thus, conversion of the land to a power plant would be a beneficial use. During construction, access could be readily provided via a major route (Route 146) rather than by the low-volume rural roads surrounding the Sherman Farm Road site.

A disadvantage of the Ironstone site is that about 0.4 miles of new transmission line right-of-way would be required, approximately 0.9 miles of other right-of-way sections would have to be widened and a new switching station would need to be built. This results in total clearing of about 35 acres compared with only 17 acres at the Sherman Farm Road site. The new right-of-way and expanded clearing of existing right-of-way at the Ironstone site would traverse primarily agricultural or vacant land. These impacts would not be experienced at the Sherman Farm Road site.

There are also two uncertainties regarding the Ironstone site, the resolution of which would require policy decisions by governmental entities. First, the land at Ironstone is presently zoned agricultural, and a recent attempt by the landowner to rezone the site from agricultural to industrial use was not approved, mainly due to concern that the quality of a groundwater aquifer underlying the site could be compromised by industrial use of the site. An evaluation of the aquifer was recently conducted by a consultant to the Town of Uxbridge, and their report concluded that the site could reasonably be rezoned to industrial purposes (IEP, 1987). However, the report did not specifically evaluate or recommend zoning that would include an electric generating facility or similar-type facility. Thus zoning remains an unresolved issue at Ironstone.

Second, water for a plant at Ironstone (in Massachusetts) would be delivered via pipeline from an intake on the Blackstone River in Rhode Island. Approval must be given by the Rhode Island Water Resources Board for interstate transfers of water, an activity for which there is a mechanism but no recent history. Dry cooling could be used at Ironstone to avoid this issue, however, dry cooling would involve other environmental and cost trade-offs.

The Bryant College site, located along Douglas Pike (Route 7), is approximately 9 miles south of the Sherman Farm Road site. Bryant College is considered by the FERC Staff to be another reasonable alternative. The Bryant College site is zoned industrial and has a mix of nearby residential, commercial, and industrial facilities. Access could be readily provided by Douglas Pike and I-295, which is located approximately 1 mile from the site. Although a single circuit 345-kV transmission line passes adjacent to the site, the power plant would require an additional 345-kV line within the same right-of-way so that reliable service could be ensured to the NEPOOL grid. Cooling water would be provided by an intake structure at the Blackstone River in Woonsocket and be transported by pipeline to the Bryant College site. This pipeline would be shorter than the pipeline required at Sherman Farm Road. The proposed Rhode Island Extension natural gas pipeline would pass adjacent to the site if the FERC approves Tennessee's Providence Project.

A significant disadvantage of the site is the location of Bryant College directly across Douglas Pike. Several student housing facilities and a track are located within 0.5 mile of the site; additionally, future expansion of the college may take place within the 0.5-mile radius. Commuter traffic to Bryant College contributes significantly to traffic congestion along Douglas Pike.

FERC Staff acknowledges that the process of design and permit approval is underway for the Sherman Farm Road site, and according to OSP, delays in the overall project of up to 2 years could be expected if a new site is selected. Further, a delay in the start of plant operation would result in the loss of a 6.5 percent investment tax credit which would increase costs to ratepayers. These issues, while not a significant factor in Staff's environmental review, might be considered by other agencies with siting approval jurisdiction.

In addition to its proposed plant site on Sherman Farm Road, OSP has proposed locations and route alignments for ancillary facilities that would support the plant. FERC Staff has reviewed OSP's proposed facilities (described in Section 2.1.3) and evaluated a number of alternatives (Section 2.1.4). Based on its review, Staff recommends the following action as being environmentally preferable to OSP's proposed action. OSP's proposed oil and water pipeline route follows primarily city streets and local highways from a Woonsocket intake to the Sherman Farm site. FERC Staff's preferred route is shown on Figure 2.1-9 as Alternatives OP-1, OP-4, and OP-5 and would mainly follow existing or abandoned railroad and electric transmission line rights-of-way.

5.1.3 Planned and Recommended Mitigation Measures

During the course of the development of this EIS, both the applicant and the FERC Staff have identified several areas where mitigation measures could be employed to minimize or reduce impacts on the surrounding environment. This section identifies measures that are proposed or recommended by the applicant or the Staff and discusses the effectiveness of each measure. It should be noted that since the inception of this project, a significant number of mitigation measures have been incorporated by the applicant, primarily in response to public or agency comments. These measures and their anticipated effectiveness are discussed throughout the document. Mitigative measures inherent to the design of the project will not be discussed here.

5.1.3.1 Applicant's Proposed Measures

1. General Impact: Possible minor ground vibrations produced by construction and operation of the power plant could compromise validity of nearby MIT seismograph station, located less than 1 mile from the proposed site.

   Mitigation: OSP has agreed with MIT to pay for the relocation of MIT's seismograph station to an area that will not be affected.

   Effectiveness: This measure will eliminate any concerns about the reliability of MIT's seismograph observations. Although no significant changes in ground vibration will be perceived by local residents, the extreme sensitivity of the MIT seismograph could detect changes in baseline ground vibrations.

2. General Impact: Construction blasting at the OSP site could result in adverse offsite impacts.

   Mitigation: OSP would employ a specialized consultant in the field of blasting to investigate the site geology and provide oversight to the blasting program.

   Effectiveness: The potential for adverse effects from blasting would be reduced by placing the direction and coordination of the program under a technical specialist.

3. General Impact: Construction of the OSP project will require significant filling, excavation, and regrading that may result in a significant increase in soil erosion.

Mitigation: OSP has developed a comprehensive erosion and sediment control and stormwater management plan designed to control stormwater runoff and minimize erosion of excavated soil to offsite areas; this plan is described in OSP's Rhode Island Wetlands Alteration permit application.

Effectiveness: The applicant's plan should be effective in decreasing water erosion of loose soils.

4. General Impact: Construction of the OSP power plant may result in possible degradation of local surface water quality in the Nipmuc and Blackstone River Basins.

Mitigation: OSP's stormwater management plant was developed to minimize the effects to nearby streams in stormwater runoff.

Effectiveness: The applicant's plan should be effective in minimizing sediment transport and water quality impacts to nearby streams.

5. General Impact: There is concern that the withdrawal of 4.4 million gallons of water per day from the Blackstone River will affect the quality of the water downstream of the cooling water intake location in Woonsocket.

Mitigation: OSP would continue coordination with the Rhode Island Department of Environmental Management regarding the effects of the plant's operation on water quality and quantity in Blackstone River. Water would only be withdrawn in accordance with State permit requirements. Water quality downstream of the cooling water intake would be monitored as required by the State. Additional mitigative measures, including dissolved oxygen replenishment and environmental monitoring programs, would be implemented as required by the State permits.

Effectiveness: Any conditions of permit issued by the State agency will necessitate some level of monitoring of the Blackstone River water quality and/or its flow conditions and rate of withdrawal. This should provide an effective means of protecting the river, within the guidelines stipulated by the permitting agency, from impacts associated with plant operation.

6. General Impact: Construction of the OSP power plant would have the effect of temporarily increasing sound levels in the vicinity of the site.

Mitigation: OSP has agreed to limit construction noise at the property line to an equivalent noise level (L_{eq}) of 55 dBA during daylight hours.

Effectiveness: Construction noise would be reduced to a level considered acceptable by the U.S. Environmental Protection Agency.

7. General Impact: Plant lighting at night and the plant public address system could be disruptive to nearby residents.

Mitigation: OSP's outdoor lighting of the plant would include roadway lighting and lighting around equipment where maintenance might be required. Directional high pressure sodium lighting would be used. OSP would not perimeter light the entire site. OSP would install localized public address equipment and limit its use.

Effectiveness: These actions would limit lighting and sound to those areas where it is specifically needed, and thus minimize offsite impacts.

8. General Impact: High dust levels could be present during construction as a result of soil excavation and construction traffic on and around the site.

Mitigation: The applicant plans to minimize fugitive dust during construction by employing conventional dust control techniques (i.e., watering). This will be necessary to comply with air quality regulation that the Rhode Island Department of Environmental Management will apply as a condition of their permit.

Effectiveness: The measures that are to be employed would reduce the impacts of fugitive dust in direct proportion to the level of control applied.

9. General Impact: The construction and operation of the power plant facility are expected to change the land use of approximately 17 acres from vacant/forested to industrial.

Mitigation: Up to 24 acres within the plant boundary will be utilized as a buffer zone around the plant equipment to reduce visual and other potential impacts to nearby residents.

Effectiveness: To the extent the buffer zone is left in a vegetated state, visual and noise impacts of the plant should be reduced. However, some areas, particularly the stacks, will be visible from neighboring property. Noise impacts will depend not only on the depth of the buffer (minimum of 100 feet) but on the distance of the observer from the plant.

10. General Impact: The construction of the power plant will result in the disruption of several local wetlands on or near the site.

Mitigation: OSP has reoriented the original configuration of the plant. Construction will be, in accordance with an erosion and sediment control plan and stormwater management plan, developed by the applicant for this project.

Effectiveness: Reorientation of the plant minimized the impact of the plant on nearby wetlands. Construction effects on nearby wetlands would be minimized by erosion and sediment control measures.

5.1.3.2 FERC Staff Recommended Measures

If the Rhode Island Energy Facility Siting Board approves the OSP project at the proposed site, the FERC Staff recommends that the following conditions be included to further mitigate the environmental impacts of plant construction and operation.

1. <u>General Impact:</u> There is concern that waste resulting from cooling tower blowdown and processed by the onsite electrodialysis reversal (EDR) unit may be considered hazardous.

   <u>Mitigation:</u> OSP shall conduct appropriate chemical or physical analyses, in accordance with EPA and State regulations, to determine if the solid or semi-solid waste produced through cooling tower/boiler blowdown should be considered hazardous waste. OSP shall demonstrate that a suitable disposal facility is available if these wastes are determined to be hazardous.

   <u>Effectiveness:</u> There will be no onsite disposal or long-term storage of any hazardous waste, and any hazardous wates generated at the site will be disposed of in an approved manner.

2. <u>General Impact:</u> Malfunction of critical equipment in the zero discharge water treatment equipment at the OSP plant could extend over a longer period than could be accommodated by the wastewater holding pond and through operational techniques such as increasing the cycles of concentration.

   <u>Mitigation:</u> OSP shall, in the event of an extended failure of its onsite zero discharge water treatment beyond the capacity of its backup measures, cease operation of the plant until repairs are effected.

   <u>Effectiveness:</u> Shutdown of the plant would avoid offsite discharges of potentially contaminated water.

3. **General Impact:** During periods of relatively low flow in the Blackstone River, OSP's cooling water needs may require an unacceptably high percentage of total river flow.

Mitigation: OSP should establish a contingency plan to provide a back up water supply during periods of restricted withdrawal from the Blackstone River. Use of groundwater from the Branch River aquifer near Slatersville would provide an adequate back up supply.

Effectiveness: The incorporation of a back up water supply during any low-flow condition would ensure that the plant would be able to continue to operate at full load during periods of peak energy usage.

4. **General Impact:** Construction activities may disturb local residents during quiet hours and weekends.

Mitigation: OSP shall, to the maximum extent feasible, confine all construction and operating noise generating activities above an L_{eq} of 55 dBA at the property line to weekday, daylight hours. Construction noise levels shall be monitored during off-hours to ensure compliance with this requirement.

Effectiveness: This will ensure that the effective offsite noise levels during the hours of construction of the plant will be within guidelines published by the U.S. Environmental Protection Agency. It is expected, however, that there will be limited periods when noise levels will exceed 55 dBA.

5. **General Impact:** Offsite noise levels during power plant operation may disturb local residents.

Mitigation: OSP shall install mufflers, barriers, or other noise-suppression devices so that noise attributable to operation of any proposed facility component does not exceed an

L_{dn} of 55 dBA at the nearest residence. This shall apply to the plant site, the water intake, and any pipeline booster stations. Post-construction sound level surveys shall be conducted to verify that these performance goals are achieved. Corrective action shall be taken if necessary.

Effectiveness: This will ensure that offsite noise levels are within recommended ambient noise guidelines as set forth by the U.S. Environmental Protection Agency and the FERC Staff. It will not, however, eliminate noticeable noise from the plant.

6. General Impact: Offsite noise levels during power plant construction may disturb local residents.

Mitigation: Construction activity shall be restricted to Monday through Saturday, 7 a.m. to 5. p.m., except for indoor work that can be performed without adverse noise effects on local residences. This restriction will not apply to those activities that may occasionally require extended work hours, such as a continuous concrete pour.

Effectiveness: This should restrict the majority of the construction activities on the project to periods when most people are away from their homes.

7. General Impact: Impulse noises such as blasting and steam blowdowns may negatively impact local livestock breeding operations. It may also negatively impact the nearest residents.

Mitigation: OSP shall as reasonably as possible schedule blasting and steam blows during construction to avoid the breeding season--March through late September. Where such scheduling is not possible, OSP shall notify the local breeder prior to conducting each occurrence of such activities. Nearest residents should also be notified.

Effectiveness: This will minimize the impact on any local animal breeding and the nearest residents.

8. General Impact: The visual presence of the plant may negatively impact the surrounding area.

Mitigation: OSP shall develop a site clearing and grading plan that maximizes the effectiveness of existing vegetation on the site as a visual barrier to the plant. A 100-foot minimum, undisturbed vegetated buffer shall be left around the perimeter of the plant property to reduce aesthetic impacts and noise levels at nearby residences. Screen plantings shall replace vegetation removed during construction.

Effectiveness: The presence of vegetation barriers will reduce the visibility of the plant.

9. General Impact: The construction of the plant may negatively impact local wetlands.

Mitigation: To the maximum extent practical, topsoil shall be segregated in all wetlands to be crossed by the water and oil pipelines unless the Rhode Island Department of Environmental Management specifically grants OSP relief from the requirement. Wetlands shall be protected, preserved, and--to the maximum extent practicable--returned to their preconstruction condition. OSP shall employ, to the extent feasible, structural measures such as retaining walls to avoid wetlands encroachments. No herbicides shall be applied in or adjacent to wetlands.

Effectiveness: Impacts on local wetlands will be minimized.

10. General Impact: Construction-related traffic will unduly disturb local residents on secondary roads.

Mitigation: Construction equipment traffic, including all vehicles other than workers' personal vehicles, shall be prohibited from using West Ironstone Road and Douglas Pike. All construction traffic should be limited to Sherman Farm Road insofar as is practical.

Effectiveness: Heavy equipment traffic will be minimized on roads where the majority of the nearest residences are located.

11. General Impact: Construction of the oil/water pipeline on the route proposed by OSP would require disruption of heavily traveled streets in Woonsocket, North Smithfield, and Burrillville, Rhode Island.

Mitigation: OSP shall, to the extent technically and environmentally feasible, undertake to utilize all or part of Staff's preferred oil and water pipeline route OP-4, OP-1, and OP-5 along the Providence and Worcester Railroad spur line in Woonsocket and North Smithfield, Rhode Island; the abandoned railroad line in North Smithfield; and the 345 kV transmission line that runs adjacent to the Sherman Farm Road site.

Effectiveness: Implementation of all or part of OP-4, OP-1, and OP-5 would reduce impacts along local streets and roads. Depending on the portion of OP-4 and OP-5 implemented, impacts to wetlands and water bodies would be somewhat greater than for the proposed route.

12. General Impact: Those residents located nearest the plant site may suffer a negative economic impact if local real estate values are affected by the presence of the plant.

Mitigation: OSP shall develop a plan to compensate local residents for property value losses which may result from proximity to the power plant. Ideally, the plan would be similar to the one offered by Applied Energy System (AES)/Riverside, Inc. to property owners in the Manville Road area of Woonsocket, Rhode Island, where AES is proposing to construct its Riverside Cogeneration Project (see Appendix F).

<u>Effectiveness:</u> Residents suffering property value loss will be compensated.

13. <u>General Impact:</u> The construction of the plant may negatively impact the local historical features such as the family cemetery and the Crow Hollow site.

<u>Mitigation:</u> OSP shall implement the site development plan which allows for a sufficient buffer zone to be established between the plant facilities and the adjacent family cemetery. OSP shall undertake no construction-related activities that would affect the Crow Hollow site.

<u>Effectiveness:</u> Local archeological and historical sites will be protected.

14. <u>General Impact:</u> Construction of the oil and water pipelines may negatively impact cultural and/or historic resources.

<u>Mitigation:</u> Phase 1 cultural resource surveys, including background research and field testing, shall be conducted to identify and locate any cultural resources that may exist in the proposed (or alternative) locations of the oil/water pipelines. The need to perform additional cultural resource investigations will be based on the results of Phase 1 surveys. As it becomes available, OSP shall file with FERC all Phase 1 survey results on its cultural resources impact evaluation for the proposed project, including the comments of the appropriate State Historic Preservation Officers regarding any cultural resources that are on, or recommended as eligible for, the National Register of

Historic Places. Original documents, including detailed maps and site locations, shall be provided directly to the Environmental Analysis Branch, with the official FERC copies marked "NOT FOR PUBLIC DISCLOSURE." The FERC staff shall review all survey results to determine if further action is required. If any cultural resource concerns are not finalized prior to certification, OSP shall agree to obtain any outstanding information or comments (including FERC's review and approval) necessary to comply with the National Historic Preservation Act. If sites on or eligible for the National Register of Historic Places would be affected, the FERC Staff will give the Advisory Council on Historic Preservation an opportunity to comment on the effects of the project and on the merits of proposed mitigation plans. FERC's subsequent approval shall be obtained before any mitigation plans are implemented. OSP shall agree that no construction of the water and oil pipelines would be started without the completion of this process.

Effectiveness: This will minimize the effects on any cultural resource affected by construction.

15. General Impact: The plant will be visible from various sections of Douglas Pike, Sherman Farm Road, and West Ironstone Road.

Mitigation: OSP shall cooperate with Boston Edison and Blackstone Valley Electric Company to mitigate the visual impact of the plant from views off Douglas Pike, Sherman Farm Road, and West Ironstone Road. Visual barriers such as earthen berms or vegetation screening shall be planted on both sides of Douglas Pike and elsewhere, as appropriate.

Effectiveness: The use of these types of mitigation would eliminate the most significant adverse impacts to visual resources. However, the plant will still be visible in some areas to the extent that further mitigation will not be possible.

5.1.4 Environmental Impacts of the Proposed Action That Cannot Be Mitigated

Construction of the OSP plant and the associated oil and water pipelines would result in traffic and noise impacts and disruption of the local neighborhood that cannot be fully mitigated. During plant operation, the closest neighbors to the plant might experience a substantial increase in noise levels. Nearby neighbors would be aware of the presence of the plant; the stacks and cooling towers would be visible from certain locations, especially during winter; and there would be some nighttime plant lighting. Under certain meteorological conditions, a plume would be visible from the cooling towers.

5.2 GAS PIPELINES

5.2.1 Environmental Impacts of the Proposed Action

The most significant impact of the proposed construction of the pipeline loops, meter stations, and compressor stations would be the disruption and deforestation of approximately 360 acres of farmland, forested areas, and wetlands. Approximately 200 acres of these lands would be retained as permanent right-of-way or held in fee (compressor and meter station sites). The marketable timber cleared along rights-of-way would be returned to the landowners. In most cases, affected cropland would be out of production for one growing season. Wetlands would be returned to their original contours and natural condition, except that woody vegetation (trees and shrubs) would be kept clear of the permanent rights-of-way.

The following discussion describes impacts of particular concern that are associated with portions of the proposed action.

5.2.1.1 Loop 1

A 240-acre wetland (LE-19), designated Class II by the State of New York, is crossed by Loop 1 near its western end, east of Creek Road. Approximately 2 acres of previously undisturbed wetland would remain in permanent right-of-way after construction. Woody vegetation would not be allowed to return along this right-of-way.

Loop 1 also crosses a KOA campground in the vicinity of LE-19. Construction activities would eliminate access to about half of the available campsites during the construction period, representing a potential economic loss to the campground owner.

A Coastal Zone Management Plan consistency determination has been issued by New York.

5.2.1.2 Loop 5

Loop 5 crosses Nelson Swamp, a New York State-designated Class I wetland. Nelson Swamp is unique in that it represents a rare northern white cedar natural community and contains two plant species of particular concern because of their limited numbers and distribution within the State. The FERC Staff recommends that Tennessee conduct a pre-construction survey for these plants to determine the need for further mitigation. Approximately 2 acres of Nelson Swamp would be cleared during construction--one-third of which would be retained as permanent right-of-way. The permanent right-of-way would be periodically cleared so that woody plants would not be allowed to revegetate. With the exception of woody species of flora within the permanent right-of-way, the impact (displacement) on flora and fauna within Nelson Swamp would be temporary.

5.2.1.3 Loop 6

Two New York State-protected streams and one major wetland containing a protected stream would be affected by Loop 6. Moordener Kill would be crossed by the pipeline loop, and construction activities would occur adjacent to Vierda Kill. Papscanee Marsh and Creek would also be crossed by Loop 6. Papscanee Marsh is a suspected breeding habitat for the least bittern, a State-listed species of concern. Impacts on fish spawning in Moordener Kill may be significant if crossing occurs during spawning season. The FERC Staff recommends that Moordener Kill (a trout propagation stream) not be crossed between October and June (spawning season). In addition, the Staff recommends that Tennessee either avoid construction within Papscanee Marsh during the least bittern nesting season, or conduct a pre-construction survey to determine the need for further mitigation.

A Coastal Zone Management Plan consistency determination has been issued by New York.

5.2.1.4 Loop 7

The most significant impact along Loop 7 would be the sociocultural impacts associated with construction activities where the loop passes through Fernwood and Amberwood subdivision, in Southwick, Masachusetts. Special construction techniques and restoration measures would mitigate some of these impacts.

5.2.1.5 Rhode Island Extension

Construction activities along the proposed route of the 11-mile Rhode Island Extension represents the greatest amount of clearing and grading to occur along any pipeline route associated with the proposed action. This is because the Extension requires considerable new right-of-way. Much of the route is forested and would require clear cutting a 75-foot-wide swath, with retention of a 50-foot width for permanent right-of-way. Many sections of the Extension's route also cross areas of shallow soils over bedrock or bedrock outcrop. Blasting a trench through these areas may create a short-term nuisance situation for area residents in terms of noise and vibrations.

5.2.1.6 Compressor Stations

No significant impacts would occur as a result of the proposed compressor station additions. Construction of Compressor Station 230C would be a new use for a currently cultivated parcel of land. No significant impacts are anticipated.

5.2.2 Alternatives With Less Severe Environmental Impacts and Actions Preferred by the FERC Staff

Section 2.2 discusses several variations and alternatives to proposed pipeline loops that may reduce the impacts on wetlands, sand and gravel resources, developable property, and virgin right-of-way. Increased economic and sociocultural impacts diminish the viability of most of these variations and alternatives.

In Section 2.2, several variations or route modifications and an alternative are presented for the Rhode Island Extension to avoid wetlands and sand and gravel resources, to minimize impinging on property development potential, and to minimize the amount of virgin right-of-way required.

An alternative suggested by Algonquin Gas Transmission Company (Alternative A-1) could deliver the proposed 50,000 Mcfd to OSP with the addition of significantly less pipeline facilities than proposed by Tennessee. Alternative A-1 is therefore environmentally preferable to the Rhode Island Extension portion of Tennessee's proposed project. However, the Commission may wish to consider alternative A-1 as it relates to Tennessee's current proposal (in Docket No. CP 87-75-000) to continue construction of the Rhode Island Extension for another 25 miles south of the proposed OSP plant to serve Providence Gas Company. Also, if future deliveries of gas for OSP's Unit 2 are considered, the Staff's analysis indicates that alternative A-1 would require construction of substantially more than 11 miles of pipeline.

Of the several variations to the Rhode Island Extension discussed previously, FERC Staff believes three are preferable to the proposed route. From its beginning at Tennessee's 200 Main Line in Sutton, Massachusetts, Staff recommends following the V-1 Modification (V-1M). V-1M begins at the intersection of the electric transmission line corridor and the 200 Main Line, approximately 1,500 feet east of route 146 (See Figure 2.2-20). V-1M follows the east side of the transmission line south for approximately 1,800 feet before proceeding generally southeasterly until intersecting the proposed route approximately 3,000 feet south of the 200 Main Line. Following this route would take advantage of the existing power line corridor to minimize construction right-of-way clearing and would avoid an approximately 20-acre wetland adjacent to the 200 Main Line.

The second preferred variation involves a minor lateral shift of the proposed route in the vicinity of Maple Street in Douglas, Massachusetts. This variation, the Seaver Variation (V-5), shifts the proposed route approximately 400 feet to the west on the north side of Maple Street (See Figure 2.2-22). Following V-5 would avoid bisecting two private parcels, thereby limiting their development potential.

The third variation to the Rhode Island Extension preferred by Staff would reroute the Extension just before reaching the proposed Sherman Farm Road plant site. This variation, identified as the Boston Edison Line Variation (V-7), would diverge from the proposed route approximately 800 feet north of Douglas Pike at the north side of the existing Boston Edison right-of-way (Figure 2.1-6). V-7 would then parallel the power line right-of-way for approximately 1,600 feet before crossing under the Boston Edison power lines and entering the proposed plant site. V-7 would be approximately 700 feet shorter than the proposed route and take advantage of approximately 1,200 feet of existing right-of-way, which would reduce the required amount of clearing during pipeline construction.

Tennessee's proposed route in the immediate vicinity of the OSP plant site is located to provide continuity with the proposed southward extension of the pipeline to Providence. However, V-7 would allow for the Rhode Island Extension to follow the power line right-of-way that borders the southwest side of the power plant site and therefore take further advantage of existing corridors and minimize unnecessary clearing. OSP should therefore provide sufficient space in its plant layout for the pipeline extension to cross the plant site in the event that the Commission approves Tennessee's Providence Project.

5.2.3 Planned and Recommended Mitigation Measures

A variety of techniques may be used to mitigate the adverse environmental impacts of pipeline construction activities. This section identifies several measures that would be used by the applicant, Tennessee Gas Pipeline Company, and additional measures recommended by the FERC Staff to further reduce environmental impacts.

5.2.3.1 Applicant's Proposed Measures

1. General Impact: Acquisition of an additional 50 feet of permanent right-of-way in high-density residential areas, through which looping would proceed, would severely limit residential land uses.

   Mitigation: In areas of limited space adjacent to residential structures, Tennessee proposes to place the new loop piping within 10-15 feet of the existing Main Line, as opposed to the usual separation distance of 25 feet.

   Effectiveness: Adverse impacts to residential land uses would be minimized.

2. General Impact: Existing underground utilities could be damaged by pipeline construction activities.

   Mitigation: Tennessee proposes to locate and mark underground utilities during right-of-way survey. Excavation around utilities would be accomplished using a backhoe and hand tools.

   Effectiveness: Damage to underground utilities would be minimized to the extent that their location is marked correctly.

3. General Impact: Disruption of train and vehicular traffic could occur at road and railroad crossings.

   Mitigation: Tennessee proposes to construct the pipeline by boring under all major roads and railroad crossings.

   Effectiveness: Disruption in traffic and train flow would be minimized by boring as opposed to road cuts or train track dismantling.

4. General Impact: Loss of topsoil fertility could result from the mixing of topsoil with less fertile subsoils.

   Mitigation: Tennessee proposes to segregate topsoil from the trenchspoil in all agricultural areas.

Effectiveness: This mitigation minimizes loss of topsoil fertility in agricultural areas.

5. General Impact: Crops would be lost through clearing and grading of the construction right-of-way.

Mitigation: Tennessee proposes to pay the landowner fair market value for any crop losses including timber cut from the right-of-way.

Effectiveness: This measure is an effective means of compensating landowners for the market value of timber and crops, but does not compensate landowners for the aesthetic value of that vegetation.

6. General Impact: Sedimentation of drainage courses may occur during construction.

Mitigation: Hay bale filters or silt screens would be installed at critical points where sediment-laden runoff could enter streams, ponds, lakes, drains, and ditches.

Effectiveness: If maintained properly, silt screens are an effective means to minimize sediment transport. Hay bale filters are less effective than silt screens, though silt screens are more subject to collapse and subsequent failure than hay bales.

7. General Impact: Structural or personal injury associated with blasting rock may occur during pipeline trench excavation.

Mitigation: Tennessee proposes the use of matting when blasting in congested areas or near structures that could be damaged by fly-rock. Warning signals, flags, and barricades would also be used. Excess vibration would be controlled by limiting charge size and by using charge delays. Tennessee would hire an independent contractor to perform pre-blast and post-blast structural inspections.

Water well monitoring would be performed to detect damage caused by blasting. Damaged wells would be replaced or the owner would be compensated for the damage.

Effectiveness: Tennessee's proposed mitigation would minimize potential adverse impacts to the structural integrity of adjacent buildings, homes, and wells.

8. General Impact: Agricultural drainage tile damage may be caused by pipeline trench excavation.

Mitigation: Tennessee proposes to use a snake to clean out and detect any crushed or otherwise damaged drain tiles that cross the working side of the right-of-way. A metal pipe would be installed across the pipeline trench to connect tiles and prevent damage associated with trench fill subsidence.

Effectiveness: Tennessee's mitigation would prevent or repair damage to the integrity of drainage tile systems identified during pipeline construction.

9. General Impact: Groundwater channeling and subsequent erosion may occur along the ditch line and pipe.

Mitigation: Sandbags or foamed concrete sprayed in place would be used as ditch line breakers to prevent water flow down the ditch line. Ditch plugs composed of compacted earth or other low-permeability material would be used to prevent groundwater channeling down the pipeline.

Effectiveness: The proposed mitigation measures would minimize groundwater channeling and erosion of the trench backfill.

10. General Impact: Wetland destruction may occur during pipeline construction.

Mitigation: Tennessee has developed procedures for minimizing impacts to wetlands as described in their Wetland and

Water Crossing Plan. These procedures are summarized in Section 2.2.3.2 of this EIS and will not be repeated here.

Effectiveness: Tennessee's proposed mitigation of impacts on wetlands should minimize environmental damage to wetlands during construction. Some adverse impacts are unavoidable but, with the exception of the elimination of woody plant species along the permanent right-of-way, will be only temporary. No foreign fill material will be placed in wetlands associated with the project subject to this EIS.

5.2.3.2 FERC Staff Recommended Measures

In order to further mitigate the environmental impacts associated with the construction and/or operation of the proposed pipeline sections, the FERC Staff recommends that the following mitigative measures be included as conditions to any certificate issued by the FERC.

1. General Impact: (Please see discussion on page 5-1.) Implementation of the Staff's recommended mitigating measures relative to the OSP Project should be incorporated as license or permit conditions by other authorizing agencies or as a condition to Tennessee's authorization.

Mitigation: Tennessee shall not operate the proposed facilities unless: (1) OSP has implemented or agrees to implement the FERC Staff's recommended mitigating measures contained in Section 5.1.3.2 of this EIS, or (2) the Rhode Island Energy Facility Siting Board attaches these mitigating measures as licensing conditions, or (3) the Economic Regulatory Administration attaches these mitigating measures as conditions to its permit granting Permanent Exemption from the requirements of the Fuel Use Act.

Effectiveness: All appropriate mitigating measures would be implemented.

2. General Impact: Changes made by Tennessee to its proposed project during the Staff review process, and assumed for the purpose of the conclusions presented herein, must be incorporated as part of Tennessee's proposal.

Mitigation: Except as required otherwise by certificate conditions, Tennessee shall adhere to the proposed route, construction procedures, and mitigative measures described in its application and in its responses to FERC data requests filed with the Commission on April 21, June 26, September 17, October 5, and November 5, 1987, and May 13 and June 16, 1988.

Effectiveness: The analyses performed for this EIS and the conclusions reached regarding the environmental impacts of the proposed construction of Tennessee's gas pipeline facilities would remain valid.

3. General Impact: Tennessee's proposed route of the Rhode Island Extension would require establishing a new right-of-way through a large wetland in Sutton, Massachusetts.

Mitigation: Tennessee shall follow the preferred route for the Rhode Island Extension identified as V-1M on Figure 2.2-20.

Effectiveness: Following the preferred route identified as V-1M should minimize the impact to the large wetland in Sutton, Massachusetts.

4. General Impact: Tennessee's proposed route of the Rhode Island Extension would diminish the potential for development of the Seaver property.

Mitigation: The preferred route of the Rhode Island Extension shall follow the route identified as the Seaver Variation (V-5) on Figure 2.2-22.

Effectiveness: Following V-5 should minimize the impact on potential development of the Seaver property.

5. <u>General Impact:</u> Tennessee's proposed route of the Rhode Island Extension and gas delivery line to the proposed Sherman Farm Road plant site would require cutting two new right-of-way corridors through heavily forested areas in the vicinity of the plant site (i.e., one corridor for the Extension, and one for the delivery line). In the vicinity of the plant site several corridors already exist, and local landowners object to the construction of additional corridors.

<u>Mitigation:</u> Tennessee shall follow the preferred route of the Rhode Island Extension identified as V-7 on Figure 2.1-6.

<u>Effectiveness:</u> Following V-7 would shorten the route of the Rhode Island Extension to the proposed plant site by approximately 700 feet. By paralleling the Boston Edison right-of-way, V-7 reduces the width of permanent right-of-way required and the amount of clearing associated with pipeline construction. V-7 would also reduce the amount of new right-of-way corridor required for constructing the proposed Rhode Island Extension.

6. <u>General Impact:</u> Construction of the pipeline during the wet season (i.e., April 1 to May 15) may result in excessive disturbance of cropland.

<u>Mitigation:</u> Tennessee shall plan to avoid operating heavy construction equipment in cropland during the wet season from April 1 to May 15 when cultivated soils are particularly susceptible to rutting and compaction. Such equipment includes but is not limited to bulldozers, backhoes, stringing trucks, and side-boom tractors.

<u>Effectiveness:</u> Soil structure disturbance and consequent reduction in soil productivity will be minimized.

7. <u>General Impact:</u> Mixing topsoil with subsoils in wetland areas may destroy indigenous species of plants which reproduce from roots and rhizomes in the topsoil.

Mitigation: Topsoil shall be segregated in all regulated wetland areas crossed by the proposed pipeline facilities to the maximum extent practicable, unless the appropriate permitting authority specifically grants Tennessee relief from this requirement.

Effectiveness: The rapid repopulation of indigenous wetland species should be facilitated by segregating topsoil in wetlands.

8. General Impact: Trees might be unnecessarily cut for the purpose of obtaining timber for workmats in wetland areas.

Mitigation: Where necessary to support construction equipment, Tennessee shall use prefabricated workmats for wetland crossings where insufficient timber for workmats is available from the cleared right-of-way. All material placed in wetland areas for construction purposes, including timber mats, shall be removed during right-of-way restoration.

Effectiveness: Excessive environmental impacts from unnecessary tree cutting and the operation of heavy construction equipment in wetland areas should be minimized.

9. General Impact: Campground revenue could be lost if pipeline construction occurs through the KOA campground during the primary camping season.

Mitigation: Tennessee shall complete construction of the pipeline within the KOA campground along Loop 1 in the minimum time feasible if construction occurs between April 1 and September 30, and shall maintain access to the campsites or otherwise compensate the facility owner for lost revenue.

Effectiveness: The economic impact on the KOA campground owners would be minimized through ensured access or compensation.

10. <u>General Impact:</u> Pipeline construction across trout propagation streams during spawning through hatchout (October 1 through June 1) could kill trout eggs and fingerlings.

<u>Mitigation:</u> No construction activities shall take place in or across trout propagation streams between October 1 and June 1, unless otherwise allowed by appropriate state permitting agencies.

<u>Effectiveness:</u> The loss of eggs and fingerlings from changes in water chemistry and smothering sediments should be minimized.

11. <u>General Impact:</u> Construction of Loop 5 through Nelson Swamp could destroy populations of two rare species of flora.

<u>Mitigation:</u> Prior to beginning construction in Nelson Swamp, Tennessee shall conduct a survey of the area to be disturbed to determine the occurrence of two plant species that are recognized by New York as rare and unusual--the spreading globeflower and striped coral root. The survey shall be conducted by a qualified botanist in consultation with the New York DEC, and a report of the results shall be filed with FERC. The report shall identify the name and qualifications of the person conducting the survey, the methods used, and the actual area surveyed and date of the survey. The FERC Staff shall review the survey results and determine if any additional mitigative measures are necessary.

<u>Effectiveness:</u> Locating the two species of flora in question can only be assured through an extensive knowledge of the species, conducting the survey at the most appropriate time, and meticulous attention to detail. This should minimize potential adverse environmental impacts on the two species.

12. General Impact: Construction activities for Loop 6 through Papscanee Marsh could disturb the breeding activities of the least bittern, a New York State-listed special concern species.

Mitigation: Prior to beginning construction in Papscanee Marsh (Loop 6), Tennessee shall conduct a survey of the area of sound, visual, and actual construction impact, including routes for construction equipment and personnel ingress and egress from Papscanee Marsh to determine the occurrence of least bittern populations or evidence of nesting. The survey shall be conducted by a qualified ornithologist, in consultation with the New York DEC, and a report of the results shall be filed with FERC. The report shall identify the name and qualifications of the person conducting the survey, the methods used, the actual area surveyed, and date of the survey. The FERC Staff shall review the survey results and determine if any additional mitigative measures are necessary. Avoidance of construction within the marsh between April 1 and June 30 would negate the need for a survey.

Effectiveness: The proposed mitigation would minimize disturbance to the least bittern during the sensitive breeding season.

13. General Impact: Standard overland construction procedures through densely developed residential areas could damage residential structures and unnecessarily inconvenience local residents.

Mitigation: The construction of Loop 4 through the Manor Heights subdivision and Loop 7 through the Fernwood subdivision shall follow the site-specific construction procedures outlined in Tennessee's environmental report in Docket No. CP87-132.

Effectiveness: This will minimize the impact on local residents. There will be some unavoidable short-term impacts.

14. General Impact: The use of seeding mixes unsuitable to the soils or growing conditions of a given area could result in problems with right-of-way restoration and soil erosion.

Mitigation: Tennessee's right-of-way restoration shall comply with the specified seeding mixes, rates, and dates, and with the use of mulch as shown in Table 4.2-1 of this EIS unless the landowners or land management agency has specific alternative seeding requirements.

Effectiveness: Use of the prescribed seeding mixes, rates, and dates should minimize problems with right-of-way restoration and soil erosion.

15. General Impact: Excessive widths for pipeline rights-of-way may unfairly and unnecessarily burden landowners.

Mitigation: Tennessee shall not seek condemnation for any permanent right-of-way in excess of the widths proposed in its environmental report filed in Docket Nos. CP87-132-000 and CP87-132-001 (i.e., 25 feet for pipeline loops and 50 feet for new pipeline right-of-way).

Effectiveness: Keeping permanent rights-of-way to the widths prescribed in the FERC Dockets mentioned above should minimize adverse effects of right-of-way condemnation on affected landowners.

16. General Impact: Right-of-way clearing for pipelines at intersections with roads creates breaks in vegetative cover that reduces the aesthetic quality of forested areas and exposes activities behind the vegetative screen.

Mitigation: Tennessee shall install and maintain visual barriers of natural vegetation and/or earthen berms where the proposed gas delivery pipeline for the OSP plant crosses Douglas Pike to help maintain the wooded character of the area. This shall be done to the extent that the integrity and safety of the pipe will not be compromised by nearby root systems.

Effectiveness: This should minimize visibility of the plant from Douglas Pike and return the area along the roadway to a state similar to its original wooded condition.

17. General Impact: The unauthorized use of pipeline rights-of-way by off-road vehicles may destroy flora, displace fauna, and contribute to soil erosion problems.

Mitigation: Tennessee shall cooperate with landowners and land managing agencies to prevent unauthorized off-road vehicle use on the right-of-way. Where agreeable to the landowner or land managing agency, gates or other barriers shall, where necessary, extend beyond the edges of the right-of-way to prevent access.

Effectiveness: These measures should prevent access to the rights-of-way and minimize the adverse environmental impacts associated with unauthorized use.

18. General Impact: Increases in sound levels caused by the addition of compression facilities may be a nuisance to nearby noise-sensitive receptors.

Mitigation: Tennessee shall design the proposed compressor additions such that operational compressor noise shall not exceed an L_{dn} of 55 dBA at any existing noise-sensitive areas nearby (such as hospitals and residences). Tennessee shall submit to FERC post-construction sound level surveys to verify that these performance goals have been achieved. Corrective measures shall be taken if necessary.

Effectiveness: Maintaining noise levels at nearby sensitive areas to an L_{dn} of 55 dBA should minimize adverse impacts to affected noise-sensitive receptors.

19. General Impact: The construction of the pipeline or its supporting facilities may adversely impact cultural resources.

Mitigation: As it becomes available, Tennessee shall file with FERC all outstanding information on its cultural resources impact evaluation for the proposed project at Compressor Station 230C and the Rhode Island Extension. This information would include survey results and comments of the appropriate State Historic Preservation Officers regarding any properties that are on, or recommended as eligible for placement on, the National Register of Historic Places. Original documents, including detailed maps and site locations, shall be provided directly to the Environmental Analysis Branch, with official FERC copies marked "NOT FOR PUBLIC DISCLOSURE." The Staff shall review all survey data to determine if further action is required. If any cultural resource concerns are not finalized prior to certification, Tennessee shall agree to obtain any outstanding information or comments (including FERC review and approval) necessary to comply with the National Historic Preservation Act. If sites on or eligible for the National Register of Historic Places would be affected, the FERC Staff shall give the Advisory Council on Historic Preservation an opportunity to comment on the effects of the project and on the merits of proposed mitigation plans. FERC's subsequent approval shall be obtained before any mitigation plans are implemented. Tennessee Gas shall agree that no construction shall be started without the completion of this process.

Effectiveness: These measures should ensure compliance with the National Historic Preservation Act and minimize adverse impacts to cultural resources.

5.2.4 Environmental Impacts of the Proposed Action That Cannot be Mitigated

Construction and operation of the pipelines and associated aboveground facilities (compressor and meter stations) would have a limited long-term impact. Woody vegetation in the permanent right-of-way (50 feet of new virgin right-of-way, 25 feet for loops) would be prevented from revegetation. Air emissions from compressor station turbines would impair air quality to a degree, but the degradation of air quality would not be allowed to violate applicable state and Federal standards. Another long-term impact would result from noise generated by compressor station turbines. Sound insulation in compressor buildings could mitigate noise levels to a degree, though some increase in noise levels is expected. These increased levels would not be allowed to violate applicable state and Federal guidelines.

APPENDIX A

LIST OF PREPARERS

Lister, Lonnie A. — FERC Project Manager
B.S., Geology, 1976 (Brooklyn College, City University of New York)

Kear, Ronald E. — Dames & Moore Project Director
B.S., Civil Engineering, 1966 (San Jose State University)

Kittridge, John C. — Dames & Moore Project Manager
M.S., Civil Engineering, 1969 (University of New Hampshire)
B.S., Civil Engineering, 1967 (University of New Hampshire)

Doyle, Timothy J. — Dames & Moore Hydrologist
B.S., Civil Engineering, 1961 (Purdue University)

Flynn, Kurt W. — FERC Wildlife Biologist
B.S., Biology, 1983 (Old Dominion University)

Howroyd, George C. — Dames & Moore Air Quality Engineer
Ph.D., Mechanical Engineering, 1979 (University of Waterloo)
M.S., Mechanical Engineering, 1975 (University of Waterloo)
B.S., Mechanical Engineering, 1973 (University of Waterloo)

Manning, Susan H. — Dames & Moore Economist
Ph.D., Economics, 1987 (George Mason University)
M.A., Economics, 1981 (George Mason University)
B.A., Economics, 1978 (University of Virginia)

McCuskey, Sue A. — Dames & Moore Ecologist
Ph.D., Environmental Sciences, 1975 (University of Virginia)
M.A.T., English, 1970 (Northwestern University)
B.A., English, 1968 (Northwestern University)

McDonough, Robert B. — Dames & Moore Systems Analyst
M.A., Geography, 1976 (University of Hawaii)
B.S., Computer Science, 1985 (University of Maryland)
B.A., Journalism, 1973 (Pennsylvania State University)

McMillen, Matthew C. — Dames & Moore Environmental Scientist
M.S., Resource Development/Planning, 1982 (Michigan State University)
B.S., Natural Resources and Environmental Sciences, 1979 (Michigan State University)

Norden, Daniel A. — FERC Chemical Engineer
B.S., Chemical Engineering, 1984 (University of Maryland)

LIST OF PREPARERS (cont'd)

O'Brien, Robert W. — Dames & Moore Chemical Engineer
M.S., Chemical Engineering, 1982 (Purdue University)
B.S., Chemical Engineering, 1980 (Illinois Institute of Technology)

Vrabel, Deborah M. — FERC Archeologist
M.A., Anthropology, 1981 (George Washington University)
B.A., Anthropology, 1976 (Temple University)

Wheeler, Allison W. — Dames & Moore Biologist
B.A., Biology, 1980 (Duke University)

Wheeler, Howard, J. — FERC Geologist
B.S., Geosciences, 1982 (Pennsylvania State University)

White, William T. — Dames & Moore Sociologist
Ph.D., Sociology, 1973 (University of Florida)
M.A., Sociology, 1971 (University of Florida)
M.S., Nuclear Engineering, 1968 (North Carolina State University)
B.S., Nuclear Engineering, 1967 (North Carolina State University)

APPENDIX B

EIS Distribution List

Federal Government Agencies

Advisory Council on Historic Preservation
Center for Environmental Health
Council on Environmental Quality
Department of Commerce
Department of Defense
Department of Energy
Department of Housing and Urban Development
Department of Human Health Services
Department of the Interior
Department of Labor
Department of State
Department of Transportation
Environmental Protection Agency
Federal Energy Regulatory Commission
Fish and Wildlife Service
Interstate Commerce Commission
Soil Conservation Service
U.S. Army Corps of Engineers

Congressional Representatives

Senator John Chafee (RI)
Senator Alfonse D'Amato (NY)
Senator Edward Kennedy (MA)
Senator John Kerry (MA)
Senator Daniel P. Moynihan (NY)
Senator Claiborne Pell (RI)
Representative Edward P. Boland (MA)
Representative Silvio O. Conte (MA)
Representative Joseph D. Early (MA)
Representative Fernand St. Germain (RI)
Representative Jack F. Kemp (NY)
Representative John J. LaFalce (NY)
Representative Henry J. Nowack (NY)
Representative Claudine Schneider (RI)
Representative Gerald B.H. Solomon (NY)
Representative George C. Wortley (NY)

State Government Agencies

Massachusetts: Governor Michael Dukakis
Department of Environmental Quality Engineering
Division of Fisheries and Wildlife
Division of Forests and Parks
Division of Water Pollution Control
Division of Waterways

Energy Facility Siting Council
Environmental Planning Office
Executive Office of Community Development
Historical Commission
Secretary of Energy Resources
State Conservationist

New York:

Governor Mario Cuomo
Attorney General's Office
Bureau of Energy and Radiation
Bureau of Public Water Supply
Department of Agriculture and Markets
Conservation Council
Department of Commerce
Department of Environmental Conservation
Department of State
Department of Transportation
Division of Budget
Division of Regulatory Affairs
Energy Office
Farm Bureau
Public Archeologist
Public Service Commission
State Historic Preservation Officer

Rhode Island:

Governor Edward DiPrete
Attorney General's Office
Department of Community Affairs
Department of Environmental Management
Department of Policy and Planning
Department of Transportation
Energy Facility Siting Board
Historic Preservation Commission
Office of Intergovernmental Relations
Public Utilities Commission
State Conservationist
Statewide Planning Program

Local Government Agencies

Erie County, NY
Hampden County, MA
Livingston County, NY
Niagara County, NY
Onondaga County, NY
Providence County, RI
Rensselaer County, NY
Worcester County, MA
Wyoming County, NY
Blackstone, MA
Burrillville, RI
Charlton, MA

Comstock Gardens, RI
Cranston, RI
Cumberland, RI
Douglas, MA
Esmond, RI
Georgiaville, RI
Granville, MA
Greenville, RI
Hampden, MA
Harrisville, RI
Holland, MA
Hopkinton, MA
Millville, MA
New Village, MA
Northbridge, MA
North Smithfield, RI
Simmonsville, RI
Skaneateles, NY
Slatersville, RI
Smithfield, RI
Southwick, MA
Springfield, MA
Sturbridge, MA
Sutton, MA
Union Chapel, RI
Uxbridge, MA
Wampsville, NY
West Warwick, RI
Worcester, MA

Organizations and Individuals

Aitken, Linda - Uxbridge, MA (Concerned Citizens of Burrillville/Uxbridge)
Aldrich - Southwick, MA
Algonquin Gas Transmission Company - Boston, MA
American Conservation Association, Inc.
American Petroleum Institute
Argonne National Laboratories - Argonne, IL
Audubon Society of Rhode Island
Bechtel Eastern Power Corporation - Gaithersburg, MD
Beres, Rev. - Uxbridge, MA
Bibeault, Robert - Uxbridge, MA
Bishop, Albert W. - Uxbridge, MA
Blackstone Valley Regional Development Corp.
Boldur, Brian - North Smithfield, RI
Bourdon, Wilfred - Woonsocket, RI
Burrillville Lions Club - Pascoag, RI
Capistron, Andres J. - Harrisville, RI
Center for Action on Endangered Species
Chafee, Zechariah - Boston, MA
Christianson's Orchard - North Smithfield, RI
Citizen's for Consumer Justice - Cranston, RI

C.L.F. - Boston, MA
Colvin, Raymond W., Jr. - Harrisville, RI
Dayutis, William - Uxbridge, MA
Defenders of Wildlife
DeVries, Joseph A. - Linwood, MA
Donovan - Southwick, MA
Duffy & Shanley - Providence, RI
Dunning, James & Jennifer - Uxbridge, MA
Eastern Utilities Associates - Boston, MA
Empire State Petroleum Association, Inc.
Environmental Defense Fund, Inc.
Erickson, Robert G., Jr. - Harrisville, RI
Featherstone, Dennis J. - Uxbridge, MA
Flower Fashions - Southwick, MA
Gelineau, Joseph W. - North Smithfeld, RI
General Electric - Schenectady, NY
Gomes, Sandra Lee - Mapleville, RI
Granutec, Inc. - East Douglas, MA
Greiner, Ellen - Barrington, RI
Hahn's Farm - Cambria Heights, NY
Hinckley, Allen, et. al. - Providence, RI
Hoffman-Bonk - Skaneateles, NY
Hogan, Gail - Harrisville, RI
Hoyle - North Smithfield, RI
Hutnak Construction Co. - Douglas, MA
Kavinoky & Cook - Buffalo, NY
Kerchner, R.N. - Skaneateles, NY
Koback, Stephen F. - Harrisville, RI
Kurzon, J. - Newtonville, MA
Kut, Bruce E. - North Scituate, RI
Johnson, C.H. - North Smithfield, RI
Jorden - Skaneateles, NY
Lafabvre, R. - North Smithfield, RI
Laferriere, David - Uxbridge, MA
Larson, Martha - Providence, RI
Lebourveau, John - Needham, MA
Lewis, James A. - Boston, MA
Maguire Group - Providence, RI
Maker - North Smithfield, RI
Massachusetts Association of Conservation Commissions
Massachusetts Audubon Society
Massachusetts Public Interest Research Group - Uxbridge, MA
Massachusetts Wildlife Federation
McGregor, Gregor - Boston, MA
Miltmore - Southwick, MA
Monroe, J. Harold, Jr. - Forestdale, RI
Morin - North Smithfield
Morley, Caskin & Generelly - Washington, DC
Muratore, John - Uxbridge, MA
National Audubon Society
National Wildlife Federation
Natural Resources Defense Council, Inc.

Nature Conservancy
Nelson, Robert - Pascoag, RI
New England Botanical Club
New England Power Company - Westborough, MA
New England Rivers Center
New England Wildflower Society
Newport Electric Corporation
Niagara Falls KOA
Nixon, Linda - Pascoag, RI
Nolan, Raymond J. - North Smithfield, RI
O'Connell, Charles - Harrisville, RI
Ocean State Power
Oliver, E. - Schodack, NY
Pare - North Smithfield, RI
Parenteau, Rene - Harrisville, RI
Pascoag Business Associates - Pascoag, RI
Pitts, Bob - Harrisville, RI
Powers, Harsch & Kinder - Washington, DC
Public Service of New Hampshire
Remington, Hon. Clinton O., III - Harrisvile, RI
Rice - Schodack, NY
Rivet, Roland A. - Postmaster, Harrisville, RI
Saravara, Wayne - Uxbridge, MA
Seaver, William T. - East Douglas, MA
Sierra Club
Southwick Funeral Home
Stockwell Estate - Sutton, MA
Stearns, David - Harrisville, RI
Stone & Webster - Boston, MA
Taddeo, Gail - North Smithfield, RI
Tennessee Gas Pipeline Company
Transcanada Pipelines - Toronto, Canada
Tri-State Regional Planning Commission
Trout Unlimited
Tupperware - North Smithfield, RI
Utility Data Institute, Inc. - Washington, DC
Waterbed Factory Warehouse - Southwick, MA
Whalley Computer Assoc. Inc. - Southwich, MA
Whiting, Clint & Joan - North Smithfield, RI
Whiting, R. - North Smithfield, RI
Wild Oak Farm - Harrisville, RI
Woods, Robert - Harrisville, RI

Media

Advertiser, East Aurora, NY
Buffalo News, Buffalo, NY
Cranston Mirror, Cranston, RI
The Evening News, Southbridge, MA
Herald American, Syracuse, NY
The New York Times, New York, NY
Providence Journal, Providence, RI

Skaneateles Press, Skaneateles, NY
Southbridge News, Southbridge, MA
Springfield Republican, Springfield, MA
Times-Union, Albany, NY
Woonsocket Call, Woonsocket, RI
Worcester Telegram, Worcester, MA

APPENDIX C

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APPENDIX D

Staff Report - Alternative Site Analysis
(not reissued for FEIS)

APPENDIX E
DISCUSSION OF NOISE TERMINOLOGY

The sounds we hear are a result of a sound source causing a vibration in the air. The vibration spreads outward from the source the same as ripples on water after a stone is thrown into it. The result of the vibration is a fluctuation in the normal atmospheric pressure or sound waves. These waves radiate in all directions from the source and may be reflected or dissipated by various objects. Sound can be described in terms of three basic components:

1. Amplitude. A measure of the magnitude of the sound, typically given in units of decibels (dB). The amplitude of sound is measured on a logarithmic scale because the range of sound intensities is so great that the scale must be compressed to encompass all sounds that need to be measured. The human ear responds to a range of sounds that is 10 million times greater than the least audible sound. In decibels, this 10 million to 1 ratio is simplified logarithmically to 140 dB.

   Another unusual property of the decibel scale is that two separate sound levels are not directly (arithmetically) additive. For example, if two 50 dB sounds are superimposed on one another, the total is only a 3 dB increase to 53 dB, not a doubling to 100 dB. Furthermore, if two <u>different</u> sound levels are superimposed, the lower level adds less to the higher level as the difference increases. If the difference is as much as 10 dB, the lower level adds almost nothing to the higher level. In other words, superimposing a 60 dB sound on a 70 dB sound results in almost no change in the overall sound level of 70 dB.

2. Frequency. The rate at which a sound source vibrates determines the frequency. Units of frequency are usually measured in hertz (Hz) and are used to designate the number of vibrations per second. The human ear can identify sounds in the range of 16-20,000 Hz. Because pure tones are relatively rare, most sounds consist of a mixture of many frequencies.

3. Time Pattern. The temporal nature of sound may be described in terms of its pattern of time and level. Sounds may be continuous, fluctuating, or instantaneous.

The evaluation of ambient noise impacts reported in this document have been based primarily on the amplitude of sound levels expected to result from the construction and operation of the power plant, and how those sound levels compared with existing sound levels of the surrounding environment. Sound is typically measured on the A-weighted scale, a method for weighting the frequency spectrum to mimic the human ear. A-weighted sound level units of dBA (i.e., decibels on the A-weighted scale) are used exclusively in this EIS.

In order to evaluate noise impacts and report time varying ambient sound levels, it has become common practice to measure and/or report sound levels in a variety of different ways. A description of the more common examples and some of their uses are described below.

Instantaneous Sound Level (L)

The instantaneous sound level L is merely the sound level observed at any instant in time. Its usefulness is typically limited to characterizing an absolute minimum or maximum sound level in a given observation period to provide a range of sound level measurements.

Equivalent Sound Level (L_{eq})

The equivalent sound level is the level of a steady-state sound that has the same total (equivalent) energy as the time-varying sound of interest, taken over a specified period of time. The L_{eq} is a single-valued, A-weighted sound level that expresses the time-averaged total energy of the entire ambient sound energy. It includes both the high sound level single-event ambient sounds and the relatively steady background sounds. For a constant source of noise, the instantaneous sound level L will be the same as the equivalent sound level L_{eq}.

Day-Night Sound Level (L_{dn})

The day-night sound level is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB weighting imposed on the equivalent sound levels occurring during nighttime hours (10 p.m. to 7 a.m.). Adding 10 dB to the nighttime sound levels is a method of accounting for the expectation that an acoustic environment be quieter at night than in the daytime. OSP has agreed to a FERC Staff recommendation that offsite day-night noise levels be limited to an L_{dn} of 55 dBA at the nearest residence for sounds attributable to the operation of the OSP facility. An environment that has a measured daytime L_{eq} of 60 dB and a measured nighttime Leq of 50 dB can be said to have an Ldn of 60 dB (i.e., 50 + 10).

Noise Exceedance Levels (L_n)

Another method of characterizing noise levels is to refer to the noise exceedance level Ln, which is the level of noise that is exceeded n percent of the time as follows:

L_{10}--Sound level exceeded 10 percent of the time

L_{50}--Sound level exceeded 50 percent of the time

L_{90}--Sound level exceeded 90 percent of the time.

For example, the L_{90} sound level is used by the Massachusetts DEQE and the New York PSC to characterize ambient background levels.

Figure E-1 illustrates schematically how the above-described sound level descriptors compare with one another.

Major contributions to outdoor noise come from transportation, industrial, commercial, human, and animal sources. The daily noise exposure of people depends on how much time they spend in different areas. Table E-1 lists a variety of typical indoor and outdoor noise levels that range from the threshold of hearing to 120 dBA.

Noise Perception

In order to access the noise impact of a proposed industrial facility, it is beneficial to understand the perceived effect on the human ear caused by a specific noise level change. When reading the noise level impact section pertaining to power plant or compressor station operational noise, refer to the table below, which summarizes incremental noise level increases versus the effect on the human ear.

Noise Change		Effect
1	dBA	Barely perceptible
3	dBA	Threshold of noticeable difference
5	dBA	Clearly noticeable difference
10	dBA	Doubling of perceived loudness

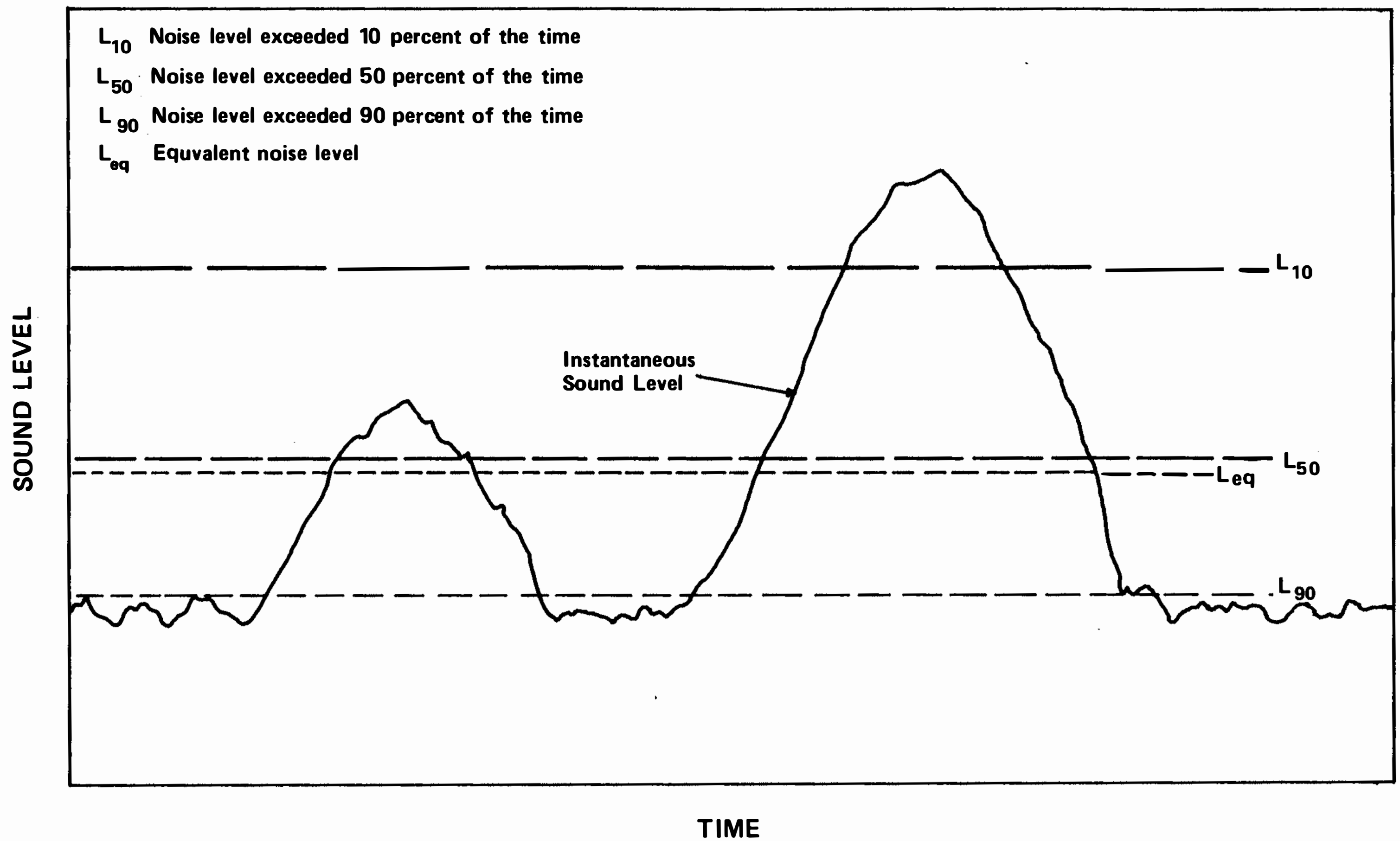

FIGURE E-1

SCHEMATIC REPRESENTATION OF VARIOUS METHODS OF CHARACTERIZING AMBIENT SOUNDS

TABLE E-1

Representative Sound Levels

Common Indoor Sounds	Sound Level (dBA)	Common Outdoor Sounds
	120------120	
Live Music (Rock N Roll)		
	110------110	
	100------100	
	90------90	Train at 100 Feet
Food Blender	80------80	Truck at 100 Feet
Garbage Disposal	70------70	
Vacuum Cleaner TV/Radio		Gas Lawn Mower at 100 Feet
	60------60	
Normal Conversation		Forest Insects, Summer Evening
	50------50	
Dishwasher in Next Room		Irrigation Sprinklers at 500 Feet Moderate Rainfall on Foliage
	40------40	Wooded Residential Area Noises
Refrigerator		Bird Calls at 100 Feet
Library, Bedroom at Night	30------30	Small Brook at 25 Feet Wilderness Area Noises
	20------20	
	10------10	
Threshold of Hearing		Threshold of Hearing
	0------0	

APPENDIX F

AES Riverside, Inc.
Property Value Protection Plan

September 30, 1987

Name
Address

Property: Plat: , Lot:

Dear Property Owner:

AES Riverside, Inc. is pleased to introduce a plan meant to address the concerns of property owners in the Manville Road area with respect to any affect the Riverside Cogeneration Plant may have on property values. The Plan, which is being called the Property Value Protection Plan, is described in the enclosed Information Release.

It has been determined that the subject property is in the designated area for which the Plan is intended. If, after reading the enclosed information, you would like to participate in or obtain more information about the Plan, including the initial valuation of your property, please sign and return the copy of this letter in the enclosed, pre-addressed stamped envelope.

Sincerely,

Mark S. Fitzpatrick
Project Director
AES Riverside, Inc.

____
Signature

AES/Riverside Inc.

1925 North Lynn Street • Arlington, Virginia 22209 • (703) 522-1315 • Telecopier—(703) 528-4510

INFORMATION RELEASE

AES Riverside, Inc. has received a number of sincere inquiries from property owners in the Manville Road area who are worried about the cogeneration plant's impact on property values. These inquiries were voiced by residents during the neighborhood canvassing and at the public forum on September 2, 1987 at Saint Agatha's Church. AES Riverside, Inc. has thus far expressed confidence that the project, considering the existing zoning and condition of the proposed site, would not adversely affect property values. In order to substantiate that confidence and make an effort to resolve any property value related concerns, AES Riverside, Inc. is initiating a plan, the Property Value Protection Plan (the Plan), to guarantee property values in the area.

AES Riverside, Inc. is pleased to announce that Marc Coté of Coté Real Estate, Inc. has agreed to administer the Plan. Using regionally recognized appraisers together with Marc's personal and corporate experience, we are confident that the Plan will be designed and implemented correctly and fairly.

The Plan, very simply, is a commitment from AES Riverside, Inc. to purchase at a fair price, any property in the Manville Road area whose owner believes that the property value will be adversely affected by the construction and/or operation of the Riverside Cogeneration Plant. Subject to the following terms, this commitment from AES Riverside, Inc. is absolute:

1. Professional property appraisers have determined a designated area around the proposed site. Within this area, any property owner, who was the owner of record on July 1, 1987, qualifies.

2. At anytime up to two (2) years following the commercial operation date of the facility, a qualified property owner may apply to be included in the Plan.

3. No transaction will take place until AES Riverside, Inc. has secured financing for the plant (the Financial Closing Date), estimated to be in late 1988 or early 1989.

4. An initial property value will be determined by a professional appraiser with the aid of public real estate records. The valuation process is nearly complete and at the request of the property owner, the initial value of the particular property will be released in confidence. If the

AES/Riverside Inc.

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property owner believes the valuation to be in error a new appraisal can be requested, which would be paid for in equal shares by the property owner and AES Riverside, Inc. The new appraiser would be chosen by the property owner from a list of certified appraisers. The property owner may select either the newly appraised value or the initial property value.

5. Since no transactions will take place for approximately 18 months, the initial property value will be adjusted according to the rate of change of the sale price of single family homes in the greater Woonsocket area.

6. In order to qualify for the plan, a person must simply own property in the designated area as determined in #1 above. However, prior to AES Riverside, Inc. actually purchasing the property, the property owner must demonstrate that they have attempted to sell the property for at least 6 months. This qualification is intended to insure that the Plan is first and primarily serving those property owners who are sincerely concerned.

7. The actual purchase price, to be paid by AES Riverside, Inc. will be 100% of fair market value plus a $4,000 allowance for moving and new residence loan costs. The purchase price will be adjusted to 110% of fair market value plus $4,000 for those property owners who apply for the program after commercial operation.

8. Fair market value will be the initial property value as determined in #4 above, adjusted quarterly per #5 above.

9. Interested property owners should sign and return the enclosed letter whereupon the initial property valuation and necessary forms and instructions to continue the process will be returned.

AES Riverside Inc., as a privately financed corporation, must conduct the Plan in accordance with the requirements of the plant financing. As such, a budgeted amount of $2 million for the Plan must be set and although unlikely, could conceivably be depleted. If such a depletion were to occur, the result would only be a possible delay in further transactions until profits from the operation of the plant would be sufficient to conduct such purchases.

The Property Value Protection Plan is a new endeavor for an AES subsidiary and is hopefully taken as an indication of our willingness to accomodate the concerns of the community to the maximum practical extent. If anyone has any specific concerns or comments please do not hesitate to contact Marc Coté at (401)765-3360 or AES Riverside, Inc. directly by asking for Ann Murtlow or Mark Fitzpatrick at (703)522-1315.

APPENDIX G

STATE OF RHODE ISLAND AND PROVIDENCE PLANTATIONS

Department of Environmental Management
DIVISION OF FISH AND WILDLIFE
Box 218
West Kingston, R.I. 02892

May 4, 1988

Mr. Kurt Flynn
Federal Energy Regulatory Commission PR-213
825 North Capital St. N.E.
Washington D.C. 20426

Dear Mr. Flynn:

I am writing you in regard to the proposal we discussed on 4/21/88 regarding the use of the Electric R.O.W. on the Black Hut Management Area for a new gas line. After a site inspection of the area on 4/28/88, I agree that it would be more acceptable to use this site rather than cutting a new R.O.W. in the area, if the following conditions are addressed.

1. That entrances to the R.O.W. on Ironstone Road and Douglas Pike are blocked off to unauthorized traffic. Presently, those entrances are open to vehicle traffic of all types, which is subjecting the area to illegal poaching, trash dumping, and activity not in agreement to the objectives of the Management Area.

2. Gates, such as the types used by the D.E.M. Division of Forest Environment, should be purchased, maintained, and checked at least twice a week. Prompt repairs should be made when needed.

3. The wetland areas should be addressed in the following manner.

   1. The small coldwater stream should be protected and unmodified at all costs.

   2. The less valuable wet sections, after construction, should be dug out from 6" to 2' and left as pot holed for breeding and migrating waterfowl.

   3. All drainage flow should still conform to similar rates and directions we have at present.

   4. If the pipeline is above ground a R.O.W, in several places, should be provided for wildlife movement.

   5. Coniferous shrubs should be placed at road entrances to act as a visual buffer to the R.O.W.

Sincerely,

Edward DiLuglio
Division of Fish and Wildlife - DEM

ED:djd

APPENDIX H
Subject Index