ORIGINAL

Rhode Island Energy Facility Siting Board Application

Clear River Energy Center
Burrillville, Rhode Island

PREPARED FOR:
Invenergy Thermal Development LLC
One South Wacker Drive
Suite 1900
Chicago, IL 60606

FOR SUBMITTAL TO:
State of Rhode Island Energy Facility Siting Board
Public Utilities Commission
89 Jefferson Boulevard
Warwick, RI 02888

PREPARED BY:
ESS Group, Inc.
10 Hemingway Drive, 2nd Floor
East Providence, RI 02915

ESS Project No. I108-005

October 28, 2015

Invenergy

1 South Wacker Drive, Suite 1800
Chicago, IL 60606

October 28, 2015

Todd Anthony Bianco, Coordinator
Rhode Island Energy Facilities Siting Board
89 Jefferson Boulevard, Warwick, RI 02888

Re: Clear River Energy Center – Energy Facility Siting Board Application

Dear Commissioners:

Invenergy Thermal Development LLC (Invenergy) is requesting approval from the Rhode Island Energy Facility Siting Board (RIEFSB) to construct and operate the Clear River Energy Center ("CREC"), a combined-cycle electric generating facility to be located on Wallum Lake Road (State Route 100) in Burrillville, Rhode Island (the Project or the Facility). The Project will provide many benefits to the region including reduced air emissions, improved air quality, lower regional energy costs, employment for skilled local workers during construction and operation. In addition, there will be direct economic benefits to the Town of Burrillville and to local businesses.

The Facility will be configured as a two-unit one-on-one (1x1), combined-cycle generation station. Each unit will consist of an advanced class combustion turbine operated in a combined-cycle configuration with a heat recovery steam generator (HRSG), a steam turbine and an air cooled condenser (ACC) for each train. The combustion turbine, steam turbine, and generator of each unit will be connected via a common shaft (otherwise referred to as a single shaft machine). Each gas turbine will fire natural gas as a primary fuel and ultra-low sulfur diesel (ULSD) fuel as a backup fuel.

The CREC Facility will have a nominal power output at base load of approximately 850-1,000 megawatts (MW) while firing natural gas. The electrical power generated by the Facility will be transmitted through a new 345-kV transmission line to be installed from the Facility through an existing National Grid right-of-way (ROW) to the Sherman Road Substation in Burrillville, Rhode Island.

The CREC will utilize air cooling with an air cooled condenser which reduces water consumption by more than 90 percent as compared to a traditional water cooled plant. The water supply for the Facility will be provided by the Pascoag Utility District (PUD) through a dedicated pipeline to be installed from an existing PUD well to the Facility. Wastewater from the Facility will be discharged to the Burrillville Wastewater Treatment Facility through a dedicated sewer line that will connect to the local sewer system.

The Facility will be equipped with state-of-the art air emissions control and sound abatement systems and has been designed to minimize and avoid impacts to the environment to the greatest extent technologically and economically feasible.

FACILITY BENEFITS

The Facility being proposed will participate in the ISO New England Forward Capacity Market in order to address need for new capacity that has been created by announced and pending retirements of existing generators and load growth. Additional retirements are expected to occur due to changing market conditions, the age of a good portion the existing generation fleet and as a result of improved market performance as mandated by the EPA's Clean Power Plan. More specifically CREC will provide potential benefits including:

1 South Wacker Drive, Suite 1800
Chicago, IL 60606

1. Utilization of Existing Infrastructure: The Facility is located on a site within the Town of Burrillville that is part of a larger parcel of land that includes both gas pipelines and electric transmission lines each of which have adequate capacity to support the project without requiring additional costly (and controversial) laterals for each of these interconnections.

2. Compliance with State and Federal Energy Policy: The design of the proposed CREC Facility is in compliance with the policies and requirements of the EPA's recently announced Clean Power Plan as well as the recently issued R.I. State Energy Plan and the cooperative efforts of the regional states as they relate to types of technologies needed in order to improve air quality and reduce emissions.

3. Modernize and replace aging generation infrastructure: the Facility will be the most efficient power generator in the New England market to date and will replace older, more polluting, less efficient and less flexible modes of power generation that the region currently relies upon.

4. Environmental Benefits: The CREC Facility will provide additional environmental benefits in the form of:
    a. Clean up and possible complete remediation of a currently shut down and contaminated well in Burrillville. The use of Pascoag Utility District's (PUD) well, which was deemed unsuitable for drinking water purposes more than ten years ago due to contamination, will be accomplished by installing a ground water treatment system. Through the installation of the treatment system, CREC's use and cleaning of the groundwater has the potential to eventually lead to complete remediation of the groundwater, as an additional environmental benefit of the CREC Project.
    b. Invenergy analyzed the air emissions impact of the CREC on the ISO-NE and New York ISO ("NYISO") footprints (both ISO-NE and NYISO footprints were considered given their high degree of interconnectivity) and found that the addition of the CREC will reduce CO_2, NO_x and SO_2 emissions every year when compared to existing system wide emission rates. Invenergy's analysis also determined that without the CREC Facility, the recently announced retirement of the Pilgrim nuclear facility would have resulted in higher regional emissions (through more dependence on existing generation sources), and as a result of the CREC Project emissions reductions are forecasted to be even greater in the region when this nuclear facility is retired.

5. Economic Benefits: CREC will create economic benefits from the large investment, the added new employment for skilled local workers during construction and operation, as well as direct economic benefits to the Town of Burrillville and to local businesses. Economic development benefits associated with CREC will result from the following three areas:
    a. Construction of the facility – Equipment, materials, and skilled labor employed during construction as well as, permitting fees, and expenditure associated with other project activities. The construction of CREC will support the creation of new construction jobs and generate millions of dollars per year in income for Rhode Island residents during the construction period.
    b. Ongoing operation of the Facility – Upon conclusion of the construction phase, ongoing facility operations create expenditures associated with the materials and labor needed to operate the facility which will support additional economic benefits in the form of new jobs, added property taxes and added monies for Rhode Island residents.

1 South Wacker Drive, Suite 1800
Chicago, IL 60606

c. Power market cost savings to Rhode Island ratepayers – The addition of new efficient generation capacity in Rhode Island will result in lower capacity and power prices in the near term, thereby driving significant savings to Rhode Island.

ADDRESSING MARKET NEEDS

The CREC proposal will help the New England Independent System Operator (ISO-NE) meet its capacity, reliability and operational requirements for the regional electric transmission network. The restructuring of New England's electric power industry in the late 1990s created an open, competitive wholesale electricity marketplace that is managed by the ISO-NE. The marketplace allows the ISO-NE to secure sufficient electricity and related services for the region at the lowest prices. The ISO operates a Forward Capacity Market to ensure the reliability of the New England power supply and assign Forward Capacity Obligations (FCO) to Generation Suppliers. Invenergy will offer the CREC Project into upcoming Forward Capacity Auction(s), and once the Project is awarded an FCO, Invenergy will construct the Facility. The CREC Project will be able to address many of the challenges facing the New England ISO region, more specifically:

- Provide new, highly advanced generating technology that will be one of the most efficient generators in New England, helping lower regional energy costs.
- Reduce regional air emissions by displacing older, less efficient and more polluting generation and improve air quality through the facilities use of best available emission control technology.
- Modernize the electric generating infrastructure by providing new, highly efficient generation that has fast start and high ramp rate (flexible) generating capability, replacing older, less flexible generation. The fast start and flexible generating capability will support the integration of new and existing renewable generation onto the power grid.

The region's coal- and oil-fired generators represent approximately 28 percent of the installed power generating capacity and most are more than 40 years old. These units are far less efficient than CREC and rely on more expensive fuels as compared to natural gas which means they have higher operating costs. Their higher operating costs result in these units running mainly to meet peak demand and only produced a small portion of the region's electricity, which is one of the reasons these units are retiring and being replaced by newer, more efficient generators.

The performance of the existing older resources can be uncertain when called on, due to age and infrequent operation, posing risks to reliability. For example:

- Equipment issues can affect their performance when dispatched. Unexpected outages of older units tend to increase during extreme cold conditions.
- They have long start-up times. In some instances up to 24 hours are needed to reach full output, which makes it difficult for ISO-NE operators to rely on these resources.

Regional power markets have shifted in recent years in response to fast-changing supply and demand parameters. The ISO-NE has identified issues that have led to inadequate peak generation capacity that have resulted in high-profile "narrowly missed catastrophic events" that have spurred market design changes like the new Pay-for-Performance Initiative (PI) that will result in a more efficient, flexible fleet, and penalize less reliable and more inflexible oil/gas steam-fired units that cannot respond to the market signals in a timely fashion. This market change will likely result in accelerating retirements of oil/gas steam capacity and incentivize the construction of newer and more efficient units.

The proposed CREC, along with the new market rules should result in lower energy prices in ISO-NE, as more efficient units displace less economic generation.

RATEPAYER SAVINGS

Rhode Island ranks 7th highest in average price of electricity to end-use customers in the nation (*Source: U.S. Energy Information Administration, Form EIA-826, Monthly Electric Sales and Revenue Report with State Distributions Report)*. Rhode Island residential consumers pay about 35 percent more for electricity than the national average. In addition, the price of electricity for industrial use is 64 percent higher in Rhode Island compared to the national average. This puts Rhode Island businesses and industries in a disadvantageous cost-position to compete across the nation and reduces disposable income for Rhode Island residents.

Due to its high efficiency, CREC will likely reduce the electricity price for end-use consumers by producing energy at a lower cost than other existing generators. Invenergy's studies indicate that from 2019 to 2022, cumulative savings to Rhode Island ratepayers resulting from the electricity price reductions that are anticipated by the CREC Project are projected to be over $280 million, or approximately $70 million annually. This represents significant savings to Rhode Island ratepayers.

The price of natural gas is a key component to cost of electricity produced by CREC. The natural gas supply system has been constrained in recent years which has led to increased gas price in the region. In fact, the cost of natural gas in the region can at times be the highest in the United States, whereas the lowest price of natural gas in the United States is right next door in Pennsylvania. This cost difference is entirely due to the capability of the natural gas pipeline infrastructure capability to meet demand. This is the reason that Invenergy took the unique approach to include an incremental pipeline expansion to meet CREC's fuel supply needs as part of the CREC development. The ratepayer savings described above were based on this approach.

COMPLIANCE WITH RHODE ISLAND AND FEDERAL ENERGY POLICIES AND PLANS

Both the recently issued Rhode Island State Plan -- *Energy 3035* (State Guide Plan Element – Report #120) and the EPA's Clean Power Plan (CPP), calls for reductions in emissions and an increase in regional renewable generation. There are several ways in which to do this, but given New England's already high cost for energy, the implementation of the goals set forth in the State Energy Plan and the CPP must be accomplished in a cost effective manner. Renewable resources such as solar and wind create challenges for grid operators due to their intermittent and variable nature which can have rapid and sizeable swings in electricity output due to wind speed, time of day, cloud cover, haze, and temperature changes (which is why they are called variable or intermittent resources). Intermittent resources are not dispatchable on demand and, as such, have a limited ability to serve peak load. The ISO-NE needs to balance the variable output from wind and solar resources, in order for the power system to operate reliably. In order to do this, the ISO-NE must hold generating units in reserve, or have access to units that have highly flexible operating characteristics that allows them to adjust output to meet changing conditions. This means that the generation fleet needs to evolve as more renewables are added. This includes the ability of generators to react to rapid and sizeable swings in electricity output as well as having additional fast-start capacity held in reserve. The CREC Project supports these security, cost effectiveness and sustainability goals recommended in the RI State Energy Plan by complementing and supporting the introduction of more renewable generation resources.

The proposed CREC Facility located in Burrillville has the necessary characteristics to meet the challenges of a renewable future and units like CREC cannot be considered as being independent or in

Invenergy

1 South Wacker Drive, Suite 1800
Chicago, IL 60606

lieu of renewables but rather necessary in order to support the further development and addition of renewables as a crucial part of the solution to the regional efforts to meet the Clean Power Plan goals as well as the Rhode Island State Energy Policy.

Invenergy respectfully requests an expedited review of this application and a Final Decision on its approval by no later than September 15, 2016. This Facility will be bid into the ISO-NE's Forward Capacity Auction number 10 ("FCA 10") in February 2016, and if selected, commercial operation of the Facility will be required by June 1, 2019, with significant financial penalties due if this capacity obligation is not met. In order to meet this obligation, construction of the facility needs to commence in late 2016. A RIEFSB Final Decision by no later than September 15, 2016 would allow sufficient time for project financing and construction commencement to meet the FCM 10 capacity obligation deadline. Invenergy will work with and provide the RIEFSB with the information necessary to make a timely Final Decision.

Thank you in advance for your assistance with meeting this important project timeline milestone which should allow the CREC to provide the above mentioned benefits to Rhode Island and the region,.

Best Regards,

John E. Niland
Director, Thermal Development

cc: Richard Beretta
Alan Shoer

Rhode Island Energy Facility Siting Board Application

Clear River Energy Center
Burrillville, Rhode Island

PREPARED FOR:
Invenergy Thermal Development LLC
One South Wacker Drive
Suite 1900
Chicago, IL 60606

FOR SUBMITTAL TO:
State of Rhode Island Energy Facility Siting Board
Public Utilities Commission
89 Jefferson Boulevard
Warwick, RI 02888

PREPARED BY:
ESS Group, Inc.
10 Hemingway Drive, 2nd Floor
East Providence, RI 02915

ESS Project No. I108-005

October 28, 2015

www.essgroup.com

RHODE ISLAND ENERGY FACILITY SITING BOARD APPLICATION

Clear River Energy Center
Burrillville, Rhode Island

Prepared For:

Invenergy Thermal Development LLC
One South Wacker Drive
Suite 1900
Chicago, Illinois 60606

For Submittal To:

State of Rhode Island Energy Facility Siting Board
Public Utilities Commission
89 Jefferson Boulevard
Warwick, Rhode Island 02888

Prepared By:

ESS Group, Inc.
10 Hemingway Drive, 2nd Floor
East Providence, Rhode Island 02915

ESS Project No. I108-005

October 28, 2015

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLES

FIGURES

FIGURES (CONTINUED)

APPENDICES

1.0 PROJECT OVERVIEW

1.1 Clear River Energy Center

Invenergy Thermal Development LLC (Invenergy) is an independently owned company that develops, owns, and operates power generation and energy storage facilities across North America and Europe.

Invenergy's expertise includes a complete range of fully integrated in-house capabilities, including Project Development, Permitting, Transmission, Interconnection, Energy Marketing, Finance, Engineering, Project Construction, Operations, and Maintenance.

To date, the Company has developed over 9,056 MW of utility-scale renewable and natural gas-fueled power generation facilities across the United States, Canada, and Europe, including more than 7,132 of projects in operation and over 607 MW under contract or in construction. Our portfolio also includes over 1,316 MW of projects developed and sold under Build/Transfer or Development/Transfer Agreements.

Invenergy Thermal Development LLC is requesting approval from the Rhode Energy Facility Siting Board (RIEFSB) to construct and operate the Clear River Energy Center,("CREC") a combined-cycle electric generating facility to be located at the Spectra Energy Algonquin Compressor Station site on Wallum Lake Road (State Route 100) in Burrillville, Rhode Island (the Project or the Facility). The Project will provide many benefits to the region including reduced air emissions and improved air quality, lower regional energy costs, employment for skilled local workers during construction and operation, as well as direct economic benefits to the Town of Burrillville and to local businesses.

The Facility being proposed will participate in the ISO New England Forward Capacity Market in order to address need for new capacity that has been created by retirements of existing generators and the additional potential retirements of other generators in the New England market. The benefits associated with the Facility include:

1. Location: The Facility is located on a site with the Town of Burrillville is that is part of a larger parcel of land that includes both gas pipelines and electricity transmission lines each of which have adequate capacity to support the Project without requiring additional costly (and controversial) laterals for each.
2. Compliance with EPA's Clean Power Plan: The proposed design of the Facility complies with the EPA's recently announced Clean Power Plan requirements as they relate to types of technologies needed in order to improve air quality and reduce emissions.
3. Modernize and replace aging infrastructure: the facility will be the most efficient power generator in the New England market to date and will replace older, more polluting, less efficient modes of power generation that the region currently relies upon.
4. Other Environmental benefits: The Facility will help clean up a currently contaminated well in Burrillville that the Town has not been able to remediate. The cleanup will be accomplished by installing a treatment system and utilizing the treated water in the Facilities steam cycle.

The Facility will be configured as a two-unit one-on-one (1x1), duct fired, combined cycle generation station. Each unit will consist of an advanced class (G-, H-, or J-class) gas turbine operated in a combined-cycle configuration with a heat recovery steam generator (HRSG) equipped with natural fired duct burners and one steam turbine. The combustion turbine, steam turbine, and generator of each unit will be connected via a common shaft (otherwise referred to as a single shaft machine). Each gas turbine will fire natural gas as a primary fuel and ultra-low sulfur diesel (ULSD) fuel as a backup fuel from two-1,000,000 gallon on-site storage tanks for limited periods when natural gas is unavailable. ULSD will be delivered to the Facility by truck. The natural gas supply for the Facility will be provided by a pipeline from the adjacent Spectra Energy Algonquin Compressor Station.

The Facility will have a nominal power output at base load of approximately 850-1,000 megawatts (MW) while firing natural gas (with supplementary HRSG duct firing) and 650-800 MW while firing ULSD. The electrical power generated by the Facility will be transmitted through a new 345-kV transmission line to be installed from the Facility through an existing National Grid right-of-way (ROW) to the Sherman Substation.

Each unit will utilize air-cooled condensers (ACC) to limit water usage and wastewater discharge. The water supply for the Facility will be provided by the Pascoag Utility District (PUD) through a dedicated pipeline to be installed from the PUD water supply well field to the Facility. Wastewater from the Facility will be discharged to the Burrillville Wastewater Treatment Facility for treatment through a dedicated sewer line to be installed.

The Facility will be equipped with state-of-the art air emissions control and sound abatement systems. It has been designed to minimize and avoid impacts to the environment to the greatest extent technologically and economically feasible for such a facility. This will be assured by the numerous environmental permits that need to be obtained for the Project, and as detailed in this application.

1.2 Jurisdiction of the Rhode Island Energy Facility Siting Board

This application is being submitted to satisfy the applicable requirements of Rhode Island General Laws 42-98-1 et seq., the Energy Facility Siting Act (the Act). Section 4 of the Act states that “No person shall site, construct, or alter a major energy facility within the state without first obtaining a license from the siting board pursuant to this chapter.” A major generating facility is defined as a facility to be used for the generation of electricity designed or capable of operating at a gross capacity of 40 megawatts or more. The RIEFSB application filing requirements and associated procedures for a major generating facility are established in the “State of Rhode Island and Providence Plantations Energy Facility Siting Board Rules of Practice and Procedure, April 11, 1996.”

1.3 Application Organization

This application is complete and contains all of the information required by the RIEFSB Rules of Practice and Procedure, Section 1.6 as follows:

- Section 2.0 - Identifies the Applicant, the primary Project Contacts and the entities which make up the Project Team
- Section 3.0 - Provides a detailed Project Description
- Section 4.0 - Provides information on the Project Cost, the Project Schedule, and the Project Financing Plan
- Section 5.0 - Details the Project Benefits, including Community and Economic Benefits and local and Regional Environmental Benefits
- Section 6.0 - Includes an Assessment of the Environmental Impacts of the Project
- Section 7.0 - Provides an Assessment of Need for the Project
- Section 8.0 - Provides Evidence of how the Project conforms to Rhode Island Energy Policy
- Section 9.0 - Details the Life Cycle Management Plan for the Project
- Section 10.0 - Includes a Study of Alternatives for the Project
- Section 11.0 - Details the Status of Environmental Permits for the Project

Pertinent supporting documentation has been provided in Tables, Figures, and Appendices. A complete list of application requirements and the location of where that requirement is met can be found in Appendix J.

2.0 IDENTIFICATION AND DESCRIPTION OF APPLICANT AND AFFILIATES

2.1 The Applicant

Invenergy is an independently owned company that develops, owns, and operates power generation and energy storage facilities across North America and Europe.

Invenergy's expertise includes a complete range of fully integrated in-house capabilities, including Project Development, Permitting, Transmission, Interconnection, Energy Marketing, Finance, Engineering, Project Construction, Operations, and Maintenance.

To date, the Company has developed over 9,056 MW of utility-scale renewable and natural gas-fueled power generation facilities across the United States, Canada, and Europe, including more than 7,132 MW of projects in operation and over 607 MW under contract or in construction. Invenergy's portfolio also includes over 1,316 MW of projects developed and sold under Build/Transfer or Development/Transfer Agreements.

Invenergy's senior executives - each with more than 25 years in the energy generation industry - have worked together for over two decades. Invenergy's founder, president, and CEO, Michael Polsky, is a recognized and respected industry leader and is the majority owner of Invenergy and its affiliated companies.

Invenergy values integrity, commitment to business partners and host communities, and environmental responsibility. Furthermore, as an independently owned company and with a staff that is the best in the business – Invenergy operates nimbly and efficiently, delivering long-term growth.

Invenergy headquarters are in Chicago with regional offices in Denver, Toronto, Mexico City, Warsaw, and Tokyo.

2.2 Primary Contacts

All correspondences and communications concerning the Clear River Energy Center's Rhode Island Energy Facility Siting Board Application should be addressed to the Primary Contacts Identified below:

Project Manager	John E. Niland Director of Business Development Invenergy Thermal Development LLC One South Wacker Drive Suite 1900 Chicago, IL 60600
Project Counsel	Joseph Condo Senior Vice President and General Counsel Invenergy Thermal Development LLC One South Wacker Drive Suite 1900 Chicago, IL 60600
Rhode Island Counsel	Alan M. Shoer & Richard Beretta Adler, Pollock & Sheehan One Citizens Plaza, 8th Floor Providence, Rhode Island 02903

Environmental Permitting Project Manager Mike Feinblatt
ESS Group, Inc.
100 Fifth Avenue, 5th Floor
Waltham, MA 02451

Project Engineer Roger Nagel
HDR
5405 Data Court
Ann Arbor, MI 48108

2.3 Project Team

Rhode Island Counsel – Adler Pollock & Sheehan, P.C.

Adler Pollock & Sheehan (AP&S) is a New England law firm representing local, national, and international clients in a wide range of complex legal matters. Since 1960, AP&S has been committed to providing clients with the highest levels of legal services through a wide variety of practice areas from four office locations: Providence and Newport, RI, Boston, MA, and Manchester, NH.

AP&S represents some of the largest energy utility companies in the United States with comprehensive advice to facilitate some of the largest (500 to 1,000 MW) and most efficient thermal energy projects in the region. AP&S provides the critical legal representation necessary to allow developer clients to secure the necessary environmental permits, energy facility siting approvals, real estate agreements, local municipal approvals, construction agreements, labor contracts, legislation and the required financing from investors.

Environmental Consultant - ESS Group, Inc.

ESS Group, Inc. (ESS) is a multi-disciplinary environmental consulting company with offices in East Providence, RI, Waltham, MA, Norfolk, VA, and Portsmouth, NH. Over the past 15 years, ESS has provided energy-consulting services for more than 14,000 MW of proposed power generation and more than 700 miles of proposed electric transmission.

ESS's experience includes licensing and permitting of a broad spectrum of generation and transmission facilities, from greenfield projects and re-powering of existing generation facilities to upgrades of existing transmission and storage assets. ESS supports energy facilities during operation with environmental compliance, multi-media monitoring, waste management, data collection, and reporting, and permits renewals. We also regularly conduct environmental due diligence for energy facility asset acquisition and divestiture.

Project Engineer - HDR Engineering

HDR specializes in engineering, architecture, environmental, and construction services. Founded in 1917, the company now operates out of 225 office locations around the world. HDR's integrated power development consulting services range from comprehensive owner's engineer services to site selection, environmental reviews, air quality evaluations, permitting support, transmission planning, feasibility analysis, plant layout, preliminary/final engineering, procurement management, construction management and operational start-up.

Noise Consultant – Michael Theriault Acoustics, Inc.

Michael D. Theriault of Michael Theriault Acoustics, Inc. (MTA) has provided environmental noise control consulting services to the North American electric power industry since 1998. His services include preparation of noise impact studies for owners and developers; implementation of large-scale noise control programs for architectural engineering firms; noise level compliance testing for constructors; and noise control due diligence reviews for municipalities and financial underwriters. MTA has advised clients on hundreds of energy facilities, ranging in size from one to 2,000 megawatts, many from conceptual design through final testing, using combustion turbine, wind turbine, biomass, and conventional fossil-fueled technologies.

Cultural Consultant - Gray & Pape

Established in 1987, Gray & Pape is a national consulting firm specializing in cultural resources management and historic preservation services. Gray & Pape has conducted more than 1,500 projects and established a reputation for understanding the intricacies of the CRM process. Headquartered in Cincinnati, OH, the firm maintains offices in Indianapolis, IN; Richmond, VA; Providence, RI; and Rabbit Hash, KY, and qualifies as a Small Business Enterprise (SBE).

The professional staff at Gray & Pape includes individuals with experience in all phases of cultural resources studies, from archival research and analysis of cultural landscapes, to archaeological and architectural site survey. Their staff meets or exceeds the professional standards for historians and archaeologists outlined in the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation.

EMF Consultant - Exponent

Exponent is a leading engineering and scientific consulting firm with a staff of approximately 900, located in 20 offices throughout the United States and in 6 international offices. Exponent scientists and engineers provide advisory and consulting support to electric utilities, the telecommunications industry, the electronics industry, research organizations, and regulatory agencies. Exponent's consultants are involved with research studies involving electric and magnetic fields (EMF) and radiofrequency (RF) exposures. Research regarding the potential human health effects of exposure to EMF and RF forms the scientific basis for exposure limits and provides a firm basis for the safe use of these technologies. Their projects address potential risks to human health by conducting exposure assessments, epidemiologic studies, and evaluations of data to establish human exposure limits to EMF/RF.

Economic Consultant – PA Consulting

PA Consulting Group, Inc. is an independent, employee-owned, global consultancy with over 2,500 people across 30 offices. Founded in 1943, PA has extensive experience supporting businesses and governments worldwide and blends creative thinking with leading-edge expertise to solve today's most pressing and complex challenges. PA's experts are supported by over 250 scientists, technologists, and engineers that allow us to deliver more than just great thinking – we have proven hands-on experience of bringing innovative ideas and technology to market.

PA's Global Energy & Utilities practice helps their clients create markets, anticipate changes to their markets, use technology and IT to respond to regulator and customer demands, improve their reliability while reducing costs, and optimize investments. They work with regulators, policy makers, market and system operators, electric utilities, independent power producers, investment banks, private equity, and other clients to navigate through market uncertainty and prepare for operational change. They have extensive experience in U.S. power markets, having supported the development, acquisition, divestiture, or financing of over $100 billion in power generation assets since 2011 alone.

3.0 PROJECT DESCRIPTION AND SUPPORT FACILITIES

3.1 Facility Description

Invenergy Thermal Development LLC (Invenergy) is requesting approval from the Rhode Energy Facility Siting Board (RIEFSB) to construct and operate the Clear River Energy Center (CREC), a combined-cycle electric generating facility to be located at the Spectra Energy Algonquin Compressor Station site on Wallum Lake Road (State Route 100) in Burrillville, Rhode Island (the Project or the Facility). The Project will provide many benefits to the region including reduced air emissions and improved air quality, lower regional energy costs, employment for skilled local workers during construction and operation, as well as direct economic benefits to the Town of Burrillville and to local businesses.

The Facility will be configured as a two-unit one-on-one (1x1), duct fired, combined cycle generation station. Each unit will consist of an advanced class (G, H, or J class) gas turbine operated in a combined-cycle configuration with a heat recovery steam generator (HRSG) equipped with natural gas fired duct burners and one steam turbine. The combustion turbine, steam turbine, and generator of each unit will be connected via a common shaft, (single shaft). Each gas turbine will fire natural gas as a primary fuel and ultra-low sulfur diesel (ULSD) fuel as a backup fuel for limited periods when natural gas is unavailable. The ULSD will be stored in two 1,000,000-gallon on-site storage tanks. ULSD will be delivered to the Facility by truck. The natural gas supply for the Facility will be provided by pipeline from the adjacent Spectra Energy Algonquin Compressor Station.

The Facility will have a nominal power output at base load of approximately 850-1,000 megawatts (MW) while firing natural gas (with supplementary HRSG duct firing) and 650-800 MW while firing ULSD. The electrical power generated by the Facility will be transmitted through a new 345-kV transmission line to be installed from the Facility within a short section of new ROW and the existing National Grid right-of-way (ROW) to the Sherman Substation.

Each unit will utilize air-cooled condensers (ACC) to limit water usage and wastewater discharge. The water supply for the Facility will be provided by the Pascoag Utility District (PUD) through a dedicated pipeline to be installed from the PUD water supply well field to the Facility. Wastewater from the Facility will be discharged to the Burrillville Wastewater Treatment Facility for treatment through a dedicated sewer line to be installed.

3.2 Purpose and Function

CREC is proposed to help the New England Independent System Operator (ISO-NE) meet its capacity, reliability, and operational requirements and needs for the regional electric transmission network. Additionally CREC will provide many benefits to the region including:

- Provide new, highly advanced generating technology that will be one of the most efficient generators in New England, helping lower regional energy costs
- Reduce regional air emissions by displacing older, less efficient and more polluting generation and improve air quality through Best Available emission control technology
- Modernize the electric generating infrastructure by providing new, highly efficient generation that has fast start and high ramp rate (flexible) generating capability, replacing older, less flexible generation. The fast start and flexible generating capability will also help support the integration of new and existing renewable generation onto the power grid
- Utilize previously unusable Pascoag Utility District (PUD) water supply wells, which were shut down and deemed unsuitable for drinking water purposes more than ten years ago due to contamination, by installing a ground water treatment system that will help facilitate the remediation of the contamination

- Create new employment for skilled local workers during construction and operation, as well as direct economic benefits to the Town of Burrillville and to local businesses

The restructuring of New England's electric power industry in the late 1990s created an open, competitive wholesale electricity marketplace that is managed by the ISO-NE. The marketplace allows the ISO-NE to secure sufficient electricity and related services for the region at the lowest prices. The ISO operates a Forward Capacity Market to ensure the reliability of the New England power supply and assign Forward Capacity Obligations (FCO) to Generation Suppliers. Invenergy will offer CREC into upcoming Forward Capacity Auction(s), and once CREC is awarded an FCO, Invenergy will construct the Project.

Rising costs associated with oil and coal, the lower cost of natural gas combined with the advanced age of many of the power plants that use these fuels make it difficult for these resources to compete against newer, more efficient generators—primarily natural gas units. For this reason, coal and oil units are now run mainly to meet peak demand, when natural gas plants are unavailable, or when natural gas price spikes surpass oil prices. The region's coal- and oil-fired generators represent about 28% of capacity in the region, but only produced about 6% of its electricity in 2014. Almost all of the existing coal and oil facilities are close to or beyond their original design life. Additionally, most of these existing units are not located in an area where the existing natural gas supply infrastructure has adequate capacity to support their conversion to combined cycle technology. As a result, new units are being proposed in locations where sufficient supply of natural gas can be assured.

The performance of many existing fossil fuel power plants can be uncertain when called on, due to age and infrequent operation, posing risks to reliability. For example:

- Equipment issues can affect their performance when dispatched. Unexpected outages of older or poorly maintained units tend to increase during extreme cold conditions.
- They have long start-up times. In some instances, up to 24 hours are needed to reach full output, which makes it difficult for ISO operators to rely on these resources.

Additionally the Facility will help meet the needs of the region by being able to replace the capacity that will be lost by the recently announced retirement of the Pilgrim Nuclear Station by Entergy.

Regional power markets have shifted in recent years in response to fast-changing supply and demand parameters. The Independent System Operator-New England (ISO-NE) regional transmission organization have identified issues in their capacity market designs that have led to inadequate peak generation capacity or failed to provide appropriate incentives for investment in flexible capacity. In region, these problems have resulted in high-profile "narrowly missed catastrophic events" that have spurred market design changes.

The most significant of these proposals has been the new Pay-for-Performance Initiative (PI) that alters how a generation resource's capacity payments are calculated. Approved in May 2014, the PI will influence bidding behavior in the market beginning in 2018. Capacity payments in ISO-NE will be subject to a two-settlement process, including a capacity base payment and an additional capacity performance payment that redistributes penalty payments from underperforming resources to over performing resources. These capacity performance payments will be allowed to be negative, creating a substantial financial penalty for underperformance in scarcity conditions.

In the long term, PI will result in a more efficient, flexible fleet with lower energy prices. Under the new regime, new, efficient units can meet this need based on their flexibility and low forced outage rates and less reliable and more inflexible oil/gas steam-fired units, that cannot respond to the market signals in a timely fashion, (as such reduce reliability) will potentially be penalized. This relative advantage will likely result in accelerating the retirement of oil/gas steam capacity and incentivizing the construction of new, efficient units. In the long run, this dynamic should result in lower energy prices in ISO-NE, as more efficient units displace less economic generation. In the near- to medium-term though, the dynamic could result in periods of capacity shortfall and price spikes if the transition is not orderly.

Rhode Island ranks 7th highest in average price of electricity to end-use customers in the nation. Rhode Island residential consumers pay about 35 percent more for electricity than the national average. In addition, the price of electricity for industrial use is 64 percent higher in Rhode Island compared to the national average. This puts Rhode Island businesses and industries in a disadvantageous cost-position to compete across the nation and reduces disposable income for Rhode Island residents.

Table 3.2-1
Average Price of Electricity to Ultimate Customers
July 2015, Cents per Kilowatt hour

Sector	*Rhode Island* Average Price	Rank	*U.S* Average Price
Residential	17.59	8	12.98
Commercial	14.00	9	11.06
Industrial	11.96	6	7.3
All Sectors	15.37	7	10.96

Source: U.S. Energy Information Administration, Form EIA-826, Monthly Electric Sales and Revenue Report with State Distributions Report.

According to estimates produced by the PA Consulting group, the development, construction, and operation of CREC is expected to result in a reduction of electricity prices for end-use consumers. From 2019 to 2022, cumulative savings to the Rhode Island customer resulting from electricity prices are projected to be over $280 million, or approximately $70m annually. This represents significant savings to Rhode Island ratepayers.

The EPA's Clean Power Plan, (CPP) calls for reductions in emissions and an increase in regional renewable generation. There are several ways in which to do this, but given New England's already high cost for energy, the implementation of the CPP must be accomplished in a cost effective manner. Renewable resources, such as solar and wind, create challenges for grid operators due to their intermittent and variable nature. They can have rapid and sizeable swings in electricity output due to wind speed, time of day, cloud cover, haze, and temperature changes—hence why they are called variable or intermittent resources. The ISO-NE recognizes the variable nature of these resources and states in their 2015 Regional Electricity Outlook that" *Wind and solar resources will eventually help achieve federal and state environmental goals. Paradoxically, the operating characteristics of these renewable resources which are different than traditional power plants will increase reliance on fossil-fuel-fired natural gas generators."* This is because intermittent resources are not dispatchable on demand and, as such, have a limited ability to serve peak load. Wind speeds can be at their lowest levels in the summer, while extreme cold and ice can also hinder output. Widespread use of solar power, meanwhile, will likely shift peak net load to later in the afternoon, just as output diminishes with the setting sun.

The New England ISO needs to balance the variable output from wind and solar resources, in order for the power system to operate properly. In order to do this, the ISO must hold generating units in reserve, or have access to units that have highly flexible operating characteristics that allows them to adjust output to meet changing conditions. This means that the generation fleet needs to evolve as more renewables are added. This includes the ability of generators to react to rapid and sizeable swings in electricity output as well as having additional fast-start capacity held in reserve.

CREC has the necessary characteristics to meet the challenges of a renewable future. Units like CREC cannot be considered independent or in lieu of renewables, but rather necessary in order to support the further development and addition of renewables as a crucial part of the solution to the regional efforts to meet the Clean Power Plan goals as well as the Rhode Island State Energy Policy.

The CREC will use a dry cooling system by using an air-cooled condenser, (ACC) which is similar to the cooling provided by a typical automobile radiator, which cools by the use of ambient air supplied by fans. The use of an ACC reduces the amount of water by approximately 90% compared to a conventional wet cooling tower. The use of a dry cooling system also reduces the amount of wastewater generated by the Project. Through its proposed use of an ACC, CREC is able to develop and utilize the proposed installation of the treatment system at PUD's closed well. Through the installation of the treatment system, CREC's use and cleaning of the groundwater will eventually lead to complete remediation of the groundwater as an additional environmental benefit of the CREC.

Economic development benefits associated with CREC will result from the following three areas:

1. Construction of the facility – Equipment, materials, and skilled labor employed during construction as well as, permitting fees, and other activities.
2. Ongoing operation of the facility – Fixed and variable costs associated with the materials and labor needed to operate the facility as well as annual property taxes.
3. Power market cost savings to Rhode Island ratepayers – The addition of new efficient generation capacity in Rhode Island will result in lower capacity and power prices in the near term, thereby driving significant savings to Rhode Island ratepayers during the plant's early years.

In terms of economic impact, Section 5 below includes the detailed estimates that from 2017 to 2018 the construction of the CREC will support the creation of new construction jobs and generate approximately $100 million/year in income for Rhode Island residents. Upon conclusion of the construction phase, ongoing facility operations and expenditures will support approximately 250 jobs/year in the state. Therefore, CREC construction and operation produces significant economic benefits to Rhode Island residents including lower energy prices, jobs, and income.

3.3 Land Area

The CREC site is located in a forested, predominantly rural area. The 67 acres of land area will be purchased from the Spectra Energy Algonquin Compressor Station site ("Spectra") and is a subset of a 730-acre site that Spectra owns that currently contains the Burrillville Compressor Station. The Facility will be constructed just south of the existing compressor station. The Algonquin Gas Compressor Station is surrounded by dense vegetation. The CREC will require a new access road which will be located south of, and parallel to, the existing Algonquin Road. The closest residents are approximately 2,300 feet to the north of the north-northeast corner of the property line.

3.4 Site Plan

Figure 3.4-1 is an aerial photograph of the existing site. Figure 3.4-2 is a locus map showing the location of the site. Figure 3.4-3 provides the proposed site plan.

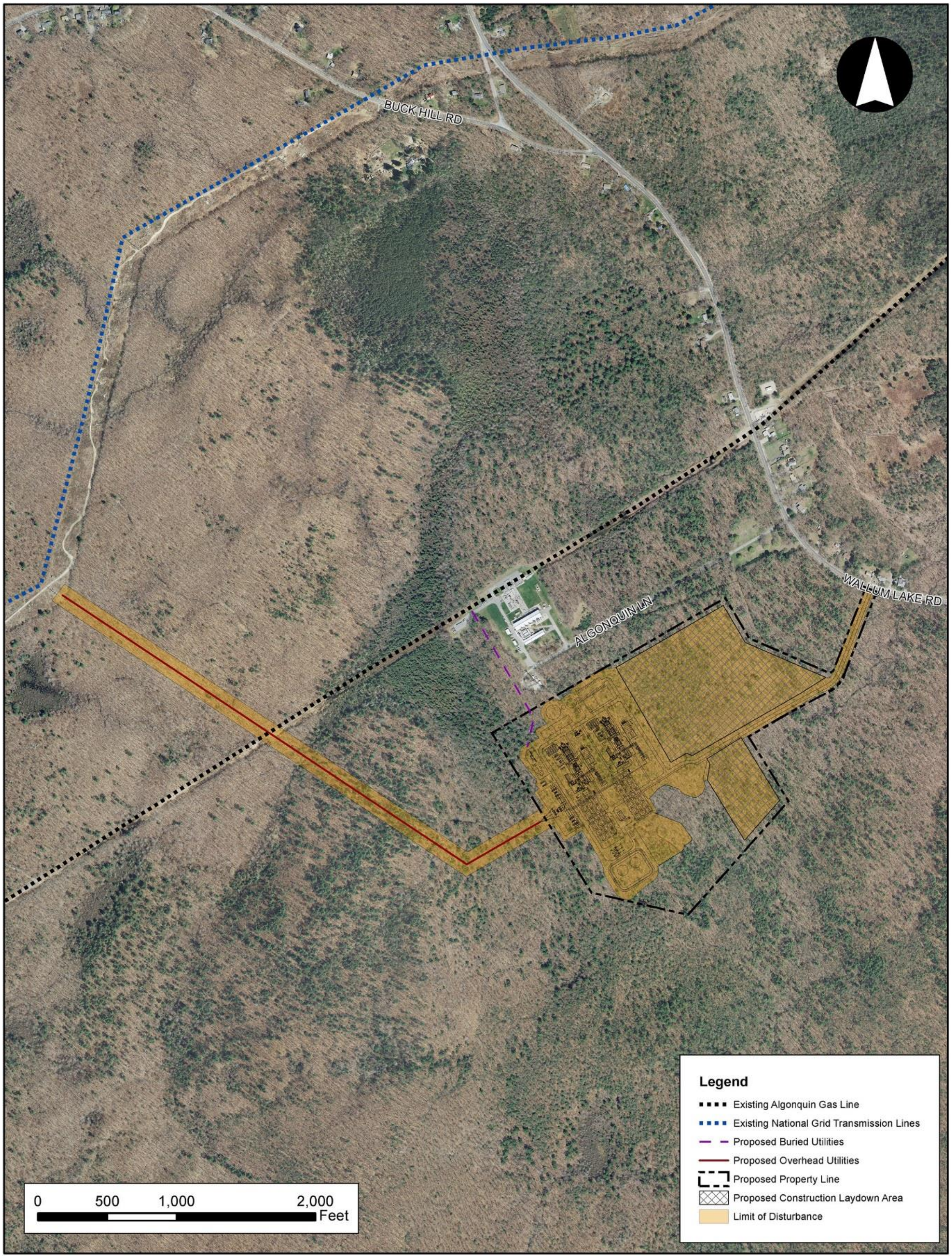


Figure 3.4-1
Site Layout

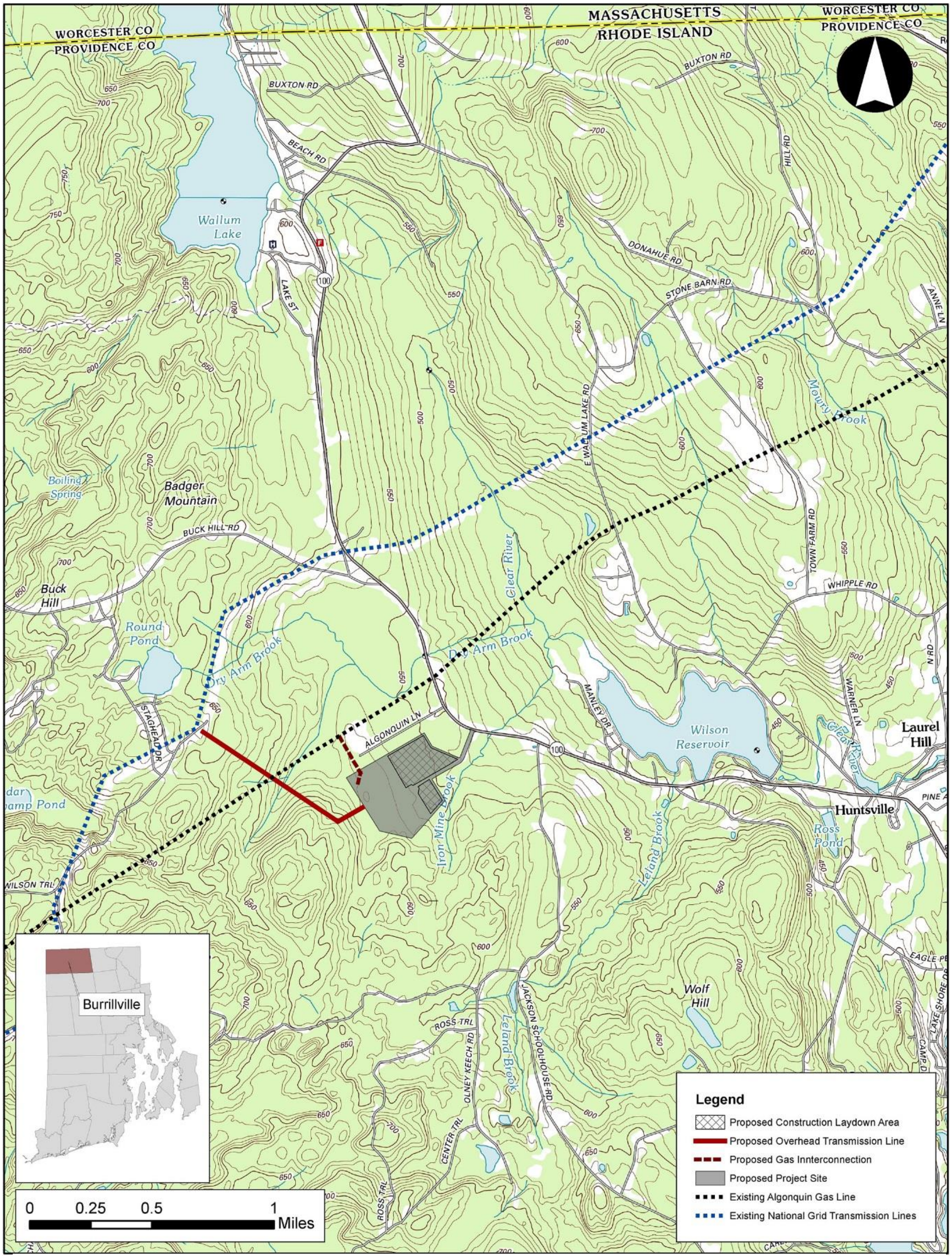


Figure 3.4-2
Site Locus

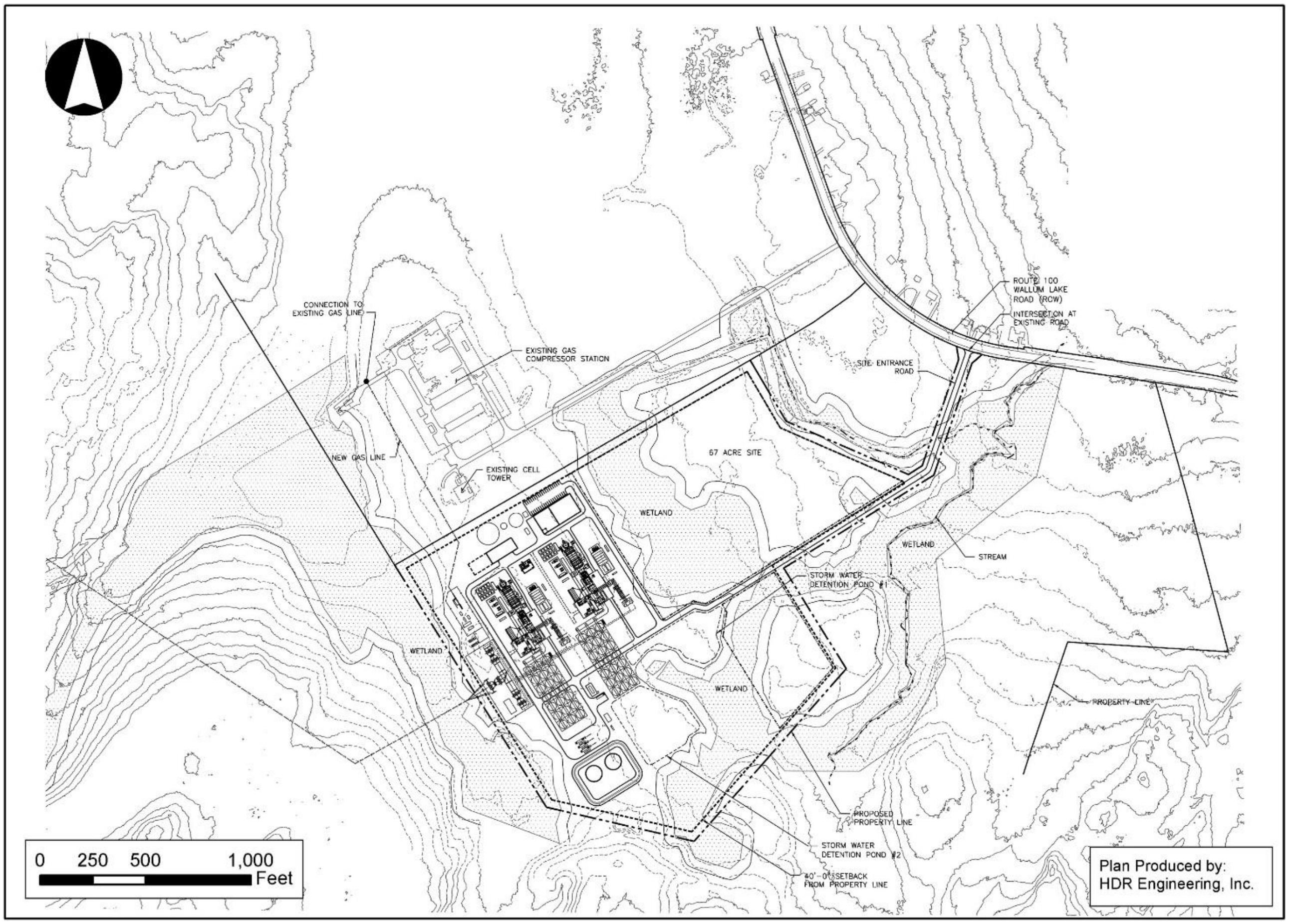


Figure 3.4-3
Site Plan

3.5 Structures

3.5.1 Primary Powerhouse Building

Each single-shaft, 1x1 combined cycle power train will be enclosed in a powerhouse building. The building will be designed to enclose the combustion turbine, steam turbine, single-shaft generator and associated ancillary equipment. The primary structure of this building will be approximately 150ft long, 94ft wide, and 80ft tall and will include an overhead crane to facilitate equipment maintenance activities as well as equipment laydown areas for maintenance. A drive-through access road through this portion of the building will be available for component delivery and removal. In addition, the structure will include balance of plant equipment such as condensate pumps, air compressors, drains tanks and other equipment.

The combustion turbine exhaust will exit the north-west end of the building into a heat recovery steam generator and stack, and the steam turbine exhaust will exit the southeast end of the building via an exhaust duct to each ACC.

The powerhouse building will be constructed of a steel structure with acoustically attenuated siding for noise control. The building and internal equipment components will be supported by suitable concrete foundations (mat, spread footing, etc.) bearing on existing soils or supported on deep foundations (piles, caissons, etc.).

3.5.2 Smaller, Auxiliary Buildings, Fuel Oil Equipment, and Electrical Equipment Buildings

In addition to the Primary Powerhouse buildings, the Facility will include the following smaller buildings:

- Administration and Controls/Warehouse Building – The administration and control portion of this building will house the plant control room, offices and meeting rooms for plant staff, locker rooms, restrooms, lunchroom, and service rooms for communications, electrical, control, and mechanical systems. The warehouse portion of the building will include an area to store spare parts, and a workshop area for performing maintenance of small equipment (such as motors and pumps).
- Auxiliary Boiler Building – This building will house the natural gas fueled auxiliary boiler to supply steam to the HRSGs during certain operating conditions (discussed in Section 9.1.2.2). The auxiliary boiler building is located between the HRSGs of each unit. The Facility will have one auxiliary boiler installed in a building.
- Fire Pump Building – This building will house the diesel fueled fire pump.
- Feed Water Pump Building – Boiler feed water will be supplied to the individual HRSGs by multiple large feed water pumps located in this building. This building will also include the closed cooling circulating water pumps and a water sampling station. Each unit will include a dedicated feed water pump building.
- Water Treatment Building – Water filtration and demineralization equipment will be located in the water treatment building.
- Gas Compressor Building – The Facility gas compressor will be installed in this building. Natural gas will be compressed to satisfy the combustion turbine inlet pressure requirements.
- Fuel Oil Equipment Building – Equipment required to operate and maintain back up fuel oil operations shall be located in the fuel oil equipment building

3.5.3 Storage Tanks

The Facility will include the following storage tanks:

- Fuel Oil Storage Tanks - The Facility will include two 1,000,000 gallon above ground ULSD storage tanks equipped with secondary containment, as required by law. These welded steel tanks will be approximately 30 feet tall and 80 feet in diameter.
- Demineralized Water Storage Tank – The Facility will include one demineralized water storage tank with approximately 1, 000,000-gallon storage capacity. The tank will be approximately 30 feet tall and 110 feet in diameter. This storage capacity will provide water for approximately 10 days of continuous operation on natural gas at summer conditions.
- Waste Water Storage Tank – Blowdown from the HRSGs, evaporative coolers, and other wastewater from the Facility will be collected in an approximately 160,000-gallon waste water storage tank. The tank will be approximately 30 feet tall and 30 feet in diameter.
- Fire Water / Service Water Storage Tank – Plant service water /fire water will be stored in a tank with a storage capacity of approximately 800,000 gallons. The tank will be approximately 30 feet tall and 68 feet in diameter.
- Ammonia Storage Tank – Part of the plant emissions control systems will include selective catalytic reduction systems for controlling NO_x emissions in the HRSGs. The SCR systems will use ammonia as a reagent. Aqueous ammonia will be stored at a concentration less than 20% in a storage tank with a storage capacity of approximately 40,000 gallons.

3.5.4 Switchyard

Each 1x1 combined cycle unit will have a generator step-up (GSU) transformer to increase the voltage from the generator voltage to 345kV. The GSU transformers will be connected to the Facility switchyard located along the western edge of the site via underground cable duct banks. The Facility switchyard will occupy a footprint of approximately 370 feet by 155 feet and will be configured as a 345kV three-breaker collector bus switchyard. The switchyard will be separately fenced and will include a separate enclosure for control equipment and auxiliary power systems. An overhead 345kV transmission line exits the switchyard and runs along new and existing right of way (ROW) interconnecting at the National Grid Sherman Road Switching Station.

3.5.5 Appurtenant Equipment

The following is a list of appurtenant equipment and systems:

- Standby diesel generator – The Facility will include a 2 MW standby diesel generator.
- Natural gas system - A natural gas fuel yard will be installed at the Facility that includes fuel gas filters, fuel gas dew point heaters, gas regulation trains and flow meters, and a gas compressor.
- Duct burner fuel skids – Each HRSG will be equipped with a dedicated natural gas control and regulation skid to reduce pressure and measure and modulate gas flow to the duct burners.
- Hydrogen tube trailer – The unit generators will use gaseous hydrogen for cooling and heat rejection. Truck trailer mounted hydrogen tube racks will be used for on-site hydrogen storage and makeup to the generators. Alternately, a hydrogen generator may be used for this purpose.
- Waste water collection – Wastewaters generated by the Facility will be collected and pumped via a forced main to a connection with the Burrillville Sewer Authority wastewater treatment system. Alternately, a zero liquid discharge system may be used.
- BOP Electrical – Balance of plant electrical systems (medium and low voltage transformers, switchgear and distribution systems) will be installed in an enclosure adjacent to each combined cycle unit. These systems will be energized by the station auxiliary transformers that will reduce voltage from the generator voltage to the appropriate medium voltage.

3.5.6 Cooling Systems

The Facility has been configured to use dry-type heat rejection systems using an ACC. Each combined cycle unit will have a dedicated ACC and associated subsystems and piping. Steam turbine exhaust steam will be ducted through large horizontal ducts feeding several vertical risers on each ACC. Each riser will deliver steam to a distribution manifold that will run horizontally along the top of a row of finned tube air-cooled heat exchangers arranged in an A-frame configuration. Fans will be used to move ambient air over the finned tubes causing the steam to condense releasing heat to ambient air and the condensate will be drained back to the condensate collection system. Each ACC will occupy a footprint of approximately 350 feet by 150 feet and be approximately 120 feet tall.

The facility will also include air cooled closed cycle cooling water heat exchangers (one for each combined cycle unit) to reject heat from various auxiliary systems such as lube oil and hydrogen cooling. The heat exchanger will use fans to move ambient air over the finned tubes carrying the hot closed cycle cooling water.

3.5.7 Transmission Facilities

The Facility will connect to the National Grid electric utility system at the Sherman Road Switching Station as determined from a recently completed feasibility study conducted by ISO New England (ISO-NE). The transmission line will be installed and owned by National Grid as part of the generation interconnection application process. Connection to the Sherman Road Switching Station will be via a new 6-mile long 345kV transmission line that will be constructed. The transmission line will run west from the CREC switchyard along a new right of way to the two existing 345 kV transmission lines north-west of the Facility. The new transmission line will run on new towers set within the National Grid right of way from a point north-west of the Facility to the Sherman Road Switching Station.

3.6 Transmission and Interconnection

The Facility will connect to the National Grid Sherman Road Switching Station via a new 6-mile long 345kV transmission line. In addition, the 345kV Sherman Road Switching Station will also be expanded to add a breaker to accommodate the new transmission line connection and generation capacity addition. Other transmission system improvements proposed to accommodate the interconnection include upgrades to Line 3361, a 10.8-mile line from the Sherman Road Switching Station to ANP Blackstone with a minimum (NOR/LTE/STE) rating set of: 1400/1685/1685 MVA.

3.7 Underground Construction

Underground construction will include concrete foundation substructures as well as site utility piping for water, natural gas, fuel oil, and electrical cables. The Facility will include underground duct banks to route high voltage electrical cables at 345kV to connect the two Generator Step Up transformers to the Facility switchyard.

3.8 Environmental Controls

3.8.1 Air Emission Controls

The Facility will utilize state-of-the-art air emission controls. Each gas turbine/HRSG will be equipped with a Selective Catalytic Reduction (SCR) system for the control of nitrogen oxides (NO_X) and an oxidation catalyst for the control of carbon monoxide (CO), volatile organic compounds (VOCs) and hazardous air pollutants (HAPs). Water injection will also be used during ULSD firing for NO_X emissions control. Emissions of carbon dioxide (CO_2), sulfur dioxide (SO_2), and particulate matter (PM_{10}/$PM_{2.5}$) from the gas turbines/HRSGs will be minimized by the use of clean burning, low sulfur, low ash fuels, and the most efficient gas turbine combustion technology commercially available.

NO_X emissions from the natural gas fired auxiliary boiler and dew point heater will be controlled by the use of ultra-low NO_X burners and flue gas recirculation (FGR).

3.8.2 Wastewater Discharge Controls

As discussed above, the Facility will use ACCs for cycle heat rejection, which will significantly reduce water use and the production of wastewater. Wastewater generated within the Facility will be segregated by area into separate wastewater streams according to the source of the wastewater. The primary sources of wastewater include process wastewater (primarily from the water treatment processes), general service water (general housekeeping floor and equipment drains) and sanitary wastewater.

Process wastewater sources needing pH adjustment will be treated by a wastewater neutralization system and wastewater from the general service system will collected and treated through an oil/water separator to remove oil that might be in drains from various pieces of equipment. Wastewaters generated from process wastewater and general service water sources will be collected and stored in an on-site wastewater storage tank.

The Project is in discussions with Town of Burrillville and the Burrillville Sewer Commission (BSC) to determine whether wastewaters from the Facility can be discharged and treated within the existing Burrillville Wastewater Treatment plant. If approved by BSC and RIDEM, periodically wastewaters collected within the Facility will be pumped via a force main to a sewer connection with the Burrillville Sewer Authority wastewater system.

3.8.3 Stormwater Discharge Controls

Stormwater management at the Facility will comply with the requirements of RIDEM's Rhode Island Stormwater Design and Installation Standards Manual (as amended March 2015). The Facility will meet the Minimum Stormwater Management Standards outlined in the referenced guidance document to the extent practicable. The proposed Project is new development and, therefore, Minimum Standard 6 (Redevelopment and Infill Projects) does not apply. Minimum Standards 1-5 and 7-11 will be met by the Facility's stormwater management program described below.

The majority of the Facility's improved surface area qualifies as a "Land Use with Higher Potential Pollutant Load (LUHPPL)" as defined in RIPDES Rule 31(b)(15)(vi) – Steam electric power generating facilities. Because of the required site arrangement, the Facility is ineligible for a No Exposure Certification for Exclusion from RIPDES Stormwater Permitting and accordingly a stormwater management program will be developed to comply with the criteria of the LUHPPL classification (where appropriate). Areas to be classified as LUHPPL will drain stormwater to a lined wet vegetated treatment system or filtering practice Stormwater BMP approved for use at LUHPPLs. Infiltration practices will not be proposed in LUHPPL areas.

Portions of the Facility site that are not classified as LUHPPLs include the administration building, parking area, and the site's proposed access road. These areas will drain stormwater to proposed infiltration basin BMPs as applicable based on tested infiltration rates.

Regardless of pollutant load classification, low impact development (LID) strategies will be employed to the maximum extent practicable to reduce the generation of stormwater runoff from the Facility. Please refer to Section 6.4 for more information on proposed LID strategies. Non-LUHPPL areas will achieve groundwater recharge in post-developed conditions in the same watershed as pre-developed conditions through the use of infiltration BMPs. Pollutant reduction of stormwater (water quality Minimum Requirement) will occur from the use of wet vegetated treatment systems or filtering practices (LUHPPL areas) and infiltration (non-LUHPPL areas). Conveyance facilities, natural channels, and overbanks will be sized and designed to protect them from stormwater flows in accordance with RIDEM standards.

Source control and pollution prevention measures will be employed to minimize adverse water quality impacts from Facility runoff. A Stormwater Pollution Prevention Plan (SWPPP) and Soil Erosion and Sediment Control (SESC) Plan will be developed in accordance with provisions of the Rhode Island Soil Erosion and Sediment Control Handbook and best practices. Illicit discharges are prohibited under a National Pollutant Elimination Discharge Elimination System (NPDES). The Facility is designed to fully separate stormwater from other wastewaters including sanitary wastewater. Following construction the Facility designs will be conformed to as-builts, in part, to ensure that no illicit connections occurred. A stormwater management system operation and maintenance program will be developed and included as part of the stormwater management program. The operation and maintenance program will be implemented at the Facility following termination of coverage under construction stormwater permits.

3.8.4 Noise Controls

As summarized in Table 3.8-1, the proposed acoustical design of the Project includes extensive noise attenuation features.

Table 3.8-1

Proposed Acoustical Design

Equipment Item	Control
Air Cooled Condenser	Low-Noise Design
Auxiliary Boiler	Enclosed within a Building
Auxiliary Boiler FD Fan Intake	High-Performance Duct Silencer Banks
Auxiliary Boiler Louvered Ventilation Openings	Acoustical Louvers
CCW Heat Exchanger	Low-Noise Design
Combustion Turbine Air Intakes	High-Performance Air Intake Silencers
Combustion Turbine	Enclosed within a Building
Combustion Turbine Ventilation	Ventilation System Silencers
Combustion Turbine Exhaust Diffusers	Exhaust Diffuser Noise Walls
Combustion Turbine Exhausts	Exhaust Mitigated via SCR/HRSGs and High-Performance Exhaust Stack Silencers
Fuel Gas Compressors	Enclosed within a Building
Generation Building Louvered Ventilation Openings	Acoustical Louvers
GSU Transformers	Low-Noise Design
HRSG Boiler Feedwater Pumps	Enclosed within a Building
HRSG Transition Ducts	Acoustical Shrouds
Steam-Turbine	Enclosed within a Building
Water Treatment Equipment	Enclosed within a Building

3.9 Identification of Support Facilities and Accessibility

3.9.1 Roads

The site access road connects the Facility to the Wallum Lake Road (Route 100). This road is designed as a Class A road to handle equipment loads during and after plant construction. The route of the road is shown on Figure 3.4-3.

3.9.2 Gas Line

Natural gas will be delivered to the Facility from the neighboring Spectra Energy gas compression station north of Algonquin Lane. Gas delivery pressure varies throughout the year and is estimated at about 450 – 800 psig .The Facility design includes natural gas compressors to boost and maintain gas pressure at levels necessary for gas turbine operation, dew point heaters, and other associated equipment identified in section 3.3.5. The preliminary route of the natural gas pipeline from the Spectra Energy compressor station to the Facility is shown on Figure 3.4-2.

3.9.3 Electric Transmission Lines

The electrical grid interconnection for the Facility will be at the National Grid Sherman Road Switching Station to the northeast of Burrillville, Road Island. The Project will include the construction of a new 345 kV overhead transmission line approximately 0.8 miles in length along a new right-of-way from the switchyard located at the Facility to the existing National Grid 345kV ROW located west of the Facility.

From this point, the new transmission line will run within the existing national Grid ROW approximately 6.0 miles to the Sherman Road Switching Station. The switchyard and the new transmission line are shown on Figure 3.4-3.

In addition, the 345 kV Sherman Road Switching Station will also be expanded to accommodate the new transmission line connection and generation capacity addition. There will also be upgrades to Line 3361, a 10.8-mile line from the Sherman Road Switching Station to ANP Blackstone.

3.10 Water Supply Pipeline

Water supplied to the Facility will be provided from the Pascoag Utility District (PUD) by re-activation and treatment of a currently inactive PUD groundwater well that became contaminated in 2001 by an off-site contamination source. As a result of this well-documented groundwater contamination event, PUD was forced to terminate is use of its primary well water supply and interconnect its water supply system with the Harrisville Fire District (HFD) to meet the requirements of its customers for potable water.

Because of that 2001 contamination event and the closure of PUD's primary groundwater supply, PUD currently receives approximately 88% of its water supply from the HFD under a wholesale water purchase agreement. PUD's average annual water demand today is approximately 0.3 MGD with a summer peak of approximately 0.35 MGD. PUD supplements the water supplied from HFD from PUD's only operating groundwater well (Well #5) which was not impacted by the 2001 contamination event. PUD's wholesale water supply agreement with the HFD is for a maximum supply of 0.6 MGD provided through PUD's Main Street interconnection with the HFD water supply system. Although PUD has a wholesale water agreement with the HFD for as much as 0.6 MGD, PUD currently only draws a portion of that maximum flow to meet its daily needs.

To meet the water supply requirements for the Facility, Invenergy and PUD will execute a water supply agreement that PUD will, on an exclusive basis, provide water treated to an industrial standard to the Facility from PUD's contaminated well water supply (well #3A). Water to be supplied to the Facility will be treated by an activated carbon treatment system producing water of sufficient quality for use in the Facility. This treated water will be supplied to the Facility in a dedicated water supply pipeline that will not be interconnected into the PUD potable water supply system; there will be no other users of this industrial water supply. None of this treated water intended for use by the Facility will be used as a potable water supply and none of the water produced by the carbon treatment system will be supplied to any other user in the community. Costs related to the treatment of the PUD contaminated supply will be covered entirely by the Facility under a long-term water supply agreement with PUD.PUD will secure, with the help of CREC, all of the required permits and authorizations to implement this water supply agreement.

The proposed Facility has been configured as a nominal 850-1,000 MW, energy efficient, dual-fuel combined cycle power plant that will utilize dry cooling to conserve water use. The Facility's daily water demand will vary considerably depending on plant load, ambient air temperature, and use of natural gas as a fuel. Additionally, if during the winter season natural gas supplies coming into New England are in short supply or constrained, the gas turbines can be fired by ultra-low sulfur distillate (ULSD), as requested by Independent System Operator New England (ISO-NE). This will also affect the Facility's daily water demand.

The Facility's daily water demand with both combustion turbines firing natural gas under full-load normal conditions will be approximately 104,000 gallons per day (gpd) or 0.104 million gallons per day (MGD),a full-load summer condition will be approximately 225,000 gpd, or 0.225 MGD assuming the evaporative cooler is running 24 hours a day. During the infrequent periods when the Facility is requested to fire one of the gas turbines on oil, the daily water demand for the Facility will increase to approximately 925,000 gpd, or 0.925 MGD for each day of oil firing. Although the total water use of the Facility increases when firing ULSD oil, the total number of days that the Facility will be required to fire oil will typically be determined by the grid operator (ISO-NE) based on the severity of winter conditions when there is a need to conserve natural gas for heating needs of the region. Generally, based on history, the number of days per year the Facility will be requested to use ULSD will be approximately five days.

Water will be supplied to the Facility by PUD in a dedicated water supply pipeline that will extend from PUD's well water carbon treatment facility to the Facility site. Figure 3.10-1 provides a map of the planned route of the dedicated water supply pipeline. This dedicated water pipeline will be installed in existing public roads.

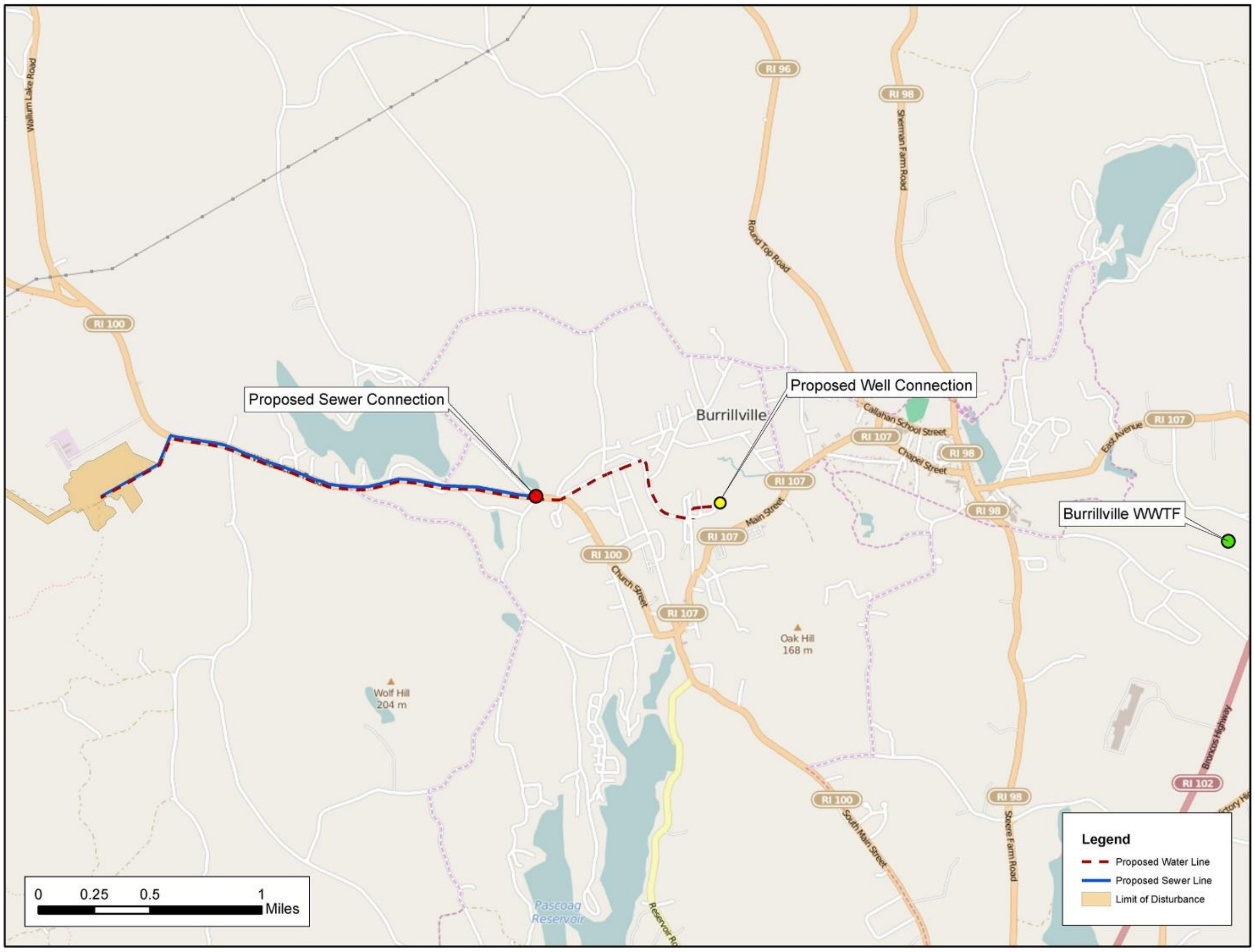


Figure 3.10-1
Water and Sewer Connection

3.11 Wastewater Sewer Pipeline

The Facility has been configured to use dry cooling to conserve its water use, which also reduces the total volume of wastewater generated by the Facility. The wastewater volume generated by the Facility will vary throughout the year depending on the operating load and ambient conditions. The typical daily flow will vary from 69,000 gpd to 89,000 gpd. During the infrequent times in the winter that the Facility is required to fire USD oil, the total wastewater volume discharge will be approximately 200,000 gpd.

The Project has held discussions with Town of Burrillville and the Burrillville Sewer Commission (BSC) to determine whether wastewaters from the Facility can be discharged and treated within the existing Burrillville Wastewater Treatment plant. The BCS has provided a letter of support, which is included in Appendix I. If approved by BSC and RIDEM, wastewater collected within the Facility will be pumped periodically via a force main to a sewer connection with the Burrillville Sewer Authority waste water system.

If the Project's wastewater can be accepted for discharge and treatment by the Burrillville Wastewater Treatment Plant, a dedicated force main sewer line will be installed from the Facility to an interconnection to the existing Town of Burrillville sewer system. Figure 6.2-1 provides a map of the planned route of the force main. The dedicated force main will be installed in existing roads to the point of interconnection to the existing Town sanitary sewer system.

4.0 PROJECT COST, SCHEDULE, AND FINANCING PLAN

4.1 Project Cost

Invenergy is privately funding the construction of the Project and will seek project financing from third party debt providers, as described below. This structure does not impose a burden on ratepayers but rather shifts the risks of costs for development and operations to Invenergy.

A brief summary of Invenergy's expected Project costs are set forth below. The Project is being privately financed, without ratepayer funds, and the power produced will be sold into the competitive ISO-NE market through a competitive bidding process.

In the previous EFSB decisions (e.g. Tiverton Power Associates, L.P., Docket SB-97-1 (March 25, 1998)) the EFSB explained that the requirements for a detailed cost analysis of the project are largely anachronistic after the restructuring of the wholesale electric industry implemented by the Utility Restructuring Act of 1996.

Therefore, a brief description of project cost is provided here. Should project costs proves uneconomic, the risk will be entirely placed on Invenergy and not on Rhode Island ratepayers. Also, as a result of the restructuring of the electric industry, and the competitive nature of the wholesale markets, detailed information on project cost structure is commercially sensitive and would put Invenergy at a competitive disadvantage, if disclosed to competitors

Equipment

- *Combustion Turbines and Generators*
- *Heat Recovery Steam Generators*
- *Exhaust Stacks*
- *Steam Turbine Generators*
- *Cooling and Related Systems*
- *Switchyard*

Total Equipment Cost Estimate: $350 Million

Construction and Other Costs

- *Development*
- *Design*
- *Construction*

Total Construction Cost Estimate: $350 Million

TOTAL ESTIMATED PROJECT COST: $700 Million

4.2 Project Schedule

Clear River Energy Center will be bidding into the NE ISO Forward Capacity Auction 10 on February 8, 2016 to support obligation to provide capacity to NE ISO beginning June 1, 2019. Invenergy began early stage development of the Clear River Energy Center with the execution of the site land option in December 2014.

Permitting and project development work is expected to continue into 2016. An Air Permit application was submitted to RIDEM on June 26 2015. Concurrently, industry-leading Equipment Manufacturers (OEM) and Engineering, Procurement, and Construction Contractors (EPC) were engaged to develop proposals for the Project. The selected OEM will be determined by November 13, 2015 and released under a Notice to Proceed (NTP) by May 2016. The selected EPC contractor will be released under a Limited Notice to Proceed (LNTP) by July 2016. The NE ISO Interconnection Agreement will be signed in April 2016. All other permits and approvals are expected to be issued by financial close in Q4 of 2016. Following financial close, the EPC will be released under a Full Notice to Proceed (FNTP) and will mobilize to site. Expected Substantial Completion dates for Units 1 and 2 are March 1, 2019 and May 1, 2019 respectively.

4.3 Financing Plan

Over the last 10 years, Invenergy has raised more than $15 billion to support its worldwide portfolio of 70 projects totaling over 9,000 MW that are operating or under construction. Invenergy is an experienced company that proficiently structures project financing and maintains strong relationships with banks in the United States, Canada, Europe, and Asia.

To illustrate Invenergy's financial capability, the Company was able to bring over 630 MW into operation in 2014 spanning across all technologies within Invenergy's expertise: wind, natural gas, storage and solar.

Invenergy would seek financial institutions that have an existing relationship with Invenergy to develop a more detailed approach to financing. Invenergy has successfully worked with the following institutions (in alphabetical order): Allstate, Associated Bank, BAML, Bayern LB, BNP Paribas, CoBank, Credit Suisse, Dexia, Deka Bank, GE EFS, HSH Nordbank, ING, John Hancock (Manulife), JP Morgan, Heleba, Macquaire Bank, MetLife, Mizuho, Morgan Stanley, Natixis, Nord LB, Prudential, Rabobank, RBC, RBS, Sabadell United Bank, Santander, Siemens, Sumitomo Mitsui Banking Corporation (SMBC), SunLife, UniCredit, Union Bank (now MUFG), US Bank, and Wells Fargo / Wachovia.

5.0 PROJECT BENEFITS

5.1 Economic Benefits

To characterize and evaluate the economic development impacts resulting from the construction and ongoing operation of the 1,000 MW Clear River natural gas-fired combined cycle generation facility, Invenergy retained the services of Professor Edinaldo Tebaldi and PA Consulting Group ("PA").

Dr. Tebaldi is an associate professor of economics at Bryant University. He also serves as the Rhode Island forecast manager for the New England Economic Partnership (NEEP). He is an applied econometrician with research interests in economic growth, development, and labor market outcomes. Dr. Tebaldi has published several articles in refereed journals and co-authored a number of economic impact assessment studies and reports analyzing economic conditions across New England States.

PA's Global Energy & Utilities practice regularly performs power market analyses and evaluates the economics of power generating assets across the U.S., including the New England power market. PA understands the economic development considerations associated with power generation investment and utility power procurement, and has used input-output models to evaluate the economic impacts driven by such decisions.

This subsection introduces the methodology and projected impacts on employment, wages, and the overall economy in Rhode Island and the surrounding area.

5.1.1 Overview

As is typically the case with generation facilities, CREC will drive significant economic impacts in the State of Rhode Island. Economic development impacts associated with the Project will result from the following three areas:

1. Construction of the facility – Equipment, materials, and labor employed during construction as well as state sales tax, permitting fees, and other activities.
2. Ongoing operation of the facility – Fixed and variable costs associated with the materials and labor needed to operate the facility as well as annual property taxes.
3. Power market cost savings to Rhode Island ratepayers – The addition of new efficient generation capacity in Rhode Island will result in lower capacity and power prices in the near term, thereby driving significant savings to Rhode Island ratepayers during the plant's early years. From 2019-2022, cumulative savings to the Rhode Island customer are projected to be greater than $280 million, or approximately $70m annually. PA has evaluated the induced economic effects on the Rhode Island economy associated with these near-term electricity customer cost savings.

5.1.2 Methodology

To estimate the magnitude of the resulting economic impacts, this study uses input-output (I-O) analysis. I-O analysis accounts for inter-industry relationships within a city, state, or expanded area, and employs the resulting economic activity multipliers to estimate how the local economy will be affected by a given investment (in this case the construction and ongoing operation of CREC).

Multiplier analysis is based on the notion of feedback through input-output linkages among firms and households who interact in regional markets. Firms buy and sell goods and services to other firms and pay wages to households. In turn, households buy goods from firms within the economic region. Thus, the economic impact of CREC spreads to other local businesses through direct purchases from them as well as from purchases of locally produced goods and services, which arise from the income derived by the employment that is created. Further impacts occur because of feedback effects – where other local firms require more labor and inputs to meet rising demand for their output, which has been stimulated by CREC construction and operation.

The economic impact of CREC construction and operation can be categorized as follows:

1. **Direct Effects** – Jobs, income, output and fiscal benefits that are created directly by the construction and ongoing operations of CREC. The jobs (and other benefits) that are created may be short-term, as in the case of construction jobs, or long-term, such as the operations and maintenance positions that exist throughout the life of the generation facility.
2. **Indirect Effects** – Jobs, income, output and fiscal benefits that are created throughout the supply chain and that are spawned by the direct investment to build and operate the facility. Indirect jobs include the jobs created to provide the materials, goods, and services required by the construction and operation of CREC, as well as the jobs created to provide the goods and services paid for with the wages from the direct jobs.
3. **Induced Effects** – Jobs, earnings, and output and fiscal benefits created by household spending of income earned either directly from CREC or indirectly from businesses that are impacted by CREC.

There is significant complexity involved in the calculation of these effects, particularly in the calculation of the indirect and induced effects, but comprehensive estimates of economic impacts require all three. These estimates are also sensitive to the set of assumptions considered in the study, principally assumptions regarding the leakage of economic activity outside the state. In addition, a series of variables, including changes to the price of electricity, will influence the multiplier benefit analysis and therefore have been considered in tandem to assess the true contribution of CREC to the Rhode Island economy.

5.1.2.1 Input-Output Models Employed

The job creation, earnings, and overall economic impact of CREC on Rhode Island have been analyzed using project cost specifics and two input-output models: IMPLAN and the National Renewable Energy Lab's Jobs and Economic Development Impact model (JEDI).

IMPLAN is an economic analysis tool that takes data from multiple government sources and employs an estimation method based on industry accounts or Input-Output Matrix that allows using multipliers to make estimations of how changes in income and spending impact the local economy. IMPLAN estimates are generated by interacting the direct economic impact of CREC with the Regional Input-Output Modeling System (RIMS II) multipliers for Rhode Island. The U.S. Bureau of Economic Analysis (BEA) provides these multipliers.

The Jobs and Economic Development Impact (JEDI) model estimates the economic impact of constructing and operating power generation plants at the state level. The JEDI model also uses an input-output methodology and was built utilizing economic data from IMPLAN. The JEDI model allows estimating of the economic impact of power generation investment in a state including local labor, services, materials, other components, fuel, and other inputs. The model also allows adjusting the portion of project investment that occurs locally.

5.1.2.2 Modeling Assumptions

As discussed above, the JEDI and IMPLAN estimates are sensitive to the set of assumptions utilized in the model, particularly the portion of project investment that occurs locally (local share). Through local share percentages, the model allows accounting for the leakage of economic activity outside the state's border. Table 5.1-1 presents the local shares for the construction phase that were used to estimate the economic impact of CREC on Rhode Island only. These parameters are consistent with those utilized in other similar studies and were adjusted to match Rhode Island's specific conditions. For instance, 100 percent of the spending with turbines (power generation) is paid to vendors outside Rhode Island. On the other hand, the model assumes that 87% of the construction labor required to construct the facility will be sourced from within Rhode Island.

Table 5.1-1
Local Share - Construction Phase

Item	Local Share
Facility and Equipment	
Power Generation	0%
General facilities	75%
Plant Equipment	5%
Labor and Management	
Construction Labor	87%
Project Management (construction and owner's)	16%
Others	
Engineering/Design	17%
Construction insurance	0%
Land	100%
Permitting Fees	100%
Grid intertie	25%
Spare Parts	5%
Sales Tax (Materials & Equipment Purchases)	100%

Table 5.1-2 provides the local shares utilized to calculate the economic impact of the ongoing operation of the CREC. It is worth noting that 100% of the spending on natural gas fuel (the commodity itself) will be paid to vendors outside Rhode Island. However, it also worth noting that 100% of the labor and 85% of the services, two major sources of ongoing spending and investment for a generation facility, are assumed to be sourced from State of Rhode Island business.

Table 5.1-2

Local Share- Operations and Maintenance Phase

Item	Local Share
Fixed Costs	
Labor	100%
Materials	25%
Services	85%
Variable Costs	
Water	100%
Catalysts & chemicals	85%
Fuel Cost	0%

The economic impact analysis also incorporates power market cost savings to Rhode Island ratepayers. The addition of new efficient generation capacity in Rhode Island will result in lower capacity and power prices for Rhode Island ratepayers in the near term, thereby driving significant savings to Rhode Island ratepayers during the plant's early years. These power market cost savings were determined by comparing Rhode Island's portion of energy and capacity market costs under modeling scenarios completed 1) with CREC at 1,000 MW-net, and 2) without CREC.

5.1.3 Economic Development Impacts

The construction, ongoing operation, and near-term ratepayer savings resulting from the Project will create jobs and drive significant economic development, both in Rhode Island and throughout the Northeast region.

The estimates in this section include the direct, indirect, and induced impacts of Project construction, ongoing operation, and ratepayer bill savings on Rhode Island's economy.

5.1.3.1 Economic Impacts – Rhode Island Only

To evaluate the economic impacts of CREC within Rhode Island, input-output analysis was completed according to the local share percentages introduced in Section 5.1.2.1.

Table 5.1-3 reports the annual job creation, earnings, and overall economic impact of CREC on the state of Rhode Island. It is important to note that the most significant economic impacts will be realized in the early years of the Project: the construction of CREC will bring significant investment and construction activity to Rhode Island from 2016 to 2019, and the first four years of operation will produce substantial energy and capacity cost savings to customers.

Table 5.1-3

Economic Development - Results Summary

Rhode Island Only, 2016-2034

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Employment Impact (FTEs per year)																			
Construction Period	47	718	930	250	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Facility Operations	0	0	0	123	216	220	225	230	235	240	246	251	257	262	268	274	280	286	292
Cost Savings to Customer	0	0	0	498	733	419	159	0	0	0	0	0	0	0	0	0	0	0	0
Total Employment Impact	**47**	**718**	**930**	**871**	**949**	**639**	**384**	**230**	**235**	**240**	**246**	**251**	**257**	**262**	**268**	**274**	**280**	**286**	**292**
Earnings Impact ($ - millions)																			
Construction Period	5.9	90.7	117.4	31.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Facility Operations	0.0	0.0	0.0	8.3	14.5	14.8	15.1	15.5	15.8	16.2	16.5	16.9	17.3	17.6	18.0	18.4	18.8	19.2	19.7
Cost Savings to Customer	0.0	0.0	0.0	26.3	39.5	23.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Earnings Impact	**5.9**	**90.7**	**117.4**	**66.2**	**54.0**	**38.3**	**24.1**	**15.5**	**15.8**	**16.2**	**16.5**	**16.9**	**17.3**	**17.6**	**18.0**	**18.4**	**18.8**	**19.2**	**19.7**
Economic Output ($ - millions)																			
Construction Period	8.9	137.1	177.4	47.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Facility Operations	0.0	0.0	0.0	19.9	34.8	35.6	36.3	37.1	38.0	38.8	39.6	40.5	41.4	42.3	43.3	44.2	45.2	46.2	47.2
Cost Savings to Customer	0.0	0.0	0.0	75.3	113.2	66.1	25.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Economic Output	**8.9**	**137.1**	**177.4**	**142.9**	**148.0**	**101.6**	**62.0**	**37.1**	**38.0**	**38.8**	**39.6**	**40.5**	**41.4**	**42.3**	**43.3**	**44.2**	**45.2**	**46.2**	**47.2**

In summary, the job creation, earnings, and overall economic impact of the Project on the state of Rhode Island are projected as follows:

- **Rhode Island Jobs** – From 2017-2021, which includes the most intense two years of construction and the first years of operation, CREC will support the creation of more than 820 full-time jobs per year. CREC will create an average of more than 400 full-time jobs per year from 2016-2034 in Rhode Island.
- **Rhode Island Earnings** – From 2017-2021, CREC will support the creation of approximately $370 million in earnings to Rhode Island workers, or more than $70 million per year. Earnings to Rhode Island employees as a result of CREC will total more than $600 million from 2016-2034.
- **Rhode Island Economic Output** – From 2017-2021, the total economic impact on Rhode Island is projected to be more than $700 million, or approximately $140 million per year. The overall impact of CREC on the Rhode Island economy will total almost $1.3 billion from 2016-2034, or an average of nearly $70 million annually.

Figure 5.1-1 provides a breakdown of the direct impacts versus the indirect and induced impacts of CREC construction and ongoing operations.

The direct economic impacts themselves will be significant, realized in the form of jobs, income, output, and benefits created directly by the construction and ongoing operations of CREC. In addition, CREC will generate significant economic activity in Rhode Island through input-output linkages among firms and households who are affected by its construction and operations. From 2016-2034, the indirect and induced economic impact of CREC on the Rhode Island economy will total $943 million, approximately 74% of the total output creation.

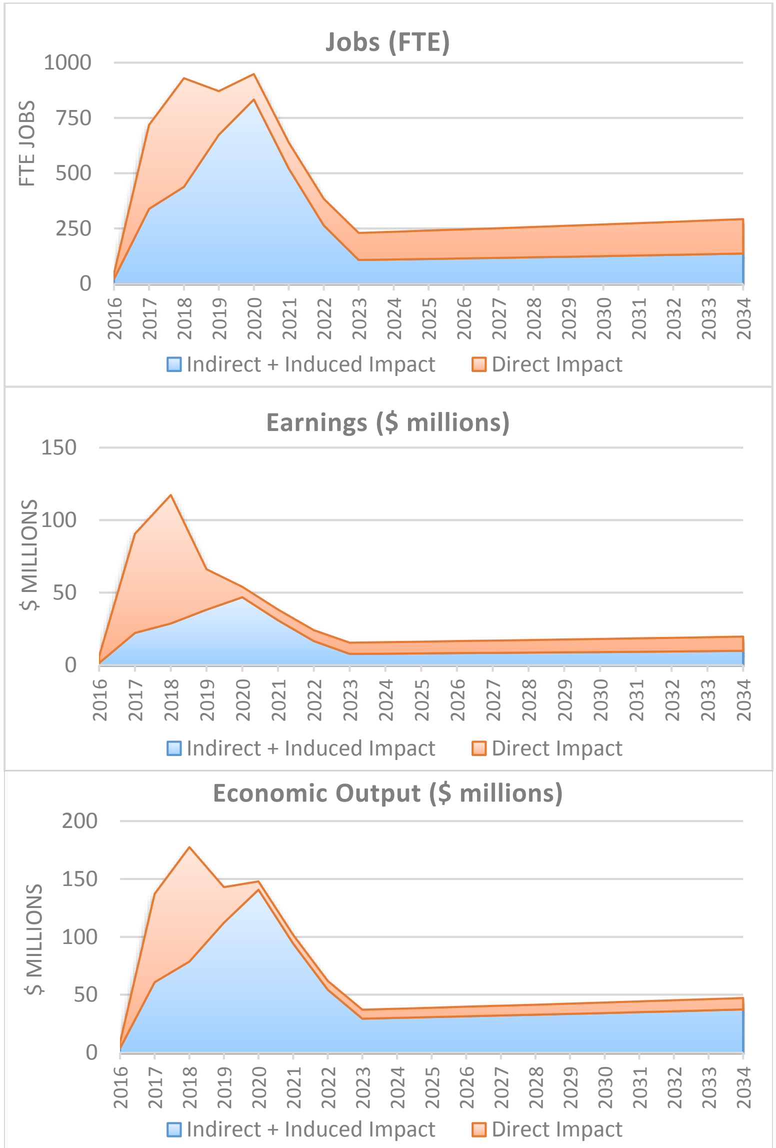


Figure 5.1-1
Direct vs Indirect/Induced Economic Impacts
Rhode Island Only

Similarly, approximately 50% of the $600 million in earnings that CREC will generate in the state from 2016 to 2024 will be indirect and induced earnings, and the jobs chart demonstrates that just under 60 percent of the jobs supported by CREC will be induced and indirect jobs. Overall, the impact estimates suggest that CREC operation and demand for local services and materials will have a significant multiplier effect on the state economy. This multiplier effect will be particularly strong for output creation.

5.1.3.2 Economic Impacts - Rhode Island and Surrounding Region

Significant economic impacts will accrue outside of Rhode Island as well. Project needs that cannot be met within Rhode Island – most notably generation equipment that is not currently manufactured within the state – will drive job creation and economic development in surrounding states. To evaluate the economic impacts of CREC on Rhode Island and the surrounding region, input-output analysis was completed with all local share percentages introduced in Section 5.1.2.1 set to 100% except for fuel, which was kept at 0%. In other words, this scenario is designed to evaluate the approximate the economic impact of the construction and ongoing operation of CREC on Rhode Island and the surrounding region, but excludes the U.S. impact associated with ongoing natural gas procurement.

Table 5.1-4 presents the impact estimates of the plant on the economy as a whole.

Table 5.1-4

Economic Development Results Summary

Rhode Island and Surrounding Region, 2016-2034

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Employment Impact (FTEs per year)																			
Construction Period	147	2256	2921	786	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Facility Operations	0	0	0	258	453	463	473	483	494	505	516	527	539	551	563	575	588	601	614
Cost Savings to Customer	0	0	0	498	733	419	159	0	0	0	0	0	0	0	0	0	0	0	0
Total Employment Impact	**147**	**2256**	**2921**	**1542**	**1186**	**881**	**632**	**483**	**494**	**505**	**516**	**527**	**539**	**551**	**563**	**575**	**588**	**601**	**614**
Earnings Impact ($ - millions)																			
Construction Period	32.7	501.0	648.6	174.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Facility Operations	0.0	0.0	0.0	16.6	29.2	29.8	30.5	31.1	31.8	32.5	33.2	34.0	34.7	35.5	36.2	37.0	37.9	38.7	39.5
Cost Savings to Customer	0.0	0.0	0.0	26.3	39.5	23.5	9.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Earnings Impact	**32.7**	**501.0**	**648.6**	**217.4**	**68.7**	**53.3**	**39.4**	**31.1**	**31.8**	**32.5**	**33.2**	**34.0**	**34.7**	**35.5**	**36.2**	**37.0**	**37.9**	**38.7**	**39.5**
Economic Output ($ - millions)																			
Construction Period	33.6	515.2	667.0	179.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Facility Operations	0.0	0.0	0.0	69.8	122.3	125.0	127.7	130.5	133.4	136.3	139.3	142.4	145.5	148.7	152.0	155.4	158.8	162.3	165.8
Cost Savings to Customer	0.0	0.0	0.0	75.3	113.2	66.1	25.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Economic Output	**33.6**	**515.2**	**667.0**	**324.5**	**235.4**	**191.0**	**153.4**	**130.5**	**133.4**	**136.3**	**139.3**	**142.4**	**145.5**	**148.7**	**152.0**	**155.4**	**158.8**	**162.3**	**165.8**

Excluding the significant U.S. jobs impact associated with ongoing natural gas procurement, the economic impact of the plant on the economy as a whole (this time not limited to Rhode Island) is projected as follows:

- **Jobs** - The Project will support an average of approximately 850 full-time jobs per year from 2016-2034, with an average of approximately 1,750 full-time jobs created annually from 2017-2021, the most intense two years of construction and the first years of operation.
- **Earnings** - The Project will create nearly $2 billion in total earnings from 2016-2034.
- **Economic Output** -The Project will generate approximately $3.9 billion in total economic output from 2016-2034.

Figure 5.1-2 provides a breakdown of the direct impacts versus the indirect and induced impacts of CREC construction and ongoing operations. The direct impacts are similar in magnitude to those in the Rhode Island only analysis because most direct economic effects from the facility are realized within the state, but the total output is approximately three times as large and the indirect and induced impacts account for a much larger percentage of the economic impacts in this case.

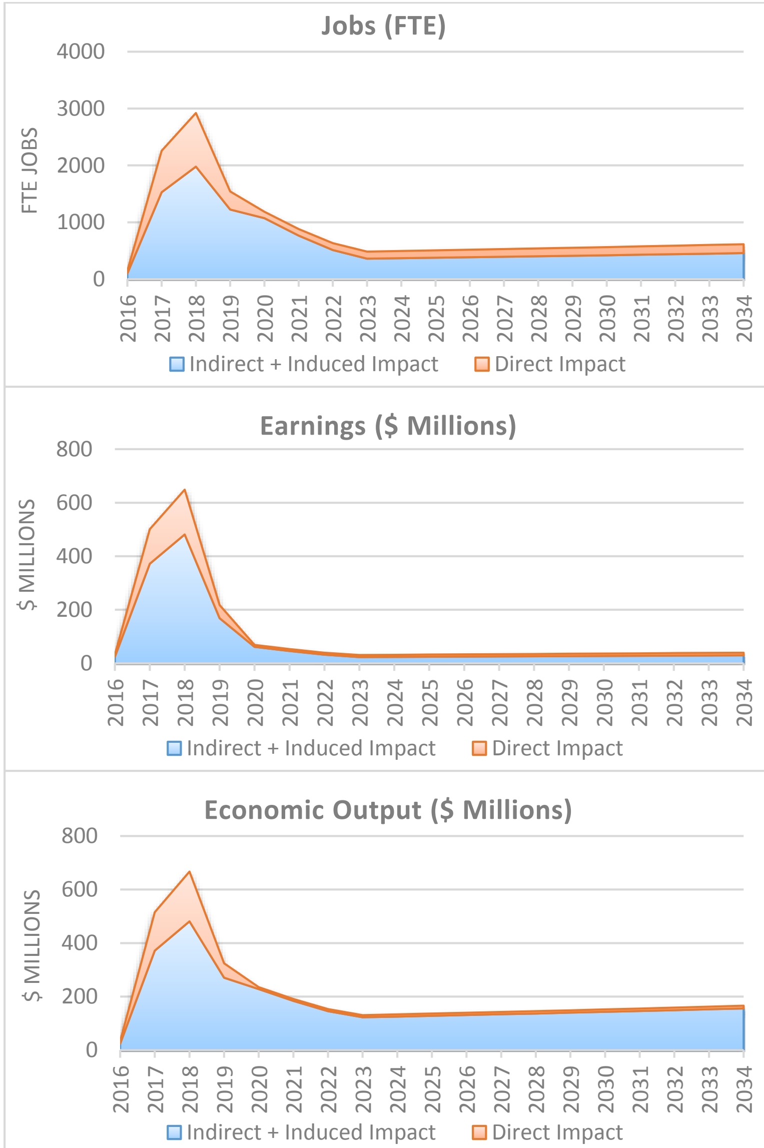


Figure 5.1-2
Direct vs Indirect/Induced Economic Impacts
Rhode Island and Surrounding Region

5.2 Regional Environmental Benefits

In addition to the economic benefits, the addition of the Project will reduce ISO-NE/NYISO Footprint CO_2, NO_x and SO_2 emissions by one (1) to four (4) percent per annum. See Table 5.2-1, which presents the results of the Aurora modeling analysis further described in section 7.0. These results include the recently announced retirement of Entergy's Pilgrim Nuclear Station

Table 5.2-1

Project Impact on Total Emissions Reductions on ISO-NE/NYISO Footprint

% Change

	2019	2020	2021	2022	2023	2024	2025
CO_2 Emission Change	-1%	-1%	-1%	-1%	-1%	-1%	-1%
NO_x Emission Change	-2%	-3%	-3%	-2%	-3%	-2%	-3%
SO_2 Emission Change	-3%	-4%	-4%	-3%	-3%	-2%	-3%

The net system-wide decrease is a result of CREC being a highly efficient natural gas-fired combined cycle power plant. CREC requires less fuel per MWh generated than its gas-fired peers, resulting in economic and emissions advantages relative to existing gas-fired generators. As such, CREC will displace less efficient, higher cost and potentially higher emitting resources that are currently dispatched on the power system. As a participant in the Regional Greenhouse Gas Initiative ("RGGI"), all thermal generators greater than 25 MW located within Rhode Island are subject to RGGI program CO_2 emissions caps. As such, the addition of the Facility will not impact the overall emissions reduction goals of RGGI given its emissions are also accounted for under the RGGI cap. Moreover, given the likelihood that the addition of the Facility will actually lead to an overall decrease in regional CO_2 emissions given the high efficiency of the unit (see previous section), it may lead to an overall less costly compliance trajectory for the region under the RGGI program.

In addition, as a new unit, the Facility will not be subject to the Environmental Protection Agency's ("EPA") recently finalized Clean Power Plan ("CPP"), which addresses CO_2 emissions from existing thermal resources. As such, the addition of the Facility will not impact the state of Rhode Island's overall ability to meet the CPP targets and, in some instances, could assist the state in meeting targets depending on the ultimate compliance pathways to be included in Rhode Island's yet-to-be developed and filed State Implementation Plan ("SIP").[1]

6.0 ASSESSMENT OF ENVIRONMENTAL IMPACTS

6.1 Air

The Project will comply with all applicable air pollution control regulations and air quality standards and will have a significant positive impact on air quality in the region. The Facility will be the most efficient and lowest emitting fossil fuel fired electric generating facility in the ISO-NE region. The power generated by the Facility will displace power currently being produced by less efficient and higher emitting generating resources. As a result, there will be significant decreases in criteria pollutant, hazardous air pollutant, and greenhouse gas emissions from the electric generating sector in the region resulting from the operation of the Facility, as documented in Section 5.2. These decreases in emissions will lead to improved air quality, helping achieve and maintain attainment with the National Ambient Air Quality Standards (NAAQS). The expected decreases in greenhouse gas emissions will help Rhode Island and other neighboring states to achieve compliance with the EPA's Clean Power Plan and other state and regional greenhouse gas emission reduction goals and initiatives.

The NAAQS have been established by the EPA for the criteria pollutants for the protection of public health and welfare. The criteria pollutants are nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), ozone (O_3), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead (Pb). The NAAQS consist of primary and secondary standards. The primary standards are intended to protect human health, including the most sensitive of the population, with a margin

[1] Current regulations contemplate a final version or draft of the SIP to be submitted no later than September 2016.

of safety. The secondary standards are intended to protect the public welfare from known or anticipated adverse effects associated with the presence of air pollutants, such as damage to property, soils, or vegetation.

Areas that have demonstrated compliance with an NAAQS via collected ambient air monitoring data are designated as being in attainment with the NAAQS, or unclassifiable if insufficient data has been collected for an attainment designation by the EPA. Areas for which the collected ambient air monitoring data shows an exceedance of an NAAQS are designated as nonattainment, and must implement emission reduction measures in a State Implementation Plan (SIP) to achieve compliance.

RIDEM has adopted the NAAQS and has also established Acceptable Ambient Levels (AALs) for various air toxic compounds. The State of Rhode Island is currently designated as being in moderate nonattainment with the 1997 8-hour ozone NAAQS. Rhode Island is also included in the Ozone Transport Region (OTR). Rhode Island is designated as attainment/unclassifiable for the remaining criteria pollutants. The power generated by the Facility will displace power being generated in Rhode Island and in the region, by less efficient, higher emitting energy resources, helping Rhode Island achieve attainment with the 8-hour ozone NAAQS and maintaining attainment with the NAAQS for the other criteria pollutants.

An air quality impact analysis has been completed for the Project which demonstrates that the emissions from the Facility, when combined with existing ambient air background concentrations and the ambient air impacts from nearby interacting emission sources, will not cause or contribute to an exceedance of any NAAQS or AAL at or beyond its property line. The results of the air quality impact analysis conducted for the Project have demonstrated that air quality in the area surrounding the Facility will be maintained at levels which have been deemed by the EPA and RIDEM to be protective of human health and the public welfare, including the most sensitive of the population, with a margin of safety.

6.1.1 Major Source Air Permit

The Facility will be a major source of nitrogen oxides (NO_X), volatile organic compounds (VOC), carbon monoxide (CO) and particulate matter (PM10 & PM2.5) emissions. In accordance with (RIDEM) Air Pollution Control Regulation (APCR) No. 9, Sections 9.4.2 and 9.5.2, new major stationary sources must obtain a Major Source Permit from RIDEM prior to commencing construction.

The following conditions must be met for the issuance of a Major Source Permit:

- A new major stationary source must apply Best Available Control Technology (BACT) for each pollutant it would have the potential to emit.
- New major stationary sources of VOC and/or NO_X must apply the Lowest Achievable Emission Rate (LAER) for each of these pollutants for which it is major. LAER must be based on technological factors and can be in the form of a numerical emission standard or a design, operational or equipment standard.
- The applicant must certify that all existing major stationary sources owned or operated by the applicant within the state are in compliance with all applicable state and federal air pollution control rules and regulations.
- The applicant must provide evidence that the total tonnage of emissions of VOC and/or NO_X (if major) allowed from the proposed new source will be offset by a greater reduction in the actual emissions of each pollutant from other sources.
- The applicant must submit an analysis of alternative sites, sizes, production processes, and environmental control techniques that demonstrate that the benefits of the proposed source significantly outweigh the environmental and social cost imposed as a result of its location and construction.

- The applicant must demonstrate, by means of air quality modeling based on the applicable air quality models, data bases and other requirements specified in the EPA Guideline on Air Quality Models, that allowable emission increases from the proposed Project, in conjunction with all other applicable emission increases or decreases (including secondary emissions), would not cause or contribute to:
  - Air pollution in violation of any national ambient air quality standard; or
  - Any increase in ambient concentrations exceeding the remaining available increment for the specified air contaminant.
- The applicant must provide an analysis of the impairment to visibility, soils, and vegetation that would occur as a result of the source and general commercial, residential, industrial and other growth associated with the source.
- The applicant must provide an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial and other growth associated with source.
- The applicant must demonstrate that emissions from the stationary source will not cause an impact on the ground level ambient concentration at or beyond the property line in excess of that allowed by Air Pollution Control Regulation No. 22 and any Calculated Acceptable Ambient Levels.
- The applicant must conduct any studies required by the Guidelines for Assessing Health Risks from Proposed Air Pollution Sources and meet the criteria therein.
- The applicant must demonstrate that the stationary source will be in compliance with all applicable state or federal air pollution control rules or regulations at the time the stationary source commences operation.

A Major Source Permit Application for the Project, which demonstrates adherence to each of the conditions listed above, was submitted to RIDEM on June 26, 2015. A copy of the Major Source Permit Application has been included in Appendix B. By meeting each of the conditions listed above, the Project has demonstrated that it has been designed to minimize air emissions and air quality impacts to the maximum degree that is technologically feasible for such a source.

6.1.2 Facility Emissions

The Facility's potential emissions of criteria pollutants are summarized on Table 6.1-1. The Facility's potential emissions of non-criteria pollutants are summarized on Table 6.1-2.

For the gas turbines/HRSGs, the annual criteria pollutant potential emissions during steady-state operation firing natural gas are based on base load operation with duct firing at 59°F, which will be base operating load on natural gas. The potential emissions during steady-state operation on ULSD are based on base load operation at 10°F for 720 hours per year per unit, as it is expected that ULSD firing will predominately be during the winter months, when natural gas may be diverted for commercial and residential heating uses.

The potential emissions during gas turbine startups and shutdowns are based on startup/shutdown emissions and event duration information provided by the manufacturers, and the number of each startup and shutdown events Invenergy expects could occur each year.

The potential emissions for the other emission sources are based on their maximum emission rates at full load and their proposed maximum permitted hours of operation per year.

As shown on Table 6.1-1, the Facility will be a major source for NO_X, CO, VOC, CO_2, PM_{10}, and PM $_{2.5}$. The Facility will not be a major source of hazardous air pollutants (HAPs), as shown on Table 6.1-2.

The Facility stationary emission sources are detailed below. The equipment specifications and emissions information provided are based on the current Facility design, preliminary equipment and emissions information provided to date by the potential equipment manufacturers including GE, Siemens and MHI, and the available emission factors. The actual equipment vendors for the Project, the Facility design and layout, the equipment specifications, and the emission rates of each pollutant from each emission source are all subject to change as the Project design advances.

Table 6.1-1

Facility Potential Emissions of Criteria Pollutants[1]

Potential Emissions	Units	Total	Major Source Threshold	Major Source?	Attainment Status	Offsets/Allowances Required
NO_x	ton/yr	285.15	50	Yes	Ozone Nonattainment	342
CO	ton/yr	220.03	100	Yes	Attainment	NA
VOC	ton/yr	77.54	50	Yes	Ozone Nonattainment	93
CO_2	ton/yr	3,626,113	100,000	Yes	No NAAQS	3,579,867
SO_2	ton/yr	50.84	100	No	Attainment	NA
PM/PM10/PM2.5	ton/yr	197	100	Yes	Attainment	NA

[1]Based on preliminary project equipment specifications and emissions estimates provided by GE. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.

Table 6.1-2

Potential Emissions of Non-Criteria Pollutants

Non-Criteria Pollutant	Hazardous Air Pollutant Yes/No	Total Facility Potential Emissions lb/yr	RIDEM APCR No. 22 Minimum Quantity lb/yr	RIDEM APCR No. 22 Applicability Determination Yes/No	Total Potential HAP Emissions ton/yr	Major HAP Source Threshold
1,3-Butadiene	Yes	10	3	Yes	0.01	10
2-Methylmaphthalene	No	0.032	NA	NA		
3-Methylchloranthrene	No	0.0023	NA	NA		
7,12-Dimethylbenz(a)anthracene	No	0.021	NA	NA		
Acenaphthene	No	0.015	NA	NA		
Acenaphthylene	No	0.012	NA	NA		
Acetaldehyde	Yes	219	50	Yes	0.11	10
Acrolein	Yes	0.08	0.07	Yes	0	10
Ammonia	No	81,240	300	Yes		
Anthracene	No	0.013	NA	NA		
Arsenic	Yes	2.7	0.02	Yes	0	10
Barium	No	53	2,000	No		
Benz(a)anthracene	No	0.008	NA	NA		
Benzene	Yes	80	10	Yes	0.04	10
Benzo(a)pyrene	No	0.0039	NA	NA		
Benzo(b)fluoranthene	No	0.01	NA	NA		

Non-Criteria Pollutant	Hazardous Air Pollutant Yes/No	Total Facility Potential Emissions lb/yr	RIDEM APCR No. 22 Minimum Quantity lb/yr	RIDEM APCR No. 22 Applicability Determination Yes/No	Total Potential HAP Emissions ton/yr	Major HAP Source Threshold
Benzo(g,h,i)perylene	No	0.0059	NA	NA		
Benzo(k)fluoranthene	No	0.0047	NA	NA		
Beryllium	Yes	1.7	0.04	Yes	0	10
Butane	No	3,978	NA	NA		
Cadmium	Yes	14	0.07	Yes	0.01	10
Chromium	Yes	28	20,000	No	0.01	10
Chrysene	No	0.012	NA	NA		
Cobalt	Yes	1	0.1	Yes	0	10
Copper	No	11	40	No		
Dibenzo(a,h)anthracene	No	0.0047	NA	NA		
Dichlorobenzene	No	2.3	NA	NA		
Ethane	No	5,883	NA	NA		
Ethylbenzene	Yes	175	9,000	No	0.09	10
Fluoranthene	No	0.013	NA	NA		
Fluorene	No	5.4	NA	NA		
Formaldehyde	Yes	1,450	9	Yes	0.72	10
Hexane	Yes	3,418	20,000	No	1.71	10
Indeno(1,2,3-cd)pyrene	No	3.5	NA	NA		
Lead	Yes	10	0.9	Yes	0	10
Manganese	Yes	5.9	0.2	Yes	0	10
Mercury	Yes	3.2	0.7	Yes	0	10
Molybdenum	No	14	60	No		
Naphthalene	Yes	27	3	Yes	0.01	10
Nickel	Yes	33	0.4	Yes	0.02	10
Pentane	No	4,930	NA	NA		
Phenanthrene	No	0.26	NA	NA		
Propane	No	3,035	NA	NA		
Propylene	No	18	36,500	No		
Propylene Oxide	Yes	158	30	Yes	0.08	10
Pyrene	No	0.015	NA	NA		
Selenium	Yes	1.6	2,000	No	0	10
Sulfuric Acid	No	32,670	40	Yes		
Toluene	Yes	717	1,000	No	0.36	10
Vanadium	No	28	0.07	Yes		
Xylenes	Yes	350	3,000	No	0.18	10
Zinc	No	352	3,000	No		
Total					3.35	25

Gas Turbines/HRSGs

The Facility will utilize two gas turbines operated in a combined cycle configuration, each with a duct fired HRSG to generate electricity and to generate steam for a steam turbine. Based on the preliminary information provided by the manufacturers, each gas turbine will have a maximum heat input rate of approximately 3,393 MMBtu/hr while firing natural gas and approximately 3,507 MMBtu/hr. while firing ULSD fuel. Each HRSG will be equipped with a natural gas fired HRSG duct burner with a maximum heat input capacity of approximately 721 MMBtu/hr to provide additional energy for the steam turbine during natural gas firing.

Each GT/HRSG will be equipped with a selective catalytic reduction (SCR) system for NO_X emissions control. Water injection will also be used during ULSD firing for NO_X emissions control. Each HRSG stack will have a maximum stack NO_X concentration of 2.0 parts per million dry by volume at 15 percent oxygen (ppmvd@15%O_2) during natural gas firing, and 5.0 ppmvd@15%O_2 during ULSD firing during steady-state operation (down to a minimum of 30%-50% load on natural gas and 50% load on ULSD).

Each SCR will utilize ammonia (NH_3) injection for NO_X emissions control. The Facility will include a 40,000 gallon aboveground storage tank of 19% aqueous NH_3 for this purpose. The SCR will be designed to achieve a maximum NH_3 stack concentration (NH3 slip concentration) of 2.0 ppmvd@15%O_2 both while firing natural gas and while firing ULSD.

Each GT/HRSG will be equipped with an oxidation catalyst (OC) for the control of CO, VOCs, and organic hazardous air pollutants (HAPs). Each OC will be designed to achieve a maximum stack CO concentration of 2.0 ppmvd@15%O_2 while firing natural gas and 5.0 ppmvd@15%O_2 while firing ULSD. The maximum VOC stack concentration will be 1.0 ppmvd@15%O_2 while firing natural gas without duct firing, 1.7 ppmvd@15%O_2 while firing natural gas during duct firing, and 5.0 ppmvd@15%O_2 during ULSD firing. Each OC will also reduce organic HAP by at least 90%. The potential emissions of organic HAP emissions from the GT/HRSGs have been estimated using information provided by the potential equipment manufacturers and using emission factors from AP-42.

The emissions of CO_2, SO_2, H_2SO_4, and PM_{10}/$PM_{2.5}$ from the GT/HRSGs will be minimized by the use of clean burning, low sulfur, low ash fuels, and by the use of the most efficient gas turbine combustion technology commercially available at this time. The emission rates of CO_2, SO_2, H_2SO_4, and PM_{10}/$PM_{2.5}$ from the gas turbines at each operating condition are detailed in in Appendix A of the Major Source Permit Application (see Appendix B). The average CO_2 emission rates from the GT/HRSGs at base load will be approximately 814 lb /MW-hr (net) while firing natural gas and 1,227 lb/MW-hr (net) while firing ULSD.

The exit height of each GT/HRSG stack will be 200 feet above grade. The GT/HRSG stacks will have an inside diameter of 22 feet. The GT/HRSG stack exhaust flow rates and exit temperatures, and criteria pollutant emission rates over the full range of expected operating conditions, based on preliminary information provided by the manufacturers, are provided in Appendix A of the Major Source Permit Application. Each HRSG stack will be equipped with a certified continuous emissions monitoring system (CEMS) to monitor compliance with permit emission limits.

The gas turbines will be permitted for unlimited operation on natural gas. Invenergy is proposing to permit the gas turbines to operate for the equivalent total ULSD fuel usage of up to 60 days per year at base load when natural gas is unavailable only. It is expected that the gas turbines will only fire ULSD fuel during the winter months when commercial and residential natural gas usage for heating purposes is at its peak.

Auxiliary Boiler

The Facility will utilize a natural gas fired auxiliary boiler to supply gland sealing steam to the steam turbine, sparging steam to the HRSG steam drums, sparging steam to the ACC condensate tank, and motive steam to establish initial vacuum in the ACC and the steam turbine. The auxiliary boiler is currently designed to provide up to 107,910 lb. /hr. of steam at 215 psia and 390°F, at a boiler efficiency of approximately 82 percent. Based on the current design, the maximum heat input rate to the natural gas fired auxiliary boiler will be 140.6 MMBtu/hr.

The auxiliary boiler will be equipped with ultra-low NO_X burners and flue gas recirculation (FGR) for emissions control. The exhaust gases from the auxiliary boiler will be vented through a 48-inch diameter exhaust stack at an exit height of 50 feet above grade. The auxiliary boiler will exhaust at 38,067 actual cubic feet per minute (acfm) at 344°F at full load. The criteria pollutant emission rates from the auxiliary boiler at its maximum natural gas firing rate are summarized on Table 6.1-1.

The auxiliary boiler will only operate prior to and during gas turbine startup periods and will not operate during normal, steady-state gas turbine operating periods. Invenergy is proposing to permit the auxiliary boiler to operate up to 4,576 hours per year, the equivalent of up to 8 hours per day during weekdays (at night) and through each weekend.

Dew Point Heater

The Facility will utilize a natural gas fired dew point heater to maintain the temperature of the natural gas delivered to the gas turbines at a nominal 50°F above the hydrocarbon dew point of the natural gas. Based on the current design, the dew point heater will have a maximum heat input rate of 15 MMBtu/hr.

The dew point heater will be equipped with an ultra-low NO_X burner and FGR for emissions control. The exhaust gases from the dew point heater will be vented through a 20-inch diameter exhaust stack at an exit height of 35 feet above grade. The dew point heater will exhaust at 7,252 acfm at 1,000°F at full load. The criteria pollutant emission rates from the dew point heater at its maximum natural gas firing rate are summarized on Table 6.1-1.

Invenergy is proposing to permit the dew point heater for unlimited operation firing natural gas.

Emergency Diesel Generator

The Facility will utilize a 2 MW emergency diesel generator equipped with a 2,682 horsepower (Hp) engine to manage the combined cycle critical shutdown and maintenance loads during a loss of site power from the grid. Based on the current design, the emergency diesel generator will have a maximum heat input rate of 19.5 MMBtu/hr. firing ULSD fuel.

The exhaust gases from the emergency diesel generator will be vented through an 8-inch diameter exhaust stack at an exit height of 35 feet above grade. The emergency diesel generator will exhaust at 15,295 acfm at 752°F at full load. The criteria pollutant emission rates from the emergency diesel generator at its maximum ULSD fuel firing rate are summarized on Table 6.1-1.

Invenergy is proposing to only operate the emergency diesel generator when grid power is unavailable and for maintenance and readiness testing for up to 1 hour per week and up to 300 hours per year.

Diesel Fire Pump

The Facility will utilize a 315 BHP diesel engine fire pump. Based on the current design, the diesel fire pump engine will have a maximum heat input rate of 2.1 MMBtu/hr. firing ULSD fuel.

The diesel fire pump will be located in a building southeast of the GT/HRSGs, near the water treatment building. The exhaust gases from the diesel fire pump will be vented through a 6-inch diameter exhaust stack at an exit height of 35 feet above grade. The diesel fire pump will exhaust at 1,673 acfm at 865°F at full load. The criteria pollutant emission rates from the diesel fire pump at its maximum ULSD fuel firing rate are summarized on Table 6.1-1.

Invenergy is proposing to only operate the fire pump during emergency situations and for maintenance and readiness testing for up to 1 hour per week and up to 300 hours per year.

Fuel Oil Tanks

The Facility will include a pair of a 1,000,000-gallon aboveground ULSD storage tanks equipped with secondary containment, as required. The potential fugitive VOC emissions (working losses and breathing losses) associated with the ULSD storage tanks at the Facility have been estimated using the EPA's TANKS program. Appendix A of the Major Source Permit Application (See Appendix B) contains a summary of the results and the data printouts from the TANKS analysis for the ULSD storage tanks.

6.1.3 Regulatory Framework

The Project will comply with all applicable State and Federal Air Pollution Control Regulations, as detailed in the Major Source Permit Application previously submitted to RIDEM.

The following RIDEM Air Pollution Control Regulations apply to the proposed Project:

No. 1 – Visible Emissions

No. 5 – Fugitive Dust

No. 6 – Opacity Monitors

No. 7 – Emission of Air Contaminants Detrimental to Person or Property

No. 8 – Sulfur Content of Fuels

No. 9 – Air Pollution Control Permits

No. 10 – Air Pollution Episodes

No. 11 – Petroleum Liquids Marketing and Storage

No. 13 – Particulate Emissions from Fossil Fuel Fired Steam or Hot Water Generating Units

No. 14 – Record Keeping and Reporting

No. 16 – Operation of Air Pollution Control Systems

No. 17 – Odors

No. 22 – Air Toxics

No. 27 – Control of Nitrogen Oxide Emissions

No. 28 – Operating Permit Fees

No. 29 – Operating Permits

No. 45 – Rhode Island Diesel Anti-Idling Program

No. 46 – CO_2 Budget Trading Program

The following federal Air Pollution Control Regulations apply to the proposed Project:

40 CFR 50 – National Primary and Secondary Ambient Air Quality Standards

40 CFR 52.21 – Prevention of Significant Deterioration of Air Quality

40 CFR 60 – Standards of Performance for New Stationary Sources

Subpart A – General Provisions

Subpart Db – Standards of Performance for Industrial-Commercial-Institutional Steam Generating Units

Subpart IIII – Standards of Performance for Stationary Compression Ignition Internal Combustion Engines

Subpart KKKK – Standards of Performance for Stationary Combustion Turbines

Appendix B – Performance Specifications

Appendix F – Quality Assurance Procedures

40 CFR 63 – National Emission Standards for Hazardous Air Pollutants for Source Categories

Subpart A – General Provisions

Subpart ZZZZ – National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines

40 CFR 70 & 71 – Operating Permits Program

40 CFR 72 – Permits Regulation

40 CFR 73 – Acid Rain Program Sulfur Dioxide Allowance System

40 CFR 75 – Continuous Emissions Monitoring

40 CFR 80 – Regulation of Fuels and Fuel Additives

40 CFR 89 – Control of Emissions from New and In-Use Non-Road Compression-Ignition Engines

40 CFR 98 – Mandatory Greenhouse Gas Reporting

The applicable requirements of each of these regulations and how the Project will comply with each applicable requirement are detailed in the Major Source Permit Application included in Appendix B.

6.1.4 Emissions Control Technology Evaluation

RIDEM requires that a new major stationary source apply (BACT) for each pollutant it could have the potential to emit. BACT is defined as an emissions limitation based on the maximum degree of reduction for each air pollutant, 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 stationary source through the application of production processes or available methods, systems and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of such pollutant.

In no case can the application of BACT result in emissions which would exceed that allowed by any applicable state or federal air pollution control rule or regulation. If the Director determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of air standards infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed to satisfy the BACT requirement. Such a standard, to the degree possible, must set forth the emission reduction achievable by its implementation and provide for compliance by achieving equivalent results.

The EPA issued the PSD and Title V Greenhouse Gas Tailoring Rule in 2010 to address GHG emissions from stationary sources under the Clean Air Act permitting program. The rule sets thresholds for GHG emissions that define when permits under the PSD and Title V Operating Permit programs are required for new and existing facilities not subject to these program for other pollutants. The rule requires that sources subject to the PSD permitting program for other pollutants also be subject for their GHG emissions.

A BACT Determination is a top-down process in which all available control technologies for that pollutant and emission source are identified. Each control technology is then evaluated for its technical feasibility and those demonstrated to be technically infeasible are eliminated from consideration. The remaining control technologies are then ranked in descending order of control effectiveness. The most effective remaining control technology is deemed to be BACT unless it is demonstrated that technical considerations, or the associated energy, environmental, or economic impacts justify a conclusion that the control technology is not available for the source. If the most stringent control technology is eliminated from consideration, the additional control technologies are similarly evaluated in descending order of control effectiveness until the most stringent available control technology is identified as the BACT determination for that pollutant and emission source.

RIDEM requires that a new major stationary source of a nonattainment pollutant meet an emission limitation that is considered LAER for each nonattainment pollutant for which it is a major source. LAER is defined as the most stringent limitation which is contained in the implementation plan of any state for such class or category of stationary source (unless it is demonstrated that such limitations are not achievable), or the most stringent emission limit which is achieved in practice by such class or category of stationary source. In no event can the application of LAER permit a proposed new source to emit any pollutant in excess of the amount allowable under applicable new source performance standards. The LAER requirement applies to each new emissions unit at which emissions will occur.

Unlike BACT, the LAER requirement does not consider economic, energy, or other environmental factors. An emissions limit cannot be considered LAER if the cost of maintaining the level of control is so great that the source could not be built or operated. Thus, for a new source, LAER costs are only considered to the degree that those costs significantly differ from the typical cost for the rest of the industry. Cost should not be considered for a LAER determination if sources in the same industry are already using that control technology.

The Project will implement BACT for each pollutant it has the potential to emit and will implement LAER for the NO_X and VOC emissions from each emission source at the Facility. The BACT/LAER determinations for the Project are detailed in the Major Source Permit Application included in Appendix B.

6.1.5 Air Quality Impact Assessment

An air quality impact analysis has been completed for the Project to assess the potential off-site impacts of the emissions from the proposed Facility with respect to the NAAQS and the Prevention of Significant Deterioration (PSD) Increments. The analysis also included the additional impact analyses required by the RIDEM major source permitting regulations.

The RIDEM "Rhode Island Air Dispersion Modeling Guidelines for Stationary Sources (March 2013 Revision)" (RIDEM, 2013) outlines the accepted procedures for performing modeling analyses in conformance with the EPA Guideline on Air Quality Models (40 CFR 51, Appendix W). To ensure that all modeling analyses subject to the approval of RIDEM are performed in accordance with applicable state and federal guidance, an applicant must submit a modeling protocol prior to conducting the analysis. The protocol describes the input parameters, models, and assumptions that will be used in the analysis.

An Air Dispersion Modeling Protocol, was prepared for the Project in accordance with the applicable RIDEM and EPA regulations and guidance, describing the procedures to be used for the air quality impact analysis and addresses the pertinent checklist criteria of Appendix B of RIDEM's Air Dispersion Modeling Guidelines. The Air Dispersion Modeling Protocol was submitted to RIDEM on April 20, 2015. RIDEM issued a conditional approval of the Air Dispersion Modeling Protocol on July 27, 2015.

An Air Dispersion Modeling Report for the Project will be submitted to RIDEM for approval. The Report will detail the impact analyses conducted, including all of the modeling inputs and assumptions, and includes copies of all modeling output files.

The Modeling Report will also include the following:

- Isopleths and the location and magnitude of the maximum predicted impacts for each modeled pollutant and averaging time
- A table comparing the maximum predicted impact for each air toxic contaminant for each averaging time with the corresponding AALs and CAALs
- A table showing the maximum predicted criteria pollutant impacts with the corresponding SIL for each pollutant and averaging period
- A table comparing the maximum predicted criteria pollutant impacts with the corresponding available PSD increment for each pollutant and averaging period
- A table showing modeled impacts, background levels, total impact levels, and the NAAQS for each pollutant and averaging period
- The results of all additional impact analyses completed for the Project

A Health Risk Assessment Protocol was prepared for the Project in accordance with the Guidelines for Assessing Health Risks from Proposed Air Pollution Sources. The Health Risk Assessment Protocol was submitted to RIDEM on June 26, 2015. RIDEM issued a preliminary comment letter on the Health Risk Assessment Protocol on August 11, 2015.

A Health Risk Assessment Report for the Project will be submitted to RIDEM for approval. The Health Risk Assessment Report will detail the health risk assessment conducted, including all of the modeling inputs and assumptions, and includes copies of all modeling output files.

The Health Risk Assessment Report will also include the following:

- A description of the health risk assessment methodology used, including all modeling inputs, assumptions, and risk assessment health risk values used.
- Tables summarizing all assessment results and comparisons of all results with the applicable AALs, CAALs, and other health risk standards.
- Figures showing maps with isopleths of the predicted ambient air impacts from the Facility and the highest modeled concentration for the five years modeled at each receptor for the 1-hour, 24-hour, and annual averaging periods. Each isopleth figure identifies the sensitive receptors located within the Project impact area.
- Electronic versions and printouts of all AERMOD input and output files and all risk characterization output files.

The results to be presented in the Air Dispersion Modeling Report will demonstrate that the emissions from the Facility, when combined with existing ambient air background concentrations and the ambient air impacts from nearby interacting emission sources, will not cause or contribute to an exceedance of any NAAQS or AAL at or beyond its property line. The results to be presented in the Health Risk Assessment Report will demonstrate that the emissions from the Facility meet all of the applicable health risk based acceptance criteria of RIDEM's guidelines. The results of the air quality impact analysis to be conducted for the Project will demonstrate that air quality in the area surrounding the Facility will be maintained at levels deemed by the EPA and RIDEM to be protective of human health and the public welfare, including the most sensitive of the population, with a margin of safety.

6.2 Water

The proposed Project site is located within the Clear River watershed (HUC 12), which is part of the larger Lower Blackstone River basin (HUC 10). The majority of the surface water within the Clear River watershed drains into the Clear River, which flows generally west to east through Burrillville and eventually discharges into the Blackstone River (Town of Burrillville, 2011). The Clear River falls into Class-A, Class-B, and Class-C for inland surface waters along different sections of the river.

A modern energy efficient gas fired combined cycle electric generating facility is not the classical power plant of the past; the overall efficiency of the generation processes has significantly increased over recent years and as a result the amount of fuel used and the air emissions and wastewater produced have been significantly reduced over older generation technologies.

The Upper Branch River Groundwater Reservoir is located within the Town of Burrillville and the groundwater within the town is classified principally as either Class GAA or Class GA groundwater resources. The entire Project area falls into Class GA groundwater resource.

6.2.1 Ground Water

6.2.1.1 Existing Conditions

The Town of Burrillville is entirely dependent upon groundwater for its drinking water resources. The Project site is located entirely atop a Class GA groundwater area, meaning the underlying groundwater is known or presumed to be suitable for drinking water use with no treatment (RIDEM, 2010). The principal groundwater reservoir in the Project area is the Upper Branch River Groundwater Reservoir, located approximately 1.5 miles to the east/southeast of the property. No community or other wellhead protection areas are located near the Site. Refer to Figure 6.2-1 for the locations of community or other wellhead protection areas and mapped groundwater reservoirs relative to the Site. Groundwater may be shallow on the property based on the presence of the wetland areas and the tributaries to Dry Arm Brook.

Within the bounds of the proposed Project area, there are no mapped groundwater reservoirs, or sole source aquifers. Potable water is provided to residences near to the Project site through the use of private water supply wells, typically located proximal to each residence. Glacial till and/or bedrock are the principal sources of groundwater to these wells. The median yield of a typical bedrock well in New Hampshire, for example, is 6.5 gallons per minute (gpm) in a similar bedrock setting to the Project site (NHDES, 2010).

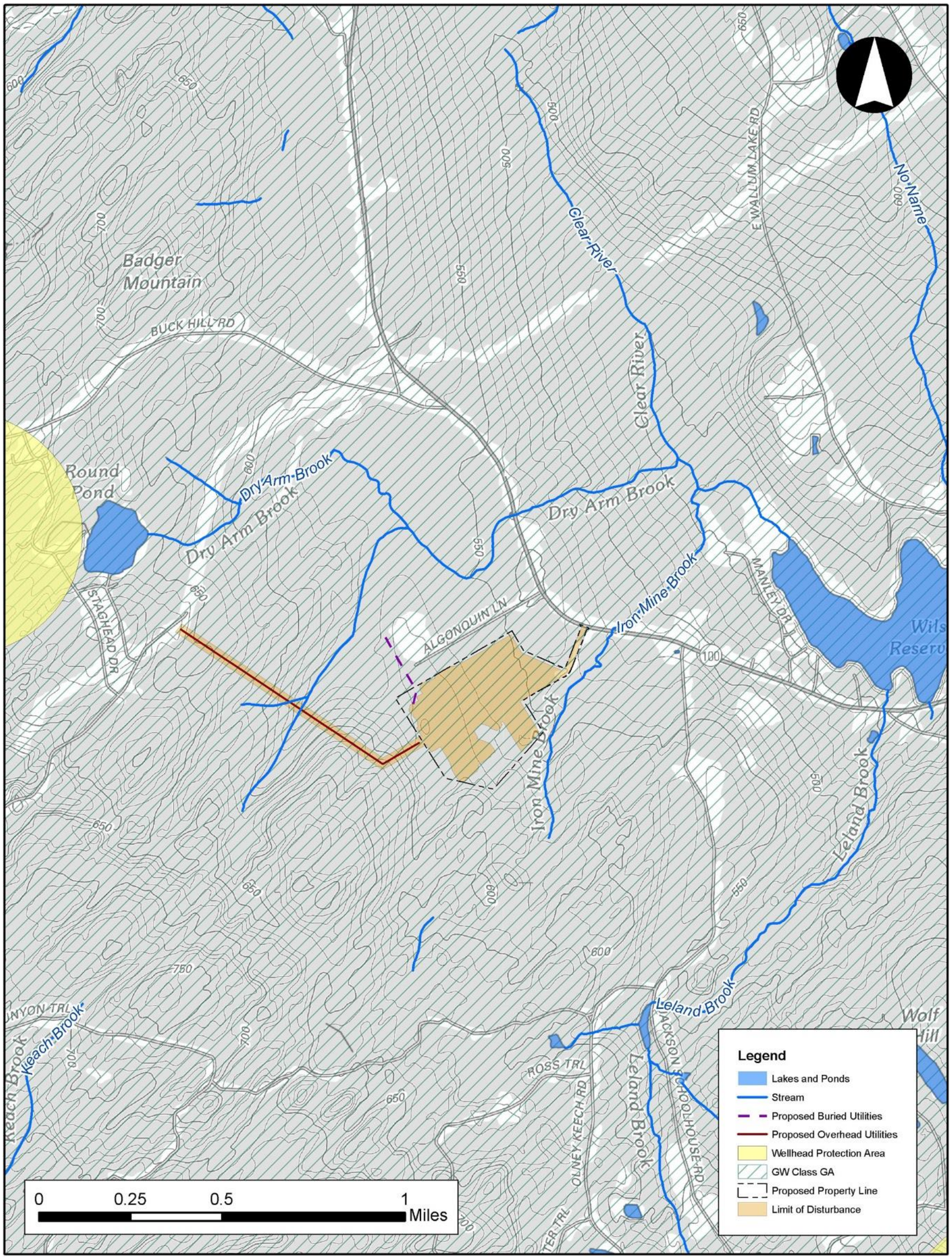


Figure 6.2-1
Ground Water Resources

6.2.1.2 Potential Impacts to Ground Water

During construction, dewatering may be necessary to control surface or subsurface water to allow the necessary construction activities to be performed. Dewatering will be performed using standard construction practices, including the installation of temporary sumps and/or gravel backfill to allow for the operation of dewatering pumps and to allow dewatering to the target depth or elevation. Pump intakes will be positioned and screened to minimize the intake of sediment. Sediment content of pumped water will also be controlled using typical construction techniques, such as portable sediment tanks/basins or sediment filter bags. All equipment used during the dewatering process will be removed from the site as soon as possible after the construction activities have been completed.

Sediment collected within any of the sediment control devices (e.g., portable sediment tank, filter bags) will be utilized at the construction location, to the extent possible, at an acceptable distance from any wetlands or waterbodies. Any excess soil or sediment will be managed off-site in a state-approved solid waste disposal facility, in accordance with a Project-specific Soil Management Plan.

If any contaminated groundwater is encountered in any of the construction areas potentially requiring dewatering, the appropriate state and/or local permits or approvals will be obtained to address discharge or off-site management of the pumped water.

6.2.2 Surface Water

6.2.2.1 Existing Conditions

The primary surface hydrologic feature, Iron Mine Brook, is located east of the CREC site. Iron Mine Brook is a perennial stream that flows in a northeasterly direction through the southern portion of Wetland 1. Iron Mine Brook is a lower perennial stream (R2) with a sandy bottom. Iron Mine Brook flows beneath Wallum Lake Road to the east of the proposed CREC via culvert and eventually discharges to the Clear River. Iron Mine Brook is a RIDEM Category 3 river, meaning that there is insufficient or no data to identify its designated uses, and is classified as a Class-B waterbody. A Class-B waterbody can be considered for bathing, fish and wildlife habitat, recreational use, agricultural use, industrial supply and other legitimate uses, including navigation. Iron Mine Brook is approximately 10 to 12 feet wide; it therefore has an associated 200-foot Riverbank Wetland per the RIDEM Wetland Regulations.

Two unnamed intermittent streams are present in the eastern Project area. Both of these streams originate north of the Project area, and flow under Algonquin Lane via culverts. The two streams meet in the northeastern portion of Wetland 1 and flow south, passing through a metal pipe culvert under the woods road, until ultimately reaching Iron Mine Brook. These streams average less than 10 feet wide in their reach through the proposed Project site; they therefore have an associated 100-foot Riverbank Wetland per the RIDEM Wetland Regulations.

The primary surface hydrologic feature in the western portion of the proposed Project area is an unnamed perennial tributary to Dry Arm Brook, which flows through the western branch of Wetland 2 in a generally northeasterly direction. This perennial stream is designated as a Class-B waterbody. In its reach through the proposed Project site, this stream is a lower perennial stream with a sandy and muddy bottom (R2). Where it passes through the proposed Project area, this stream averages less than 10 feet wide; it therefore has an associated 100-foot Riverbank Wetland per the RIDEM Wetland Regulations.

Two unnamed intermittent streams are located in the western portion of the proposed Project site, which discharge into the unnamed perennial tributary to Dry Arm Brook. A fifth unnamed intermitted stream is located in the central Project area and flows through a forested wetland. Each of these streams average less than 10 feet wide in their reach through the proposed Project site; they therefore have an associated 100-foot Riverbank Wetland per the RIDEM Wetland Regulations.

ESS conducted a field evaluation of each of the streams where they cross the site to evaluate existing conditions on July 23, 2015. The evaluation included assessment of the following stream features:

- Riparian habitat
- Bottom substrate/sedimentation
- Detritus and woody debris
- Water flow
- Macroinvertebrate community
- Fish community
- Other observed wildlife species

The two intermittent streams on site were confirmed to not be flowing on July 23, 2015. This was not unexpected given their known status as intermittent streams and the extended dry period that had proceeded the day of survey. The portion of Dry Arm Brook that crosses the site was also found to be dry on the day of survey. Wetted conditions within the stream channel did occur as the stream channel approached Wetland 2; however, flowing water was not observed. As a result of these non-flowing conditions, fish and aquatic macroinvertebrates were not assessed as part of the assessment. The channels of all three of these non-flowing channels were small with no evidence of pooled water.

Wetted leaves and muck were present in the Dry Arm Brook channel, and the wetted areas widened and deepened as the stream approached Wetland 2 where dense understory vegetation characterized the riparian stream bank. Canopy cover along the stream corridor was estimated to be 90%. No direct observations of wildlife were made within the stream channel; however, deer tracks were observed in the wet muck and scat was evident in and around the stream channel itself.

Iron Mine Brook was flowing on the day of survey. The stream channel itself was averaged 18 inches across and approximately 2.5 inches deep. Pools within the stream offered the most potential refuge for fish species with average pool depths of about 4 inches. The stream would be classified as having suitable to good fish habitat value based on the dominance of coarse substrates, boulders, undercut banks, and abundant large woody debris within the channel. Although leaf litter and muck was observed to collect within small backwater areas and the deeper pools, the stream did have numerous shallow riffles and runs to provide potentially suitable and well oxygenated benthic macroinvertebrate habitat. Riparian vegetation along Iron Mine Brook was predominantly mature forest with a less dense understory. Canopy cover was approximately 95%.

The fish in Iron Mine Brook were assessed using a backpack unit electro-fisher and the fishing effort covered a brook length of approximately 100 meters from just south of Wallum Lake Road to where the brook was found to grow too shallow to be expected to support a fish population. A sustained electro-fishing pass through the deeper portions of Iron Mine Brook yielded no fish. No fish were observed either; however, the electro-fishing effort did yield five common crayfish (*Cambarus bartonii bartonii*) and two green frogs (*Rana clamitans melanota*).

Benthic macroinverterbrates were sampled in a manner consistent with the state-wide biomonitoring program established for Rhode Island. Three benthic samples from Iron Mine Brook were collected using a D-framed net with a 500 µm mesh by agitating bottom substrate in front of the net for a consistent 30-second period for each sample. Samples were processed by ESS taxonomists to reveal a relatively diverse and healthy macroinvertebrate community. Table 6.2-1 lists the abundance of each taxa encountered on the day of survey.

The results of the benthic macroinvertebrate community analysis indicate that the community is typical of that expected in a warm-water forested stream system.

Table 6.2-1

Invenergy Stream Assessment: Macroinvertebrate Taxonomic Data

Taxa Group	Final Identification	Life Stage	Station ID Trib 1/1	Trib 1/2	Trib 1/3
Coleoptera	*Oulimnius*	Adult		32	
	Oulimnius	Larva	96		
Collembola	*Sminthuridae*	Unidentified	32		
Crustacea	*Caecidotea communis*	Unidentified	32		
	Harpacticoida	Unidentified	64	32	
Diptera	*Chironomini*	Larva		32	64
	Corynoneura	Larva	32		96
	Cricotopus	Larva		32	224
	Hemerodromia	Larva			32
	Labrundinia pilosella	Larva		96	64
	Micropsectra	Larva	96	416	128
	Microtendipes	Larva		64	
	Nilotanypus	Larva	32		
	Orthocladius	Larva		32	416
	Parametriocnemus	Larva	192	256	64
	Rheotanytarsus	Larva	64		
	Stenochironomus	Larva		64	
	Tanytarsus	Larva	320	1472	1312
	Thienemanniella xena	Larva	64		
	Thienemannimyia group	Larva	288	224	192
Ephemeroptera	*Paraleptophlebia*	Larva		736	608
Megaloptera	*Nigronia*	Larva	32		
Odonata	*Boyeria*	Larva	32		32
	Calopteryx	Larva			32
	Cordulegaster	Larva	160		
Oligochaeta	*Lumbriculidae*	Unidentified	256	32	32
	Naididae	Unidentified		32	
	Pristina rupestris	Unidentified	288	32	96
	Tubificidae	Unidentified		32	32
Plecoptera	*Capniidae*	Larva	96	160	
	Leuctra	Larva	608	352	544
	Paracapnia	Larva			32
	Perlodidae	Larva	32		
Trichoptera	*Hydropsychidae*	Larva	192		
	Lepidostoma	Larva		32	32
	Polycentropus	Larva	32	128	32
	Rhyacophila	Larva	64		
Total			**3104**	**4288**	**4064**

6.2.2.2 Potential Impacts to Surface Water

The access road to the facility will cross an unnamed intermittent stream in the eastern portion of the proposed Project area. This crossing will likely require installation of a new, larger culvert capable to support the improved roadway.

The proposed new overhead transmission line will cross the unnamed perennial tributary to Dry Arm Brook and one or both of the unnamed intermittent tributaries to the perennial stream. Construction of an access road along the proposed overhead transmission line will require the installation of new culverts in each of the stream crossings. The removal of trees along the banks of the streams will increase light penetration to the streams, and hence will increase the water temperature in this reach. This may result in negative impacts to fish, amphibians, and other aquatic organisms that inhabit these streams.

6.2.3 Water Use & Wastewater Discharge

A modern energy efficient gas fired combined cycle electric generating facility is not the classical power plant of the past; the overall efficiency of the generation processes has significantly increased over recent years and as a result the amount of fuel used, air emissions and wastewater produced have been significantly reduced over older generation technologies.

Modern combined cycle electric generating facilities in New England are primarily fueled by natural gas and at times in the winter when natural gas supplies are under severe stress some electric generation plants are required by the electric grid operator (ISO-NE) to fire distillate oil to conserve the natural gas supplies for home heating and commercial use.

In a combined cycle power plant the majority of the electricity (approximately two-thirds) is generated separately by gas fired combustion turbine(s), each of which is tied to an electrical generator that is also connected to the steam turbine. Waste exhaust heat from the combustion turbine is recovered and used to generate steam in a “Heat Recovery Steam Generator” (HRSG) that uses the waste heat to generate high pressure steam used to spin a more conventional steam turbine which is tied the common electrical generator. The two types of turbines involved (gas and steam turbines) is where the term “combined cycle” is derived.

After passing through the steam turbine, the exhaust steam, now devoid of its useful energy, must be condensed back into water in a steam condenser which is then reused in the cycle and pumped back to the HRSG. To condense the steam, the Project features a dry cooling system, which is similar to the cooling provided by a typical automobile radiator, which cools by the use of ambient air supplied by fans.

The use of a dry cooling system by the Project reduces by approximately 90% the amount of water that would have otherwise been required if a more conventional wet cooling tower had been selected. The use of a dry cooling system also considerably reduces the amount of waste water that will be generated by the Project, eliminating cooling tower blowdown required to control the cooling water chemistry in a conventional wet cooling tower system.

As a result of the Project’s overall configuration as a modern energy efficient combined cycle generating plant using a dry cooling system, the water use and associated wastewater generated by the Project have been significantly reduced from other more conventional approaches used in other older power plant designs.

The water use of the Project will vary with the level of generation output and will vary seasonally to meet the needs of specific processes within the facility. For this Project the major water uses are: high purity water for steam cycle makeup (required throughout the year), water for makeup to the evaporative coolers that cool the combustion turbine inlet air (increases overall efficiency and output - required only in the summer), and high purity water for injection into the combustion turbine combustors to control emissions (only needed when firing distillate oil which will only occur if needed in the dead of winter). It is important to note that water used as makeup to the evaporative coolers, when in use in the summer, and water injected into the combustion turbines when required to fire oil in the dead of winter are consumptive water uses, the water is evaporated into the combustion turbine exhaust and does not result in an associated wastewater flow.

Other than the three specific water uses identified above, the balance of water use within the facility for normal operation is for miscellaneous low volume uses such as general housekeeping and sanitary use by the operating staff of the plant and at times for maintenance of the facility. A separate storage tank for potable drinking water will be used.The source of this water will be by truck from a potable source.

6.2.3.1 Water Sources

The CREC is expected to operate at a high capacity factor given the overall efficiency of the facility when compared to older generating facilities in New England. The water supply to the Project must be from a reliable source that can meet the water quality and volume requirements.

The Project is planning to secure its water supply from the Pascoag Utility District (PUD) by making use of water from an existing groundwater well that had historically became contaminated from on off-site source and was shut down by a court order, as a result is no longer available as a potable water source for the community.

Water from the PUD's well will be treated at the wellhead by an activated carbon treatment process (similar to carbon treatment on home faucets for taste improvement) to remove the existing contamination to levels that will meet the needs of the Project. Over time, by pumping and treating the groundwater supplied from PUD's well, the existing contamination will be reduced within or removed from the aquifer and the well could be restored for potential future use by the community. It is not known how long this process could take to restore the groundwater quality but it is estimated that it could take 20 to 30 years or more.

Water supplied by the activated carbon treatment system will be pumped to the Project site where it will be stored in a raw water tank. The raw water tank will be used to supply the Project's fire protection needs and will be a source of water for the demineralized water treatment system. The demineralized water treatment system is an on-site advanced water treatment system designed to produce high purity water suitable for use within the Project's generation steam cycle processes (identified above). The advanced water treatment processes will include reverse osmosis and electro-deionization (EDI) systems. These advanced water treatment processes were selected because they produce high purity water by use of electrical energy as opposed to the chemical based processes (ion exchange) used in many older generating facilities.

Reverse Osmosis and EDI are separation technologies that separate the supplied water (raw water) into two streams; a high purity water containing no dissolved minerals and a waste water stream containing all of the minerals that were in the raw water supplied to the treatment system. As a result wastewater from the reverse osmosis and EDI processes will separate and concentrate only those minerals originally in the raw water supplied to the system. Given that the PUD water that will be supplied to the Project has essentially no dissolved metals the wastewaters from the reverse osmosis and EDI processes will only contain those minerals normally found in groundwater in the region (sodium chloride, calcium bicarbonate, magnesium bicarbonate for example).

The majority of wastewater generated by the Project's processes will be from four primary sources; wastewater from the high purity water treatment processes (reverse osmosis and EDI systems), blowdown from the steam generator (HRSG) needed to control chemistry in the stream generator, blowdown from the evaporative coolers used to control chemistry (summer use only) and sanitary wastewater from the operating staff. The balance of wastewater generated within the facility will be the customary house cleaning required for any industrial complex. There are other sources of wastewater that will be generated infrequently that are related to maintenance of the facility but these will be temporary in nature and in many cases will be disposed of off-site by licensed facilities contracted to dispose of these materials.

Steam Electric Power Generating Point Source Category - Categorical Effluent Standards

Approximately 52% of the water withdrawn from the PUD groundwater supplied to the Project will be returned to the Clear River through the Burrillville WWTF.

The U.S. Environmental Protection Agency (USEPA) developed and promulgated on November 19, 1982 under 40 CFR Part 423 - effluent limits applicable to the Steam Electric Power Generating Point Source Category. The Categorical Effluent Standards issued in 1982 were described as applicable to "discharges resulting from the operation of a generating unit by an establishment primarily engaged in the generation of electricity for distribution and sale, which results primarily from a process utilizing fossil-type fuel (coal, oil, or gas) or nuclear fuel in conjunction with a thermal cycle employing the steam water system as the thermodynamic medium."

The USEPA, on June 7, 2013, proposed revisions to the regulation issued in 1982 aimed at strengthening the controls from certain steam electric power plants by revising these technology-based effluent limitations guidelines and standards for the steam electric generating point source category. The United States EPA finalized this revision to 40 CFR Part 423 on September 30, 2015.

The revised Categorical Effluent Standards are applicable to a wide range of technologies used in the electric generating sector from coal, oil, and nuclear facilities of all sizes and configurations. These Categorical Effluent Standards also apply to modern gas fired combined cycle generating facilities because combined cycle generating facilities employ as part of the overall facility design "a thermal cycle employing the steam water system".

In developing the Categorical Effluent Standards, the USEPA had to consider a wide range of generating technologies employing many different materials of construction of the steam water systems. Conventional steam boiler cycles built in the 1950s, 1960s and 1970s are still in operation in many areas of the country and as such the wastewaters from these facilities reflect the materials of construction that included significant use of copper alloys both in the boiler systems and often in the steam condensers of these facilities. As a result, significant focus was placed on effluents from these facilities for a range of heavy metals, especially copper, and the USEPA has included a specific limit on copper in the discharges from steam electric generating facilities.

Many of the USEPA proposed Categorical Effluent Standards are also focused on coal-based power plants and coal gasification technologies that have the wide range of wastewaters associated with coal ash and coal based power plant emission control systems, which are not applicable to gas fired combined cycle power plants.

In developing the revised regulations, the USEPA specifically focused on the Categorical Effluent Standards applicable to new Steam Electric Power Generating facilities discharging to Publically Owned Treatment Works (POTWs).

In developing the new standards, the USEPA defined Low Volume Waste Sources as "wastewater from all sources including but not limited to ion exchange water treatment systems, water treatment evaporator blowdown, laboratory and sampling streams, boiler blowdown, floor drains, cooling tower basin cleaning wastes, and recirculating house services water systems. Sanitary and air conditioning wastes and carbon capture wastewaters are not included."

As a result, wastewaters generated by most modern combined cycle generating facilities fit the definition of Low Volume Wastewaters under the revised USEPA Steam Electric Point Source Category.

The CREC has reviewed the recently revised categorical pretreatment standards. The attached Table 6.2-2 provides information on the PUD source water and provides projections for the two primary sources of wastewater from the Project. Table 6.2-2 provides the projected wastewater compositions expected for process wastewaters and for sanitary wastewaters. Table 6.2-2 also identifies the recently promulgated effluent pretreatment discharge standards.

Table 6.2-2

Summary of Well Water and Wastewater Discharge Parameters for Clear River Energy Center

Parameters	Units	PUD Well Water Supply	Projected CREC Wastewater Discharge (Max)	Projected CREC Sanitary Drain (Avg)	Categorical Pretreatment Standards Applicable to Discharges to POTWs
Flow Rate	gpm	700	140	1	
Ammonia - N (NH4)	mg/L	0.1	0.4	12	≤ 30
Arsenic	mg/L	< 0.001	< 0.001		ND*
Benzene (Note 2)	mg/L	0.015	0.07		ND*
Bicarbonate (HCO3)	mg/L	20	362		NOT REGULATED
Biochemical Oxygen Demand	mg/L	-	-	220	≤ 300
Calcium (Ca)	mg/L	10	35		NOT REGULATED
Carbon Dioxide (CO_2)	mg/L	96	74		NOT REGULATED
Carbonate (CO3)	mg/L	0.0003	0.15		NOT REGULATED
Chemical Oxidation Demand	mg/L	-	-	500	NOT REGULATED
Chloride (Cl)	mg/L	116	416	50	NOT REGULATED
Chloroform	mg/L	0.0008	0.004		ND*
Copper	mg/L	< 0.1	< 0.1		1.0
Fluoride (F)	mg/L	0.06	0.21		NOT REGULATED
Iron	mg/L	< 0.1	< 0.1		NOT REGULATED
Lead	mg/L	< 0.001	< 0.001		ND*
Magnesium (Mg)	mg/L	1	5		NOT REGULATED
Manganese (Mn)	mg/L	0.01	0.04		NOT REGULATED
MTBE (Note 2)	mg/L	0.055	0.20		
Nitrogen	mg/L	-	-	20	NOT REGULATED
Nitrate (NO3)	mg/L	2	5		NOT REGULATED
Nitrite	mg/L	< 0.05	< 0.05		NOT REGULATED
pH	S.U.	5.6	7.7	5.5 - 9.5	6.0 - 9.0
Phosphorous	mg/L	-	-	4	NOT REGULATED
Potassium (K)	mg/L	2	8		NOT REGULATED
Silica (SiO2)	mg/L	15	54		NOT REGULATED
Sodium (Na)	mg/L	73	370		NOT REGULATED
Sulfate (SO4)	mg/L	10	36	30	NOT REGULATED
TBA (Note 3)	mg/L	0.012	0.06		
TDS	mg/L	249	1293	500	NOT REGULATED
Temperature	deg. F	60	140	70	≤ 150
Total Suspended Solids	mg/L	< 5	< 5	220	NOT REGULATED

As shown on Table 6.2-2, the wastewater discharged from the Project will meet the pretreatment standards applicable to discharges to POTWs without any additional treatment.

All discharges from the facility will meet all applicable pretreatment discharge standards and any additional standards imposed by the Commission and/or RIDEM. The Project will work with the Commission and its representatives to implement a sampling program required to demonstrate and affirm that the wastewater composition being discharged to the Burrillville Wastewater Treatment facility fully complies with all applicable discharge standards and that wastewaters from the CREC do not impact operations at the Wastewater Treatment Facility.

Water Balance and Seasonal Use

Appendix C includes the three water balances developed for the Project. The water balances cover the full range of ambient operating conditions expected throughout a typical year. Each of these water balances reflects the Project operating under a full load condition (maximum output) so the water flows are the maximum expected for each operating case. Water balance VMB-01 depicts water flows for the average annual operating condition (average annual air temperature). Water balance VMB-04 depicts a winter condition if the Project were requested by the electric grid ISO-NE to fire distillate oil on one combustion turbine. Water balance VMB-03 depicts a typical summer condition when firing natural gas and with the evaporative coolers in operation cooling the inlet air to the combustion turbines. These three water balances identify all of the major operational water uses and associated wastewater sources throughout the year with each flow reported in gallons per minute.

Table 6.2-3 then identifies the daily water use, daily wastewater generated, and daily consumptive or evaporative losses by the Project at its maximum generation output for each of these three operating conditions.

Table 6.2-3

Daily Water Use, Wastewater Generated and Evaporative Water Use

Operating Season and Fuel	Water Use	Wastewater Generated	Consumptive Evaporative Loss
Summer *Firing Natural Gas*	224,640 gpd	89,280 gpd	135,360 gpd
Annual Average *Firing Natural Gas*	102,240 gpd	69,120 gpd	33,120 gpd
Winter *One CT Firing Gas other CT Firing Oil*	924,489 gpd	200,160 gpd	724,329 gpd

gpd - gallons per day

Gas versus Distillate Oil Firing

Table 6.2-3 provides the expected seasonal daily wastewater flows from the Project that will either need to be discharged to the Town of Burrillville's sanitary sewer system for treatment.

The Project's normal (annual average) daily discharge flow while firing natural gas is expected to be 69,120 gpd, with a summer time high discharge rate of 89,280 gpd. These wastewater flows are representative of the vast majority of operating hours for the Project.

These wastewater flows would only be exceeded during the most severe winter conditions when natural gas supplies may be under stress and electric generation plants are required by the electric grid operator (ISO-NE) to fire distillate oil to conserve the natural gas supplies for home heating and commercial use.

Only under these conditions, the Project will be required to fire distillate oil, requiring an increase in water use and a commensurate increase in wastewater flow to approximately 200,000 gpd. Distillate oil is considerably more expensive than natural gas, and the Project's air permit will restrict the total number of days that distillate oil can be fired to limit air emissions, which are higher during oil firing.

The natural gas supply to New England is delivered via pipeline from outside of the region. Historically, expansion of the natural gas supply into the region was not pursued because natural gas was more expensive than distillate oil. With the major expansion in natural gas supply in the U.S., there has been a significant reduction in the price of natural gas, and as a result, many major gas pipeline companies are pursuing projects to expand their delivery capacity into the region. As a result, once these natural gas pipeline expansions are complete, the pressures on the regional natural gas distribution system that historically have forced the use of distillate oil firing will be lessened.

To put the above in perspective, over the last five years with the current limited pipeline capacity into the region, there has been an average of only five days per year when gas fired electric generation was asked to switch to distillate oil. Five days per year means, if the Project had existed for the last five years, that the Project would have fired natural gas 98.6% of the time, and as a result, the Project's daily water use and wastewater discharge would have been in the range of 102,240 gpd and 69,000 gpd respectively 98.6% of the year. Projecting forward with the natural gas pipeline expansions underway, the total annual days of Project oil firing should lessen with the increasing supplies of natural gas helping to reduce winter shortage of this critical fuel to the region.

6.2.4 Water Supply – Impacts of Withdrawals on Clear River

Water supplied to the CREC will be provided exclusively from PUD's well #3A which is presently not used as a potable water source because of past contamination (historic gasoline spills) of the aquifer in the area of PUD's well. As a result of the groundwater contamination impacting its largest well, PUD presently receives approximately 88% of its water supply from the Harrisville Fire District with the balance of its supply coming from one existing PUD ground water well (well #5) that was not affected by the groundwater contamination.

Both PUD and the Harrisville Fire District rely exclusively on groundwater wells as the entire water supply source to meet the needs of their current customers. All PUD and Harrisville Fire District customers also either discharge their sanitary wastewaters to the Burrillville sewer system or to on-site septic tanks/leaching fields. As a result, the majority of the groundwater pumped by PUD and the Harrisville Fire District is returned to the Clear River either as a discharge to groundwater (in the case of on-site septic tanks/leach fields) or to the Burrillville WWTF which discharges to the Clear River.

Although neither PUD nor the Harrisville Fire District has a surface water intake on the Clear River, the Clear River groundwater reservoir and the river are hydraulically connected. As a result, water supplied to the Project from PUD's well #3A should be considered to decrease the water flow available in the Clear River and for the purposes of this analysis it will be assumed that there is a one for one reduction in the Clear River flow based on water supplied to the Project from PUD's well #3A.

To assess the potential impact of the CREC's water use on the Clear River, the Project referred to the Rhode Island Streamflow Depletion Methodology (SDM) published by the Rhode Island Department of Environmental Management - Office of Water Resources dated May 13, 2010. Included in that methodology, the Monthly Allowable Streamflow Depletion criteria identified which is the percent reduction of the 7Q10 flow of a watershed based on its classification. The Clear River is classified as a Class 3 watershed according to RIDEM's classification system used in the SDM.

> According to the SDM, *"the Rhode Island SDM establishes the volume of water that can be extracted from a stream (whether as direct stream withdrawals or indirect groundwater withdrawals) while still leaving sufficient flow to maintain habitat conditions essential to a healthy*

aquatic ecosystem. The methodology maintains natural variations of streamflow and considers ecological sensitivity of each resource. It also incorporates the concept of balancing human and ecological needs for water by differentiating the degree of allowable depletions according to water shed characteristics and current human influences. This methodology will help quantity the amount of water that may be available for human uses by defining the degree to which streamflow may be altered and continue to sustain environmental resources"

As noted in the SDM, the methodology allows for a simple calculation of allowable streamflow depletion by considering:

- Existing withdrawals and returns
- Locations of these withdrawals and returns within the watershed
- Time of year
- Watershed characteristics
- Natural low-flow conditions of the stream/river

Table IV-3 of the SDM provides the results of an SDM analysis completed by RIDEM for selected locations in northern Rhode Island, including the Clear River, which relied on specific USGS reports. The RIDEM SDM analysis identifies the Natural 7Q10 for the Clear River as 5.1 MGD and the Allowable Depletion for the Clear River as 1.5 MGD (30% of the Natural 7Q10; allowable summer depletion). The 1.5 MGD allowable depletion would need to cover all groundwater uses impacting the flow of the Clear River including pumping by PUD, the Harrisville Fire District, other residences using private wells and the water supply required by the Project to meet its summer water use requirements.

A State of Rhode Island Water Resources Board report "Statewide Supplemental Water Supply Feasibility Assessment Phase II Executive Summary in August 2008 provides water needs projections out to the year 2025 for each community in Rhode Island, assuming continued population growth for each community, and for the eventual build-out for each water supply system.

Table 6.2-4

Average and Maximum Daily Demands *(MGD)*

Water Supplier	2005		2025		Build-Out	
	Average Daily Demand	Maximum Daily Demand	Average Daily Demand	Maximum Daily Demand	Average Daily Demand	Maximum Daily Demand
Harrisville Fire District	0.24	0.40	0.28	0.59	0.75	0.43
Pascoag Utility District	0.32	0.45	0.41	0.57	0.74	1.05
Total	0.56	0.85	0.69	1.16	1.49	1.48

Table 6.2-4 above identifies the combined average daily water demand for both PUD and the Harrisville Fire District as 0.56 MGD in 2005 and that water demand is essentially the same today. Table 6.2-4 above also makes projections of the average daily combined water demand of PUD and the Harrisville Fire District in 2025 (0.69 MGD) and at ultimate "Build-Out" (1.49 MGD). The projection of an increase in the average daily demand in 2025 and in the future for the combined water demands of PUD and the Harrisville Fire District is based on an assumption of an increase in population in these communities through 2025 and beyond.

In April 2013 the Rhode Island Statewide Planning Program published Technical Paper 162 "Rhode Island Population Projections for 2010-2040".The preface for this report advises that "Population projections assist planners with assessing future built environment and natural resource needs, including transportation options, housing and sufficient water supply". Statewide Planning Program report provides a specific population projection for each of the communities in Rhode Island. Table 6.2-5 summarizes the population projections for Burrillville between 2015 and 2040. As shown on Table 6.2-5, the Statewide Planning Program predicts the Town of Burrillville's population to decline by 2040 by 0.6% overall and to remain relatively flat for the next 25 years. As a result, neither PUD nor the Harrisville Fire District will see an increase in their combined water demand over the next 25 years unless these water suppliers were to have a major expansion of their current service areas. In fact, it is likely that these water suppliers may experience a decrease in water use based on population declines and/or increased water conservation efforts.

Table 6.2-5

Population Projections

City/Town	Count	Projection					
	2010	2015	2020	2025	2030	2035	2040
Burrillville	15,955	15,757	15,713	15,813	15,860	15,818	15,675

The Project is aware that both PUD and the Harrisville Fire District have applications for new wells currently under review by RIDEM. PUD is seeking to install a new well along the Clear River (far from its presently contaminated well #3A) to supply water to meet its customer's needs and to allow it to come off the Harrisville Fire District water supply. The Harrisville Fire District also has an application for new well construction filed with RIDEM. It is believed that these applications are to develop new wells to increase the overall reliability of its water supply and to provide operational flexibility as opposed to supporting an increase in the number of customers supplied.

Although both PUD and the Harrisville Fire District have applications for new wells, plans to build these wells will not result in an increase in the water demand on the regional aquifer beyond that currently existing in the community. Based on the population projections made by the State of Rhode Island Planning Program it does not appear there will be an increase in water demand by either PUD nor for the Harrisville Fire District for the next 25 years and possibly further into the future.

The USGS completed a report "Estimated Water Use and Availability in the Lower Blackstone River Basin, Northern Rhode Island, and South-Central Massachusetts, 1995-99 (Water Resources Investigations Report 03-4190). This report was completed in cooperation with the Rhode Island Water Resources Board and made available in 2003. On page 19 of this report, the USGS identifies water withdrawals for Lower Blackstone River basin and for each sub-basin including the Clear River. Table 5 of that report provides a breakdown of water withdrawals by both public supply withdrawals and self-supply withdrawals (residential and commercial use on dedicated wells). It concludes the total withdrawals in the Town of Burrillville (public and self-supply withdrawals) and elsewhere in Rhode Island (Glocester; self-supply withdrawals) and Massachusetts (Douglas and Uxbridge; self-supply withdrawals) that impact the Clear River sub-basin are 1.093 MGD, which includes both the PUD and Harrisville Fire District withdrawals.

From the above reports, the USGS concluded that the total water withdrawals from the Clear River sub-basin is approximately 1.1 MGD (1.093 MGD) and RIDEM identifies from its SDM analysis that the total available water supply available from the Clear River sub-basin during the summer months (30% of the Natural 7Q10) is approximately 1.5 MGD. Based on this information, there is approximately 0.4 MGD of water capacity available in the summer from the Clear River sub-basin to support future needs. The 0.4 MGD capacity is the minimum with considerably more water being available at all other times of the year.

The Project's daily average water demand in the summer months (June to Sept) is projected to be 224,460 gallons per day or 0.22 MGD which if supplied from PUD's well #3A would leave approximately 0.4 MGD – 0.22 MGD = 0.18 MGD to cover growth in water supply of the community in the future.

The RIDEM SDM also includes guidance on the monthly allowable streamflow depletion as a percent of the 7Q10 for each watershed for the time period of January/February which coincides with the months the Project may be required to fire distillate oil should that be required in any winter season. For the January/February months, the RIDEM SDM methodology identifies (see Table 6.2-6 below) of the SDM document an Allowable Streamflow Depletion for Watershed Classification 3 of 180% of the 7Q10 given the higher flows available in the winter season.

Given that RIDEM has determined that the Natural 7Q10 flow for the Clear River is 5.1 MGD and using the allowed January/February streamflow depletion of 180% of the 7Q10 finds that the January/February total allowable water withdrawal could be as high as 1.8 X 5.1 MD = 9.2 MGD.

Although the Project expects to be fired almost exclusively on natural gas, for those days when the Project is required to fire distillate oil, the Project's water demand will be approximately 0.9 MGD for each oil-fired day. In contrast, the water withdrawals to support the community are essentially the same in the winter as that in the summer, and from the above reports, will remain at approximately 1.1 MGD. Thus, the Project's need for an increased water supply in the winter (January/February) season could be readily sustained from PUD's well #3A and from the Clear River sub-basin within the SDM criteria.

Based on the above conservative analysis the Project believes that the Clear River and the regional aquifer can support the water supply needs of the Project throughout the year. Even with the construction and operation of the Project there appears to be sufficient water availability to meet both the needs of the community and the Project.

Table 6.2-6

Monthly Allowable Streamflow Depletion as a Percent of 7Q10 for each Watershed Classification

Month	Bioperiod	Hydroperiod	Class 1	Class 2	Class 3	Class 4	Class 5
October	Spawning & Outmigration	Medium - Low	20%	40%	60%	80%	100%
November December	Overwinter	Medium	40%	80%	120%	160%	200%
January February	Overwinter & Channel Forming	High	60%	120%	**180%**	240%	300%
March April	Anadromous Spawning	High	60%	120%	180%	240%	300%
May	Anadromous Spawning	Medium	40%	80%	120%	160%	200%
June	Peak Resident Spawning	Medium-Low	20%	40%	60%	80%	100%
July August September	Resident Spawning Rearing & Growth Herring & Shad Out	Low	10%	20%	**30%**	40%	50%

Source: Table 5 of RIDEM Office of Water Resources Streamflow Depletion Methodology May 13, 2010

6.2.5 Sewer Connection Method

The Project is proposing to connect to the Town's Public Sanitary Sewer System by use of a new forced main that will run from the Project site to a sewer connection at the corner of Wallum Lake and Old Wallum Lake Roads. Figure 3.10-1 provides an aerial view of the proposed sewer line route from the Project's site to the proposed sewer connection point and shows the route of the proposed water line from PUD's well to the Project site.

The proposed sewer line connection point is the closest connection to the Project's site and the existing sewer line at the intersection of Wallum Lake and Old Wallum Lake Roads is an existing eight-inch gravity sewer pipeline that is believed fully capable of accepting the expected wastewater volumes from the Project.

The Project is proposing a force main pipeline instead of a gravity sewer line for connection of the Project into the Town's sewer system for a number of reasons that are discussed below.

The Project believes a force main is the best approach because it will provide for the smallest use of the exiting right of way of the Town and State roads along the proposed route. The Project understands that the Burrillville Sewer Commission does not currently intend to extend its existing sewer system beyond the currently serviced areas of the Town because it is believed that other more cost effective alternatives exists that include on-site treatment system.

Another advantage of a force main over a gravity sewer system is that a force main will reduce the overall construction time required and the amount of disruption to traffic along the roads impacted. Gravity sewer systems are necessarily large in diameter and require considerably larger excavations than that required for a force main. If ledge is identified in the route, gravity sewer systems can require blasting or re-routing of the gravity sewer system to complete the installation. A force main, because of its overall reduced diameter, can more easily be routed around obstructions and as a result takes less overall construction time and results in less overall excavation and traffic impact to Town and States roads.

6.3 Wetlands

The proposed Project site is located within the Clear River watershed (HUC 12), which is part of the larger Lower Blackstone River basin (HUC 10). ESS was contracted by Invenergy to delineate jurisdictional wetland resource areas at the proposed Project site. A description of the existing wetland resource areas present at the site; the permanent and temporary impacts to those wetlands expected to occur as a result of the proposed project; and the avoidance, minimization, and mitigation practices proposed to lessen wetland impacts at the site is presented in the following sections.

6.3.1 Existing Conditions

ESS wetland scientists delineated wetlands in accordance with the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Northcentral and Northeast Region (Version 2.0, 2012) (Regional Supplement). The delineation included an initial desktop data review followed by a field investigation as described in the following sections.

6.3.2 Desktop Review

ESS reviewed existing desktop data sources prior to conducting the field investigation to determine the general extent of wetlands and streams in the project vicinity. Desktop data sources included a review of National Wetlands Inventory (NWI) maps from the U.S. Fish and Wildlife Service (USFWS), RIDEM mapped wetlands, Natural Resources Conservation Service (NRCS) soils maps, and Federal Emergency Management Agency (FEMA) flood mapping data.

National Wetlands Inventory Maps

NWI wetlands are mapped and classified by USFWS in accordance with the Classification of Wetlands and Deepwater Habitats (Cowardin et al. 1979). Wetlands are classified by dominant plant community (hydrophytes), soils (hydric soils), and frequency of flooding. Based on the NWI mapping, three different forested wetland types are located at the proposed Project site (Figure 6.3-1), including the following:

- PFO4E: A seasonally flooded/saturated needle-leaved evergreen palustrine forested wetland.
- PFO1E: A seasonally flooded/saturated broad-leaved deciduous palustrine forested wetland.
- PFO4/1E: A seasonally flooded/saturated mixed needle-leaved evergreen and broad-leaved deciduous palustrine forested wetland.

In general, the mapping does not identify wetland resources within the proposed property limits. A portion of the proposed new 345 kV overhead transmission line ROW is located within NWI mapped wetlands

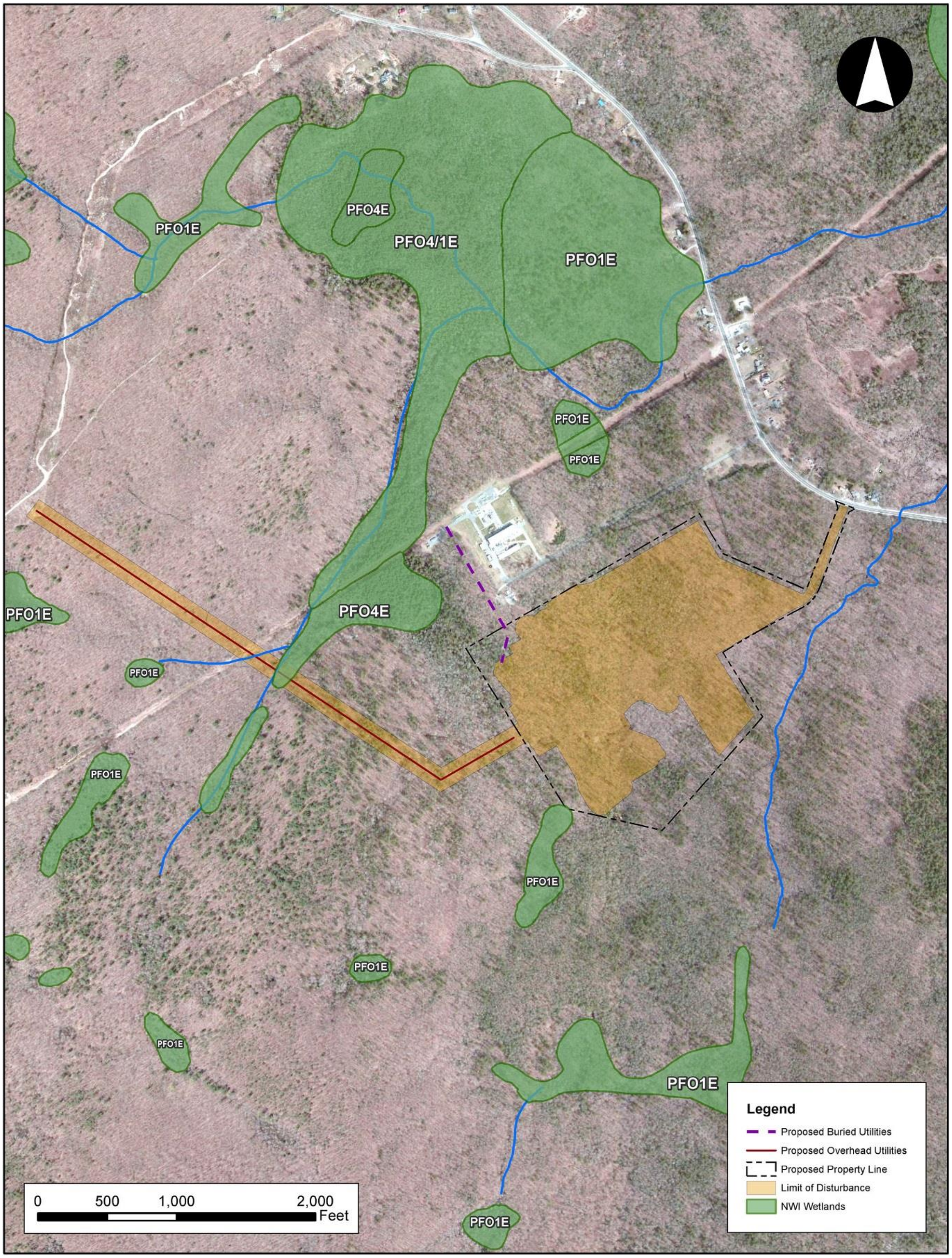


Figure 6.3-1
National Wetlands Inventory (NWI) Map

Rhode Island Department of Environmental Management Wetland Maps

Freshwater wetlands in Rhode Island were mapped based on interpretation of aerial photographs collected in 1988. According to the RIDEM wetland maps, three RIDEM mapped wetlands are located at the proposed Project site (Figure 6.3-2). These wetlands are classified as deciduous forested wetland and coniferous-forested wetland. In general, the mapping does not identify wetland resources within the proposed property limits. Portions of the proposed new 345 kV overhead transmission line corridor are located within RIDEM mapped wetlands.

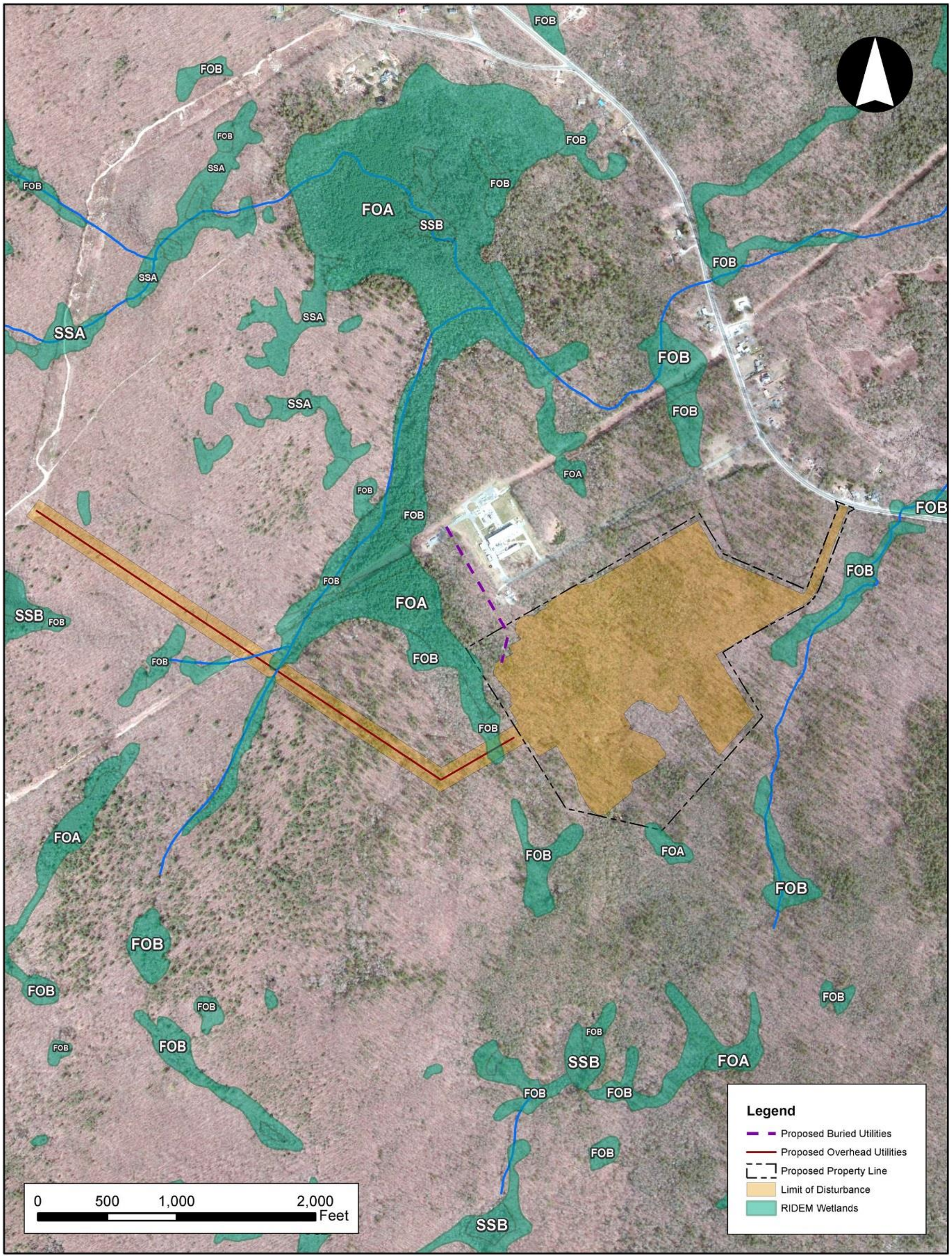


Figure 6.3-2
RIDEM Wetlands

Natural Resources Conservation Service Soil Data

Seven different soil map units are present at the proposed project according to the data available from NRCS (Figure 6.3-3). Three of these soil map units (Scarboro mucky sandy loam; Ridgebury, Whitman, and Leicester extremely stony fine sandy loams; and Freetown muck) include hydric soil components as summarized in Table 6.3-1. Mapped hydric soil units can be an indicator of the presence of regulated wetland resources. Portions of the proposed property limits as well as the proposed new 345 kV overhead located within mapped hydric soils.

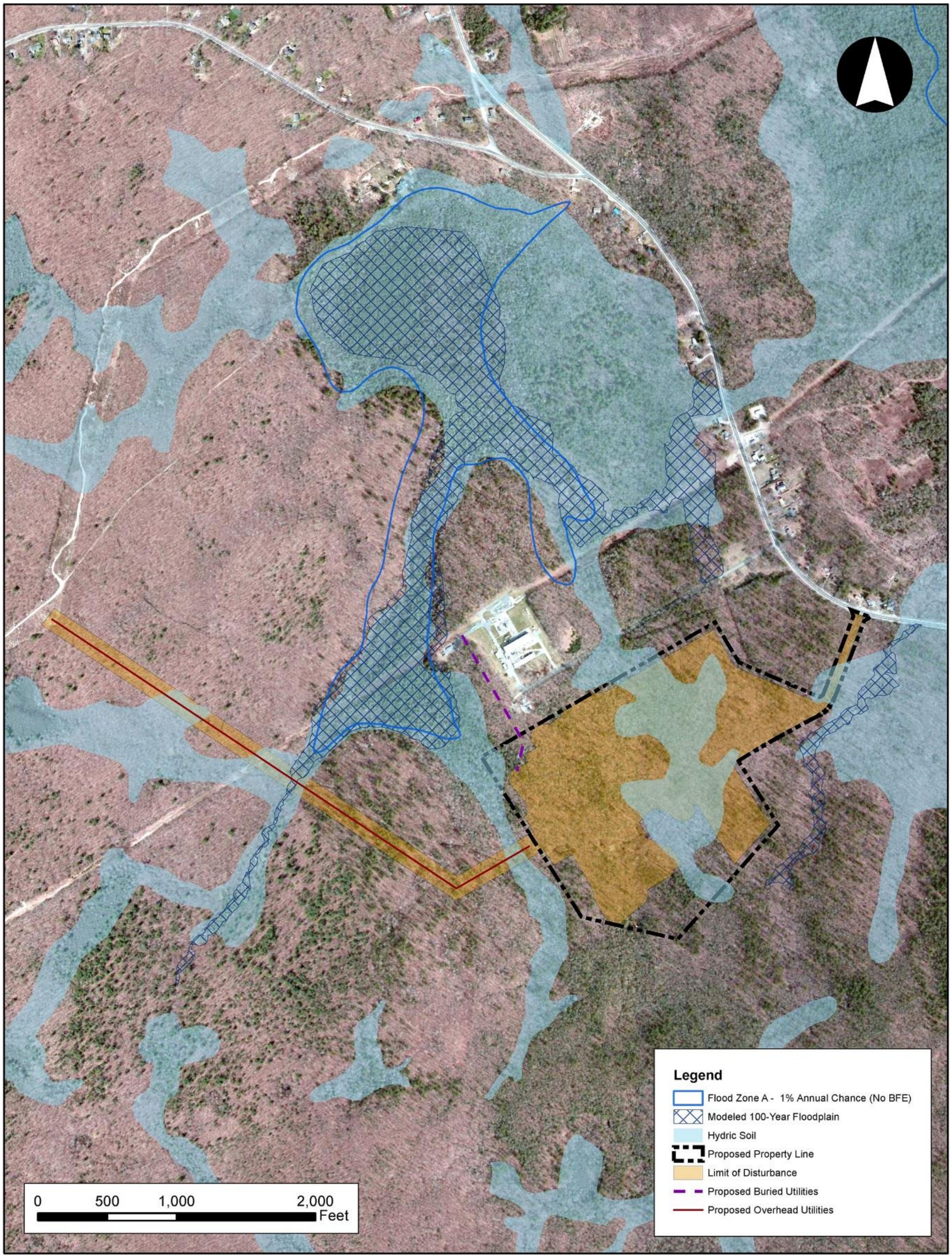


Figure 6.3-3
Hydric Soils

Table 6.3-1

List of Soil Map Units at the Proposed Project site

Map Unit Symbol	Map Unit Name	Hydric Soil	Landforms
CeC	Canton and Charlton fine sandy loams, very rocky 3 to 15 percent slopes	N	Side slopes and crests of hills
ChD	Canton and Charlton very stony fine sandy loams 15 to 25 percent slopes	N	Side slopes of hills
FeA	Freetown muck 0 to 2 percent slopes	Y	Depressions
Rf	Ridgebury, Whitman, and Leicester extremely stony fine sandy loams 0 to 3 percent slopes	Y	Depressions and drainageways
Sb	Scarboro mucky sandy loam 0 to 3 percent slopes	Y	Depressions and drainageways
SuB	Sutton very stony fine sandy loam 0 to 8 percent slopes	N	Depressions and lower side slopes
WoB	Woodbridge very stony fine sandy loam 0 to 8 percent slopes	N	Side slopes and crests of hills

Federal Emergency Management Agency Floodplain Data

Digital floodplain data available from FEMA indicates that the proposed locations of the generation facility and substation are located outside of the FEMA mapped 100-year floodplain associated with Iron Mine Brook as well as the perennial tributary to Dry Arm Brook (Figure 6.3-3). In both cases the floodplain limits ae designated as Zone A where no base flood elevations have been determined (FEMA Map Nos. 44007C0110G [Effective date: March 2, 2009] and 44007C0130G [Effective Date: March 2, 2009]). No portions of the proposed project limits or proposed 345 kV overhead transmission line corridor are located within Flood Zone A (100-year floodplain).

As 100-year flood elevations are not available from published sources, an evaluation of flooding during the 100-year flood event to establish a Base Flood Elevation (BFE) for both streams potentially impacted by project activities was conducted. The limits of flooding based on this analysis are shown on Figure 6.3-3. A portion of the proposed 345 kV overhead transmission line corridor is located within the modelled 100-year floodplain of the Dry Arm Brook system.

Field Delineation

ESS wetland scientists completed a delineation of wetlands and streams at the proposed Project site in the fall of 2014 and spring of 2015. Wetlands were delineated in accordance with the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetlands and the Regional Supplement. An Wetland Edge Verification application will be submitted to RIDEM. Representative photographs of delineated wetlands and streams have been provided in Appendix D

Wetlands and soils mapping, along with field observations of vegetation types, soils and surface hydrology, were used to locate areas for evaluation. At each evaluation area, three parameters were considered to document whether the sample point was within a wetland: (1) a predominance of hydrophytic vegetation, (2) the presence of hydric soils, and (3) the presence of wetland hydrology. Details regarding the application of these techniques are provided below.

Hydrophytic Vegetation: The hydrophytic vegetation criterion is satisfied at a location if more than 50% of all the dominant species present within the vegetation unit have a wetland indicator status of obligate (OBL), facultative wetland (FACW), or facultative (FAC). An OBL indicator status refers to plants that have a 99% probability of occurring in wetlands under natural conditions. A FACW indicator status refers to plants that usually occur in wetlands (67% to 99% probability) but occasionally are found elsewhere. A FAC indicator status refers to plants that are equally likely to occur in wetlands or elsewhere (estimated probability 34% to 66% for each).

Hydric Soils: The hydric soil criterion is satisfied at a location if soils in the area can be inferred or observed to have a high groundwater table, if there is evidence of prolonged soil saturation, or if there are any indicators suggesting a long-term reduced environment in the upper 18 inches of the soil profile. Hydric soil indicators from the Regional Supplement were used to identify whether a particular soil observed within a sample location met the hydric soil criteria.

Wetland Hydrology: The wetland hydrology criterion is satisfied at a location based on conclusions inferred from field observations that indicate that an area has a high probability of being inundated or saturated (flooded, ponded, or tidally influenced) long enough during the growing season to develop anaerobic conditions in the surface soil environment, especially within the root zone.

In addition, ESS classified each delineated wetland according to criteria outlined by Cowardin, et al, 1979, in *Classification of Wetlands and Deepwater Habitats of the United States*.

Wetlands were identified in the field by marking the wetland boundary with pink flagging, labeled "WETLAND DELINEATION". Each flag was labeled in consecutive order. Flags were tied so that each flag was visible from the flag tied previously.

Delineated Wetland Resource Areas

ESS delineated four jurisdictional wetlands (Wetlands 1, 2, 3, and 4) at the Project site (Figure 6.3-4). Wetland 1, 2 and 3 are greater than three acres in size, and therefore have associated 50-foot perimeter wetlands, which begin at the wetland edge per the RIDEM Wetland Regulations. The four wetland areas delineated at the Project site are described in the following section.

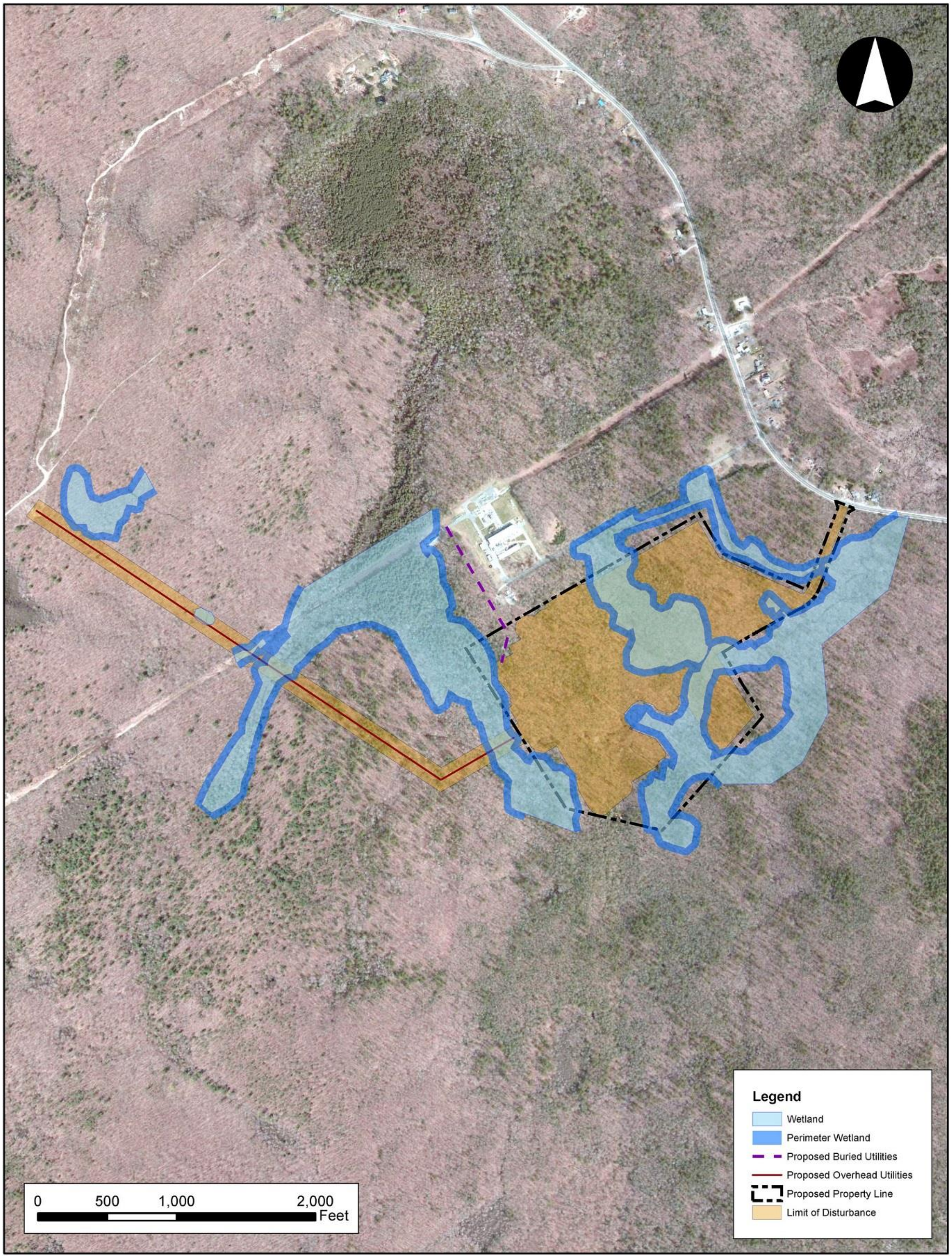


Figure 6.3-4
Delineated Wetlands

Wetland 1 – Wetland 1 is located in the eastern portion of the site and includes a forested wetland (PFO1E), Iron Mine Brook (R2), and two intermittent streams (R4). Typical plant species found in this wetland included red maple (*Acer rubrum*), red oak (*Quercus rubra*), highbush blueberry (*Vaccinium corymbosum*), sweet pepperbush (*Clethra alnifolia*), witch hazel (*Hamamelis virginiana*), mountain laurel (*Kalmia latifolia*), cinnamon fern (*Osmunda cinnamomea*), New York fern (*Thelypteris noveboracensis*), three-leaf goldthread (*Coptis trifolia*), Canada mayflower (*Maianthemum canadense*), and peat moss (*Sphagnum* sp.). Primary soils types in Wetland 1 were Woodbridge very stony fine sandy loams and Ridgebury, Leicester, and Whitman extremely stony soils. Soils in Wetland 1 are saturated at or near the surface in most areas. The forested communities in Wetland 1 share a hydrologic connection with Iron Mine Brook and its unnamed intermittent tributaries at the proposed Project site. Iron Mine Brook, which flows generally to the northeast, is an approximately 10 to 12 foot wide perennial stream with a sandy bottom in this reach. Iron Mine Brook has an associated 200-foot riverbank wetland, while the two intermittent streams located within Wetland 1 have an associated 100-foot riverbank wetland. Riverbank wetland areas are not shown on Figure 6.3-4. The main channel of Iron Mine Brook, as well as, the modeled 100-year floodplain does not extend into the proposed property limits (Figure 6.3-3).

Wetland 2 – Wetland 2 is located in the western portion of the site and includes a forested wetland (PFO4/1E), a perennial tributary stream to Dry Arm Brook (R2), and two intermittent streams (R4). Wetland 2 is generally bounded by distinct topographic breaks, including a prominent hill located in the southwestern portion of the site. Primary plant species in Wetland 2 included red maple, red oak, yellow birch (*Betula alleghaniensis*), black birch (*Betula nigra*), eastern hemlock (*Tsuga canadensis*), sweet pepperbush, highbush blueberry, witch hazel, mountain laurel, cinnamon fern, New York, fern, threeleaf goldthread, and peat moss. Primary soil types are Ridgebury, Leicester, and Whitman extremely stony soils; Freetown muck; and Sutton very stony fine sand loams. Soils within Wetland 2 are saturated at or near the surface in most areas, and other indicators of hydrology, including water-stained leaves and drainage pathways, are also present. The unnamed perennial stream in this area is low-gradient and flows generally to the northeast and has an associated 100-foot riverbank wetland. Riverbank wetland areas are not shown on Figure 6.3-4. The modeled 100-year floodplain associated with perennial tributary stream to Dry Arm Brook is shown in Figure6.3-3.

Wetland 3 – Wetland 3 is a forested wetland (PFO1E) located in the northwestern portion of the Project site. Wetland 3 is vegetated primarily with red maple, red oak, gray birch (*Betula populifolia*), highbush blueberry, sweet pepperbush, witch hazel, and peat moss. The primary soil type in Wetland 3 is Sutton very stony fine sandy loam. No surface waterbodies are present within Wetland 3, however surface saturation and drainage pathways are present.

Wetland 4 – Wetland 4 is a forested wetland (PFO1E) located in the northwestern portion of the Project site. Wetland 4 is vegetated primarily with red maple, black birch, witch hazel, highbush blueberry, sweet pepperbush, dewberry, swamp dewberry, New York fern, cinnamon fern, and peat moss. The wetland is approximately 0.3 acres in size and lies within a small, isolated topographic depression. Due to its small size, there is no perimeter wetland associated with this forested wetland.

6.3.3 Project Impacts

The proposed generation facility, switchyard, new 345 kV overhead transmission line ROW and new gas line have been designed and sited to be located outside delineated wetland areas to the greatest extent practicable. The proposed improvement of the existing woods road to serve as the facility access road will also minimize wetland impacts compared to the development of an entirely new road crossing through wetlands. Despite these measures, permanent and temporary wetland impacts will occur because of the proposed project; these are discussed in the sections below.

6.3.3.1 Permanent Impacts to Wetlands

Forested Wetland Conversion

The proposed new 150-foot wide, 0.8 mile long 345 kV overhead transmission line ROW will pass through both branches of Wetland 2 as well as through Wetlands 3 and 4. Clearing of trees within these wetlands will be necessary to establish the new transmission line ROW. Following tree clearing and installation of the new 345 kV overhead transmission line, the new transmission line ROW will be kept free of trees by mowing, pruning, and other vegetation control measures. These areas must be kept free of trees to ensure the safety and reliability of the overhead transmission line.

The total amount of forested wetland conversion in Wetlands 2, 3, and 4 resulting from the construction of the transmission line corridor is approximately 1.53 acres. These areas will be permanent converted from forested wetland to scrub-shrub and/or emergent wetland. An additional 1.39 acres of the perimeter wetlands associated with Wetlands 2, 3, and 4 will also be converted from forest to non-forested habitats.

Permanent Fill for Improvements to Woods Road

The existing woods road will require widening in order to accommodate construction vehicles and operational traffic associated with the proposed facility. Widening of the existing woods road would entail the placement of approximately 0.44 acres of permanent fill within Wetland 1. An additional 0.97 acres of permanent fill would be placed within the perimeter wetland of Wetland 1.

Permanent Fill for the Generation Facility

While the proposed facility has been sited outside of wetlands to the greatest extent practicable, some minor impacts resulting from fill associated with the generation facility are expected. Approximately 0.08 acres of permanent fill will be placed within Wetland 1 to accommodate the facility. An additional 0.70 acres of permanent fill will be placed within the perimeter wetlands of Wetlands 1 and 2 for construction of the facility.

Other Permanent Wetland Impacts

Additional areas of permanent fill within wetlands or perimeter wetlands may be required. These areas could include permanent fill for pole foundations within the overhead transmission line corridor, permanent fill associated with a potential gravel access road within the overhead transmission line corridor, or permanent fill associated with installation of culverts under the facility access road. These additional potential impacts will be developed as the project design is advanced.

6.3.3.2 Temporary Impacts to Wetlands

Construction Lay-down/Staging Areas

Construction of the proposed facility will require a construction lay-down/staging area of approximately 10-15 acres. The project proponents are currently investigating alternative lay-down locations within the proposed property limits as well as off-site to minimize any additional impacts to wetlands associated with construction. Any unavoidable temporary impacts to wetlands associated with the staging of construction vehicles, equipment, and materials during the construction would be restored once construction is completed.

Other Facility Construction - Temporary Wetland Impacts

Additional areas of temporary fill within wetlands or perimeter wetlands may be required. These areas could include temporary fill for an access road within the overhead transmission line corridor and temporary fill for construction work pads. These additional potential impacts will be developed as the project design is advanced.

Transmission Line Construction Impacts

Anticipated impacts associated with the construction and maintenance of this line are described in subsequent sections of this report. The construction of the proposed transmission line from the point of interconnection with the existing National Grid ROW to the Sherman Road Switching Station will occur within the existing National Grid right-of-way. National Grid is currently constructing a new, 17.7-mile, 345 kV transmission line (the 341 Line) from the West Farnum Substation to the Rhode Island/Connecticut border in Burrillville within the same right-of-way as a component of the Interstate Reliability Project. The new transmission line for the Facility will be constructed by National Grid in the existing Right of Way (ROW) adjacent to the two 345 kV transmission lines.

The transmission system upgrades as part of the Interstate Reliability Project was reviewed and approved by the Energy Facility Siting Board and include installing a new set of structures and conductor for a second 345-kilovolt transmission line parallel to the existing line. In order to accommodate the space needed for this new 341 transmission line, segments of existing lines have been realigned and rebuilt within the existing right-of way. The Sherman Road Switching Station in Burrillville will also be reconstructed and the existing switching station will be retired. Construction of this project commenced in 2014 and is anticipated to run through 2015. This transmission Site preparation for the Interstate Reliability Project included:

- Tree clearing and vegetation maintenance within the right-of-way to meet clearance codes,
- Upgrades of existing access roads to and within the right-of-way, and
- Installation of timber ("swamp") mats to protect wetlands and environmentally sensitive areas.

6.3.4 Proposed Mitigation

Three general practices have been employed in order to reduce the impacts to wetland resulting from construction of the proposed project. These are impact avoidance, impact minimization, and impact mitigation, and are described in the following sections.

Impact Avoidance

The proposed Project has been designed to avoid impacts to wetlands wherever possible. The generation facility, switchyard, substation, and proposed new gas line have been designed and sited to be entirely outside of delineated wetland resources areas. The proposed improvement of the existing woods road to serve as the Facility access road will also avoid wetland impacts that would otherwise occur as a result of the development of an entirely new road crossing through wetlands.

Impact Mitigation

Despite the impact avoidance measures described in the above section, some impacts to wetlands resulting from construction of the proposed project will occur. The total area of permanent forested wetland conversion is 1.53 acres and the total area of permanent wetland fill is 1.24 acres. Additional temporary wetland impacts may also be required for construction of the facility.

Wetland areas that are temporarily impacted as a result of the placement of temporary fill will be restored to conditions comparable to those that existed before construction following completion of construction activity in that area. Restoration activities will include the removal of all temporary fill, construction debris, and equipment from wetland areas; removal of temporary erosion controls; re-grading as necessary to re-establish wetland hydrology; and re-establishing any disturbed vegetative communities including through plantings of native wetland tree and shrub species and spreading of a wetland seed mix.

When available, details on the extent of environmental impacts associated with the installation of the new transmission line from the Facility will be provided by National Grid. The recent National Grid improvements within the right-of-way are anticipated to substantially reduce any additional adverse environmental impacts. Similar to the Interstate Reliability Project, restoration work following installation of the new line will include:

- Removal of swamp mats,
- Clean up and removal of construction materials and debris,
- Reseeding of work pad and other disturbed areas, and
- Natural regrowth of vegetation.

6.4 Stormwater

The Project will produce a series of hard surfaces (e.g., roads, buildings, equipment) that will increase the amount of run-off beyond current pre-development flows. To minimize impacts and to meet "control" requirements of the Manual, utilization of best management practices (BMPs) established in DEM's Manual and supplemental publications is appropriate. Initial power plant siting by Invenergy and HDR avoided placement of structures and pavements within the boundaries of delineated wetlands to the extent practicable (see Figures 3.4-3 and 3.4-4).

The proposed power plant site is located outside of FEMA mapped floodplain. Similarly, the 67-acre parcel is not adjacent to a named waterbody. Stomwater management facilities will be sited to avoid wetlands to the extent practicable. From a topographic perspective, natural drainage is predominantly west to east towards Route 100 (Wallum Lake Road).

The following BMPs are intended to be utilized in final design[2]:

1. Preservation of Undisturbed Areas – construction on elevated land areas, protecting wetlands from soil erosion and sediment transport during construction and operations. The proposed entrance road will approximately follow an existing access road, which passes through wetlands. Culverts will be used to preserve predevelopment hydrologic regime and wildlife passage.
2. Preservation of Buffers and Floodplain – no FEMA mapped floodplains are present onsite. Stormwater BMPs will be used to protect wetlands from storm flows and water quality impacts.
3. Minimized Clearing and Grubbing – construction is concentrated in the uplands, with maximum use of off-site modularization to minimize space needs and impacts on vegetation. All construction-phase actions will be preceded by installation of appropriate soil erosion and sediment control measures per RI Handbook.
4. Locating Development in Less Sensitive Areas
5. Compact Development – Site planning will address snow removal and other actions that could further impact surrounding wetlands.
6. Work with the Natural Landscape Conditions, Hydrology, and Soils
7. Reduce Impervious Cover – minimization of hard surfaces and use of pervious pavements, porous asphalt, diversion ditches, trash racks, level splitters, and ditch checks will be used to effectively reduce impervious surfacing impacts.
8. Disconnect Impervious Areas – on-site bioretention and ponding features will be used between and amongst impervious areas (roads, buildings, equipment) to mitigate run-off concentration. Vegetation

[2] Requisite topographic survey, geotechnical, and hydrology data is still being acquired to enable conceptual engineering design to proceed and permit application to be developed.

added within the developed area will be native to the area and selected for its beneficial contributions to sediment reduction and velocity control.

9. Mitigation of Runoff at Point of Generation – Consideration will also be made in detailed design regarding the use and location of select hydrodynamic separators, as a means of further reducing sediment and pollution from stormwater flows.
10. Stream/Wetland Restoration – aside from the wetlands-integrated Iron Mine Brook, there are no other defined water bodies. We anticipate minimal impact to wetlands on site. Proposed impacts will be limited to temporary encroachment for construction access only. Final site plans will address restoration and will include replanting, monitoring, and management as needed.
11. Reforestation – included as part of any wetlands reconstruction (Item 10).
12. Source Control – each impervious surface generating increased run-off will be addressed in terms of volume flow, content, and diversion into the adjacent wetlands where such flow currently travels. So as to sustain the health of on-site wetlands.

References

Rhode Island Department of Environmental Management (RIDEM) and Coastal Resources Management Council, “Rhode Island Stormwater Design and Installation Standards Manual”, December, 2010.

RIDEM, Office of Water Resources, “Wetland BMP Manual: Techniques for Avoidance and Minimization”, 2010.

Rhode Island State Conservation Committee, “Rhode Island Soil Erosion and Sediment Control Handbook”, Issued 1989 (Revised 2014).

RIDEM, “Multi-Sector General Permit, Rhode Island Pollutant Discharge Elimination System, Storm Water Discharge Associated with Industrial Activity”, Effective Date: August 15, 2013.

6.5 Vegetation

6.5.1 Site Vegetation

The site contains a mix of forested upland and wetland habitats; according to the *Rhode Island Ecological Communities Classification* (Enser et al. 2011) the primary vegetative community types present at the site are: oak forest, mixed deciduous/coniferous forest, tree plantation, forested swamp, and shrub swamp. These ecological communities are described by Enser et al. as follows:

- **Oak forest:**
  - **Black oak/scarlet oak – heath forest.** The predominant oak forest type in Rhode Island on well-drained, acidic soils. Chestnut oak and white oak may also be common constituents along with black birch, black gum, red maple, and sassafras. American chestnut was formally a common constituent. Understory is primarily ericaceous shrubs, especially huckleberry and lowbush blueberries.
  - **White oak – mountain laurel forest.** Typically found on well-drained coarse or gravelly soils such as on moraine deposits and eskers. Shrub layer is dominated by dense cover of mountain laurel with sparse herbaceous cover. Tends to occur in small patches within mixed oak and oak-pine forests.
- **Mixed deciduous/coniferous forest:**
  - **Mixed oak/white pine forest.** A forest community on well-drained soils with a canopy of mixed oak and 40-50% cover of white pine. Patches with >50% of white pine may also be found, but the overall pattern in larger stands is an even mix of oaks and pine. Shrub and

ground layers are generally similar to oak-dominated forests, although understory cover is diminished in closed canopy stands of pine.

- **Tree plantation:** Land cover is apparently modified and appears as a managed tree plantation, usually coniferous, even-aged trees planted in rows. Species may be native or non-native and include various spruces, pines, firs, and larch.

- **Forested swamp:**
  - **Red maple – deciduous swamp.** Understory is mixed deciduous shrubs including highbush blueberry, pepperbush, spicebush, winterberry, and swamp azalea. Skunk cabbage and cinnamon fern are common ground cover plants.
  - **Hemlock/hardwood swamp.** A mixed coniferous/deciduous swamp on mineral soil in depressions receiving groundwater discharge. Characterized by a closed canopy (75-100%), sparse shrub layer, and low species diversity. The canopy is dominated by hemlock at >50% with lesser amounts of yellow birch and red maple.
- **Shrub swamp.** Wetland communities dominated by shrubs 0.5 to 5 m tall that occur along the margin of a pond or river, isolated in a wet depression or valley, or as a transition community between a marsh and upland communities. This type is highly variable with the dominant shrub species dictated by local conditions, including water depth, topographic position, and microclimate. At wetter sites, buttonbush or water willow may dominate with over 90% cover. Sites not permanently flooded may support a mix of shrubs with characteristic species including highbush blueberry, sweet pepperbush, winterberry, alders, silky dogwood, maleberry, spicebush, spiraea, and swamp azalea.

ESS characterized the vegetation at the proposed Project site in the fall of 2014 and the spring of 2015. The primary vegetation species found at the site are given in Table 6.5-1.

Table 6.5-1
Primary Plant Species Found at the Proposed Project Site

Common Name	Scientific Name	Locations
Trees		
Red maple	*Acer rubrum*	Site-wide
Red oak	*Quercus rubrum*	Site-wide
White oak	*Quercus alba*	Site-wide
Black oak	*Quercus velutina*	Site-wide
White pine	*Pinus strobus*	Site-wide
Eastern Hemlock	*Tsuga canadensis*	Wetland 2
Yellow birch	*Betula alleghaniensis*	Site-wide
Black birch	*Betula lenta*	Site-wide
Gray birch	*Betula populifolia*	Wetland 3
Black gum	*Nyssa sylvatica*	Site-wide
Shrubs		
Sweet pepperbush	*Clethra alnifolia*	Site-wide
Highbush blueberry	*Vaccinium corymbosum*	Site-wide
Lowbush blueberry	*Vaccinium angustifolium*	Site-wide (upland areas)
Witch hazel	*Hamamelis virginiana*	Site-wide
Mountain laurel	*Kalmia latifolia*	Site-wide
Tall huckleberry	*Gaylussacia frondosa*	Site-wide (upland areas)
Maleberry	*Lyonia ligustrina*	Wetland 2 shrub swamp
Ground cover		
New York fern	*Thelypteris noveboracensis*	Site-wide (wetland areas)
Cinnamon fern	*Osumundastrum cinnamomeum*	Site-wide (wetland areas)
Threeleaf goldthread	*Coptis trifolia*	Site-wide (wetland areas)
Canada mayflower	*Maianthemum canadense*	Site-wide
Partridgeberry	*Mitchella repens*	Site-wide
Northern starflower	*Trientalis borealis*	Site-wide
Dewberry	*Rubus flagellaris*	Wetland 4
Swamp dewberry	*Rubus hispidus*	Wetland 4
Meadowsweet	*Spiraea tomentosa*	Wetland 2 shrub swamp
Fringed sedge	*Carex crinata*	Wetland 1
Broom sedge	*Carex scoparia*	Wetland 2 shrub swamp
Slender rush	*Juncus tenuis*	Wetland 2 shrub swamp
Solomon's seal	*Polygonatum biflorum*	Site-wide
Greenbrier	*Smilax rotundifolia*	Site-wide
Peat moss	*Sphagnum* sp.	Site-wide (wetland areas)

6.5.2 Construction Impacts

Construction of the proposed project will impact the vegetative community at the proposed Project site. This impact will be greatest within the footprint of the proposed generation facility, where the existing native oak-pine forest will be converted to impervious surfaces, and in the proposed construction laydown areas, where existing forest will be cleared and vegetation will be replaced following completion of the construction project. Vegetation will also be impacted along the proposed overhead transmission line corridor and the proposed new gas line to the facility. Within these areas, the existing trees will be removed, and the corridors will be permanently maintained with low-growing vegetation such as shrubs, grasses, and forbs. Impacts to the existing vegetative communities at the site will also occur at the proposed substation location and along the alignment of the proposed site access road, where vegetation will be cleared and the areas converted to impervious surfaces.

In addition to the areas cleared for construction of the proposed project, adjacent forested areas that are not cleared will also be impacted by the clearing. The creation of new forest edges will result in greater light penetration to these areas, and in turn will promote the growth of sun-tolerant, early-successional plant species and inhibit the grown of shade-tolerant, forest interior species. The disturbance and creation of new forest edges associated with this work has the potential to promote the growth of invasive plant species such as multiflora rose (*Rosa multiflora*), honeysuckles (*Lonicera*), glossy buckthorn (*Rhamnus frangula*), Japanese barberry (*Berbus thunbergii*), and others. These non-native species often out-compete native plants, which decreases the quality of wildlife habitat compared to areas free of invasive species

6.6 Terrestrial Ecology and Earth Resources

6.6.1 Terrestrial Ecology

The following sections provide details on the existing conditions on the Project site.

6.6.1.1 Ecological Community Classification

The proposed Project site is located entirely within a mature woodland typical of those found throughout southeastern New England. Dominant canopy species are white pine (*Pinus strobus*), white oak (*Quercus alba*), red oak (*Quercus rubra*), and red maple (*Acer rubrum*), while the shrub story is composed primarily of mountain laurel (*Kalmia latifolia*), sweet pepperbush (*Clethra alnifolia*), witch-hazel (*Hamamelis virginiana*), lowbush blueberry (*Vaccinium angustifolium*), and highbush blueberry (*Vaccinium corymbosum*). Common herbaceous species include cinnamon fern (*Osmunda cinnamomea*), green brier (*Smilax rotundifolia*), and, in wetland areas, *Sphagnum* moss.

The predominant ecological communities present at the proposed Project site have been characterized according to the classification system presented in the *Rhode Island Ecological Communities Classification* (Enser et al. 2011), and are presented below.

Black Oak/Scarlet Oak – Heath Forest

The Black Oak/Scarlet Oak – Heath Forest is the most common oak forest type in Rhode Island uplands. Chestnut oak (*Quercus prinus*) and white oak may be common in this community, along with black birch (*Betula lenta*), black gum (*Nyssa sylvatica*), red maple, and sassafrass (*Sassafrass albidum*). The understory is composed primarily of ericad shrubs including lowbush blueberry and huckleberry (*Gaylussacia* sp.).

White Oak – Mountain Laurel Forest

White Oak – Mountain Laurel Forest is usually found on well-drained soils and often occurs as small patches within larger mixed oak woodlands. The dominant canopy species is white oak, while the understory is primarily composed of dense mountain laurel, with little herbaceous ground cover present.

Mixed Oak/White Pine Forest

This community is found on well-drained soils and features a relatively even mix of oak species and white pine. The shrub story and ground cover species are typical of those found in oak-dominated forests.

Red Maple – Deciduous Swamp

Red maple is the dominant canopy species in this ecological community, with the understory characterized by a mix of deciduous shrubs including highbush blueberry, sweet pepperbush, spicebush (*Lindera benzoin*), and winterberry (*Ilex verticillata*). Common ground cover species include cinnamon fern and skunk cabbage (*Symplocarpus foetidus*).

Utility Rights-of-Way

This community is a linear, managed shrubland and/or grassland on utility corridors. Power line rights-of-way typically contain larger patches of shrubs, while gas pipelines tend to be mowed regularly and are therefore dominated by herbaceous plants.

Shrub Swamp

Portions of the existing gas pipeline are located within this ecological community, which is dominated by shrubs that occur in wet depressions or transitional areas. Shrub swamps can be highly variable, and species composition is dictated by water depth, topography, and other local conditions.

6.6.2 Wildlife

The overall wildlife community at the proposed Project site is typical of that normally found in mature, mixed forests of southeastern New England. Wildlife species detected at the proposed Project site by ESS ecologists are given in Table 6.6-1.

Table 6.6-1

Wildlife Species Observed at the Proposed Project Site

Common Name	Scientific Name	Season(s) Detected			Means of Detection	Breeding Status at Site*
		Spring	Summer	Fall		
Birds						
Mallard	*Anas platyrhynchos*		X		Visual	Unlikely
Ruby-throated Hummingbird	*Archilochus colubris*	X	X		Visual	Probable
Mourning Dove	*Zenaida macroura*	X	X		Visual	Possible
Hairy Woodpecker	*Picoides villosus*	X	X		Visual	Possible
Eastern Wood-pewee	*Contopus virens*	X	X		Auditory	Probable
Great Crested Flycatcher	*Myiarchus crinitus*	X	X		Visual & Auditory	Probable
Eastern Phoebe	*Sayornis phoebe*	X	X		Visual & Auditory	Probable
Red-eyed Vireo	*Vireo olivaceus*	X	X		Visual & Auditory	Probable
Blue Jay	*Cyanocitta cristata*	X	X	X	Visual & Auditory	Possible
Black-capped Chickadee	*Poecile atricapillus*	X	X	X	Visual & Auditory	Possible
Brown Creeper	*Certhia americana*			X	Visual	Possible
White-breasted Nuthatch	*Sitta carolinensis*	X	X	X	Visual & Auditory	Possible
Veery	*Catharus fuscescens*	X	X		Visual & Auditory	Probable
Wood Thrush	*Hylocichla mustelina*	X	X		Auditory	Probable
American Robin	*Turdus migratorius*	X	X	X	Visual & Auditory	Possible
Ovenbird	*Seiurus aurocapilla*	X	X		Visual & Auditory	Probable
Northern Waterthrush	*Parkesia noveboracensis*	X	X		Visual & Auditory	Probable

Common Name	Scientific Name	Season(s) Detected			Means of Detection	Breeding Status at Site*
		Spring	Summer	Fall		
Black-and-white Warbler	*Mniotilta varia*	X	X		Visual & Auditory	Probable
Black-throated Blue Warbler	*Setophaga caerulescens*	X	X		Visual & Auditory	Probable
Black-throated Green Warbler	*Setophaga virens*	X	X		Visual & Auditory	Probable
Common Yellowthroat	*Geothlypis trichas*		X		Visual & Auditory	Possible
Canada Warbler	*Cardellina canadensis*	X	X		Visual & Auditory	Probable
Pine Warbler	*Setophaga pinus*	X	X		Auditory	Probable
Chipping Sparrow	*Spizella passerina*		X	X	Visual & Auditory	Possible
Northern Cardinal	*Cardinalis cardinalis*	X	X	X	Visual	Probable
Scarlet Tanager	*Piranga olivacea*	X	X		Visual & Auditory	Probable
Amphibians						
Wood Frog	*Lithobates sylvaticus*	X	X		Visual	Possible
Green Frog	*Lithobates clamitans*	X	X		Visual	Possible
American Toad	*Anaxyrus americanus*	X	X		Visual	Possible
Spring Peeper	*Pseudacris crucifer*	X			Auditory	Possible
Reptiles						
Eastern Garter Snake	*Thamnophis sirtalis*	X	X		Visual	Possible
Eastern Box Turtle	*Terrapene carolina*		X		Visual	Possible
Mammals						
White-tailed Deer	*Odocoileus virginianus*	X	X	X	Sign	Possible
Eastern Gray Squirrel	*Sciurus carolinensis*	X	X	X	Visual	Possible
Eastern Chipmunk	*Tamias striatus*	X	X	X	Visual	Possible
Big Brown Bat	*Eptesicus fuscus*		X		Acoustic	Possible
Silver-haired Bat**	*Lasionycteris noctivagans*		X		Acoustic	Possible
Hoary Bat	*Lasiurus cinereus*		X		Acoustic	Possible
Invertebrates						
Eastern Tiger Swallowtail	*Papilio glaucus*		X		Visual	Possible
Eastern Black Swallowtail	*Papilio polyxenes*		X		Visual	Possible
Six-spotted Tiger Beetle	*Cicindela sexguttata*		X		Visual	Possible

Unlikely means that no evidence of breeding activity was observed *and* the site does not provide appropriate breeding habitat for the species. **Possible** means that the site provides appropriate breeding habitat, but no specific evidence of breeding was observed. **Probable** means that the species was observed at the site during the breeding season, the site provides appropriate breeding habitat, and some evidence of breeding (i.e. nest, territorial display) was observed.

**Silver-haired bat call signature could not be confidently differentiated from Big Brown Bat calls and therefore the presence of silver-haired bat is potential.

The following wildlife species were not observed at the proposed Project site, but are expected to occur there based on the habitats present at the site. This list was generated based on habitat preferences of wildlife species given in *New England Wildlife: Habitat, Natural History, and Distribution* (DeGraaf and Rudis, 1986).

Table 6.6-2

Wildlife Species Expected to Occur at the Proposed Project Site

Common Name	Scientific Name
Birds	
Wild Turkey	*Meleagris gallopavo*
Cooper's Hawk	*Accipiter cooperii*
Red-tailed Hawk	*Buteo jamaicensis*
Great Horned Owl	*Bubo virginianus*
Barred Owl	*Strix varia*
Downy Woodpecker	*Picoides pubescens*
Northern Flicker	*Colaptes auratus*
American Crow	*Corvus brachyrhynchos*
Tufted Titmouse	*Baeolophus bicolor*
Carolina Wren	*Thryothorus ludovicianus*
House Wren	*Troglodytes aedon*
Hermit Thrush	*Catharus guttatus*
Gray Catbird	*Dumetella carolinensis*
Cedar Waxwing	*Bombycilla cedrorum*
Baltimore Oriole	*Icterus galbula*
Common Grackle	*Quiscalus quiscula*
American Goldfinch	*Spinus tristis*
Amphibians	
Northern Redback Salamander	*Plethodon c. cinereus*
Northern Two-lined Salamander	*Eurycea b. bislineata*
Gray Treefrog	*Hyla versicolor*
Reptiles	
Spotted turtle	*Clemmys guttata*
Northern Brown Snake	*Storeria dekayi*
Eastern Ribbon Snake	*Thamnophis s. sauritis*
Black Rat Snake	*Elaphe o. obsoleta*
Eastern Milk Snake	*Lampropeltis triangulum*
Mammals	
Northern Raccoon	*Procyon lotor*
Virginia Opossum	*Didelphis virginiana*
Striped Skunk	*Mephitis mephitis*
Coyote	*Canis latrans*
Red Fox	*Vulpes vulpes*
Gray Fox	*Urocyon cinereoargenteus*
Fisher	*Martes pennanti*
Red Squirrel	*Tamiasciurus hudsonicus*
Northern Flying Squirrel	*Glaucomys sabrinus*
Eastern Cottontail	*Sylvilagus floridanus*
Woodchuck	*Marmota monax*
White-footed Mouse	*Peromyscus leucopus*
Southern Red-backed Vole	*Clethrionomys gapperi*

6.6.2.1 Northern Long Eared Bat

In addition to the species listed above, a mixed forest habitat, similar to the Project area, also provides suitable habitat for several species of bats including the federally threatened Northern Long-Eared Bat (NLEB). The NLEB is a medium-sized bat that has been listed due to disturbance, summer habitat loss or degradation, impacts to hibernacula, and white-nose syndrome. White-nose syndrome poses the most severe and immediate threat to NLEB and is the primary reason for the species listing (USFWS 2015).

The NLEB are distributed throughout north-central United States to the northeastern states. During summer months these bats roost singly or in colonies in wooded areas, while non-reproductive females and males roost in cooler places such as caves and mines (USFWS 2015). Typically, the northern long-eared bats migrate to their hibernacula sites (caves and abandoned mines) in August and September, and then enter hibernation around October and November. Come April the bats emerge from hibernation to migrate back to their summer habitat where they feed on insects. As oppose to Indiana Bats, this species has much shorter migrations, typically ranging between 35-55 miles (USFWS NJFO 2015).

Northern long-eared bats are known or believed to occur in Providence County according to the USFWS (2015); however, there are no known maternity or hibernation occurrences in the county. To determine the presence/absence of this species at the Project area an acoustic survey was conducted in accordance with the 2015 USFWS Range-Wide Summer Survey Guidelines (Guidelines). Anabat SD2 acoustic detectors were deployed at 4 locations spaced across the linear and square components of the project design as prescribed in the Guidelines. At each location, the detectors collected data for 5-6 days between 7/31-8/9/2015. The results of the survey were then vetted by a USFWS qualified bat surveyor. Bats identified during the survey are included in Table 6.6-1; no NLEB were identified.

References

[USFWS] U.S. Fish and Wildlife Service. 2015 Northern Long-eared Bat (*Myotis septentrionalis*). Accessed online April 14, 2015 at: http://www.fws.gov/midwest/endangered/mammals/nleb/

[USFWS NJFO] U.S. Fish and Wildlife Service New Jersey Field Office. 2015. Northern Long-eared Bat (*Myotis septentrionalis*) [threatened]. Accessed online April 14, 2015 at: http://www.fws.gov/northeast/njfieldoffice/endangered/LBEbat.html

6.6.2.2 Impacts to Wildlife and Ecology

Construction of the proposed project (including laydown areas) could result in the alteration of up to approximately 67 acres of existing forest habitats. The ecological communities within the site that would be affected by the proposed construction are discussed in Section 6.6.1. The wildlife populations associated with these habitat types will also be affected. In general, construction of the proposed project will reduce the overall availability of habitat at the site by through development. Within the proposed overhead transmission line and gas line corridors, forested areas will be cleared and maintained as shrubland and/or grasslands. This alteration will reduce the quality of the habitat for some species, and will render it unsuitable to forest-dependent species. However, other species that require early successional shrubland or grassland habitats may benefit from this conversion. Forested areas impacted to provide construction laydown areas will be restored following construction. These areas would displace most wildlife during construction, benefit species associated with shrublands in the near term and ultimately provide habitat for forest dependent species once the tree strata is re-established.

A forest interior impact analysis was conducted for the proposed work area as well as an additional indirect impact extending an additional 300 feet beyond the anticipated limit of work. Interior forest was defined as forested habitat greater than 300 feet from the nearest disturbance that would cause a break in the forest canopy (i.e. a road, power line ROW, etc.) (MDNR, Federation of Ontario Naturalists). The results of the analysis indicate that approximately 90% (62.1 acres) of the anticipated work limits would be considered interior forest, while 9% is non-interior forest, and 1% is non-forested areas. The existing forest interior habitat indirectly affected by the proposed limits of work includes an additional 83 acres.

Therefore, the overall size of the interior forest habitat at the site will be reduced, both due to the direct alteration of some areas and the increase in forest fragmentation that will result from clearing within the existing forest. This reduction in forest interior habitat will negatively impact species that require forest interior habitat, especially breeding birds such as warblers and scarlet tanager. Multiple pairs of black-throated blue warblers, which are listed by RIDEM as a threatened species in the state, were observed displaying territorial breeding behavior in the general footprint of the generation facility during the 2015 breeding season. Fragmentation of the existing forest can also increase the potential for non-native, invasive plant species such as multiflora rose (*Rosa multiflora*), honeysuckles (*Lonicera*), glossy buckthorn (*Rhamnus frangula*), Japanese barberry (*Berbus thunbergii*), and others to become established within and along the edge of the proposed clearing limits. Invasive plant species, if left unmanaged, have the potential to displace native plants and decrease the value of the habitat for wildlife. Forest fragmentation also increases the rate of brood parasitism of Neotropical migratory breeding birds by the brown-headed cowbird (*Molothrus ater*), which negatively impacts the reproductive success of forest breeding birds. Table 6.6-3 provides a list of species of Neotropical migratory birds that are considered forest interior breeders and which breed in Rhode Island.

Table 6.6-3
Neotropical Migratory Forest-Interior Breeding Birds in Rhode Island

Common Name	Scientific Name
Whip-poor-will	*Caprimulgus vociferus*
Acadian Flycatcher	*Empidonax virescens*
Blue-gray Gnatcatcher	*Polioptila caerulea*
Veery*	*Catharus fuscescens*
Wood Thrush*	*Hylocichla mustelina*
Yellow-throated Vireo	*Vireo flavifrons*
Red-eyed Vireo*	*Vireo olivaceus*
Northern Parula	*Setophaga americana*
Black-throated Blue Warbler*	*Setophaga caerulescens*
Black-throated Green Warbler*	*Setophaga virens*
American Redstart	*Setophaga ruticilla*
Black-and-White Warbler*	*Mniotilta varia*
Worm-eating Warbler	*Helmitheros vermivorus*
Ovenbird*	*Seiurus aurocapilla*
Northern Waterthrush*	*Parkesia noveboracensis*
Hooded Warbler	*Wilsonia citrina*
Canada Warbler*	*Wilsonia canadensis*
Scarlet Tanager*	*Piranga olivacea*
*Table adapted from G. D. Therres, Integrating Management of Forest Interior Migratory Birds with Game in the Northeast. Undated. *Species observed at proposed Project site during breeding season (10 of 18 species listed).*	

The reduction in the amount of interior forest habitat at the proposed Project site will negatively impact species that require interior forest habitat, such as breeding birds. However, the net increase in non-interior forest habitat within the proposed limits of work may benefit other species that require early-successional or edge habitats. Increased light penetration into the newly-created interior forest may promote the growth of understory species which could support edge-dependent wildlife.

6.6.3 Geology and Soils

The Project will have minimal impacts to earth resources. The following sections present a description of the topography, geology, soils, and vegetation associated with the property, along with a discussion of the potential impacted to topography, geology, soils and vegetation associated with the construction and operation of the proposed facility.

6.6.3.1 Existing Topography

According to elevation data collected in 2011 with Light Detection and Ranging technology and obtained from the Rhode Island GIS database, the elevation of the proposed site varies from approximately 530 to 590 feet above sea level, with the parcel sloping downward from southwest to northeast. The average grade on the property is 5.5%, but the hill in the southwestern portion of the Site has steeper slopes (see Figure 6.6-1). The property contains a lowland area on the northern portion of the property that is associated with a two unnamed intermittent streams that discharges to Dry Arm Brook to the northeast of the Site.

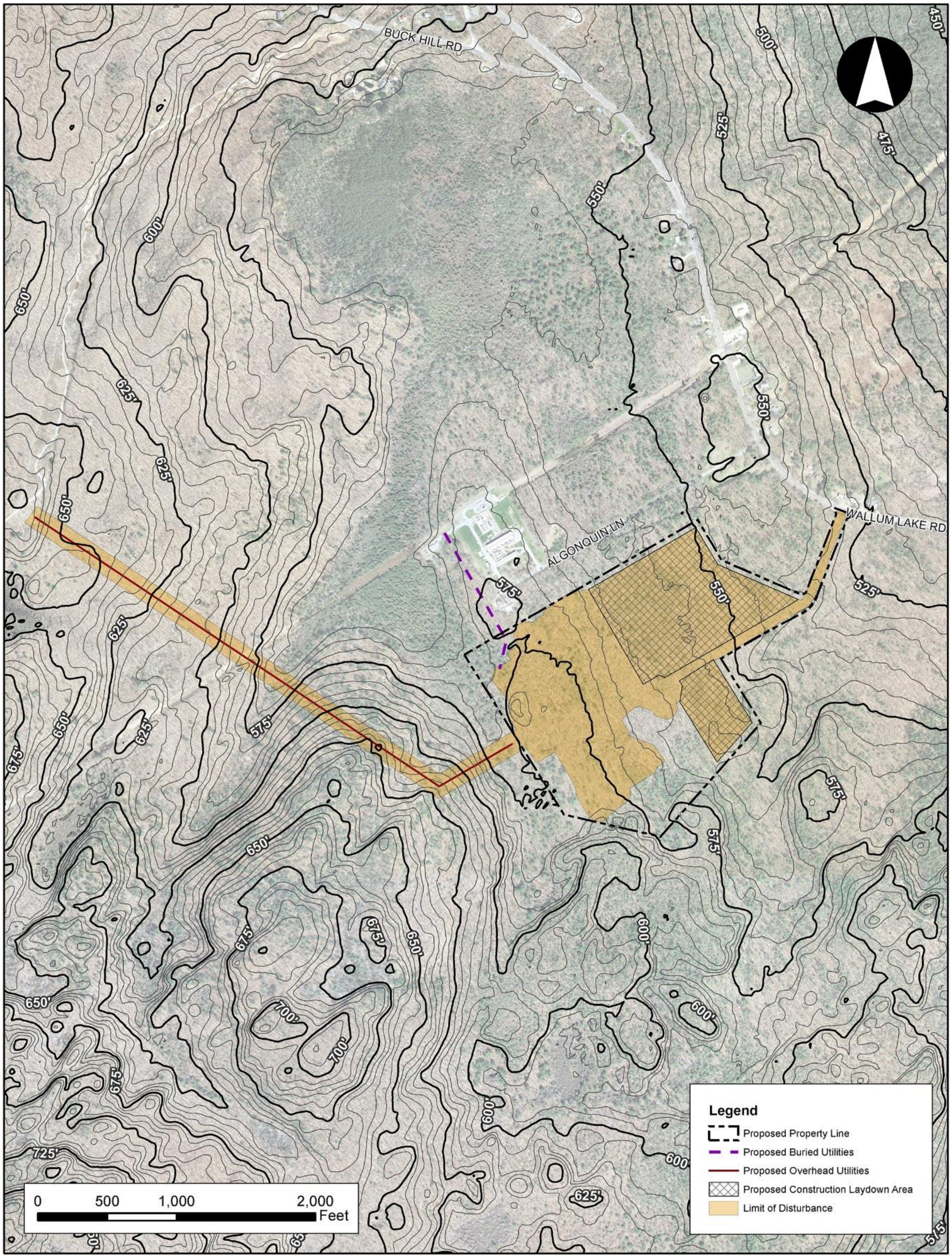


Figure 6.6-1
Topography

6.6.3.2 Geologic Setting

During the last two million years at least twenty episodes of continental glaciation covered the earth, and the last of these episodes, the Wisconsin glaciation, was predominantly responsible for the surficial geology of the region. This mile thick sheet of ice reached its southernmost extent in nearby New York City and Long Island approximately 20,000 years ago. Glacial till was deposited by both the advancing and retreating ice sheet, often directly on the underlying bedrock. The surficial geology on the Site is mapped predominantly as Till and Bedrock Uplands and the surficial deposits on the property are likely dominated by glacial till. Swamp and wetland deposits (typically organic peat deposits and organic silts) are likely associated with the wetland areas previously mapped on the Site. Refer to Figure 6.6-2 for the glacial geology designations for the Project area from the Rhode Island Geographic Information System (RIGIS).

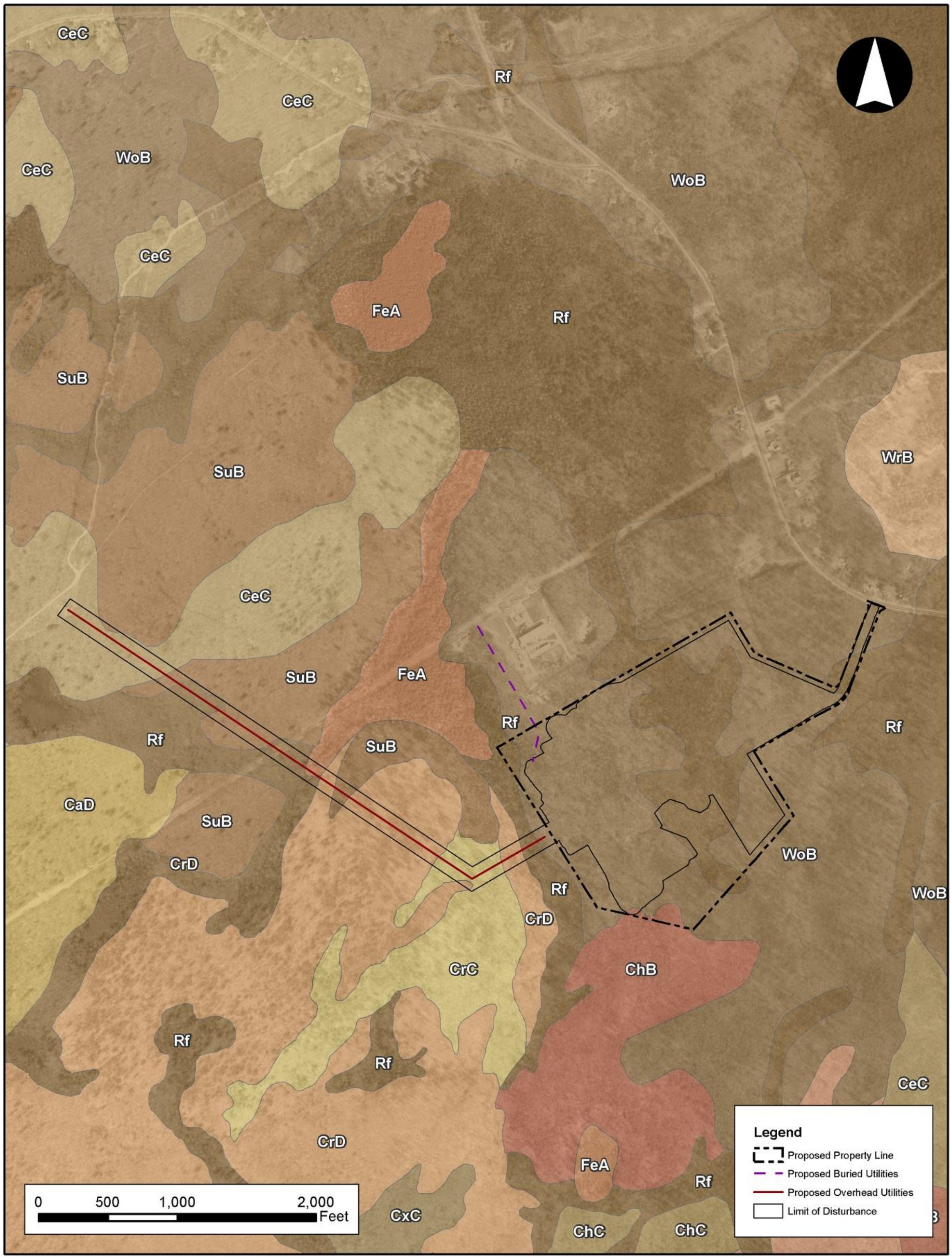


Figure 6.6-2
Surficial Geology

The Site area is mapped within the West Bay Area of the Esmond-Dedham Subterrane and is located approximately 1,600 feet to the east of the Hope Valley Shear Zone. The Hope Valley Shear Zone is a mapped Alleghanian strike-slip fault that marks the boundary between the Esmond-Dedham Subterrane and the Hope Valley Subterrane. A strike-slip fault is a fault on which the movement is parallel to the fault's strike. The Alleghanian orogeny or Appalachian orogeny is one of the geological mountain-forming events that formed the Appalachian Mountains. The Alleghanian orogeny occurred approximately 325 million to 260 million years ago over at least five deformation events

The underlying bedrock beneath the property is mapped as the Augen Granite Gneiss (Z_{eag}) member of the Esmond Igneous Suite. This late Proterozoic formation consists mostly of augen granite gneiss, a pale to dark grey medium- to coarse-grained igneous unit characterized by large (>1 centimeter) lenticular feldspar porphyroclasts called augen. The formation also includes structurally conformable layers of amphibolite.

The Site is located within the CREC subbasin of the Lower Blackstone River watershed. No significant surface water bodies are located in close proximity to the property. Round Pond is located approximately one mile to the northwest of the Site and Wilson Reservoir is located approximately one mile to the east of the Site. Tributaries of Dry Arm Brook run in a north/northeast direction to the northeast and east of the property.

6.6.3.3 Project Impacts

This section identifies and assesses potential impacts to the topography and geology during construction and operation of the Project. The potential impact to the topography and geology from the construction and operation of the Project will be negligible to minor. Additional details are provided below.

6.6.3.4 Impacts to Topography and Geology

The facility will be designed and constructed to be compatible with the local geologic conditions at the Site. The facility will be designed and constructed in accordance with seismic design criteria applicable to the Site area. As a result, the Project does not appear to be at any significant risk from seismic activity or existing geologic conditions. Construction at the Site will involve site grading and preparation. Existing Site topography, geology, soils, and vegetation have been considered in the placement and design of the facility. Detailed geotechnical evaluations will be performed within the structural footprint of the proposed facility and its associated electrical interconnect equipment to further determine the subsurface conditions and the necessary design criteria.

Construction activities on-Site will be confined to a limited area. Soil erosion and sedimentation control devices will be installed and will remain in place until final grading and re-vegetation is completed. This will ensure that construction activities remain contained and controlled throughout the construction process, and that on-Site and off-Site wetland resource areas are protected from potential erosion and/or sedimentation. A Project-specific Erosion and Sedimentation Control Plan will be developed to support these activities.

Excavation will be required for construction of foundations for major on-Site structures. Excavated material will be re-used on-Site when and where possible. Although, not currently anticipated, any off-Site disposal of excavated materials will be in accordance with all applicable state and local regulations and guidance, including a Project-specific Soil Management Plan.

Operational impacts associated with the Project will be negligible. Periodic maintenance or repair of the various facilities associated with the Project may require trenching activity or excavation in localized areas. Impacts will be localized, temporary and to a similar or lesser extent than those experienced during installation.

6.7 Coastal Resources

The Project will have no impact on any coastal resources. To be complete, a request for a determination of no impact has been submitted to the Rhode Island Coastal Resources Management Council (CRMC) on behalf of the Project.

6.8 Traffic

6.8.1 Existing conditions

The area surrounding the Project site is predominantly rural with long curved roads. Major roads and highways within the immediate vicinity of the Project area include Algonquin Lane, Wallum Lake Road (Rt. 100), and Church Street (Rt. 100). Roads in the immediate vicinity of the Project area, as well as main roads leading to major highways, may experience an increase in traffic flow due to the construction and operation of the proposed Facility. Below is a brief description of the roads and highways that may experience an increase in traffic volume during the construction and operation of the Facility.

Algonquin Lane, located in Pascoag, RI, is a one lane per direction road that serves as the primary entrance to the Algonquin Gas Compressor Station.

Route 100 is a 9.3 mile State Highway that begins in Gloucester, RI and ends in Douglas, MA. The portion of the Rt. 100 that is in RI is maintained by RIDOT. (Wallum Lake Road)

Wallum Lake Road, located in Pascoag, RI, is a one-lane per direction road that makes up a portion of Route 100.

Pascoag Main Street, located in Pascoag, RI, makes up a portion of Route 100. This portion of Route 100 includes a bridge with a posted 15 ton weight limit.

Church Street, located in Pascoag, RI, is a one-lane per direction road that makes up a portion of Route 100.

U.S. Route 44 is an east-west orientated United States Highway that spans a total of 237 miles through New York, Connecticut, Massachusetts, and Rhode Island. Lane numbers and speed limits vary by location.

Putnam Pike is located in Rhode Island and makes up a portion of Route 44 and Route 102. The number of lanes per direction and speed limit vary depending on location.

Route 7 is a 16 mile State Highway that begins in Providence, RI and ends in Burrillville, RI. Rt. 7 is a one-lane per direction highway that is maintained by RIDOT.

Route 98 is a State Highway that spans 6.1 miles. It begins in Chepachet, RI and ends in Burrillville, RI. Route 98 is a one lane per direction highway that is maintained by RIDOT.

Route 102 (Victory Highway) is a 44.4 mile State Highway that begins in North Kingstown and ends in North Smithfield, Rhode Island. Rt. 102 is a one-lane highway that is maintained by the RI DOT. The number of lanes and speed limit vary depending on location.

Broncos Highway is located in Burrillville, RI and makes up a portion of Rt. 102. Burrillville Middle School is located on this road. Speed limit is dependent on location and time of day.

Route 104 (Putnam Pike) is a State Highway that spans from North Providence to Woonsocket, RI. Route 104 is a one-lane per direction highway that is maintained by the RI DOT.

Farrum Pike, located in Rhode Island, and makes up a portion of Rt. 104.

Route 107 is a 3.9 mile State Highway that begins in Pascoag and ends in Burrillville. Route 107 is maintained by the RI DOT. (Pascoag Main Street and Chapel Street)

East Avenue is located in Burrillville, RI. It makes up a portion of Rt. 107. This portion of Rt 107 includes a bridge with a posted 19-ton weight limit (No Blanket Permit Vehicles).

Chapel Street is located in Harrisville, RI and makes up a portion of Rt. 107. This portion of Rt. 107 is a one lane per direction road with a posted speed limit of 30 miles per hour.

Route 116 is a 5.1 mile State Highway that begins in Coventry, RI and ends in Cumberland, RI. Route 116 is a one-lane per direction highway that is maintained by the RI DOT. Smithfield High School is located on this road.

Pleasant View Avenue, located in Smithfield, RI, is part of Route 116. Smithfield High School is located on this road. Speed limit is dependent on location and time of day.

Interstate 295 spans 26.58 miles through Massachusetts and Rhode Island and serves as a western bypass of Providence and Pawtucket, RI. I-295 alternates between two and three lanes and has a posted speed limit of 65 miles per hour.

Union Avenue is a two-way town road located in Pascoag, RI

Centennial Street is a two-way town road located in Pascoag, RI.

Grove Street is a two-way town road located in Pascoag, RI.

Lauren Hill is a two-way town road located in Pascoag, RI.

6.8.2 Site Access and Transportation Plan

The project will commence construction in the first quarter of 2017 and the expected construction duration is 30 months with commercial operation in June of 2019. Construction personnel will consist of construction craft (laborers, welders, etc.) and staff (professional staff, engineers administrative, etc.). Figure 6.8-1 shows the Heavy Haul and Main Road, Wallum Lake Road, the New Entrance Road, proposed parking and the equipment laydown area.

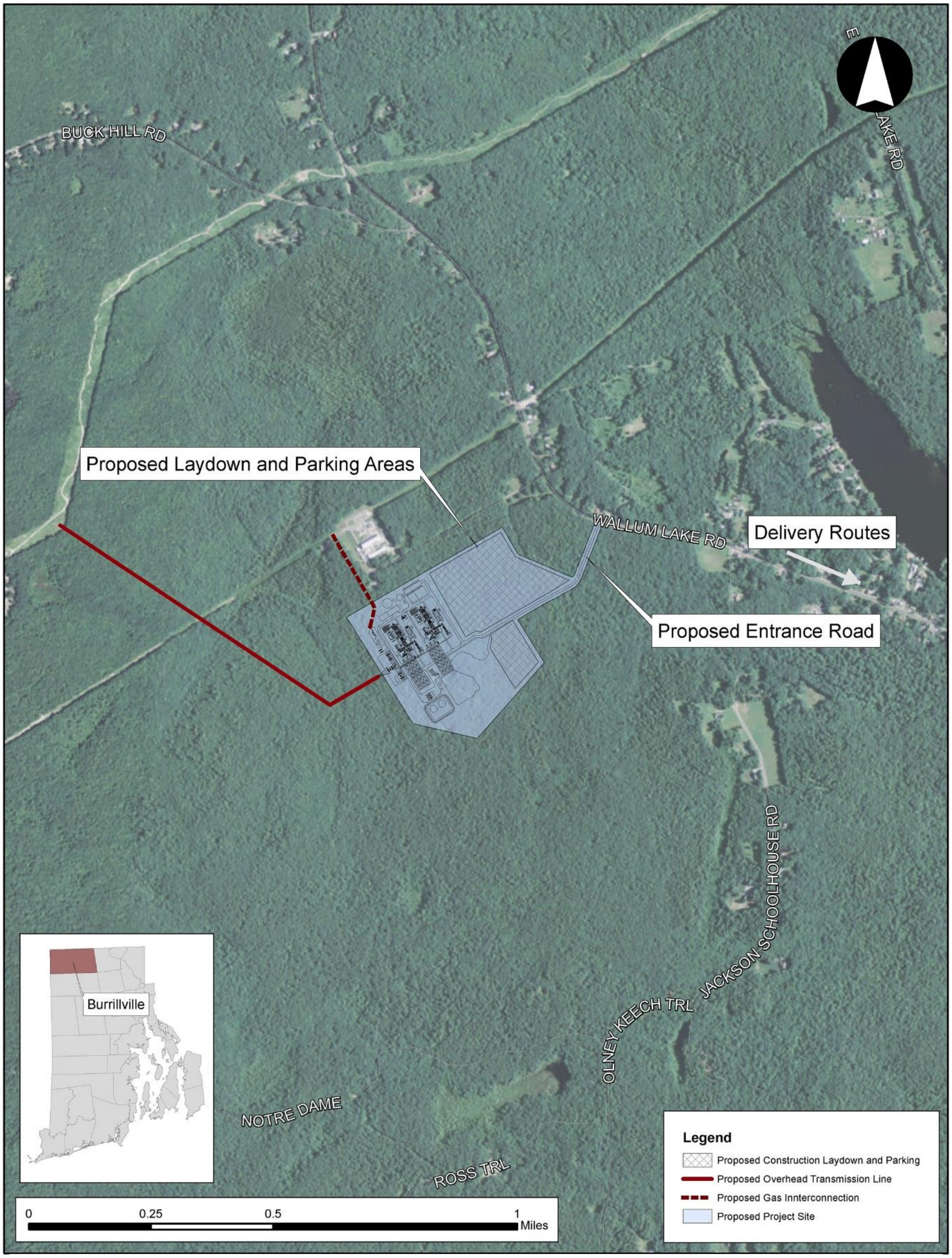


Figure 6.8-1
Site Access

6.8.2.1 Staff / Craft Traffic Control

Most staff traffic will occur between 6:00am-7:00 am with change of shift at 5:00pm-6:00pm. Staff will peak at approximately 150 people in the second quarter of 2018. Craft will also peak at 440 people the second quarter of 2018.

6.8.2.2 Daily Truck Deliveries

Mobilization during LNTP Phase

Site Mobilization will take place in the first 3 months of construction. The mobilization chart below, Table 6.8-1, identifies early items to be delivered and approximate number of loads.

Table 6.8-1

Mobilization during the LNTP Phase
Early Deliveries

Item Description	Number of Trucks
Office Trailers (Owner & Contractor)	30
Craft Trailers	10
Civil Equipment	80
Warehouse	30
Maintenance Shop	20
Aggregate Trucks	300

Note: The quantities listed above are estimated quantities and will not be finalized until the project is further along with the design and engineering phase.

The average daily deliveries will be 10 – 12 trucks per day. During the rock plating of the office site, parking areas, and on site laydown areas, the loads per day could reach 60 or more. All of this traffic is planned to come up Wallum Rd. The only overweight loads requiring permits will be the Civil Equipment such as Off Road Haul Trucks and Excavators. The Office and Craft trailers will be over width and may also require special permits. Table 6.8-2 identifies major equipment deliveries to be made during the FNTP Phase.

Table 6.8-2

Mobilization during FNTP Phase

Major Equipment Deliveries

Item Description	Delivery Period	Number of Trucks
Air Cooled Condenser	3rd QTR 2017-1st QTR 2018	900
STG	3rd QTR 2017-2nd QTR 2018	20
HRSG's	3rd QTR 2017-1st QTR 2018	250
CTG's	1st QTR 2018-4th QTR 2018	250
Transformers	4th QTR 2017-1st QTR 2018	4
Power Distribution Modules (PDC's)	4th QTR 2017-1st QTR 2018	6
Aux Boiler	4th QTR 2017	30
1200 Crane	3rd QTR 2017	15
1300 Crane	3rd QTR 2017	15
1400 Crane w/ Luffing Jib	3rd QTR 2017	30
1600 Crane w/ Wagon	4th QTR 2017	40
Misc RT Cranes	3rd QTR 2017- 4th QTR 2017	6

Anchor Bolts Down, Underground Work

The Anchor Bolts Down portion of work will occur in the first 12 to 14 months of the project. The peak craft during this phase will be between around 270 employees in the 12th thru 14th month. During the underground phase of work, the deliveries will consist of aggregates, concrete, rebar, pipe, electrical conduit, and small tools and supplies. Excluding concrete deliveries, the construction contractor will work with the remaining vendors to ensure deliveries are between 8 AM to 3 PM, Monday through Friday. It is anticipated that approximately 10 to 15 truckloads per day (excluding concrete), based on past projects. Concrete deliveries are discussed in Section IV.

Anchor Bolts Up, Aboveground Work

During the aboveground phase of work most of the large and permit required deliveries will be by heavy haul. The peak craft during this phase will be between 300 and 350 people in the 18th and 19th month. The other deliveries during this time will be pipe commodities (i.e. valves, pipe, gaskets, supports, etc.), electrical commodities (i.e. conduit, wire/cable, junction boxes, etc.), instrumentation commodities (i.e. tubing, instruments, etc.), structural steel, skids, pumps, misc. equipment, man lifts, welding machines, and small tools and supplies. The construction contractor will work with the vendors to ensure deliveries are between 8 AM to 3 PM, Monday through Friday.

The air-cooled condenser (ACC) will require a minimum of 10 trucks per day for 30 plus days. The majority of the ACC may be stored at an off-site location.

There will also be deliveries occurring from major equipment manufacturer for the Power Island Package and these deliveries are expected to be between 8 AM to 3 PM, Monday through Friday. From previous experience and based on conversation Invenergy has had with potential contractors, we anticipate about 10 to 15 truckloads a day that would not need a special permit to be on the road.

Demobilization

Demobilization will take place in the last 4 months of the project and will be very similar to the Mobilization phase of the job.

6.8.2.3 Earth Work Deliveries

The majority of Earth Work deliveries will be between the hours of 7:30AM and 4PM and will come from Interstate 295 along the route identified in Figure 6.8-2. All of the trucks will meet Rhode Island Department of Transportation regulations for legal haul loads and no over size or weight permits will be required. Invenergy expects an average of approximately 30 to 50 trucks per day.

Figure 6.8-2
Earth Work Delivery Route

6.8.2.4 Concrete Work Deliveries

The majority of deliveries will be between the hours of 7:30AM and 4PM along the route identified in Figure 6.8-3. The exceptions would be for the delivery of major foundations shown in Table 6.8-3. These major placements with the Ready Mix suppliers may need to be made in the early hours of the day, starting at 2 or 3AM and possibly only on Saturdays to reach the required productions. These major placements will occur in the third and fourth quarter of 2017.

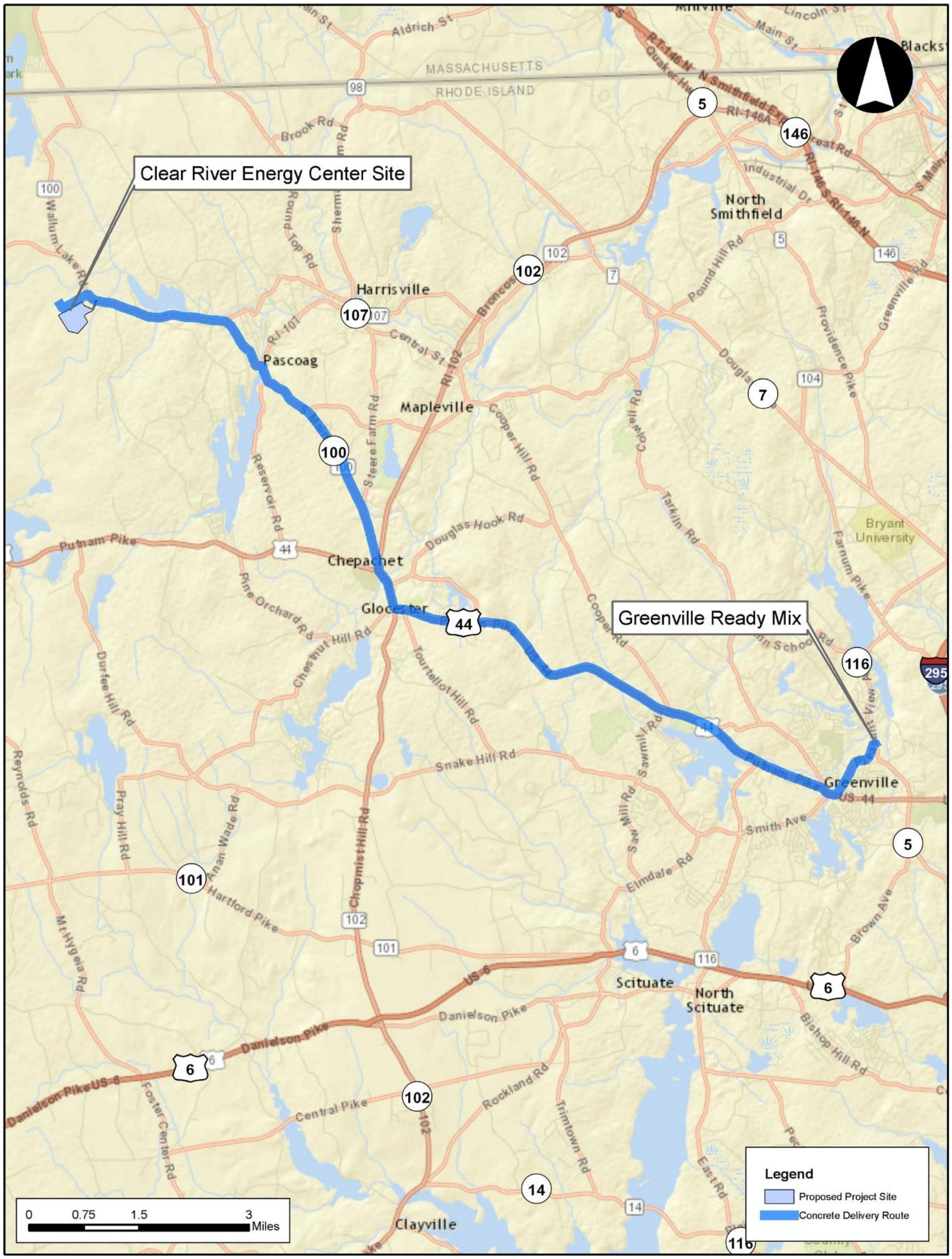


Figure 6.8-3
Concrete Work Delivery Route

Table 6.8-3

Work Delivery Schedule of Major Foundations

Foundation	Quantity CY	Trucks per Hour	Total trucks	Plant total	Hours
STG foundation	1000	18	100	200	5.6
CTG	1450	19	145	290	7.6
Generator	1000	20	100	200	5.0
HRSG	1000	21	100	200	4.8
Transformer	300	22	30	60	1.4
Admin BLDG	600	23	60	120	2.6
Water treatment	350	24	35	70	1.5

6.8.2.5 Heavy Haul Access Route

The combustion turbine and steam turbine equipment supplier plans to deliver the STG, CTG's, and HRSG Modules from the Port of Providence which is approximately 27 miles away from the project. The port has the necessary facilities or space such that the equipment can off loaded and placed on appropriate heavy haul trackers. There will be two loads for the STG, 17 loads for each the CTG, and 25 loads for each HRSG. The number of oversize/overweight loads delivered by goldhofer's to site is not defined at this time. It is expected to take the goldhoffer 12.5 hours to travel the 27 miles to site.

Delivery Schedule: The expected delivery is six loads per day. There are two options for receiving 6 per day:

- **Option 1**: Three goldhofer's cycling two times per day. It is expected that the first delivery would happen before rush hour and be on site before 6:00am and returning to rail site after the morning rush. A second delivery would then occur before the evening rush hour and return after the evening rush.
- **Option 2**: Two goldhofer's cycling three times per. It is expected that the first delivery would happen before rush hour and be on site before 6:00am and returning to rail site after the morning rush. A second delivery would then occur prior to noon and return to rail site early afternoon. The third delivery would occur before the evening rush hour and return to rail site after the evening rush.

Delivery Routes:

The current plan to move the heavy haul loads from the Port of Providence to the Project site is identified in Figure 6.8-4.

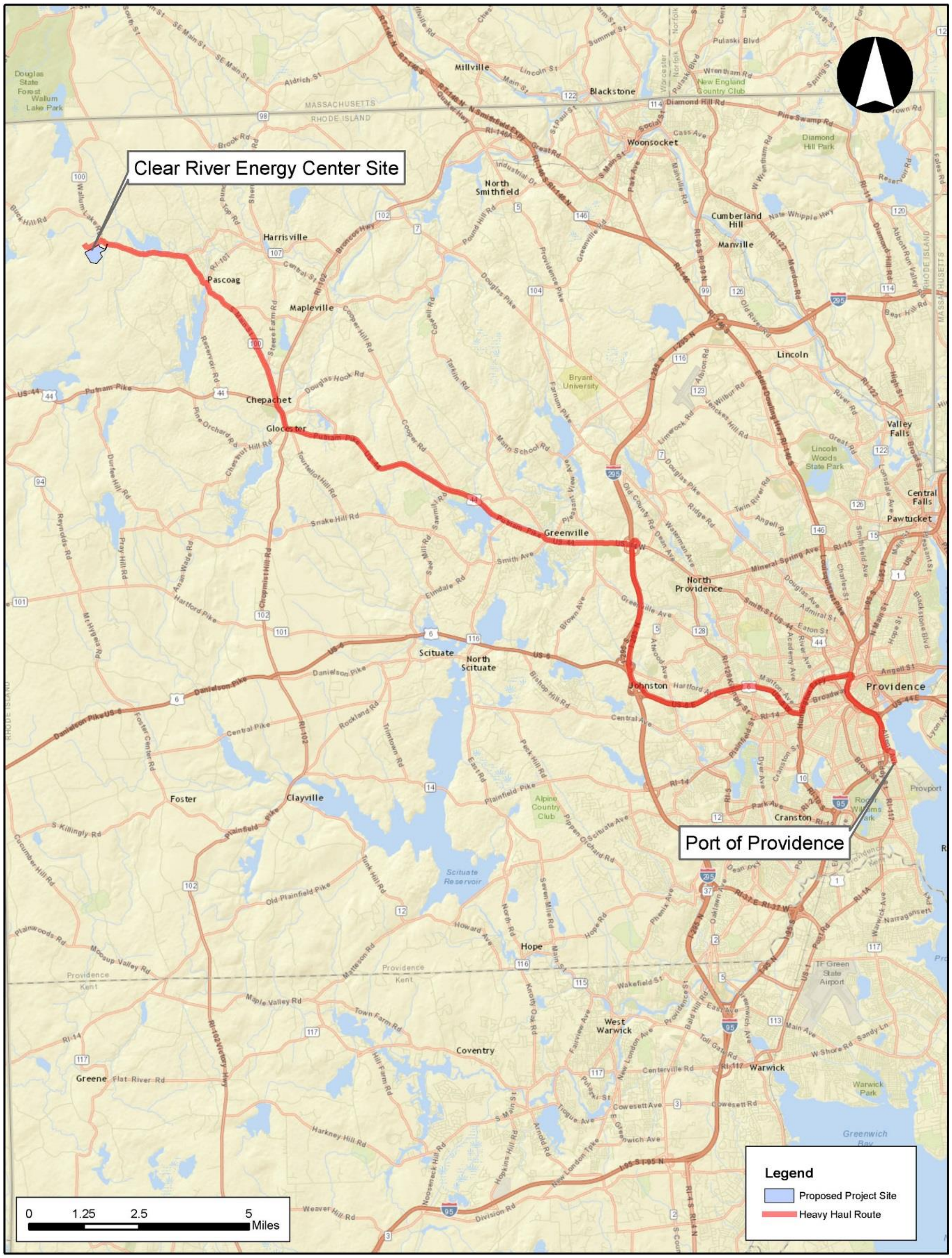


Figure 6.8-4
Port of Providence Route

6.8.2.6 Operation Phase

The operation of the Facility will have minimal, if any, impact on traffic. Employees will commute to and from the Facility on a daily basis but these vehicle trips will be spread out over multiple work shifts. There will daily deliveries of supplies and equipment but such deliveries will be intermittent. There will be delivery of ULSD by truck to the Facility when ULSD is fired; however as described previously this will likely occur no more than a few days per year so any impact on traffic resulting from such deliveries would be temporary.

6.8.3 Mitigation

Invenergy is committed to identifying and mitigating potential traffic related issues associated with the construction and operation of the Facility. Invenergy and its contractors will coordinate closely with the Rhode Island Department of Transportation (RIDOT) and the Town of Burrillville to develop and implement a pragmatic Traffic Management Plan (TMP). The TMP will alleviate the impacts of an increase in traffic volume in a predominantly rural community. Invenergy is devoted to working with the Town of Burrillville to maintain the safety and wellbeing of its citizens and the integrity of its infrastructure throughout the construction and operation of this Project.

6.9 Noise

An evaluation was conducted to examine the potential for construction and operation of the Facility to subject sensitive land uses (e.g., residences, care centers, schools, etc.) to interference from noise. The complete Noise Assessment Report has been included in Appendix E. The evaluation consisted of: 1) identifying all laws, ordinances, regulations and standards (LORS) governing noise emissions for the Project; 2) determining all Noise Sensitive Areas (NSAs) in the immediate vicinity of the site potentially impacted by noise; 3) monitoring background ambient noise levels at these locations; 4) predicting project-related (construction and operation) noise levels at NSA's using a computer-generated acoustical model of the Facility; 5) comparing project-related noise levels to applicable regulations, existing ambient noise levels, and various noise impact criteria; and 6) assessing any need for additional noise control measures in order to comply with performance standards and minimize potential impact.

Noise produced during operation of the CREC must conform to levels approved by the Rhode Island Energy Facilities Siting Board, (RIEFSB). As such, a review of approvals for combustion turbine merchant power projects similar to the CREC was conducted to determine noise limits imposed on other power generating facilities. Those limits ranged from 40 to 49 at the nearest residences. The Town of Burrillville also has a performance standard as established in their Code of Ordinances, which generally limits both broadband (A-weighted) and octave-band Facility noise levels at nearby residences to an equivalent level of 43 dBA. Burrillville's Code however, is not applicable in instances where "The facility generating the noise has been granted a permit or license by a federal and/or state agency and the authorization to operate within set noise limits". In the case of the CREC, permitting is governed by the EFSB. Nonetheless, the EFSB will seek the Town's opinion on the project, and the Town will likely rely on their Code of Ordinances to judge CREC's suitability. As such, Invenergy examined the design approaches needed to comply with their ordinance. Although achieving the broadband portion of the code (43 dBA) was feasible with extensive controls, including placing the combustion turbines within buildings, attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable and even beyond engineering feasibility. In an effort to arrive at a noise level design goal that was both respectful of the Code's intent to protect the community from excessive noise, yet commercially feasible to achieve and consistent with previous EFSB approvals, the Project proposes to comply with the same stringent noise limit imposed by the EFSB on Burrillville's Ocean State Power Project, namely 43 dBA at the closest residence, which is also the equivalent broadband limit for the Code of Burrillville. The proposed noise limit, in comparison to absolute limits for other US jurisdictions, is among the lowest we have encountered.

The nearest NSAs to CREC are located in five general areas: (1) residences along Wallum Lake Road to the northeast, (2) residences along Jackson Schoolhouse Road to the east and southeast, (3) residences in the Doe Crossing Drive area to the west, (4) residences along Buck Hill Road to the north, and (5) residences further south along Jackson Schoolhouse Road.

An ambient noise level survey was conducted from April 21st through April 24th, 2015 in Burrillville to characterize the existing acoustical environment at the nearest NSAs. Results of short-term noise monitoring (20-minute intervals) showed that background (L_{A90}) ambient levels at noise sensitive receivers ranged from the high-20's to high-40's (dBA) during daytime hours, and from the low-30's to mid-40's (dBA) during nighttime hours.

In the absence of natural sounds and traffic, noise from the Burrillville Compressor Station (BCS) is a major contributor to ambient background levels at nearby residences. During the ambient survey, the quietest levels were observed when BCS operated at reduced loads. As such, ambient increases due to CREC will be lower during normal BCS operation. Additionally, CREC noise levels were compared to measurements conducted as part of the noise evaluation for BCS reported by Hoover & Keith while BCS operated close to maximum capacity (88%)[3]. BCS levels were found to be 2 to 7 decibels higher (45 to 50 dBA) than the maximum predicted noise level at M1 for the CREC (43 dBA).

In summary, when considering various operating profiles of the BCS, in addition to environmental factors such as prevailing winds, foliage attenuation, high ground absorption, and potential for the ISO 9613 standard to overpredict, ambient increases may be conservatively overstated for some receivers.

BCS levels were found to be 2 to 7 decibels higher (45 to 50 dBA) than the maximum predicted noise level at M1 for the CREC (43 dBA). In general, CREC levels are expected to be below those when BCS is operated at or near full capacity.

A three-dimensional, computer-generated acoustical model of construction activity was developed using SoundPLAN® 7.3 and industry-standard prediction methods to estimate noise levels at nearby receivers for each of five major construction phases. Noise levels during Project construction are expected to be near or below current daytime ambient noise levels (L_{AEQ}). While construction noise may occasionally be discernible, it is not expected to increase ambient noise levels significantly. The majority of construction will take place during daytime hours (i.e., when the risk of sleep disturbance and interference with relaxation activities is low). As such, construction of the Project is not expected to result in any significant community noise impact.

A three-dimensional, computer-generated acoustical model of Project operations was also developed, in order to predict noise levels at off-site receivers and to identify any need for additional mitigation measures. Analysis results showed that given the proposed acoustical design of the Facility, noise levels during full load operation and under favorable sound propagation conditions are expected to range from about 34 to 43 dBA at nearby residences and therefore fully comply with Town of Burrillville noise ordinance broadband performance standards (≤ 43 dBA).

Furthermore, predicted Facility noise levels are appreciably lower than limits found in most laws, ordinances, regulations and standards promulgated throughout the U.S. for the control of industrial noise at residential land uses. Moreover, Project levels are consistent with: 1) outdoor noise level guidelines historically recommended by acoustical consultants; 2) criteria for the avoidance of speech interference both outdoors and indoors; 3) criteria for the avoidance of sleep disturbance; and 4) criteria for avoidance of low-frequency noise impacts. The Facility is also not expected to produce tonal noise. Although existing ambient noise levels for some receivers may increase at times during Facility operation, the overall magnitude and spectral content of Facility noise is not expected to result in significant community noise impact. Finally, although existing ambient noise

3 - *Burrillville Compressor Station, (Providence County, Rhode Island), Results of a Pre-Construction Sound Survey and an Acoustical Analysis of Station Modifications Associated with the Proposed Algonquin Incremental Market ("AIM") Project*, H&K Report No. 2976, H&K Job No. 4664, February 2014).

levels for some receivers may increase during CREC operation, the overall magnitude and spectral content of CREC noise is not expected to result in significant community noise impact.

In order to achieve these predicted outcomes, the proposed extensive acoustical design of the Facility includes high-performance silencers within the air intake ductwork of the combustion turbines to reduce high-frequency (spectral) compressor and turbine blade aerodynamic noise; silencers installed on fans providing ventilation air for the combustion turbine enclosure compartments; low-noise air cooled condensers and closed cooling water heat exchangers; combustion turbine exhaust diffuser noise walls; combustion turbine exhaust noise attenuated via the SCR/HRSG units and high-performance exhaust stack silencers; auxiliary boiler FD fan intake silencer banks; low-noise GSU transformers; acoustical shrouds over the HRSG transition ducts; buildings enclosing the auxiliary boiler, combustion turbines, gas compressors, steam turbines, boiler feed water pumps and water treatment equipment; and acoustical louvers on ventilation openings in the auxiliary boiler building and generation building.

During Facility commissioning, the Engineering, Procurement and Construction (EPC) Contractor for the project, will conduct a noise level performance test to confirm that Facility noise levels comply with Town of Burrillville broadband performance standards for noise.

State, County and Local LORS for Noise Control *- At* the state level, noise produced during operation of the CREC must conform to limits approved by the Rhode Island Energy Facilities Siting Board, (EFSB). At the county level, no numerical (decibel) noise limits have been promulgated which are applicable to the CREC. At the local level, the Town of Burrillville regulates noise through Chapter 16, Article II of their Code of Ordinances.

EFSB - Noise produced during operation of the CREC must conform to levels acceptable to the Rhode Island Energy Facilities Siting Board, (EFSB). As such, a review of approvals for combustion turbine merchant power projects similar to the CREC, (including Ocean State Power, RI Hope Energy and the Tiverton Power Project) was conducted to determine noise limits imposed on other power generating facilities. As summarized in Table 6.9-1, those limits ranged from 40 to 49 at the nearest residences.

Table 6.9-1

Summary of Residential Noise Level Limits from EFSB Approvals

Project Name	Noise Level at Nearest Residences (dBA)	Distance to Nearest Residence (feet)
Ocean State Power	43	1,200
RI Hope Energy	49	1,500
Tiverton	40	3,700

Town of Burrillville - The Town of Burrillville, through their Code of Ordinances, generally limits both broadband (A-weighted) and octave-band Facility noise levels at nearby residences to an equivalent level of 43 dBA. Burrillville's Code however, is not applicable in instances where "The facility generating the noise has been granted a permit or license by a federal and/or state agency and the authorization to operate within set noise limits". In the case of the CREC, permitting is governed by the EFSB. Nonetheless, the EFSB will seek the Town's opinion on the project, and the Town will likely rely on their Code of Ordinances to judge CREC's suitability.

Chapter 16, Article II of the Town of Burrillville Code of Ordinances, specifies the limits for noise emissions at receiving property boundaries according to the land use of the receiver, and the time period of noise source operation. Specifically, CREC noise emissions at receiving residential property boundaries during nighttime hours would be limited to the broadband (A-weighted) and octave-band levels in Table 6.9-2. Moreover, for noise sources that emit a tone, these noise limits are reduced by five (5) decibels. Tones are characterized as any sound that can be distinctly heard as a single pitch or set of pitches, and occur if any octave band noise level exceeds both adjacent octave bands by five (5) or more decibels. The Burrillville noise ordinance can be found in Appendix N1 (*Burrillville Noise Ordinance*).

Table 6.9-2

Town of Burrillville Nighttime Residential Noise Limits (dB)

Octave-Band Center Frequency (Hz)									A-Weight
31.5	63	125	250	500	1000	2000	4000	8000	
53	52	48	44	40	37	33	29	28	43

The Burrillville noise limits, specifically in the low-frequency octave-bands (31.5 Hz, 63 Hz, and 125 Hz), are among the most stringent we have encountered in the United States. Compared to octave band noise limits used in other U.S. jurisdictions, the Burrillville Ordinance is significantly more restrictive. This is particularly relevant since low-frequency emissions are generally more difficult to mitigate than are high-frequency noise emissions. Moreover, there is questionable benefit to establishing such stringent limits in these lower frequency bands, since the levels are considerably lower than needed to minimize annoyance.

As part of a screening analysis, a preliminary computer-generated, three-dimensional acoustical model of the CREC showed that although achieving the broadband portion of the code (43 dBA) was feasible with extensive controls, including placing the combustion turbines within buildings, attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable. Moreover, it is possible that specific necessary control measures (CTG air intake silencing; HRSG exhaust stack silencing; high-transmission loss building roofs) are beyond engineering feasibility. This is primarily due to the increase in back pressure additional air intake and exhaust silencing would create, potentially exceeding manufacturer's safe operating limits.

Recommended Noise Level Design Goal - As previously discussed, noise produced during operation of the CREC must conform to levels approved by the Rhode Island Energy Facilities Siting Board, (EFSB). A noise level ranging from 40 to 49 dBA at the nearest residences was historically permitted by the EFSB for similar power generating facilities.

The Town of Burrillville through their Code of Ordinances, generally limits both broadband (A-weighted) and octave-band Facility noise levels at nearby residences to an equivalent level of 43 dBA. Although Burrillville's code is supplanted by EFSB jurisdiction, Invenergy nonetheless examined the design approaches needed to comply with their ordinance. Burrillville's noise limits, specifically in low-frequency octave-bands (31.5 Hz, 63 Hz, and 125 Hz), are among the most stringent we have encountered and although achieving the broadband portion of the code (43 dBA) was feasible with extensive control, including enclosing the combustion turbines within buildings, attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable and even beyond engineering feasibility.

In an effort to arrive at a noise level design goal that was both respectful of the Code's intent to protect the community from excessive noise, yet commercially feasible to achieve and consistent with previous EFSB approvals, the Project proposes to comply with the same stringent noise limit imposed by the EFSB on Burrillville's Ocean State Power Project, namely 43 dBA at the closest residence, which is also the equivalent broadband limit for the Code of Burrillville. The proposed noise limit, in comparison to absolute limits for other US jurisdictions, is among the lowest of any promulgated.

Establishing a noise level design goal of 43 dBA at residential receivers would ensure that CREC noise emissions will be consistent with: 1) the broadband (A-weighted) limits of the Burrillville noise ordinance; 2) the noise limits for previously approved EFSB projects, 3) Federal guidelines for community noise (EPA and HUD); and 4) internationally recognized guidelines for minimizing speech and sleep disturbance. Achieving

43 dBA would still require extensive noise controls, including enclosing the combustion turbines within buildings.

Acoustical Design - As summarized in Table 6.9.3, the proposed extensive acoustical design of the CREC includes installation of the combustion turbines and steam turbines within buildings; high-performance silencers installed within the air intake ductwork of the combustion turbines to reduce high-frequency (spectral) compressor and turbine blade aerodynamic noise; silencers installed on fans providing ventilation air for the combustion turbine enclosure compartments; low-noise air cooled condensers and closed cooling water heat exchangers; combustion turbine exhaust diffuser noise walls; combustion turbine exhaust noise attenuated via the SCR/HRSG units and high-performance exhaust stack silencers; auxiliary boiler FD fan intake silencer banks; low-noise GSU transformers; acoustical shrouds over the HRSG transition ducts; buildings enclosing the auxiliary boiler, gas compressors, boiler feed water pumps and water treatment equipment; and acoustically louvered ventilation openings for the auxiliary boiler and generation buildings.

Table 6.9-3

Proposed Acoustical Design

Equipment Item	Control
Air Cooled Condenser	Low-Noise Design
Auxiliary Boiler	Enclosed within a Building
Auxiliary Boiler FD Fan Intake	High-Performance Duct Silencer Banks
Auxiliary Boiler Louvered Ventilation Openings	Acoustical Louvers
CCW Heat Exchanger	Low-Noise Design
Combustion Turbine Air Intakes	High-Performance Air Intake Silencers
Combustion Turbine	Enclosed within a Building
Combustion Turbine Ventilation	Ventilation System Silencers
Combustion Turbine Exhaust Diffusers	Exhaust Diffuser Noise Walls
Combustion Turbine Exhausts	Exhaust Mitigated via SCR/HRSGs and High-Performance Exhaust Stack Silencers
Fuel Gas Compressors	Enclosed within a Building
Generation Building Louvered Ventilation Openings	Acoustical Louvers
GSU Transformers	Low-Noise Design
HRSG Boiler Feedwater Pumps	Enclosed within a Building
HRSG Transition Ducts	Acoustical Shrouds
Steam-Turbine	Enclosed within a Building
Water Treatment Equipment	Enclosed within a Building

The 'absolute' level of CREC noise at all residences remains reasonably low (≤ 43 dBA) regardless of BCS operating profiles or environmental factors, and appreciably less than limits found in most laws, ordinances, regulations and standards promulgated throughout the U.S. for the control of industrial noise at residential land uses.

6.10 Generation and Disposal of Wastes

6.10.1 Environmental Characteristics

The Facility will generate relatively little industrial solid waste, and the waste generated will be managed in an environmentally responsible manner and in accordance with all town, state, and federal regulations. Industrial solid wastes generated by the facility may include wash water from the compressor cleaning operation, waste lubricating oils from equipment, spent antifreeze, oily rags, and other absorbents from cleaning up small leaks and spills, and parts washing liquids.

6.10.2 Potential Impacts

6.10.2.1 Construction Impacts

Minimal amounts of wastes will be generated during the construction of the Facility. Any wastes that are generated or disposed during the construction will be managed in an environmentally responsible manner and in accordance with all town, state, and federal regulations.

6.10.2.2 Operation Impacts

The Project will generate relatively little industrial solid waste, and the waste that is generated will be managed in an environmentally responsible manner and in accordance with all town, state, and federal regulations. Anticipated industrial solid wastes generated by the facility will include wash water from the compressor cleaning operation, waste lubricating oils from equipment, spent antifreeze, oily rags, and other absorbents from cleaning up small leaks and spills, and parts washing liquids.

6.10.3 Proposed Mitigation

Solid waste and other industrial solid wastes will be collected and stored on site in 55-gallon drums, or other compatible containers. Reuse and recycling will always be considered prior to disposal at facilities permitted to handle such wastes. All wastes will be stored in an area provided with cover, secondary containment, and an impervious surface. Any hazardous wastes shall be accumulated, labeled, inspected, managed, and disposed of in accordance with state and federal hazardous waste regulations. All waste accumulation areas will be provided with appropriate spill response equipment. A telephone or other means of communication will be available at the waste storage area, and emergency response information will be posted near the telephone. Employees will be trained initially and, afterward, annually, to manage wastes safely and in accordance with state and federal regulations.

6.11 Electric and Magnetic Fields

This section provides an assessment of electric and magnetic fields (referred to as EMF) resulting from the operation of the Project's dedicated 345 kV AC electric transmission line that will interconnect the Project into the regional electric transmission system. The complete EMF Analysis Report for the CREC Transmission Line is located in Appendix F.

6.11.1 Background for Electric and Magnetic Fields

Everyone experiences in their daily lives a variety of natural and man-made electric and magnetic fields.

Electric fields arise naturally during electrical storms from the separation of charges and from voltages applied to conductors. These fields are typically measured in volts per meter. Most objects including fences, buildings and other conductive structures reflect or attenuate electric fields. Electric fields are generated around all power lines when they are in operation or energized. The resulting strength of the electric field formed is dependent on the voltage of the power line and decreases with distance from the power line.

Magnetic fields are another type of field produced by the flow of electricity or current in a conductor. The strength of a magnetic field also decreases quickly with distance from the conductor, which is one of the most frequently applied methods of controlling exposure to magnetic fields from transmission lines. Magnetic fields are also common in everyday life in household appliances, building wiring or other items that use electricity. The earth's core itself creates a static magnetic field that can be easily demonstrated with a compass needle. The size of the earth's magnetic field, in the Northern United States, is about 570 mG. Knowing the strength of the earth's magnetic field provides a perspective on the low magnetic field measurements experienced near most electric transmission lines.

Table 6.11-1 lists common household devices and typical magnetic field levels measured at the distances indicated from the source.

Table 6.11-1

Common Sources of Magnetic Fields (mG)

	Distance From Source	
Sources*	**6 inches (mG)**	**24 inches (mG)**
Microwave Ovens	100-300	1-30
Dishwashers	10-100	2-7
Refrigerators	Ambient - 40	Ambient – 10
Fluorescent Lights	20-100	Ambient – 8
Copy Machines	4-200	1-13
Drills	100-200	3-6
Power Saws	50-1,000	1-40

Source EMF Electric & Magnetic Fields Public Service Commission of Wisconsin

Since the flow of electricity or load on a transmission line varies with time of day based on the need for electric power in the region, the magnetic field associated with electric transmission lines also varies throughout the day and with seasonal changes in electric demand.

Above ground transmission lines are typically located in transmission corridors or Rights of Ways (ROWs) with the conductors suspended from towers or poles to keep the transmission lines at a safe height above the ground. Access to transmission line ROWs is usually restricted for safety reasons.

Table 6.11-2 is provided to illustrate guidelines suggested by various national and international health organizations for exposure to both electric and magnetic fields. The EMF guidelines identified in Table 6.11-2 were developed by the identified organizations to be protective against adverse health effects from EMF, but which should not be viewed as representing EMF levels that have been proven as safe versus levels that are un-safe; the values shown are simply guidelines based on current knowledge.

Table 6.11-2

60-Hz EMF Guidelines Established by Health and Safety Organizations

Organization	Magnetic Field	Electric Field
American Conference of Governmental and Industrial Hygienists (ACGIH) (occupational)	10,000 mG [a] 1,000 mG [b]	25 kV/m [a] 1 kV/m [b]
International Commission on Non-Ionizing Radiation Protection (ICNIRP) (general public, continuous exposure)	2,000 mG	4.2 kV/m
Non-Ionizing Radiation (NIR) Committee of the American Industrial Hygiene Assoc. (AIHA) endorsed (in 2003) ICNIRP's occupational EMF levels for workers	4,170 mG	8.3 kV/m
International Committee on Electromagnetic Safety (ICES)	9,040 mG	5.0 kV/m
U.K., National Radiological Protection Board (NRPB) [now Health Protection Agency (HPA)]	2,000 mG	4.2 kV/m
Australian Radiation Protection and Nuclear Safety Agency (ARPANSA), Draft Standard, Dec. 2006 [c]	3,000 mG	4.2 kV/m
*Comparison to **steady** (DC) EMF, encountered as EMF outside the 60-Hz frequency range:*		
Earth's magnetic field and atmospheric electric fields, steady levels, typical of environmental exposure [d]	[550 mG]	[0.2 kV/m up to > 12 kV/m]
Magnetic Resonance Imaging Scan, static magnetic field intensity [d]	[20,000,000 mG]	---

Notes:
[a] *ACGIH guidelines for the general worker.*
[b] *ACGIH guideline for workers with cardiac pacemakers.*
[c] *http://www.arpansa.gov.au/pubs/comment/dr_elfstd.pdf; and http://www.arpansa.gov.au/News/events/elf.cfm*
[d] *These EMF are steady fields, and do not vary in time at the characteristic 60-cycles-per-second that power-line fields do. However, if a person moves in the presence of these fields, the body experiences a time-varying fields*

Table 6.11-3 shows guidelines that have been adopted by a number of states to establish EMF design guidance for future transmission line right of ways that are equivalent to that currently measured within or at the edge of existing transmission rights of way for similarly configured transmission-lines. These EMF state guidelines are not health-based standards, but simply guidelines to maintain EMF values for new transmission lines at EMF measurements experienced for existing similarly configured transmission lines.

Table 6.11-3
State EMF Standards and Guidelines for Transmission Lines

State / Line Voltage	Electric Field		Magnetic Field	
	On ROW	Edge ROW	On ROW	Edge ROW
Florida [c] 69 – 230 kV	8.0 kV/m	2.0 kV/m [f]		150 mG
230 kV and <= 500 kV	10.0 kV/m	2.0 kV/m [f]		200 mG,
>500 kV	15.0 kV/m	5.50 kV/m		250 mG [e]
Minnesota	8.0 kV/m			
Montana	7.0 kV/m [a]	1.0 kV/m [b]		
New Jersey		3.0 kV/m		
New York [c]	11.8 kV/m 11.0 kV/m [d] 7.0 kV/m [a]	1.6 kV/m		200 mG
Oregon	9.0 kV/m			

Key: ROW = right of way; mG = milliGauss; kV/m = kilovolts per meter

Notes:

[a] Maximum for highway crossings
[b] May be waived by the land owner
[c] Magnetic fields for winter-normal, maximum line-current capacity
[d] Maximum for private road crossings
[e] 500 kV double-circuit lines built on existing ROW's
[f] Includes the property boundary of a substation

Sources: "Questions and Answers about EMF." National Institute of Environmental Health Sciences and U.S. Department of Energy, 2002. http://www.niehs.nih.gov/health/topics/agents/emf/index.cfm

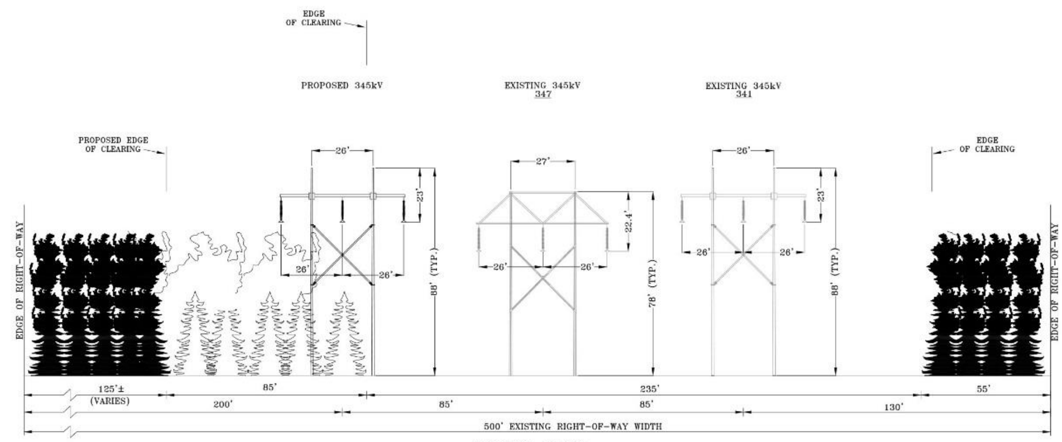
Florida, see: http://www.dep.state.fl.us/siting/files/rules_statutes/62_814_emf.pdf

6.11.2 Project's Planned Electrical Interconnection to the Regional Transmission System

To interconnect the CREC into the regional transmission system a new 345 kV transmission line will be installed within National Grid's ROW and a 0.8 mile 345kV transmission line will be constructed in new ROW from the CREC switchyard to the existing 345kV transmission line on the Spectra Site. This new 345 kV transmission line will be owned, operated and maintained by National Grid. The Project's new 345 kV line will run approximately 6.8 miles in the ROW from the proposed Project site in the Town of Burrillville to the existing Sherman Road Substation also in the Town of Burrillville. The National Grid ROW runs contiguous to the proposed site and provides a direct access to the regional transmission system.

Presently there are two existing 345 kV transmission lines already installed in the National Grid ROW which are designated by National Gird as the 341 and 347 transmission lines. These existing transmission lines are presently installed on transmission towers having an "H" type configuration.

Figure 6.11-1 provides National Grid's planned arrangement of the new 345 kV line and the existing 341 and 347 transmission lines and towers. Two cross sectional drawings are provided in Figure 6.11-1 representing the range of widths of the transmission ROW for the majority of the route from the Project site to the Sherman Road Substation. The top cross sectional drawing depicts the planned arrangement for approximately 4.4 miles of the route and the bottom cross sectional drawing depicts the planned arrangement for the balance (1.6 miles) of the 6 mile route. Figure 6.11-1 depicts the arrangement of the transmission towers and associated transmission lines looking south along the ROW with the Project's new 345 kV lines located on the east side (left side) of Figure 6.11-1.



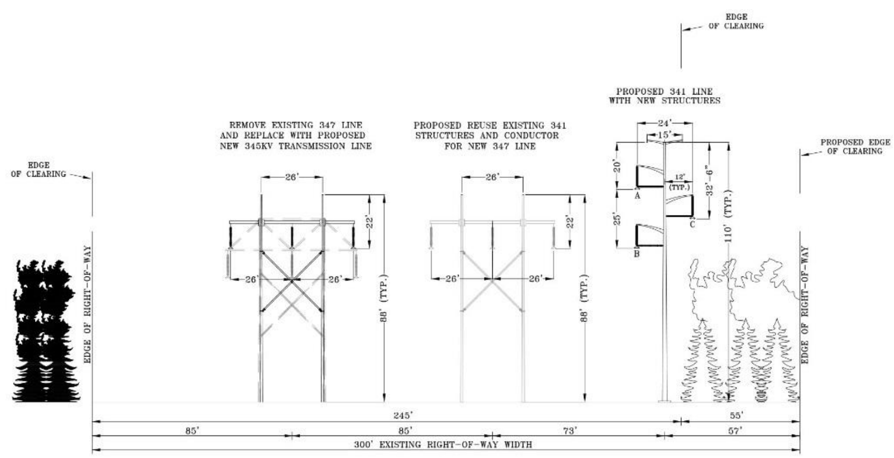
LOOKING SOUTH

TYPICAL RIGHT OF WAY CROSS SECTION

SHERMAN ROAD SUBSTATION TO THE DIVISION OF R.O.W. AT 0.19 MILES WEST OF THE CLEAR RIVER

APPROXIMATELY 4.4 MILES

BURRILLVILLE, RI



LOOKING SOUTH

TYPICAL RIGHT OF WAY CROSS SECTION

THE DIVISION OF R.O.W. AT 0.19 MILES WEST OF THE CLEAR RIVER TO PROPOSED QP489 SUBSTATION

APPROXIMATELY 1.6 MILES

BURRILLVILLE, RI

Figure 6.11-1
Right of Way Cross Section

The Project's electrical interconnect into the Sherman Road substation was the result of an Interconnection Study conducted by the Regional Grid operator ISO-New England (IS-ONE) for the Project. ISONE selected this method of interconnect (interconnection into the Sherman Road Substation) as the most reliable interconnection method for the Project and the regional transmission system.

6.11.3 Projected EMF Impacts

EMF standards and guidelines are applied at those locations where the public could have access to the Project. Most electric generation facilities are closed for general public access and as a result exposure to EMF within the facility is not an issue for the general public. Areas open to the public are typically publically accessible land along the edges of the ROW or for homes located contiguous to transmission rights of way.

As a result of the construction and operation of the Project the EMF levels along the six miles of the transmission ROW used by the Project will be impacted. To assess these impacts EMF estimates were developed that included impacts for the two existing 345 kV transmission lines (lines 341 and 347) and the addition of the Project's new 345 kV transmission line interconnecting the Project into the regional transmission system.

Table 6.11-4 provides the analysis of the magnetic fields (existing and proposed) within the ROW, at the edges of the ROW and 100 feet to either side of the ROW for the two arrangements of transmission towers depicted in Figure 6.11-1.

Table 6.11-4

Magnetic-field Levels (mG) at Peak Loading of CREC Line and Average and Peak Loading of the Existing 341 and 347 Lines

			Distance from Centerline of ROW				
Section	**Loading**	**Condition**	**East ROW Edge -100 ft**	**East ROW Edge**	**Max on ROW**	**West ROW Edge**	**West ROW Edge +100 ft**
4.4 Mile Section (See Figure 6.11-1)	Average	Existing	1.0	1.8	116	1.9	1.1
		Proposed	5.0	12	365	4.3	2.3
	Peak	Existing	0.5	1.1	171	8.2	2.0
		Proposed	6.4	14	342	3.8	1.6
1.6 Mile Section (See Figure 6.11-1)	Average	Existing	4.5	21	116	1.9	1.1
		Proposed	13	65	366	5.9	1.6
	Peak	Existing	3.5	22	171	8.2	2.0
		Proposed	19	79	336	46	14
Reference Exponent, Inc. Report Dated October 27, 2015 See APPENDIX F							

Table 6.11-5 provides the analysis of the electric fields (existing and proposed) within the ROW, at the edges of the ROW and 100 feet to either side of the ROW for the two arrangements of transmission towers depicted in Figure 6.11-1.

Table 6.11-5

Electric-field Levels (kV/m) With CREC and the Existing 341 and 347 Lines At Maximum Voltage

			Distance from Centerline of ROW				
Section	Voltage	Condition	East ROW Edge -100 ft	East ROW Edge	Max on ROW	West ROW Edge	West ROW Edge +100 ft
4.4 Mile Section (See Figure 6.11-1)	Maximum	Existing	0.02	0.05	7.5	0.39	0.02
		Proposed	0.04	0.11	7.5	0.38	0.04
1.6 Mile Section (See Figure 6.11-1)	Maximum	Existing	0.14	1.2	7.5	0.39	0.14
		Proposed	0.13	1.2	7.7	1.5	0.13
Reference Exponent, Inc. Report Dated October 27, 2015 See APPENDIX F							

The results of the analysis of the Magnetic and Electric field levels (EMF Levels) for the existing and the proposed addition of the CREC's transmission line within the National Grid ROW finds that the Magnetic and Electric Field levels at the edges of the ROW and 100 feet to either side of the ROW are calculated to be well below the reference levels recommended by International Committee on Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) (see Table 6.11-1) and well within the Standards and Guidelines set by many other States for new transmission line additions (see Table 6.11-3).

6.12 Visual Impacts and Aesthetics

6.12.1 Introduction

A preliminary visual assessment for the Project. The purpose of this analysis is to assess the potential for visual impacts to public resources in the vicinity of the Project.

For the purpose of this analysis, adverse visual impact occurs when "there is a detrimental effect on the perceived beauty of a place or structure". (NYSDEC, 2000) This adverse effect is only significant when one of the following criteria is triggered:

- Does the Project diminish the public enjoyment and appreciation of a place?
- Does the Project impair the quality or character of a place?

It is important to recognize that visibility is not visual impact by default. A project can be visible from a location, but may have little effect on the view or the enjoyment of that location. Additionally, adverse visual impact from a single location does not insinuate that the project has an adverse visual impact across the entire study area. The study area must be considered collectively in conjunction with the project need and benefit.

To determine whether the project may trigger the visual impact threshold, the following steps will be taken:

- Establish a visual study area
- Describe the visual study area
- Analyze the existence and location of visual resources
- Assess the regional visibility of the proposed project
- Assess visibility from visual resources

- Determine potential visual impacts and recommendation for additional review

The visual study area established for the Project extends five miles from the Project limits. Visibility and visual impact from distances beyond five miles are expected to be insignificant due to the atmospheric effects of visibility diminishment, as well as the nature of the vegetation and topography found within the study area.

6.12.2 Existing Conditions and Project Visibility

6.12.2.1 Description of the Visual Study Area

The visual study area includes the Towns of Burrillville and Glocester both in Providence County, Rhode Island, the Town of Douglas in Worcester County, Massachusetts, and the Towns of Tompson, Putnam, and Killingly in Windham County, Connecticut. The study area, which is primarily located within Rhode Island consists of heavily forested land interspersed with lakes, ponds, reservoirs, and villages. Elevations generally range from 300 feet to 800 feet and the terrain can be characterized as rolling to steep hills. The study area consists of over 80 percent forest vegetation which are generally large, contiguous stretches of undeveloped land interrupted occasionally by roads or other types of development. Lakes and ponds make up another four percent of the study area and the remaining land uses are a mixture of emergent wetlands, developed land, agricultural pasture and scrub shrub. Through most of the study area small single family residential lots line the local roads.

6.12.2.2 Inventory of Aesthetic Resources

Aesthetic resources consist of publically accessible places which are considered to have scenic value. In order to inventory these resources, ESS consulted multiple data layers provided by the Rhode Island Geographic Information System online data portal. These include historic, recreational, conservation and designated scenic areas. Table 1 is available in Appendix G and lists the nearby aesthetic resources. The location of these resources is presented below on Figure 6.12-1.

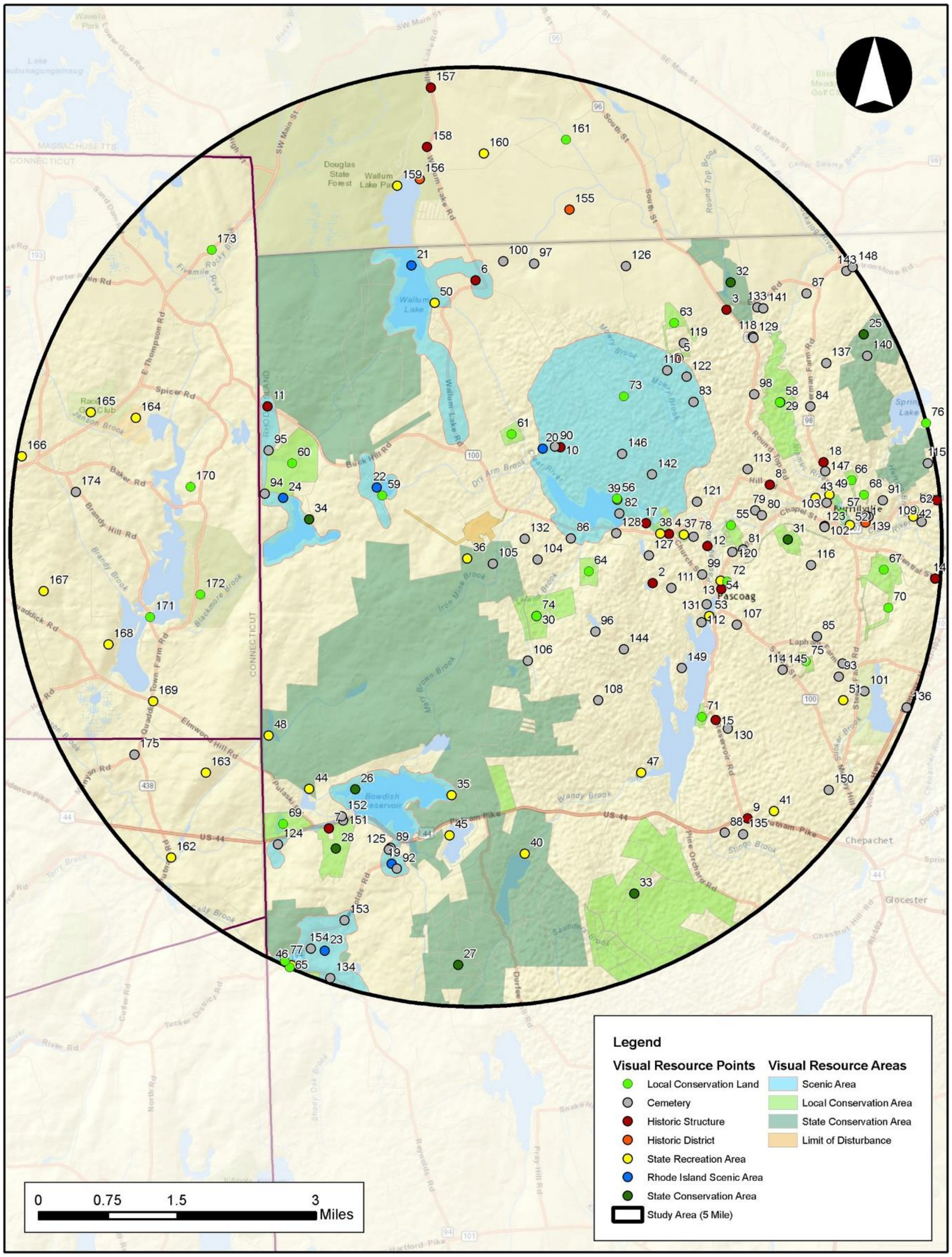


Figure 6.12-1
Aesthetic Resources

6.12.3 Viewshed Analysis

The purpose of the viewshed analysis is to determine the geographic areas within which there is a reasonable probability of Project visibility. The viewshed analysis considers the highest point of the Project components, the stacks, at a height of 200 ft.

To create the viewshed analysis, 10-Meter USGS Digital Elevation Models (DEM's) are imported into a Geographic Information Systems (GIS) workspace for the five-mile Study Area. The proposed stack locations are used as the origin of the analysis, set at 200 ft. The GIS software then scans each of the 10-meter cells within the three-mile Study Area. The scan assumes a 5.1-foot receiver elevation to simulate the viewer eye height to determine whether an uninterrupted line of sight to the Project is available. If the cell is determined to have potential visibility, each of those cells is coded as visible. The resulting data layer includes a combination of those cells with project visibility. This result represents the geographic area in which the project would be visible under bare earth conditions. The bare earth viewshed result is considered the worst case visibility for a project and is inherently conservative since bare earth conditions do not exist in the Project area and it does not consider screening by buildings.

An additional viewshed analysis was created to account for the screen effects of surrounding vegetation. The vegetation data is extracted from the 2011 NLCD, which analyses cover type in 30 meter square blocks. The vegetation data is then combined with the DEM and assigned a height of 40 ft. The viewshed model was rerun and the areas of vegetation excluded from the visible areas. This scenario is also conservative since screening by buildings is not considered, and as mentioned previously, the areas surrounding the Project are heavily forested with the occasional occurrence of villages.

6.12.4 Field Assessment

On July 22, 2015 a visual assessment technician visited the visual study area to document views and verify the results of the viewshed analysis map. A GPS point was taken at the Project site and the GPS navigation function was set to always point in the direction of the proposed facility. The visual technician then drive the visual study area paying particular attention to areas in which the vegetated viewshed analysis (Figure 6.12-2) indicated potential visibility. At each of the locations visited, the technician took a high resolution digital photo with a DSLR camera with a lens setting equivalent to 50 mm to represent a normal perspective (as opposed to a zoomed or wide angle view). Photos taken during the field visit can be found in Figure 6.12-3.

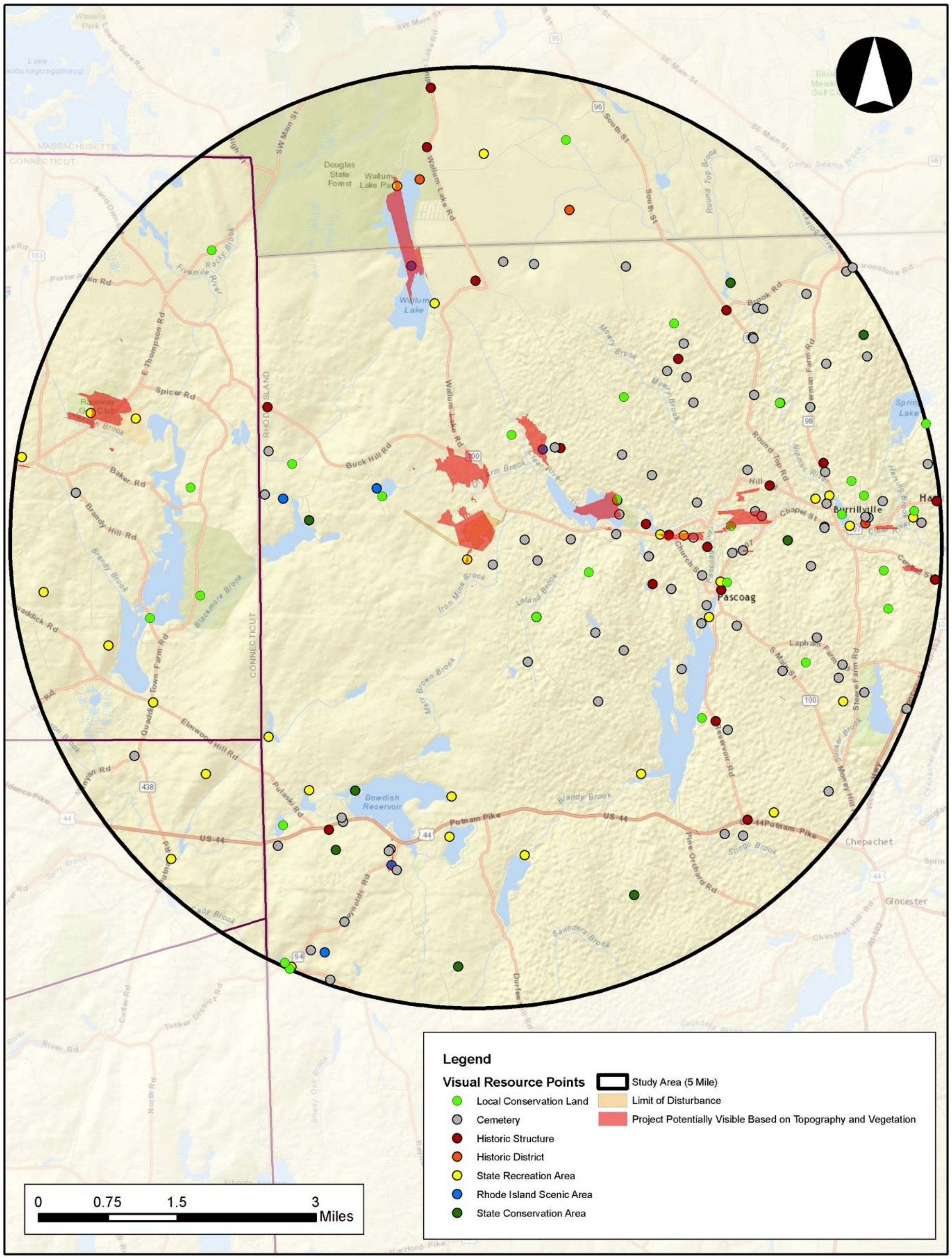


Figure 6.12-2
Viewshed Analysis

6.12.5 Visual Simulations

Simulations make it possible to demonstrate how the Project will appear in the view once complete.

A visual simulation was created by using the photographs obtained during the field visit. A three dimensional virtual camera is created using a 3D software application. This virtual camera matches the location, height, and focal length of the original photograph. These settings allow duplication of the original photograph's size, perspective, and zoom level.

The proposed facility stacks were the only portion of the facility visible from the simulation location. These were modeled to reflect the design intent of the facility so that the simulation accurately reflects how the facility will look from the photographed location. In order to ensure correct position and scale of the objects, all data was georeferenced to Rhode Island State Plane NAD 83. A terrain model, derived from RIGIS 2011 LIDAR Data, was converted to a mesh for use in the 3D software. Next, the camera was aligned and adjusted to match the original photograph and a virtual sunlight system was placed in the model to mimic the project location, time of day, day of year, and atmospheric conditions observed in the field. The 3D model was then rendered for final production and post-processing, including the process of placing the model into the photograph in the appropriate zone (e.g. existing foreground vegetation is placed in front of the object).

Viewpoint 1 (see Figure 6.12-3 Photo Log) is located on Wilson Reservoir within a Rhode Island Designated Scenic Area.

Photo 1 - Wilson Reservoir, Burrillville, RI
(Simulated View)

Photo 2 - Wallum Lake State Park, Douglas, MA
Not Visible

Photo 3 - Callahan School Ball Field, Burrillville, RI
Not Visible

Photo 4 - Emerson Road, Burrillville, RI
Not Visible

Photo 5 - Hauser Field, Pascoag, RI
Not Visible

Tompson Raceway Golf Club, Thompson, CT
Not Visible

Figure 6.12-3
Photo Log

Existing View

Simulated View

Figure 6.12-4
Visual Simulation

6.12.6 Potential Project Impacts

6.12.6.1 Viewshed Analysis Results

The bare earth viewshed indicates that approximately 29 percent of the study area will have project visibility. If 175 visual resources, the bare earth viewshed suggests that 152 would have project visibility assuming a landscape void of vegetation and structures (Appendix G, Table 1). As shown in Appendix G, Table 1, Bare Earth Viewshed Analysis, visibility tends to diminish to the east and west of the Project site due to intervening topographic features in the form of north-south oriented hills.

The results of the vegetated viewshed analysis suggests that only one percent of the visual study are will have project visibility. Figure 6.12-2, Vegetated Viewshed Analysis, shows the areas with potential visibility highlighted in red. Areas of visibility are generally limited to the site, large tracts of non-vegetated land, and open water. According to the vegetated viewshed maps, visibility does occur from 23 of 175 visual resources (Appendix G, Table1). It is important to note that vegetated wetlands were not included in the forest layer used in the viewshed analysis. This is due to the fact that these areas can sometimes be classified incorrectly, or may have sparse or small vegetation stands. However, a review of the aerial photographs strongly suggests that some large areas of visibility appear in dense forested wetlands, thus if removed, the total visibility would be less than one percent. Additionally, visibility tends to occur in Bridgeton, Pascoag and Graniteville where concentrations of buildings and houses occur. Since structures are not included in the vegetated viewshed analysis, it is very likely that the occurrence of visibility would be even less frequent.

6.12.6.2 Field Assessment Results

The field analysis completed on July 22, 2015 suggests that visibility will be minimal throughout the study area. A 193-foot communications tower approximately 700 feet to the north of the proposed stacks was used as a visual beacon while performing the field analysis and only one of the multiple locations visited, had visibility of the tower (see Figure 6.12.3, Photo Log). Actual field visibility is less than suggested by the vegetation viewshed analysis due building and structures in village areas, vegetation taller than 40 feet (50-70 foot vegetation is common in the visual study area), and the occurrence of multiple heavily vegetated wetlands which were dropped from the viewshed analysis. In addition, there are multiple small lots of vegetation throughout the study area that were missed by the NLCD dataset due to the large sample resolution.

6.12.6.3 Simulation Results

The visual simulation was produced in a photograph taken from Wilson Reservoir, 1.6 miles from the Project site. This simulation (Figure 6.12-4) shows that only the top 30 to 40 percent of the 200-foot stacks are visible. The view has multiple existing vertical features such as a communications tower and several variable sized trees at different distances from the viewer. The introduction of the stacks to the view, while clearly a built element, does not appear out of place or out of scale from this vantage point. Additionally, because the facility is dry cooled, the presence of a plume will not extend the visibility.

6.12.7 Conclusion

The Project will have minimal visibility from most locations within the visual study area. As suggested by the vegetated viewshed analysis and the field confirmation, less than one percent of the entire five mile visual study area will have project visibility. From the locations with visibility, it will be a partial view, often with the lower portions of the project screened by vegetation. Based on the existing mitigating factors such as vegetation and structures, the Project is not likely to have any significant visual impact during daytime viewing conditions. However, since the stack is 200 feet tall, the Federal Aviation Administration (FAA) must be consulted to determine lighting needs. If nighttime lighting is required, additional analysis should be completed to determine the potential for nighttime visual impacts.

6.13 Cultural Resources

The proposed Project will be permitted through the United States Army Corps of Engineers (USACE), and therefore must be in compliance with legislation and regulations concerning the impact to archaeological properties from federally-funded or permitted activities. These include Section 106 of the National Historic Preservation Act of 1966, the National Environmental Policy Act of 1969, Executive Order 11593, 1971, Procedures for the Protection of Historic and Cultural Properties, and the Archaeological and Historic Preservation Act of 1974. It is expected that the Rhode Island Historical Preservation and Heritage Commission (RIHPHC) will review the Project under Section 106, in consultation with the USACE.

6.13.1 Phase I Archaeological Intensive Survey

A Phase I Archeological Intensive Survey was conducted in each of the site areas designated for the Project. Shovel test pits were excavated at 10.0 meter intervals. Shovel test pits measured 50 by 50 cm square and were typically excavated no greater than 80 cm below the ground surface.

Three of the areas surveyed yielded historical and Native American cultural material:

- The electrical interconnection line yielded historical structure remains likely associated with an ephemeral cabin dating to the mid-nineteenth century. This structure and its immediate surrounding area will be not be disturbed by the Project.
- A single piece of quartzite shatter was recovered in the northeastern portion of the power block area and a small historical artifact scatter comprised of glass fragments was identified in the southeast portion of the power block area. No further work is recommended at either of these site locales due to the paucity of materials and lack of diagnostic materials.
- The area south of the power block yielded a total of six Native American artifacts, all lithic debitage, or the waste products of making or reworking stone tools. The need for Project avoidance or additional survey in this area will be determined in consultation with the RIHPHC.

The Project will work with the RIHPHC to minimize any impacts to historical or cultural resources. The complete Phase I Archaeological Management Summaries can be found in Appendix H.

7.0 ASSESSMENT OF NEED

7.1 Standards for Determining Need for the Proposed Facility

Load-serving entities ("LSE") located within the state of Rhode Island are members of ISO-NE, an independent, non-profit Regional Transmission Organization ("RTO") serving Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont. Among other items, ISO-NE is tasked with system planning, operating the power system, and administering the region's Federal Energy Regulatory Commission ("FERC") approved wholesale energy, ancillary and capacity markets for members operating within these states.

In 1997, ISO-NE was created by NEPOOL[4] market participants to operate the regional power system, implement wholesale markets, and ensure open access to transmission. In 2005, FERC Order 2000 designated ISO-NE as an RTO. As an RTO, ISO-NE assumed the additional responsibility for system planning. In order to facilitate this mission, system planning for capacity and reliability within ISO-NE member states is accomplished through ISO-NE's Forward Capacity Market ("FCM") capacity procurement mechanism, approved by FERC in 2006.

As members of ISO-NE, Rhode Island LSEs rely upon the ISO-NE FCM capacity procurement mechanism developed by ISO-NE stakeholders and approved by FERC, in which ISO-NE seeks to procure sufficient capacity, on a both a system-wide and localized basis, three-years in advance of a Delivery Year[5] ("DY") in order to meet projected peak demand *plus* minimum target reserve margins.

7.1.1 Governing Rhode Island Statutes, Policy and Regulation

In 1996, in accordance with FERC Orders 888 and 889, state regulators and LSEs throughout the New England region began the process of electricity market deregulation. The State of Rhode Island Public Utilities Commission ("PUC") began formal participation in the region's process of deregulation with the enactment of the Rhode Island Restructuring Act of 1996, and facilitated more broadly by the NEPOOL organization.

In December 1997, the Rhode Island PUC issued an order approving retail choice for all Rhode Island consumers. Retail choice allows Rhode Island ratepayers the flexibility to select a competitive retailer to supply their electricity, while relying on the local electric utility for distribution service; this order fundamentally altered the state's electric market structure by relying on regional NEPOOL/ISO-NE mechanisms to incent the economic development of new (and economic retention of) capacity to maintain system reliability. Currently, there are three distribution companies operating in Rhode Island. National Grid manages the distribution system for approximately 99 percent of Rhode Island. Block Island Power Company and the Pascoag Utility District serve the remaining areas on Block Island and in western Burrillville, respectively.

7.1.2 ISO-NE FCM Overview and Objectives

ISO-NE's FCM capacity procurement mechanism is utilized by ISO-NE market participants as a means to ensure that the ISO-NE power system has sufficient resources to reliably meet the future demand for electricity. Under the FCM, Forward Capacity Auctions ("FCA") are utilized as a market-based approach to determine both system-wide and localized needs for both existing and new generation capacity through a competitive auction process designed to select the portfolio of existing and new resources needed for system-wide and local reliability with the greatest social surplus.[6] In other words, resources that clear an FCA are, by definition, the resources that maximize social surplus in order to meet both system-wide and local reliability needs.

---

[4] New England Power Pool, the historical central authority for region-wide resource planning and dispatch in the New England region.
[5] Within ISO-NE, a Delivery Year runs from June 1 through May 31 of the following year.
[6] Social surplus, sometimes called social welfare, is the sum of consumer and supplier surplus, which is maximized when demand equals supply.

FCAs are conducted three-years prior to the capacity commitment period (i.e., DY) for which it is being held. In addition to the FCA, annual, seasonal, and monthly reconfiguration auctions are held in order to adjust the amount of capacity needed.[7] The FCA is a descending clock auction whereby the auction starting price is reduced in each round until the amount of remaining capacity is equal to the value that ISO-NE places on additional excess capacity, based on its demand curve parameters. Capacity resources participating in the FCA do not submit sell offers; existing capacity resources that wish to withdraw from the auction must submit a de-list bid, which is subject to a reliability review.[8]

The capacity that is required to meet ISO-NE's future system-wide demand is called the Installed Capacity Requirement ("ICR"). The ICR is the minimum amount of capacity required for ISO-NE to meet its resource adequacy-planning criterion. Additionally, the FCM takes into account locational capacity needs to ensure that regional zones have sufficient capacity to maintain reliability when transmission constraints prevent the delivery of electricity to any particular capacity zone. Capacity requirements vary from year to year, with the specific system-wide and local capacity requirements for the 2019/2020 capacity commitment period to be filed with FERC in late 2015.

For each FCA, capacity resources incur a capacity obligation of one year, which requires the capacity resource to bid into the day-ahead energy market. In return, cleared resources are financially compensated to do so at the applicable clearing price for that FCA (and are financially penalized if the resource does not deliver on the assigned capacity obligation). New resources can opt to convert the one-year obligation into a multi-year award, up to seven years.

7.2 Need for the Proposed Facility

ISO-NE's next FCA is for the 2019/2020 capacity commitment period ("FCA 10"), which will be held in February 2016. This auction will ultimately determine the capacity that is needed in the market for reliability in ISO-NE during the 2019/2020 DY, and the CREC intends to participate in this auction. As a planned participant in FCA 10, the system-wide and local need for Clear River's capacity will be determined via the FCM capacity auction mechanism. In other words, if the facility clears FCA 10, then ISO-NE will have determined CRECto be a needed resource that maximizes social surplus to meet the overall system-wide and local reliability needs of ISO-NE.

Given FCA 10 will not occur until February 2016, PA Consulting Group, Inc. ("PA") prepared an analysis of Clear River's impacts within the ISO-NE wholesale market, including (1) economic projections related to the outcome of FCA 10; (2) impacts on Rhode Island electric reliability; (3) impacts on Rhode Island ratepayer costs; and (4) impacts on Rhode Island emissions reduction objectives.

7.2.1 Analysis of Need - Economic

PA has a robust, well-developed, and industry-tested fundamental power market modeling process, including its proprietary stochastic dispatch optimization, capacity compensation, environmental, renewable, and valuation models along with the use of production cost, transmission, and natural gas models that are operated by PA's subject matter experts and populated with PA proprietary data. Since 2011, PA has utilized this power market modeling process to support the development, acquisition,

[7] For the 2010/11 through the 2014/15 Delivery Years, two annual reconfiguration auctions were held, 14 months prior and 2 months prior to the start of the Delivery Year. For the 2015/16 Delivery Year and beyond, 3 annual reconfiguration auctions are to be held, 26 months, 14 months and 2 months prior the start of the Delivery Year. Seasonal reconfiguration auctions are held prior to June, for the summer seasonal reconfiguration auction (June-September), and prior to October, for the winter seasonal reconfiguration auction (October-May).

[8] A de-list bid allows existing capacity to exit the auction if the price falls below a pre-defined level. Two common types of de-list bids are static and dynamic bids. A static de-list bid is submitted prior to the auction; a dynamic de-list bid is submitted during the auction. All de-list bids are subject to a reliability review by ISO-NE prior to being accepted. For the 2016/17 and prior FCAs, de-list bids below 0.80 x CONE were subject to ISO review. For the 2017/18 FCA, static de-list bids below the associated offer review trigger price for a specific resource type were subject to ISO-NE review. Dynamic de-list bids can only be entered after clearing prices have dropped below $1.00/kW-mo and the bid(s) must be below $1.00/kW-mo.

divestment, and financing of over 200,000 MW of power generating assets in North America, including 15,000 MW in the ISO-NE market.

PA's modeling process incorporates a suite of tools, including (1) AURORAxmp[9] for its production cost modeling in order to project wholesale energy market prices; (2) PA's proprietary environmental optimization model that integrates the natural gas-power-coal sector, as well as the coal generator capital expenditure versus coal selection and resulting emissions prices, paradigms; (3) PA's proprietary stochastic model to assess specific generator operations and economics relative to the electric system; and (4) PA's proprietary FCM Simulation Model. PA's fundamental power market projections were generated using the Aurora^{XMP} model. Aurora^{XMP} is a power market simulation tool based on an hourly dispatch engine that simulates the dispatch of power plants in a chronological, multi-zone, transmission-constrained system and is widely used for electric-market price forecasting, resource valuation and market risk analysis. For emissions analyses, emissions are aggregated on an annual basis in Aurora^{XMP} from individual hourly plant-level dispatch results, with calculated emissions for each resource determined as a function of the plant's simulated dispatch level, assumed emissions rate, and resource heat rate.

7.2.1.1 PA's FCM Simulation Methodology and Results

Utilizing PA's proprietary FCM Simulation Model, within the context of PA's broader wholesale energy market analysis of the ISO-NE region utilizing the aforementioned modeling architecture, PA's FCA capacity price forecast was developed based on its forecasts of (1) existing and new capacity (i.e., total capacity); and (2) PA's projected FCA 10 demand curve parameters as of June 2015. The demand curve parameters effectively determine the capacity price based on a given amount of capacity. All else equal, the higher the total capacity the lower the capacity price. This mechanism is illustrated in Figure 7.2-1 below.

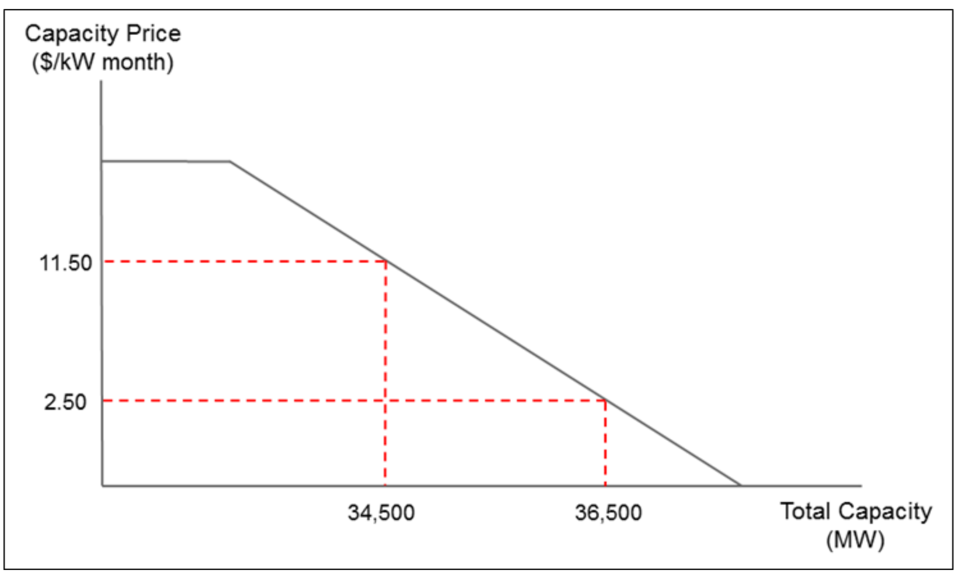


Figure 7.2-1
FCA Capacity Price Derivation - Illustrative

[9] EPIS, Inc.

For FCA 10, PA projected existing capacity based on capacity from FCA 9, and the following expected changes for FCA 10:

1. In FCA 10, ISO-NE is planning to combine the Southeastern Massachusetts/Rhode Island ("SEMA/RI") transmission constrained capacity zone with the Northeastern Massachusetts/Boston ("NEMA/Boston") capacity zone to form a new, larger transmission-constrained capacity zone – called the Southeastern New England ("SENE") zone;
2. In FCA 9, the SEMA/RI capacity zone had less capacity than was needed for reliability (the zone had a deficit of approximately 250 MW), while NEMA/Boston had more capacity than was needed for reliability; and

CRECis projected to participate in FCA 10, bidding approximately 1,000 MW into the new SENE zone. [10]

This results in a projection of total capacity for FCA 10 of 35,841 MW. (In comparison, the total capacity in FCA 9 was 34,694 MW.) When the total capacity of 35,841 MW was overlaid against PA's forecast of the FCA 10 demand curve, the resulting capacity price was lower than the clearing prices that resulted from the last capacity auction. The resulting price represents PA's projection of FCA 10 capacity prices for all capacity resources in New England with CREC clearing the auction mechanism.

With the announced retirement of the Pilgrim Nuclear Station in Plymouth MA, which is in the SENE zone and the loss of its 690 MW, there will be capacity needs in this zone to make up that loss. In evaluating the impact of this loss on the FCA 10 demand curve, the resulting capacity price is expected to be increased over prior projections with Pilgrim still in service.

7.2.1.2 Conclusions

Based on the aforementioned analysis, and combined with (1) PA's broader independent economic analysis of the ISO-NE wholesale energy, ancillary and capacity markets; and (2) underlying CREC development costs, PA projects that CREC would clear FCA 10 at a projected clearing below previous clearing prices for the SEMA/RI zone. As previously outlined, by definition, if the facility clears FCA 10, then ISO-NE (and, by proxy, Rhode Island LSEs whom are participants in ISO-NE) will have determined CREC to be a needed resource that maximizes social surplus to meet the overall system-wide and local reliability needs of ISO-NE.

7.2.2 Analysis of Need - Reliability

As discussed in the previous sections, (1) a resource that clears the FCA has been determined by ISO-NE to be a needed resource that will maximize social surplus to meet the overall system-wide and local reliability needs of ISO-NE; and (2) the state of Rhode Island is located within a transmission constrained zone (SENE) for FCA 10, indicating the need for locally sited resources (existing or new) to address current and on-going transmission import constraints – without which reliability within the SENE capacity zone (and, by proxy, the state of Rhode Island) may be comprised under certain scenarios.

By definition, the siting of a new facility, such as Clear River, within the SENE capacity zone will enhance, all else equal, reliability within the SENE capacity zone (and, as such, the reliability of electric service for Rhode Island ratepayers). In addition, even under a scenario in which the SENE capacity zone has adequate capacity to meet local reliability needs[11], the addition of a capacity resource within the SENE zone will still promote the overall reliability of the broader ISO-NE footprint with which the SENE zone

[10] In addition to Clear River's capacity, PA assumes approximately 175 MW of incremental renewable and demand response capacity.

[11] It should be noted that local capacity requirements within transmission-constrained zones can change year-to-year, based on capacity retirements, capacity additions, load growth, and transmission topology changes. In other words, a single FCA result is not necessarily indicative of whether future reliability needs will be met within the capacity zone – a scenario that the FCM construct is designed to account for.

electrically interconnects (and upon which it relies for a portion of its reliability needs as an interconnected system). In other words, regardless of whether or not the SENE capacity zone "breaks out" from the broader Rest of Pool capacity zone, the result of CREC clearing FCA 10 indicates that it will maximize social surplus and promote reliability in the region.[12]

7.2.2.1 Reliability of CREC Natural Gas Supply

In addition to the aforementioned electric reliability narrative, it is important to point out that, in addition to the physical location of the resource within the SENE capacity zone, the CREC is projected to provide enhanced reliability to the SENE capacity zone (and, by proxy, Rhode Island ratepayers) through its planned used of firm natural gas transport for a portion of its natural gas needs. The election of this fuel transport service, from a reliability standpoint, should advantageously position the facility vis-à-vis other generators that rely on interruptible transport service and, to a lesser extent, those facilities that rely on fuel oil as a back-up fuel source during extreme events (e.g., the Polar Vortices of Winter 2013/2014).

7.2.3 Analysis of Need – Rhode Island Ratepayer Cost Impact

As part of its due diligence, PA analyzed the rate impacts of CREC to Rhode Island electricity customers and found that CREC would result in reduced energy and capacity costs to Rhode Island ratepayers. In order to perform the analysis, PA analyzed the rate impacts for Rhode Island customers under two scenarios, and then compared the two scenarios to determine the net impacts of CREC on Rhode Island ratepayers.

1. The first scenario projected total energy and capacity costs to Rhode Island without the addition of CREC to the ISO-NE market; and
2. The second scenario projected total energy and capacity costs to Rhode Island with the addition of Clear River.

Partially due to the participation of CREC in FCA 10, PA projects FCA 10 capacity prices for capacity resources in Rhode Island and across New England to be significantly lower than FCA 9 capacity prices – resulting in significantly lower capacity prices. For example, the FCA 10 capacity revenues projected to be earned by CREC (based on the expected capacity price) are approximately $130 million lower than they would be if CREC had received Exelon Medway's FCA 9 capacity price, and approximately $30 million lower than they would be if CREC had received Competitive Power Ventures ("CPV") Towantic's FCA 9 capacity price.

In the first four years of operation (2019-2022), market projections indicate that CREC would save Rhode Island ratepayers $284 million in capacity and energy costs, or more than $70 million annually. The additional CREC capacity is projected to result in capacity cost savings of nearly $220 million in this timeframe, with energy cost savings of approximately $65 million as CREC displaces less efficient generation resources. Thereafter, Rhode Island ratepayers would continue to realize approximately $23 million in energy cost savings per year, with capacity cost impacts (which could offset some of, or be accretive to, these savings) determined by the types of new development capacity that enter the ISO-NE market to maintain reliability after Clear River's market entry.

[12] We utilize the term "breaks out" to indicate that the SENE capacity zone clears at a higher capacity price than resources located outside of the SENE zone – indicating an enhanced need for (or current deficit of) supply within the SENE capacity zone vis-à-vis the rest of the ISO-NE footprint.

7.2.4 Analysis of Need – Impact on Rhode Island Emissions Goals

In addition to the system need and the economic impact of CREC to Rhode Island ratepayers, PA also assessed the emissions impact of CREC on the ISO-NE and New York ISO ("NYISO") footprints[13] and found that the addition of CREC will reduce CO_2, NO_x and SO_2 emissions every year. See Table 7.2-1

Table 7.2-1

Impact of CREC on Total Emissions Reductions on ISO-NE/NYISO Footprint

(CO_2 in 000's of Short Tons; NO_x and SO_2 in Short Tons)

	2019	2020	2021	2022	2023	2024	2025
CO_2 Emission Change	-783	-1,233	-1,122	-1,011	-998	-985	-1,002
NO_x Emission Change	-1,591	-3,169	-2,668	-2,168	-1,939	-2,047	-2,096
SO_2 Emission Change	-1,960	-3,985	-3,325	-2,664	-2,539	-2,417	-2,442

The net system-wide decrease is a result of CREC being a highly efficient natural gas-fired combined cycle power plant. CREC requires less fuel per MWh generated than its gas-fired peers, resulting in economic and emissions advantages relative to existing gas-fired generators. As such, CREC will displace less efficient (and less environmentally-friendly) resources that are currently dispatched on the power system.

CREC will not materially impact the ability of New England (or Rhode Island) to meet CO_2 emissions reduction targets.

As a participant in the Regional Greenhouse Gas Initiative ("RGGI"), all thermal generators greater than 25 MW located within Rhode Island are subject to RGGI program CO_2 emissions caps. As such, the addition of CREC will not impact the overall emissions reduction goals of RGGI given its emissions are also accounted for under the RGGI cap. Moreover, given the likelihood that the addition of CREC will actually lead to an overall decrease in regional CO_2 emissions given the high efficiency of the unit (see previous section), it may lead to an overall less costly compliance trajectory for the region under the RGGI program.

In addition, as a new unit, CREC will not be subject to the Environmental Protection Agency's ("EPA") recently finalized Clean Power Plan ("CPP"), which addresses CO_2 emissions from existing thermal resources. As such, the addition of the facility will not impact the state of Rhode Island's overall ability to meet the CPP targets and, in some instances, could assist the state in meeting targets depending on the ultimate compliance pathways to be included in Rhode Island's yet-to-be developed and filed State Implementation Plan ("SIP") or the EPA's under-development Federal Implementation Plan ("FIP").

7.3 Need Analysis Conclusion

The analysis conducted in this section has demonstrated that the FCM is the appropriate and core mechanism to determine system need for member states within ISO-NE. While FCA 10 will ultimately determine if CREC is needed, PA's analysis suggests that the facility will clear the auction. As previously outlined, by definition, if the facility clears FCA 10, then ISO-NE (and, by proxy, Rhode Island LSEs whom are participants in ISO-NE) will have determined CREC to be a needed resource that maximizes social surplus to meet the overall system-wide and local reliability needs of ISO-NE. In addition, and in concert with this capacity market construct, PA's analysis suggests that Clear River's physical location within the SENE capacity zone and its proposed use of

[13] PA analyzed the combination of the ISO-NE and NYISO footprints given their high degree of interconnectivity and seams agreements that help to facilitate participation of a resource in either market's wholesale and capacity markets; in addition, states in both markets are subject to regional greenhouse gas reduction programs.

firm natural gas transport contracts will further reliability goals of the transmission-constrained SENE zone (of which Rhode Island is a part).

Additionally, it has been demonstrated that CREC will have a positive economic and environmental impact on Rhode Island customers. PA's analysis indicates that with the addition of Clear River, Rhode Island ratepayers will save $284 million in capacity and energy costs within the first four years of Clear River's commercial operations. Moreover, the analysis indicates CREC will have a net positive emissions impact in the region by displacing less efficient forms of generation that have higher emissions per unit of energy produced, and will have no detrimental impact on Rhode Island or the broader New England region in meeting RGGI or CPP emissions goals.

8.0 CONFORMANCE WITH RHODE ISLAND ENERGY POLICY

The Energy Policy Act of 1992 (Act) granted states the power to create competitive markets for electricity generation changing the electricity industry from regulated local monopolies, providing all electric services (generation, transmission and distribution), into a network of independent competitive companies providing electricity generation with regulated utilities providing transmission and local distribution of electricity. As a result, in 1996 Rhode Island became the first state in the nation to deregulate its electric industry.

In 2002 the State of Rhode Island adopted the Rhode Island Energy Plan 2002 to help Rhode Island determine how best to meet its future energy production and consumption needs. The objective was a reliable, low-cost and environmentally benign supply of energy, to support economic growth and safeguard consumers from supply disruptions. The planning horizon for Energy Plan 2002 extended to the year 2020.

In June 2015 Rhode Island issued a Preliminary Draft of "Energy 2035", which when finalized and adopted by the State will replace Energy Plan 2002 with a new Energy Plan with a planning horizon out to 2035. Energy 2035 plan is the product of a collaborative effort over a number of years by numerous private and public stakeholders. Energy 2035, once finalized and adopted by the State, is intended to guide the activities of the Rhode Island Office of Energy Resources and the Division of Planning by setting goals and policies to improve energy security, cost-effectiveness, and sustainability in all sectors of energy production and consumption of the State of Rhode Island.

Although Energy 2035 has not as yet been adopted by the State, Invenergy has reviewed the preliminary draft of Energy 2035 and believes the Project supports many of the goals and policies of Energy 2035 in its current form.

The State of Rhode Island's electric generation portfolio has scarcely changed over the past decade while energy use and specifically the use of electricity has significantly increased over the same period. A reliable electricity supply is a necessity to both Rhode Island and regional economies as recognized by Energy 2035. New England must compete with other regions of the U.S. to attract businesses and investment opportunities and a reliable electric supply is critical to sustain competitiveness with other regions. The Project will provide a new modern energy efficient electricity generation resource to the State of Rhode Island and the region to help ensure a reliable energy supply supporting local and regional economies and help maintain the overall competitiveness of New England.

Rhode Island has few indigenous energy resources and must import most of the fuels from which its electricity is generated. Although renewables have experienced significant growth in the last few years and is a promising resource for the future, renewables are not growing at a sufficient pace to fully replace the rate of retirements of older electric generation facilities. Many of these older electric generation facilities have lower energy efficiencies; do not employ modern emission controls and/or rely solely on more polluting fuels like oil and coal.

Until the total generation provided by renewables in New England (primarily wind and solar) grows to a sufficient level to allow consideration of fully relying on renewable energy resources in the future, another energy resource, such as natural gas, must be used to provide the bulk of the energy supply and provide a backup energy source to balance the intermittency of renewable energy resources. Over time the growth of renewable energy resources, supplemented by energy storage, will expand to a level that will reduce dependency on natural gas fueled electric generation but in the interim Rhode Island must rely on a mix of generation technologies and energy resources to meet the needs of the region.

Energy 2035 has many goals and policies that will set the energy programs in Rhode Island for the near future. Energy 2035 emphasizes as key to the overall program initiatives for increasing energy efficiency, need for integration of renewables, need to achieve reductions in greenhouse gases and need to modernize the electric grid to support transfers of energy within the region and ensure the overall reliability of the energy supply within New England.

The Project will be the most energy efficient electric generating facility in New England and has been sited to take advantage of other major infrastructure investments being made in the natural gas supply and regional electric transmission system.

Major investments to the natural gas infrastructure are currently being made by the natural gas pipeline suppliers to increase the overall reliability of natural gas supply to New England and to alleviate winter shortages of this important fuel. Commensurate with these investments are major investments being made by the electric transmission utilities in the region to increase the overall reliability of the transmission system and to ensure flow of electricity within the region to the benefit of both existing and future electric generation. The site of the Project takes advantage of these major investments in natural gas supply and regional electric transmission infrastructure upgrades.

The Project will in its early years be a base loaded generating facility (operating near full capacity) because of its lower cost of generation owing to its high energy efficiency compared to other older generating facilities in the region. Older less efficient generating facilities in the region will be operated as intermittent generating units (operated less of the time) owing to their higher energy costs. As a result, the construction and operation of the Project will directly reduce the amount of greenhouse gases and other air pollutants generated in the region by displacing these older less efficient electric generating facilities. Rhode Island is a coastal state with a uniquely high percentage of coast line compared to any other costal state. As such, impacts of greenhouse gases on global warming are of significant interest to the State and is a major focus of Energy 2035.

In the future with increasing investments in renewable energy resources (on-shore and off-shore wind and PV solar) the percentage of time that natural gas electric generation facilities will operate will be reduced as a great percentage of the regions energy supply is met by the renewable energy resources. As a result natural gas generating facilities must be designed to provide the future flexibility needed to provide high energy efficiency, quick startup capabilities and have load following features to balance the intermittency and variability of the growing renewable energy resources of the region. The Project has been specifically designed to meet these future challenges featuring fast start capabilities while under full emission control allowing the Project to fully integrate with the needs of the region with increasing renewable investments in the future.

For the reasons outlined above the Project is believed to be fully in conformance with Rhode Island Energy Policy.

9.0 LIFE CYCLE MANAGEMENT PLAN

9.1 Protection of Public Health and Safety

The Project has been designed for the protection of the health and safety of the public and the Facility staff. All chemicals will be stored and handled in accordance with all applicable guidelines and regulations. All Facility staff responsible for handling hazardous materials will receive the required training in their storage and handling. Chemical storage areas will be properly labelled and secondary containment will be utilized as required. Invenergy will coordinate with local authorities to ensure that all required fire protection and emergency response procedures and policies are in place at the Facility.

9.2 Protection of the Environment

The Facility will be equipped with state-of-the art air emissions control and sound abatement systems and has been designed to minimize and avoid impacts to the environment to the greatest extent technologically and economically feasible for such a facility, which will be assured by the numerous environmental permits which will need to be obtained for the Project, as detailed in this application.

9.3 Waste Handling and Disposal

The Facility has been designed and will operate in a manner to minimize the quantity of hazardous wastes generated. All employees responsible for handling hazardous wastes will undergo the required training to ensure proper handling procedures are maintained. The shipping of hazardous wastes generated off-site will be conducted in strict accordance with DOT manifest procedures and protocols.

9.4 De-Commissioning

The Facility life expectancy is greater than 20 years and if market conditions are favorable the units could continue to operate for 30 or perhaps 40 years. At the end of its useful life the facility could be replaced with more up to date technology, or alternatively the facility will be dismantled and foundations will be removed to grade elevation.

10.0 STUDY OF ALTERNATIVES

Invenergy conducted a detailed evaluation of the New England market to identify specific areas that may be in need for new generation, have available infrastructure that could support a new combined cycle plant and have sufficient land and proper zoning that would allow a combined cycle plant to be built.

As part of the Forward Capacity Market (FCM), ISO New England Inc. (ISO-NE) conducts a Forward Capacity Auction (FCA) three years in advance of each Capacity Commitment Period (CCP) to meet the region's resource adequacy needs. The latest FCA 9, conducted on February 2, 2015, resulted in capacity (megawatts) commitments of sufficient quantities to meet the Installed Capacity Requirement (ICR) for the 2018/19 CCP however, the SEMA/RI capacity zone had less capacity than was needed for reliability (the zone had a deficit of approximately 250 MW).

ISO-NE issued the report "ISO New England Installed Capacity Requirement, Local Sourcing Requirements and Capacity Requirement Values for the System-Wide Capacity Demand Curve for the 2018/19 Capacity Commitment Period", Feb. 2015, documenting the assumptions and simulation results of the 2018/19 CCP ICR, Local Sourcing Requirements (LSR) and Capacity Requirement Values for the System.

For the 2018/19 CCP, ISO-NE has identified three Load Zones that are import constrained and as a result, modeled as Capacity Zones in FCA9. These Capacity Zones are Connecticut, Northeast Massachusetts/Boston (NEMA/Boston) and the combined Load Zones of Southeastern Massachusetts and Rhode Island (SEMA/RI).

LSR for import-constrained Capacity Zones involves calculating the amount of resources located within the Capacity Zone that are required to meet needs. For instances where there is insufficient generation within a zone, Proxy units are required to meet the resource adequacy planning criterion specified by ISO NE. For the FCA 9 SEMA/RI LSR analysis, an 800 MW proxy unit was needed to bring the zone and the system into compliance with the system requirements. A similar report was issued by ISO NE in 2014 that contained similar results and it was this report that Invenergy used to identify specific geographic areas where locating a new facility would satisfy this need. The SEMA/RI area encompasses all of Rhode Island and the Southeastern portion of Massachusetts. Within this area there are few locations to site a new facility. Suitable locations must have access to a large natural gas pipeline (like Algonquin) access to high voltage transmission, preferably 230 kV and higher, be properly zoned, have suitable buffer to any nearby residential properties at a minimum. The Algonquin pipeline is only 8 miles long within the State of Rhode Island and the only industrial parcels that it crosses where a power plant would be permitted are the parcels owned by Algonquin Gas Transmission (AGT) and TransCanada's Ocean State power plant site. There are additional parcels within the town of Burrillville that are suitably zoned to allow a power plant, however these parcels are surrounded by residential parcels and were deemed much less ideal as a result.

AGT's total acreage is approximately 730 acres and includes not only the AGT pipeline but also a double circuit 345 kV transmission line making it an ideal location for a power plant as no additional Rights of Way are needed (beyond those the project will need from AGT). Invenergy and AGT evaluated locating the project within the 730 site at several locations and collectively determined the proposed location as being the best for the following reasons;

1. Parcel will have frontage on Wallum Lake road
2. There will not be a need to have a new access road that would cross over the pipe line
3. Suitable buffer to nearby residential properties and to the AGT compressor station

Based on the above Invenergy determined that the proposed location is the best location.

10.1 Power Generation Alternatives

The power generation production process alternatives considered included fossil fuels, renewable energy technologies (e.g., wind, solar, biomass, geothermal and hydropower), energy efficiency and conservation, and the no-action alternative.

An analysis of alternatives necessarily begins with a definition of the objective being considered. For purposes of discussing technology alternatives, the major considerations are the size of the energy need proposed to be met and the characteristics of operation, i.e., peaking, intermediate, or baseload. In this case, Invenergy has proposed a generating plant intended to meet the local and regional electric energy needs that are expected to reach over 6,000 MW in the regional grid into which the Project will be connected. This figure consider older fossil fuel plant retirements caused by increased environmental regulation and negative economics resulting from the surge in availability of low cost natural gas. In addition to the retirements, there is also a steady increase in energy demand to be considered.

Many of the older fossil fuel power plants mentioned above that have been announced or expected to be retired are fueled by coal and or oil. As such, they have traditionally been looked to for baseload power supply, i.e., constant operation throughout the year subject only to maintenance outages.

10.1.1 Fossil Fuel and Technology Alternatives

Fossil plants using coal or oil were removed from consideration because the costs to comply with the anticipated environmental regulations (on a $/kW basis) were much higher than a comparably sized natural gas plant. Further, even with the installation of control technologies on coal or oil plants, the resulting environmental impacts were still far greater than a comparably sized natural gas plant. Compared to fuel oil or coal, natural gas is a relatively clean and efficient fuel that can reduce relative impacts on air quality (e.g., reduce emissions of nitrogen oxides, sulfur dioxide, particulate matter and carbon dioxide) to generate the same amount of electricity. In addition, the characteristics of the technology that is used in these plants is such that they have long start times, relatively slow response times to changing power demand and as a result they are sometimes termed as being in-flexible and not able to compensate for the generation demand that a modern power supply network has when a large amount (greater than 10%) of renewable generation is present. the overall footprint of a comparably sized coal plant is significantly larger than that of a natural gas plant.

Invenergy also considered available natural gas power generation processes (e.g., reciprocating engines, boilers, combustion turbines), energy recovery cycles (e.g., simple-cycle, combined-cycle, combined heat and power), and cooling systems (e.g., evaporative, dry, and once-through cooling). Combustion turbines in combined-cycle operation were determined to be the most efficient and cost-effective for the proposed size. Combined heat and power systems were not considered due to the inability to find end users with sufficient load in the area selected for the Project.

Invenergy also considered impacts associated with use of fuel oil as a back-up fuel. Given the Project's location in the New England ISO market, and the fact that during critical winter periods there may be times when sufficient gas is not available due to the current limitations on available gas transportation (e.g. pipeline capacity). Therefore, it was determined that to meet ISO-NE reliability requirements, the Project would incorporate the use of fuel oil as a backup fuel.

10.1.2 Renewable Technology Alternatives

Wind Generation

Modern wind turbines represent potentially viable alternatives to large bulk power fossil power plants as well as small-scale distributed systems. The capacity for an individual wind turbine today ranges from 400 watts up to 3.6 MW. Although air emissions are essentially eliminated for wind facilities, wind turbines can have significant visual and noise impacts that generate strong opposition. Apart from the visual impact of the structures themselves, rotating wind turbine blades interrupt the sunlight producing unavoidable flicker bright enough to pass through closed eyelids, and moving shadows cast by the blades on windows can affect illumination inside buildings. This effect, commonly known as shadow flicker, has been claimed to have the potential to induce photosensitive epilepsy seizures.

Wind turbines also cause bird mortality (especially for raptors) resulting from collision with rotating blades. The rotating blades also affect bats and the Indiana bat, a federally listed endangered species, habits almost all of Pennsylvania. Recent opposition to wind farms has led to shutdowns and curtailments of operation for fear that Indiana bats might be killed.

Wind generation facilities would require large land areas in order to generate 1,000 MW of electricity. Depending on the size of the wind turbines, wind generation “farms” require large tracts of land – approximately two to five acres of directly impacted area (turbine area, roads, substation, and transmission) and approximately 84 to 138 acres of indirectly impacted area (terrain and wind patterns greatly affect the spacing of the turbines so as to obtain optimal production; buffer areas are also required) to generate one MW. See National Renewable Energy Laboratory, Land-Use Requirements of Modern Wind Power Plants in the United States, Technical Report, NREL/TP-6A2-45834 (August 2009). This calculation results in as much as 120,000 acres required to generate 1,000 MW. See also California Energy Commission, Commission Decision, Russell City Energy Center (July 2002, P800-02-007) (wind farm would require 17 acres per MW; thus requiring 17,000 acres to generate 1,000 MW). These land requirements are significantly more than the amount of land used by the Invenergy CREC Project.

Offshore wind is in its infancy and the first phase of the Deepwater Wind project is sized at 35 MW and the second phase is planned to be 1,000 MW assuming it’s proved economically viable. That stated, the wind available for land-based wind generating facilities in Rhode is not as good at the wind available off shore. One other item to consider is that the output of wind and other renewable resources is variable and not dispatchable on demand and can have rapid and sizeable swings in electricity output due to wind speed, time of day, cloud cover, haze, and temperature changes (which is why they are called variable or intermittent resources). The ISO-NE recognizes the variable nature of these resources and states in their 2015 Regional Electricity Outlook that” *Wind and solar resources will eventually help achieve federal and state environmental goals. Paradoxically, the operating characteristics of these renewable resources—which are different than traditional power plants—will increase reliance on fossil-fuel-fired natural gas generators.* This is because intermittent resources are not dispacthable on demand and, as such, have a limited ability to serve peak load and still need to have a dispatchable resource available to help match their output variations.

Finally, wind energy technologies cannot provide full-time availability due to the natural intermittent availability of wind. The inflexible and non-dispatchable nature of wind generation – its limited dependability – are defining differences between that electricity generating alternative and the Project.

With all the aforementioned characteristics and impacts, i.e., environmental trade-offs, wind energy generation is not a feasible alternative to the Project.

Solar Generation

Like wind farms, solar resources, both solar thermal and solar photovoltaic, would require large land areas in order to generate the approximate 1,000 MW of electricity proposed to be supplied by the Project.[14]

---

[14] Most solar thermal technologies collect solar radiation, then heat water to create steam to power a steam turbine generator. The primary systems that have been used in the United States capture and concentrate the solar radiation with a receiver. The three main receiver types are mirrors located around a central receiver (power tower), parabolic dishes and parabolic troughs. Another solar thermal technology collects the solar radiation in a salt pond and then uses the heat collected to generate steam and drive a steam turbine generator. Solar photovoltaic (“PV”) technology uses photovoltaic "cells" to convert solar radiation directly to direct current electricity, which is then converted to alternating current. Solar thermal facilities are generally dispatchable while solar PV facilities are not.

Specifically, assuming location in an area receiving maximum consistent solar exposure (such as desert areas of the southwest), central receiver solar thermal projects require five or more acres per MW, so 1,000 MW would require approximately 5,000 acres of land under ideal "desert-like" conditions and much more land under "Rhode Islandia-like" conditions. See generally http://en.wikipedia.org/wiki/Solar_power_plants_in_the_Mojave_Desert; California Energy Commission, Commission Decision, Russell City Energy Center (July 2002, P800-02-007). Solar PV plants, depending on the type of cells used and construction techniques, can require over 12 acres per MW. See U.S. Department of Energy, Energy Efficiency and Renewable Energy, PV FAQs, http://www.nrel.gov/docs/fy04osti/35097.pdf. Depending on the location of the solar resource, acquiring then blanketing such large areas of land could lead to habitat destruction.

Finally, solar energy technologies like PV, cannot provide full-time availability due to the natural intermittent availability of sunlight. The inflexible and non-dispatchable nature of solar generation – its limited dependability (to produce power when it's needed) – are defining differences between that electricity generating alternative and the Project.

One other technical consideration should be mentioned when considering alternatives such as solar or wind and that is energy storage. Invenergy has energy storage facilities and has used this technology in conjunction with some of our wind facilities. The technology involves the use of batteries and can provide power for short periods of time and is used in helping smooth out or regulate the renewable energy source's energy production, However at larger scales is not cost effective or even economically viable to store and produce energy for time frames much beyond one hour. As the time for production increases beyond 30 minutes the number of batteries increases directly. To illustrate one example of this Invenergy's Beech Ridge storage facility which has a capacity to produce 31 MW for short periods or an overall production of 12 MW Hrs. The facility consists of sixteen container sized trailers (8 ft wide by 40 feet long) placed in an array that occupies approximately an half an acre. A facility that was capable of producing 1,000 MW for an hour (1,000 MWHrs) would need to be 83 times the size of Beech Ridge, would encompass approximately 39 acres, would only be able to match the output of the Project for one hour, and would have a capital cost that is more than twice that of the proposed Clear River Energy Center. Today's storage does have a place in that it helps promote reliability, grid resiliency, power quality, increases renewable penetration, but is used for short term applications and cannot meet the long term (more than an hour) capacity needs that are required to be satisfied in order to meet load.

With all the aforementioned characteristics and impacts, i.e., environmental trade-offs, solar energy technologies are considered as infeasible for the Project's objectives.

Biomass Generation

Biomass generation uses a vegetation fuel source such as wood chips (scrap wood from broken pallets and crates, wood waste generated by pruning, trimming or land-clearing activities, forest management activities or dedicated woody crops) or agricultural waste. The fuel is burned to generate steam in a boiler that is then directed to a steam turbine. Biomass facilities generate much greater quantities of air pollutant emissions than combined-cycle natural gas burning facilities on a per-MW basis due to the inherently lower efficiency of the steam-electric generating technology.

In addition, biomass plants are typically sized to generate less than 25 MW, which is substantially less than the capacity of the Invenergy Project, due to the economics of transporting the biomass fuel from distant locations. Accordingly, many biomass facilities would be required to meet the Invenergy's goal of generating approximately 1,000 MW. Land, infrastructure, and transportation impacts would be significantly more damaging to the environment than the proposed Project.

Emissions from the large number of generating units needed to generate the same electric output as the Project would be significantly greater than proposed by Invenergy, and air quality impacts would be significantly higher, especially for nitrogen oxides, carbon monoxide, volatile organic compounds, and fine particulate matter.

With all the aforementioned characteristics and impacts, biomass energy generation is not a feasible alternative to the Project.

Geothermal

Geothermal technologies use steam or high-temperature water obtained from naturally occurring geothermal reservoirs to drive steam turbine/generators. Geothermal technology is limited to areas where geologic conditions resulting in high subsurface water temperatures occur. There are no viable geothermal resources in the location of the Project site. See generally U.S. Department of Energy, Energy Efficiency and Renewable Energy, Geothermal Maps, http://www1.eere.energy.gov/geothermal/maps.html. Therefore, geothermal technologies are not a feasible alternative to the Project.

Hydropower

Hydropower facilities require large quantities of water (either stored or flowing water) and sufficient topography to allow power generation as water drops in elevation and flows through a turbine to generate electricity. There are no rivers or bodies of water located in close proximity to the Project site that would offer a viable source of water for power generation via flowing water because elevation changes are not present to the degree needed for efficient power generation. In order to create the necessary elevation differential, a full or partial dam (high-impact hydropower) could be constructed in the River and turbines placed inside the structure; however, unless extremely large areas are intended to be flooded to create a high enough dam, the power produced in such fashion would be limited. While hydropower is generally considered to be a baseload power source, except during times of drought, the small size of such a facility in the vicinity of the Project site would not meet Invenergy's objective of making a significant contribution to the replacement and demand needs in the region.

With all the aforementioned characteristics and impacts, hydropower energy generation is not a feasible alternative to the Project.

Energy Efficiency and Conservation

Energy efficiency is appropriate for both end users of electricity and the equipment that produces electricity. As for end users, Rhode Island is already a perennial national leader in end user energy efficiency. In the most recent rankings by the American Council for an Energy Efficient Economy (http://aceee.org/state-policy/scorecard) Rhode Island ranked number 4 in the nation Even if the state continues to work on ways to promote and encourage even greater efficiency efforts for end users it is highly unlikely, or feasible, to rely exclusively on additional end user improvements to energy efficiency as an alternative to the need for new generation, particularly given the announced retirement of significant MW generation in the region, coupled with the ISO/NE forecast for growth in demand over the next several years.

As for energy efficiency for new power generation the technology employed by Invenergy will rank it amongst the most efficient producers of electricity in the United States and the world. This efficiency carries with it important environmental benefits within the region. Specifically, in the NE-ISO, wholesale electricity markets determine which power plants run to meet electricity demand and determine the wholesale price of electricity. Electricity generators offer bids determined by short-term variable costs (include incremental costs of fuel, operation and maintenance, and emission allowances) into auctions administered by NE-ISO, the entity responsible for market operation, NE ISO selects the lowest priced plant one-by-one until electricity demand is met. The last electricity generator selected to meet demand is referred to as the marginal unit. Due to the current and projected price of natural gas, combined-cycle natural gas plants can offer low priced electricity and disrupt the order in which plants dispatch their electricity. The plants most likely to be displaced by the new generation will be those units that are the last to be selected (marginal units), which tend to be older coal and oil facilities. Therefore, the Invenergy Project will displace old, inefficient coal and oil fired power.

Even when coal and oil plants are included in the dispatch queue, the nature of their operation is inherently inefficient in the current market because they cannot start quickly or cycle up or down quickly. In instances where there are rapid changes in generation demand coal plants will continue to operate until they can be slowly brought to the proper level of generation. As described in more detail below, natural gas combined-cycle plants handle swings in load demand with ease.

10.1.3 No-Action Alternative

Another alternative is the "no action" alternative under which the Project would not be built or operated. In such case, the energy need described above and in Invenergy's Application would not be met or, if met, would necessarily be met using one or more alternate generation sources.

The no-action alternative would also mean that more inefficient generation sources, including those using coal or oil, would not be displaced by the Project and the environmental benefits associated with such displacement would not be realized.

In sum, the no-action alternative, while eliminating all impacts of the Project, would not achieve the benefits of needed reliable electrical energy resources in Rhode Island, especially in light of the overall reduction in air emissions.

11.0 STATUS OF APPLICABLE FEDERAL, STATE, LOCAL, AND FOREIGN PERMITTING

11.1 Identification of Federal Agencies with Jurisdiction

The following federal agencies have licensing or permitting authority over the Project:

- ACOE
- FAA

11.2 Identification of State and Local Agencies with Jurisdiction

The following state and local agencies have licensing or permitting authority over the Project:

- RIEFSB
- RIDEM
- RIDOT
- RIHPHC
- Burrillville Zoning Board
- Burrillville Fire Department

Invenergy, LLC has applied, or will apply, for permits discussed in this filing. Furthermore, Invenergy, LLC will ensure that all applicable regulations administered by aforementioned agencies will be strictly adhered to during construction and operation of the facility.

11.3 Identification of Foreign Agencies with Jurisdiction

There are no foreign governmental agencies that have licensing or permitting authority over the Project.

11.4 Pertinent Information for Local, State, and Federal Licenses

Invenergy, LLC has applied, or will apply, for any and all applicable permits and approvals in accordance with local, state, and federal regulations. Invenergy will provide the EFSB with copies of any pertinent permit applications or approvals upon request.

Appendix A

Glossary of Terms

Glossary of Terms

AALs	Acceptable Ambient Levels
ACC	Air Cooled Condenser
acfm	Actual Cubic Feet Per Minute
AP&S	Adler Pollock & Sheehan, P.C.
APCR	Air Pollution control Regulation
Ave	Average
BACT	Best Available Control Technology
BEA	U.S. Bureau of Economic Analysis
BFE	Base Flood Evaluation
BMPs	Best Management Practices
BSC	Burrillville Sewer Commission
CCP	Capacity Comment Period
CEMS	Continuous Emissions Monitoring System
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CPP	Clean Power Plan
CPV	Competitive Power Ventures
CREC	Clear River Energy Center
CRMC	Coastal Resources Management Council
dB	Decibels
dB(A)	A-Weighted Decibels
DY	Delivery Year
EDI	Electro-Deionization
EMF	Electromagnetic Field
EPA	Environmental Protection Agency
EPC	Engineering, Procurement, and Construction
ESS	ESS Group, Inc.
F°	Fahrenheit
FAA	Federal Aviation Administration
FAC	Facultative
FACW	Facultative Wetland
FCA	Forward Capacity Auctions
FCM	Forward Capacity Market
FCO	Forward Capacity Obligations
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FGR	Flue Gas Recirculation
FIP	Federal Implementation Plan
FNTP	Full Notice to Proceed
G	Gauss
GE	General Electric
GIS	Geographic Information System
gpd	Gallons Per Day
GSU	Generator Step-Up
GT	Gas Turbine
HAPs	Hazardous Air Pollutants
HDR	HDR Engineering

Glossary of Terms

HFD	Harrisville Fire District
Hp	Horsepower
Hr.	Hour
HRSG	Heat Recovery Steam Generators
Hz	Hertz
ICR	Installed Capacity Requirement
Invenergy	Invenergy Thermal Development LLC
I-O	Input - Output
ISO-NE	Independent System Operator New England
JEDI	Jobs and Economic Development Impact
kg	Kilograms
km	Kilometers
kV	Kilovolts
LAER	Lowest Achievable Emissions Rate
LID	Low Impact Development
LNTP	Limited Notice to Proceed
LORs	Laws, Ordinances, Regulations and Standards
LSE	Load Serving Entities
LSR	Local Sourcing Requirements
LUHPPL	Land Use with Higher Potential Pollutant Load
m	Meter
Max	Maximum
mG	Milligauss
mg	milligrams
mgd	Million Gallons Per Day
Michael Theriault Acoustics	MTA
MMBtu	One Million British Thermal Units
MW	Megawatt
NAAQS	National Ambient Air Quality Standard
NEEP	New England Economic Partnership
NH_3	Ammonia
NLCD	National Land Cover Database
NOI	Notice of Intent
NOX	Nitrogen Oxides
NPDES	National Pollutant Elimination Discharge Elimination System
NRCS	Natural Resources Conservation Services
NSA	Noise Sensitive Areas
NSR	New Source Review
NTP	Notice to Proceed
NWI	National Wetlands Inventory
NYISO	New York ISO
NYSDEC	New York State Department of Environmental Conservation
O3	Ozone
OBL	Obligate
OC	Oxidation Catalyst
OEM	Equipment Manufacturers

Glossary of Terms

PA	PA Consulting Group
Pb	Lead
PI	Pay-for-Performance Initiative
PM	Particulate Matter
PM_{10}	Particulate Matter with an Aerodynamic Diameter of 10 Microns or Less
$PM_{2.5}$	Particulate Matter with an Aerodynamic Diameter of 2.5 Microns or Less
POTWs	Publically Owned Treatment Works
ppmvd	Parts Per Million By Volume, Dry Basis
PSD	Prevention of Significant Deterioration
PUD	Pascoag Utility District
RF	Radiofrequency
RGGI	Regional Greenhouse Gas Initiative
RIDEM	Rhode Island Department of Environmental management
RIEFSB	Rhode Island Energy Facility Siting Board
RIGIS	Rhode Island Geographic Information System
RIHPHC	Rhode Island Historical Preservation and Heritage Commission
RIHPHC	Rhode island Historical Preservation and Historical Commission
RIMS	Regional Input-Output Modeling System
ROW	Right-of-Way
RTO	Regional Transmission Organization
SBE	Small Business Enterprise
SBE	Small Business Enterprise
SCR	Selective Catalytic Reduction
SDM	Streamflow Depletion Methodology
SESC	Soil Erosion and Sediment Control
SHLO	State Highway Layout
SIC Code	Standard Industrial Classification Code
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
STP	Shovel Test Pits
SWPPP	Stormwater Pollution Prevention Plan
T	Tesla
THPO	Tribal Historic Preservation Office
TPM	Traffic Management Plan
ULSD	Ultra-Low-Sulfur Diesel
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Services
USGS	United States Geological Society
V	volts
VOC	Volatile Organic Compounds
WPA	Wellhead Protection Areas
ZLD	Zero-Liquid Discharge
μT	Microtesla

Appendix B

Major Source Permit Application

ess group

MASSACHUSETTS
100 Fifth Avenue, 5th Floor
Waltham, Massachusetts 02451
p 781.419.7696

RHODE ISLAND
401 Wampanoag Trail, Suite 400
East Providence, Rhode Island 02915
p 401.434.5560

VIRGINIA
999 Waterside Drive, Suite 2525
Norfolk, Virginia 23510
p 757.777.3777

June 26, 2015

Mr. Doug McVay, Chief
Rhode Island Department of Environmental Management
Office of Air Resources
235 Promenade Street
Providence, Rhode Island 02908

Re: ***Major Source Permit Application***
Clear River Energy Center – Burrillville, Rhode Island

Dear Mr. McVay:

Enclosed for your review is a Major Source Permit Application for the Clear River Energy Center, a combined-cycle electric generating facility being proposed by Invenergy Thermal LLC at the Spectra Energy Algonquin Compressor Station site on Wallum Lake Road (State Route 100) in Burrillville, Rhode Island (the Project or the Facility).

The Facility will be a new major stationary source, as it will have the potential to emit 50 tons per year or more of nitrogen oxides (NO_X) and volatile organic compounds (VOC) and 100 tons per year or more of other regulated new source review (NSR) pollutants (CO, PM_{10} & $PM_{2.5}$). In accordance with Rhode Island Department of Environmental Management (RIDEM) Air Pollution Control Regulation No. 9, Sections 9.4.2 and 9.5.2, new major stationary sources must obtain a Major Source Permit from RIDEM prior to commencing construction.

This Major Source Permit Application for the Clear River Energy Center has been prepared in accordance with RIDEM APCR No. 9. Please contact me at (781) 419-7749 or at mfeinblatt@essgroup.com with any questions you may have about the enclosed Major Source Permit Application.

Sincerely,

ESS GROUP, INC.

Michael E. Feinblatt
Practice Leader, Energy & Industrial Services

Enclosures

C: John Niland, Invenergy

www.essgroup.com
environmental consulting & engineering services

Major Source Permit Application Combined-Cycle Electric Generating Facility

CLEAR RIVER ENERGY CENTER
BURRILLVILLE, RHODE ISLAND

PREPARED FOR:
Invenergy Thermal Development LLC
One South Wacker Drive
Suite 1900
Chicago, IL 60606

FOR SUBMITTAL TO:
Office of Air Resources
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02908

PREPARED BY:
ESS Group, Inc.
10 Hemingway Drive, 2nd Floor
East Providence, Rhode Island 02915

ESS Project No. I108-003.04

June 26, 2015

MAJOR SOURCE PERMIT APPLICATION
COMBINED-CYCLE ELECTRIC GENERATING FACILITY

Clear River Energy Center
Burrillville, Rhode Island

Prepared For:

Invenergy Thermal Development LLC
One South Wacker Drive
Suite 1900
Chicago, Illinois 60606

For Submittal To:

Office of Air Resources
Rhode Island Department of Environmental Management
235 Promenade Street
Providence, Rhode Island 02908

Prepared By:

ESS Group, Inc.
10 Hemingway Drive
2nd Floor
East Providence, Rhode Island 02915

ESS Project No. I108-003.01

June 26, 2015

TABLE OF CONTENTS

SECTION **PAGE**

TABLE OF CONTENTS (CONTINUED)

TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

1.1 Background

Invenergy Thermal Development LLC (Invenergy) is proposing to construct and operate the Clear River Energy Center, a combined-cycle electric generating facility at the Spectra Energy Algonquin Compressor Station site on Wallum Lake Road (State Route 100) in Burrillville, Rhode Island (the Project or the Facility).

The State of Rhode Island is designated as being in moderate nonattainment with the 1997 8-hour ozone National Ambient Air Quality Standard (NAAQS). The Facility will be a major source of both nitrogen oxides (NO_X) and volatile organic compounds (VOC), both precursors of ozone. Rhode Island is designated as attainment for the remaining criteria pollutants. The Facility will be a major source of carbon monoxide (CO) and particulate matter (PM_{10} & $PM_{2.5}$) emissions. In accordance with Rhode Island Department of Environmental Management (RIDEM) Air Pollution Control Regulation No. 9, Sections 9.4.2 and 9.5.2, new major stationary sources must obtain a Major Source Permit from RIDEM prior to commencing construction.

This Major Source Permit Application for the Clear River Energy Center has been prepared in accordance with RIDEM APCR No. 9. A facility description is provided below. Section 2.0 details the Project emission sources, proposed emission limits, and potential emissions. The regulatory framework for the Project is described in Section 3.0. Section 4.0 includes the required emissions control technology evaluation. The air quality impact analyses to be completed for the project are summarized in Section 5.0. Emissions data summaries, BACT/LAER documentation, and the required RIDEM permit application forms have been included in the appendices to this application.

1.2 Facility Description

The Clear River Energy Center is a combined-cycle electric generating facility being proposed by Invenergy at the Spectra Energy Algonquin Compressor Station site located along Wallum Lake Road in Burrillville, Rhode Island. An aerial photo of the area surrounding the proposed Facility location is shown in Figure 1. The preliminary Facility site layout plan is shown in Figure 2. A topographic map of the area within 3 km of the proposed Facility location is shown in Figure 3.

The Facility will consist of two advanced class (G-class or above) gas turbines operated in a combined-cycle configuration with two heat recovery steam generators (HRSG) equipped with natural fired duct burners and one steam turbine. Invenergy will finalize the selection of the vendor for the combustion turbines prior to finalizing the Major Source Permit. Each gas turbine will fire natural gas as a primary fuel and ultra-low sulfur diesel (ULSD) fuel as a backup fuel from a 2,000,000 gallon on-site storage tank for limited periods when natural gas is unavailable. The facility will utilize an air cooled condenser (ACC). The facility will have a nominal power output at base load of approximately 800-1080 megawatts (MW) while firing natural gas (with supplementary HRSG duct firing) and 600-930 MW while firing ULSD.

2.0 PROJECT EMISSIONS

The Facility's potential emissions of criteria pollutants are summarized on Table 1. The Facility's potential emissions of non-criteria pollutants are summarized on Table 2.

For the gas turbines/HRSGs, the annual criteria pollutant potential emissions during steady-state operation firing natural gas are based on base load operation with duct firing at 59°F, which will be base operating load on natural gas. The potential emissions during steady-state operation on ULSD are based on base load operation at 10°F for 720 hours per year per unit, as it is expected that ULSD firing will predominately be during the winter months, when natural gas may be diverted for commercial and residential heating uses.

The potential emissions during gas turbine startups and shutdowns are based on startup/shutdown emissions and event duration information provided by the manufacturers, and the number of each startup and shutdown events Invenergy expects could occur each year. Appendix A contains a summary of expected startup shutdown events on each fuel per year, including their number, duration, and potential emissions of criteria pollutants.

The potential emissions for the other emission sources are based on their maximum emission rates at full load and their proposed maximum permitted hours of operation per year.

As shown on Table 1, the Facility will be a major source for NO_X, CO, VOC, CO_2, PM_{10}, and PM $_{2.5}$. The Facility will not be a major source of hazardous air pollutants (HAPs), as shown on Table 2.

The Facility stationary emission sources are detailed below. Appendix A contains emissions data summaries. The equipment specifications and emissions information provided in Tables 1 and 2, and in Appendix A, are based on the current Facility design, preliminary equipment and emissions information provided to date by the potential equipment manufacturers including GE, Siemens and MHI, and the available emission factors. The actual equipment vendors for the Project, the Facility design and layout, the equipment specifications, and the emission rates of each pollutant from each emission source are all subject to change as the Project design advances.

2.1 Gas Turbines/HRSGs

The Facility will utilize two gas turbines operated in a combined cycle configuration, each with a duct fired HRSG to generate electricity and to generate steam for the single steam turbine proposed. Based on the preliminary information provided by the manufacturers, each gas turbine will have a maximum heat input rate of approximately 3,393 MMBtu/hr while firing natural gas and approximately 3,507 MMBtu/hr while firing ULSD fuel. Each HRSG will be equipped with a natural gas fired HRSG duct burner with a maximum heat input capacity of approximately 721 MMBtu/hr to provide additional energy for the steam turbine during natural gas firing.

Each GT/HRSG will be equipped with a selective catalytic reduction (SCR) system for NO_X emissions control. Water injection will also be used during ULSD firing for NO_X emissions control. Each HRSG stack will have a maximum stack NO_X concentration of 2.0 parts per million dry by volume at 15 percent oxygen (ppmvd@15%O_2) during natural gas firing, and 5.0 ppmvd@15%O_2 during ULSD firing during steady-state operation (down to a minimum of 30%-50% load on natural gas and 50% load on ULSD).

Each SCR will utilize NH_3 injection for NO_X emissions control. The Facility will include a 40,000 gallon aboveground storage tank of 19% aqueous NH_3 for this purpose. The SCR will be designed to achieve a maximum NH_3 stack concentration (NH_3 slip concentration) of 2.0 pmvd@15%O_2 both while firing natural gas and while firing ULSD.

Each GT/HRSG will be equipped with an oxidation catalyst (OC) for the control of CO, VOCs, and organic hazardous air pollutants (HAPs). Each OC will be designed to achieve a maximum stack CO concentration of 2.0 ppmvd@15%O_2 while firing natural gas and 5.0 ppmvd@15%O_2 while firing ULSD. The maximum VOC stack concentration will be 1.0 ppmvd@15%O_2 while firing natural gas without duct firing, 1.7 ppmvd@15%O_2 while firing natural gas during duct firing, and 5.0 ppmvd@15%O_2 during ULSD firing. Each OC will also reduce organic HAP by at least 90%. The potential emissions of organic HAP emissions from the GT/HRSGs have been estimated using information provided by the potential equipment manufacturers and using emission factors from AP-42.

The emissions of CO_2, SO_2, H_2SO_4, and PM_{10}/$PM_{2.5}$ from the GT/HRSGs will be minimized by the use of clean burning, low sulfur, low ash fuels, and by the use of the most efficient gas turbine combustion technology commercially available at this time. The emission rates of CO_2, SO_2, H_2SO_4, and PM_{10}/$PM_{2.5}$ from the gas turbines at each operating condition are detailed in Appendix A. The average CO_2 emission rates from the GT/HRSGs at base load will be 814 lb/MW-hr while firing natural gas and 1,227 lb/MW-hr while firing ULSD.

The exit height of each GT/HRSG stack will be 200 feet above grade. The GT/HRSG stacks will have an inside diameter of 22 feet. The GT/HRSG stack exhaust flow rates and exit temperatures, and criteria pollutant emission rates over the full range of expected operating conditions, based on preliminary information provided by the manufacturers, are provided in Appendix A. Each HRSG stack will be equipped with a certified continuous emissions monitoring system (CEMS) to monitor compliance with permit emission limits.

The gas turbines will be permitted for unlimited operation on natural gas. Invenergy is proposing to permit the gas turbines to operate for the equivalent total ULSD fuel usage of up to 60 days per year at base load when natural gas is unavailable only. It is expected that the gas turbines will only fire ULSD fuel during the winter months when commercial and residential natural gas usage for heating purposes is at its peak.

2.2 Auxiliary Boiler

The Facility will utilize a natural gas fired auxiliary boiler to supply gland sealing steam to the steam turbine, sparging steam to the HRSG steam drums, sparging steam to the ACC condensate tank, and motive steam to establish initial vacuum in the ACC and the steam turbine. The auxiliary boiler is currently designed to provide up to 107,910 lb/hr of steam at 215 psia and 390°F, at a boiler efficiency of approximately 82 percent. Based on the current design, the maximum heat input rate to the natural gas fired auxiliary boiler will be 140.6 MMBtu/hr.

The auxiliary boiler will be located within a building located to the immediate southeast of the GT/HRSGs. It will be equipped with ultra-low NO_X burners and flue gas recirculation (FGR) for emissions control. The exhaust gases from the auxiliary boiler will be vented through a 48-inch diameter exhaust stack at an exit height of 50 feet above grade. The auxiliary boiler will exhaust at 38,067 acfm at 344°F at full load. The criteria pollutant emission rates from the auxiliary boiler at its maximum natural gas firing rate are summarized on Table 1.

The auxiliary boiler will only operate prior to and during gas turbine startup periods and will not operate during normal, steady-state gas turbine operating periods. Invenergy is proposing to permit the auxiliary boiler to operate up to 4,576 hours per year, the equivalent of up to 8 hours per day during weekdays (at night) and through each weekend.

2.3 Dew Point Heater

The Facility will utilize a natural gas fired dew point heater to maintain the temperature of the natural gas delivered to the gas turbines at a nominal 50°F above the hydrocarbon dew point of the natural gas. Based on the current design, the dew point heater will have a maximum heat input rate of 15 MMBtu/hr.

The dew point heater will be located northwest of the GT/HRSGs next to the fuel oil storage tank. It will be equipped with an ultra-low NO_X burner and FGR for emissions control. The exhaust gases from the dew point heater will be vented through a 20-inch diameter exhaust stack at an exit height of 35 feet above grade. The dew point heater will exhaust at 7,252 acfm at 1,000°F at full load. The criteria pollutant emission rates from the dew point heater at its maximum natural gas firing rate are summarized on Table 1.

Invenergy is proposing to permit the dew point heater for unlimited operation firing natural gas.

2.4 Emergency Diesel Generator

The Facility will utilize a 2 MW emergency diesel generator equipped with a 2,682 horsepower (Hp) engine to manage the combined cycle critical shutdown and maintenance loads during a loss of site power from the grid. Based on the current design, the emergency diesel generator will have a maximum heat input rate of 19.5 MMBtu/hr firing ULSD fuel.

The emergency diesel generator will be located to the immediate southeast of the GT/HRSGs. The exhaust gases from the emergency diesel generator will be vented through an 8-inch diameter exhaust stack at an exit height of 35 feet above grade. The emergency diesel generator will exhaust at 15,295 acfm at 752°F at full load. The criteria pollutant emission rates from the emergency diesel generator at its maximum ULSD fuel firing rate are summarized on Table 1.

Invenergy is proposing to only operate the emergency diesel generator when grid power is unavailable and for maintenance and readiness testing for up to 1 hour per week and up to 300 hours per year.

2.5 Diesel Fire Pump

The Facility will utilize a 315 BHP diesel engine fire pump. Based on the current design, the diesel fire pump engine will have a maximum heat input rate of 2.1 MMBtu/hr firing ULSD fuel.

The diesel fire pump will be located in a building southeast of the GT/HRSGs, near the water treatment building. The exhaust gases from the diesel fire pump will be vented through a 6-inch diameter exhaust stack at an exit height of 35 feet above grade. The diesel fire pump will exhaust at 1,673 acfm at 865°F at full load. The criteria pollutant emission rates from the diesel fire pump at its maximum ULSD fuel firing rate are summarized on Table 1.

Invenergy is proposing to only operate the fire pump during emergency situations and for maintenance and readiness testing for up to 1 hour per week and up to 300 hours per year.

2.6 Fuel Oil Tank

The Facility will include a 2,000,000 gallon aboveground ULSD storage tank equipped with secondary containment, as required. The potential fugitive VOC emissions (working losses and breathing losses) associated with the ULSD storage tank at the Facility have been estimated using the EPA's TANKS program. Appendix A contains a summary of the results and the data printouts from the TANKS analysis for the ULSD storage tank.

3.0 REGULATORY FRAMEWORK

3.1 Rhode Island Air Pollution Control Regulations

The following section details the applicability of the RIDEM Air Pollution Control Regulations to the proposed Project and its proposed compliance with the applicable RIDEM APCR requirements:

3.1.1 No. 1 – Visible Emissions

RIDEM APCR No. 1 limits the opacity of visible emissions from sources of air contaminants. It limits the opacity of the emissions from any source to less than 20 percent opacity (not including uncombined water), except for an aggregate period of less than or equal to three minutes in any hour. It also requires that all opacity tests be performed as per 40 CFR 60, Appendix A, Method 9 by observers qualified per Method 9.

Invenergy will limit the opacity of visible emissions from each of its emission sources to less than 20 percent opacity (not including uncombined water), except for an aggregate period less than or equal to three minutes in any hour. Any tests conducted by Invenergy to demonstrate compliance with this limitation will be conducted per 40 CFR 60, Appendix A, Method 9 by observers qualified according to the requirements of this test method.

3.1.2 No. 5 – Fugitive Dust

RIDEM APCR No. 5 limits the release of fugitive dust. It applies to the demolition and construction of buildings and structures, material stockpiles and earth moving activities, stationary sources, vehicles transporting materials, paved roads, and any other activities which may cause airborne particulate matter. It requires that adequate precautions be taken to prevent particulate matter from becoming airborne, where it could travel beyond the property line of the source.

There will be fugitive particulate matter emissions generated during Project construction. There will be minimal fugitive particulate matter emissions generated during Facility operation. Invenergy will take precautions and employ reasonable fugitive dust prevention measures to prevent particulate matter from becoming airborne and traveling beyond the property line both during construction and operation. Such measures could include the use of temporary screens during activities which could result in significant airborne particulate matter emissions and the wetting of roadways and other paved areas to limit fugitive particulate matter emissions from becoming airborne as needed.

3.1.3 No. 6 – Opacity Monitors

RIDEM APCR No. 6 specifies the requirements for continuous emissions monitors for opacity at specified stationary sources. Fossil fuel fired steam or hot water generating units burning liquid fuels other than No. 6 residual oil and having a heat input capacity greater than or equal to five million Btu per hour are required to install and operate an opacity monitor with audio alarm. These devices must be operated continuously during the combustion of fuel and be calibrated to sound an alarm at 20 percent opacity.

It also requires stationary sources specified in 40 CFR 51, Appendix P, Parts 1-5 to install, calibrate, operate, and maintain a continuous emission monitoring system in accordance with the requirements therein. In addition, subject stationary sources must record and report the total process operating time of the equipment for each calendar quarter to the Office of Air Resources and use the resulting data to determine compliance with applicable emission limits and/or operating and maintenance requirements. The data collected must be kept for at least two years.

Invenergy will install a continuous emissions monitoring system (CEMS) and a continuous opacity monitoring system (COMS) on each HRSG stack. These devices will be operated continuously during the combustion of fuel and each COMS will be equipped with an audio alarm at 20 percent opacity. The CEMS will be installed, calibrated, operated, and maintained in accordance with the applicable requirements of 40 CFR 51, Appendix P, Parts 1-5. Invenergy will submit quarterly reports that include the total operating time of each gas turbine/HRSG duct burner to the Office of Air Resources. All data collected will be kept for at least two years.

3.1.4 No. 7 – Emission of Air Contaminants Detrimental to Person or Property

RIDEM APCR No. 7 prohibits the emission of air contaminants which either alone or in connection with other emissions, by reason of their concentration or duration, may be injurious to human, plant, or animal life, or cause damage to property or which unreasonably interferes with the enjoyment of life and property.

For new sources, the sole criteria for determination of compliance with regard to human health are the following:

- Compliance with all primary and secondary NAAQS
- Compliance with the applicable requirements of Section 22.3 or APCR No. 22 regarding the emission of listed toxic air contaminants
- Compliance with a calculated ambient air level as required by APCR No. 9

For new sources, the sole criteria for compliance with regard to animal life are the following:

- Compliance with all secondary NAAQS
- Compliance with the applicable provisions of APCR 9.5.2(d), which requires the application of the applicable procedures of the Guidelines for Assessing Welfare Impacts of Proposed Air Pollution Sources and that its criteria be met.

For new sources, the sole criteria for compliance with regard to plant life and vegetation are the following:

- Compliance with all secondary NAAQS
- Compliance with the applicable provisions of APCR 9.5.2(d), which requires the application of the applicable procedures of the Guidelines for Assessing Welfare Impacts of Proposed Air Pollution Sources and that its criteria be met.

For new sources, the sole criterion for compliance with regard to damage to property is the following:

- Compliance with all secondary NAAQS

For new sources, the sole criterion for compliance with regard to interference with the enjoyment of life and property is compliance with each of the criteria listed above.

Section 5.0 of this application details the air quality impact analysis which will be conducted to demonstrate that the ambient air impacts resulting from the Facility's emissions, when combined with the emissions from other nearby sources and representative background levels, will not cause or contribute to an exceedance of any NAAQS, AAL, or CAAL. It also details how the applicable procedures of the Guidelines for Assessing Welfare Impacts of Proposed Air Pollution Sources will be applied and how its criteria will be met. The results of the air quality impact analysis detailed in Section 5.0 will demonstrate full compliance with RIDEM APCR No. 7.

3.1.5 No. 8 – Sulfur Content of Fuels

RIDEM APCR No. 8 limits the sulfur content the sulfur content of fuels. On and after July 1, 2018, no person may use any distillate oil having a sulfur content in excess of 0.0015% (15 ppm). Compliance with this limitation may be demonstrated by emissions testing, obtaining a certification from the fuel supplier which contains the sulfur content of the distillate oil, conducting laboratory analysis after each new shipment of oil is received by the source, or by a continuous monitoring system for the measurement of sulfur dioxide that meets the performance specifications in Appendix B of 40 CFR 60.

Invenergy will only use ultra-low sulfur distillate oil with a sulfur content less than or equal to 15 ppm. Invenergy will obtain a certification from each ULSD fuel supplier which demonstrates that the distillate oil being supplied meets the sulfur content limitation of APCR No. 8. Each certificate will include the name of the supplier, the date the fuel oil was received from the supplier, the sulfur content of the fuel oil, the ASTM method used to determine the sulfur content of the fuel oil, and the date and location of the fuel oil when the sample was drawn for analysis to determine the sulfur content.

3.1.6 No. 9 – Air Pollution Control Permits

RIDEM APCR No. 9 establishes a preconstruction permitting program for stationary sources of air pollution and air pollution control systems. It prohibits the construction, installation, or modification of any stationary source without obtaining a Minor Source Permit or a Major Source Permit.

The entire state of Rhode Island is designated as being in moderate nonattainment for the 1997 8-hour ozone NAAQS and is designated as attainment or unclassifiable for the remaining criteria pollutants. The permitting requirements for major stationary sources in nonattainment areas (Nonattainment New Source Review, or NANSR) are established in APCR Section 9.4. The permitting requirements for major stationary sources in attainment or unclassifiable areas (Prevention of Significant Deterioration) or in APCR Section 9.5.

The Facility will be a Major Stationary Source and is therefore required to obtain a Major Source Permit from RIDEM for its construction. The following sections detail the NANSR and PSD permitting requirements applicable to the Project, and how the Project will comply with those requirements.

3.1.6.1 Major Source Permits in Nonattainment Areas

The Facility has potential NO_X and VOC emissions which are greater than 50 tons per year. NO_X and VOC are precursors to ozone. The Facility is therefore a major stationary source in a nonattainment area subject to the applicable NANSR permitting requirements of APCR Section 9.4 for its NO_X and VOC emissions.

New major stationary sources must apply the lowest achievable emission rate (LAER) for each nonattainment pollutant for which it is a major stationary source, based on its potential emissions. Invenergy will apply LAER for the Facility's NO_X and VOC emissions. Section 4.0 of this application details the LAER determination for NO_X and VOC emissions for each proposed emissions source at the Facility.

Applicants must certify that all existing major stationary sources owned or operated by the applicant located within the state are in compliance with all applicable state and federal air pollution rules and regulations. Invenergy does not own or operate any existing major stationary sources within Rhode Island.

Applicants must provide evidence that the total tonnage of emissions of the applicable nonattainment pollutant from the proposed source will be offset by a greater reduction in the actual emissions of the pollutant from other sources. The emission offsets must be approved by the Director and meet the following requirements:

- o Be federally enforceable prior to the issuance of the Major Source Permit
- o Actually occur at the source of the offsets prior to the new source's startup
- o Be at an offset ratio of at least 1.2 to 1 for NO_X and VOC
- o Be obtained from sources within the same nonattainment area or another nonattainment area which has an equal or higher nonattainment classification than the area of the proposed source and which contributes to an NAAQS violation in the area of the proposed source
- o When considered in conjunction with the proposed emission increase, have a net air quality benefit in the area

Invenergy will fully offset its NO_X and VOC emissions by obtaining emission reduction credits (ERC) which meet the above criteria prior to commencing Facility operations. Invenergy has identified sufficient ERCs to offset its NO_X and VOC emissions by a ratio of at least 1.2 to 1 prior to Facility startup. Invenergy will provide RIDEM with documentation that sufficient ERCs have been secured for the Project prior to issuance of the Major Source Permit. These ERCs will be purchased prior to Facility startup.

Applicants must submit an analysis of alternative sites, sizes, production processes, and environmental control techniques that demonstrate the benefits of the proposed source significantly outweigh the environmental and social cost imposed as a result of its location and construction.

Invenergy's alternatives analysis for the Project is detailed below.

Invenergy conducted a detailed evaluation of the New England market to identify specific areas that may be in need for new generation, have available infrastructure that could support a new combined cycle plant and have sufficient land and proper zoning that would allow a combined cycle plant to be built.

As part of the Forward Capacity Market (FCM), ISO New England Inc. (ISO-NE) conducts a Forward Capacity Auction (FCA) three years in advance of each Capacity Commitment Period (CCP) to meet the region's resource adequacy needs. The latest FCA, conducted on February 2, 2015, resulted in capacity (megawatts) commitments of sufficient quantities to meet the Installed Capacity Requirement (ICR) for the 2018/19 CCP.

ISO-NE issued the report "ISO New England Installed Capacity Requirement, Local Sourcing Requirements and Capacity Requirement Values for the System-Wide Capacity Demand Curve for the 2018/19 Capacity Commitment Period", Feb. 2015, documenting the assumptions and simulation results of the 2018/19 CCP ICR, Local Sourcing Requirements (LSR) and Capacity Requirement Values for the System.

For the 2018/19 CCP, ISO-NE has identified three Load Zones that are import constrained and as a result, modeled as Capacity Zones in FCA9. These Capacity Zones are: Connecticut, Northeast Massachusetts/Boston (NEMA/Boston) and the combined Load Zones of Southeastern Massachusetts and Rhode Island (SEMA/RI).

LSR for import-constrained Capacity Zones involves calculating the amount of resources located within the Capacity Zone that are required to meet needs. For instances where there is insufficient generation within a zone, Proxy units are required to meet the resource adequacy planning criterion specified by ISO NE. For the SEMA/RI LSR analysis, an 800 MW proxy unit was needed to bring the zone and the system into compliance with the system requirements. A similar report was issued by ISO NE in 2014 that contained similar results and it was this report that Invenergy used to identify specific geographic areas where locating a new facility would satisfy this need. The SEMA/RI area encompasses all of Rhode Island and the Southeastern portion of Massachusetts. Within this area there are few locations to site a new facility. Suitable locations must have access to a large natural gas pipeline (like Algonquin) access to high voltage transmission, preferably 230 kV and higher, be properly zoned, have suitable buffer to any nearby residential properties at a minimum. The Algonquin pipeline is only 8 miles long within the State of Rhode Island and the only industrial parcels that it crosses where a power plant would be permitted are the parcels owned by Algonquin Gas Transmission (AGT) and TransCanada's Ocean State power plant site. There are additional parcels within the town of Burrillville that are suitably zoned to allow a power plant, however these parcels are surrounded by residential parcels and were deemed to be much less ideal as a result.

AGT's total acreage is approximately 730 acres and includes not only the AGT pipeline but also a double circuit 345 kV transmission line making it an ideal location for a power plant as no additional Rights of Way are needed (beyond those the project will need from AGT). Invenergy and AGT evaluated locating the project within the 730 site at several locations and collectively determined the proposed location as being the best for the following reasons;

1. Parcel will have frontage on Wallum Lake road
2. There will not be a need to have a new access road that would cross over the pipe line
3. Suitable buffer to nearby residential properties and to the AGT compressor station

Based on the above Invenergy determined that the proposed location is the best location.

Invenergy has identified sufficient ERCs to offset Applicants must demonstrate that emissions from the source will not cause an impact on the ground level ambient concentration at or beyond the property line in excess of that allowed by APCR No. 22 and any CAAL. Applicants must also conduct any studies required by the <u>Guidelines for Assessing Health Risks from Proposed Air Pollution Sources</u> and meet the criteria therein. Section 5.0 of this application details the air quality impact analysis which will be conducted for the Project, which will include the required analyses and compliance demonstrations.

Applicants must demonstrate that the source will be in compliance with all applicable state or federal air pollution control rules or regulations at the time the source commences operation. Section 3.0 of this application provides such a demonstration for the Project.

3.1.6.2 Major Source Permits in Attainment or Unclassifiable Areas

The Facility will be a major stationary source in an attainment or unclassifiable area subject to the applicable PSD permitting requirements of APCR Section 9.5 for its CO, PM_{10}, and $PM_{2.5}$ emissions. The Facility will also have potential emissions of H_2SO_4 which exceed the corresponding PSD significant emission rate threshold.

According to the PSD rules, a new major stationary source must apply BACT for each pollutant it would have the potential to emit in a significant amount. Invenergy will apply BACT for all regulated pollutants to be emitted from the Facility. Section 4.0 of this application details the BACT determination completed for each Facility emission source and pollutant.

Applicants must demonstrate, by means of air quality modeling conducted in accordance with the EPA Guideline on Air Quality Models, that the allowable emissions from the source, in conjunction with all other applicable emission increases or decreases, would not cause or contribute to air pollution in violation of any NAAQS or any increase in ambient concentrations exceeding the remaining available increment for the specified air contaminant. The air quality impact analysis must also include the additional information detailed in APCR Section 9.5.2(b) through (f). Section 5.0 of this application details the air quality impact analysis to be completed for the Project, including all of the analyses required by APCR Section 9.5.2(b) through (f).

Applicants must demonstrate that the source will be in compliance with all applicable state or federal air pollution control rules or regulations at the time the source commences operation. Section 3.0 of this application provides such a demonstration for the Project.

3.1.7 No. 10 – Air Pollution Episodes

RIDEM APCR No. 10 establishes the criteria of conditions justifying the proclamation of an Air Pollution Alert, Air Pollution Warning, or Air Pollution Emergency and regulates how sources must plan for and then respond to such air pollution episodes. When the governor determines that a specified criteria level has been reached, subject sources will be notified that the abatement strategies listed below must be put into effect until the criteria of the specified level are no longer met.

During an Air Pollution Alert or Air Pollution Warning, oil-fired electric power generating facilities must utilize fuels having low ash and sulfur content, maximize mid-day boiler lancing and soot blowing, and divert electric power generation to facilities outside of the Alert or Warning Area.

During an Air Pollution Emergency, all construction work except that which must proceed to avoid emergent physical harm must cease, and oil-fired electric power generating facilities must utilize fuels having low ash and sulfur content, maximize mid-day boiler lancing and soot blowing, and divert electric power generation to facilities outside of the Emergency Area.

Invenergy will prepare a written Standby Plan for reducing the emissions of air pollutants from the Facility during air pollution episodes, as required. Invenergy's Standby Plan will identify the sources of air pollutants, the approximate amount of pollutant reduction, and a description of the process proposed to achieve the said reduction of air pollution in the event that the governor declares an air pollution episode. The Standby Plan will be submitted to the Director upon request, will remain on-site at all times, and be readily available for review by any authorized personnel.

3.1.8 No. 11 – Petroleum Liquids Marketing and Storage

RIDEM APCR No. 11 regulates the storage and marketing of petroleum liquids to minimize emissions of volatile organic compounds.

Invenergy will comply with the prohibitions and requirements set forth in APCR Section 11.2 for its ULSD storage tank to minimize emissions of VOC. Invenergy will maintain records of all tank inspections conducted, the throughput quantity, and all scheduled and unscheduled maintenance activities. These records will be maintained for at least 3 years and will be accessible for review upon request.

3.1.9 No. 13 – Particulate Emissions from Fossil Fuel Fired Steam or Hot Water Generating Units

RIDEM APCR No. 13 regulates the emissions of particulate matter from fossil fuel fired steam or hot water generating units. It limits the particulate matter emission rate from such units with a maximum rated heat input capacity of one million Btu per hour or more to 0.1 lb/MMBtu or less.

Invenergy will limit the PM emissions from the gas turbines/HRSGs and the auxiliary boiler to 0.1 MMBtu/hr or less, thus complying with APCR No. 13. Compliance with the PM emission limitation for the gas turbines/HRSGs will be determined by emission testing conducted according to Method 5 of 40 CFR 60, Appendix A. Compliance for the auxiliary boiler will be demonstrated by the equipment manufacturer's performance specifications.

3.1.10 No. 14 – Record Keeping and Reporting

RIDEM APCR No. 14 specifies the record keeping and reporting requirements that apply to stationary sources that emit air contaminants.

Invenergy will provide RIDEM with the records necessary to determine if the Facility is in compliance with the air pollution control regulations on an annual basis or as requested by the Director. Emission statements for NO_X and VOC emissions which contain the information listed in APCR Section 14.3.2 will also be submitted to RIDEM on an annual basis. All annual reports will be submitted no later than April 15^{th} each year unless otherwise specified by RIDEM. All required records will be maintained at the Facility for a minimum of five years.

3.1.11 No. 16 – Operation of Air Pollution Control Systems

RIDEM APCR No 16 specifies the requirements for the operation of and response to the malfunction of air pollution control systems.

Invenergy will operate all Facility air pollution control systems in accordance with their design specifications whenever the source on which they are installed is in operation. In the event that an air pollution control system malfunctions, Invenergy will take all reasonable measures to assure resumption of the designed control efficiency as soon as possible. Invenergy will submit a petition for a variance to operate an emission source uncontrolled in the event that the malfunction is expected to continue for longer than 24 hours, and in the event that it would be impractical to cease the source operation during that period.

3.1.12 No. 17 – Odors

RIDEM APCR No 17 prohibits the release of any air contaminant which may create an objectionable odor beyond the source's property line.

Invenergy will not emit or cause to be emitted into the atmosphere any air contaminant or combination of air contaminants that may create an objectionable odor beyond the property line of the Facility.

3.1.13 No. 22 – Air Toxics

RIDEM APCR No. 22 limits emissions of toxic air contaminants from stationary sources. It applies to any stationary source that emits a listed toxic air contaminant, unless exempted. Fuel burning equipment where the emission of listed toxic air contaminants is solely from the combustion of fuel oil, propane, or natural gas is exempted. However, new major fuel-burning sources that begin operation after April 27, 2004 are not exempted from APCR No. 22.

No permit to construct can be issued for a stationary source subject to APCR No. 22 unless it can be demonstrated, in accordance with the procedures outlines in the Rhode Island Guideline for Air Quality Modeling for Air Toxics Sources, that the emissions of any listed toxic air contaminant from the proposed facility will not cause an impact, at or beyond the property line of the facility, which exceeds the AAL for that contaminant.

Section 5.0 of this application details the air quality impact analysis to be completed for the Project, including the air toxics modeling analysis to demonstrate compliance with APCR No. 22.

3.1.14 No. 27 – Control of Nitrogen Oxide Emissions

RIDEM APCR No. 27 limits emissions of nitrogen oxides emitted form stationary sources which have the potential to emit 50 tons of NO_x per year from all pollutant-emitting equipment or activities.

Invenergy will submit a Reasonably Available Control Technology (RACT) Proposal to the Director within six (6) months after the Facility becomes a potential 50 tons per year NO_X stationary source. Invenergy’s RACT proposal will include the applicable information listed in APCR Section 27.3 and comply with the applicable requirements of APCR Section 27.4. Invenergy will demonstrate compliance through compliance testing and emission-monitoring, in accordance with APCR Section 27.5. Invenergy will maintain records of all measurements, performance evaluations, calibration checks, and maintenance or adjustments for each CEMS. Fuel usage will be measured and recorded monthly. A written report of excess emissions will be submitted to RIDEM for each calendar quarter.

3.1.15 No. 28 – Operating Permit Fees

RIDEM APCR No. 28 establishes a fee system for the operating permits program.

Invenergy will pay all annual fees associated with its operating permit to RIDEM on or before the designated due date. A form provided by RIDEM will accompany all payments.

3.1.16 No. 29 – Operating Permits

RIDEM APCR No. 29 specifies operating permit requirements for stationary sources.

Invenergy will submit an operating permit application to RIDEM within twelve months after commencing operation. The application will contain all of the information requested in APCR Section 29.5.1.

3.1.17 No. 45 – Rhode Island Diesel Anti-Idling Program

RIDEM APCR No. 45 specifies the requirements for Rhode Island’s Diesel Engine Anti-Idling Program. Rhode Island’s Anti-Idling Program aims to reduce emissions and conserve fuel.

Invenergy will not allow unnecessary idling of any engine of a diesel motor vehicle at the Facility while the vehicle is stopped for a period of time in excess of five minutes in any sixty minute period. Invenergy will also not allow unnecessary idling of non-road diesel engines under its control or on its property.

3.1.18 No. 46 – CO2 Budget Trading Program

RIDEM APCR No. 46 establishes the Rhode Island component of the CO_2 Budget Trading Program. The program applies to any unit that, at any time on or after January 1, 2005, serves an electricity generator with a nameplate capacity equal to or greater than 25 MWe. Each such unit is a CO_2

budget unit and any source that includes one or more of such units is a CO2 budget source subject to the requirements of APCR No. 46.

Invenergy will submit a complete CO_2 budget permit application to RIDEM for approval at least 12 months prior to commencing operation. The application will include the elements listed in APCR Section 46.6.3(a). Invenergy will also submit a complete account certificate of representation to establish a CO_2 authorized account representative. Upon receipt, RIDEM will establish a compliance account for the Facility.

Invenergy will hold CO_2 allowances available for compliance deductions, as of the CO_2 allowance transfer deadline, in its compliance account in an amount not less than the total CO_2 emissions for each control period from the Facility gas turbines/HRSGs (CO_2 budget sources). Each control period is a three calendar-year period. The CO_2 allowance transfer deadline is midnight of the March 1 occurring after the end of each control period.

Invenergy will also hold CO_2 allowances available for compliance deductions, as of the CO_2 allowance transfer deadline, in its compliance account in an amount not less than the total CO_2 emissions for each interim control period from the Facility gas turbines/HRSGs (CO_2 budget sources) multiplied by 0.50. The first two calendar years of each 3-year control period are each defined as an interim control period.

Invenergy will install, certify, calibrate, maintain and operate a CEMS on each HRSG stack in accordance with 40 CFR Part 75 to monitor CO_2 mass emissions. Invenergy will submit a monitoring plan in accordance with 40 CFR 75.62 and then a CEMS certification application within 45 days after completing all initial CEMS certification tests.

Invenergy will maintain each of the documents required by APCR Section 46.3.3 at the Facility for a period of 10 years from the date the document was created. Invenergy will submit quarterly reports of the CO_2 mass emissions data from each unit within 30 days following the end of each calendar quarter, as specified 40 CFR Part 75, Subpart H and 40 CFR 75.64. Each quarterly report will include a compliance certification from the CO_2 authorized account representative, as required.

Invenergy will submit an output monitoring plan in accordance with APCR Section 46.10.7(c). Annual output reports will be submitted by March 1 of each year.

Invenergy will submit a compliance certification report by March 1 following each control period. The report will include each of the elements listed in APCR Section 46.11(b).

3.2 Federal Air Pollution Control Regulations

The following section details the applicability of the Federal Air Pollution Control Regulations to the proposed Project and its proposed compliance with the applicable Federal requirements:

3.2.1 40 CFR 50 – National Primary and Secondary Ambient Air Quality Standards

40 CFR 50 establishes the National primary and secondary ambient air quality standards. The national primary ambient air quality standards define levels of air quality which have been judged to be necessary, with an adequate margin of safety, to protect the public health. The national secondary ambient air quality standards define levels of air quality judged to be necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

As detailed in Section 5.0 of this application, Invenergy will complete an air quality impact analysis which will demonstrate that the emissions from the Facility will not cause or contribute to an exceedance of any NAAQS.

3.2.2 40 CFR 52.21 – Prevention of Significant Deterioration of Air Quality

40 CFR 52.21 establishes the Federal PSD Program, which provides New Source Review pre-construction permitting requirements for new major stationary sources located in an area designated as attainment or unclassifiable with the NAAQS.

RIDEM has been delegated the authority to implement the Federal PSD Program by the EPA. APCR Section 9.5 establishes RIDEM's PSD permitting requirements. The Project will fully comply with all of the applicable PSD permitting requirements, as detailed in Section 3.1.6.2 above.

3.2.3 40 CFR 60 – Standards of Performance for New Stationary Sources

40 CFR 60 establishes standards of performance for new stationary sources in select source categories. The following sections detail the subparts from 40 CFR 60 which are applicable to the Project, the applicable requirements, and how the Project will comply with those requirements.

3.2.3.1 Subpart A – General Provisions

40 CFR 60 Subpart A establishes the general provisions of the standards of performance for new stationary sources. It includes general requirements which apply when the applicable subpart does not include specific requirements for the source.

Invenergy will comply with all applicable record keeping, performance testing, monitoring, work practice, and notification requirements, prescribed in 40 CFR 60, Subpart A which are not specified in the applicable subparts of 40 CFR 60.

3.2.3.2 Subpart Da –Electric Utility Steam Generating Units

40 CFR 60 Subpart Da establishes standards of performance for electric utility steam generating units that are capable of combusting more than 250 MMBtu/hr heat input of fossil fuel and commenced construction after September 18, 1978.

Heat recovery steam generators used with duct burners associated a stationary combustion turbine that are capable of combusting more than 250 MMBtu.hr heat input of fossil fuel are subject to Subpart Da except in cases where the HRSG meets the applicability requirements of and is subject to Subpart KKKK.

Subpart KKKK applies to stationary combustion turbines with a heat input at peak load greater than 10 MMBtu/hr, which commenced construction after February 18, 2005. Only heat input to the combustion turbine is included for the determination of applicability. Any additional heat input from the HRSG duct burners is not included; however, Subpart KKKK does apply to emissions from any associated HRSG duct burners. HRSG duct burners regulated under Subpart KKKK are exempted from the requirements of Subpart Da.

Because the Facility combustion turbines have a heat input at peak load greater than 10 MMBtu/hr without the heat input from the duct burners, the turbines are subject to Subpart KKKK. Therefore, the Facility HRSG duct burners are also regulated by Subpart KKKK and are exempted from the requirements of Subpart Da.

3.2.3.3 Subpart Db –Industrial-Commercial-Institutional Steam Generating Units

40 CFR 60 Subpart Db applies to each steam generating unit that commences construction after June 19, 1984, and that has a heat input capacity greater than 100 MMBtu/hr. The natural gas fired auxiliary boiler for the Project has a maximum heat input capacity of 140 MMBtu//hr, and is therefore subject to the applicable requirements of Subpart Db.

Subpart Db does not include SO_2 or PM emission standards for natural gas fired units. The NO_X emission rate from the Facility auxiliary boiler of 0.011 lb/MMBtu will meet the Subpart Dc NO_X emission limit for natural gas fired units of 0.10 lb/MMBtu.

Invenergy will install, calibrate, maintain, and operate a CEMS for the auxiliary boiler for measuring NO_X and O_2 emissions discharged to the atmosphere. The CEMS will be operated and data will be recorded during all periods of operation, including during calibration checks and zero and span adjustments. The procedures of 40 CFR 60.13 will be followed for the installation, evaluation, and operation of the auxiliary boiler CEMS.

Compliance with the Subpart Db NO_X emission limit will be demonstrated through performance testing using the CEMS. For the initial compliance test, NO_X will be monitored for successive operating days and the 30-day average emission rate will be used to determine compliance with the NO_X emission standard. Ongoing compliance will be demonstrated by the 30-day rolling average emission rate measured by the CEMS.

Invenergy will submit notification of the date of initial startup within 15 days after such date. Invenergy will submit the performance test data from the initial performance test and the CEMS performance evaluation. Invenergy will submit excess emission reports semiannually for any excess emissions which occur during each reporting period.

Invenergy will maintain records of the amount of fuel combusted in the auxiliary boiler each day, the average hourly NO_X emission rate, and the 30-day average NO_X emission rate for the preceding 30 unit operating days. All records will maintained for a period of 2 years.

3.2.3.4 Subpart IIII – Stationary Compression Ignition Internal Combustion Engines

40 CFR 60 Subpart IIII establishes standards of performance for owners and operators of stationary CI ICE that commence construction after July 11, 2005, where the stationary CI ICE manufactured after April 1, 2006 and are not fire pump engines, or manufactured as a certified NFPA fire pump engine after July 1, 2006. The Facility emergency generator and fire pump are subject to the applicable requirements of Subpart IIII.

The Facility emergency generator will be certified by its manufacturer to comply with the Subpart IIII emission standards for 2007 model year and later emergency stationary CI ICE with a displacement less than 30 liters per cylinder that are not fire pump engines (40 CFR 60.4205(b)). The Facility fire pump will be certified by its manufacturer to comply with the emission standards in Table 4 of Subpart IIII, for all pollutants (40 CFR 60.4205(c)). Compliance with these emission standards will be maintained over the entire life of each engine, as required.

Invenergy will use diesel fuel in the emergency generator and fire pump that meets the requirements of 40 CFR 80.510(b). 40 CFR 80.510(b) requires all non-road diesel fuel to have a sulfur content less than or equal to 15 ppm, beginning June 1, 2010.

The Facility emergency generator and fire pump will each be equipped with a non-resettable hour meter prior to startup. The engines will be operated according to the manufacturer's instructions. The engines will be limited to 50 hours per year of operation in non-emergency situations and for up to 100 hours per year for maintenance and readiness testing.

No initial notification is required for emergency engines. Invenergy will keep records of the operation of each engine in emergency and non-emergency service that are recorded through the non-resettable hour meter. The time of operation and reason for operation will also be recorded for each engine. All records will be retained for at least two years.

3.2.3.5 Subpart KKKK –Stationary Combustion Turbines

40 CFR 60 Subpart KKKK establishes emission standards and compliance scheduled for the control of emissions from stationary combustion turbines with a heat input at peak load equal to or greater than 10 MMBtu/hr that commenced construction after February 18, 2005. The heat input from associated duct burners should not be included in the determination of applicability, however Subpart KKKK does apply to emissions from any associated HRSG duct burners. Subpart KKKK regulates the emissions of NO_X and SO_2 from affected sources.

The Facility combustion turbines and associated HRSG duct burners are affected sources subject to Subpart KKKK. The NO_X emission limits for new turbines with heat input at peak load greater than 850 MMBtu/hr are 15 ppm at 15 percent O_2 firing natural gas and 42 ppm at 15 percent O_2 firing fuels other than natural gas. The Facility combustion turbines will comply with these emission limits while firing natural gas (2.0 ppmvd@15%O_2) and while firing ULSD (5.0 ppmvd@15%O_2).

Subpart KKKK limits the emission rate of SO_2 for turbines located in a continental area to less than or equal to 0.060 lb/MMBtu or 0.90 lb/MW-hr. The Facility combustion turbines will comply with the Subpart KKKK SO_2 emission limit firing either natural gas (0.0017 lb/MMBtu) or ULSD (0.0019 lb/MMBtu).

The combustion turbines/HRSGs and their associated air pollution control systems and CEMS will be operated and maintained in a manner consistent with good air pollution control practices for minimizing emissions at all times, including during startup, shutdown, and malfunction.

Each combustion turbine/HRSG will be equipped with a NO_X CEMS which will be installed and certified according to 40 CFR 75, Appendix A. Invenergy will develop and maintain on-site a quality assurance plan for each CEMS.

Compliance with the Subpart KKKK SO_2 emission limit will be demonstrated through fuel supplier data certifying the sulfur content of the natural gas and ULSD fuels used.

Reports of excess emissions and CEMS downtime will be submitted semiannually. Excess emissions will be reported for all periods of unit operation, including start-up, shutdown, and malfunction.

3.2.3.6 Subpart TTTT –Greenhouse Gas Emissions for Electric Utility Generating Units

The EPA has proposed 40 CFR 60, Subpart TTTT to establish emission standards and compliance schedules for the control of GHG emissions from a stream generating unit, IGCC, or a stationary combustion turbine that commences operation after its date of publication in the Federal Register. Although this regulation is not currently in effect, the EPA intends to finalize it in the summer of 2015, so its applicability to the Project has been addressed in this application, based on its current draft version. This applicability determination will need to be revisited once Subpart TTTT is finalized by the EPA.

Subpart TTTT will apply to any stationary combustion turbine that has a design heat input greater than 250 MMBtu/hr of fossil fuel that was constructed for the purpose of supplying, and supplies, one-third or more of its potential electric output and more than 219,000 MW-hr net-electric output to a utility distribution system on an annual basis.

Each affected facility is prohibited from discharging into the atmosphere any gases that contain CO_2 in excess of the applicable CO_2 emissions standard. A stationary combustion turbine that has a design heat input greater than 850 MMBtu/hr must limit CO_2 emissions to 1,000 lb/MW-hr on a 12-operating month rolling average.

The Facility combustion turbines will meet the proposed Subpart TTTT CO_2 emission standard. The weighted average CO_2 emission rate for each turbine, based on 335 days per year firing natural gas at base load (781 lb/MW-hr) and 30 days per year firing ULSD at base load (1,227 lb/MW-hr), will be approximately 818 lb/MW-hr, well below the proposed standard.

Invenergy will calculate the 12-month rolling average CO_2 emission rates from each GT/HRSG on a monthly basis. The Facility will be operated and maintained at all times in a manner consistent with safety and good air pollution control practice. An initial compliance determination will be completed within 30 days after the end of the initial 12-month compliance period.

Invenergy will submit the required notifications and prepare a monitoring plan in accordance with the applicable requirements of Subpart TTTT and 40 CFR Part 75. The hourly CO_2 mass emission rate from each GT/HRSG will be measured using a CO_2 CEMS and the hourly heat input rate (MMBtu/hr). Each CO_2 CEMS will be installed, certified, operated, maintained, and calibrated in accordance with the applicable 40 CFR 75 requirements.

Invenergy will submit a compliance report no later than 30 days after the completion of the first twelve months of operation. Thereafter, Invenergy will submit quarterly compliance reports, no later than 30 days after the end of each quarter. Each compliance report will include the rolling 12-month average CO_2 emission rate for each GT/HRSG.

Invenergy will maintain records of the information needed to demonstrate compliance, including all CEMS measurements and all recorded MW-hr data for each compliance period. These records will be maintained in a format suitable and readily available for expeditious review. The records will be maintained on-site for at least 2 years and then for at least 5 years after the date of each record.

3.2.3.7 Appendix B – CEMS Performance Specifications

40 CFR 60 Appendix B establishes performance specifications for COMS and CEMS installed for compliance with the new source performance standards.

The NO_X CEMS to be installed on the Facility auxiliary boiler and on each combustion turbine/HRSG will be fully compliant with 40 CFR 60, Appendix B, Performance Specification 2, Specifications and Test Procedures for SO_2 and NO_X Continuous Emission Monitoring Systems in Stationary Sources (PS 2).

Each NO_X CEMS will meet the CEMS equipment specifications of Section 6.0 of PS 2 and will undergo the performance specification test procedures of Section 8.0 of PS 2, including the completion of calibration drift (CD) tests and relative accuracy test audits (RATA). The calibration drift of each NO_X CEMS will not exceed 2.5 percent of the span value. The relative accuracy of each NO_X CEMS will not exceed 20 percent of the reference method average or 10 percent of the emission standard.

Each O_2 CEMS will be fully compliant with 40 CFR 60, Appendix B, Performance Specification 3, Specifications and Test Procedures for O_2 and CO_2 Continuous Emission Monitoring Systems in Stationary Sources (PS 3).

Each O_2 CEMS will meet the CEMS equipment specifications of Section 6.0 of PS 3 and will undergo the performance specification test procedures of Section 8.0 of PS 3, including the completion of calibration drift tests and relative accuracy test audits. The calibration drift of each O_2 CEMS will not exceed 0.5 percent O_2. The relative accuracy of each O_2 CEMS will not exceed 20 percent of the reference method average or 1.0 percent O_2.

3.2.3.8 Appendix F – CEMS Quality Assurance Procedures

40 CFR 60 Appendix F provides QA/QC procedures for gas continuous emissions monitoring systems used for compliance determination.

Invenergy will implement a QC program which includes written procedures for each CEMS for calibration, calibration drift determination and adjustment, preventive maintenance (including spare parts inventory), data recording, calculations, and reporting, accuracy audit procedures including sampling and analysis methods, and corrective action for malfunctions. These written procedures will be kept on record and available for inspection by RIDEM or EPA.

The calibration drift of each CEMS will checked and recorded at least once daily in accordance with the method prescribed by the manufacturer. The CEMS calibration will be adjusted whenever the daily calibration drift exceeds two times the applicable Appendix B limit. If the calibration drift exceeds twice the applicable limit for five consecutive days, or four times the applicable limit during any check, the CEMS will be deemed out-of-control. Corrective action will then be taken and the calibration drift checks will be repeated until compliant results are achieved.

Each CEMS will be audited at least once each calendar quarter. Successive quarterly audits will occur no closer than 2 months.

A RATA will be conducted on each CEMS at least once every four calendar quarters, except in the case where the unit does not operate in the fourth calendar quarter since the last RATA. In that case, the RATA will be performed in the quarter in which the unit resumes operation.

Cylinder gas audits (CGA) will be performed in three of every four calendar quarters, but in no more than three quarters in succession. CGA will not be conducted in calendar quarters in which the unit does not operate. The performance criteria for each CGA will be less than 15 percent of the average audit value or 5 ppm, whichever is greater.

3.2.4 40 CFR 63 – National Emission Standards for Hazardous Air Pollutants for Source Categories

40 CFR 63 establishes the National Emission Standards for Hazardous Air Pollutants (NESHAPs) for applicable source categories. The following sections detail the subparts from 40 CFR 63 which are applicable to the Project, the applicable requirements, and how the Project will comply with those requirements.

3.2.4.1 Subpart A – General Provisions

40 CFR 63 Subpart A establishes the general provisions of the NESHAPs for applicable source categories. It includes general requirements which apply when the applicable subpart does not include specific requirements for the source.

Invenergy will comply with all applicable record keeping, performance testing, monitoring, work practice, and notification requirements, prescribed in 40 CFR 63, Subpart A which are not specified in the applicable subparts of 40 CFR 63.

3.2.4.2 Subpart YYYY –Stationary Combustion Turbines

40 CFR 63 Subpart YYYY establishes national emission limits and operating limitations for HAP emissions from stationary combustion turbines located at major sources of HAP emissions. A major source of HAP emissions is a contiguous site under common control that emits or has the

potential to emit any single HAP at a rate of 10 tons or more per year or any combination of HAP at a rate of 25 tons or more per year.

As a shown on Table 2, the Facility has the potential to emit any single HAP (hexane) at a maximum rate of 1.7 tons per year and any combination of HAP at a maximum rate of 3.4 tons per year. The Facility will therefore not be a major source of HAP, and the Facility combustion turbines will not be subject to any of the requirements of Subpart YYYY.

3.2.4.3 Subpart ZZZZ –Stationary Reciprocating Internal Combustion Engines

40 CFR 63 Subpart ZZZZ establishes national emission limits and operating limitations for HAP emissions from stationary reciprocating internal combustion engines (RICE) located at major and area sources of HAP emissions. It applies to new stationary RICE located at an area source of HAP emissions which commenced construction after June 12, 2006.

The Facility will not be a major source of HAP emissions, and will therefore, by definition, be an area source of HAP emissions. The proposed Facility diesel emergency generator and diesel fire pump will meet the Subpart ZZZZ applicability criteria for new stationary RICE located at an area source of HAP.

According to Subpart ZZZZ, new stationary RICE located at an area source must meet the requirements of Subpart ZZZZ by meeting the requirements of 40 CFR 60, Subpart IIII for compression ignition engines. No further Subpart ZZZZ requirements apply for such engines.

The Facility diesel emergency generator and fire pump will comply with all applicable requirements of 40 CFR 60, Subpart IIII, as detailed in Section 3.2.3.4 of this application. As such, no Subpart ZZZZ requirements will apply to the emergency generator or fire pump at the Facility.

3.2.4.4 Subpart UUUUU – Coal and Oil Fired Electric Steam Generating Units

40 CFR 63 Subpart UUUUU establishes national emission limitations and work practice standards for HAP emitted from coal and oil-fired electric utility steam generating units. An electric utility steam generating unit is defined in Subpart UUUUU as a fossil fuel-fired combustion unit of more than 25 MW that serves a generator that produces electricity for sale. An oil-fired electrical utility steam generating unit is defined as a unit that burns oil for more than 10.0 percent of the average annual heat input during any 3 consecutive calendar years or for more than 15.0 percent of the annual heat input during any one calendar year.

Any unit designated as a stationary combustion turbine, other than an integrated gasification combined cycle unit, covered by 40 CFR 63, Subpart YYYY, is not subject to Subpart UUUUU. As such, Subpart UUUUU does not apply to the Facility gas turbines nor to the Facility.

3.2.4.5 Subpart JJJJJJ –Industrial, Commercial, and Institutional Boilers Area Sources

40 CFR 63 Subpart JJJJJJ establishes national emission limitations and work practice standards for industrial, commercial, and institutional boilers located at area sources of HAP emissions. Gas-fired boilers are not subject to Subpart JJJJJJ are any of its requirements. A gas-fired boiler is defined in Subpart JJJJJJ as any boiler that burns gaseous fuels not combined with any solid fuels and burns liquid fuel only during periods of gas curtailment, gas supply interruption, startups, or periodic testing on liquid fuel.

The Facility auxiliary boiler will fire natural gas only and is therefore a gas-fired boiler, as defined in Subpart JJJJJJ, and not subject to Subpart JJJJJJ or any of its requirements.

3.2.5 40 CFR 64 – Compliance Assurance Monitoring

40 CFR 64 applies to an emission unit at a major source that is subject to an emission limit, uses a control device to achieve compliance with the limit, and has potential pre-control emissions of the pollutant which exceed the major source threshold for that pollutant. It does not apply to emission limitations proposed after November 15, 1990.

The only proposed emission sources at the Facility which have pre-control potential emissions of a pollutant which exceeds the major source threshold are the combustion turbines. The only such pollutant from the turbines for which a control device will be used to achieve compliance is NO_X. Since the Subpart KKKK NO_X emission limitations applicable to the combustion turbines were proposed after November 15, 1990, 40 CFR 64 does not apply to the combustion turbines for any pollutant nor does it apply to the Facility.

3.2.6 40 CFR 68 - Chemical Accident Prevention Provisions

40 CFR 68 sets forth the list of regulated substances and thresholds, and the requirements for owners and operators of stationary sources concerning the prevention of accidental releases. It applies to a stationary source that has more than a threshold quantity of a regulated substance.

The only regulated substance which will be stored at the Facility is ammonia. The threshold quantity for ammonia listed on Table 1 of 40 CFR 68 is 10,000 pounds at a concentration of 20% or greater. The ammonia to be stored at the Facility will be at a 19% concentration. Therefore, 40 CFR 68 and its associated requirements do not apply to the Facility because it will not store a regulated substance at more than its threshold quantity.

3.2.7 40 CFR 70 & 71 – Operating Permit Program

40 CFR 70 provides for the establishment of comprehensive state air quality permitting programs consistent with Title V of the Clean Air Act. The comprehensive federal air quality permitting program consistent with Title V of the Clean Air Act is established in 40 CFR 71.

The State of Rhode Island's Operating Permit Program, developed per the requirements of 40 CFR 70 & 71, is established in RIDEM APCR No. 29.

Invenergy will submit an operating permit application to RIDEM within twelve months after commencing operation. The application will contain all of the information requested in APCR Section 29.5.1.

3.2.8 40 CFR 72 – Acid Rain Permits

40 CFR 72 establishes the requirements of the EPA's Acid Rain Program.

Invenergy will submit a complete Acid Rain permit application which includes the required information at least 24 months before commencing operation and will fully comply with the applicable monitoring requirements of 40 CFR 75. The Facility will maintain the required records on-site for at least five years.

Invenergy will assign a designated representative with regard to the Acid Rain Program requirements. A complete certificate of representation for the designated representative for the Facility will be submitted as required.

3.2.9 40 CFR 73 – Acid Rain Program Sulfur Dioxide Allowance System

40 CFR 73 establishes the requirements and procedures for the allocation of sulfur dioxide allowances, and the tracking, holding, and transfer of allowances under the EPA's Acid Rain Program.

Invenergy will establish a compliance account for each gas turbine. Invenergy will hold allowances in its compliance accounts not less than the total annual emissions of SO_2 from each turbine. Invenergy will submit an annual compliance certification report as required.

3.2.10 40 CFR 75 – Acid Rain Program Continuous Emissions Monitoring

40 CFR 75 establishes the continuous emission monitoring requirements for affected sources under the EPA's Acid Rain Program.

Invenergy will comply with the applicable requirements of 40 CFR 75 for the CEMS to be installed on each HRSG stack for NO_X and CO_2 emissions. SO_2 monitoring will be conducted using fuel analytical analyses and heat input rate monitoring. Each CEMS will be designed to meet the applicable performance specifications of 40 CFR 75, Appendix A.

Invenergy will submit a written notice of the dates of initial certification testing of each CEMS and a complete certification application which includes the required information within 45 days after completing all initial certification tests. Invenergy will complete each of the required certification tests on each CEMS.

Invenergy will prepare and maintain a monitoring plan which contains the required information. The monitoring plan will be submitted no later than 21 days prior to the initial certification tests. Each CEMS will be operated, calibrated and maintained according to the QA/QC requirements of 40 CFR 75, Appendix B. Standard missing data procedures will be followed as required.

All required monitoring and operational records will be kept and maintained. Reports of all CEMS measurements will be submitted electronically on a quarterly basis as required.

3.2.10 40 CFR 80 – Regulation of Fuels and Fuel Additives

40 CFR 80 prescribes regulations for the control and/or prohibition of fuels and additives. 40 CFR 80, Subpar I provides standards and requirements for Nonroad diesel fuel. Beginning June 1, 2010, all Nonroad diesel fuel is subject to a fuel sulfur content limit of 15 ppm.

Invenergy will only use ULSD fuel for the gas turbines, emergency generator, and fire pump which meets the 40 CFR 80 sulfur content limit of 15 ppm.

3.2.11 40 CFR 97 – Cross State Air Pollution Rule

40 CFR 97, the Cross-State Air Pollution Rule (CSAPR), requires 23 states to reduce annual SO_2 and NO_X emissions to help downwind areas attain compliance with the 24-hour and annual $PM_{2.5}$ NAAQS. It also requires 25 states to reduce ozone season NO_X emissions to help downwind areas attain the 1997 8-hour ozone NAAQS.

The State of Rhode Island is not included in CSAPR and is not required to achieve under emission reductions to comply with CSAPA. As a result, the Project will not be subject to any CASPR requirements.

3.2.12 40 CFR 98 – Mandatory Greenhouse Gas Reporting

40 CFR 98 establishes mandatory GHG reporting requirements for owners and operators of facilities that directly emit GHG. Any facility which contains a source category listed in Table A-3 of 40 CFR 98 must submit an annual report of GHG emissions from fuel combustion sources and any listed source categories. The source categories listed on Table A-3 include electricity generation units that report CO_2 mass emissions year round through 40 CFR 75.

Invenergy will be required to submit an annual GHG report, no later than March 31 of each calendar year for GHG emissions in the previous year. The GHG emissions from the gas turbines will be reported in accordance with 40 CFR 98 Subpart D. The GHG emissions from the auxiliary boiler and dewpoint heater will be reported in accordance with 40 CFR 98 Subpart C. The GHG emissions from emergency generators and emergency equipment such as the fire pump are not included.

The GHG emissions to be reported will be CO_2, methane (CH_4), and nitrous oxide (N_2O). Each annual GHG report will be submitted electronically in the required format. All of the required records will be kept and maintained.

4.0 EMISSIONS CONTROL TECHNOLOGY EVALUATION

The following sections describe the emissions control technology evaluation which has been completed for the Project.

4.1 Best Available Control Technology

RIDEM requires that a new major stationary source apply Best Available Control Technology (BACT) for each pollutant it would have the potential to emit. BACT is defined as an emissions limitation based on the maximum degree of reduction for each air pollutant 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 stationary source through the application of production processes or available methods, systems and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of such pollutant.

In no case can the application of BACT result in emissions which would exceed that allowed by any applicable state or federal air pollution control rule or regulation. If the Director determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of air standards infeasible, a design, equipment, work practice, operational standard or combination thereof, may be prescribed to satisfy the BACT requirement. Such a standard, to the degree possible, must set forth the emission reduction achievable by its implementation and provide for compliance by achieving equivalent results.

The EPA issued the PSD and Title V Greenhouse Gas Tailoring Rule in 2010 to address GHG emissions from stationary sources under the Clean Air Act permitting program. The rule sets thresholds for GHG emissions that define when permits under the PSD and Title V Operating Permit programs are required for new and existing facilities not subject to these program for other pollutants. The rule requires that sources subject to the PSD permitting program for other pollutants also be subject for their GHG emissions.

A BACT Determination is a top-down process in which all available control technologies for that pollutant and emission source are identified. Each control technology is then evaluated for its technical feasibility and those demonstrated to be technically infeasible are eliminated from consideration. The remaining control technologies are then ranked in descending order of control effectiveness. The most effective remaining control technology is deemed to be BACT unless it is demonstrated that technical considerations, or the associated energy, environmental, or economic impacts justify a conclusion that the control technology is not available for the source. If the most stringent control technology is eliminated from consideration, the additional control technologies are similarly evaluated in descending order of control effectiveness until the most stringent available control technology is identified as the BACT determination for that pollutant and emission source.

4.2 Lowest Achievable Emission Rate

RIDEM requires that a new major stationary source of a nonattainment pollutant meet an emission limitation that is considered the lowest achievable emission rate (LAER) for each nonattainment pollutant for which it is a major source. LAER is defined as the most stringent limitation which is contained in the implementation plan of any state for such class or category of stationary source (unless it is demonstrated that such limitations are not achievable), or the most stringent emission limit which is achieved in practice by such class or category of stationary source. In no event can the application of LAER permit a proposed new source to emit any pollutant in excess of the amount allowable under applicable new source performance standards. The LAER requirement applies to each new emissions unit at which emissions will occur.

Unlike BACT, the LAER requirement does not consider economic, energy, or other environmental factors. An emissions limit cannot be considered LAER if the cost of maintaining the level of control is so great that the source could not be built or operated. Thus, for a new source, LAER costs are only considered to the degree that those costs significantly differ from the typical cost for the rest of the industry. Cost should not be considered for a LAER determination if sources in the same industry are already using that control technology.

4.3 Source-Specific BACT/LAER Determinations

The following sections detail the BACT/LAER determinations for each Project emission source.

4.3.1 Gas Turbines/HRSGs

To complete the BACT/LAER analysis for the gas turbines/HRSGs at the Facility, control technologies demonstrated in practice for similar sources, and corresponding emission limits established by various state agencies and the EPA were reviewed. BACT determinations listed in the USEPA RACT/BACT/LAER Clearinghouse (RBLC), the South Coast Air Quality Management District BACT determinations, the California Air Resources Board's BACT Clearinghouse Database, and any available recently issued air permits were also reviewed. Appendix B contains a full listing of the information resources used for these determinations.

The review was limited to combustion turbines permitted since 2000 with an output greater than 400 MW fired on natural gas and/or distillate oil used in a combined-cycle power plant configuration. The information gathered from these sources was used in determining the proposed BACT/LAER emission levels. This control technology analysis demonstrates that the proposed gas turbine/HRSG emissions are consistent with recent BACT/LAER determinations for similar sources.

Appendix B contains a listing of the recent BACT determinations considered for this analysis. The following sections provide a discussion of the emission control techniques that were considered to control the emissions from the gas turbines/HRSGs and the selected BACT or LAER proposal for each pollutant.

4.3.1.1 Oxides of Nitrogen (NO_X)

NO_x emissions contribute to ground-level ozone formation, stratospheric ozone depletion and acid rain. NO_x emissions from the combustion of fossil fuels are mainly formed by the following three mechanisms:

- Fuel-bound NOx; originated from fuel-bound nitrogen in the fuel
- Prompt NOx promptly formed at the flame front
- Thermal NO_x; created by high temperature and is the main form of NO_x production

Natural gas has negligible fuel-bound nitrogen. Virtually all of the NO_X formed from the combustion of natural gas is thermal. Distillate oil has low levels of fuel-bound nitrogen. Thermal NO_X is the primary source of NO_X formation for distillate oil-fired turbines.

Beyond the selection of low emitting fuels, several design and add-on technologies have been developed to minimize NO_x emissions. These methods are divided in two main categories:

In-combustor NO_x control, which reduces the formation of NO_x during the combustion process:

- Diluent Injection
- Dry Low-NOx Combustors
- Catalytic Combustion / XONON

Post-combustion NO_x control, which reduces the NO_x emissions in the flue gas stream:

- SCONOx
- SCR

The following sections further discuss and evaluate these methods as LAER for NO_x emissions.

Diluent Injection

Diluent injection (water injection) or wet controls involve injection of a small amount of water or steam into the immediate vicinity of the combustor burner flame. Instantaneous cooling reduces the NO_x formation in the combustion chamber. However water or steam injection also leads to combustor flame instability and potential increases in emissions of CO and hydrocarbons (HC) resulting from incomplete fuel combustion. When water is used, it must be treated to meet strict chemical balance, similar to boiler feedwater. The amount of water required can be greater than one-half of the fuel flow. This results in a heat rate penalty; however, the power output rises somewhat. The corrosive impacts of excessively high water injection on plant maintenance must be considered. Therefore, vendors recommend an optimum balance of water-to-fuel ratios to minimize impacts on plant maintenance while minimizing NO_x emissions.

This control technique is a well-demonstrated technology. It will be utilized for the Facility during ULSD firing for additional NO_x control.

Dry Low - NO_x Combustors

In conventional combustors fuel and air are introduced into the combustion chamber separately and mix in small, localized zones. This translates to more localized hot spots and higher NO_x production. In dry low-NO_x (DLN) burners, air and fuel are mixed before entering the combustor to provide more homogeneous charge combustion. To achieve low NO_x emission levels, the mixture of fuel and air should be near the lean flammability limit of the mixture. At reduced load conditions, lean premixed combustors switch to diffusion combustion mode to avoid combustion instability and excess CO emissions; this means uncontrolled NO_x emissions in this mode.

This control technique is a well-demonstrated technology. This technology will be utilized for the Facility.

Catalytic Combustion / XONON

In catalytic combustion or XONON, a catalyst bed is used to oxidize the lean air fuel mixture instead of burning it with a flame. This limits the combustion temperature and therefore the formation of NO_x.

Catalytic combustion (XONON) has not been applied commercially to combustion turbines of a similar power output as those proposed for the Facility. The largest combustion turbine for which catalytic combustion has been applied was a 1.4 MW test turbine. Because this technology has not been successfully demonstrated in practice on a similar sized turbine, it is not technically feasible for the Facility.

SCONOx

The SCONOx process oxidizes both CO and NO to CO_2 and NO_2, with subsequent absorption of NO_2 by a potassium carbonate (K_2CO_3) coated catalyst. The carbonate coating reacts with NO_2 to form KNO_3 and CO_2. The system continually regenerates one of the multiple sections of the catalyst bed using hydrogen gas, which reacts and forms carbonate, water, and nitrogen. A two-stage catalytic hydrogen gas generator is also part of this process. In the first stage, natural gas and air are reacted across an oxidation catalyst to form CO and H_2. Steam is then added and the gases are reacted across another catalyst forming CO_2 and more H_2. This mixture is then diluted to 4% using steam or another inert gas (due to its explosivity). The regeneration cycle must take place in an oxygen free environment, which requires isolation from the CT exhaust gases. This is performed using many sets of louvers and seals both upstream and downstream of each catalyst section; with each regeneration cycle only lasting three to five minutes.

SCONOx has not been applied commercially to combustion turbines of a similar power output as the ones being proposed for the Facility. The largest turbine which has had SCONOx successfully installed was 43 MW. Because this technology has not been successfully demonstrated in practice on a similar sized turbine, it is not technically feasible for the Facility.

Selective Catalytic Reduction (SCR)

The SCR system is a method for converting NO_x generated from the CT to diatomic nitrogen and water by reacting with NH_3 in the presence of a catalyst. NH_3 is vaporized and injected in the flue gas upstream of the catalyst, which, when passing over the catalyst, results in the following dominant chemical reactions.

1. $4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$
2. $2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O$

The operating temperature and the flue gas properties are critical to both the performance and life of the catalyst. In simple-cycle settings, modules of the catalyst are installed downstream of the gas turbine. The typical operational temperature range for base-metal catalysts is 600°F to 800°F. In simple-cycle power plants where no heat recovery is accomplished, high temperature catalysts (1100ºF) may be used. The key technical and economic issues are the performance and life of the catalyst.

Environmental impacts associated with SCR are emissions and storage of NH_3 and catalyst disposal. Low levels of NH_3 slip are to be considered in assessment of environmental impacts. Throughout the life span of the catalyst, NH_3 slip is expected to be less than 2 ppm at 15 percent O_2 while firing natural gas and while firing ULSD. SCR can also result in some additional PM_{10} emissions in the form of ammonium bisulfate compounds, which typically increase as ammonia slip is reduced by adding catalyst. By balancing the allowable ammonia slip and the required catalyst necessary to achieve the required level of NOx control, the SCR system's contribution to the potential PM_{10} emissions of the proposed Facility is considered to be negligible.

This control technique is a well-demonstrated technology. This technology will be utilized for the Facility.

Prior BACT Determinations for NO_x

There are numerous similar projects that have been permitted since 2000 with a stack concentration of 2.0 ppmvd @ 15% O_2 while firing natural gas. This is the lowest permitted NOx concentration that has been achieved while firing natural gas. It has been achieved by these facilities utilizing DLNC and SCR

The Pioneer Valley Energy Center in Westfield, MA was recently permitted with a stack NO_X concentration of 5.0 ppmvd while firing ULSD and utilizing water injection and SCR. This is the lowest permitted NOx concentration identified while firing ULSD.

LAER for NO_x

The Project will fire natural gas and ULSD, which are the lowest NO_x emitting fuels available for a combustion turbine. DLN combustion and SCR are the available control technologies with the highest control efficiencies for NO_X while firing natural gas. SCR and water injection are the available control technologies with the highest NO_X control efficiencies while firing distillate oil. $SCONO_X$ and catalytic combustion (XONON) are not considered technically feasible for turbines of this size. Therefore, BACT for NO_x is proposed based on the use of DLN combustion while firing natural gas, SCR, and water injection during ULSD firing. Consistent with recent determinations for similar projects, the proposed LAER emission rates for NO_X are stack concentrations of 2 ppmvd @ 15% O_2 while firing natural gas, and 5 ppmvd @ 15% O_2 while firing ULSD fuel.

4.3.1.2 Sulfur Dioxide/Sulfuric Acid (H_2SO_4)

Emissions of SO_2 and H_2SO_4 from combustion turbines are formed from the oxidation of sulfur in the fuel. Given that flue gas desulfurization systems have not been applied to natural gas combustion turbines, the only means for controlling SO_2 and H_2SO_4 emissions from a combustion turbine is to limit the sulfur content of the fuel. The Facility will utilize natural gas and ULSD fuel, the fuels with the lowest sulfur content available for use by combustion turbines.

Prior BACT Determinations for SO_2 & H_2SO_4

All prior BACT determinations for SO_2 and H2SO$_4$ for similar projects were based on the use of low sulfur content natural gas and ULSD fuels. The permitted emission rates have varied based on the assumed sulfur content of the fuels fired.

BACT for SO_2 & H_2SO_4

The use of natural gas fuel and ULSD fuel will serve as BACT for SO_2 and H_2SO_4. The proposed emission rates of SO_2 and H_2SO_4 while firing both natural gas and ULSD are consistent with recent BACT determinations for similar facilities.

4.3.1.3 Particulate Matter (PM/PM_{10}/$PM_{2.5}$)

PM from fuel combustion is formed from non-combustible constituents (ash) in the fuel, soot resulting from unburned hydrocarbons, and the formation of ammonium sulfates within the SCR. The type of fuel, the design and operation of the combustion turbine, and the SCR system design and operation will each impact the formation of PM emissions. All PM emitted from combustion turbines is typically less than 10 microns (PM_{10}) in diameter. Although logically a subset of PM_{10}, the emissions of fine particulate matter ($PM_{2.5}$) from the turbines have been conservatively assumed to be equal to the emissions of PM_{10}.

Due to the high temperatures and flow rates of the exhaust stream and low particulate concentrations in the exhaust, add-on particulate controls such as electrostatic precipitators, fabric filters or wet scrubbers have not been applied to combustion turbines. The implementation of any such controls would create unacceptable backpressure due to the high excess air needed for combustion turbine operation. Such add-on controls for combustion turbines of the size of the Facility are not considered technically feasible or demonstrated in practice. Rather, particulate emission control is achieved at the source by efficiently burning low ash and low sulfur fuel.

The PM emissions from natural gas firing are considered to be negligible, and marginally significant for distillate-oil firing, providing the most stringent degree of particulate emissions control available for combustion turbines. The design and operation of the turbine and SCR system, along with the use of natural gas and ULSD fuel, will result in PM_{10} and $PM_{2.5}$ emission rates of 0.0053 lb/MMBtu of heat input to the turbine while firing natural gas and 0.020 lb/MMBtu while firing ULSD.

Prior BACT Determinations for PM/PM_{10}/$PM_{2.5}$

The permitted PM/PM_{10} emission rates for similar recently permitted projects firing natural gas have ranged from 0.004 to 0.008 lb/MMBtu. The Pioneer Valley Energy Center in Westfield, MA was recently permitted at an emission rate of 0.014 lb/MMBtu firing ULSD. Because there are no add-on controls which are technically feasible to control particulate matter emissions from combustion turbines, the differences in emission rates for different projects is a product of varying conservatism in the emission rate guarantees provided by different equipment manufacturers, and not actual differences in the level of particulate matter expected to be generated by each turbine model per unit of fuel combusted.

BACT for PM/PM_{10}/$PM_{2.5}$

The use of natural gas as the primary fuel, and limited use of ULSD as the back-up fuel for the combustion turbines will serve as BACT for PM/PM_{10}/$PM_{2.5}$. Particulate emissions will also be controlled through efficient combustion in the combustion turbines.

4.3.1.4 Carbon Monoxide (CO) & Volatile Organic Compounds (VOC)

CO and VOC emissions are formed due to incomplete combustion of the fuel typically caused by insufficient residence time, temperature or oxygen to combine unburned carbon with oxygen at high temperatures. CO and VOC emissions are typically higher during transient and low load operating conditions. Control technologies used to minimize CO emissions include the use of clean burning fuels, state-of-the-art combustion technology, add-on oxidation catalyst systems, and establishing minimum load restrictions. An evaluation of combustion controls and oxidation catalysts are presented below.

Combustion Controls

When considering combustion technology as a control measure for CO and VOC emissions, a balance must be achieved to maintain efficient combustion while minimizing the formation of NO_x emissions. There have been several combustor designs for power generation introduced by combustion turbine vendors within the past twenty years that have focused on improving maintenance, efficiency, and emissions. Until very recently, the “standard combustor” employed water or steam to lower the combustion temperature, which reduced thermal NO_x. The DLN technology uses a lean, premix combustion chamber where fuel is premixed with high excess air to lower the flame temperatures and NO_x emissions without water or steam injection.

This control technique is a well-demonstrated technology. It will be incorporated in the design for the combustion turbines to be installed at the Facility.

Oxidation Catalysts

Oxidation catalysts are typically used on turbines to achieve control of CO and VOC emissions. The CO catalyst promotes the oxidation of CO to carbon dioxide (CO_2) and water as the emission stream passes through the catalyst bed. The oxidation process takes places spontaneously, without the requirement for introducing reactants. Oxidation catalysts typically achieve at least 90% control efficiency in combustion turbines.

The use of an oxidation catalyst provides the highest level of CO and VOC control available for a combustion turbine. The Facility will utilize an oxidation catalyst for the control of CO and VOC emissions from the combustion turbines.

Prior BACT/LAER Determinations for CO & VOC

There are several similar turbine projects in the RBLC database that have been permitted since 2000 that utilize an oxidation catalyst for CO & VOC control. The lowest identified permitted CO stack concentration while firing natural gas is 2.0 ppmvd @ 15% O_2 and 5.0 ppmvd@15% O_2 while firing ULSD. The lowest identified permitted VOC stack concentration while firing natural gas is 1.0 ppmvd @ 15% O_2 and 5.0 ppmvd@15% O_2 while firing ULSD.

BACT for CO

The use of combustion controls and an oxidation catalyst provides the highest level of CO control available for a combustion turbine. The Facility will utilize combustion controls and an oxidation catalyst for the control of CO emissions from the combustion turbines. Consistent with recent BACT determinations, the Facility will maintain a CO stack concentration of no more than 2.0 ppm at 15 percent O_2 while firing natural gas and no more than 5.0 ppm at 15 percent O_2 while firing ULSD.

LAER for VOC

The use of combustion controls and an oxidation catalyst provides the highest level of VOC control available for a combustion turbine. The Facility will utilize combustion controls and an oxidation catalyst for the control of VOC emissions from the combustion turbines. Consistent with recent LAER determinations, the Facility will maintain a VOC stack concentration of no more than 1.0 ppm at 15 percent O_2 while firing natural gas without duct firing, 1.7 ppm at 15 percent O_2 while firing natural gas with duct firing, and 5.0 ppm at 15 percent O_2 while firing ULSD.

4.3.2 Auxiliary Boiler & Dewpoint Heater

The control of emissions from sources such as the auxiliary boiler and the dewpoint heater can be accomplished by using clean fuels, combustion controls, add-on emissions control systems, or by limiting operation. Both the auxiliary boiler and the dewpoint heater will fire clean natural gas fuel and be equipped with ultra-low NO_X burners and flue gas recirculation (FGR) systems. Based on a review of available permits, the combined effect of these control technologies offers the highest level of emissions control technically feasible for these types of sources. As a result, the use of natural gas and the proposed emission control systems represent BACT and LAER for the auxiliary boiler and dew point heater.

4.3.3 Emergency Generator & Fire Pump

Both the emergency generator and the diesel powered emergency fire pump will fire ULSD fuel and will be limited to no more than 300 hours of operation per year.

There are no add-on emissions controls that have been demonstrated in practice for small, limited use, ULSD fired reciprocating engines similar to the Facility's emergency generator and the diesel powered emergency fire pump. Emissions will be controlled through the use of clean burning ULSD fuel oil with a sulfur content of 15 parts per million or less, state-of-the-art combustion controls, and limitations on annual operation. The units will typically operate no more than one hour per week for maintenance and reliability testing, except in the case of an emergency. The proposed units will comply with the applicable EPA non-road engine standard emissions limits at the time of installation; stringent emissions limitations developed to meet BACT requirements. Based on a review of available permits, limited operation, the use of ULSD fuel, and compliance with the applicable EPA non-road engine emission limits represent BACT and LAER for the standby engines proposed for the Project.

4.4 Facility GHG BACT Determination

The EPA issued the Tailoring Rule in 2010 requiring new facilities subject to the PSD permitting program to address BACT for GHG emissions as part of the PSD permitting process. Beginning on June 2, 2011, GHGs are a regulated NSR pollutant under the PSD major source permitting program. For PSD purposes, GHGs are a single pollutant defined as the aggregate group of the following six gases:

- Carbon dioxide (CO_2)
- Nitrous Oxide (N_2O)
- Methane (CH_4)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF_6)

The Tailoring Rule has been implemented in steps. Currently, GHGs emitted in any amount from a facility subject to PSD for other pollutants are subject to PSD and are a regulated NSR pollutant from the source. According to EPA guidance, a determination of BACT for GHGs should be conducted in the same manner as it is done for any other PSD regulated pollutant.

The EPA's "PSD and Title V Permitting Guidance for Greenhouse Gases" recognizes that GHG emissions from electric generating facilities can be most effectively minimized by using highly efficient power generating equipment and by optimizing the energy efficiency of the overall generating facility design. Such equipment minimizes the quantity of GHG emissions generated per unit of net power produced by minimizing the quantity of fuel combusted, as well as the quantity of power consumed by the generating facility itself. The best measure of the overall generating facility efficiency is the "net heat rate", defined as the ratio of total energy input divided by the quantity of power distributed to the electric supply grid.

4.4.1 Facility GHG Emissions

The Facility has total potential CO_2 emissions of approximately 3.6 million tons per year. Approximately 99% of the Facility's GHG emissions will result from the combustion of natural gas and ULSD in the gas turbines. Consistent with EPA guidance, the Facility GHG BACT determination is focused on maximizing the efficiency of the gas turbines in order to minimize fuel usage and the GHG emissions generated by the gas turbines during the combustion of fuel. Because 99% of the Facility GHG emissions come from the gas turbines, implementing BACT for GHG on any other source of GHG emissions at the Facility would have a negligible impact on the total amount of GHG emitted.

4.4.2 Available Control Technologies

The use of clean burning fuel and combustion efficiency are the only technically and economically feasible control technologies currently available to minimize GHG emissions from combustion turbines.

The Project will utilize the state-of-the-art in combustion turbine technology, optimized to produce power from fuel more efficiently than any other unit commercially available. The Facility combustion turbines will have the lowest net heat rate commercially available for turbines of this size.

Natural gas and ULSD oil are the cleanest burning combustion turbine fuels commercially available at the scale are required for the Project. Both fuels are readily available from regional distribution systems and providers. Syngas fuels produced by integrated gasification systems and biofuels can be treated to have lower carbon emissions than natural gas, however these fuels are not commercially available in the quantities needed for the Project nor have they been approved for use in commercially available combustion turbines by their manufacturers.

The only other method for controlling CO_2 emissions from combustion turbines is carbon capture and sequestration (CCS) which involves the removal of carbon from the fuel prior to combustion and scrubbing carbon dioxide from the combustion exhaust. Even if these technologies were commercially viable and demonstrated in practice at the scale of the Project, their application would involve economic costs which would make the Project not viable. The use of add-on controls for GHG emissions reduction is therefore not technically feasible for the Project.

4.4.3 GHG BACT Determination

There are several similar projects which have been recently permitted with GHG emission limits applicable to the Project, as shown on the summary table in Appendix B. Recently permitted facilities have combustion turbine GHG permit limits ranging from 825 to 947 lb/MW-hr firing natural and ULSD with no add-on controls.

The weighted average CO_2 emission rate for each Facility gas turbine, based on 335 days per year firing natural gas at base load (814 lb/MW-hr) and 30 days per year firing ULSD at base load (1,227 lb/MW-hr), will be approximately 818 lb/MW-hr, below each of the recently permitted GHG limits**.**

The GHG BACT determination for the Facility, consistent with EPA guidance and recently permitted similar facilities, will be the use of state-of-the-art gas turbine combustion technology with the lowest net heat rate commercially available, and the use of clean burning natural gas and ULSD fuels.

5.0 AIR QUALITY IMPACT ANALYSIS

An Air Quality Impact Analysis will be completed for the Project. The purpose of this analysis will be to assess the potential off-site impacts of the emissions from the Facility with respect to the NAAQS and the PSD Increments. The analysis will also include the additional impact analyses required by RIDEM's major source PSD permitting regulations.

The RIDEM "Rhode Island Air Dispersion Modeling Guidelines for Stationary Sources (March 2013 Revision)" (RIDEM, 2013) outlines the accepted procedures for performing modeling analyses in conformance with the EPA Guideline on Air Quality Models (40 CFR 51, Appendix W). To ensure that all modeling analyses subject to the approval of RIDEM are performed in accordance with applicable state and federal guidance, an applicant must submit a modeling protocol prior to conducting the analysis. The protocol describes the input parameters, models, and assumptions that will be used in the analysis.

An Air Dispersion Modeling Protocol was submitted for the Project to RIDEM on April 20, 2015. Once the protocol has been approved, the air quality impact analysis for the Project will be completed in accordance with the approved protocol, and the results will be submitted to RIDEM as a supplement to this application.

The following sections describe the air quality impact analysis to be completed for the Project.

5.1 Model selection factors

5.1.1 Land Use

Land use within a 3 kilometer (km) radius of the proposed facility location has been classified according to the method specified in the RIDEM Modeling Guideline (Auer, 1978). Land use classification information contained on the USGS topographic maps of the area (Chepachet and Thompson, RI, quadrangles) was used to assess the urban/rural distribution. Figure 4 presents the percentage breakdown of the various land use categories within 3 km of the facility location. As shown on Figure 5, nearly 90% of the land use within 3 km is forested area and nearly 96% is associated with rural land uses.

5.1.2 Good Engineering Practice (GEP) Stack Height

US EPA's modeling guidance limits the stack height used in performing dispersion modeling analyses. Each source must be modeled at its actual physical height unless that height exceeds its GEP stack height. If the physical stack height is less than the GEP height, the actual stack height is input to the model and the potential for the plume to be affected by aerodynamic wakes created by nearby buildings must be evaluated in the dispersion modeling analysis. If the actual stack height exceeds its GEP stack height, the GEP stack height must be used in the analysis.

A GEP stack height analysis has been performed in accordance with "Guideline for Determination of Good Engineering Practice Stack Height" (US EPA, 1985). A GEP stack height, as measured from the base elevation of the stack, is defined as the greater of 65 meters (213 feet) or the formula height (H_g) determined from the following equation:

$H_g = H + 1.5L$

Where

H = height of the nearby structure which maximizes H_g

L = lesser dimension (height or projected width) of the building

The GEP formula height is based on the "nearby" buildings or building tiers that result in the greatest justifiable height. For the purposes of determining the maximum GEP formula height, "nearby" is limited to five building heights or widths (5L), whichever is less, from the trailing edge (edge closest to the source) of the building.

A GEP stack height analysis was performed for each facility stack and structure. The four structures that result in the highest GEP formula height are presented on Table 4. For any source with a proposed stack height that is less than the GEP height, assessment of building downwash in the modeling analysis will be required.

5.1.3 Cavity Region

The cavity region created by a building can extend out to a distance of 3L. Cavity impacts need to be analyzed for these lesser downwind distances when the stack height is less than the calculated GEP height. The results of the cavity analysis are presented in Table 4.

Only cavities that reach ambient air (accessible to the public) are required to be evaluated. If a cavity falls entirely within a fenceline or on a facility roof, it may be excluded from consideration. The AERMOD analysis to be performed will evaluate the impacts of plumes potentially entrapped within the cavity regions of those structures for which there is a potential for the cavities to extend offsite.

5.1.4 Local Topography

Local topography plays a role in the selection of an appropriate dispersion model. Dispersion models can be divided into two categories: (1) those applicable to areas where terrain is less than or equal to the height of the top of the stack (simple terrain), and (2) those applicable to areas where terrain is greater than the top of the stack (complex terrain). The two HRSG stacks will have base elevations of approximately 570 above mean sea level. With 200-foot proposed stack heights, nearby terrain at an elevation of 770 feet or more above mean sea level will be treated as complex terrain for this analysis.

5.1.5 Model Selected For Use

The dispersion environment, potential for aerodynamic building downwash effects on ground-level concentrations, and the local topography help to determine the appropriate models for use in a dispersion modeling analysis.

Screening modeling is typically performed with US EPA's AERSCREEN (dated 14147) model. The model is appropriate for assessing concentrations within the cavity region of a building, and also includes algorithms from the US EPA AERMOD model, the preferred refined model for assessing building downwash effects within the wake region.

AERSCREEN is limited to assessing impacts from a single source. In order to evaluate the cumulative impacts from multiple sources, the maximum AERSCREEN impacts from each individual source are combined, regardless of location or meteorological condition. Based on the number of sources to be modeled for the Facility, the air quality impact analysis will only utilize AERSCREEN to determine the worst-case modeling scenarios for the two gas turbines.

The air dispersion modeling analysis for all Facility sources (and off-site potentially interacting sources) will be completed using the refined EPA AERMOD (Version 14134) model. AERMOD will be used to calculate maximum 1-hour average ground-level concentrations at all receptor locations, including offsite locations within the cavity region, from which it will determine block averages for the other required averaging periods. AERMOD is a refined model that utilizes actual historical meteorological data in the project area, assesses the potential building downwash effects on ground-level concentrations, and estimates concentrations in either simple or complex terrain.

5.2 Preliminary Screening Modeling

5.2.1 Operating Parameters

AERSCREEN will be applied to determine the worst-case short term modeling scenarios for the two gas turbines. Screening modeling will be performed for the flue gas characteristics associated with the operating conditions and ambient temperatures shown in Appendix A for both natural gas and ULSD firing. The ambient temperatures represent the expected range of temperatures that would be expected throughout the year.

5.2.2 Screening Model Application

The AERSCREEN dispersion model will be applied in accordance with the recommendations made in USEPA's "Guideline on Air Quality Models" to assess the magnitude of maximum pollutant concentrations from the gas turbines over the range of operating loads and ambient temperatures presented in Appendix A. AERSCREEN will be applied using dispersion parameters based on the site land use characteristics, default meteorology, building downwash, terrain elevations and a 1 gram per second emission rate.

AERSCREEN allows the incorporation of several AERMOD refinements. The stacks will be modeled as rural sources.

AERSCREEN generates worst-case meteorology through MAKEMET. Default values will be used for minimum and maximum temperatures and minimum wind speed. Surface roughness values will be based on the predominant land use (rural) near meteorological tower that will subsequently be used in the AERMOD modeling (T. F. Green Airport). MAKEMET will be applied for a rural setting with average moisture conditions.

Automated receptor distances will be used in AERSCREEN extending out to 50 kilometers. By default, receptors will be placed at 25-meter increments out to 5 kilometers, and 450-meter increments out to 50 kilometers. AERSCREEN will determine the maximum receptor elevations through the application of AERMAP. National Elevation Data (NED) data will be input to AERMAP. The data will be downloaded from the USGS website (http://seamless.usgs.gov/index.php).

5.2.3 Scaling Factors

The AERSCREEN model calculates 1-hour concentrations at cavity region and simple and complex terrain locations. AERSCREEN provides 3-hour, 24-hour and annual averaging period estimates from the 1-hour values. The 3-hour, 8-hour, 24-hour and annual scaling factors in AERSCREEN are 1.0, 0.9, 0.6, and 0.1, respectively.

5.2.4 Screening Results

AERSCREEN will be applied to determine the gas turbine operating conditions which result in the highest predicted ambient air impact concentrations for each fuel, pollutant and averaging period. For each operating scenario, the actual 1-hour average impacts predicted for each pollutant will be determined by scaling the unit emission rate (i.e., 1 gram per second) normalized 1-hour concentrations by the maximum actual emission rate. To evaluate annual impacts, only the 59ºF cases will be modeled, as these cases represent the average meteorological conditions expected over the course of each year.

Once the worst-case gas turbine operating condition for each pollutant and averaging has been identified using AERSCREEN, refined modeling with AERMOD will be performed to assess the total ambient pollutant concentrations resulting from the combined emissions from the gas turbines (at the worst-case operating condition for each fuel, pollutant and averaging period), the auxiliary boiler, the dew point heater, the emergency diesel generator, and the diesel fire pump.

5.3 Model Preparation

5.3.1 Meteorological Data

AERMOD will be applied using the five most recent years (currently 2007-2011) of hourly meteorological data that has been pre-processed by RIDEM of surface observations from T. F. Green Airport in Providence and concurrent upper air observations from Chatham, MA. These data sets will be downloaded from the RIDEM website, at http://www.dem.ri.gov/pubs/regs/index.htm#Air.

5.3.2 Land Use

As shown on Figure 5, land use near the facility is predominately rural. All facility sources will be modeled as rural sources. The population of Burrillville is 15,955, based on the 2010 estimate from the U. S. Census Bureau.

5.3.3 Receptor Grid

A polar receptor grid will be centered at the GT/HRSG 1 stack. Receptor coverage will extend out to 50 kilometers, as shown in Figures 5 and 6. Receptors will be located at:

- 25-meter increments out to 1 kilometer,
- 100-meter increments out to 2 kilometers,
- 200-meter increments out to 5 kilometers,
- 500-meter increments out to 10 kilometers, and
- 1,000-meter increments out to 50 kilometers.

Receptors will be placed along the property fenceline at 10-meter increments. On-site locations will not be included in the analysis. The maximum terrain elevation and hill height will be assigned for each receptor through the application of AERMAP. National Elevation Data (NED) data will be input to AERMAP (Version 11103). The data will be downloaded from the USGS website (http://seamless.usgs.gov/index.php).

5.3.4 Preliminary Refined Modeling - Significant Impact Determination

A preliminary refined modeling analysis will be conducted using the AERMOD model which evaluates the ambient air impact concentrations resulting from the proposed emissions from the Facility for five years of hourly meteorological data. Each emissions source will be modeled at its maximum capacity and proposed allowable operation. The highest total modeled concentration predicted for each pollutant and averaging time will be compared to the corresponding Significant Impact Level (SIL).

If one or more SILS is exceeded, the project's Significant Impact Area (SIA) will be calculated. The SIA will be defined as the circular area with a radius extending from the source to the furthest point where a significant impact is predicted to occur. The SIA will be determined for each pollutant and averaging period for which the SIL was exceeded.

RIDEM requested in the pre-application meeting for the Project that the impacts from the Algonquin Compressor Station facility in Burrillville, the Ocean State Power (OSP) generating facility in Harrisville, and the Tennessee Gas Compressor Station facility in Harrisville, be included in a multi-source modeling analysis for the Facility, regardless of whether any SILs were exceeded. The exhaust parameters for these facilities will be verified by a file review at RIDEM, and their ambient air impacts will be modeled for interaction with the impacts from the Facility for the determination of NAAQS and PSD increment compliance. RIDEM also requested that Invenergy consider nearby Massachusetts power plants for inclusion in the analysis, depending on the extent of the SIA.

A figure showing the SIA and the locations of any other identified off-site emission sources within that SIA will be submitted to RIDEM for a determination as to whether any additional sources should be included in the multi-source modeling analysis. According to the RIDEM Modeling Guidelines, RIDEM will consider the type and size of the subject source and the potentially interacting sources, the SIA, the distance between the subject source and potentially interacting sources, the concentration gradient in the vicinity of the subject source, monitored background concentrations, and the likelihood of modeled violations of air quality standards.

The multisource modeling will be conducted using the same methodology described in this application, with the inclusion of the requested off-site emission sources.

5.3.5 Class II Area Impacts

AERMOD will be run with each emission source operating simultaneously, for five years of hourly meteorological data. The annual impacts from the gas turbines will be based on the worst-case 59°F operating cases for each fuel, pollutant, and averaging period. The auxiliary boiler will not operate while the gas turbines are in steady-state operation, so its short term impacts will be determined during startup periods only. For the annual impact modeling, the emission rates from the emergency diesel generator and the diesel fire pump will be pro-rated for the number of hours each will be permitted to operate each year.

According to the EPA guidance memo issued on March 1, 2011, compliance demonstrations for the 1-hour NO_2 NAAQS should address emission scenarios that can logically be assumed to be relatively continuous or which occur frequently enough to contribute significantly to the annual distribution of daily maximum 1-hour concentrations, providing sufficient discretion for reviewing authorities to not include the emissions from emergency generators or other intermittent sources from 1-hour NO_2 compliance demonstrations. Consistent with this guidance, and with RIDEM modeling guidance, the emissions from the emergency diesel generator and the diesel fire pump will not be included in the 1-hour NO_2 or SO_2 modeling completed for the Project.

The EPA guidance memo issued on June 29, 2010 presented a three-tiered approach for 1-hour NO_2 NAAQS compliance demonstrations. Tier 1 assumes that all NO emissions are converted to NO_2. Tier 2 incorporates the default Ambient Ratio Method (ARM) to estimate NO_2 concentrations from NO_x emissions. RIDEM has adopted the recommendation from the EPA guidance memo that a default ARM of 0.80 can be used without further justification. The default ARM is based on the assumption that 80% of the NO_x emissions are converted to NO_2. Tier 3 utilizes the Ozone Limiting Method (OLM) or Plume Volume Molar Ratio Method (PVMRM) to predict the conversion of NO to NO_2.

For this analysis, the NO_x emission rates from each source will initially be modeled to determine potential NO_2 concentrations. The Tier 2 default ARM of 0.80 will then be used to convert the modeled NO_X ambient air impact concentrations to NO_2 concentrations.

Per the RIDEM Modeling Guidelines, the following modeled values will be used for the NAAQS compliance demonstration:

- 1-hour CO: the highest, second-high modeled concentration for each of the five years modeled
- 8-hour CO: the highest, second-high modeled concentration for each of the five years modeled
- 3-hour $SO_{2:}$ the highest, second-high modeled concentration for each of the five years modeled
- 24-hour SO_2: the highest, second-high modeled concentration for each of the five years modeled
- Annual NO_2: the highest predicted annual average concentration
- Annual SO_2: the highest predicted annual average concentration
- 1-hour NO_2: the highest average of the 98^{th} percentile (8^{th} highest) daily maximum concentrations at each receptor for each of the five years modeled
- 1-hour SO_2: the highest average of the 99^{th} percentile (4^{th} highest) daily maximum concentrations at each receptor for each of the five years modeled
- 24-hour PM_{10}: the 6^{th} highest predicted concentration for the five years modeled
- Annual $PM_{2.5}$: the highest average of the modeled annual averages at each receptor for the five modeled years
- 24-hour $PM_{2.5}$: the highest average of the maximum modeled 24-hour averages at each receptor across the five years modeled
- 3-month Pb: the maximum 3-month rolling average in the five year period at each receptor

5.3.6 Class I Area Impacts

Figure 7 shows the location of the Facility in relation to the closest designated Class I areas in the region. The closest Class I area is the Lye Brook Wilderness Area in Vermont, whose boundary is located approximately 160 kilometers northwest of the proposed Facility location.

AERMOD will be applied to determine the extent of Facility impacts greater than the Class I SILs, out to a maximum distance of 50 kilometers. The Class I analysis will use the same modeling inputs and methodology as the Class II AERMOD analysis. Receptors beyond 10 kilometers will be located at 1-kilometer increments.

CALPUFF is a long-range transport model developed to evaluate impacts beyond 50 kilometers. If AERMOD demonstrates the potential for Facility impacts greater than their respective Class I SILs at 50 kilometers, CALPUFF will be used to evaluate facility impacts within the nearest Class I area. If required, a modeling protocol addendum will be submitted to RIDEM detailing the methodology to be used for the CALPUFF analysis.

5.3.7 Background Air Quality

When conducting an air quality impact analysis with respect to NAAQS, the existing background air quality in the absence of the proposed source must be considered in combination with the predicted impacts resulting from the proposed source. When background air quality data is not available for the project area, other representative background data from nearby monitoring stations must be used.

The PSD rules require that the air quality impact analysis include an analysis of ambient air quality in the area that the major stationary source would affect for each pollutant that it would have the potential to emit in a significant amount. The analysis should include four months to a year of ambient air monitoring data gathered during the year preceding application submission. Ambient air monitoring is not required if the emissions increase of the pollutant will cause air quality impacts less than the Significant Monitoring Concentrations (SMC) listed in Section 9.5.2(d)((i) of RIDEM APCR No. 9.

SMCs are listed in Section 9.5.2(d)(i) of APCR Reg. 9 for CO, NO_X, PM_{10}, and SO_2. Preliminary modeling conducted for the Facility has determined that the predicted impacts for CO, NO_X, PM_{10}, and SO_2 are all below their respective SMCs, so ambient air monitoring will not be required for these pollutants. There currently is no SMC for $PM_{2.5}$ in RIDEM's PSD rules. The EPA's $PM_{2.5}$ SMC was vacated in a January 22, 2013 ruling by the U.S. Court of Appeals for the District of Columbia (Sierra Club vs. EPA).

The EPA's "Guidance for $PM_{2.5}$ Permit Modeling", May 20, 2014, provides guidance on demonstrating compliance with the $PM_{2.5}$ NAAQS and PSD increments, and reflects the EPA's recommendations for how a major stationary source seeking a PSD permit can demonstrate that it will not cause or contribute to a violation of the NAAQS and PSD increments for $PM_{2.5}$.

According to this EPA guidance, as a result of the recent court decision that vacated the $PM_{2.5}$ SMC, each PSD application must include ambient monitoring data representative of the area of concern. However, these data need not be collected by the applicant if existing data are determined by the permitting authority to represent the air quality in the area of concern over the 12-month period preceding the application's submittal. Historically, the use of background data which is a conservative representation of the ambient air concentrations at the site of the proposed PSD source, have been deemed representative by the EPA and other permitting authorities, because their use provides margin for future area growth.

The background concentrations to be used for this analysis will be the monitoring concentrations recommended for use by RIDEM, as summarized on Table 6. These monitoring concentrations have been determined using monitoring data from the closest ambient air monitors with sufficient monitoring data available for a NAAQS compliance demonstration for the Facility, using the most recent ambient air quality monitoring data available (2012-2014) for this area, and are representative or conservative representations of the air quality in the area surrounding the proposed Facility, as described below.

Any ambient air impacts resulting from the operation of the adjacent Algonquin Compressor Station or the nearby Tennessee Gas Compressor Station or Ocean State Power facility which could potentially interact with the impacts from the Project's emission sources will be accounted for in the multi-source modeling analysis being required by RIDEM. Therefore, any consideration of the impacts from those facilities when selecting the project site's background concentrations to be used for this analysis would be double counting their potential impact.

The monitored NO_2 background concentrations are from ambient air monitoring data collected by a monitor located on the roof of Rockefeller Library at Brown University in Providence. RIDEM recommends the use of this monitor for modelling all Rhode Island sources.

The monitored CO and SO_2 background concentrations are from ambient air monitoring data collected by a monitor located on the roof of a building at the Francis School in East Providence. RIDEM recommends the use of this monitor for modelling all Rhode Island sources for CO and for modelling all Rhode Island sources outside of Bristol County and northern Newport County for SO_2.

The monitored PM_{10} and $PM_{2.5}$ background concentrations are from ambient air monitoring data collected by a monitor located in a cleared area surrounded by forest on the W. Alton Jones campus of the University of Rhode Island in West Greenwich. RIDEM recommends the use of this monitor for modelling all Rhode Island sources in a rural area.

The ambient air monitors located at Brown University and at the Francis School are located in densely populated residential neighborhoods with high volumes of vehicular traffic. The ambient air concentrations of NO_X, CO, and SO_2 at these locations would be expected to be much higher than in the area surrounding the proposed Facility, which is rural, lightly populated, and with very low vehicular traffic levels. Thus, the use of data from these monitoring stations for the Facility NAAQS demonstration is conservative, and consistent with previous determinations from the EPA and other permitting agencies, provides an additional margin of safety for future ambient air quality concentration increases in the area.

The ambient air monitor at URI is located in a clearing surrounded by dense forested area, with few surrounding residences or local vehicular traffic, which is a very similar setting as the area surrounding the proposed Facility site. Because of the similarity of their settings, the monitoring data from this location is clearly representative of the ambient air concentrations in the area surrounding the proposed Facility site.

5.3.8 PSD Increment Analysis

RIDEM requires new major stationary sources to demonstrate that their emissions will not cause or contribute to any increase in ambient concentrations exceeding the available increment for any air contaminant. Increments represent the maximum increase in ambient concentrations allowed for each pollutant over baseline levels, which are established according to the definitions in RIDEM APCR No. 9, Section 9.5.

All of Rhode Island is classified as a Class II area. The Class II PSD Increments are listed in Table III of the RIDEM Modeling Guidelines. No major stationary source is allowed to consume more than 75 percent of the remaining 24-hour increment or 25 percent of the remaining annual increment.

A PSD increment analysis will be conducted to determine the available increment for each applicable pollutant and averaging period within the baseline area. RIDEM APCR No. 9, Section 9.5.1 defines the baseline area for sources seeking a major source permit in Rhode Island as the state of Rhode Island.

The major source baseline date is the date for each pollutant when the EPA first promulgated PSD increments for that pollutant. This date is the date after which actual emissions of a pollutant associated with a construction at a major source affect the available PSD increments for that pollutant. The trigger date is the fixed date after which the minor source baseline date may be established. The minor source baseline date is the earliest date after the trigger date on which a complete PSD application is received by the permitting authority for a source within the baseline area.

The major source baseline dates, trigger dates and minor source baseline dates established by the EPA and RIDEM for each pollutant are summarized in the following table.

Pollutant	Major Source Baseline	Trigger Date	Minor Source Baseline

	Date		Date
PM/PM_{10}	January 6, 1975	August 7, 1977	December 3, 1982
SO_2	January 6, 1975	August 7, 1977	December 3, 1982
NO_2	February 8, 1988	February 8, 1988	August 5, 1988
$PM_{2.5}$	October 20, 2010	October 20, 2011	NA

The minor source baseline date marks the point in time after which actual emissions changes from all sources affect the available increment. The amount of each PSD increment that has been consumed in a PSD area includes actual emissions increases occurring after the major source baseline date at major stationary sources (from modifications or construction) and actual emissions increases at any incrementing-affecting source after the minor source baseline date.

An inventory of PSD increment-affecting sources within the project's significant impact area (SIA) will be developed for each pollutant and averaging period. The inventory will include all major stationary sources which had actual emissions changes (from construction or modifications) after the major source baseline date and other increment-affecting sources identified that had changes in emissions after the minor source baseline date. The inventory will be developed using the publicly available information on RIDEM and EPA's web-sites and from file reviews.

The inventory will include the amount of each PSD increment consumed by each source, based on the modeling analysis conducted for the source during its permitting. The available increment will then be determined for each pollutant and averaging period by subtracting the sum of the consumed increment from the increment-affecting sources from the total PSD increment.

For $PM_{2.5}$, it is assumed that the Facility will submit the first complete PSD application since the trigger date, so the date this application is submitted will be the minor source baseline date. The PSD increment analysis for the Facility will therefore be based on the assumption that the full $PM_{2.5}$ PSD increments are available.

The results of the AERMOD analysis conducted for the Facility will demonstrate that there will be no increase in the ambient air concentration of any pollutant averaging period which exceeds the allowable percentage of the remaining available increment for that pollutant averaging period. Short term increments (3-hour and 24-hour) will be compared to the highest, second-high concentrations modeled because exceedances of the allowable short term increments are allowed once per year.

5.3.9 NAAQS Compliance Analysis

The total modeled impacts from the Facility emission sources and all off-site emission sources required by RIDEM to be included in the multi-source modeling analysis for the Facility will be added to the background concentrations for each pollutant and averaging period to demonstrate compliance with the NAAQS.

5.3.10 Air Toxics Analysis

RIDEM requires new major stationary sources to demonstrate that emissions of both listed and non-listed air toxic contaminants from the stationary source will not cause an impact on the ground level ambient concentration at or beyond the property line in excess of that allowed by RIDEM APCR No. 22. RIDEM APCR No. 22 exempts fuel burning equipment where the air toxics emissions are solely from the combustion of fuel oil or natural gas. However, new major fuel-burning sources that begin operation after April 27, 2004 are not exempt from the regulation.

Table 2 lists the quantity of each RI listed toxic air contaminant which could potentially be emitted from each emission source at the Facility. The non-criteria pollutant emission rates and annual potential emissions from each Facility emission source are summarized in Appendix A. The ammonia and sulfuric acid emissions from the gas turbines have been estimated based on preliminary information provided by the manufacturers. The metals emissions from gas turbine ULSD usage have been estimated using Siemens Westinghouse's Survey of Ultra-Trace Metals in Gas Turbine Fuels (2004). The gas turbine formaldehyde emissions have been estimated using the MACT standard for combustion turbines (91 ppb@15%O_2) previously proposed by the EPA, but currently stayed by court order.

All of the other non-criteria pollutant emission rates from each emission source have been estimated using emission factors from the EPA's AP-42 Compilation of Emission Factors. Because the emission factors in AP-42 are primarily based on the results of stack tests conducted 20 or more years ago, and in many cases are based on non-detect stack test results, the use of AP-42 emission factors to estimate the emissions of non-criteria pollutants from the Project should be conservative. Based on the advances in combustion technology and fuel processing since AP-42 was last updated, it is expected that the actual emissions of non-criteria pollutants from the Project emission sources will be much lower than the values presented in Table 2.

The AERMOD results will be applied to each listed air toxic which has the potential to be emitted at a level which exceeds its respective Minimum Quantity from Table III of RDEM APCR No. 22, as shown on Table 2. The results of the analysis will demonstrate that the predicted ambient air impacts from the Facility at or beyond the property line do not exceed any of RIDEM's Acceptable Ambient Levels (AALs) or Calculated Acceptable Ambient Levels (CAALs) developed by RIDEM for any non-listed air toxics.

5.3.11 Human Health Risk Assessment

RIDEM also requires new major stationary sources to conduct any studies required by the Guidelines for Assessing Health Risks from Proposed Air Pollution Sources and meet the criteria therein. The Facility will be a major source of air pollutants, excluding emissions caused by firing natural gas, and has a heat input capacity greater than 250 MMBtu/hr. It is therefore a "first tier power plant", as defined in the guideline, and a multi-pathway human health risk assessment must be completed.

As required by the guideline, a protocol for the health risk assessment will be submitted to RIDEM for approval. The protocol will include an outline of the proposed assessment document. It will specify the methodology to be used to determine environmental transport, human exposure, and health impacts resulting from the facility's emissions. It will also include a listing of the pollutants to be included in the assessment, the locations for sensitive receptors, the exposure pathways for each pollutant, and the deposition modeling techniques to be utilized for the assessment.

5.3.12 Visibility Impacts

The PSD regulations protect Class I areas, such as wilderness areas and national parks, from plume visibility impacts. Sufficiently large particulate and nitrogen dioxide air emissions can cause visible plumes. When the components of the plume scatter or absorb light, the plume may contrast with the viewing background. The EPA's Workbook for Plume Visual Impact Screening and Analysis (EPA, 1992b), is typically used as guidance for the completion of a visibility impairment analysis for Class I areas.

The Federal Land Managers' Air Quality Related Values Work Group (FLAG) Phase I Report, revised 2010, provides initial screening criteria for exempting a source from conducting a visibility analysis for Class I areas based on the annual emissions from the source and its distance to the nearest Class I area. According to this report, any source located more than 50 km from any Class I area is exempt from the Class I visibility analysis if its total annual emissions of SO_2, NO_X, PM_{10}, and H_2SO_4 in tons divided by the distance in kilometers from the source to the nearest Class I area (Q/D factor) is 10 or less.

The total potential annual emissions of SO_2, NO_X, PM_{10}, and H_2SO_4 from the facility are approximately 549 tons. The distance from the Facility to the nearest Class I area, Lye Brook, is approximately 160 kilometers. The Q/D factor is approximately 3.4. Because the Q/D factor is less than 10, no Class I visibility impairment analysis is required for the Project.

5.3.13 Impacts to Welfare, Soils and Vegetation

RIDEM requires new major stationary sources to apply the applicable procedures of the Guidelines for Assessing the Welfare Impacts of Proposed Air Pollution Sources and meet the criteria therein. RIDEM also requires new major stationary sources to provide an analysis of the impairment to soils and vegetation that would occur as a result of the source. Both requirements are met by applying the procedures and complying with the screening concentrations in the EPA's A Screening Procedure for the Impacts of Air Pollution on Plants, Soils, and Animals (EPA, 1981).

Such an assessment will be conducted for the proposed Facility by adding the applicable predicted ambient air impacts with the background concentrations and comparing the results to the vegetation sensitivity screening levels presented in Table 3.1 of the EPA guidance document. These screening levels represent the minimum levels at which visible damage or growth effects to vegetation may occur. The analysis conducted will demonstrate that the predicted impacts from the Facility, when combined with representative background concentrations, will not exceed the EPA screening levels.

5.3.14 Impacts from Associated Area Growth

RIDEM requires the new major stationary sources provide an analysis of the air quality impact projected for the area as a result of general commercial, residential, industrial and other growth associated with the source.

The Project is being proposed to address the need for more efficient and reliable, lower polluting sources of energy production within the state and within the region. The anticipated impact from the Project will be lower energy prices and fewer emissions from the energy sector both state-wide and throughout the region. It is not anticipated that the Project will directly result in any increase in general commercial, residential, industrial, or other growth within the local area. Therefore, it is expected that the air quality impact projected for the area as a result of such growth will be negligible.

5.3.15 Startup & Shutdown

The AERMOD analysis will also be applied to Facility startup/shutdown conditions to demonstrate that the facility will not cause or contribute to an exceedance of the NAAQS during such events. Appendix A includes a summary of the modeling input parameters to be used for such events for this analysis.

5.3.16 Modeling Report

The results of the air quality impact analysis will be included in a Modeling Report to be submitted to RIDEM as a supplement to this application. The report will describe the impact analyses conducted, including all of the modeling inputs and assumptions, and will include electronic copies of all modeling output files.

The Modeling Report will also include the following:

- Isopleths and the location and magnitude of the maximum predicted impacts for each modeled pollutant and averaging time
- A table comparing the maximum predicted impact for each air toxic contaminant for each averaging time with the corresponding AALs and CAALs
- A table showing the maximum predicted criteria pollutant impacts with the corresponding SIL for each pollutant and averaging period
- A table comparing the maximum predicted criteria pollutant impacts with the corresponding available PSD increment for each pollutant and averaging period
- A table showing modeled impacts, background levels, total impact levels, and the NAAQS for each pollutant and averaging period
- The results of all additional impact analyses completed for the Project

5.4 References

Auer, A. H., 1978. Correlation of Land Use and Cover with Meteorological Anomalies, Journal of Applied Meteorology, 17: 636-643.

Census Bureau, 2015, Website www.census.gov.

National Park Service, 2010. Federal Land Managers' Air Quality Related Values Working Group (FLAG) Phase I Report – Revised 2010. Natural Resource Report NPS/NRPC/NRR-2010/32. Natural Resource Program Center.

RIDEM, 2013. Rhode Island Air Dispersion Modeling Guidelines for Stationary Sources, Revised March 2013. Rhode Island Department of Environmental Management.

Siemens Westinghouse Power Corporation, 2004. Survey of Ultra-Trace Metals in Gas Turbine Fuels.

US EPA, 1980. A Screening Procedure for the Impacts of Air Pollution on Plants, Soils and Animals, Document Number EPA-450/2-81-078. Office of Air Quality Planning and Standards, Research Triangle Park, NC. December 12, 1980.

US EPA, 1985. Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (revised), Document Number EPA-450/4-80-023R. Office of Air Quality Planning and Standards, Research Triangle Park, NC. June 1985.

US EPA, 2009. AERMOD Implementation Guide. Office of Air Quality Planning and Standards, Research Triangle Park, NC. March 19, 2009.

US EPA, 2010. General Guidance for Implementing the 1-hour NO_2 National Ambient Air Quality Standard in Prevention of Significant Deterioration Permits, Including an Interim 1-hour NO_2 Significant Impact Level. Office of Air Quality Planning and Standards, Research Triangle Park, NC. June 28, 2010.

US EPA, 2010. Guidance Concerning the Implementation of the 1-hour NO_2 NAAQS for the Prevention of Significant Deterioration Program. Office of Air Quality Planning and Standards, Research Triangle Park, NC. June 29, 2010.

US EPA, 2011. Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard. Office of Air Quality Planning and Standards, Research Triangle Park, NC. March 1, 2011.

US EPA, 2014. Guidance for PM2.5 Permit Modeling. Office of Air Quality Planning and Standards, Research Triangle Park, NC. May 20, 2014.

Tables

Table 1
Clear River Energy Center - Burrillville, Rhode Island
Facility Potential Emissions Summary[1]

Emission Source	Units	Gas Turbines/HRSGs/Duct Burners Steady State Operation		Gas Turbines/HRSGs Startup/Shutdown		Auxiliary Boiler	Dewpoint Heater	Emergency Generator	Fire Pump	ULSD Tank	Total	Major Source Threshold	Major Source?	Attainment Status	Offsets/Allowances Required
Fuel Type		Natural Gas	ULSD	Natural Gas	ULSD	Natural Gas	Natural Gas	ULSD	ULSD						
Emission Controls		SCR/OC	SCR/OC	SCR/OC	SCR/OC	Ultra-Low NOx/FGR	Ultra-Low NOx/FGR								
Annual Operation (per unit)	hrs/yr	7,865	720	155	20	4,576	8,760	300	300						
Maximum Heat Input Per Unit (per Gas Turbine)	MMBtu/hr	3,393	3,507			140.6	15.0	19.5	2.1						
Maximum Heat Input Per Unit (per HRSG)	MMBtu/hr	721	0												
Maximum Power Output (total)	MW net	1,080	940												
Maximum Engine Output	Hp							2,682	315						
Proposed Emissions	per unit														
NOx	ppmvd@15%O2	2.0	5.0												
CO	ppmvd@15%O2	2.0	5.0												
VOC	ppmvd@15%O2	1.7	5.0												
CO2	lb/MW-hr	781	1,227												
SO2	lb/MMBtu	0.0017	0.0019												
PM/PM10/PM2.5	lb/MMBtu	0.0053	0.020												
Full Load Average Emission Rates	per unit														
NOx	lb/hr	24.90	68.60			1.55	0.16	32.23	1.88						
CO	lb/hr	15.10	41.75			10.55	1.65	1.77	0.47						
VOC	lb/hr	7.36	23.85			1.12	0.12	0.65	0.07						
CO2	lb/hr	399,000	577,000			16,591	1,770	3,206	349						
SO2	lb/hr	5.75	6.49			0.21	0.02	0.03	0.00						
PM/PM10/PM2.5	lb/hr	18.00	69.10			0.98	0.11	0.15	0.05						
Potential Emissions															
NOx	ton/yr	195.85	49.39	27.92	4.03	3.55	0.70	4.83	0.28	0.00	286.55	50	Yes	Ozone Nonattainment	344
CO	ton/yr	118.77	30.06	50.05	8.90	24.14	7.23	0.27	0.07	0.00	239.48	100	Yes	Attainment	NA
VOC	ton/yr	57.89	17.17	7.03	2.60	2.56	0.53	0.10	0.01	0.44	88.32	50	Yes	Ozone Nonattainment	106
CO2	ton/yr	3,138,251	415,440	13,062	3,592	37,960	7,753	481	52	0	3,616,592	100,000	Yes	No NAAQS	3,570,346
SO2	ton/yr	45.23	4.67	0.19	0.04	0.48	0.09	0.00	0.00	0.00	50.70	100	No	Attainment	NA
PM/PM10/PM2.5	ton/yr	141.58	49.75	1.64	1.09	2.24	0.48	0.02	0.01	0.00	196.81	100	Yes	Attainment	NA

[1] Based on preliminary project equipment specifications and emissions estimates. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.

Table 2
Clear River Energy Center - Burrillville, Rhode Island
Non-Criteria Pollutants Potential Emission Summary[1]

Emission Source(s):		Gas Turbines	Gas Turbines	HRSG Duct Burners	Auxiliary Boiler	Dewpoint Heater	Diesel Generator	Fire Pump					
Number of Sources:		2	2	2	1	1	1	1	Total	RIDEM	RIDEM	Total	Major
Fuel Fired:	Hazardous Air	Natural Gas	ULSD	Natural Gas	Natural Gas	Natural Gas	ULSD	ULSD	Facility	APCR No. 22	APCR No. 22	Potential	HAP
Maximum Unit Heat Input (MMBtu/hr):	Pollutant (Yes/No)	3,393	3,507	721	140.6	15.0	19.5	2.1	Potential	Minimum	Applicability	HAP	Source
Annual Operation (hrs/yr):		8,040	720	8,040	4,576	8,760	300	300	Emissions	Quantity	Determination	Emissions	Threshold
		lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	lb/yr	Yes/No	ton/yr	
1,3-Butadiene	Yes	2.3	8.1					0.0025	10	3	Yes	0.01	10
2-Methylmaphthalene	No			0.027	0.0015	0.0031			0.032	NA	NA		
3-Methylchloranthrene	No			0.0020	0.00011	0.00023			0.0023	NA	NA		
7,12-Dimethylbenz(a)anthracene	No			0.018	0.0010	0.0021			0.021	NA	NA		
Acenaphthene	No			0.0020	0.0011	0.00023	0.0027	0.0090	0.015	NA	NA		
Acenaphthylene	No			0.0020	0.0011	0.00023	0.0054	0.0032	0.012	NA	NA		
Acetaldehyde	Yes	218					0.15	0.48	219	50	Yes	0.11	10
Acrolein	Yes	0.07					0.0046	0.0058	0.08	0.07	Yes	0.00	10
Ammonia	No	73,968	7,272						81,240	300	Yes		
Anthracene	No			0.0027	0.0015	0.00031	0.0072	0.0012	0.013	NA	NA		
Arsenic	Yes		0.23	2.3	0.13	0.0026			2.7	0.02	Yes	0.00	10
Barium	No			50	2.78	0.57			53	2,000	No		
Benz(a)anthracene	No			0.0020	0.0011	0.00023	0.0036	0.0011	0.0080	NA	NA		
Benzene	Yes	65	6.1	2.4	1.3	0.27	4.5	0.59	80	10	Yes	0.04	10
Benzo(a)pyrene	No			0.0014	0.00076	0.00016	0.0015	0.00012	0.0039	NA	NA		
Benzo(b)fluoranthene	No			0.0020	0.0011	0.00023	0.0065	0.000062	0.010	NA	NA		
Benzo(g,h,i)perylene	No			0.0014	0.00076	0.00016	0.0033	0.00031	0.0059	NA	NA		
Benzo(k)fluoranthene	No			0.0020	0.0011	0.00023	0.0013	0.000098	0.0047	NA	NA		
Beryllium	Yes		1.6	0.14	0.0076	0.0016			1.7	0.04	Yes	0.00	10
Butane	No			2,387	1,320	271			3,978	NA	NA		
Cadmium	Yes		0.026	13	0.69	0.14			14	0.07	Yes	0.01	10
Chromium	Yes		11	16	0.88	0.18			28	20,000	No	0.01	10
Chrysene	No			0.0020	0.0011	0.00023	0.0089	0.00022	0.012	NA	NA		
Cobalt	Yes			1.0	0.0053	0.0011			1.0	0.1	Yes	0.00	10
Copper	No			10	0.54	0.11			11	40	No		
Dibenzo(a,h)anthracene	No			0.0014	0.00076	0.00016	0.0020	0.00037	0.0047	NA	NA		
Dichlorobenzene	No			1.4	0.76	0.16			2.3	NA	NA		
Ethane	No			3,524	1,960	399			5,883	NA	NA		
Ethylbenzene	Yes	175							175	9,000	No	0.09	10
Fluoranthene	No			0.0034	0.0019	0.00039	0.0024	0.0048	0.013	NA	NA		
Fluorene	No			3.2	1.8	0.37	0.0075	0.0018	5.4	NA	NA		
Formaldehyde	Yes	1,191	116	85	47	9.7	0.46	0.74	1,450	9	Yes	0.72	10
Hexane	Yes			2,046	1,140	232			3,418	20,000	No	1.71	10
Indeno(1,2,3-cd)pyrene	No			2.1	1.2	0.24	0.0024	0.00024	3.5	NA	NA		
Lead	Yes		3.9	5.7	0.32	0.0064			10	0.9	Yes	0.00	10
Manganese	Yes		1.4	4.3	0.24	0.0049			5.9	0.2	Yes	0.00	10
Mercury	Yes		0.052	3.0	0.16	0.0034			3.2	0.7	Yes	0.00	10
Molybdenum	No			13	0.69	0.14			14	60	No		
Naphthalene	Yes	7.1	18	0.69	0.39	0.0079	0.76	0.0053	27	3	Yes	0.01	10
Nickel	Yes		7.5	24	1.32	0.27			33	0.4	Yes	0.02	10
Pentane	No			2,955	1,640	335			4,930	NA	NA		
Phenanthrene	No			0.019	0.0011	0.0022	0.24	0.0019	0.26	NA	NA		
Propane	No			1,819	1,010	206			3,035	NA	NA		
Propylene	No						16.3	1.6	18	36,500	No		
Propylene Oxide	Yes	158							158	30	Yes	0.08	10
Pyrene	No			0.0057	0.0032	0.00064	0.0022	0.0030	0.015	NA	NA		
Selenium	Yes		1.3	0.27	0.0015	0.0031			1.6	2,000	No	0.00	10
Sulfuric Acid	No	29,668	3,002						32,670	40	Yes		
Toluene	Yes	709		3.9	2.1	0.44	1.60	0.26	717	1,000	No	0.36	10
Vanadium	No			26	1.5	0.30			28	0.07	Yes		
Xylenes	Yes	349					1.10	0.18	350	3,000	No	0.18	10
Zinc	No			330	18.3	3.7			352	3,000	No		
											Total:	3.35	25

[1] Based on preliminary project equipment specifications and emissions estimates. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.

Table 3
Clear River Energy Center - Burrillville, Rhode Island
Modeling Input Summary[1]

Emission Source	Units	Gas Turbines/HRSGs/Duct Burners				Auxiliary Boiler	Dewpoint Heater	Emergency Generator	Fire Pump
		GT/HRSG-1		GT/HRSG-2					
Fuel Type		Natural Gas	ULSD	Natural Gas	ULSD	Natural Gas	Natural Gas	ULSD	ULSD
Annual Operation (per unit)	hrs/yr	8,040	720	8,760	720	4,576	8,760	300	300
Stack Parameters									
Stack Location	UTM N (Z 19T)	4649568.7		4649527.1		4649470.9	4649670.7	4649460.6	4649420.0
Stack Location	UTM E (Z 19T)	271841.7		271869.9		271874.6	271699.0	271848.3	271946.6
Stack Base Elevation	ft AMSL	570		570		570	570	570	570
Stack Height	feet	200.0		200.0		50	35	35	35
Stack Diameter	inches	264.0		264.0		48	20	8	6
Stack Flow	acfm	see App. A	see App. A	see App. A	see App. A	38,067	7,252	15,295	1,673
Stack Exit Temperature	deg. F	see App. A	see App. A	see App. A	see App. A	344	1,000	752	855
Maximum Emission Rate									
NOx	lb/hr	see App. A	see App. A	see App. A	see App. A	1.55	0.16	32.23	1.88
CO	lb/hr	see App. A	see App. A	see App. A	see App. A	10.55	1.65	1.77	0.47
SO2	lb/hr	see App. A	see App. A	see App. A	see App. A	0.21	0.020	0.031	0.0033
PM/PM10/PM2.5	lb/hr	see App. A	see App. A	see App. A	see App. A	0.98	0.11	0.15	0.054
Maximum Emission Rate									
NOx	g/sec	see App. A	see App. A	see App. A	see App. A	0.20	0.020	4.06	0.24
CO	g/sec	see App. A	see App. A	see App. A	see App. A	1.33	0.21	0.22	0.059
SO2	g/sec	see App. A	see App. A	see App. A	see App. A	0.026	0.0025	0.0039	0.00042
PM/PM10/PM2.5	g/sec	see App. A	see App. A	see App. A	see App. A	0.12	0.014	0.019	0.0068

[1] Based on preliminary project equipment specifications and emissions estimates. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.

Table 4
Clear River Energy Center – Burrillville, Rhode Island
GEP Stack Height Analysis

Structure	Height (ft)	Length (ft)	Width (ft)	Projected Width (ft)	Formula GEP Height (ft)	Stacks > GEP Height	Building Distance from Stack (ft)						'5L' Distance (ft)	Stacks within 5L?
							GT-1	GT-2	FP	Aux Boiler	DP Heater	EG		
Air Cooled Condenser	135	300	290	417.3	337.5	None	502	348	85	197	951	197	675	All except DP Heater
Heat Recovery Steam Generator 1	115	160	65	172.7	287.5	None	13	131	568	279	443	289	565	All except FP
Heat Recovery Steam Generator 2	115	160	65	172.7	287.5	None	138	13	400	115	614	141	565	All except DP Heater
Steam Turbine Building	100	200	115	230.7	250	None	351	200	203	33	781	20	500	All except DP Heater
Warehouse	55	112	65	129.5	137.5	GT-1, GT-2	230	390	820	545	230	551	275	GT-1, DP Heater

Table 5
Clear River Energy Center – Burrillville, Rhode Island
Cavity Analysis

Structure	Height (ft)	Projected Width (ft)	Cavity Height (1.5L) (ft)	Stacks > Cavity Height	Cavity Region Distance (3L) (ft)	Stacks within Cavity Region	Distance from Property Line (ft)	Cavity Extends Offsite?
Air Cooled Condenser	135	417.3	202.5	None	405	GT-2, FP, Aux Boiler, EG	190	Yes
Heat Recovery Steam Generator 1	115	172.7	172.5	GT-1, GT-2	345	Aux Boiler, EG	328	Yes
Heat Recovery Steam Generator 2	115	172.7	172.5	GT-1, GT-2	345	Aux Boiler, EG	328	Yes
Steam Turbine Building	100	230.7	150	GT-1, GT-2	300	FP, Aux Boiler, EG	423	No
Warehouse	55	129.5	82.5	GT-1, GT-2	165	None	135	No

Table 6
Clear River Energy Center - Burrillville, Rhode Island
Ambient Air Monitoring Background Concentrations*

Criteria Pollutant	Averaging Period	Monitoring Location	Background Value ($\mu g/m^3$)	2012-2014 Monitoring Value
NO_2	1-hour	Rockefeller Library, Brown University (Providence)	80	3-year average of 98^{th} percentile of 1-hour daily maxima
NO_2	Annual	Rockefeller Library, Brown University (Providence)	19.7	highest annual mean
CO	1-hour	Francis School (East Providence)	2,346	highest 2nd annual daily high value
CO	8-hour	Francis School (East Providence)	1,495	highest 2nd annual daily high value
SO_2	1-hour	Francis School (East Providence)	123	3-year average of 99^{th} percentile of 1-hour daily maxima
SO_2	3-hour	Francis School (East Providence)	200	highest 2nd annual daily high value
PM_{10}	24-hour	URI W.Alton Jones Campus (W.Greenwich)	17	average 2nd annual daily average
$PM_{2.5}$	24-hour	URI W.Alton Jones Campus (W.Greenwich)	13.1	3-year average of 98^{th} percentile
$PM_{2.5}$	Annual	URI W.Alton Jones Campus (W.Greenwich)	5.17	3-year average of annual mean

* From RIDEM's "Background Criteria Pollutant Air Monitoring Data for Modeling Rhode Island Sources" http://www.dem.ri.gov/programs/benviron/air/pdf/dispdata.pdf

Figures

Path: K:\I108-000 Invenergy\00-mxd\I108 Figure 1 - Aerial Photo.mxd
Drawing Date: 2015/06/22

environmental consulting & engineering services

Clear River Energy Center
Burrillville, Rhode Island

1 inch = 1,667 feet

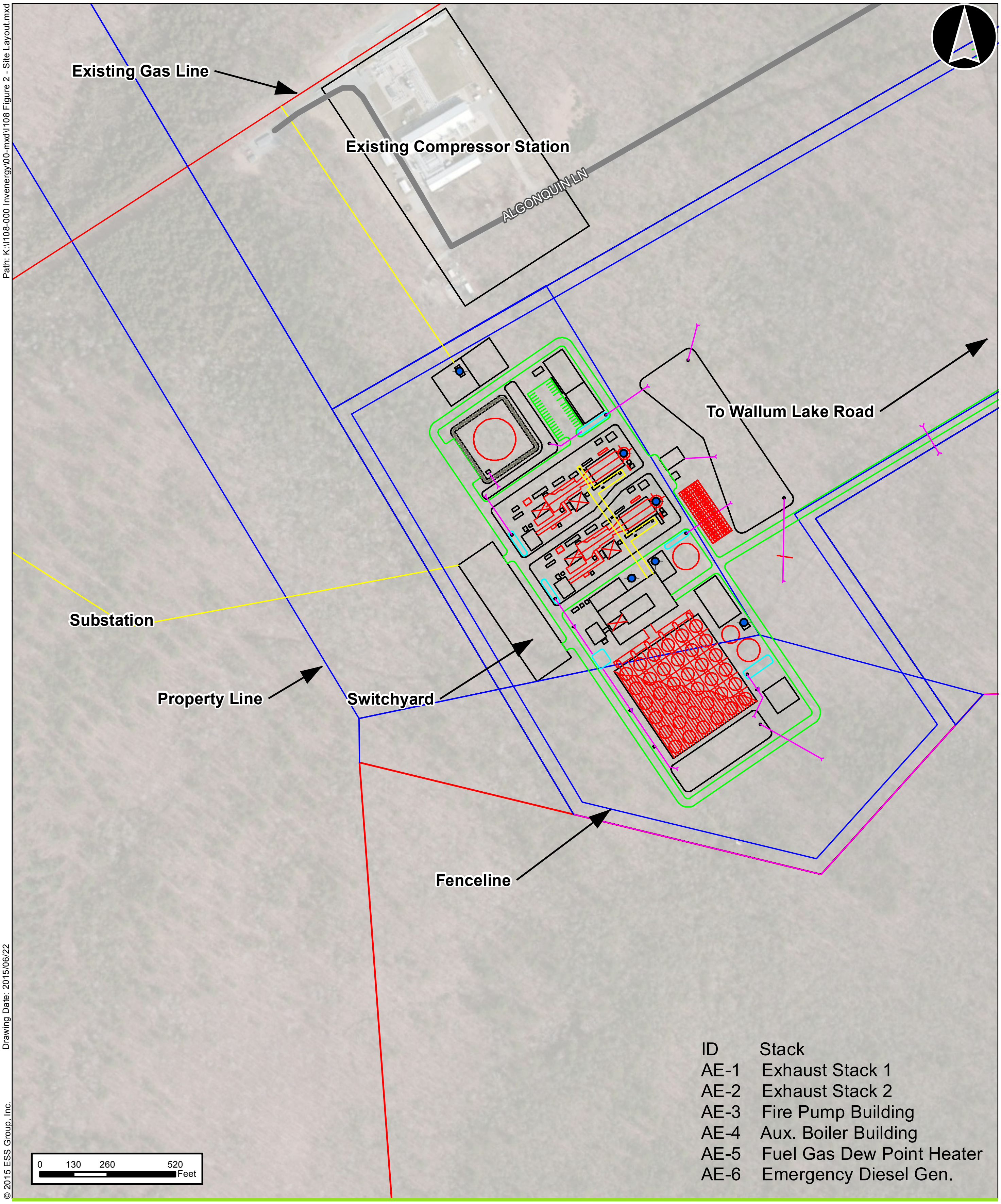
Source: 1) ESRI, Imagery, 2014
2) ESS, Site Location, 2014
3) RIGIS, Roads, 2013

Legend

Project Area Boundary

Aerial Photo

Figure 1



Path: K:\I108-000 Invenergy\00-mxd\I108 Figure 2 - Site Layout.mxd

Drawing Date: 2015/06/22

ID	Stack
AE-1	Exhaust Stack 1
AE-2	Exhaust Stack 2
AE-3	Fire Pump Building
AE-4	Aux. Boiler Building
AE-5	Fuel Gas Dew Point Heater
AE-6	Emergency Diesel Gen.

ess group
environmental consulting & engineering services

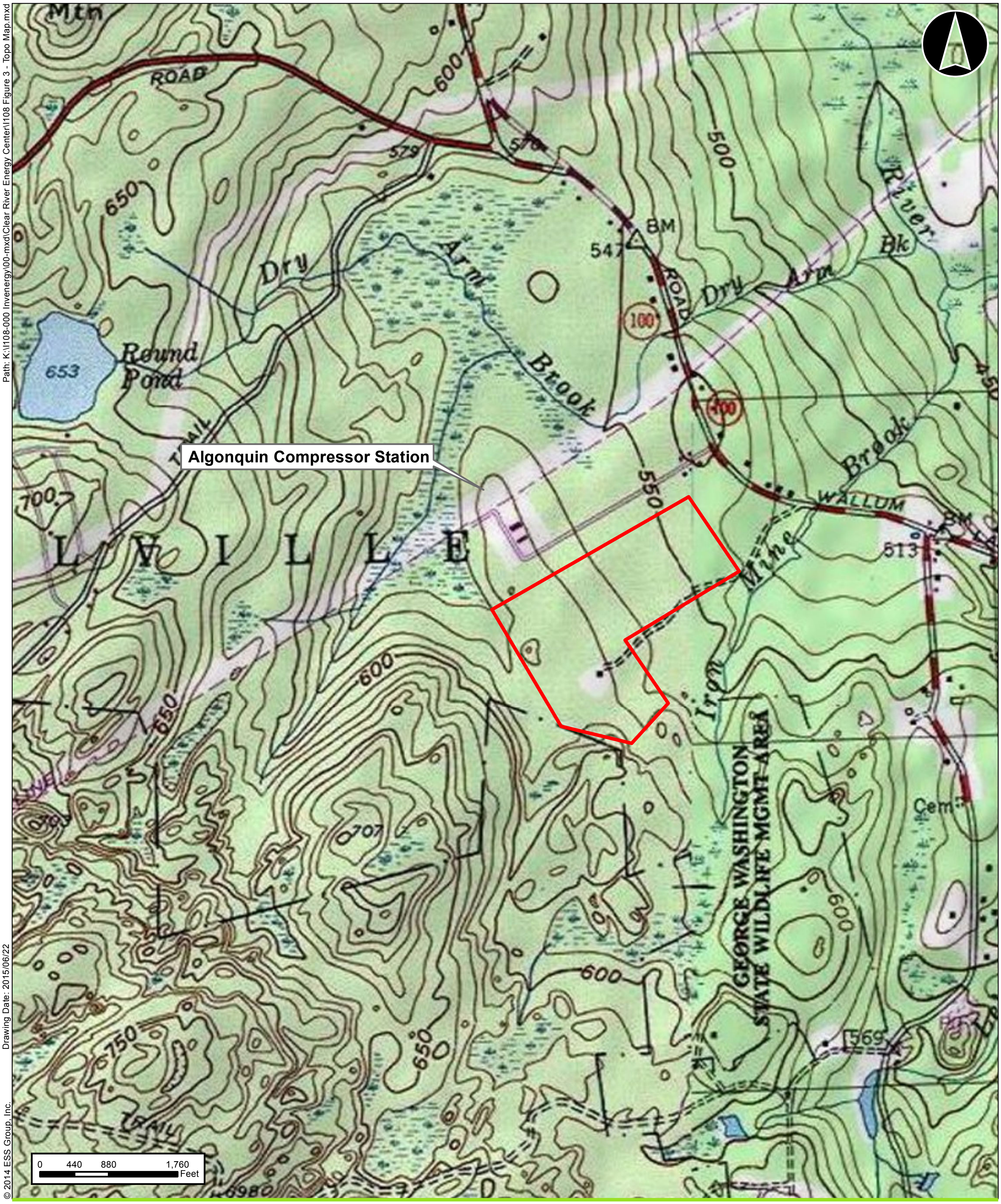
Clear River Energy Center
Burrillville, Rhode Island

1 inch = 501 feet

Source: 1) HDR, Site Layout 2/09/15
2) ESS, Site Location, 2014
3) RIGIS, Roads, 2013

Site Layout

Figure 2



Path: K:\1108-000 Invenergy\00-mxd\Clear River Energy Center\1108 Figure 3 - Topo Map.mxd

Drawing Date: 2015/06/22

ess group
environmental consulting & engineering services

Clear River Energy Center
Burrillville, Rhode Island

1 inch = 1,667 feet

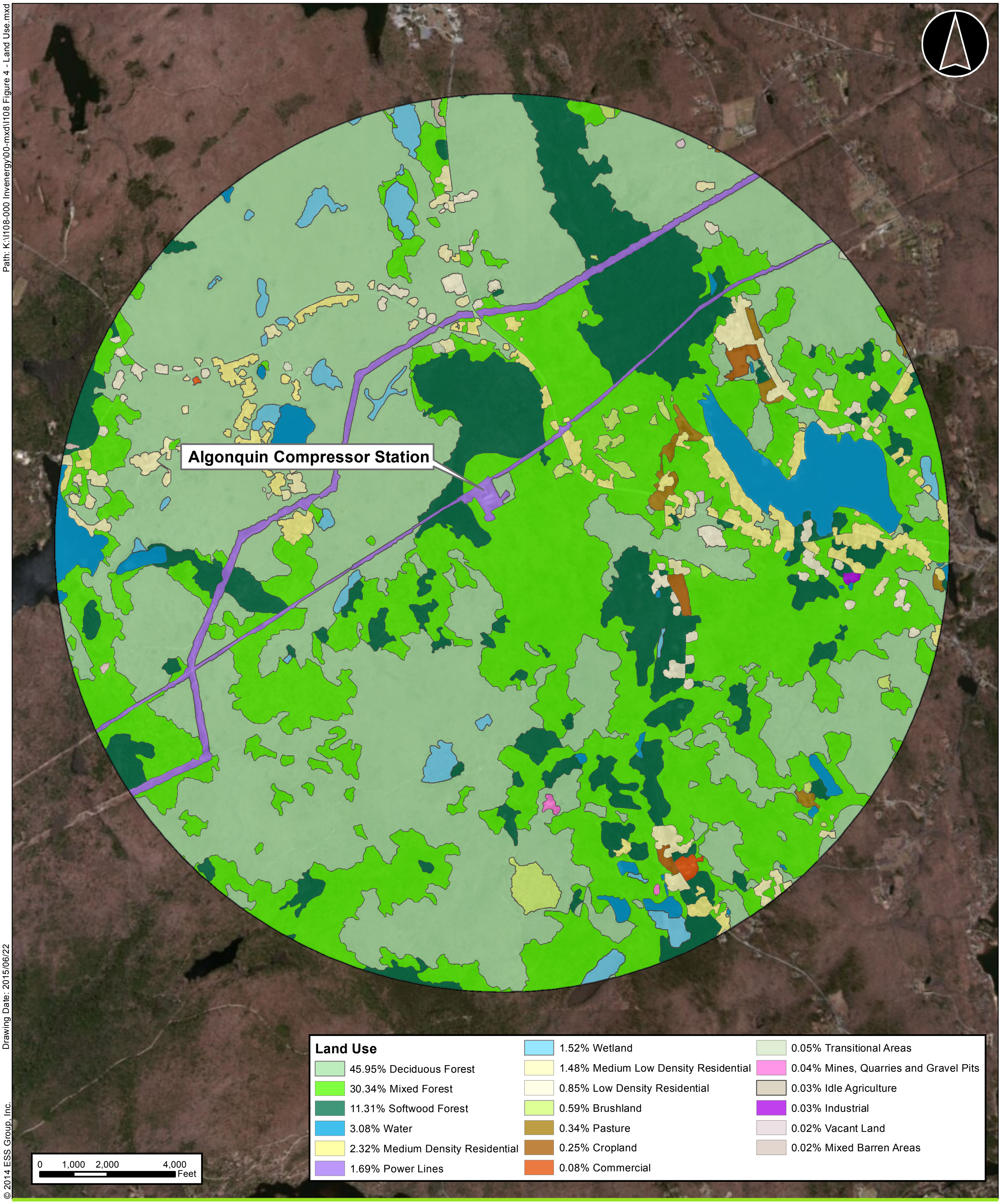
Source: 1) USGS, Topo Map, 2013
2) ESS, Site Location, 2014

Topographic Map

Legend

Project Area

Figure 3



Path: K:\1108-000 Invenergy\00-mxd\1108 Figure 4 - Land Use.mxd

Drawing Date: 2015/06/22

ess group environmental consulting & engineering services

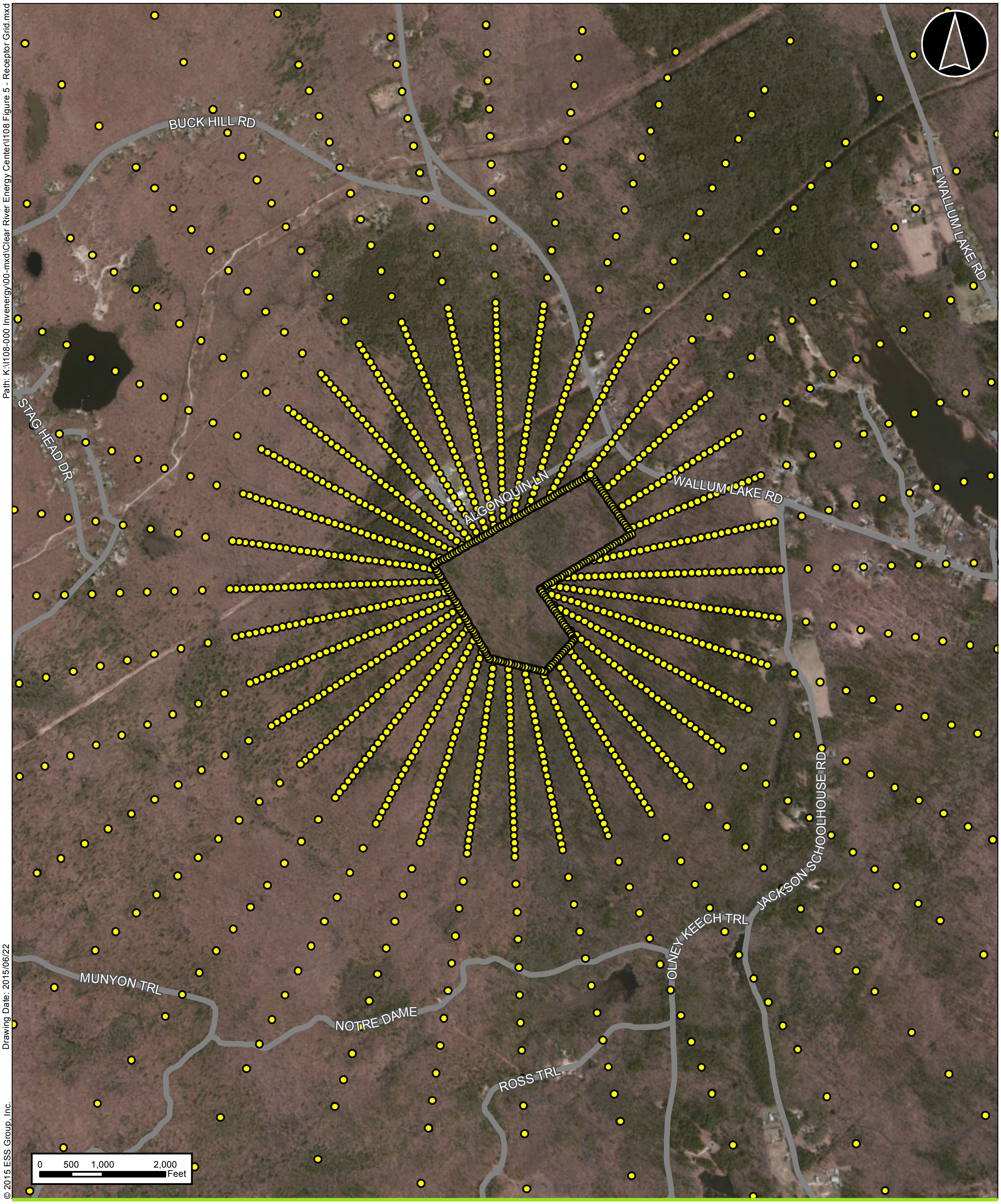
Clear River Energy Center
Burrillville, Rhode Island

1 inch = 3,863 feet

Source: 1) RIGIS, Imagery, 2014
2) ESS, Site Location, 2014
3) RIGIS, Land Use, 2011

Surrounding Land Use (3 km)

Figure 4



Path: K:\I108-000 Invenergy\00-mxd\Clear River Energy Center\I108 Figure 5 - Receptor Grid.mxd

Drawing Date: 2015/06/22

ESS group environmental consulting & engineering services

Invenergy Air Dispersion Modeling Protocol

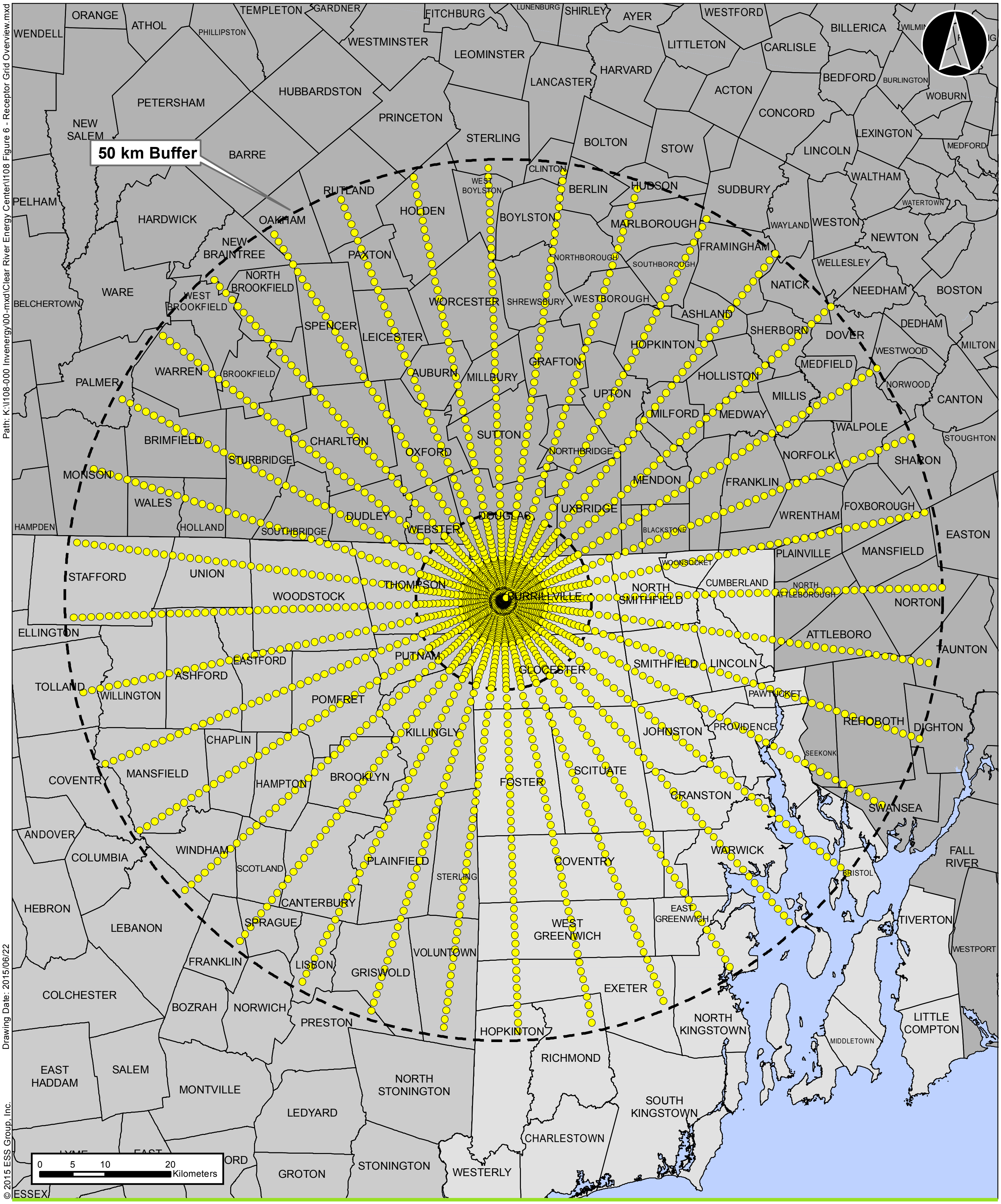
Burrillville, Rhode Island

1 inch = 2,083 feet

Source: 1) ESRI, Imagery, 2014
2) HDR, Site Layout, 2015
3) RIGIS, Roads, 2013

Receptor Grid

Figure 5



Path: K:\1108-000 Invenergy\00-mxd\Clear River Energy Center\1108 Figure 6 - Receptor Grid Overview.mxd

Drawing Date: 2015/06/22

ess group
environmental consulting
& engineering services

Clear River Energy Center
Burrillville, Rhode Island

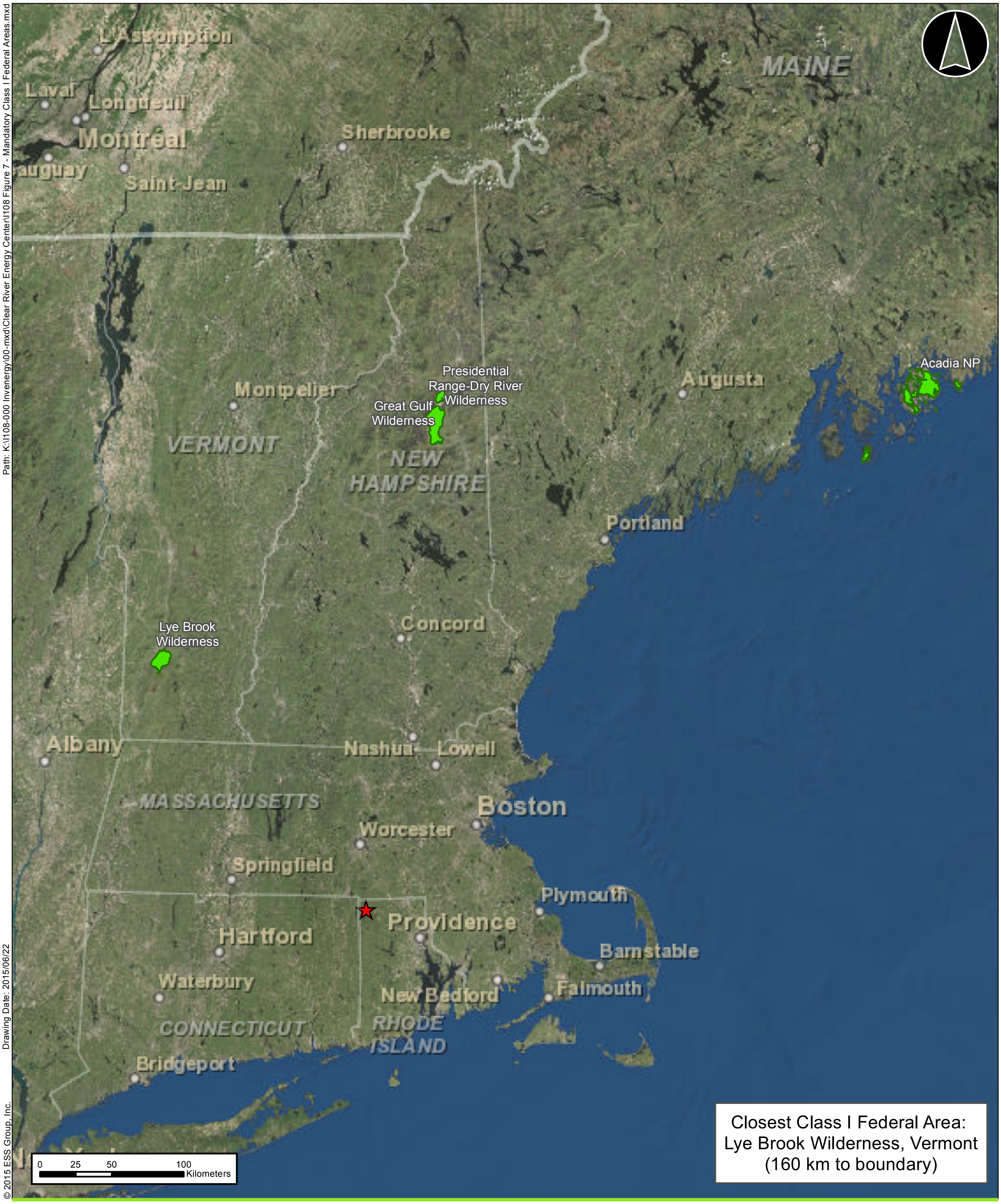
1 inch = 65,536 feet

Source: 1) ESRI, Imagery, 2014
2) HDR, Site Layout, 2015
3) RIGIS, Roads, 2013

Receptor Grid Overview

Figure 6

Path: K:\I108-000 Invenergy\00-mxd\Clear River Energy Center\I108 Figure 7 - Mandatory Class I Federal Areas.mxd
Drawing Date: 2015/06/22



Clear River Energy Center
Burrillville, Rhode Island

1 centimeter = 36 kilometers

Source: 1) ESRI, Imagery, 2014
2) ESS, Site Location, 2014
3) National Park Service, Class I Areas, 2015

Legend

Site Location

Class I Federal Areas

Mandatory Class I Federal Areas

Figure 7

ESS group
environmental consulting & engineering services

Appendix A

Emissions Data Summaries

Table A-1
Clear River Energy Center - Burrillville, Rhode Island
CT/HRSG Emission Summaries[1]

Modeling Case No.	Units	1	2	3	4	5	6	7	8	9	10	11	12	13
GE Case No.		1	4	5	6	7	15	17	18	19	25	27	28	29
Fuel Fired		Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Gas Turbine Load	% of Base	100	100	100	75	38	100	100	75	30	100	100	75	35
Ambient Temperature	deg. F	90	90	90	90	90	59	59	59	59	10	10	10	10
Ambient Pressure	psia	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Ambient Relative Humidity	%	50	50	50	50	50	60	60	60	60	61	61	61	61
Duct Burner Firing	% of capacity	31	0	0	0	0	34	0	0	0	37	0	0	0
Evaporative Cooler Status	On/Off	On	On	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Stack Gas Molecular Weight	lb/lb-mole	28.11	28.14	28.20	28.22	28.27	28.29	28.33	28.35	28.42	28.38	28.42	28.43	28.49
Stack Flow	lb/hr	5,757,500	5,747,700	5,565,000	4,645,200	3,340,100	5,692,300	5,681,600	4,704,000	3,124,800	6,066,200	6,054,300	4,855,200	3,444,000
Stack Flow	acfm	1,638,360	1,623,680	1,568,723	1,308,512	939,213	1,599,503	1,594,243	1,318,999	874,034	1,699,161	1,693,441	1,359,686	960,950
Stack Exit Temperature	deg. F	184	180	180	180	180	180	180	180	180	180	180	181	180
Emission Rate														
NOx	lb/hr	24.8	23.1	22.1	17.5	11.4	24.9	23.0	18.2	10.5	26.6	24.5	19.5	12.3
CO	lb/hr	15.1	14.1	13.4	10.6	6.95	15.1	14.0	11.1	6.40	16.2	14.9	11.9	7.46
SO2	lb/hr	5.74	5.35	5.10	4.04	2.64	5.75	5.33	4.21	2.44	6.14	5.68	4.50	2.83
PM/PM10/PM2.5	lb/hr	17.9	12.0	11.9	11.3	10.6	18.0	12.0	11.4	10.5	18.1	12.1	11.5	10.7
Emission Rate														
NOx	g/sec	3.12	2.91	2.78	2.21	1.44	3.14	2.90	2.29	1.32	3.35	3.09	2.46	1.55
CO	g/sec	1.90	1.78	1.69	1.34	0.88	1.90	1.76	1.40	0.81	2.04	1.88	1.50	0.94
SO2	g/sec	0.72	0.67	0.64	0.51	0.33	0.72	0.67	0.53	0.31	0.77	0.72	0.57	0.36
PM/PM10/PM2.5	g/sec	2.26	1.51	1.50	1.42	1.34	2.27	1.51	1.44	1.32	2.28	1.52	1.45	1.35

Modeling Case No.	Units	14	15	16	17	18	19	20	21
GE Case No.		36	37	42	43	48	49	51	52
Fuel Fired		ULSD	ULSD	ULSD	ULSD	ULSD	ULSD	ULSD	ULSD
Gas Turbine Load	% of Base	100	50	100	50	100	50	100	50
Ambient Temperature	deg. F	90	90	59	59	10	10	0	0
Ambient Pressure	psia	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Ambient Relative Humidity	%	50	50	60	60	61	61	52	52
Duct Burner Firing	% of capacity	0	0	0	0	0	0	0	0
Evaporative Cooler Status	On/Off	Off	Off	Off	Off	Off	Off	Off	Off
Stack Gas Molecular Weight	lb/lb-mole	27.99	28.14	28.11	28.23	28.20	28.32	28.21	28.38
Stack Flow	lb/hr	5,865,300	3,587,900	6,002,900	3,684,500	6,181,400	3,921,800	6,188,700	4,037,300
Stack Flow	acfm	1,978,114	1,149,749	2,015,878	1,155,866	2,028,357	1,228,120	2,051,831	1,380,003
Stack Exit Temperature	deg. F	300	266	300	253	285	254	293	321
Emission Rate									
NOx	lb/hr	63.3	38.3	65.6	40.2	68.6	42.5	68.8	42.1
CO	lb/hr	38.5	23.3	40.0	24.5	41.8	25.8	41.8	25.8
SO2	lb/hr	5.99	3.62	6.22	3.80	6.49	4.02	6.50	3.98
PM/PM10/PM2.5	lb/hr	68.8	67.6	68.9	67.7	69.0	67.8	69.1	67.8
Emission Rate									
NOx	g/sec	7.98	4.83	8.27	5.07	8.64	5.36	8.67	5.30
CO	g/sec	4.85	2.94	5.04	3.08	5.26	3.24	5.26	3.24
SO2	g/sec	0.75	0.46	0.78	0.48	0.82	0.51	0.82	0.50
PM/PM10/PM2.5	g/sec	8.67	8.52	8.68	8.53	8.69	8.54	8.71	8.54

[1] Based on preliminary project equipment specifications and emissions estimates provided by GE. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.

Table A-1
Clear River Energy Center - Burrillville, Rhode Island
CT/HRSG Emission Summaries[1]

Modeling Case No.	Units	1	2	3	4	5	6	7	8	9	10	11	12	13
MHI Case #		1	4	5	6	7	23	25	26	27	41	43	44	45
Fuel Fired		Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Gas Turbine Load	% of Base	100	100	100	75	50	100	100	75	50	100	100	75	50
GTs Operating[2]		2	1	1	1	1	2	1	1	1	2	1	1	1
Ambient Temperature	deg. F	90	90	90	90	90	59	59	59	59	10	10	10	10
Ambient Pressure	psia	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Ambient Relative Humidity	%	50	50	50	50	50	60	60	60	60	61	61	61	61
Duct Burner Firing	% of capacity	31	0	0	0	0	34	0	0	0	37	0	0	0
Evaporative Cooler Status	On/Off	On	On	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Stack Gas Molecular Weight	lb/lb-mole	28.11	28.14	28.20	28.22	28.27	28.29	28.33	28.35	28.42	28.38	28.42	28.43	28.49
Stack Flow	lb/hr	4,507,000	4,480,000	4,378,000	3,646,000	2,935,000	4,698,000	4,671,000	3,877,000	2,977,000	5,041,000	5,024,000	4,237,000	3,202,000
Stack Flow	acfm	1,278,533	1,263,587	1,228,334	1,015,813	804,669	1,291,233	1,312,719	1,082,013	811,876	1,396,556	1,418,432	1,192,114	873,884
Stack Exit Temperature	deg. F	182	179	177	173	164	166	181	177	164	173	186	184	166
Emission Rate														
NOx	lb/hr	26.1	21.0	20.3	16.2	12.7	26.9	21.8	17.4	13.3	27.3	24.0	19.3	14.9
CO	lb/hr	15.9	12.8	12.3	9.9	7.70	16.4	13.3	10.6	8.10	16.6	14.6	11.8	9.10
SO2	lb/hr	2.30	1.80	1.80	1.40	1.10	2.30	1.90	1.50	1.20	2.40	2.10	1.70	1.30
PM10	lb/hr	14.9	7.3	7.2	5.9	4.8	15.2	7.7	6.4	4.9	13.3	8.4	7.0	5.4
Emission Rate														
NOx	g/sec	3.29	2.65	2.56	2.04	1.60	3.39	2.75	2.19	1.68	3.44	3.02	2.43	1.88
CO	g/sec	2.00	1.61	1.55	1.25	0.97	2.07	1.68	1.34	1.02	2.09	1.84	1.49	1.15
SO2	g/sec	0.29	0.23	0.23	0.18	0.14	0.29	0.24	0.19	0.15	0.30	0.26	0.21	0.16
PM/PM10/PM2.5	g/sec	1.88	0.92	0.91	0.74	0.60	1.92	0.97	0.81	0.62	1.68	1.06	0.88	0.68

Modeling Case No.	Units	14	15	16	17	18	19	20	21
MHI Case #		10	11	30	31	48	49	57	58
Fuel Fired		ULSD	ULSD	ULSD	ULSD	ULSD	ULSD	ULSD	ULSD
Gas Turbine Load	% of Base	100	60	100	60	100	60	100	60
GTs Operating[2]		1	1	1	1	1	1	1	1
Ambient Temperature	deg. F	90	90	59	59	10	10	0	0
Ambient Pressure	psia	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Ambient Relative Humidity	%	50	50	60	60	61	61	52	52
Duct Burner Firing	% of capacity	0	0	0	0	0	0	0	0
Evaporative Cooler Status	On/Off	Off	Off	Off	Off	Off	Off	Off	Off
Stack Gas Molecular Weight	lb/lb-mole	27.99	28.14	28.11	28.23	28.20	28.32	28.21	28.38
Stack Flow	lb/hr	4,452,000	3,009,000	4,751,000	3,225,000	4,601,000	3,618,000	4,565,000	3,683,000
Stack Flow	acfm	1,294,029	836,737	1,387,637	901,038	1,337,511	1,020,321	1,326,575	1,038,067
Stack Exit Temperature	deg. F	195	170	201	175	200	183	200	184
Emission Rate									
NOx	lb/hr	45.2	32.5	49.0	35.1	49.0	39.5	49.0	40.4
CO	lb/hr	27.5	19.80	29.8	21.40	29.8	24.0	29.8	24.6
SO2	lb/hr	3.50	2.60	3.80	2.80	3.80	3.10	3.80	3.20
PM/PM10/PM2.5	lb/hr	29.1	20.1	31.3	21.7	30.6	24.5	30.4	24.9
Emission Rate									
NOx	g/sec	5.70	4.10	6.17	4.42	6.17	4.98	6.17	5.09
CO	g/sec	3.47	2.49	3.75	2.70	3.75	3.02	3.75	3.10
SO2	g/sec	0.44	0.33	0.48	0.35	0.48	0.39	0.48	0.40
PM/PM10/PM2.5	g/sec	3.67	2.53	3.94	2.73	3.86	3.09	3.83	3.14

[1] Based on preliminary project equipment specifications and emissions estimates provided by MHI. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.

[2] All emission rates and stack flow characteristics are on a per stack basis

Table A-1
Clear River Energy Center - Burrillville, Rhode Island
CT/HRSG Emission Summaries[1]

Modeling Case No.	Units	1	2	3	4	5	6	7	8	9	10	11	12	13
Siemens Case #		1	2	3	4	5	8	9	10	11	14	15	16	17
Fuel Fired		Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas	Natural Gas
Gas Turbine Load	% of Base	100	100	100	75	45	100	100	75	45	100	100	75	45
GTs Operating[2]		2	1	1	1	1	2	1	1	1	2	1	1	1
Ambient Temperature	deg. F	90	90	90	90	90	59	59	59	59	10	10	10	10
Ambient Pressure	psia	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Ambient Relative Humidity	%	50	50	50	50	50	60	60	60	60	61	61	61	61
Duct Burner Status	On/Off	On	Off	Off	Off	Off	On	Off	Off	Off	On	Off	Off	Off
Evaporative Cooler Status	On/Off	On	On	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off
Stack Gas Molecular Weight	lb/lb-mole	28.09	28.15	28.21	28.23	28.27	28.28	28.34	28.36	28.40	28.37	28.42	28.43	28.47
Stack Flow	lb/hr	4,800,209	4,786,910	4,638,446	3,809,426	2,996,880	5,008,709	4,996,248	4,047,282	3,151,583	5,256,687	5,245,299	4,188,222	3,261,498
Stack Flow	acfm	1,398,763	1,377,130	1,327,496	1,077,730	836,118	1,432,114	1,412,389	1,127,365	865,606	1,505,154	1,483,204	1,167,411	903,553
Stack Exit Temperature	deg. F	199	192	190	183	175	191	185	176	168	194	187	178	175
Emission Rate														
NOx	lb/hr	22.0	19.6	18.6	14.8	10.6	22.8	20.5	16.2	11.5	24.2	22.2	17.5	12.4
CO	lb/hr	13.4	12.0	11.3	9.0	6.5	13.9	12.5	9.9	7.0	14.7	13.5	10.7	7.6
SO2	lb/hr	4.47	3.99	3.78	3.03	2.21	4.63	4.18	3.33	2.40	4.92	4.51	3.59	2.58
PM10	lb/hr	15.1	11.7	11.3	9.3	8.0	15.6	12.3	10.0	8.0	16.0	13.0	10.4	8.1
Emission Rate														
NOx	g/sec	2.77	2.47	2.34	1.86	1.34	2.87	2.58	2.04	1.45	3.05	2.80	2.21	1.56
CO	g/sec	1.69	1.51	1.42	1.13	0.82	1.75	1.58	1.25	0.88	1.85	1.70	1.35	0.96
SO2	g/sec	0.56	0.50	0.48	0.38	0.28	0.58	0.53	0.42	0.30	0.62	0.57	0.45	0.33
PM/PM10/PM2.5	g/sec	1.90	1.47	1.42	1.17	1.01	1.97	1.55	1.26	1.01	2.02	1.64	1.31	1.02

Modeling Case No.	Units	14	15	16	17	18	19		
Siemens Case #		6	7	12	13	18	19		
Fuel Fired		ULSD	ULSD	ULSD	ULSD	ULSD	ULSD		
Gas Turbine Load	% of Base	100	60	100	60	100	60		
GTs Operating[2]		1	1	1	1	1	1		
Ambient Temperature	deg. F	90	90	59	59	10	10		
Ambient Pressure	psia	14.4	14.4	14.4	14.4	14.4	14.4		
Ambient Relative Humidity	%	50	50	60	60	61	61		
Duct Burner Status	On/Off	Off	Off	Off	Off	Off	Off		
Evaporative Cooler Status	On/Off	Off	Off	Off	Off	Off	Off		
Stack Gas Molecular Weight	lb/lb-mole	28.47	28.57	28.67	28.71	28.83	28.87		
Stack Flow	lb/hr	4,721,117	3,527,096	5,061,768	3,751,624	5,350,344	3,958,503		
Stack Flow	acfm	1,435,623	1,053,450	1,539,437	1,119,916	1,627,392	1,178,530		
Stack Exit Temperature	deg. F	237	227	242	230	246	232		
Emission Rate									
NOx	lb/hr	52.4	35.9	54.9	38.0	55.1	38.9		
CO	lb/hr	21.3	14.6	22.3	15.4	22.4	15.8		
SO2	lb/hr	4.13	2.87	4.33	3.04	4.35	3.12		
PM/PM10/PM2.5	lb/hr	30.0	30.0	30.0	30.0	30.0	30.0		
Emission Rate									
NOx	g/sec	6.60	4.52	6.92	4.79	6.94	4.90		
CO	g/sec	2.68	1.84	2.81	1.94	2.82	1.99		
SO2	g/sec	0.52	0.36	0.55	0.38	0.55	0.39		
PM/PM10/PM2.5	g/sec	3.78	3.78	3.78	3.78	3.78	3.78		

[1] Based on preliminary project equipment specifications and emissions estimates provided by Siemens. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.
[2] All emission rates and stack flow characteristics are on a per stack basis

Table A-2
Clear River Energy Center - Burrillville, Rhode Island
Non-Criteria Pollutant Emissions Summaries[1]

Emission Source(s):	Gas Turbines	
Number of Sources:	2	
Fuel Fired:	Natural Gas	
Maximum Unit Heat Input:	3,393	MMbtu/hr
Annual Operation:	8,040	hrs/yr

RIDEM APCR No. 22 Air Toxic Chemical	Emission Factor	Measurement Units	Uncontrolled PTE lb/hr	Uncontrolled PTE lb/yr	Control %	Controlled PTE lb/hr	Controlled PTE lb/yr	Reg. 22 MQ lb/yr
Ammonia	0.0027	lb/MMBtu	9.2	73,968.00	0.00%	9.20E+00	73,968	300
Sulfuric Acid	1.1E-03	lb/MMBtu	3.69	29,667.60	0.00%	3.69E+00	29,668	40
1,3-Butadiene	4.3E-07	lb/MMBtu	0.0029	23.46	90.00%	2.92E-04	2.3	3
Acetaldehyde	4.0E-05	lb/MMBtu	0.27	2,182.38	90.00%	2.71E-02	218	50
Acrolein	6.4E-06	lb/MMBtu	0.043	349.18	90.00%	4.34E-03	35	0.07
Benzene	1.2E-05	lb/MMBtu	0.081	654.71	90.00%	8.14E-03	65	10
Ethylbenzene	3.2E-05	lb/MMBtu	0.22	1,745.90	90.00%	2.17E-02	175	9,000
Formaldehyde	2.2E-04	lb/MMBtu	1.48	11,914.98	90.00%	1.48E-01	1,191	9
Naphthalene	1.3E-06	lb/MMBtu	0.009	70.93	90.00%	8.82E-04	7.1	3
PAH	2.2E-06	lb/MMBtu	0.015	120.03	90.00%	1.49E-03	12	NA
Propylene Oxide	2.9E-05	lb/MMBtu	0.20	1,582.22	90.00%	1.97E-02	158	30
Toluene	1.3E-04	lb/MMBtu	0.88	7,092.73	90.00%	8.82E-02	709	1,000
Xylenes	6.4E-05	lb/MMBtu	0.43	3,491.80	90.00%	4.34E-02	349	3,000

Emission Source(s):	Gas Turbines	
Number of Sources:	2	
Fuel Fired:	ULSD	
Maximum Unit Heat Input:	3,507	MMbtu/hr
Annual Operation:	720	hrs/yr

RIDEM APCR No. 22 Air Toxic Chemical	Emission Factor	Measurement Units	Uncontrolled PTE lb/hr	Uncontrolled PTE lb/yr	Control %	Controlled PTE lb/hr	Controlled PTE lb/yr	Reg. 22 MQ lb/yr
Ammonia	0.0029	lb/MMBtu	10.1	7,272.00	0.00%	1.01E+01	7,272	300
Sulfuric Acid	1.2E-03	lb/MMBtu	4.17	3,002.40	0.00%	4.17E+00	3,002	40
1,3-Butadiene	1.6E-05	lb/MMBtu	0.11	80.80	90.00%	1.12E-02	8.1	3
Benzene	1.2E-05	lb/MMBtu	0.084	60.60	90.00%	8.42E-03	6.1	10
Formaldehyde	2.3E-04	lb/MMBtu	1.62	1,163.64	90.00%	1.62E-01	116	9
Naphthalene	3.5E-05	lb/MMBtu	0.25	176.75	90.00%	2.45E-02	18	3
PAH	4.0E-05	lb/MMBtu	0.28	202.00	90.00%	2.81E-02	20	NA
Arsenic	4.6E-08	lb/MMBtu	0.00	0.23	0.00%	3.24E-04	0.23	0.02
Beryllium	3.1E-07	lb/MMBtu	0.00	1.57	0.00%	2.17E-03	1.6	0.04
Cadmium	5.1E-09	lb/MMBtu	0.00	0.03	0.00%	3.60E-05	0.026	0.07
Chromium	2.2E-06	lb/MMBtu	0.02	11.31	0.00%	1.57E-02	11	20,000
Lead	7.7E-07	lb/MMBtu	0.01	3.88	0.00%	5.39E-03	3.9	0.9
Manganese	2.8E-07	lb/MMBtu	0.00	1.42	0.00%	1.98E-03	1.4	0.2
Mercury	1.0E-08	lb/MMBtu	0.00	0.05	0.00%	7.22E-05	0.052	0.7
Nickel	1.5E-06	lb/MMBtu	0.01	7.47	0.00%	1.04E-02	7.5	0.4
Selenium	2.6E-07	lb/MMBtu	0.00	1.29	0.00%	1.80E-03	1.3	2,000

Emission Source(s):	HRSG Duct Burners	
Number of Sources:	2	
Fuel Fired:	Natural Gas	
Maximum Unit Heat Input:	721.0	MMbtu/hr
Annual Operation:	8,040	hrs/yr

RIDEM APCR No. 22 Air Toxic Chemical	Emission Factor	Measurement Units	Uncontrolled PTE lb/hr	Uncontrolled PTE lb/yr	Control %	Controlled PTE lb/hr	Controlled PTE lb/yr	Reg. 22 MQ lb/yr
Lead	4.9E-07	lb/MMBtu	7.1E-04	5.68	0.00%	7.07E-04	5.7	0.9
Benzene	2.1E-06	lb/MMBtu	3.0E-03	23.87	90.00%	2.97E-04	2.4	10
Formaldehyde	7.4E-05	lb/MMBtu	1.1E-01	852.48	90.00%	1.06E-02	85	9
Hexane	1.8E-03	lb/MMBtu	2.5E+00	20,459.44	90.00%	2.54E-01	2,046	20,000
Naphthalene	6.0E-07	lb/MMBtu	8.6E-04	6.93	90.00%	8.62E-05	0.69	3
Toluene	3.3E-06	lb/MMBtu	4.8E-03	38.65	90.00%	4.81E-04	3.9	1,000
Arsenic	2.0E-07	lb/MMBtu	2.8E-04	2.27	0.00%	2.83E-04	2.3	0.02
Barium	4.3E-06	lb/MMBtu	6.2E-03	50.01	0.00%	6.22E-03	50	2,000
Beryllium	1.2E-08	lb/MMBtu	1.7E-05	0.14	0.00%	1.70E-05	0.14	0.04
Cadmium	1.1E-06	lb/MMBtu	1.6E-03	12.50	0.00%	1.56E-03	13	0.07
Chromium	1.4E-06	lb/MMBtu	2.0E-03	15.91	0.00%	1.98E-03	16	20,000
Cobalt	8.2E-08	lb/MMBtu	1.2E-04	0.95	0.00%	1.19E-04	1.0	0.1
Copper	8.3E-07	lb/MMBtu	1.2E-03	9.66	0.00%	1.20E-03	10	40
Manganese	3.7E-07	lb/MMBtu	5.4E-04	4.32	0.00%	5.37E-04	4.3	0.2
Mercury	2.5E-07	lb/MMBtu	3.7E-04	2.96	0.00%	3.68E-04	3.0	0.7
Molybdenum	1.1E-06	lb/MMBtu	1.6E-03	12.50	0.00%	1.56E-03	13	60
Nickel	2.1E-06	lb/MMBtu	3.0E-03	23.87	0.00%	2.97E-03	24	0.4
Selenium	2.4E-08	lb/MMBtu	3.4E-05	0.27	0.00%	3.39E-05	0.27	2,000
Vanadium	2.3E-06	lb/MMBtu	3.3E-03	26.14	0.00%	3.25E-03	26	0.07
Zinc	2.8E-05	lb/MMBtu	4.1E-02	329.62	0.00%	4.10E-02	330	3,000
2-Methylmaphthalene	2.4E-08	lb/MMBtu	3.4E-05	0.27	90.00%	3.39E-06	0.0273	NA
3-Methylchloranthrene	1.8E-09	lb/MMBtu	2.5E-06	0.02	90.00%	2.54E-07	0.0020	NA
7,12-Dimethylbenz(a)anthracene	1.6E-08	lb/MMBtu	2.3E-05	0.18	90.00%	2.26E-06	0.0182	NA
Acenaphthene	1.8E-09	lb/MMBtu	2.5E-06	0.02	90.00%	2.54E-07	0.0020	NA
Acenaphthylene	1.8E-09	lb/MMBtu	2.5E-06	0.02	90.00%	2.54E-07	0.0020	NA
Anthracene	2.4E-09	lb/MMBtu	3.4E-06	0.03	90.00%	3.39E-07	0.0027	NA
Benz(a)anthracene	1.8E-09	lb/MMBtu	2.5E-06	0.02	90.00%	2.54E-07	0.0020	NA
Benzo(a)pyrene	1.2E-09	lb/MMBtu	1.7E-06	0.01	90.00%	1.70E-07	0.0014	NA
Benzo(b)fluoranthene	1.8E-09	lb/MMBtu	2.5E-06	0.02	90.00%	2.54E-07	0.0020	NA
Benzo(g,h,i)perylene	1.2E-09	lb/MMBtu	1.7E-06	0.01	90.00%	1.70E-07	0.0014	NA
Benzo(k)fluoranthene	1.8E-09	lb/MMBtu	2.5E-06	0.02	90.00%	2.54E-07	0.0020	NA
Butane	2.1E-03	lb/MMBtu	3.0E+00	23,869.34	90.00%	2.97E-01	2,387	NA
Chrysene	1.8E-09	lb/MMBtu	2.5E-06	0.02	90.00%	2.54E-07	0.0020	NA
Dibenzo(a,h)anthracene	1.2E-09	lb/MMBtu	1.7E-06	0.01	90.00%	1.70E-07	0.0014	NA
Dichlorobenzene	1.2E-06	lb/MMBtu	1.7E-03	13.64	90.00%	1.70E-04	1.4	NA
Ethane	3.0E-03	lb/MMBtu	4.4E+00	35,235.69	90.00%	4.38E-01	3,524	NA
Fluoranthene	2.9E-09	lb/MMBtu	4.2E-06	0.03	90.00%	4.24E-07	0.0034	NA
Fluorene	2.8E-06	lb/MMBtu	4.0E-03	32.46	90.00%	4.04E-04	3.2	NA
Indeno(1,2,3-cd)pyrene	1.8E-06	lb/MMBtu	2.6E-03	20.87	90.00%	2.60E-04	2.1	NA
Pentane	2.5E-03	lb/MMBtu	3.7E+00	29,552.52	90.00%	3.68E-01	2,955	NA
Phenanthrene	1.7E-08	lb/MMBtu	2.4E-05	0.19	90.00%	2.40E-06	0.019	NA
Propane	1.6E-03	lb/MMBtu	2.3E+00	18,186.16	90.00%	2.26E-01	1,819	NA
Pyrene	4.9E-09	lb/MMBtu	7.1E-06	0.06	90.00%	7.07E-07	0.0057	NA

Emission Source(s):	Auxiliary Boiler	
Number of Sources:	1	
Fuel Fired:	Natural Gas	
Maximum Unit Heat Input:	140.6	MMbtu/hr
Annual Operation:	4,576	hrs/yr

RIDEM APCR No. 22 Air Toxic Chemical	Emission Factor	Measurement Units	Potential Emissions lb/hr	Potential Emissions lb/yr	Reg. 22 MQ lb/yr
Lead	4.9E-07	lb/MMBtu	6.9E-05	3.15E-01	0.9
Benzene	2.1E-06	lb/MMBtu	2.9E-04	1.32E+00	10
Formaldehyde	7.4E-05	lb/MMBtu	1.0E-02	4.73E+01	9
Hexane	1.8E-03	lb/MMBtu	2.5E-01	1.14E+03	20,000
Naphthalene	6.0E-07	lb/MMBtu	8.4E-05	3.85E-01	3
Toluene	3.3E-06	lb/MMBtu	4.7E-04	2.14E+00	1,000
Arsenic	2.0E-07	lb/MMBtu	2.8E-05	1.26E-01	0.02
Barium	4.3E-06	lb/MMBtu	6.1E-04	2.78E+00	2,000
Beryllium	1.2E-08	lb/MMBtu	1.7E-06	7.57E-03	0.04
Cadmium	1.1E-06	lb/MMBtu	1.5E-04	6.94E-01	0.07
Chromium	1.4E-06	lb/MMBtu	1.9E-04	8.83E-01	20,000
Cobalt	8.2E-08	lb/MMBtu	1.2E-05	5.30E-02	0.1
Copper	8.3E-07	lb/MMBtu	1.2E-04	5.36E-01	40
Manganese	3.7E-07	lb/MMBtu	5.2E-05	2.40E-01	0.2
Mercury	2.5E-07	lb/MMBtu	3.6E-05	1.64E-01	0.7
Molybdenum	1.1E-06	lb/MMBtu	1.5E-04	6.94E-01	60
Nickel	2.1E-06	lb/MMBtu	2.9E-04	1.32E+00	0.4
Selenium	2.4E-08	lb/MMBtu	3.3E-06	1.51E-02	2,000
Vanadium	2.3E-06	lb/MMBtu	3.2E-04	1.45E+00	0.07
Zinc	2.8E-05	lb/MMBtu	4.0E-03	1.83E+01	3,000
2-Methylmaphthalene	2.4E-08	lb/MMBtu	3.3E-06	1.51E-02	NA
3-Methylchloranthrene	1.8E-09	lb/MMBtu	2.5E-07	1.14E-03	NA
7,12-Dimethylbenz(a)anthracene	1.6E-08	lb/MMBtu	2.2E-06	1.01E-02	NA
Acenaphthene	1.8E-09	lb/MMBtu	2.5E-07	1.14E-03	NA
Acenaphthylene	1.8E-09	lb/MMBtu	2.5E-07	1.14E-03	NA
Anthracene	2.4E-09	lb/MMBtu	3.3E-07	1.51E-03	NA
Benz(a)anthracene	1.8E-09	lb/MMBtu	2.5E-07	1.14E-03	NA
Benzo(a)pyrene	1.2E-09	lb/MMBtu	1.7E-07	7.57E-04	NA
Benzo(b)fluoranthene	1.8E-09	lb/MMBtu	2.5E-07	1.14E-03	NA
Benzo(g,h,i)perylene	1.2E-09	lb/MMBtu	1.7E-07	7.57E-04	NA
Benzo(k)fluoranthene	1.8E-09	lb/MMBtu	2.5E-07	1.14E-03	NA
Butane	2.1E-03	lb/MMBtu	2.9E-01	1.32E+03	NA
Chrysene	1.8E-09	lb/MMBtu	2.5E-07	1.14E-03	NA
Dibenzo(a,h)anthracene	1.2E-09	lb/MMBtu	1.7E-07	7.57E-04	NA
Dichlorobenzene	1.2E-06	lb/MMBtu	1.7E-04	7.57E-01	NA
Ethane	3.0E-03	lb/MMBtu	4.3E-01	1.96E+03	NA
Fluoranthene	2.9E-09	lb/MMBtu	4.1E-07	1.89E-03	NA
Fluorene	2.8E-06	lb/MMBtu	3.9E-04	1.80E+00	NA
Indeno(1,2,3-cd)pyrene	1.8E-06	lb/MMBtu	2.5E-04	1.16E+00	NA
Pentane	2.5E-03	lb/MMBtu	3.6E-01	1.64E+03	NA
Phenanthrene	1.7E-08	lb/MMBtu	2.3E-06	1.07E-02	NA
Propane	1.6E-03	lb/MMBtu	2.2E-01	1.01E+03	NA
Pyrene	4.9E-09	lb/MMBtu	6.9E-07	3.15E-03	NA

Emission Source(s):	Fire Pump	
Number of Sources:	1	
Fuel Fired:	ULSD	
Maximum Unit Heat Input:	2.1	MMbtu/hr
Annual Operation:	300	hrs/yr

RIDEM APCR No. 22 Air Toxic Chemical	Emission Factor	Measurement Units	Potential Emissions lb/hr	Potential Emissions lb/yr	Reg. 22 MQ lb/yr
Benzene	9.33E-04	lb/MMBtu	2.0E-03	5.88E-01	10
Toluene	4.09E-04	lb/MMBtu	8.6E-04	2.58E-01	1,000
Xylenes	2.85E-04	lb/MMBtu	6.0E-04	1.80E-01	3,000
Propylene	2.58E-03	lb/MMBtu	5.4E-03	1.63E+00	36,500
Formaldehyde	1.18E-03	lb/MMBtu	2.5E-03	7.43E-01	9
Acetaldehyde	7.67E-04	lb/MMBtu	1.6E-03	4.83E-01	50
Acrolein	9.25E-05	lb/MMBtu	1.9E-04	5.83E-02	0.07
Naphthalene	8.48E-05	lb/MMBtu	1.8E-04	5.34E-02	3
1,3-Butadiene	3.91E-05	lb/MMBtu	8.2E-05	2.46E-02	3
Acenaphthylene	5.06E-06	lb/MMBtu	1.1E-05	3.19E-03	NA
Acenaphthene	1.42E-06	lb/MMBtu	3.0E-06	8.95E-04	NA
Fluorene	2.92E-05	lb/MMBtu	6.1E-05	1.84E-02	NA
Phenanthrene	2.94E-05	lb/MMBtu	6.2E-05	1.85E-02	NA
Anthracene	1.87E-06	lb/MMBtu	3.9E-06	1.18E-03	NA
Fluoranthene	7.61E-06	lb/MMBtu	1.6E-05	4.79E-03	NA
Pyrene	4.78E-06	lb/MMBtu	1.0E-05	3.01E-03	NA
Benz(a)anthracene	1.68E-06	lb/MMBtu	3.5E-06	1.06E-03	NA
Chrysene	3.53E-07	lb/MMBtu	7.4E-07	2.22E-04	NA
Benzo(b)fluoranthene	9.91E-08	lb/MMBtu	2.1E-07	6.24E-05	NA
Benzo(k)fluoranthene	1.55E-07	lb/MMBtu	3.3E-07	9.77E-05	NA
Benzo(a)pyrene	1.88E-07	lb/MMBtu	3.9E-07	1.18E-04	NA
Indeno(1,2,3-cd)pyrene	3.75E-07	lb/MMBtu	7.9E-07	2.36E-04	NA
Dibenz(a,h)anthracene	5.83E-07	lb/MMBtu	1.2E-06	3.67E-04	NA
Benzo(g,h,l)perylene	4.89E-07	lb/MMBtu	1.0E-06	3.08E-04	NA
PAH	1.68E-04	lb/MMBtu	3.5E-04	1.06E-01	NA

Emission Source(s):	Dewpoint Heater	
Number of Sources:	1	
Fuel Fired:	Natural Gas	
Maximum Unit Heat Input:	15.0	MMbtu/hr
Annual Operation:	8,760	hrs/yr

RIDEM APCR No. 22 Air Toxic Chemical	Emission Factor	Measurement Units	Potential Emissions lb/hr	Potential Emissions lb/yr	Reg. 22 MQ lb/yr
Lead	4.9E-07	lb/MMBtu	7.4E-06	6.44E-02	0.9
Benzene	2.1E-06	lb/MMBtu	3.1E-05	2.71E-01	10
Formaldehyde	7.4E-05	lb/MMBtu	1.1E-03	9.66E+00	9
Hexane	1.8E-03	lb/MMBtu	2.6E-02	2.32E+02	20,000
Naphthalene	6.0E-07	lb/MMBtu	9.0E-06	7.86E-02	3
Toluene	3.3E-06	lb/MMBtu	5.0E-05	4.38E-01	1,000
Arsenic	2.0E-07	lb/MMBtu	2.9E-06	2.58E-02	0.02
Barium	4.3E-06	lb/MMBtu	6.5E-05	5.67E-01	2,000
Beryllium	1.2E-08	lb/MMBtu	1.8E-07	1.55E-03	0.04
Cadmium	1.1E-06	lb/MMBtu	1.6E-05	1.42E-01	0.07
Chromium	1.4E-06	lb/MMBtu	2.1E-05	1.80E-01	20,000
Cobalt	8.2E-08	lb/MMBtu	1.2E-06	1.08E-02	0.1
Copper	8.3E-07	lb/MMBtu	1.3E-05	1.10E-01	40
Manganese	3.7E-07	lb/MMBtu	5.6E-06	4.90E-02	0.2
Mercury	2.5E-07	lb/MMBtu	3.8E-06	3.35E-02	0.7
Molybdenum	1.1E-06	lb/MMBtu	1.6E-05	1.42E-01	60
Nickel	2.1E-06	lb/MMBtu	3.1E-05	2.71E-01	0.4
Selenium	2.4E-08	lb/MMBtu	3.5E-07	3.09E-03	2,000
Vanadium	2.3E-06	lb/MMBtu	3.4E-05	2.96E-01	0.07
Zinc	2.8E-05	lb/MMBtu	4.3E-04	3.74E+00	3,000
2-Methylmaphthalene	2.4E-08	lb/MMBtu	3.5E-07	3.09E-03	NA
3-Methylchloranthrene	1.8E-09	lb/MMBtu	2.6E-08	2.32E-04	NA
7,12-Dimethylbenz(a)anthracene	1.6E-08	lb/MMBtu	2.4E-07	2.06E-03	NA
Acenaphthene	1.8E-09	lb/MMBtu	2.6E-08	2.32E-04	NA
Acenaphthylene	1.8E-09	lb/MMBtu	2.6E-08	2.32E-04	NA
Anthracene	2.4E-09	lb/MMBtu	3.5E-08	3.09E-04	NA
Benz(a)anthracene	1.8E-09	lb/MMBtu	2.6E-08	2.32E-04	NA
Benzo(a)pyrene	1.2E-09	lb/MMBtu	1.8E-08	1.55E-04	NA
Benzo(b)fluoranthene	1.8E-09	lb/MMBtu	2.6E-08	2.32E-04	NA
Benzo(g,h,i)perylene	1.2E-09	lb/MMBtu	1.8E-08	1.55E-04	NA
Benzo(k)fluoranthene	1.8E-09	lb/MMBtu	2.6E-08	2.32E-04	NA
Butane	2.1E-03	lb/MMBtu	3.1E-02	2.71E+02	NA
Chrysene	1.8E-09	lb/MMBtu	2.6E-08	2.32E-04	NA
Dibenzo(a,h)anthracene	1.2E-09	lb/MMBtu	1.8E-08	1.55E-04	NA
Dichlorobenzene	1.2E-06	lb/MMBtu	1.8E-05	1.55E-01	NA
Ethane	3.0E-03	lb/MMBtu	4.6E-02	3.99E+02	NA
Fluoranthene	2.9E-09	lb/MMBtu	4.4E-08	3.86E-04	NA
Fluorene	2.8E-06	lb/MMBtu	4.2E-05	3.68E-01	NA
Indeno(1,2,3-cd)pyrene	1.8E-06	lb/MMBtu	2.7E-05	2.37E-01	NA
Pentane	2.5E-03	lb/MMBtu	3.8E-02	3.35E+02	NA
Phenanthrene	1.7E-08	lb/MMBtu	2.5E-07	2.19E-03	NA
Propane	1.6E-03	lb/MMBtu	2.4E-02	2.06E+02	NA
Pyrene	4.9E-09	lb/MMBtu	7.4E-08	6.44E-04	NA

Emission Source(s):	Emergency Diesel Generator	
Number of Sources:	1	
Fuel Fired:	ULSD	
Maximum Unit Heat Input:	19.5	MMbtu/hr
Annual Operation:	300	hrs/yr

RIDEM APCR No. 22 Air Toxic Chemical	Emission Factor	Measurement Units	Potential Emissions lb/hr	Potential Emissions lb/yr	Reg. 22 MQ lb/yr
Benzene	7.76E-04	lb/MMBtu	1.5E-02	4.54E+00	10
Toluene	2.81E-04	lb/MMBtu	5.5E-03	1.64E+00	1,000
Xylenes	1.93E-04	lb/MMBtu	3.8E-03	1.13E+00	3,000
Propylene	2.79E-03	lb/MMBtu	5.4E-02	1.63E+01	36,500
Formaldehyde	7.89E-05	lb/MMBtu	1.5E-03	4.62E-01	9
Acetaldehyde	2.52E-05	lb/MMBtu	4.9E-04	1.47E-01	50
Acrolein	7.88E-06	lb/MMBtu	1.5E-04	4.61E-02	0.07
Naphthalene	1.30E-04	lb/MMBtu	2.5E-03	7.61E-01	3
Acenaphthylene	9.23E-06	lb/MMBtu	1.8E-04	5.40E-02	NA
Acenaphthene	4.68E-06	lb/MMBtu	9.1E-05	2.74E-02	NA
Fluorene	1.28E-05	lb/MMBtu	2.5E-04	7.49E-02	NA
Phenanthrene	4.08E-05	lb/MMBtu	8.0E-04	2.39E-01	NA
Anthracene	1.23E-06	lb/MMBtu	2.4E-05	7.20E-03	NA
Fluoranthene	4.03E-06	lb/MMBtu	7.9E-05	2.36E-02	NA
Pyrene	3.71E-06	lb/MMBtu	7.2E-05	2.17E-02	NA
Benz(a)anthracene	6.22E-07	lb/MMBtu	1.2E-05	3.64E-03	NA
Chrysene	1.53E-06	lb/MMBtu	3.0E-05	8.95E-03	NA
Benzo(b)fluoranthene	1.11E-06	lb/MMBtu	2.2E-05	6.49E-03	NA
Benzo(k)fluoranthene	2.18E-07	lb/MMBtu	4.3E-06	1.28E-03	NA
Benzo(a)pyrene	2.57E-07	lb/MMBtu	5.0E-06	1.50E-03	NA
Indeno(1,2,3-cd)pyrene	4.14E-07	lb/MMBtu	8.1E-06	2.42E-03	NA
Dibenz(a,h)anthracene	3.46E-07	lb/MMBtu	6.7E-06	2.02E-03	NA
Benzo(g,h,l)perylene	5.56E-07	lb/MMBtu	1.1E-05	3.25E-03	NA
PAH	2.12E-04	lb/MMBtu	4.1E-03	1.24E+00	NA

[1] Based on preliminary project equipment specifications and emissions estimates. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.
GT ammonia, formaldehyde and sulfuric acid emission factors are from equipment specifications. Gas turbine distillate oil metals emission factors are from "Survey of Ultra-Trace Metals in Gas Turbine Fuels". All other emission factors are from AP-42.

Table A-3
Clear River Energy Center - Burrillville, Rhode Island
CT/HRSG Startup & Shutdown Emission Summaries[1]

Parameter	Measurement Units	Cold Start	Warm Start	Hot Start	Shut Down	Cold Start	Warm Start	Hot Start	Shut Down
Fuel Fired		Natural Gas	Natural Gas	Natural Gas	Natural Gas	ULSD	ULSD	ULSD	ULSD
Event Duration	min/event	45	40	30	12	45	7	21	7
Events per Year	events/yr	50	100	250	400	15	45	10	30
Hours per Year	hrs/yr	37.5	66.7	125.0	80.0	11.3	5.3	3.5	3.5
Stack Gas Molecular Weight	lb/lb-mole	28.60	28.60	28.60	28.60	28.60	28.60	28.60	28.60
Stack Flow	lb/hr	4,320,000	4,320,000	4,320,000	2,880,000	4,680,000	4,680,000	4,680,000	3,420,000
Stack Flow	acfm	1,163,214	1,163,214	1,163,214	775,476	1,260,149	1,260,149	1,260,149	920,878
Stack Exit Temperature	deg. F	160	160	160	160	160	160	160	160
Emissions									
NOx	lb/event	196.0	159.0	110.0	6.6	198.0	178.0	100.0	25.0
CO	lb/event	133.0	131.0	123.0	124.0	304.0	301.0	287.0	99.0
PM/PM10/PM2.5	lb/event	9.1	8.1	4.2	2.4	53.0	47.0	25.0	8.3
Emission Rate									
NOx	lb/hr	261.3	238.5	220.0	33.0	264.0	1525.7	285.7	214.3
CO	lb/hr	177.3	196.5	246.0	620.0	405.3	2580.0	820.0	848.6
PM/PM10/PM2.5	lb/hr	12.1	12.2	8.4	12.0	70.7	402.9	71.4	71.1
Emission Rate									
NOx	g/sec	32.93	30.05	27.72	4.16	33.26	192.24	36.00	27.00
CO	g/sec	22.34	24.76	31.00	78.12	51.07	325.08	103.32	106.92
PM/PM10/PM2.5	g/sec	1.53	1.53	1.06	1.51	8.90	50.76	9.00	8.96

[1] Based on preliminary project equipment specifications and emissions estimates. Equipment vendor selection, equipment specifications, and emission rates are subject to change as the project design advances.

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	Invenergy ULSD Storage Tank
City:	Burrillville
State:	Rhode Island
Company:	Invenergy, LLC
Type of Tank:	Vertical Fixed Roof Tank
Description:	Invenergy Rhode Island Energy Center Burrillville, Rhode Island

Tank Dimensions

Shell Height (ft):	35.00
Diameter (ft):	120.00
Liquid Height (ft) :	24.00
Avg. Liquid Height (ft):	24.00
Volume (gallons):	2,000,000.00
Turnovers:	18.42
Net Throughput(gal/yr):	36,846,720.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	120.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Providence, Rhode Island (Avg Atmospheric Pressure = 14.7 psia)

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

Invenergy ULSD Storage Tank - Vertical Fixed Roof Tank
Burrillville, Rhode Island

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Pressure Calculations
Distillate fuel oil no. 2	All	52.05	47.20	56.90	50.41	0.0049	0.0041	0.0059	130.0000			188.00	Option 1: VP50 = .0045 VP60 = .0065

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

Invenergy ULSD Storage Tank - Vertical Fixed Roof Tank
Burrillville, Rhode Island

Annual Emission Calcaulations	
Standing Losses (lb):	311.7234
Vapor Space Volume (cu ft):	217,495.8417
Vapor Density (lb/cu ft):	0.0001
Vapor Space Expansion Factor:	0.0339
Vented Vapor Saturation Factor:	0.9950
Tank Vapor Space Volume:	
Vapor Space Volume (cu ft):	217,495.8417
Tank Diameter (ft):	120.0000
Vapor Space Outage (ft):	19.2309
Tank Shell Height (ft):	35.0000
Average Liquid Height (ft):	24.0000
Roof Outage (ft):	8.2309
Roof Outage (Dome Roof)	
Roof Outage (ft):	8.2309
Dome Radius (ft):	120.0000
Shell Radius (ft):	60.0000
Vapor Density	
Vapor Density (lb/cu ft):	0.0001
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Daily Avg. Liquid Surface Temp. (deg. R):	511.7234
Daily Average Ambient Temp. (deg. F):	50.3917
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):	10.731
Liquid Bulk Temperature (deg. R):	510.0817
Tank Paint Solar Absorptance (Shell):	0.1700
Tank Paint Solar Absorptance (Roof):	0.1700
Daily Total Solar Insulation Factor (Btu/sqft day):	1,228.9982
Vapor Space Expansion Factor	
Vapor Space Expansion Factor:	0.0339
Daily Vapor Temperature Range (deg. R):	19.3980
Daily Vapor Pressure Range (psia):	0.0018
Breather Vent Press. Setting Range(psia):	0.0600
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):	0.0041
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):	0.0059
Daily Avg. Liquid Surface Temp. (deg R):	511.7234
Daily Min. Liquid Surface Temp. (deg R):	506.8739
Daily Max. Liquid Surface Temp. (deg R):	516.5729
Daily Ambient Temp. Range (deg. R):	18.8167
Vented Vapor Saturation Factor	
Vented Vapor Saturation Factor:	0.9950
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):	0.0049
Vapor Space Outage (ft):	19.2309
Working Losses (lb):	560.0602
Vapor Molecular Weight (lb/lb-mole):	130.0000
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):	0.0049
Annual Net Throughput (gal/yr.):	36,846,720.0000
Annual Turnovers:	18.4234
Turnover Factor:	1.0000
Maximum Liquid Volume (gal):	2,000,000.0000
Maximum Liquid Height (ft):	24.0000
Tank Diameter (ft):	120.0000
Working Loss Product Factor:	1.0000
Total Losses (lb):	871.7837

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: Annual

Invenergy ULSD Storage Tank - Vertical Fixed Roof Tank
Burrillville, Rhode Island

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Distillate fuel oil no. 2	560.06	311.72	871.78

Appendix B

BACT/LAER Documentation

Summary of BACT Determinations
Invenergy Rhode Island Energy Center
Burrillville, Rhode Island

Facility	State	City	RBLC No.	Permit Date	Process	Add-on Control	Parameter	Emission Rate	Units	Emission Rate	Units	Emission Rate	Units	Determination	Permitting Agency	Contact	Phone
US EPA RBLC																	
Progress Energy	FL		FL-0265	06/05	530 MW Hines Power Block (4th block of power added,	GCP	CO	8	ppmvd @15%O2 (NG)	12	ppmvd @15%O2 (oil)			BACT	FL Dept of Env Protection	Jeff Koerner	850-921-9000
					total generating capacity of	SCR	NOx	2.5	ppmvd @15%O2 (NG)	10	ppmvd @15%O2 (oil)				Air Resource Division		
					the facility is approximately 2,090 MW)	CF	PM10	10	% opacity								
						CF	SO2	2	gr/100 cf gas	0.05	% S						
WEST DEPTFORD ENERGY STATION	NJ		NJ-0082	07/14	427 MW Siemens Combined Cycle Turbine with duct	NG	CO2e	1237923	ton/yr (12-mo)	947	lb/MW-hr(12-mo)			BACT	NJ Dept of Env Protection	Aliya Khan	609-292-2169
					burner	OC/NG	CO	1.5	ppmvd @15%O2 (3-hr)	10.5	lb/hr (3-hr)			BACT	Air Quality Permittings		
					Heat input rate (turbine) = 2,276 MMbtu/hr (HHV)	SCR/NG	NOx	23.0	lb/hr (3-hr)	2	ppmvd @15%O2 (3-hr)			BACT	Program		
					Heat input rate (duct burner) = 777 MMbtu/hr(HHV)	NG	FPM	15.1	lb/hr	0.0048	lb/mmbtu			BACT			
						NG	PM10	21.55	lb/hr	0.0069	lb/mmbtu			BACT			
						NG	PM2.5	21.55	lb/hr	0.0069	lb/mmbtu			BACT			
						NG	SO2	6.56	lb/hr					BACT			
						NG	H2SO4 Mist	0.98	lb/hr					BACT			
						OC/NG	VOC	1.0	ppmvd @15%O2	4	lb/hr			LAER			
					427 MW Siemens Combined Cycle Turbine with duct	OC/NG	CO	0.9	ppmvd @15%O2 (3-hr)	4.75	lb/hr (3-hr)			BACT			
					burner	OC/NG	NOx	2	ppmvd @15%O2 (3-hr)	17.33	lb/hr (3-hr)			LAER			
					Heat input rate (turbine) = 2,276 MMbtu/hr (HHV)	NG	FPM10	6	lb/hr					BACT			
					Heat input rate (duct burner) = 777 MMbtu/hr(HHV)	NG	TPM10	10	lb/hr					BACT			
						NG	TPM2.5	10	lb/hr					BACT			
						NG	SO2	4.94	lb/hr					BACT			
						NG	H2SO4 Mist	10	lb/hr					BACT			
						OC/NG	VOC	0.7	ppmvd @15%O2	2.11	lb/hr			LAER			
Berks Hollow Energy Assoc LLC/Ontelaunee	PA		PA-0296	12/13	2 combustion turbine generators and 2 heat recovery	NA	NH3	5	ppmvd	107.92	ton/yr			BACT	PA Dept of Env Protection	Regi Sam	717-772-3375
					steam generators	NA	CO2e	1,000	lb/MW-hr					BACT	Bureau of Air Quality		
					855 MW nominal	NA	CO2	1380899	ton/yr					BACT			
						OC	CO	211.92	ton/yr (12-mo)					BACT			
						SCR	NOx	131.6	ton/yr (12-mo)					BACT			
						NA	FPM10	48.56	ton/yr (12-mo)					BACT			
						NA	TPM2.5	48.56	ton/yr (12-mo)					BACT			
						NA	SOx	19.7	ton/yr (12-mo)					BACT			
						NA	H2SO4 Mist	2.97	ton/yr								
						NA	TSP	48.56	ton/yr								
						NA	VOC	93.85	ton/yr (12-mo)								
Wolf Hollow Power Plant No. 2	TX		TX-0552	03/10	Combined-cycle power plant generating a nominal	GCP	CO	10	ppmvd @15%O2 (3-hr, MHI501G)	11	ppmvd @15%O2 (3-hr, GE 7FA)			BACT	Texas Commission on	Johnny Vermillion	512-239-1292
					800 MW with either 2 MHI501G turbines or 2 GE 7FA	DL/SCR	NOx	2	ppmvd @15%O2 (24-hr, full load)	9	ppmvd @15%O2 (3-hr, reduced load)			BACT	Environmental Quality		
					turbines	GCP	VOC	4	ppmvd @15%O2 (3-hr, MHI501G)	3	ppmvd @15%O2 (3-hr, GE 7FA)			BACT	Air Permits Division		
Trinidad Generating Facility	TX		TX-0712	11/14	Mitsubishi Heavy Industries J model gas fired combustion	OC	CO	4	ppmvd @15%O2 (24-hr)					BACT	Texas Commission on	Johnny Vermillion	512-239-1292
					turbine nominally rated at 497 MW. Equipped with a	SCR	NOx	2	ppmvd @15%O2 (24-hr)					BACT	Environmental Quality		
					HRSG and DB with a maximum design capacity of 402	NA	TPM2.5	0						BACT	Air Permits Division		
					MMBtu/hr. Gross nominal output of the CTG with HRSG	OC	VOC	4	ppmvd @15%O2 (1-hr)					BACT			
					and DB is 530 MW.												
Colorado Bend Energy Center	TX		TX-0730	04/15	Two GE Model 7HA.02 Combustion Turbines and one	EP	CO2	879	lb/MWh	7395	Btu/MWh			BACT	Texas Commission on	Johnny Vermillion	512-239-1292
					steam turbine using aircooled condensers	SCR/OC	CO	4	ppmvd @15%O2 (3-hr)					BACT	Environmental Quality		
					1,100 MW Throughput	EP	CH4	37	ton/yr					BACT	Air Permits Division		
						SCR/OC	NOx	2	ppmvd @15%O2 (24-hr)					BACT			
						EP	N2O	0						BACT			
						EC	TPM	43	lb/hr					BACT			
						EC	TPM10	43	lb/hr					BACT			
						EC	TPM2.5	43	lb/hr					BACT			
						EC	SO2	2	gr/100 scf (1-hr)	0.5	gr/100 scf (annual)			BACT			
						EC	H2SO4 Mist	2	gr/100 scf (1-hr)	0.5	gr/100 scf (annual)			BACT			
						SCR/OC	VOC	4	ppmvd @15%O2 (3-hr)					BACT			
STATE AGENCIES																	
							CO2e	895	lb/MWh								
Pioneer Valley Energy Center	MA	Westfield	NA	04/12	Mitsubishi M501G		Natural Gas							BACT	MassDEP	Michael Gorski	413-755-2213
					gross heat rate of 5,846 Btu/kWH at 100% load	NG	PM10/PM2.5 (Total)	0.0040	lb/mmbtu			9.8	lb/hr	BACT	Western Regional Office		
					431 MW Combined Cycle Power Plant	NG	PM10/PM2.5 (Filt)	0.0020	lb/mmbtu			4.9	lb/hr	BACT			
						NG	PM10/PM2.5 (Cond)	0.0020	lb/mmbtu			4.9	lb/hr	BACT			
						NG	SO2	0.0019	lb/mmbtu			4.7	lb/hr	BACT			
						SCR	NOx	0.008	lb/mmbtu	2	ppmvd	20.2	lb/hr	LAER			
						OC	CO	0.0049	lb/mmbtu	2	ppmvd	12.3	lb/hr	BACT			
						OC	VOC	0.0015	lb/mmbtu	1	ppmvd	3.6	lb/hr	BACT			
							H2SO4 Mist	0.0019	lb/mmbtu			4.9	lb/hr	BACT			
							Formaldehyde	0.00028	lb/mmbtu			0.6	lb/hr	BACT			
							NH3	0.003	lb/mmbtu	2	ppmvd	7.5	lb/hr	BACT			
							S in Fuel		<=0.6gr S/1000 ft3								
							Opacity/Smoke	<=10% during normal operation, based on a 6-minute block average									
							Fuel Oil										
						NG	PM10/PM2.5 (Total)	0.014	lb/mmbtu			26.8	lb/hr	BACT			
						NG	PM10/PM2.5 (Filt)	0.007	lb/mmbtu			13.4	lb/hr	BACT			
						NG	PM10/PM2.5 (Cond)	0.007	lb/mmbtu			13.4	lb/hr	BACT			
						NG	SO2	0.0017	lb/mmbtu			3.4	lb/hr	BACT			
						SCR	NOx	0.021	lb/mmbtu	5	ppmvd	43	lb/hr	LAER			
						OC	CO	0.016	lb/mmbtu	6	ppmvd	31.5	lb/hr	BACT			
						OC	VOC	0.009	lb/mmbtu	6	ppmvd	18	lb/hr	BACT			
							H2SO4 Mist	0.0018	lb/mmbtu			3.6	lb/hr	BACT			
							Formaldehyde	0.00031	lb/mmbtu			0.6	lb/hr	BACT			
							NH3	0.0032	lb/mmbtu	2	ppmvd	6.4	lb/hr	BACT			
							S in Fuel	15 ppm S by weight									
							Opacity/Smoke	<=10% during normal operation, based on a 6-minute block average									
Footprint Power Salem Harbor	MA	Salem	NA	01/14	Two General Electric Model No. 107F Series 5	DL/SCR	NOx (CT)	2	ppmvd @15%O2	0.0074	lb/mmbtu	17	lb/hr	BACT			
					Combustion Turbine/Heat Recovery Steam Generator	DL/SCR	NOx (CT/DB)	2	ppmvd @15%O2	0.0074	lb/mmbtu	18.1	lb/hr	BACT			
					Including Duct Burner	OC	CO (CT)	2	ppmvd @15%O2	0.0045	lb/mmbtu	8	lb/hr	BACT			
					Utilizes only natural gas	OC	CO (CT/DB)	2	ppmvd @15%O2	0.0045	lb/mmbtu	8	lb/hr	BACT			
					315 MW each (346 MW with duct firing)	OC	VOC (CT)	1	ppmvd @15%O2	0.0013	lb/mmbtu	3	lb/hr	BACT			
						OC	VOC (CT/DB)	1	ppmvd @15%O2	0.0022	lb/mmbtu	5.4	lb/hr	BACT			
						NG	SO2 (CT)	0.3	ppmvd @15%O2	0.0015	lb/mmbtu	3.5	lb/hr	BACT			
						NG	SO2 (CT/DB)	0.3	ppmvd @15%O2	0.0015	lb/mmbtu	3.7	lb/hr	BACT			
							H2SO4 (CT)	0.1	ppmvd @15%O2	0.001	lb/mmbtu	2.2	lb/hr	BACT			
							H2SO4 (CT/DB)	0.1	ppmvd @15%O2	0.001	lb/mmbtu	2.3	lb/hr	BACT			
							PM/PM10/PM2.5 (CT)	0.029	ppmvd @15%O2	0.0071	lb/mmbtu	8.8	lb/hr	BACT			

							PM/PM10/PM2.5 (CT/DB)	0.041	ppmvd @15%O2	0.0062	lb/mmbtu	13	lb/hr	BACT			
							NH3 (CT)	2	ppmvd @15%O2	0.0027	lb/mmbtu	6	lb/hr	BACT			
							NH3	2	ppmvd @15%O2	0.0027	lb/mmbtu	7	lb/hr	BACT			
							CO2e	825	lb/MW hr								
Middletown Energy Center	OH	Middletown	NA	09/14	Nominal 500-megawatt (MW) combined cycle gas turbine	DL/SCR	NOx (CT)	2.0	ppmvd @15%O2	21.8	lb/hr			BACT	Ohio EPA, DAPC	Andrew Hall	513-946-7777
						DL/SCR	NOx (CT/DB)	2.0	ppmvd @15%O2	27.7	lb/hr			BACT	Southwest Ohio Air Quality Agency		
						OC	CO (CT)	2.0	ppmvd @15%O2	13.2	lb/hr			BACT			
						OC	CO (CT/DB)	2.0	ppmvd @15%O2	16.8	lb/hr			BACT			
						NG/DL	PM/PM10/PM2.5 (CT)	0.0038	lb/mmbtu	10.8	lb/hr			BACT			
						NG/DL	PM/PM10/PM2.5 (CT/DB)	0.0057	lb/mmbtu	20	lb/hr			BACT			
						GCP	GHG	1,626,781	ton/yr								
							H2SO4 (CT)	0.0011	lb/mmbtu	3.5	lb/hr			BACT			
							H2SO4 (CT/DB)	0.0011	lb/mmbtu	4.3	lb/hr			BACT			
Carroll County Energy LLC	OH	Washington Twp	NA	11/13	Two General Electric 7FA combined cycle combustion	OC	CO(CT/DB)	2.0	ppmvd @15%O2	12.5	lb/hr			BACT	Ohio EPA DAPC	Scott J. Nally	330-425-9171
					turbines	OC	CO (CT)	2.0	ppmvd @15%O2	9.9	lb/hr			BACT	Northeast District Office		
					2,045 mmBtu/hr heat input turbine	DL/SCR	NOx(CT/DB)	2.0	ppmvd @15%O2	20.5	lb/hr			BACT			
					566 mmBtu/hr heat input duct burner	DL/SCR	NOx (CT)	2.0	ppmvd @15%O2	16.3	lb/hr			BACT			
							PM/PM10/PM2.5 (CT/DB)	0.0078	lb/mmbtu	19.8	lb/hr			BACT			
							PM/PM10/PM2.5 (CT)	0.0108	lb/mmbtu	12.4	lb/hr			BACT			
						OC	VOC(CT/DB)	0.0026	lb/mmbtu	7.1	lb/hr			BACT			
						OC	VOC (CT)	0.0013	lb/mmbtu	2.8	lb/hr			BACT			
							H2SO4(CT/DB)	0.0012	lb/mmbtu	2.52	lb/hr			BACT			
							H2SO4 (CT)	0.0016	lb/mmbtu	4.26	lb/hr			BACT			
							CO2e	1,345,883	ton/yr								
Oregon Clean Energy Center	OH		NA	04/13	799 MW natural gas combined cycle combustion		For Each Mitsubishi Turbine								Ohio EPA, DAPC	Andrew Hall	419-936-3015
					turbine power plant	SCR	NOx (CT)	2.0	ppmvd @15%O2	20	lb/hr			BACT			
					Includes either of the following:	SCR	NOx (CT/DB)	2.0	ppmvd @15%O2	20.8	lb/hr			BACT			
					Two (2) Mitsubishi 501GAC turbines or	OC	VOC (CT)	2.0	ppmvd @15%O2	7	lb/hr			BACT			
					Two (2) Siemens SCC6-8000H turbines	OC	VOC (CT/DB)	2.0	ppmvd @15%O2	7.3	lb/hr			BACT			
					Each turbine is 2,932 mmBtu/hr and an HRSG of	OC	CO (CT)	2.0	ppmvd @15%O2	12.2	lb/hr			BACT			
					300mmbtu/hr	OC	CO (CT/DB)	2.0	ppmvd @15%O2	12.7	lb/hr			BACT			
							PM10/PM2.5 (CT)	0.00384	lb/mmbtu	10.1	lb/hr			BACT			
							PM10/PM2.5 (CT/DB)	0.00373	lb/mmbtu	10.1	lb/hr			BACT			
							SO2 (CT)	0.0014	lb/mmbtu	3.7	lb/hr			BACT			
							SO2 (CT/DB)	0.0014	lb/mmbtu	3.9	lb/hr			BACT			
							H2SO4 (CT)	0.00041	lb/mmbtu	1.1	lb/hr			BACT			
							H2SO4 (CT/DB)	0.00044	lb/mmbtu	1.2	lb/hr			BACT			
							NH3 (CT)	18.5	lb/hr					BACT			
							NH3 (CT/DB)	19.3	lb/hr					BACT			
							CO2 (CT)	840	lb/MWhr	305607	lb/hr			BACT			
							CO2 (CT/DB)	317920	lb/hr					BACT			
							CO2e (CT)	305907	lb/hr					BACT			
							CO2e (CT/DB)	318404	lb/hr					BACT			
							For Each Siemens Turbine										
						SCR	NOx (CT)	2	ppmvd @15%O2	20	lb/hr						
						SCR	NOx (CT/DB)	2	ppmvd @15%O2	21	lb/hr						
						OC	VOC (CT)	1	ppmvd @15%O2	3.4	lb/hr						
						OC	VOC (CT/DB)	1.9	ppmvd @15%O2	5.2	lb/hr						
						OC	CO (CT)	2	ppmvd @15%O2	12	lb/hr						
						OC	CO (CT/DB)	2	ppmvd @15%O2	13	lb/hr						
							PM10/PM2.5 (CT)	0.0047	lb/mmbtu	11.8	lb/hr						
							PM10/PM2.5 (CT/DB)	0.0055	lb/mmbtu	14	lb/hr						
							SO2 (CT)	0.0014	lb/mmbtu	3.9	lb/hr						
							SO2 (CT/DB)	0.0014	lb/mmbtu	4.2	lb/hr						
							H2SO4 (CT)	0.0006	lb/mmbtu	1.4	lb/hr						
							H2SO4 (CT/DB)	0.0007	lb/mmbtu	1.5	lb/hr						
							NH3 (CT)	18	lb/hr								
							NH3 (CT/DB)	19	lb/hr								
							CO2 (CT)	833	lb/MWhr	301814	lb/hr						
							CO2 (CT/DB)	327380	lb/hr								
							CO2e (CT)	302110	lb/hr								
							CO2e (CT/DB)	327819	lb/hr								

Notes: ns = not specified.
OX = oxidizer (specific type not specified.
COX = catalytic oxidizer.
TOX = thermal oxidizer.
RTOX = regenerative thermal oxidizer.
WS = wet scrubber
CA = carbon adsorption
OC = Oxidation Catalyst
EP = efficient processes, practices, and designs
EC = efficient combustion, natural gas fuel
GCP = Good combustion practices
DL = Dry low NOx combustors
NG = Use of natural gas/ULSD/Biodiesel as a clean burning fuel
CF = Clean Fuels

S = Scubber
I = Incinerator
EC = Emission Condenser
DC = Dust Collector
TVF = Teflon vent filter
Cond = condenser
BH = Baghouse

Information Resources for BACT Determinations

CARB/CAPCOA BACT Clearinghouse
(www.arb.ca.gov/bact/bact.htm) or (http://www.arb.ca.gov/bact/bactnew/rptpara.htm)

NJDEP State-of-the-Art (SOTA) manuals
(http://www.state.nj.us/dep/aqpp/sota.html)

EPA's RACT/BACT/LAER Clearinghouse
(http://cfpub.epa.gov/rblc/htm/bl02.cfm)

South Coast AQMD BACT Guidelines
(www.aqmd.gov/bact)
(http://www.aqmd.gov/bact/BACTGuidelines.htm)

Texas NRCC BACT Guidelines
(http://www.tceq.state.tx.us/permitting/air/nav/bact_index.html) or
(http://www.tceq.state.tx.us/permitting/air/nav/air_nsrpermits.html)

Bay Area AQMD BACT Guidelines
(http://www.baaqmd.gov/pmt/bactworkbook/index001.htm)

San Joaquin Valley Unified APCD BACT Guidelines
(www.valleyair.org/busind/pto/bact/bactidx.htm)

Performance Standards for Existing Stationary Sources
(www.arb.ca.gov/ssps/ssps.htm)

Massachusetts Facilities with Air Permits & Approvals
(http://www.mass.gov/eea/agencies/massdep/air/approvals/air-permits-and-approvals-issued-to-facilities.html)

Connecticut Title V Operating Permit Program
(http://www.ct.gov/deep/cwp/view.asp?a=2684&q=322176&deepNav_GID=1997)

New York State Department of Environmental Conservation
(http://www.dec.ny.gov/chemical/32249.html)

New Jersey Department of Environmental Protection
(http://www.nj.gov/dep/aqpp/onlinehelp.html)

Ohio Environmental Protection Agency
(http://www.epa.ohio.gov/dapc/permits/permits.aspx)

Rhode Island Department of Environmental Management
(http://www.dem.ri.gov/programs/benviron/air/)

Appendix C

RIDEM Application Forms

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY FUEL BURNING EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE (781) 424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) Gas Turbine #1/HRSG #1
4. NATURE OF BUSINESS Electric Generation

Section B

APPROVAL REQUESTED FOR:

1. CONSTRUCTION ☑ INSTALLATION ☐ MODIFICATION ☐
2. ESTIMATED STARTING DATE 12/01/2016 ESTIMATED COMPLETION DATE 06/01/2019

Section C

TYPE OF FUELS USED

1. FUEL: OIL ☑ GRADE: 2 ☑ 4 ☐ 6 ☐
   NAT. GAS ☑
   OTHER ☐
2. ANNUAL USAGE: OIL 18,036,000 GALS.
   NAT. GAS 33,077 MM FT^3
   OTHER ______
3. MAXIMUM FIRING RATE: OIL 25,050 GALS/HR.
   NAT. GAS 4,114,000 FT^3/HR.
   OTHER ______
4. MAXIMUM HEAT INPUT: OIL 3,507 MM BTU/HR.
   NAT. GAS 4,114 MM BTU/HR.
   OTHER ______ BTU/HR.
5. SEASONAL USE: OIL January TO December (MONTHS)
   NAT. GAS January TO December (MONTHS)
   OTHER ______ TO ______ (MONTHS)
6. FUEL SUPPLIER: OIL TBD
   NAT. GAS Spectra Energy/Algonquin Gas
   OTHER ______

Section D

BOILER

1. MANUFACTURER: TBD MODEL NO.: TBD
2. BOILER TYPE: ☐ WATER TUBE ☐ FIRE TUBE ☐ PACKAGE ☐ OTHER (SPECIFY) ________
3. SIZE: ________ HP ________ BTU/HR
4. TYPE OF BURNER: ☐ STEAM ATOMIZER ☐ AIR ATOMIZER ☐ TANG. FIRED ☐ OTHER (SPECIFY)
5. ARE OIL HEATERS USED? ☐ YES ☐ NO TYPE: ☐ ELECTRICAL ☐ STEAM
6. BURNER MANUFACTURER: TBD BURNER CAPACITY: TBD (GPH)

   NO. OF BURNERS: ________

COMBUSTION TURBINE

1. MANUFACTURER: TBD (G-Class or greater) MODEL NO.: TBD
2. SIZE: 250-350 MW MAXIMUM HEAT INPUT: 3,507 BTU/HR
3. STEAM OR WATER INJECTION: ☐ YES ☑ NO
4. INJECTION RATIO: NA LB/LB

INTERNAL COMBUSTION ENGINES

1. MANUFACTURER: ________ MODEL NO.: ________
2. SIZE: ________ HP ☐ RICH BURN ☐ LEAN BURN

** IF THE FUEL BURNING EQUIPMENT DOES NOT FALL INTO ANY OF THESE CATEGORIES, PROVIDE ENOUGH INFORMATION TO ADEQUATELY DESCRIBE THE EQUIPMENT.

Section E

CONTINUOUS EMISSION MONITORS

MANUFACTURER/MODEL NO.

☑ OPACITY	TBD
☑ OXYGEN	TBD
☑ CO_2	TBD
☑ NO_x	TBD
☐ SO_2	
☑ CO	TBD

Section F

STACK INFORMATION:

1. STACK EXIT DIMENSIONS I.D. 264 INCHES OR ____ INCHES X ____ INCHES
2. STACK HEIGHT ABOVE GROUND 200 FEET
3. VOLUME OF GAS DISCHARGED INTO OPEN AIR 1599503 ACFM @ 180 °F
4. IS STACK EQUIPPED WITH A RAIN HAT? YES ☐ NO ☑
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 530 FEET

Section G

EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

Signature

Title

Bryan Schueler
Vice President

Printed Name

Date

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY FUEL BURNING EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE (781) 424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) Gas Turbine #2/HRSG #2
4. NATURE OF BUSINESS Electric Generation

Section B

APPROVAL REQUESTED FOR:

1. CONSTRUCTION ☑ INSTALLATION ☐ MODIFICATION ☐
2. ESTIMATED STARTING DATE 12/01/2016 ESTIMATED COMPLETION DATE 06/01/2019

Section C

TYPE OF FUELS USED

1. FUEL: OIL ☑ GRADE: 2 ☑ 4 ☐ 6 ☐
   NAT. GAS ☑
   OTHER ☐
2. ANNUAL USAGE: OIL 18,036,000 GALS.
   NAT. GAS 33,077 MM FT^3
   OTHER
3. MAXIMUM FIRING RATE: OIL 25,050 GALS/HR.
   NAT. GAS 4,114,000 FT^3/HR.
   OTHER
4. MAXIMUM HEAT INPUT: OIL 3,507 MM BTU/HR.
   NAT. GAS 4,114 MM BTU/HR.
   OTHER BTU/HR.
5. SEASONAL USE: OIL January TO December (MONTHS)
   NAT. GAS January TO December (MONTHS)
   OTHER TO (MONTHS)
6. FUEL SUPPLIER: OIL TBD
   NAT. GAS Spectra Energy/Algonquin Gas
   OTHER

Section D

BOILER

1. MANUFACTURER: TBD MODEL NO.: TBD
2. BOILER TYPE: ☐ WATER TUBE ☐ FIRE TUBE ☐ PACKAGE ☐ OTHER (SPECIFY) ______
3. SIZE: ______ HP ______ BTU/HR
4. TYPE OF BURNER: ☐ STEAM ATOMIZER ☐ AIR ATOMIZER ☐ TANG. FIRED ☐ OTHER (SPECIFY)
5. ARE OIL HEATERS USED? ☐ YES ☐ NO TYPE: ☐ ELECTRICAL ☐ STEAM
6. BURNER MANUFACTURER: TBD BURNER CAPACITY: TBD (GPH)
   NO. OF BURNERS: ______

COMBUSTION TURBINE

1. MANUFACTURER: TBD (G-Class or greater) MODEL NO.: TBD
2. SIZE: 250-350 MW MAXIMUM HEAT INPUT: 3,507 BTU/HR
3. STEAM OR WATER INJECTION: ☐ YES ☑ NO
4. INJECTION RATIO: NA LB/LB

INTERNAL COMBUSTION ENGINES

1. MANUFACTURER: ______ MODEL NO.: ______
2. SIZE: ______ HP ☐ RICH BURN ☐ LEAN BURN

** IF THE FUEL BURNING EQUIPMENT DOES NOT FALL INTO ANY OF THESE CATEGORIES, PROVIDE ENOUGH INFORMATION TO ADEQUATELY DESCRIBE THE EQUIPMENT.

Section E

CONTINUOUS EMISSION MONITORS

MANUFACTURER/MODEL NO.

- ☑ OPACITY TBD
- ☑ OXYGEN TBD
- ☑ CO_2 TBD
- ☑ NO_x TBD
- ☐ SO_2 ______
- ☑ CO TBD

Section F

STACK INFORMATION:

1. STACK EXIT DIMENSIONS I.D. 264 INCHES OR ____ INCHES X ____ INCHES
2. STACK HEIGHT ABOVE GROUND 200 FEET
3. VOLUME OF GAS DISCHARGED INTO OPEN AIR 1599503 ACFM @ 180 °F
4. IS STACK EQUIPPED WITH A RAIN HAT? YES ☐ NO ☑
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 440 FEET

Section G	EMISSIONS INFORMATION: POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
	See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

Signature: [signature]

Title:

Bryan Schueler
Vice President

Printed Name

Date

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY FUEL BURNING EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE (781) 424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) Auxiliary Boiler Building
4. NATURE OF BUSINESS Electric Generation

Section B

APPROVAL REQUESTED FOR:

1. CONSTRUCTION ☑ INSTALLATION ☐ MODIFICATION ☐
2. ESTIMATED STARTING DATE 12/01/2016 ESTIMATED COMPLETION DATE 06/01/2019

Section C

TYPE OF FUELS USED

1. FUEL: OIL ☐ GRADE: 2 ☐ 4 ☐ 6 ☐
   NAT. GAS ☑
   OTHER ☐
2. ANNUAL USAGE: OIL ______ GALS.
   NAT. GAS 643,385,600 FT^3
   OTHER ______
3. MAXIMUM FIRING RATE: OIL ______ GALS/HR.
   NAT. GAS 140,600 FT^3/HR.
   OTHER ______
4. MAXIMUM HEAT INPUT: OIL ______ BTU/HR.
   NAT. GAS 140.6 MM BTU/HR.
   OTHER ______ BTU/HR.
5. SEASONAL USE: OIL ______ TO ______ (MONTHS)
   NAT. GAS January TO December (MONTHS)
   OTHER ______ TO ______ (MONTHS)
6. FUEL SUPPLIER: OIL ______
   NAT. GAS Spectra Energy/Algonquin Gas
   OTHER ______

Section D	**BOILER**

1. MANUFACTURER: TBD MODEL NO.: TBD
2. BOILER TYPE: ☑ WATER TUBE ☐ FIRE TUBE ☑ PACKAGE ☐ OTHER (SPECIFY) ______
3. SIZE: ______ HP 140.6 MM BTU/HR
4. TYPE OF BURNER: ☐ STEAM ATOMIZER ☐ AIR ATOMIZER ☐ TANG. FIRED ☐ OTHER (SPECIFY)
5. ARE OIL HEATERS USED? ☐ YES ☑ NO TYPE: ☐ ELECTRICAL ☐ STEAM
6. BURNER MANUFACTURER: TBD BURNER CAPACITY: TBD (GPH)
   NO. OF BURNERS: TBD

COMBUSTION TURBINE

1. MANUFACTURER: ______ MODEL NO.: ______
2. SIZE: ______ MW MAXIMUM HEAT INPUT: ______ BTU/HR
3. STEAM OR WATER INJECTION: ☐ YES ☐ NO
4. INJECTION RATIO: ______ LB/LB

INTERNAL COMBUSTION ENGINES

1. MANUFACTURER: ______ MODEL NO.: ______
2. SIZE: ______ HP ☐ RICH BURN ☐ LEAN BURN

** IF THE FUEL BURNING EQUIPMENT DOES NOT FALL INTO ANY OF THESE CATEGORIES, PROVIDE ENOUGH INFORMATION TO ADEQUATELY DESCRIBE THE EQUIPMENT.

Section E	**CONTINUOUS EMISSION MONITORS**

MANUFACTURER/MODEL NO.

☐ OPACITY	
☑ OXYGEN	TBD
☐ CO_2	
☑ NO_x	TBD
☐ SO_2	
☐ CO	

Section F	**STACK INFORMATION:**

1. STACK EXIT DIMENSIONS I.D. 48 INCHES OR ______ INCHES X ______ INCHES
2. STACK HEIGHT ABOVE GROUND 50 FEET
3. VOLUME OF GAS DISCHARGED INTO OPEN AIR 38,067 ACFM @ 344 °F
4. IS STACK EQUIPPED WITH A RAIN HAT? YES ☐ NO ☑
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 470 FEET

Section G	EMISSIONS INFORMATION:		

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

Signature ____________________ Title ____________________

Bryan Schueler
Vice President

Printed Name ____________________ Date ____________________

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY FUEL BURNING EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE (781) 424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) Dew Point Heater (Gas Yard)
4. NATURE OF BUSINESS Electric Generation

Section B

APPROVAL REQUESTED FOR:

1. CONSTRUCTION ☑ INSTALLATION ☐ MODIFICATION ☐
2. ESTIMATED STARTING DATE 12/01/2016 ESTIMATED COMPLETION DATE 06/01/2019

Section C

TYPE OF FUELS USED

1. FUEL: OIL ☐ GRADE: 2 ☐ 4 ☐ 6 ☐
   NAT. GAS ☑
   OTHER ☐
2. ANNUAL USAGE: OIL ______ GALS.
   NAT. GAS 131,400,000 FT^3
   OTHER ______
3. MAXIMUM FIRING RATE: OIL ______ GALS/HR.
   NAT. GAS 15,000 FT^3/HR.
   OTHER ______
4. MAXIMUM HEAT INPUT: OIL ______ BTU/HR.
   NAT. GAS 15.0 'MM BTU/HR.
   OTHER ______ BTU/HR.
5. SEASONAL USE: OIL ______ TO ______ (MONTHS)
   NAT. GAS January TO December (MONTHS)
   OTHER ______ TO ______ (MONTHS)
6. FUEL SUPPLIER: OIL ______
   NAT. GAS Spectra Energy/Algonquin Gas
   OTHER ______

Section D	**BOILER** 1. MANUFACTURER: TBD MODEL NO.: TBD 2. BOILER TYPE: ☐ WATER TUBE ☐ FIRE TUBE ☐ PACKAGE ☐ OTHER (SPECIFY) —— 3. SIZE: ____ HP 15,000,000 BTU/HR 4. TYPE OF BURNER: ☐ STEAM ATOMIZER ☐ AIR ATOMIZER ☐ TANG. FIRED ☐ OTHER (SPECIFY) 5. ARE OIL HEATERS USED? ☐ YES ☑ NO TYPE: ☐ ELECTRICAL ☐ STEAM 6. BURNER MANUFACTURER: TBD BURNER CAPACITY: TBD (GPH) NO. OF BURNERS: TBD
	COMBUSTION TURBINE 1. MANUFACTURER: ____ MODEL NO.: ____ 2. SIZE: ____ MW MAXIMUM HEAT INPUT: ____ BTU/HR 3. STEAM OR WATER INJECTION: ☐ YES ☐ NO 4. INJECTION RATIO: ____ LB/LB
	INTERNAL COMBUSTION ENGINES 1. MANUFACTURER: ____ MODEL NO.: ____ 2. SIZE: ____ HP ☐ RICH BURN ☐ LEAN BURN ** IF THE FUEL BURNING EQUIPMENT DOES NOT FALL INTO ANY OF THESE CATEGORIES, PROVIDE ENOUGH INFORMATION TO ADEQUATELY DESCRIBE THE EQUIPMENT.
Section E	**CONTINUOUS EMISSION MONITORS** MANUFACTURER/MODEL NO. ☐ OPACITY ____ ☐ OXYGEN ____ ☐ CO_2 ____ ☐ NO_x ____ ☐ SO_2 ____ ☐ CO ____
Section F	**STACK INFORMATION:** 1. STACK EXIT DIMENSIONS I.D. 20 INCHES OR ____ INCHES X ____ INCHES 2. STACK HEIGHT ABOVE GROUND 35 FEET 3. VOLUME OF GAS DISCHARGED INTO OPEN AIR 7,252 ACFM @ 1,000 °F 4. IS STACK EQUIPPED WITH A RAIN HAT? YES ☐ NO ☑ 5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 100 FEET

Section G

EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

Signature

Title

Bryan Schueler
Vice President

Printed Name

Date

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY FUEL BURNING EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE (781) 424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) Emergency Generator
4. NATURE OF BUSINESS Electric Generation

Section B

APPROVAL REQUESTED FOR:

1. CONSTRUCTION ☑ INSTALLATION ☐ MODIFICATION ☐
2. ESTIMATED STARTING DATE 12/01/2016 ESTIMATED COMPLETION DATE 06/01/2019

Section C

TYPE OF FUELS USED

1. FUEL: OIL ☑ GRADE: 2 ☑ 4 ☐ 6 ☐
   NAT. GAS ☐
   OTHER ☐
2. ANNUAL USAGE: OIL 41,786 GALS.
   NAT. GAS ______ FT^3
   OTHER ______
3. MAXIMUM FIRING RATE: OIL 139 GALS/HR.
   NAT. GAS ______ FT^3/HR.
   OTHER ______
4. MAXIMUM HEAT INPUT: OIL 19,500,000 BTU/HR.
   NAT. GAS ______ BTU/HR.
   OTHER ______ BTU/HR.
5. SEASONAL USE: OIL January TO December (MONTHS)
   NAT. GAS ______ TO ______ (MONTHS)
   OTHER ______ TO ______ (MONTHS)
6. FUEL SUPPLIER: OIL TBD
   NAT. GAS ______
   OTHER ______

Section D

BOILER

1. MANUFACTURER: TBD MODEL NO.: ____
2. BOILER TYPE: ☐ WATER TUBE ☐ FIRE TUBE ☐ PACKAGE ☐ OTHER (SPECIFY) ____
3. SIZE: ____ HP ____ BTU/HR
4. TYPE OF BURNER: ☐ STEAM ATOMIZER ☐ AIR ATOMIZER ☐ TANG. FIRED ☐ OTHER (SPECIFY)
5. ARE OIL HEATERS USED? ☐ YES ☐ NO TYPE: ☐ ELECTRICAL ☐ STEAM
6. BURNER MANUFACTURER: ____ BURNER CAPACITY: ____ (GPH)

   NO. OF BURNERS: ____

COMBUSTION TURBINE

1. MANUFACTURER: ____ MODEL NO.: ____
2. SIZE: ____ MW MAXIMUM HEAT INPUT: ____ BTU/HR
3. STEAM OR WATER INJECTION: ☐ YES ☐ NO
4. INJECTION RATIO: ____ LB/LB

INTERNAL COMBUSTION ENGINES

1. MANUFACTURER: TBD MODEL NO.: TBD
2. SIZE: 2,682 HP ☐ RICH BURN ☐ LEAN BURN

   ** IF THE FUEL BURNING EQUIPMENT DOES NOT FALL INTO ANY OF THESE CATEGORIES, PROVIDE ENOUGH INFORMATION TO ADEQUATELY DESCRIBE THE EQUIPMENT.

Section E

CONTINUOUS EMISSION MONITORS

MANUFACTURER/MODEL NO.

- ☐ OPACITY ____
- ☐ OXYGEN ____
- ☐ CO_2 ____
- ☐ NO_x ____
- ☐ SO_2 ____
- ☐ CO ____

Section F

STACK INFORMATION:

1. STACK EXIT DIMENSIONS I.D. 8 INCHES OR ____ INCHES X ____ INCHES
2. STACK HEIGHT ABOVE GROUND 35 FEET
3. VOLUME OF GAS DISCHARGED INTO OPEN AIR 15,295 ACFM @ 752 °F
4. IS STACK EQUIPPED WITH A RAIN HAT? YES ☐ NO ☑
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 440 FEET

Section G

EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

Signature

Title

Bryan Schueler
Vice President

Printed Name

Date

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY FUEL BURNING EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE (781) 424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) Fire Pump Building
4. NATURE OF BUSINESS Electric Generation

Section B

APPROVAL REQUESTED FOR:

1. CONSTRUCTION ☑ INSTALLATION ☐ MODIFICATION ☐
2. ESTIMATED STARTING DATE 12/01/2016 ESTIMATED COMPLETION DATE 06/01/2019

Section C

TYPE OF FUELS USED

1. FUEL: OIL ☑ GRADE: 2 ☑ 4 ☐ 6 ☐
   NAT. GAS ☐
   OTHER ☐
2. ANNUAL USAGE: OIL 4,500 GALS.
   NAT. GAS ______ FT^3
   OTHER ______
3. MAXIMUM FIRING RATE: OIL 15 GALS/HR.
   NAT. GAS ______ FT^3/HR.
   OTHER ______
4. MAXIMUM HEAT INPUT: OIL 2,100,000 BTU/HR.
   NAT. GAS ______ BTU/HR.
   OTHER ______ BTU/HR.
5. SEASONAL USE: OIL January TO December (MONTHS)
   NAT. GAS ______ TO ______ (MONTHS)
   OTHER ______ TO ______ (MONTHS)
6. FUEL SUPPLIER: OIL TBD
   NAT. GAS ______
   OTHER ______

Section D	BOILER 1. MANUFACTURER:________ MODEL NO.:________ 2. BOILER TYPE: ☐ WATER TUBE ☐ FIRE TUBE ☐ PACKAGE ☐ OTHER (SPECIFY)________ 3. SIZE: ________ HP ________ BTU/HR 4. TYPE OF BURNER: ☐ STEAM ATOMIZER ☐ AIR ATOMIZER ☐ TANG. FIRED ☐ OTHER (SPECIFY) 5. ARE OIL HEATERS USED? ☐ YES ☐ NO TYPE: ☐ ELECTRICAL ☐ STEAM 6. BURNER MANUFACTURER:________ BURNER CAPACITY:________(GPH) NO. OF BURNERS:________
	COMBUSTION TURBINE 1. MANUFACTURER:________ MODEL NO.:________ 2. SIZE: ________ MW MAXIMUM HEAT INPUT:________ BTU/HR 3. STEAM OR WATER INJECTION: ☐ YES ☐ NO 4. INJECTION RATIO: ________ LB/LB
	INTERNAL COMBUSTION ENGINES 1. MANUFACTURER: TBD MODEL NO.: TBD 2. SIZE: 315 HP ☐ RICH BURN ☐ LEAN BURN ** IF THE FUEL BURNING EQUIPMENT DOES NOT FALL INTO ANY OF THESE CATEGORIES, PROVIDE ENOUGH INFORMATION TO ADEQUATELY DESCRIBE THE EQUIPMENT.
Section E	CONTINUOUS EMISSION MONITORS MANUFACTURER/MODEL NO. ☐ OPACITY ________ ☐ OXYGEN ________ ☐ CO_2 ________ ☐ NO_x ________ ☐ SO_2 ________ ☐ CO ________
Section F	STACK INFORMATION: 1. STACK EXIT DIMENSIONS I.D. 6 INCHES OR ____ INCHES X ____ INCHES 2. STACK HEIGHT ABOVE GROUND 35 FEET 3. VOLUME OF GAS DISCHARGED INTO OPEN AIR 1,673 ACFM @ 855 ^{o}F 4. IS STACK EQUIPPED WITH A RAIN HAT? YES ☐ NO ☑ 5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 350 FEET

Section G	EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

Signature

Title

Bryan Schueler
Vice President

Printed Name

Date

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY AIR POLLUTION CONTROL EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE 781-424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) HRSG #1 - SCR System #1
4. NATURE OF BUSINESS Electric Generation

Section B

1. APPROVAL REQUESTED FOR: ☑ CONSTRUCTION ☐ MODIFICATION
2. TYPE OF EQUIPMENT: ☐ BAGHOUSE ☐ SCRUBBER ☐ AFTERBURNER ☑ SCR ☐ CARBON ADSORBER ☐ OTHER (SPECIFY)
3. MAKE AND MODEL NO.: TBD
4. ESTIMATED STARTING DATE: 12/01/2016 ESTIMATED COMPLETION DATE: 06/01/2019

Section C

1. GENERAL DESCRIPTION OF PROCESS FROM WHICH POLLUTANTS ARISE
   Combustion of natural gas or ULSD fuel for electric generation
2. PROCESS EQUIPMENT USED IN OPERATION Gas Turbine & HRSG Duct Burner
3. OPERATING PROCEDURE: ☑ CONTINUOUS 24 HRS/DAY 7 DAYS/WEEK 52 WEEKS/YEAR
   ☐ BATCH ____ HRS/BATCH ____ BATCHES/WEEK ____ WEEKS/YEAR
4. LIST THE TYPE AND QUANTITY OF RAW MATERIALS USED PER HOUR OR PER BATCH ON AN ATTACHED SHEET.

Section D

EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturers Specifications/Emission Factors

Section E

EMISSION STREAM CHARACTERISTICS

1. MAXIMUM FLOW RATE (SCFM) 2,028,357 ACFM
2. TEMPERATURE (^oF) 285
3. MOISTURE CONTENT 12.7 %
4. HALOGENATED ORGANICS: ☐ YES ☑ NO
5. HEAT CONTENT (IF APPLICABLE) NA BTU/SCF

Section F

SCRUBBER

1. WET:SCRUBBING LIQUID
   (A) COMPOSITION ________
   (B) FLOW RATE (GAL/MIN) ________
   (C) INJECTION RATE (PSI) ________
   (D) MAKE-UP RATE IF RE-CIRCULATED (GAL/MIN) ________
   PACKING-IF APPLICABLE
   (A) TYPE ________
   (B) DEPTH OF BED ________ (FEET)
   (C) PACKING SURFACE ________ (FT^2)
2. DRY:SCRUBBING REAGENT: ________ USAGE ________ LB/HR.
   INJECTION RATIO: ________ (   )
   MIXING METHOD ________
3. PRESSURE DROP ACROSS CONTROL UNIT: ________ INCHES WATER

BAGHOUSE/FABRIC FILTER

1. BAG/FILTER MATERIAL ________ 2. NUMBER OF BAGS ________
3. AIR/CLOTH RATIO ________ FEET/MINUTE
4. METHOD OF CLEANING: (A) ☐ SHAKER ☐ PULSE ☐ REVERSE AIR ☐ OTHER-SPECIFY
   (B) FREQUENCY OF CLEANING ________
   (C) IS CLEANING AUTOMATIC OR MANUAL ________

CARBON ADSORBER

1. VOLUME OF EACH CARBON BED ________ (FT^3)
2. NUMBER OF BEDS ________
3. DIAMETER OF EACH BED ________ (FT)
4. DEPTH OF EACH BED ________ (FT)
5. ADSORBTION CAPACITY OF CARBON (LB/100 LB CARBON) ________
6. ADSORBTION CYCLE TIME ________ (HR)
7. REGENERATION CYCLE TIME ________ (HR)
8. STEAM RATIO (LB STEAM/LB CARBON) ________
9. STEAM SOURCE ________
10. REMOVAL EFFICIENCY (%) ________

INCINERATION

1. THERMAL AFTERBURNER
   A. VOLUME OF COMBUSTION CHAMBER ________ (FT^3)
   B. MINIMUM OPERATING TEMPERATURE ________ (^oF)
   C. RESIDENCE TIME ________ (SECONDS)
   D. EXCESS AIR ________ %
2. CATALYTIC INCINERATION
   A. TYPE OF CATALYST ________
   B. VOLUME OF CATALYST ________ (FT^3)
   C. SPACE VELOCITY ________ (HR^{-1})
   D. CATALYST OPERATING TEMPERATURE ________ (^oF)

INCINERATION (CONT.)

3. BURNER MAKE AND MODEL NO.______________________________
   CAPACITY (BTU/HR)______________________________
4. HEAT RECOVERY: ☐ YES ☐ NO
   TYPE:______________________________ EFFICIENCY:____________%
4. DESTRUCTION EFFICIENCY:__________________%

Section G

OPERATING CONDITIONS

1. GAS VOLUME THROUGH CONTROL SYSTEM: NORMAL 1.6MM ACFM @ 180 °F
   MAXIMUM 2MM ACFM @ 285 °F
2. GAS TEMPERATURE: INLET_______°F OUTLET 185 °F
3. STACK INFORMATION: (A) I.D. 204 INCHES OR _____INCHES X _____INCHES
   (B) STACK HEIGHT ABOVE GROUND 200 FEET
   (C) CFM EXHAUSTED 2.0MM
   (D) IS STACK EQUIPPED WITH RAIN HAT? ☐ YES ☑ NO
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 550 FEET.

Section H

COLLECTION DATA

1. DESCRIPTION OF COLLECTED MATERIAL NA
2. AMOUNT COLLECTED (LBS/DAY; GAL/DAY; ETC.) NA
3. ULTIMATE DISPOSITION OF COLLECTED MATERIAL NA

Section I

IN ADDITION TO THE ABOVE INFORMATION, THE FOLLOWING INFORMATION IS <u>REQUIRED</u>:

1. FLOW DIAGRAM SHOWING RELATIVE LOCATION OF EQUIPMENT ATTACHED TO THIS CONTROL SYSTEM.
2. MANUFACTURER'S LITERATURE FOR THE CONTROL EQUIPMENT.
3. ENGINEERING DRAWINGS FOR THE CONTROL EQUIPMENT WITH PHYSICAL DIMENSIONS.
4. PARTICULATE COLLECTION EQUIPMENT SHOULD HAVE SIZE EFFICIENCY CURVES. ABSORPTION AND ADSORPTION EQUIPMENT SHOULD HAVE SIZING CALCULATIONS, GRAPHS, EQUILIBRIUM DATA, ETC.

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

B Schuel
______________________________ ______________________________
Signature Bryan Schueler Title
Vice President

______________________________ ______________________________
Printed Name Date

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY AIR POLLUTION CONTROL EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE 781-424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) HRSG #2 - SCR System #2
4. NATURE OF BUSINESS Electric Generation

Section B

1. APPROVAL REQUESTED FOR: ☑ CONSTRUCTION ☐ MODIFICATION
2. TYPE OF EQUIPMENT: ☐ BAGHOUSE ☐ SCRUBBER ☐ AFTERBURNER ☑ SCR ☐ CARBON ADSORBER ☐ OTHER (SPECIFY)
3. MAKE AND MODEL NO.: TBD
4. ESTIMATED STARTING DATE: 12/01/2016 ESTIMATED COMPLETION DATE: 06/01/2019

Section C

1. GENERAL DESCRIPTION OF PROCESS FROM WHICH POLLUTANTS ARISE
   Combustion of natural gas or ULSD fuel for electric generation
2. PROCESS EQUIPMENT USED IN OPERATION Gas Turbine & HRSG Duct Burner
3. OPERATING PROCEDURE: ☑ CONTINUOUS 24 HRS/DAY 7 DAYS/WEEK 52 WEEKS/YEAR
   ☐ BATCH ____ HRS/BATCH ____ BATCHES/WEEK ____ WEEKS/YEAR
4. LIST THE TYPE AND QUANTITY OF RAW MATERIALS USED PER HOUR OR PER BATCH ON AN ATTACHED SHEET.

Section D

EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturers Specifications/Emission Factors

AP-CE

Section E	EMISSION STREAM CHARACTERISTICS 1. MAXIMUM FLOW RATE (SCFM) 2,028,357 ACFM 2. TEMPERATURE (^{o}F) 285 3. MOISTURE CONTENT 12.7 % 4. HALOGENATED ORGANICS: ☐ YES ☑ NO 5. HEAT CONTENT (IF APPLICABLE) NA BTU/SCF
Section F	SCRUBBER 1. WET:SCRUBBING LIQUID (A) COMPOSITION ________ (B) FLOW RATE (GAL/MIN) ________ (C) INJECTION RATE (PSI) ________ (D) MAKE-UP RATE IF RE-CIRCULATED (GAL/MIN) ________ PACKING-IF APPLICABLE (A) TYPE ________ (B) DEPTH OF BED ________ (FEET) (C) PACKING SURFACE ________ (FT^2) 2. DRY:SCRUBBING REAGENT: ________ USAGE ________ LB/HR. INJECTION RATIO: ________ ( ) MIXING METHOD ________ 3. PRESSURE DROP ACROSS CONTROL UNIT: ________ INCHES WATER
	BAGHOUSE/FABRIC FILTER 1. BAG/FILTER MATERIAL ________ 2. NUMBER OF BAGS ________ 3. AIR/CLOTH RATIO ________ FEET/MINUTE 4. METHOD OF CLEANING: (A) ☐ SHAKER ☐ PULSE ☐ REVERSE AIR ☐ OTHER-SPECIFY (B) FREQUENCY OF CLEANING ________ (C) IS CLEANING AUTOMATIC OR MANUAL ________
	CARBON ADSORBER 1. VOLUME OF EACH CARBON BED ________ (FT^3) 2. NUMBER OF BEDS ________ 3. DIAMETER OF EACH BED ________ (FT) 4. DEPTH OF EACH BED ________ (FT) 5. ADSORBTION CAPACITY OF CARBON (LB/100 LB CARBON) ________ 6. ADSORBTION CYCLE TIME ________ (HR) 7. REGENERATION CYCLE TIME ________ (HR) 8. STEAM RATIO (LB STEAM/LB CARBON) ________ 9. STEAM SOURCE ________ 10. REMOVAL EFFICIENCY (%) ________
	INCINERATION 1. THERMAL AFTERBURNER A. VOLUME OF COMBUSTION CHAMBER ________ (FT^3) B. MINIMUM OPERATING TEMPERATURE ________ (^{o}F) C. RESIDENCE TIME ________ (SECONDS) D. EXCESS AIR ________ % 2. CATALYTIC INCINERATION A. TYPE OF CATALYST ________ B. VOLUME OF CATALYST ________ (FT^3) C. SPACE VELOCITY ________ (HR^{-1}) D. CATALYST OPERATING TEMPERATURE ________ (^{o}F)

INCINERATION (CONT.)

3. BURNER MAKE AND MODEL NO.______________________
   CAPACITY (BTU/HR)______________________
4. HEAT RECOVERY: ☐ YES ☐ NO
   TYPE:______________________ EFFICIENCY:__________%
4. DESTRUCTION EFFICIENCY:__________%

Section G

OPERATING CONDITIONS

1. GAS VOLUME THROUGH CONTROL SYSTEM: NORMAL 1.6MM ACFM @ 180 °F
   MAXIMUM 2MM ACFM @ 280 °F
2. GAS TEMPERATURE: INLET______ °F OUTLET 180 °F
3. STACK INFORMATION: (A) I.D. 204 INCHES OR ______ INCHES X ______ INCHES
   (B) STACK HEIGHT ABOVE GROUND 200 FEET
   (C) CFM EXHAUSTED 2.0MM
   (D) IS STACK EQUIPPED WITH RAIN HAT? ☐ YES ☑ NO
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 440 FEET.

Section H

COLLECTION DATA

1. DESCRIPTION OF COLLECTED MATERIAL NA
2. AMOUNT COLLECTED (LBS/DAY; GAL/DAY; ETC.) NA
3. ULTIMATE DISPOSITION OF COLLECTED MATERIAL NA

Section I

IN ADDITION TO THE ABOVE INFORMATION, THE FOLLOWING INFORMATION IS REQUIRED:

1. FLOW DIAGRAM SHOWING RELATIVE LOCATION OF EQUIPMENT ATTACHED TO THIS CONTROL SYSTEM.
2. MANUFACTURER'S LITERATURE FOR THE CONTROL EQUIPMENT.
3. ENGINEERING DRAWINGS FOR THE CONTROL EQUIPMENT WITH PHYSICAL DIMENSIONS.
4. PARTICULATE COLLECTION EQUIPMENT SHOULD HAVE SIZE EFFICIENCY CURVES. ABSORPTION AND ADSORPTION EQUIPMENT SHOULD HAVE SIZING CALCULATIONS, GRAPHS, EQUILIBRIUM DATA, ETC.

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

______________________ ______________________
Signature Title

Bryan Schueler
Vice President

______________________ ______________________
Printed Name Date

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY AIR POLLUTION CONTROL EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE 781-424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
   SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) HRSG #1 - Oxidation Catalyst #1
4. NATURE OF BUSINESS Electric Generation

Section B

1. APPROVAL REQUESTED FOR: ☑ CONSTRUCTION ☐ MODIFICATION
2. TYPE OF EQUIPMENT: ☐ BAGHOUSE ☐ SCRUBBER ☐ AFTERBURNER ☐ SCR ☐ CARBON ADSORBER ☑ OTHER (SPECIFY)
3. MAKE AND MODEL NO.: Oxidation Catalyst TBD
4. ESTIMATED STARTING DATE: 12/01/2016 ESTIMATED COMPLETION DATE: 06/01/2019

Section C

1. GENERAL DESCRIPTION OF PROCESS FROM WHICH POLLUTANTS ARISE
   Combustion of natural gas or ULSD fuel for electric generation
2. PROCESS EQUIPMENT USED IN OPERATION Gas Turbine & HRSG Duct Burner
3. OPERATING PROCEDURE: ☑ CONTINUOUS 24 HRS/DAY 7 DAYS/WEEK 52 WEEKS/YEAR
   ☐ BATCH ____ HRS/BATCH ____ BATCHES/WEEK ____ WEEKS/YEAR
4. LIST THE TYPE AND QUANTITY OF RAW MATERIALS USED PER HOUR OR PER BATCH ON AN ATTACHED SHEET.

Section D

EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

AP-CE

Section	
Section E	EMISSION STREAM CHARACTERISTICS

Section E — EMISSION STREAM CHARACTERISTICS

1. MAXIMUM FLOW RATE (SCFM) 2,028,357 ACFM
2. TEMPERATURE (^{o}F) 285
3. MOISTURE CONTENT 12.7 %
4. HALOGENATED ORGANICS: ☐ YES ☑ NO
5. HEAT CONTENT (IF APPLICABLE) NA BTU/SCF

Section F — SCRUBBER

1. WET:SCRUBBING LIQUID
   - (A) COMPOSITION ______
   - (B) FLOW RATE (GAL/MIN) ______
   - (C) INJECTION RATE (PSI) ______
   - (D) MAKE-UP RATE IF RE-CIRCULATED (GAL/MIN) ______

   PACKING-IF APPLICABLE
   - (A) TYPE ______
   - (B) DEPTH OF BED ______ (FEET)
   - (C) PACKING SURFACE ______ (FT^2)
2. DRY:SCRUBBING REAGENT: ______ USAGE ______ LB/HR.

   INJECTION RATIO: ______ (   )

   MIXING METHOD ______
3. PRESSURE DROP ACROSS CONTROL UNIT: ______ INCHES WATER

BAGHOUSE/FABRIC FILTER

1. BAG/FILTER MATERIAL ______ 2. NUMBER OF BAGS ______
3. AIR/CLOTH RATIO ______ FEET/MINUTE
4. METHOD OF CLEANING: (A) ☐ SHAKER ☐ PULSE ☐ REVERSE AIR ☐ OTHER-SPECIFY
   - (B) FREQUENCY OF CLEANING ______
   - (C) IS CLEANING AUTOMATIC OR MANUAL ______

CARBON ADSORBER

1. VOLUME OF EACH CARBON BED ______ (FT^3)
2. NUMBER OF BEDS ______
3. DIAMETER OF EACH BED ______ (FT)
4. DEPTH OF EACH BED ______ (FT)
5. ADSORBTION CAPACITY OF CARBON (LB/100 LB CARBON) ______
6. ADSORBTION CYCLE TIME ______ (HR)
7. REGENERATION CYCLE TIME ______ (HR)
8. STEAM RATIO (LB STEAM/LB CARBON) ______
9. STEAM SOURCE ______
10. REMOVAL EFFICIENCY (%) ______

INCINERATION

1. THERMAL AFTERBURNER
   - A. VOLUME OF COMBUSTION CHAMBER ______ (FT^3)
   - B. MINIMUM OPERATING TEMPERATURE ______ (^{o}F)
   - C. RESIDENCE TIME ______ (SECONDS)
   - D. EXCESS AIR ______ %
2. CATALYTIC INCINERATION
   - A. TYPE OF CATALYST ______
   - B. VOLUME OF CATALYST ______ (FT^3)
   - C. SPACE VELOCITY ______ (HR^{-1})
   - D. CATALYST OPERATING TEMPERATURE ______ (^{o}F)

INCINERATION (CONT.)

3. BURNER MAKE AND MODEL NO.______________________________
   CAPACITY (BTU/HR)______________________________
4. HEAT RECOVERY: ☐ YES ☐ NO
   TYPE:______________________________ EFFICIENCY:__________%
4. DESTRUCTION EFFICIENCY:______________%

Section G

OPERATING CONDITIONS
1. GAS VOLUME THROUGH CONTROL SYSTEM: NORMAL 1.6MM ACFM @ 180 °F
   MAXIMUM 2.0M ACFM @ 285 °F
2. GAS TEMPERATURE: INLET______°F OUTLET______°F
3. STACK INFORMATION: (A) I.D. 204 INCHES OR ______INCHES X ______INCHES
   (B) STACK HEIGHT ABOVE GROUND 200 FEET
   (C) CFM EXHAUSTED 2.0MM
   (D) IS STACK EQUIPPED WITH RAIN HAT? ☐ YES ☑ NO
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 650 FEET.

Section H

COLLECTION DATA
1. DESCRIPTION OF COLLECTED MATERIAL NA
2. AMOUNT COLLECTED (LBS/DAY; GAL/DAY; ETC.) NA
3. ULTIMATE DISPOSITION OF COLLECTED MATERIAL NA

Section I

IN ADDITION TO THE ABOVE INFORMATION, THE FOLLOWING INFORMATION IS REQUIRED:
1. FLOW DIAGRAM SHOWING RELATIVE LOCATION OF EQUIPMENT ATTACHED TO THIS CONTROL SYSTEM.
2. MANUFACTURER'S LITERATURE FOR THE CONTROL EQUIPMENT.
3. ENGINEERING DRAWINGS FOR THE CONTROL EQUIPMENT WITH PHYSICAL DIMENSIONS.
4. PARTICULATE COLLECTION EQUIPMENT SHOULD HAVE SIZE EFFICIENCY CURVES. ABSORPTION AND ADSORPTION EQUIPMENT SHOULD HAVE SIZING CALCULATIONS, GRAPHS, EQUILIBRIUM DATA, ETC.

This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

Signature: [signature] Title: ______________

Printed Name: Bryan Schueler Vice President Date: ______________

RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
OFFICE OF AIR RESOURCES

APPLICATION FOR APPROVAL OF PLANS TO CONSTRUCT, INSTALL, OR MODIFY AIR POLLUTION CONTROL EQUIPMENT

Return to: RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
PERMIT APPLICATION CENTER
235 PROMENADE STREET
PROVIDENCE, RI 02908

Section A

1. FULL BUSINESS NAME Clear River Energy Center PHONE 781-424-3223
2. ADDRESS OF EQUIPMENT LOCATION Wallum Lake Road, Burrillville, Rhode Island
SIC CODE 4911 # EMPLOYEES 25
3. LOCATION ON PREMISES (BLDG., DEPT., AREA, ETC.) HRSG #2 - Oxidation Catalyst #2
4. NATURE OF BUSINESS Electric Generation

Section B

1. APPROVAL REQUESTED FOR: ☑ CONSTRUCTION ☐ MODIFICATION
2. TYPE OF EQUIPMENT: ☐ BAGHOUSE ☐ SCRUBBER ☐ AFTERBURNER ☐ SCR ☐ CARBON ADSORBER ☑ OTHER (SPECIFY)
3. MAKE AND MODEL NO.: Oxidation Catalyst TBD
4. ESTIMATED STARTING DATE: 12/01/2016 ESTIMATED COMPLETION DATE: 06/01/2019

Section C

1. GENERAL DESCRIPTION OF PROCESS FROM WHICH POLLUTANTS ARISE
Combustion of natural gas or ULSD fuel for electric generation
2. PROCESS EQUIPMENT USED IN OPERATION Gas Turbine & HRSG Duct Burner
3. OPERATING PROCEDURE: ☑ CONTINUOUS 24 HRS/DAY 7 DAYS/WEEK 52 WEEKS/YEAR
☐ BATCH ____ HRS/BATCH ____ BATCHES/WEEK ____ WEEKS/YEAR
4. LIST THE TYPE AND QUANTITY OF RAW MATERIALS USED PER HOUR OR PER BATCH ON AN ATTACHED SHEET.

Section D

EMISSIONS INFORMATION:

POLLUTANT	EMISSIONS BEFORE CONTROL EQUIPMENT	AFTER
See Tables & App. A		See Tables & App. A

INDICATE METHOD USED TO DETERMINE EMISSIONS Manufacturer Specifications/Emission Factors

Section E	EMISSION STREAM CHARACTERISTICS 1. MAXIMUM FLOW RATE (SCFM) 2,028,357 ACFM 2. TEMPERATURE (^oF) 285 3. MOISTURE CONTENT 12.7 % 4. HALOGENATED ORGANICS: ☐ YES ☑ NO 5. HEAT CONTENT (IF APPLICABLE) NA BTU/SCF
Section F	SCRUBBER 1. WET:SCRUBBING LIQUID (A) COMPOSITION ____ (B) FLOW RATE (GAL/MIN) ____ (C) INJECTION RATE (PSI) ____ (D) MAKE-UP RATE IF RE-CIRCULATED (GAL/MIN) ____ PACKING-IF APPLICABLE (A) TYPE ____ (B) DEPTH OF BED ____ (FEET) (C) PACKING SURFACE ____ (FT^2) 2. DRY:SCRUBBING REAGENT: ____ USAGE ____ LB/HR. INJECTION RATIO: ____ ( ) MIXING METHOD ____ 3. PRESSURE DROP ACROSS CONTROL UNIT: ____ INCHES WATER
	BAGHOUSE/FABRIC FILTER 1. BAG/FILTER MATERIAL ____ 2. NUMBER OF BAGS ____ 3. AIR/CLOTH RATIO ____ FEET/MINUTE 4. METHOD OF CLEANING: (A) ☐ SHAKER ☐ PULSE ☐ REVERSE AIR ☐ OTHER-SPECIFY (B) FREQUENCY OF CLEANING ____ (C) IS CLEANING AUTOMATIC OR MANUAL ____
	CARBON ADSORBER 1. VOLUME OF EACH CARBON BED ____ (FT^3) 2. NUMBER OF BEDS ____ 3. DIAMETER OF EACH BED ____ (FT) 4. DEPTH OF EACH BED ____ (FT) 5. ADSORBTION CAPACITY OF CARBON (LB/100 LB CARBON) ____ 6. ADSORBTION CYCLE TIME ____ (HR) 7. REGENERATION CYCLE TIME ____ (HR) 8. STEAM RATIO (LB STEAM/LB CARBON) NA 9. STEAM SOURCE ____ 10. REMOVAL EFFICIENCY (%) ____
	INCINERATION 1. THERMAL AFTERBURNER A. VOLUME OF COMBUSTION CHAMBER ____ (FT^3) B. MINIMUM OPERATING TEMPERATURE ____ (^oF) C. RESIDENCE TIME ____ (SECONDS) D. EXCESS AIR ____ % 2. CATALYTIC INCINERATION A. TYPE OF CATALYST ____ B. VOLUME OF CATALYST ____ (FT^3) C. SPACE VELOCITY ____ (HR^{-1}) D. CATALYST OPERATING TEMPERATURE ____ (^oF)

INCINERATION (CONT.)

3. BURNER MAKE AND MODEL NO.__________
   CAPACITY (BTU/HR)__________
4. HEAT RECOVERY: ☐ YES ☐ NO
   TYPE:__________ EFFICIENCY:__________%
4. DESTRUCTION EFFICIENCY:__________%

Section G

OPERATING CONDITIONS

1. GAS VOLUME THROUGH CONTROL SYSTEM: NORMAL 1.6MM ACFM @ 180 °F
   MAXIMUM 2.0M ACFM @ 285 °F
2. GAS TEMPERATURE: INLET_____°F OUTLET_____°F
3. STACK INFORMATION: (A) I.D. 204 INCHES OR _____ INCHES X _____ INCHES
   (B) STACK HEIGHT ABOVE GROUND 200 FEET
   (C) CFM EXHAUSTED 2.0MM
   (D) IS STACK EQUIPPED WITH RAIN HAT? ☐ YES ☑ NO
5. DISTANCE FROM DISCHARGE TO NEAREST PROPERTY LINE 440 FEET.

Section H

COLLECTION DATA

1. DESCRIPTION OF COLLECTED MATERIAL NA
2. AMOUNT COLLECTED (LBS/DAY; GAL/DAY; ETC.) NA
3. ULTIMATE DISPOSITION OF COLLECTED MATERIAL NA

Section I

IN ADDITION TO THE ABOVE INFORMATION, THE FOLLOWING INFORMATION IS REQUIRED:

1. FLOW DIAGRAM SHOWING RELATIVE LOCATION OF EQUIPMENT ATTACHED TO THIS CONTROL SYSTEM.
2. MANUFACTURER'S LITERATURE FOR THE CONTROL EQUIPMENT.
3. ENGINEERING DRAWINGS FOR THE CONTROL EQUIPMENT WITH PHYSICAL DIMENSIONS.
4. PARTICULATE COLLECTION EQUIPMENT SHOULD HAVE SIZE EFFICIENCY CURVES. ABSORPTION AND ADSORPTION EQUIPMENT SHOULD HAVE SIZING CALCULATIONS, GRAPHS, EQUILIBRIUM DATA, ETC.

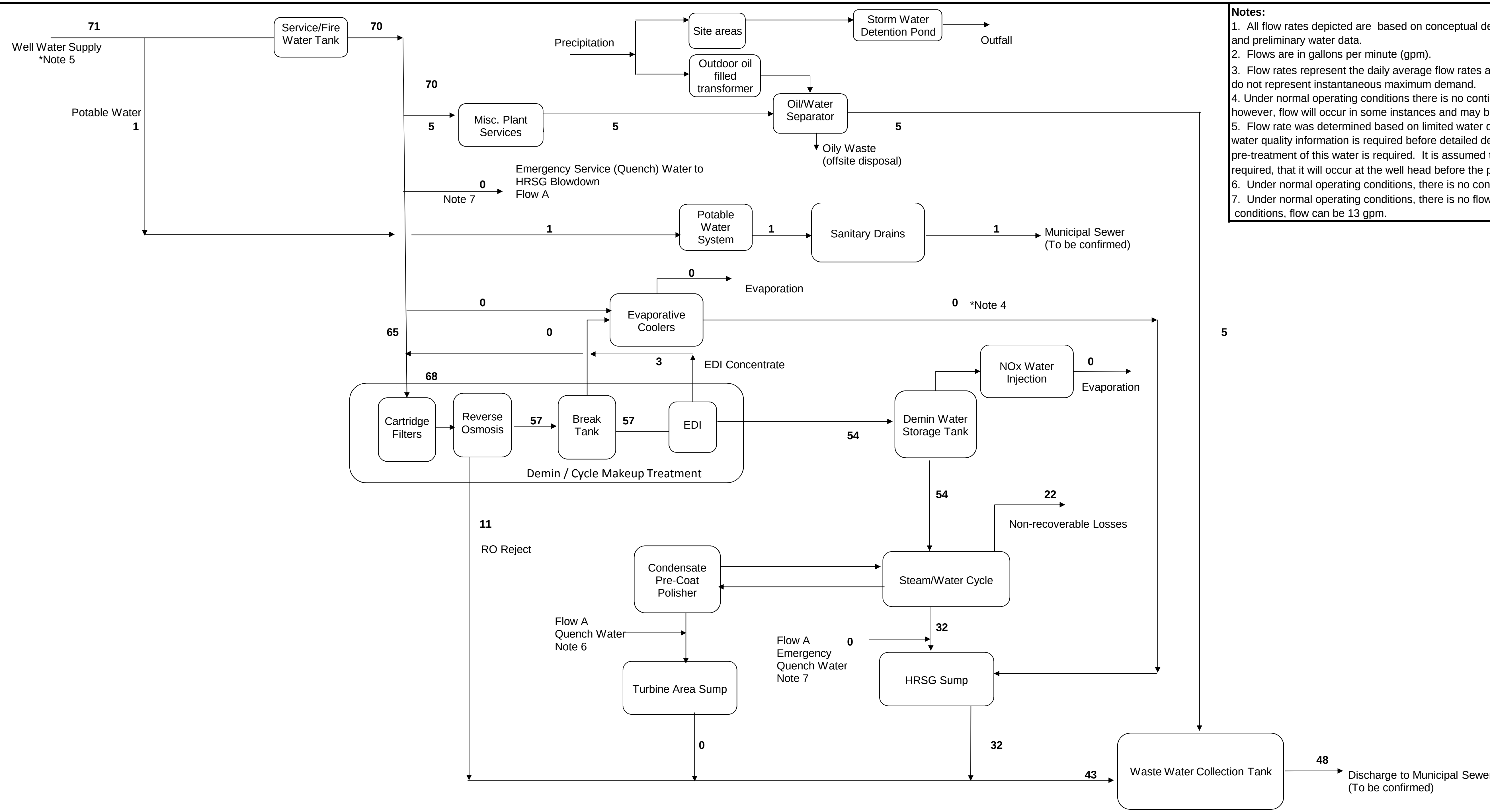
This application is submitted in accordance with the provisions of Chapter 23-23 of the General Laws, as amended, Regulation 9, and to the best of my knowledge and belief is true and correct.

[signature]__________ __________
Signature Title

Bryan Schueler
Vice President
__________ __________
Printed Name Date

Appendix C

Water Balance



Notes:

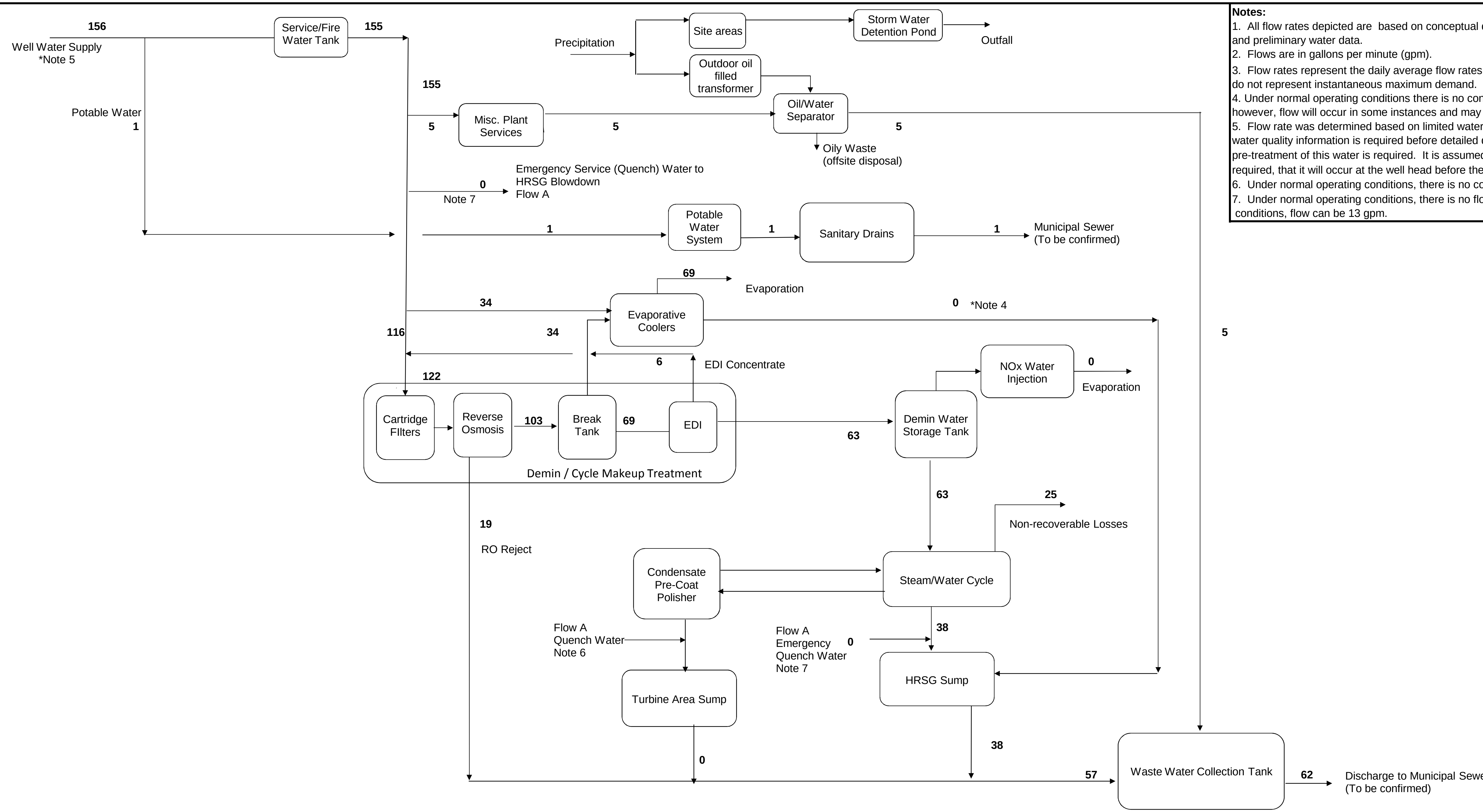
1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. Under normal operating conditions there is no continous flow, however, flow will occur in some instances and may be approx. 1 gpm.
5. Flow rate was determined based on limited water quality data available. Additional water quality information is required before detailed design in order to determine if pre-treatment of this water is required. It is assumed that if any pretreatment is required, that it will occur at the well head before the plant is supplied.
6. Under normal operating conditions, there is no continuous flow.
7. Under normal operating conditions, there is no flow. However, under emergency conditions, flow can be 13 gpm.

FOR CONCEPTUAL DESIGN ONLY

Conceptual Design Basis	7/22/15	
Demin Water Makeup Demand	1.5% of Main Steam Flow	
Potable Water Demand	20 personnel, 50 gal per day, 3 shifts	
Ambient Conditions	46°F / 67%RH	
Cycles of Concentration	NA	

Invenergy

RHODE ISLAND 2 x 1 COMBINED CYCLE	Project 238926	Drawing WMB-01
NATURAL GAS FIRED WATER MASS BALANCE 2 X 1 GE HA.02 - 992 MW - Dry Cooling Average Ambient Conditions		Rev C



Notes:

1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. Under normal operating conditions there is no continous flow, however, flow will occur in some instances and may be approx. 1 gpm.
5. Flow rate was determined based on limited water quality data available. Additional water quality information is required before detailed design in order to determine if pre-treatment of this water is required. It is assumed that if any pretreatment is required, that it will occur at the well head before the plant is supplied.
6. Under normal operating conditions, there is no continuous flow.
7. Under normal operating conditions, there is no flow. However, under emergency conditions, flow can be 13 gpm.

FOR CONCEPTUAL DESIGN ONLY

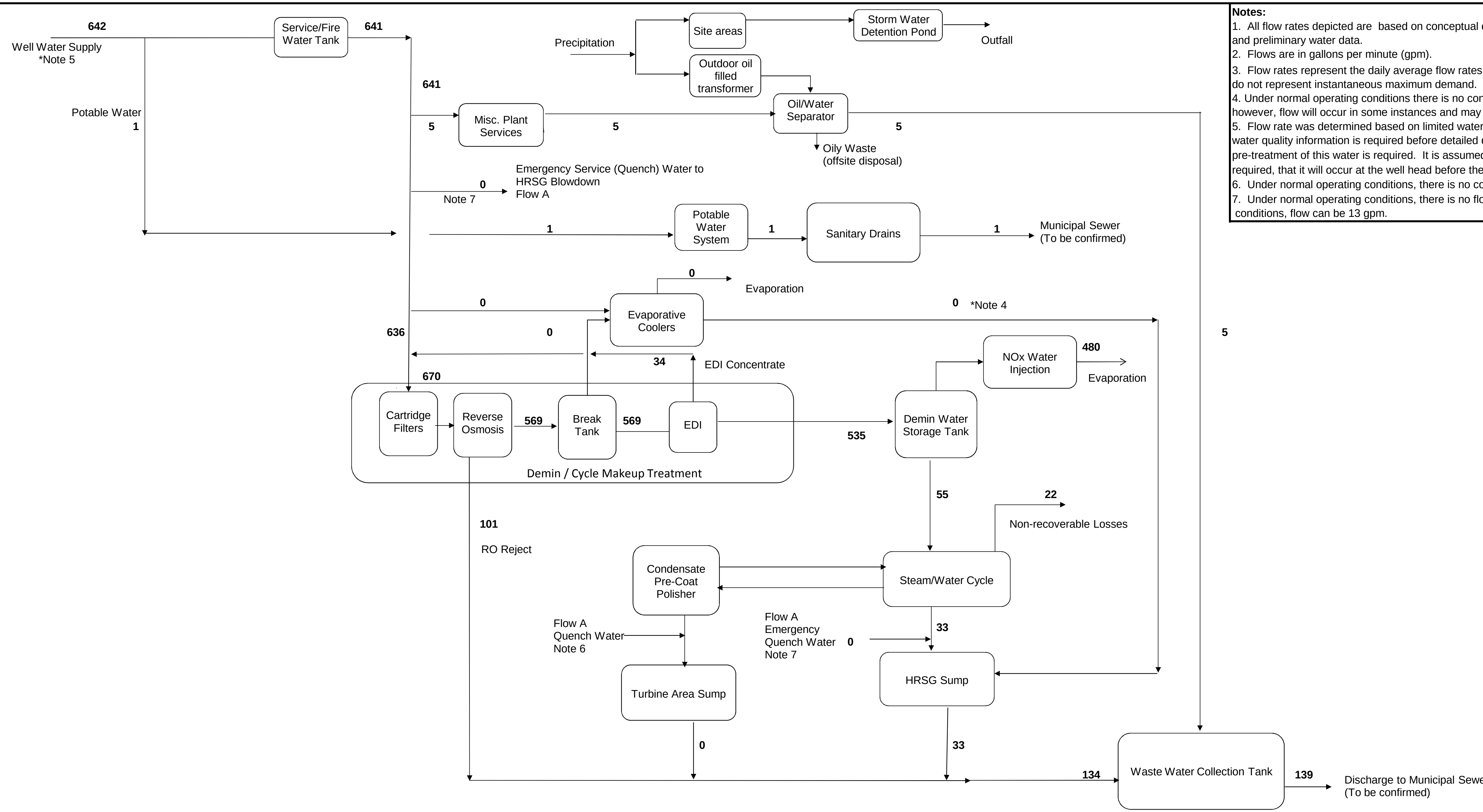
Conceptual Design Basis	7/22/15	
Demin Water Makeup Demand	1.5% of Main Steam Flow	
Potable Water Demand	20 personnel, 50 gal per day, 3 shifts	
Ambient Conditions	90°F / 50%RH	
Cycles of Concentration	N/A	

Invenergy

RHODE ISLAND 2 x 1 COMBINED CYCLE	Project 238926	Drawing WMB-03
NATURAL GAS FIRED WATER MASS BALANCE 2 X 1 GE HA.02 - 1,000 MW - Dry Cooling Summer Ambient Conditions		Rev C

Notes:

1. All flow rates depicted are based on conceptual design and preliminary water data.
2. Flows are in gallons per minute (gpm).
3. Flow rates represent the daily average flow rates and do not represent instantaneous maximum demand.
4. Under normal operating conditions there is no continous flow, however, flow will occur in some instances and may be approx. 1 gpm.
5. Flow rate was determined based on limited water quality data available. Additional water quality information is required before detailed design in order to determine if pre-treatment of this water is required. It is assumed that if any pretreatment is required, that it will occur at the well head before the plant is supplied.
6. Under normal operating conditions, there is no continuous flow.
7. Under normal operating conditions, there is no flow. However, under emergency conditions, flow can be 13 gpm.



FOR CONCEPTUAL DESIGN ONLY

HDR	Conceptual Design Basis	7/22/15		Invenergy	RHODE ISLAND 2 x 1 COMBINED CYCLE	Project 238926	Drawing WMB-04
	Demin Water Makeup Demand	1.5% of Main Steam Flow					
	Potable Water Demand	20 personnel, 50 gal per day, 3 shifts			WATER MASS BALANCE - 1 CT on GAS, 1 CT on FUEL OIL		Rev
	Ambient Conditions	20°F / 60%RH			2 X 1 GE HA.02 - 1,017 MW - Dry Cooling		
	Cycles of Concentration	NA			Winter Ambient Conditions - Full Load		C

Appendix D

Wetlands

Photograph No.: 1
Northwestern Wetland 1

Photograph No.: 2
Woods road in eastern project area. Wetland 1 located to the left.

Photograph No.: 3
Iron Mine Brook at Wallum Lake Road, Wetland 1

Photograph No.: 4
Unnamed intermittent stream in northeastern Wetland 1

Photograph No.: 5
Wetland 2, eastern arm, south of woods road

Photograph No.: 6
Eastern hemlock stand in northeastern portion of Wetland 2

Photograph No.: 7
Perennial stream in western arm of Wetland 2

Photograph No.: 8
Upland adjacent to western arm of Wetland 2

Photograph No.: 9
Wetland 2 shrub/emergent wetland in Algonquin Gas Transmission Line

Photograph No.: 10
Wetland 3

Appendix E

Noise Assessment Report

2015

Noise Level Evaluation for the Clear River Energy Center

Michael Theriault Acoustics, Inc.

401 Cumberland Avenue

Suite 1205

Portland, Maine 04101

Report No. 1955

October 2015

Contents

Tables:

Figures:

Appendices:

N1	Burrillville Noise Ordinance
N2	Noise Survey Meteorological Conditions
N3	Equipment Specifications
N4	Equipment Calibration Certificates
N5	Short-Term Noise Level Measurements
N6	Construction Noise Level Modeling Results
N7	Operation Noise Level Modeling Results
N8	Adding Decibels

Abbreviations

ACC	Air Cooled Condenser
ANSI	American National Standards Institute
Aux	Auxiliary
BCS	Burrillville Compressor Station
CCW	Closed Cooling Water
CREC	Clear River Energy Center
CT	Combustion Turbine
dB	Decibels
dBA	Decibels, A-Weighted
dBC	Decibels, C-Weighted
EEI	Edison Electric Institute
EFSB	Energy Facility Siting Board
EPA	U.S. Environmental Protection Agency
EPC	Engineering, Procurement and Construction
Facility	Clear River Energy Center
FD	Forced Draft
GE	General Electric
GSU	Generator Step-Up
HRSG	Heat Recovery Steam Generator
HUD	Department of Housing and Urban Development
HVAC	Heating, Ventilation and Air Conditioning
Hz	Hertz
Invenergy	Invenergy, LLC

Abbreviations (Continued)

ISO	International Organization for Standardization
L_{AEQ}	Equivalent Energy Level, A-Weighted
L_{A50}	Sound Level exceeded 50% of the Measurement Time, A-Weighted
L_{A90}	Sound Level exceeded 90% of the Measurement Time, A-Weighted
L_{CEQ}	Equivalent Energy Level, C-Weighted
L_{DN}	Day-Night Level
LORS	Laws, Ordinances, Regulations and Standards
Lp	Sound Pressure Level
Lw	Sound Power Level
mbar	Millibars
MTA	Michael Theriault Acoustics, Inc.
MW	Megawatt
NED	National Elevation Dataset
NLE	Noise Level Evaluation
NSA	Noise Sensitive Area
PWL	Sound Power Level
SCR	Selective Catalytic Reduction
SPL	Sound Pressure Level
STC	Sound Transmission Class
STG	Steam Turbine Generator
USGS	United States Geological Survey
WHO	World Health Organization

1.0 Executive Summary

Invenergy, LLC (Invenergy) is proposing to design and construct the Clear River Energy Center (CREC), a nominal 900 to 1,000-megawatt combined-cycle, natural gas-fired power generation facility designed for base load operation and sited in the Town of Burrillville, Providence County, Rhode Island.

An evaluation was conducted to examine the potential for construction and operation of the CREC ("Facility") to subject sensitive land uses (e.g., residences, care centers, schools, etc.) to interference from noise. The evaluation consisted of: 1) identifying all laws, ordinances, regulations and standards (LORS) governing noise emissions for CREC; 2) determining all Noise Sensitive Areas (NSAs) in the immediate vicinity of the site potentially impacted by noise; 3) monitoring background ambient noise levels at these locations; 4) predicting project-related (construction and operation) noise levels at NSA's using computer-generated acoustical models; 5) comparing project-related noise levels to applicable regulations, existing ambient noise levels, and various noise impact criteria; and 6) assessing any need for additional noise control measures in order to comply with performance standards and minimize potential impact.

Noise produced during operation of the CREC must conform to levels approved by the Rhode Island Energy Facilities Siting Board, (EFSB). As such, a review of approvals for combustion turbine merchant power projects similar to the CREC was conducted to determine noise limits imposed on other power generating facilities. Those limits ranged from 40 to 49 at the nearest residences. The Town of Burrillville also has a performance standard as established in their Code of Ordinances, which generally limits both broadband (A-weighted) and octave-band Facility noise levels at nearby residences to an equivalent level of 43 dBA. Burrillville's Code however, is not applicable in instances where "The facility generating the noise has been granted a permit or license by a federal and/or state agency and the authorization to operate within set noise limits". In the case of the CREC, permitting is governed by the EFSB. Nonetheless, the EFSB will seek the Town's opinion on the project, and the Town will likely rely on their Code of Ordinances to judge CREC's suitability. As such, Invenergy examined the design approaches needed to comply with their ordinance. Although achieving the broadband portion of the code (43 dBA) was feasible with extensive controls, including placing the combustion turbines within buildings, attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable and even beyond engineering feasibility. In an effort to arrive at a noise level design goal that was both respectful of the Code's intent to protect the community from excessive noise, yet commercially feasible to achieve and consistent with previous EFSB approvals, the Project proposes to comply with the same stringent noise limit imposed by the EFSB on Burrillville's Ocean State Power Project, namely 43 dBA at the closest residence, which is also the equivalent broadband limit for the Code of Burrillville. The proposed noise limit, in comparison to absolute limits for other US jurisdictions, is among the lowest we have encountered.

The nearest NSAs to CREC are located in five general areas *(refer to Figure 2)*: (1) residences along Wallum Lake Road to the northeast, (2) residences along Jackson Schoolhouse Road to the east and southeast, (3) residences in the Doe Crossing Drive area to the west, (4) residences along Buck Hill Road to the north, and (5) residences further south along Jackson Schoolhouse Road

An ambient noise level survey was conducted from April 21st through April 24th, 2015 in Burrillville to characterize the existing acoustical environment at the nearest NSAs. Results of short-term noise monitoring (20-minute intervals) showed that background (L_{A90}) ambient levels at noise sensitive receivers ranged from the high-20's to high-40's (dBA) during daytime hours, and from the low-30's to mid-40's (dBA) during nighttime hours *(refer to Table 9).*

A three-dimensional, computer-generated acoustical model of construction activity was developed using SoundPLAN® 7.3 and industry-standard prediction methods to estimate noise levels at nearby receivers for each of five major construction phases. Noise levels during CREC construction are expected to be near or below current daytime ambient noise levels (L_{AEQ}). While construction noise may occasionally be discernible, it is not expected to increase ambient noise levels significantly. The majority of construction will take place during daytime hours (i.e., when the risk of sleep disturbance and interference with relaxation activities is low). As such, construction of the CREC is not expected to result in any significant community noise impact.

A three-dimensional, computer-generated acoustical model of CREC operations was also developed, in order to predict noise levels at off-site receivers and to identify any need for additional mitigation measures. Analysis results showed that given the proposed acoustical design of the Facility, CREC noise levels during full load operation and under favorable sound propagation conditions are expected to range from about 34 to 43 dBA at nearby residences. These levels are appreciably lower than limits found in most laws, ordinances, regulations and standards promulgated throughout the U.S. for the control of industrial noise at residential land uses. Moreover, CREC levels are consistent with: 1) outdoor noise level guidelines historically recommended by acoustical consultants; 2) criteria for the avoidance of speech interference both outdoors and indoors; 3) criteria for the avoidance of sleep disturbance; and 4) criteria for avoidance of low-frequency noise impacts. The Facility is also not expected to produce tonal noise. Furthermore, the maximum predicted CREC noise level (43 dBA) was found to be 7 decibels lower than Burrillville Compressor Station (BCS) full-load noise levels at M1 (50 dBA). In general, CREC noise levels are expected to be significantly lower than full-load BCS noise levels at nearby residences. Finally, although existing ambient noise levels for some receivers may increase during CREC operation, the overall magnitude and spectral content of CREC noise is not expected to result in significant community noise impact.

In order to achieve these predicted outcomes, the proposed extensive acoustical design of the CREC includes installation of the combustion turbines and steam turbines within buildings; high-performance silencers installed within the air intake ductwork of the combustion turbines to reduce high-frequency (spectral) compressor and turbine blade aerodynamic noise; silencers installed on fans providing ventilation air for the combustion turbine enclosure compartments; low-noise air cooled condensers and closed cooling water heat exchangers; combustion turbine exhaust diffuser noise walls; combustion turbine exhaust noise attenuated via the SCR/HRSG units and high-performance exhaust stack silencers; auxiliary boiler FD fan intake silencer banks; low-noise GSU transformers; acoustical shrouds over the HRSG transition ducts; buildings enclosing the auxiliary boiler, gas compressors, boiler feed water pumps and water treatment equipment; and acoustically louvered ventilation openings for the auxiliary boiler and generation buildings.

During CREC commissioning, the Engineering, Procurement and Construction (EPC) Contractor for the project will conduct a noise level performance test to confirm that CREC noise levels comply with EFSB performance standards for noise.

1.1 Author Qualifications

This report was co-authored by John Orgar, Michael Hankard, and Michael D. Theriault of Michael Theriault Acoustics, Inc. (MTA). Since 1998, MTA has provided environmental noise control consulting services to the North American electric power industry, including preparation of noise impact studies for owners and developers; implementation of large-scale noise control programs for architectural engineering firms; noise level compliance testing for constructors; and noise control due diligence reviews for municipalities and financial underwriters. MTA has advised clients on hundreds of energy facilities, ranging in size from 1 to 2,000 megawatts, many from conceptual design through final testing, using combustion turbine, wind turbine, biomass, and conventional fossil-fueled technologies.

1.2 General Information on Noise

In order to provide the reader a better understanding of results presented in this report, the following section discusses how environmental noise is measured, described and predicted.

Noise. Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that interferes with or disrupts normal activities. Noise is measured using a standardized instrument called a 'sound level meter'. All sound level meters are equipped with microphones that detect minute changes in atmospheric pressure caused by the vibration of air molecules. Healthy human hearing can detect pressures as low as 0.00002 Pascals (threshold of hearing) up to 200 Pascals (painfully loud).[1] Since this range is enormous, (ten million to one) sound pressures are reported using a logarithmic scale, which compresses the numbers and keeps them more manageable. Once converted, they are referred to as sound pressure *levels*, followed by 'decibels' (abbreviated dB) as the unit of measure. On a logarithmic scale, the threshold of hearing and the threshold of pain become 0 and about 120 decibels, respectively.

A-Weighted Sound Levels. Noise is generally characterized by amplitude (loudness) and by frequency (pitch). Amplitude can be stated using various human-perception scales, similar to reporting temperature in terms of wind chill or reporting humidity in terms of dew point. The latter are better indicators of perceived coldness or dampness, respectively. Similarly, sound level measurements are often reported using the 'A-weighting' scale of a sound level meter. A-weighting slightly boosts high-pitched sound,

---

1 - A Pascal is a unit of pressure (one Pascal is equivalent to about 0.02 lbs/ft^2). One Pascal of pressure will produce a sound pressure level of 94 dB.

while reducing low frequency components (similar to the way stereo bass and treble controls work) providing a better indicator of perceived loudness at relatively modest volumes. These measures are called A-weighted levels (abbreviated dBA). A-weighted levels for familiar sources and activities are provided in Table 1.

Frequency Analysis. To better approximate human hearing, sound level meters are often equipped with octave band filters. Octave band filters divide our hearing range into nine separate frequency or 'pitch-bins' as summarized in Table 2. A helpful analogy is imagining a piano with only nine keys to represent the full range of sound. As discussed in Section 3.4 (*Operation Noise Level Analysis*), octave band noise levels for all major pieces of CREC equipment were used to develop a computer-generated acoustical model of the Facility.

Table 1: Common Sound Levels/Sources[2]

Thresholds/ Noise Sources	Noise Level (dBA)
Shotgun (at shooter's ear) - Painfully Loud	140
Loud Rock Band	130
Auto Horn (3 feet) - Threshold of Pain	120
Chain Saw, Noisy Snowmobile	110
Lawn Mower (3 feet), Noisy Motorcycle (50 feet)	100
Ambulance Siren (100 feet)	90
Pneumatic Drill (50 feet), Busy Urban Street, Daytime	80
Vacuum Cleaner (3 feet)	70
Large Air Conditioning Unit (20 feet), Conversation (3 feet)	60
Urban Residential Area, Light Auto Traffic (100 feet)	50
Library, Quiet Residence	40
Soft Whisper	30
Slight Rustling of Leaves	20
Broadcasting Studio	10
Threshold of Hearing	0

2 - Adapted from *Handbook of Acoustical Measurements and Noise Control, Third Edition*. McGraw Hill, Inc., Harris, Cyril M., 1991; *Master Handbook of Acoustics,* 2nd Edition, Tab Books, Blue Ridge Summit, PA., Everest, Alton, F., 1989; *Noise and Vibration Control,* Institute of Noise Control Engineering, McGraw Hill, Beranek, L.L. 1998.

Sound levels are sometimes measured using one-third octave band filters, in order to detect the presence of tones, which can be characterized as rumble, hum, buzz, whine or screech. As the name implies, one-third octave band filters divide octaves into three additional 'bins' for greater resolution. An analogous piano would have twenty-seven 'keys' representing the entire musical scale.

Table 2: Octave Band Filter Frequency Ranges	
Octave Band Center Frequency	**Frequency Range**
31.5 Hz	22 Hz - 44 Hz
63 Hz	44 Hz - 88 Hz
125 Hz	88 Hz - 177 Hz
250 Hz	177 Hz - 355 Hz
500 Hz	355 Hz - 710 Hz
1000 Hz	710 Hz - 1,420 Hz
2000 Hz	1420 Hz - 2,840 Hz
4000 Hz	2,840 Hz - 5,680 Hz
8000 Hz	5,680 Hz - 11,360 Hz

Statistical Levels. Environmental noise levels constantly change over time and at any given moment are often combinations of natural sounds from birds, insects or tree rustle; noise from local or distant traffic; and/or from industrial, commercial or residential activities. In order to separate low-level (amplitude), constant (temporal) sources of noise (the din of distant traffic, for example) from louder, short-duration events (such as aircraft flyovers or vehicle passbys) statistical or 'exceedance' measurements are often used. These measures help describe the 'average' level of noise, as well as the range of highs to lows for any given measurement period. As will be reported in Section 2.0 (*Affected Environment*), statistical levels were used to quantify background, (i.e., the lowest) ambient noise levels measured in the vicinity of the CREC. As shown in Figure 1:

L_{10} ('L-Ten') is the level exceeded 10% of the time, (i.e., levels are higher than this value only 10% of the measurement time.) The L_{10} typically represents the loudest and shortest noise events occurring in the environment, such as car and truck passbys or aircraft flyovers.

L_{50} ('L-Fifty') is the sound level exceeded 50% of the time. Levels will be above and below this value exactly one-half of the measurement time, and therefore the L_{50} is sometimes referred to as the 'median' sound level.

L_{90} ('L-Ninety') is the sound level exceeded 90% of the time and is often called the 'background' sound level. Levels are higher than this value most of the measurement time, so the L_{90} represents the relatively low-level, constant noise present in the environment, discernible only when intermittent or varying noises such as birdcalls, car passbys or aircraft flyovers cease.

Equivalent Energy Level. Noise levels may also be reported in terms of "equivalent energy levels" or L_{AEQ}. An L_{AEQ} is a single, calculated, *constant* value that is 'equal' in energy to the actual fluctuating noise for any given measurement period. The letter 'A' in the subscript denotes that the metric is A-weighted. As shown in Figure 1, a constant noise level of 50 dBA (L_{AEQ}) for a period of 1-minute is equivalent in energy to the fluctuating noise level for the same period, produced by the car and truck passes, which vary in level from less than 30 to more than 60 dBA. The L_{AEQ} typically falls between the L_{10} and L_{50} and is the base metric commonly used to establish other measures of environmental noise, such as the Day-Night level (L_{DN}).

Day-Night Level. The Day-Night Level or L_{DN} is a single, calculated, constant value of noise that is computed by averaging together twenty-four (24) hour-long L_{AEQ} samples. Before averaging the 24 hours of L_{AEQ} data together however, a 10-decibel 'penalty' is added to the samples collected between 10 p.m. and 7 a.m. in order to account for the potential of increased disturbance when people are resting, relaxing or sleeping. L_{DN} is the preferred metric for the assessment of environmental noise by federal bureaus such as the Environmental Protection Agency (EPA) and the Department of Housing and Urban Development (HUD). As will be reported in Section 3.5 (*Operation Noise Impact Analysis*) calculated L_{DN} values for CREC operations were used to assess the acceptability of Facility noise levels in the adjacent residential neighborhoods.

Sound Power and Sound Pressure Levels. Sound power level (PWL) is a single number that ranks how much sound energy is produced by a piece of equipment, *independent* of the surroundings or environment, and allows one piece of equipment to be directly compared with another. As a *result* of sound power, sound pressure is the measureable vibration of air molecules at a specific location, *dependent* on both the surrounding environment as well as distance from the source.

Sound power level is analogous to the *wattage* of a light bulb, whereas sound pressure level is analogous to *brightness*. When a 75-watt light bulb is placed in a room painted white or black, its electrical power remains the same regardless of the room color. Moreover, its electrical power is still 75-watts regardless of the distance one moves from the bulb. Just like the wattage of a light bulb, the sound power level of a vacuum cleaner will remain the same whether its placed in a contemporary home with sparse furnishings and hardwood floors (i.e., analogous to a room painted white - little absorbing material and many reflections) or placed in a colonial home with rugs, overstuffed chairs, and paintings on the walls, (i.e., analogous to a room painted black - many absorbing materials and few reflections.) In contrast however, the sound pressure level of the vacuum cleaner will change depending on the home it is placed and the distance from it, just like the apparent brightness of a light bulb changes as either the room color changes or as the distance to the bulb is varied.

As discussed in Section 3.4 (*Operation Noise Levels*), sound power levels for major pieces of CREC equipment were used to develop a computer-generated acoustical model of the Facility.

1.3 Federal, State and Local Performance Standards

A review of all noise control laws, ordinances, regulations and standards (LORS) applicable to the CREC was conducted, as presented in the following section.

Federal LORS for Noise Control. No noise-related federal LORS apply to the CREC. Nonetheless, as a result of the Noise Control Act of 1972, the U.S. Department of Environmental Protection (EPA) developed noise exposure guidelines for residential and similar land uses, stated in terms of Day-Night levels (L_{DN}) and summarized in Table 3. In brief, EPA concluded that exposure to outdoor noise levels at or below L_{DN} = 55 dBA or to indoor noise levels at or below L_{DN} = 45 dBA, is satisfactory to protect public health and welfare since such exposure would not normally result in adverse community reaction, complaint, or annoyance in communities with average background ambient noise levels (i.e., those observed in urban residential environments). Similarly, the Department of Housing and Urban Development (HUD) considers sites where L_{DN} levels do not exceed 65 dBA to be acceptable for housing. Although EPA and HUD guidelines do not constitute enforceable regulations, they nonetheless represent valid criteria for evaluating potential effects of project-related noise on public health and welfare.

Table 3: USEPA Noise Levels Identified to Protect Public Health and Welfare[3]		
Effect	***Level***	***Area***
Hearing loss	$L_{EQ(24)} \leq 70$ dB	All areas.
Outdoor activity interference	$L_{DN} \leq 55$ dB	Outdoors in residential areas and farms, other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use.
	$L_{EQ(24)} \leq 55$ dB	Outdoor areas where people spend limited amounts of time, such as school yards, playgrounds, parks, etc.
Indoor activity interference and annoyance	$L_{DN} \leq 45$ dB	Indoor residential areas.
	$L_{EQ(24)} \leq 45$ dB	Other indoor areas with human activities, such as schools.

State, County and Local LORS for Noise Control. At the state level, noise produced during operation of the CREC must conform to limits approved by the Rhode Island Energy Facilities Siting Board, (EFSB). At the county level, no numerical (decibel) noise limits have been promulgated which are applicable to the CREC. At the local level, the Town of Burrillville regulates noise through Chapter 16, Article II of their Code of Ordinances.

EFSB. Noise produced during operation of the CREC must conform to levels acceptable to the Rhode Island Energy Facilities Siting Board, (EFSB). As such, a review of approvals for combustion turbine merchant power projects similar to the CREC, (including Ocean State Power, RI Hope Energy and the Tiverton Power Project) was conducted to determine noise limits imposed on other power generating facilities. As summarized in Table 4, those limits ranged from 40 to 49 at the nearest residences.

---

3 - *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety,* United States Environmental Protection Agency, Office of Noise Abatement and Control, USEPA Report 550/9-74-004 (March 1974).

Table 4 – Summary of Residential Noise Level Limits from EFSB Approvals		
Project Name	**Noise Level at Nearest Residences (dBA)**	**Distance to Nearest Residence (feet)**
Ocean State Power	43	1,200
RI Hope Energy	49	1,500
Tiverton	40	3,700

Town of Burrillville. The Town of Burrillville, through their Code of Ordinances, generally limits both broadband (A-weighted) and octave-band Facility noise levels at nearby residences to an equivalent level of 43 dBA. Burrillville's Code however, is not applicable in instances where "The facility generating the noise has been granted a permit or license by a federal and/or state agency and the authorization to operate within set noise limits". In the case of the CREC, permitting is governed by the EFSB. Nonetheless, the EFSB will seek the Town's opinion on the project, and the Town will likely rely on their Code of Ordinances to judge CREC's suitability.

Chapter 16, Article II of the Town of Burrillville Code of Ordinances, specifies the limits for noise emissions at receiving property boundaries according to the land use of the receiver, and the time period of noise source operation. Specifically, CREC noise emissions at receiving residential property boundaries during nighttime hours would be limited to the broadband (A-weighted) and octave-band levels in Table 5. Moreover, for noise sources that emit a tone, these noise limits are reduced by five (5) decibels. Tones are characterized as any sound that can be distinctly heard as a single pitch or set of pitches, and occur if any octave band noise level exceeds both adjacent octave bands by five (5) or more decibels. The Burrillville noise ordinance can be found in Appendix N1 (*Burrillville Noise Ordinance*).

Table 5: Town of Burrillville Nighttime Residential Noise Limits (dB)									
Octave-Band Center Frequency (Hz)									**A-Weight**
31.5	63	125	250	500	1000	2000	4000	8000	
53	52	48	44	40	37	33	29	28	43

The Burrillville noise limits, specifically in the low-frequency octave-bands (31.5 Hz, 63 Hz, and 125 Hz), are among the most stringent we have encountered in the United States. Compared to octave band noise limits used in other U.S. jurisdictions (*see Table 6*), the Burrillville Ordinance is significantly more restrictive. This is particularly relevant since low-frequency emissions are generally more difficult to mitigate than are high-frequency noise emissions. Moreover, there is questionable benefit to establishing such stringent limits in these lower frequency bands, since the levels are considerably lower than needed to minimize annoyance.

As part of a screening analysis, a preliminary computer-generated, three-dimensional acoustical model of the CREC showed that although achieving the broadband portion of the code (43 dBA) was feasible with extensive controls, including placing the combustion turbines within buildings, attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable. Moreover, it is possible that specific necessary control measures (CTG air intake silencing; HRSG exhaust stack silencing; high-transmission loss building roofs) are beyond engineering feasibility. This is primarily due to the increase in back pressure additional air intake and exhaust silencing would create, potentially exceeding manufacturer's safe operating limits.

Table 6: Octave-Band Noise Level Limits by Other Regulating Bodies (dB)										
	Octave-Band Center Frequency (Hz)									**A-Weight**
	31.5	63	125	250	500	1000	2000	4000	8000	
Appleton, WI[4]	74	73	68	63	57	51	46	42	39	60
Fairfax County, VA[5]	70	69	64	59	53	47	42	38	35	55
Illinois State[6]	69	67	62	54	47	41	36	32	32	51
New Jersey State[7]	86	71	61	53	48	45	42	40	38	50
Portland, OR[8]	68	65	61	55	52	49	46	43	40	55
Seminole County, FL[9]	68	67	66	59	52	46	37	26	17	55
Burrillville, RI	**53**	**52**	**48**	**44**	**40**	**37**	**33**	**29**	**28**	**43**

4 - Appleton Municipal Code, Chapter 12, Article IV; 2001. Limit for industrial emitter onto residential zone between 10 p.m. and 7 a.m.

5 - Fairfax County Code, Chapter 108, Article 4; 1976. Limit for any noise source at residential receiver.

6 - Illinois Administrative Code, Title 35, Part 901; 2007. Limit for industrial (Class C) emitter to residential (Class A) receiver between 10 p.m. and 7 a.m.

7 - New Jersey Administrative Code, Title 7, Chapter 29; 2012. Limit for industrial emitter to residential receiver between 10 p.m. and 7 a.m.

8 - Portland City Code, Title 18; 2010. Limit for continuous industrial emitter to residential receiver between 10 p.m. and 7 a.m. Octave bands are enforced at the discretion of the Noise Control Officer.

9 - Seminole County Land Development Code, Chapter 30, Part 68; 2014. Limit at industrial property lines abutting residential districts.

Effects of Environmental Noise. In addition to local zoning standards, noise can be evaluated in terms of its potential for creating interference with common activities such as speech or sleep.

Speech Interference Criteria. Interference with speech communication has long been recognized as an important noise impact consideration. Speech spoken in relaxed conversation is fairly well intelligible when background (i.e., Facility) noise levels do not exceed 55 dBA.[10] Similarly, to be able to hear and understand spoken messages indoors, it is recommended that background levels do not exceed 45 dBA (L_{AEQ}). Since the noise reduction for typical homes or buildings with partially open windows is about fifteen (15) decibels[11], an exterior noise level up to 60 dBA would result in acceptable indoor levels for good speech communication, (i.e., 45 dBA $_{\text{Interior Noise Level}}$ + 15 dBA $_{\text{Open Window Noise Reduction}}$ = 60 dBA $_{\text{Exterior Noise Level}}$).

Community Noise Guidelines & Sleep Interference Criteria. In 1999, the World Health Organization (WHO) recommended that outdoor sound levels during nighttime periods not exceed 45 dBA in order to avoid sleep disturbance with bedroom windows open.[12] Since the noise reduction for typical homes with partially open windows is about 15 decibels, WHO guidelines result in indoor levels of about 30 dBA, which is consistent with levels historically recommended by acoustical consultants as acceptable for indoor settings and sufficiently low for the avoidance of sleep interference.[13, 14]

---

10 - *Community Noise*, Archives of the Center for Sensory Research, Berglund, B., & Lindvall, T. (Eds.), 1995

11 - *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety,* United States Environmental Protection Agency, Office of Noise Abatement and Control, USEPA Report 550/9-74-004 (March 1974).

12 - *Guidelines For Community Noise*, World Health Organization, Berglund, B., & Lindvall, T. Schwela, D. (Eds.), 1999.

13 - *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, United States Environmental Protection Agency, Office of Noise Abatement and Control, USEPA Report 550/9-74-004 (March 1974).

14 - *Community Noise*, Archives of the Center for Sensory Research, Berglund, B., & Lindvall, T.

Low-Frequency Noise Disturbance Criteria. In order to avoid excessive low-frequency noise (sometimes characterized as 'rumble'), C-weighted[15] levels should be limited to about 75 dBC.[16] Likewise, the maximum difference observed between C-weighted (dBC) and A-weighted (dBA) levels should not exceed twenty (20) or more decibels.

Changes in Noise Levels. The average ability of an individual to distinguish changes in noise levels is summarized in Table 7. Typically, changes less than 3-decibels are barely perceptible to most listeners outside laboratory conditions, whereas a 10-decibel change is normally perceived as a doubling (or halving) of loudness. Changes to community noise levels due to operation of the CREC are examined in Section 3.5, (*Operation Noise Impact Analysis*).

Table 7: Average Ability to Perceive Changes in Noise Levels[17]	
Change in Sound Level (dBA)	**Human Perception to Change in Sound Level**
2 to 3	Barely Perceptible
5	Readily Noticeable
10	Doubling or Halving of Loudness
≥ 10	Highly Perceptible

Recommended Noise Level Design Goal. As previously discussed, noise produced during operation of the CREC must conform to levels approved by the Rhode Island Energy Facilities Siting Board, (EFSB). A noise level ranging from 40 to 49 dBA at the nearest residences was historically permitted by the EFSB for similar power generating facilities.

Eds.), 1995.

15 - Similar to A-weighting filters, C-weighting is a type of 'human-perception' filter used in sound level meters, which places greater emphasis on the contribution of low-frequency noise components.

16 - *Gas Turbine Installation Sound Emissions*, ANSI B133.8-1997 (R2001).

17 - *Fundamentals and Abatement of Highway Traffic,* Bolt, Beranek and Newman, Inc., Report No. PB-222-703, June 1973.

The Town of Burrillville through their Code of Ordinances, generally limits both broadband (A-weighted) and octave-band Facility noise levels at nearby residences to an equivalent level of 43 dBA. Although Burrillville's code is supplanted by EFSB jurisdiction, Invenergy nonetheless examined the design approaches needed to comply with their ordinance. Burrillville's noise limits, specifically in low-frequency octave-bands (31.5 Hz, 63 Hz, and 125 Hz), are among the most stringent we have encountered and although achieving the broadband portion of the code (43 dBA) was feasible with extensive control, including enclosing the combustion turbines within buildings, attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable and even beyond engineering feasibility.

In an effort to arrive at a noise level design goal that was both respectful of the Code's intent to protect the community from excessive noise, yet commercially feasible to achieve and consistent with previous EFSB approvals, the Project proposes to comply with the same stringent noise limit imposed by the EFSB on Burrillville's Ocean State Power Project, namely 43 dBA at the closest residence, which is also the equivalent broadband limit for the Code of Burrillville. The proposed noise limit, in comparison to absolute limits for other US jurisdictions, is among the lowest of any promulgated.

Establishing a noise level design goal of 43 dBA at residential receivers would ensure that CREC noise emissions will be consistent with: 1) the broadband (A-weighted) limits of the Burrillville noise ordinance; 2) the noise limits for previously approved EFSB projects, 3) Federal guidelines for community noise (EPA and HUD); and 4) internationally recognized guidelines for minimizing speech and sleep disturbance. Achieving 43 dBA would still require extensive noise controls, including enclosing the combustion turbines within buildings, as discussed in Section 3.4 (*Operation Noise Level Analysis*).

2.0 Affected Environment

2.1 Description of Study Area

The proposed Facility is located in the Town of Burrillville, Rhode Island, which, as shown in Figure 2, is located in the northwest corner of the state. Burrillville is bordered by Massachusetts and Connecticut, and is approximately 20 miles from Providence, Rhode Island and 45 miles from Boston, Massachusetts.

The Facility is sited on a parcel of undeveloped land located on the southwest side of Wallum Lake Road (State Highway 100), four miles west of the center of town, as shown in Figure 3. The undeveloped parcel is located adjacent to and south of the existing Burrillville Compressor Station (BCS). Neighboring land in all other directions is heavily forested. Land use is primarily rural and recreational, due to some nearby state owned land and small lakes. It appears there are both permanent and non-permanent residences (i.e., primarily utilized as vacation or second homes), and there is a significant amount of foliage/trees between the site and surrounding residences.

The nearest residences are located approximately 2,300 feet to the east and northeast along Wallum Lake Road. Other more distant residences are located along Jackson Schoolhouse Road to the southeast, Doe Crossing Drive to the west, and Buck Hill Road to the north. The topography of the site is relatively flat, changing only about 100 feet between the Facility and area residences.

2.2 Noise Sensitive Areas

Noise sensitive areas (NSAs) potentially exposed to sound level increases as a result of the proposed Facility are the focus of this noise level evaluation (NLE). NSAs are associated with indoor and/or outdoor activities that may be subject to interference from noise and include residential dwellings, hotels, hospitals, care facilities, educational facilities, places of worship and libraries. (Industrial, commercial, and agricultural land uses are generally not considered sensitive to noise.) As summarized in Table 8, the nearest NSAs to the proposed Facility are located in five general areas: (1) residences along both sides of Wallum Lake Road to the northeast, (2) residences along Jackson Schoolhouse Road to the east and southeast, (3) residences in the Doe Crossing Drive area to the west, (4) residences on both sides of Buck Hill Road to the north, and (5) residences further south along Jackson Schoolhouse Road.

2.3 Ambient Noise Level Survey

An ambient noise level survey was conducted from April 21st through April 24th, 2015 in Burrillville, Rhode Island to characterize the existing acoustical environment at the nearest NSAs.

Table 8: Nearest Noise-Sensitive Areas		
Area	**Description**	**Location[18]**
1	Single family residences along Wallum Lake Road (Route 100).	Closest residences located approximately 2,300 feet northeast of site.
2	Single family residences along Jackson Schoolhouse Road.	Closest residences located ~3,500 feet east of site.
3	Single family residences along Wilson Trail and Doe Crossing Drive.	Closest residences located ~4,300 feet west of site.
4	Single family residences along Buck Hill Road.	Closest residences located ~4,300 feet north of site.
5	Single family residences along Jackson Schoolhouse Road (further south).	Closest residences located ~7,200 feet southeast of site.

Measurement Locations. As depicted in Figure 3, a total of five measurement locations were selected to acoustically represent each of the above-described noise-sensitive receiver areas. The following describes specifics for each measurement location.

Location 1: Located at the entrance to the proposed Facility and the existing gas compressor station, measurements collected here are representative of the single family homes along Wallum Lake Road. The nearest of these residences is along the northeast side of Wallum Lake Road, approximately 2,300 feet from the center of the Facility. The view from this area towards the Facility is shielded by vegetation.

Location 2: Located on Jackson Schoolhouse Road, measurements collected here are representative of the single family residences on the northernmost one-mile section of Jackson Schoolhouse Road. The nearest of these residences is along the west side of Jackson Schoolhouse Road, approximately 3,500 feet from the center of the Facility. The view from this area towards the Facility is shielded by vegetation.

Location 3: Located on Doe Crossing Drive, measurements collected here are representative of the single family residences on Staghead Drive, Wilson Trail, Deer Run Drive, and Doe Crossing Drive. The nearest of these residences is along the southeast side

18 - All distances are referenced from the center of the proposed Facility and estimated using GoogleEarthPro™ software.

of Wilson Trail, approximately 4,300 feet from the center of the Facility. The view from this area towards the Facility is shielded by vegetation.

Location 4: Located on Buck Hill Road, measurements collected here are representative of the single family residences on Buck Hill Road, Wallum Lake Road, and Scannell Drive. The nearest of these residences is along the south side of Buck Hill Road, approximately 4,300 feet from the center of the Facility. The view from this area towards the Facility is shielded by vegetation.

Location 5: Located on Jackson Schoolhouse Road, measurements collected here are representative of the single family residences further south on Jackson Schoolhouse Road. The nearest of these residences is along the west side of Jackson Schoolhouse Road, approximately 7,200 feet from the center of the Facility. The view from this area towards the Facility is shielded by vegetation.

General Measurement Procedures. Short-term (20-minute) noise levels were manually collected over a 2-day period at all five locations. Measurements were conducted at each location twice during daytime hours (generally between 11 a.m. and 6 p.m.) and twice during nighttime/early morning hours (generally between 12 a.m. and 3 a.m.). In addition, unattended, long-term noise monitors were deployed at Locations 1 and 3 for a total of 65 continuous hours to capture changes in diurnal (day/night) noise levels.

Meteorological Conditions. Weather conditions during a majority of the survey were favorable for measuring ambient noise levels. Wind conditions are paramount when measuring environmental noise. Winds during the first day and night of the survey (April 21 into 22) were calm, generally representing the quietest conditions. Winds were also calm during the early morning hours of April 23. Otherwise, winds were moderate (5 to 10 mph) with higher gusts. Sky conditions ranged from clear to partly cloudy, with daytime highs in the 60’s (°F) and nighttime lows ranging from 35 to 50 °F. No precipitation occurred during any of the daytime or nighttime short-term measurements, with the exception of very light flurries at the end of the second nighttime measurement survey that were insufficient to cause wet pavement and did not otherwise affect measured levels. No manual measurements were collected during the day on April 22 due to rainfall. The long-term unattended monitors continued to run throughout this period, however. These weather conditions did affect long term monitor levels, which were elevated 5 to 10 dB above other days, due to rain, wind, and traffic on wet pavements. Plots of meteorological conditions from a local weather terminal in Burrillville for each day of the survey are provided in Appendix N2 (*Noise Survey Meteorological Conditions*).

Instrumentation. Long-term noise measurements were collected using Larson Davis Model 820 sound level meters, which logged overall equivalent noise levels (L_{AEQ}), maximum and minimum levels, and statistical levels ($L_{A90,}$ L_{A50}). Short-term noise measurements were collected using a Larson Davis Model 831 sound level meter, which also logged octave band and one-third octave band levels. All instrumentation used are Type 1 certified according to the American National Standards Institute (ANSI). The equipment was field-calibrated using a Larson Davis Model 200 Acoustic Calibrator. A calibration laboratory qualified the equipment within the previous twelve-months using references traceable to the National Institute of Standards and Technology (see Appendix N3 and N4 for Equipment Specifications and Calibration Certificates, respectively).

Short-Term Noise Monitoring Results. As presented in Table 9, 'background' ambient (L_{A90}) sound levels during daytime hours ranged from the high-20's (dBA) to the high-40's (dBA). L_{A90} sound levels during the nighttime ranged from the low-30's to mid-40's (dBA). A complete set of short-term measurement data can be found in Appendix N5 (*Short-Term Noise Level Measurements*). As a consequence of noise associated with nocturnal animal activity, nighttime L_{A90} sound levels were slightly higher than daytime L_{A90} sound levels at some locations. The primary sources of noise at each location are:

Location M1 - Daytime noise sources included the gas compressor station and traffic on Wallum Lake Road. Early morning noise sources included the compressor station, and wind in the trees during the second nighttime measurement.

Location M2 - Daytime noise sources included the gas compressor station and distant traffic. Early morning noise sources included the compressor station, distant traffic, and wind in the trees during the second nighttime measurement.

Location M3 - Daytime noise sources included birds, distant traffic, and the activities of residents. Early morning noise sources included frogs, distant traffic, and wind in the trees during the second nighttime measurement.

Location M4 - Daytime noise sources included traffic on Buck Hill Road and the compressor station. Early morning noise sources included the compressor station and distant traffic.

Location M5 - Daytime noise sources included birds and a nearby stream. Early morning noise sources included frogs and the stream.

Table 9: Short-Term Background Community (L_{A90}) Noise Levels (A-Weighted)

Location	Direction from Site	Daytime L_{A90} Range	Nighttime L_{A90} Range	Summary of Audible Sources*
M1	Northeast ~2,300 feet from site center	46 to 48	44	Daytime: Compressor station, significant traffic on Hwy 100, birds, wind in trees Nighttime: Compressor station, wind in trees, frogs
M2	East ~2,500 feet from site center	36 to 37	36 to 38	Daytime: Compressor station, distant traffic, dogs, birds, breeze in trees, planes Nighttime: Compressor station, distant traffic, frogs, breeze in trees
M3	Northwest ~4,300 feet from site center	27 to 38	32	Daytime: Birds, distant traffic, activities of residents, dogs Nighttime: Frogs, wind in trees, distant traffic
M4	North ~4,300 feet from site center	36 to 40	30 to 33	Daytime: Traffic on Buck Hill Rd, compressor station, planes, leaf blower, dogs Nighttime: Compressor station, distant traffic, breeze in trees
M5	South ~7,200 feet from site center	33 to 35	36 to 39	Daytime: Birds, breeze in trees, stream, distant traffic Nighttime: Frogs, stream, breeze in trees, distant traffic

Note: * Listed in order of significance

Long-Term Monitoring Results. Long-term L_{A90} noise measurement results from Locations 1 and 3 are plotted in Figure 4. At M1, noise levels reach the upper-40's (dBA) during the daytime, and fall to the lower-40's (dBA) at night. At M3, daytime highs reach 40 to 45 dBA, and nighttime lows are in the 24 to 30 dBA range.

3.0 Environmental Consequences

3.1 Analysis of Effects

An evaluation was conducted to examine the potential for construction and operation of the CREC ("Facility") to subject sensitive land uses (e.g., residences, care centers, schools, etc.) to interference from noise. The evaluation consisted of: 1) identifying all laws, ordinances, regulations and standards (LORS) governing noise emissions for CREC; 2) determining all Noise Sensitive Areas (NSAs) in the immediate vicinity of the site potentially impacted by noise; 3) monitoring background ambient noise levels at these locations; 4) predicting project-related (construction and operation) noise levels at NSA's using a computer-generated acoustical model of the Facility; 5) comparing project-related noise levels to applicable regulations, to existing ambient noise levels, and to various noise impact criteria; and 6) assessing any need for additional noise control measures in order to comply with performance standards and minimize potential impact.

3.2 Construction Noise Level Analysis

A noise level analysis was conducted to evaluate the potential of subjecting sensitive land uses such as residences to interference from construction noise. The following section describes the construction process, noise modeling methods and analysis results.

Both the USEPA Office of Noise Abatement and Control and the Empire State Electric Energy Research Corporation have extensively studied noise from individual pieces of construction equipment as well as from power plant construction sites.[19,20] Information from these studies was used for this analysis since specific numbers on construction

19 - *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances,* U.S. Environmental Protection Agency, Report No. NTID300.1, December 1971.

20 - *Power Plant Construction Noise Guide,* Empire State Electric Energy Research Corporation, Bolt, Beranek and Newman, Inc. Report No. 3321, May 1977.

equipment types, quantities, and operating schedules is yet to be developed by the Engineering, Procurement and Construction (EPC) Contractor for the project. Use of this data is generally considered conservative since the evolution of construction equipment has been towards quieter designs to protect operators from exposure to noise.

CREC construction is expected to be typical of other power plants in terms of duration and equipment used. Construction can generally be divided into five phases, each using different types of equipment. These phases include: 1) site preparation; 2) concrete pouring; 3) steel erection; 4) mechanical equipment installation and 5) cleanup and commissioning.

Prior to construction of the power block, site preparation activities will include: 1) clearing of vegetation; 2) grading; 3) excavation; 4) construction of laydown, parking areas and temporary access points; 5) installation of erosion and sediment controls and 6) establishment of construction phase storm water management systems. During construction of the CREC, activities will include: 1) installation of permanent storm water management systems; 2) foundation installations; 3) installation of underground utilities; 4) construction of buildings and installation of equipment; 5) switchyard construction; 6) construction of site access points; and 7) site restoration and landscaping. A commissioning phase will be initiated towards the latter part of construction, during which all CREC equipment will be tested to ensure compliance with equipment specifications and contract performance guarantees.

CREC construction is anticipated to last approximately 30-months and likely occur over the course of one daytime shift, although it is possible that extensions of the basic workday or moderate amounts of evening or weekend work could take place. Construction activities associated with higher increases in ambient noise levels would typically occur only during weekday, daytime hours.

Like most major projects, CREC construction may temporarily increase ambient noise levels. The magnitude of the increases will generally depend on the distance between noise sources and receivers; the sound power levels of various pieces of construction equipment; and the specific tasks being performed. For example, heavy diesel-powered equipment for grading, excavation, and concrete pad construction would be required during site and foundation preparation, including shovels, front-end loaders, dump trucks and concrete-pump trucks. Conversely, non-diesel powered equipment would largely be required during the plant-finishing phase, including portable generators, air compressors, welding machines, etc. Noise levels for equipment typically employed are given in Table 10.

Table 10: Typical Noise Levels (L_{AEQ}) for Construction Equipment (dBA)[21]			
Equipment Item	**Noise Level at 50 Feet**	**Equipment Item**	**Noise Level at 50 Feet**
Air Compressors	76 - 89	Generators	71 - 87
Backhoes	81 - 90	Jackhammers	69 - 85
Concrete Batch Plant	80 - 85	Rock Drills	83 - 99
Concrete Pumps	74 - 84	Pile Drivers	81 - 107
Concrete Vibrators	68 - 81	Pumps	68 - 80
Cranes (Derrick)	79 - 86	Steel Rollers	75 - 82
Cranes (Mobil)	80 - 85	Shovels	77 - 90
Dozers	77 - 90	Trucks	81 - 87
Front-End Loaders	77 - 90	Vibratory Conveyors	70 - 80
Graders	79 - 89	Welders	66 - 75

Construction Noise Level Modeling. A three-dimensional, computer-generated acoustical model of construction operations was developed using SoundPLAN® 7.3 and industry-standard prediction algorithms to estimate noise levels at the nearest sensitive areas, based on equivalent energy levels (L_{AEQ}) for each of the five major construction phases. SoundPLAN® 7.3 is a computer-based acoustical analysis package specially designed for predicting environmental noise levels from industrial operations and activities.[22]

---

21 - *Power Plant Construction Noise Guide,* Empire State Electric Energy Research Corporation, Bolt, Beranek and Newman, Inc. Report No. 3321, May 1977.

22 - SoundPLAN® – Braunstein + Berndt GmbH, Acoustical Modeling Software, Version 7.3, (1986-2015).

Acoustical Modeling Parameters. Acoustical modeling was based on ISO 9613-2, *"Attenuation of Sound during Propagation Outdoors,"* adopted by the International Standards Organization (ISO) in 1996 (and last reviewed in 2012).[23] This standard provides a widely accepted method for predicting environmental (outdoor) sound levels from sources of known emission. The following section briefly discusses under which conditions the predictions are considered valid.

Meteorology. ISO 9613 is designed to estimate far-field outdoor sound levels under favorable propagation conditions, (that is, when wind is blowing from the site towards receivers, or under well-developed temperature inversions, which commonly occur on clear, calm nights.)[24] For other weather patterns, such as during upwind conditions, or for ground based temperature lapses, (*see Footnote 24)* observed levels would generally be less than predicted.

Air Absorption. Absorption/attenuation of sound by air is dependent on a source's spectral character or frequency (pitch), as well as on air temperature and to a lesser degree, relative humidity. In general, high temperatures and low humidity increase high-frequency sound absorption, which tends to reduce far-field predicted levels. Specific values used in the model for temperature (10^{o}C), relative humidity (70%) and barometric pressure (1013 mbar) represent cold and humid conditions, resulting in a generally conservative estimate of atmospheric attenuation.

---

23 - ISO standards are reviewed every five years**.**

24 - Temperature inversions typically develop during calm, cloudless nights, when the sun is no longer heating the ground. As a result, air near the ground begins to cool, forming a thicker and thicker 'blanket' as the evening progresses. In practical terms, this means that temperature is *increasing* with elevation, (i.e., the air is actually warmer at higher elevations, as compared to near the ground) and hence the term 'temperature inversion'. The effect of temperature inversion on sound propagation is to 'bend' sound waves back towards the ground, producing worst-case sound levels at a receiver. In contrast, a 'temperature lapse' commonly develops during calm, cloudless *daytime* periods, when the ground is being heated by the sun, which in turn produces a warm layer of air next to the ground, as opposed to at higher elevations. This means that temperature *decreases* with elevation, causing sound waves to bend upwards, reducing levels observed at a far-field observer.

***Ground Absorption*.** Sound level predictions are dependent on both the type and extent of ground 'condition' assumed for site and receiver areas. On-site ground areas were modeled as 'hard' or completely reflective, which is typical of surfaces common to industrial installations such as pavement, poured concrete and tamped soil. Off-site ground areas were assumed to be 50% absorptive, which is typical of moderately vegetated land. Site topography was based on United States Geological Survey (USGS) 10-meter resolution National Elevation Datasets (NED).

Model Accuracy. ISO 9613 predictions are expected to agree with field measurements within a $\pm$ 3-decibel range (A-weighted, dBA) out to a distance of 1,000 meters for the meteorological and environmental conditions described. As such, levels developed with this analysis represent a 'best estimate' of construction noise emissions.

Construction Noise Level Modeling Results. Sound power levels for each construction phase were adjusted for the reduction of sound by distance (*geometrical spreading);* the molecular absorption of sound by air (*air absorption*); and the absorption and reflection of sound by the ground (*ground effect).* As summarized in Table 11 and Appendix N6, *(Construction Noise Modeling Results)* worst-case construction noise levels (L_{AEQ}) are predicted to range from a low of 27 dBA to a high of 53 dBA at residential receivers. These levels represent those observed outdoors, and a home or building would provide significant reduction. Specifically, noise levels within a home would be up to 27 dBA lower assuming closed windows. Even with open windows, indoor levels would be up to 15 dBA lower than levels observed outside.[25]

---

25 - *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety*, United States Environmental Protection Agency, Office of Noise Abatement and Control, USEPA Report 550/9-74-004 (March 1974).

Table 11: Projected CREC Construction Noise Levels (L_{AEQ})*						
Location	Construction Phase					
	Grading & Excavation	Concrete Pouring	Steel Erection	Equipment Installation	Finishing	Existing Daytime Ambient Range (L_{AEQ})
M1	49	45	49	44	39	52 to 53
M2	53	49	53	48	43	50 to 52
M3	41	37	41	36	31	36 to 44
M4	47	43	47	42	37	50 to 51
M5	37	33	37	32	27	45 to 52
*Rounded to the nearest whole decibel						

3.3 Construction Noise Impact Analysis

In general, it is anticipated that construction noise levels will be near or below current daytime ambient noise levels (L_{AEQ}) at residences. While construction noise is likely to be occasionally discernible, it is not expected to increase ambient noise levels significantly. The average individual is likely to tolerate construction noise given its temporary nature and that the majority of construction will take place during daytime hours (i.e., when the risk of sleep disturbance and interference with relaxation activities is low). Any nighttime or weekend construction activities will likely be similar to the 'finishing' phase of construction, which is typically 10 decibels lower than for other phases. Also, the size of a nighttime/weekend work force would be significantly smaller than during typical daytime weekday hours, thereby further reducing noise levels. As such, construction of the CREC is not expected to result in any significant community noise impact.

Steam Line Clean Out. During the construction process, debris such as weld spatter, partially expended welding rods, metal filings, etc. will have accumulated in the piping that comprises the steam path. Without thoroughly cleaning this piping, trapped debris could damage the steam turbine. The piping is cleaned by temporarily routing the steam line to atmosphere before permanently connecting it to the steam turbine. Low-pressure steam produced in the HRSG or from a temporary boiler is then flushed through the piping over a continuous period of approximately 36 hours. A provisional silencer installed on the temporary steam line will significantly reduce steam flow noise levels. At the end of the procedure, the steam line is permanently connected to the steam turbine.

3.4 Operation Noise Level Analysis

A noise level analysis was conducted to evaluate the potential of subjecting sensitive land uses such as residences to interference from CREC operation noise. The following section describes CREC operations, noise modeling methods and analysis results.

Facility Description. CREC will generate electricity using single shaft combined-cycle technology, wherein a gas turbine and steam turbine both drive a common generator. In the gas turbine cycle, air is compressed and then heated through the combustion of natural gas. The heated air is then rapidly expanded to spin a turbine, which in turn drives an electrical generator. For the steam turbine cycle, heat created by the gas turbine, which would otherwise be wasted, is exhausted into a heat recovery steam generator (HRSG) to produce steam. Similar to the gas turbine cycle, high-pressure steam spins a turbine, which also drives the generator. The addition of the steam turbine cycle increases the amount of electricity generated from a given amount of natural gas, resulting in greater fuel efficiency and fewer emissions per unit of production.

CREC operation is expected to be typical of other base load power generation facilities in terms of scheduling and equipment used. CREC will generate up to 1,000 megawatts (MWs) of electrical power (nominal), utilizing two H Class natural gas-fired[26] combustion turbines[27] (CTs); two heat recovery steam generators (HRSG), and two steam-turbines (STs). Each CT and ST pair will share a common generator and be enclosed within separate buildings. Auxiliary support equipment will include two 21-cell air-cooled condensers (ACCs), two 15-cell closed cooling water (CCW) heat exchangers, two generator step-up (GSU) transformers, fuel gas compressors (enclosed within a building) with after coolers, and various motors, pumps and ancillary equipment skids, as summarized in Table 12.

---

26 - Combustion turbines may optionally burn fuel oil.

27 - For purposes of this evaluation, General Electric (GE) is assumed to be the power generation equipment supplier.

Table 12: Major Sources of CREC Noise	
Equipment Description	**Quantity**[28]
Air Cooled Condenser (ACC) - 21 Cells	2
Ammonia Forwarding Pump	1
Ammonia Injection Skids	2
Auxiliary Boiler Building	1
Auxiliary Transformers	2
Boiler Feedwater Pumps (Enclosed)	2
Closed Cooling Water Heat Exchangers	2
Condensate Pumps	2
Combustion Turbine Buildings	2
Combustion Turbine Air Inlet Filter Housings	2
Combustion Turbine Lube Oil Modules	2
Combustion Turbine Enclosure Ventilation Fans	2
Combustion Turbine Exhaust Diffusers	2
Demin Water Pumps	2
Fuel Gas Compressor Building	1
Fuel Gas Compressor After Coolers	2
Fuel Gas Dew Point Heater	1
Fuel Gas Metering and Regulating Station	1
Generator Step-Up Transformers	2
Heat Recovery Steam Generators (HRSG)	2
HRSG Duct Burner Skids	2
HRSG Exhaust Stack	2
HRSG Piping and Valve Systems	2
Miscellaneous Small Transformers	8
Roof-Mounted HVAC Fans	21
Scanner Cooling Air Blowers	2
Service Water Pump	1
Steam Turbine Buildings	2
Vacuum Pumps	2
Waste Water Pump	1
Water Treatment Building	1

28 - Quantity active during full load operation. For pumps and compressors installed in sets of 2 or 3, it is assumed that one set will be reserved for backup and remain on standby.

Operation Noise Level Modeling. A three-dimensional, computer-generated acoustical model of the CREC was developed using SoundPLAN® 7.3 and industry-standard prediction algorithms to estimate noise levels at the nearest off-site receivers. SoundPLAN® 7.3 is a computer-based acoustical analysis package specially designed for predicting environmental noise levels from industrial operations and activities.[29] Modeling was based on plot plans (*see Figure 6*) developed by HDR Engineering, Inc.

Acoustical Modeling Parameters. Acoustical modeling was based on ISO 9613-2, *"Attenuation of Sound during Propagation Outdoors,"* adopted by the International Standards Organization (ISO) in 1996 (and last reviewed in 2012 – *see Footnote 23*). This standard provides a widely accepted method for predicting environmental (outdoor) sound levels from sources of known emission. The following section briefly discusses under which conditions the predictions are considered valid.

Meteorology. ISO 9613 is designed to estimate far-field outdoor sound levels under favorable propagation conditions, (that is, when wind is blowing from the site towards receivers, or under well-developed temperature inversions, which commonly occur on clear, calm nights.)[30] For other weather patterns, such as during upwind conditions, or for ground based temperature lapses, (*see Footnote 30)* observed levels would generally be less than predicted.

---

29 - SoundPLAN® – Braunstein + Berndt GmbH, Acoustical Modeling Software, Version 7.3, (1986-2015).

30 - Temperature inversions typically develop during calm, cloudless nights, when the sun is no longer heating the ground. As a result, air near the ground begins to cool, forming a thicker and thicker 'blanket' as the evening progresses. In practical terms, this means that temperature is *increasing* with elevation, (i.e., the air is actually warmer at higher elevations, as compared to near the ground) and hence the term 'temperature inversion'. The effect of temperature inversion on sound propagation is to 'bend' sound waves back towards the ground, producing worst-case sound levels at a receiver. In contrast, a 'temperature lapse' commonly develops during calm, cloudless *daytime* periods, when the ground is being heated by the sun, which in turn produces a warm layer of air next to the ground, as opposed to at higher elevations. This means that temperature *decreases* with elevation, causing sound waves to bend upwards and reducing sound levels observed at a far-field observer.

Air Absorption. Absorption/attenuation of sound by air is dependent on a source's spectral character or frequency (pitch), as well as air temperature and to a lesser degree, relative humidity. In general, high temperatures and low humidity increase high-frequency sound absorption, which tends to reduce far-field predicted levels. Specific values used in the model for temperature (10^oC), relative humidity (70%) and barometric pressure (1013 mbar) represent cold and humid conditions, resulting in a generally conservative estimate of atmospheric attenuation.

Ground Absorption**.** Sound level predictions are dependent on both the type and extent of ground 'condition' assumed for site and receiver areas. On-site ground areas were modeled as 'hard' or completely reflective, which is typical of surfaces common to industrial installations such as pavement, poured concrete and tamped soil. Off-site ground areas were assumed to be 50% absorptive, which is typical of moderately vegetated land. Site topography was based on United States Geological Survey (USGS) 10-meter resolution National Elevation Datasets (NED).

Reflections. For complex installations with a large number of obstacles, such as CREC, reflected energy components can be considerable. Therefore, the number of reflections for the model was conservatively set at two, allowing for the effects of multiple sound paths from a single source to be considered.

Directivity. A vertical directivity correction was used to account for changes in source levels with direction, such as for the HRSG stack exhausts, air cooled condensers, and CCW heat exchangers.

Operating Periods and Capacity. The analysis assumes 24-hour utilization of the CREC and that all equipment is at full-load capacity, with the exception of the diesel generator and fire protection equipment. The diesel generator and fire protection systems would typically be used only for emergency conditions and exclusively tested during daytime hours.

Model Accuracy. ISO 9613 predictions are expected to agree with field measurements within a $\pm$ 3-decibel range out to a distance of 1,000 meters for the meteorological and environmental conditions described. As such, noise levels presented in this analysis represent a 'best estimate' of operation noise emissions.

Sound power levels (PWL) for all major pieces of equipment (e.g., power generation buildings, HRSGs, air cooled condensers, CCW heat exchangers, transformers, etc.) were estimated using octave-band data from manufacturers, in-house measurement data, and data from industry-standard prediction algorithms.[31] Table 13 provides a summary of modeled components and their corresponding noise levels. Additional noise level data can be found in Appendix N7 (*Operation Noise Modeling Results*).

Component power levels were adjusted for the reduction of sound by distance (*geometrical spreading);* the molecular absorption of sound by air (*air absorption*); and the absorption and reflection of sound by the ground (*ground effect).* Sound levels were further modified by the effects of shielding, (i.e., via buildings, tanks, equipment, topography, etc.) and by changes in source levels with direction (*directivity)* to estimate off-site receiver noise levels. The model included noise mitigation typically provided as 'standard' by equipment manufacturers, as well as buildings and/or enclosures primarily intended for weather protection, but which also serve to further attenuate equipment noise (see *Acoustical Design in this section)*. Figure 6 provides a three-dimensional perspective view of CREC from the acoustical model.

31 - *Electric Power Plant Environmental Noise Guide*, Edison Electric Institute, Bolt, Beranek and Newman, Inc. Report No. 3637, 1978.

Table 13: Component Noise Levels as Modeled		
Equipment Description	**Noise Level (dBA)**	**PWL/SPL**
Air Cooled Condenser (ACC) - 21 Cells	50	SPL at 400 feet
Ammonia Forwarding Pump	85	SPL at 3 feet
Ammonia Injection Skid	85	SPL at 3 feet
Auxiliary Boiler Building – At Interior Wall	95	SPL at 3 feet
Auxiliary Transformers	89	PWL
Boiler Feedwater Pumps (Enclosed)	80	SPL at 3 feet
Closed Cooling Water Heat Exchangers	48	SPL at 400 feet
Condensate Pumps	85	SPL at 3 feet
Combustion Turbine Buildings – At Interior Wall	85	SPL at 3 feet
Combustion Turbine Air Inlet Filter Housings	107	PWL
Combustion Turbine Lube Oil Modules	105	PWL
Combustion Turbine Enclosure Ventilation Fans	104	PWL
Combustion Turbine Exhaust Diffusers (Without Barriers)	107	PWL
Demin Water Pumps	85	SPL at 3 feet
Fuel Gas Compressor Building – At Interior Wall	105	SPL at 3 feet
Fuel Gas Compressor After Coolers	50	SPL at 400 feet
Fuel Gas Dew Point Heater	90	SPL at 3 feet
Fuel Gas Metering and Regulating Station	90	SPL at 3 feet
Generator Step-Up Transformers	101	PWL
Heat Recovery Steam Generators (HRSG)	55	SPL at 400 feet
HRSG Duct Burner Skids	110	PWL
HRSG Exhaust Stack	47	SPL at 400 feet
HRSG Piping and Valve Systems	99	PWL
Miscellaneous Small Transformers	80	PWL
Roof-Mounted HVAC Fans	80	SPL at 3 feet
Scanner Cooling Air Blowers	98	PWL
Service Water Pump	85	SPL at 3 feet
Steam Turbine Buildings – At Interior Wall	85	SPL at 3 feet
Vacuum Pumps	85	SPL at 3 feet
Waste Water Pump	85	SPL at 3 feet
Water Treatment Building – At Interior Wall	85	SPL at 3 feet

Note: Free-field conditions. Unless indicated, levels include proposed acoustical design and represent best estimates of actual levels in the field.

Operation Noise Level Modeling Results.

Initial modeling indicated that CREC noise levels would exceed the design goal of 43 dBA at the nearest residences (*as discussed in Section 1.3*). The model was therefore iteratively run with various amounts and types of mitigation to determine an acoustical design that will achieve the 43 dBA design goal.

Analysis results show that given this proposed acoustical design of the CREC, worst-case Facility noise levels (all units operating) are expected to fully comply with the broadband (A-weighted) portion of the Town of Burrillville nighttime residential performance standards (≤ 43 dBA), as summarized in Table 14. Specifically, noise levels during full load operation and under favorable sound propagation conditions are expected to range from about 34 dBA to 43 dBA at nearby residential properties.

Modeling results are also presented as a series of noise level contours in Figure 7, and a detailed set of modeling calculations can be found in Appendix N7 (*Operation Noise Modeling Results*). Note that although minor changes to the general arrangement may occur as the detailed design is finalized, significant changes in predicted noise levels are not expected.

Table 14: CREC Noise Levels Using Proposed Acoustical Design (L_{AEQ})*

	Operational Phase	
Location	**Direction from Site/Description**	**CREC Noise Level**
M1	Northeast – Single family houses along Wallum Lake Road	43
M2	East – Single family houses along Jackson Schoolhouse Road	41
M3	West – Single family houses along Wilson Trail and Doe Crossing Drive	40
M4	North – Single family houses along Buck Hill Road	41
M5	South – Single family houses along Jackson Schoolhouse Road	34

*Rounded to the nearest whole decibel

Acoustical Design. As summarized in Table 15, the proposed extensive acoustical design of the CREC includes installation of the combustion turbines and steam turbines within buildings; high-performance silencers installed within the air intake ductwork of the combustion turbines to reduce high-frequency (spectral) compressor and turbine blade aerodynamic noise; silencers installed on fans providing ventilation air for the combustion turbine enclosure compartments; low-noise air cooled condensers and closed cooling water heat exchangers; combustion turbine exhaust diffuser noise walls; combustion turbine exhaust noise attenuated via the SCR/HRSG units and high-performance exhaust stack silencers; auxiliary boiler FD fan intake silencer banks; low-noise GSU transformers; acoustical shrouds over the HRSG transition ducts; buildings enclosing the auxiliary boiler, gas compressors, boiler feed water pumps and water treatment equipment; and acoustically louvered ventilation openings for the auxiliary boiler and generation buildings.

Table 15: Proposed Acoustical Design	
Equipment Item	**Control**
Air Cooled Condenser	Low-Noise Design
Auxiliary Boiler	Enclosed within a Building
Auxiliary Boiler FD Fan Intake	High-Performance Duct Silencer Banks
Auxiliary Boiler Louvered Ventilation Openings	Acoustical Louvers
CCW Heat Exchanger	Low-Noise Design
Combustion Turbine Air Intakes	High-Performance Air Intake Silencers
Combustion Turbine	Enclosed within a Building
Combustion Turbine Ventilation	Ventilation System Silencers
Combustion Turbine Exhaust Diffusers	Exhaust Diffuser Noise Walls
Combustion Turbine Exhausts	Exhaust Mitigated via SCR/HRSGs and High-Performance Exhaust Stack Silencers
Fuel Gas Compressors	Enclosed within a Building
Generation Building Louvered Ventilation Openings	Acoustical Louvers
GSU Transformers	Low-Noise Design
HRSG Boiler Feedwater Pumps	Enclosed within a Building
HRSG Transition Ducts	Acoustical Shrouds
Steam-Turbine	Enclosed within a Building
Water Treatment Equipment	Enclosed within a Building

3.5 Operation Noise Impact Analysis

Federal. As discussed in Section 1.3, the USEPA has concluded that exposure to outdoor noise levels at or below L_{DN} = 55 dB is satisfactory to "protect the public health and welfare" since such exposure would not normally result in adverse community reaction, complaint, or annoyance in communities with average background ambient noise levels (i.e., those observed in urban residential environments). For sources that produce a relatively constant level of noise over time, such as the CREC, the Day-Night level is readily calculated by adding approximately 7 decibels to the projected L_{AEQ} values provided in Table 14. When comparing L_{DN} values to EPA standards, adjustments are also added to the L_{DN} at locations with a relatively quiet existing ambient environment to account for increased potential for negative community response. As shown in Table 16, L_{DN} values range from 51 to 58 dBA at the nearest noise-sensitive areas and are therefore generally consistent with EPA guidelines.

Table 16: CREC Day-Night (L_{DN}) Noise Levels Using Proposed Acoustical Design

Location	Description	Predicted CREC Noise Level (L_{AEQ})*	Day-Night Level (L_{DN})
M1	Wallum Lake Road	43	55
M2	Jackson Schoolhouse Road	41	58
M3	Wilson Trail and Doe Crossing Drive	40	57
M4	Buck Hill Road	41	53
M5	Jackson Schoolhouse Road	34	51
*Rounded to the nearest whole decibel			

Local. As discussed in Section 1.3, the Project proposes to comply with the broadband (A-weighted) portion of the Town of Burrillville Noise Ordinance (Chapter 16, Article II), which limits nighttime noise emissions at receiving residential property lines to 43 dBA. As shown in Table 14 and Figure 7, noise levels at nearby residential properties are predicted to range from 34 dBA to 43 dBA, and therefore conform to the broadband (A-weighted) portion of the Burrillville performance standards.

Presence of Tones. Although it is difficult to predict with certainty whether tones will occur (i.e., a sound that can be distinctly heard as a single pitch or set of single pitches), no

CREC octave-band noise level is predicted to exceed that of adjacent octave bands by 5 decibels or more at any residential receiver. Based on this finding, tones as defined by the Burrillville Noise Ordinance are not expected.

Community Noise Guidelines & Sleep Interference Criteria. In 1999, the World Health Organization (WHO) recommended that outdoor sound levels during nighttime periods not exceed 45 dBA, in order to avoid sleep disturbance while bedroom windows are open. As shown in Table 14, CREC noise levels outside nearby residences range from 34 to 43 dBA, which are consistent with this recommendation. Moreover, in order to avoid negative effects on sleep, interior noise levels (L_{AEQ}) within sleeping areas should not exceed 30 to 35 dBA.[32] As shown in Table 17, interior noise levels with open windows range from 19 to 28 dBA during CREC operation, which are also consistent with recommended criteria.

Table 17: Analysis of Sleep Interference Potential

Location	Predicted CREC Noise Level (L_{AEQ})*	Open Window Noise Reduction (dBA)	Interior Noise Level (dBA)
M1	43	15	28
M2	41	15	26
M3	40	15	25
M4	41	15	26
M5	34	15	19

*Rounded to the nearest whole decibel

Speech Interference Criteria. Speech spoken in relaxed conversation is typically intelligible when background noise levels are at or below 55 dBA (L_{AEQ}). As shown in Table 14, since CREC noise levels at nearby residences range from 34 to 43 dBA, no interference with outdoor speech is anticipated. To be able to hear and understand spoken messages indoors, it is recommended that indoor noise levels not exceed 35 dBA (L_{AEQ}). As shown in

32 - *Community Noise*, Archives of the Center for Sensory Research, Berglund, B., & Lindvall, T. (Eds.), 1995

Table 17, interior noise levels with open windows range from 19 to 28 dBA during CREC operation, which are consistent with recommended criteria.

Low-Frequency Noise. Low-frequency noise has generally been associated with simple-cycle rather than combined-cycle combustion turbine installations. For simple-cycle configurations, exhaust gas typically passes through a large silencer, which although effective at reducing mid- and high-frequency noise, is less efficient at reducing low-frequency components. In contrast, for combined-cycle configurations such as the CREC, exhaust gases pass through the HRSG units, which are quite efficient at reducing low-frequency combustion noise.

As shown in Table 18, C-weighted noise levels predicted at nearby residences range from 54 to 62 dBC, or significantly less than disturbance criteria for low frequency noise (i.e., ≤ 75 dBC). Moreover, the maximum difference between C-weighted (dBC) and A-weighted (dBA) levels is predicted to be approximately twenty (20) decibels and therefore consistent with significance criteria. Based on these findings, community impact from low-frequency noise is not expected.

Table 18: Analysis of Low-Frequency Disturbance Potential

Location	Predicted CREC Noise Level (L_{CEQ})*	Predicted CREC Noise Level (L_{AEQ})*	dBC minus dBA
M1	62	43	19
M2	61	41	20
M3	58	40	18
M4	61	41	20
M5	54	34	20

*Rounded to the nearest whole decibel

Changes to Ambient Levels. A comparison of CREC noise levels to measured background ambient noise levels (L_{90}) is shown in Table 19. Specifically, predicted CREC noise levels, lowest measured 'background' ambient noise levels, future ambient noise levels (CREC plus current background) and the increase to existing noise levels are presented, (see

Appendix N8 for instruction on decibel addition). As shown, ambient increases at the nearest residences are predicted to range from 3 to 16 dBA.

Table 19: Projected Ambient Increases Using Measured Background Ambient Noise Levels				
Location	**Predicted CREC Noise Level (L_{AEQ})**	**Range of Lowest Measured Ambient Levels (L_{A90})**	**Projected Future Ambient Levels (L_{A90})***	**Increase Over Existing Ambient Levels (L_{A90})**
M1	43	41 to 44	45 to 47	3 to 4
M2	41	36 to 38	42 to 43	5 to 6
M3	40	24 to 27	40	13 to 16
M4	41	30 to 33	41 to 42	9 to 11
M5	34	33 to 35	37 to 38	3 to 4
* Existing Background plus Facility.				

Ambient noise levels reported in Table 19 were the lowest observed during calm atmospheric conditions, (i.e. little to no ground wind) either using handheld or long-term monitors. Given that prevailing winds will generally originate from the north and northwest, residences in the area of M3 and M4 will be upwind of the CREC during these conditions. Acoustical modeling shows that CREC noise levels could reduce by up to 5 dBA at M3 and up to 9 dBA at M4 during these periods. In the specific case of M3, ambient increases would then range from 9 to 11 decibels, (versus 13 to 16 dBA) and for M4, ambient increases would range from 3 to 4 dBA, (versus 9 to 11). Moreover, the acoustical model of the CREC does not account for the enhanced foliage attenuation potentially due to heavy forestation of the area or to increased ground absorption as a result of the thickly-mulched forest floor. This attenuation could be substantial, since 2,300 to 7,200 feet of forested land lie between the proposed site and the nearest residences. The ISO 9613 modeling standard also tends to overpredict noise levels at distances significantly greater than about 3,000 feet.

In the absence of natural sounds and traffic, noise from the Burrillville Compressor Station is a major contributor to ambient background levels at nearby residences. During the ambient survey, the quietest levels were observed when BCS operated at reduced loads.

As such, ambient increases due to CREC will be lower during normal BCS operation. Additionally, CREC noise levels were compared to measurements reported by Hoover & Keith while BCS operated close to maximum capacity (88%)[33]. The maximum predicted CREC noise level (43 dBA) was found to be 7 decibels lower than Burrillville Compressor Station (BCS) full-load noise levels at M1 (50 dBA). In general, CREC noise levels are expected to be significantly lower than full-load BCS noise levels at nearby residences.

In summary, when considering various operating profiles of the Burrillville Compressor Station, in addition to environmental factors such as prevailing winds, foliage attenuation, high ground absorption, and potential for the ISO 9613 standard to overpredict, ambient increases presented in Table 19 may be conservatively overstated for some receivers.

Although the relative increase in ambient noise appears meaningful for certain locations, the 'absolute' level of CREC noise at all residences remains reasonably low ($\leq$ 43 dBA) regardless of BCS operating profiles or environmental factors, and appreciably less than limits found in most laws, ordinances, regulations and standards promulgated throughout the U.S. for the control of industrial noise at residential land uses. Furthermore, CREC levels are consistent with: 1) outdoor noise level guidelines historically recommended by acoustical consultants; 2) criteria for the avoidance of speech interference both outdoors and indoors; 3) criteria for the avoidance of sleep disturbance and 4) criteria for the avoidance of low-frequency noise impacts and tones. Although existing ambient noise levels for some receivers may increase at times during CREC operation, the overall magnitude and spectral content of CREC noise is not expected to result in significant community noise impact.

4.0 Noise Level Compliance Testing

During CREC commissioning, Invenergy will conduct a noise level performance test to confirm that CREC noise levels comply with Burrillville broadband performance standards. Prior to the test, Invenergy will develop a detailed noise level test protocol in accordance with Burrillville requirements, as well as with industry-standard testing procedures such as

---

33 - *Burrillville Compressor Station, (Providence County, Rhode Island), Results of a Pre-Construction Sound Survey and an Acoustical Analysis of Station Modifications Associated with the Proposed Algonquin Incremental Market ("AIM") Project*, H&K Report No. 2976, H&K Job No. 4664, February 2014).

those developed by the American National Standards Institute (ANSI) and the International Organization of Standards (ISO).

5.0 Summary

Invenergy, LLC (Invenergy) is proposing to design and construct the Clear River Energy Center (CREC), a nominal 900 to 1,000-megawatt combined-cycle, natural gas-fired power generation facility designed for base load operation and sited in the Town of Burrillville, Providence County, Rhode Island.

An evaluation was conducted to examine the potential for construction and operation of the CREC ("Facility") to subject sensitive land uses (e.g., residences, care centers, schools, etc.) to interference from noise. The evaluation consisted of: 1) identifying all laws, ordinances, regulations and standards (LORS) governing noise emissions for CREC; 2) determining all Noise Sensitive Areas (NSAs) in the immediate vicinity of the site potentially impacted by noise; 3) monitoring background ambient noise levels at these locations; 4) predicting project-related (construction and operation) noise levels at NSA's using computer-generated acoustical models; 5) comparing project-related noise levels to applicable regulations, existing ambient noise levels, and various noise impact criteria; and 6) assessing any need for additional noise control measures in order to comply with performance standards and minimize potential impact.

Noise produced during operation of the CREC must conform to levels approved by the Rhode Island Energy Facilities Siting Board, (EFSB). As such, a review of approvals for combustion turbine merchant power projects similar to the CREC was conducted to determine noise limits imposed on other power generating facilities. Those limits ranged from 40 to 49 at the nearest residences. The Town of Burrillville also has a performance standard as established in their Code of Ordinances, which generally limits <u>both</u> broadband (A-weighted) <u>and</u> octave-band Facility noise levels at nearby residences to an equivalent level of 43 dBA. Burrillville's Code however, is not applicable in instances where "The facility generating the noise has been granted a permit or license by a federal and/or state agency and the authorization to operate within set noise limits". In the case of the CREC, permitting is governed by the EFSB. Nonetheless, the EFSB will seek the Town's opinion on the project, and the Town will likely rely on their Code of Ordinances to judge CREC's suitability. As such, Invenergy examined the design approaches needed to comply with their ordinance. Although achieving the broadband portion of the code (43 dBA) was feasible with extensive controls, including placing the combustion turbines within buildings, attaining the unusually restrictive octave-band limits was found to require extraordinary mitigation measures commercially untenable and even beyond engineering feasibility. In an effort to arrive at a noise level design goal that was both respectful of the Code's intent to protect the community from excessive noise, yet commercially feasible to achieve and consistent with previous EFSB approvals, the Project proposes to comply with the same stringent noise limit imposed by the EFSB on Burrillville's Ocean State Power Project, namely 43 dBA at the closest residence, which is also the equivalent broadband limit for the Code of Burrillville. The proposed noise limit, in comparison to absolute limits for other US jurisdictions, is among the lowest we have encountered.

The nearest NSAs to CREC are located in five general areas *(refer to Figure 2)*: (1) residences along Wallum Lake Road to the northeast, (2) residences along Jackson Schoolhouse Road to the east and southeast, (3) residences in the Doe Crossing Drive area to the west, (4) residences along Buck Hill Road to the north, and (5) residences further south along Jackson Schoolhouse Road

An ambient noise level survey was conducted from April 21st through April 24th, 2015 in Burrillville to characterize the existing acoustical environment at the nearest NSAs. Results of short-term noise monitoring (20-minute intervals) showed that background (L_{A90}) ambient levels at noise sensitive receivers ranged from the high-20's to high-40's (dBA) during daytime hours, and from the low-30's to mid-40's (dBA) during nighttime hours *(refer to Table 9).*

A three-dimensional, computer-generated acoustical model of construction activity was developed using SoundPLAN® 7.3 and industry-standard prediction methods to estimate noise levels at nearby receivers for each of five major construction phases. Noise levels during CREC construction are expected to be near or below current daytime ambient noise levels (L_{AEQ}). While construction noise may occasionally be discernible, it is not expected to increase ambient noise levels significantly. The majority of construction will take place during daytime hours (i.e., when the risk of sleep disturbance and interference with relaxation activities is low). As such, construction of the CREC is not expected to result in any significant community noise impact.

A three-dimensional, computer-generated acoustical model of CREC operations was also developed, in order to predict noise levels at off-site receivers and to identify any need for additional mitigation measures. Analysis results showed that given the proposed acoustical design of the Facility, CREC noise levels during full load operation and under favorable sound propagation conditions are expected to range from about 34 to 43 dBA at nearby residences. These levels are appreciably lower than limits found in most laws, ordinances, regulations and standards promulgated throughout the U.S. for the control of industrial noise at residential land uses. Moreover, CREC levels are consistent with: 1) outdoor noise level guidelines historically recommended by acoustical consultants; 2) criteria for the avoidance of speech interference both outdoors and indoors; 3) criteria for the avoidance of sleep disturbance; and 4) criteria for avoidance of low-frequency noise impacts. The Facility is also not expected to produce tonal noise. Furthermore, the maximum predicted CREC noise level (43 dBA) was found to be 7 decibels lower than Burrillville Compressor Station (BCS) full-load noise levels at M1 (50 dBA). In general, CREC noise levels are expected to be significantly lower than full-load BCS noise levels at nearby residences. Finally, although existing ambient noise levels for some receivers may increase during CREC operation, the overall magnitude and spectral content of CREC noise is not expected to result in significant community noise impact.

In order to achieve these predicted outcomes, the proposed extensive acoustical design of the CREC includes installation of the combustion turbines and steam turbines within buildings; high-performance silencers installed within the air intake ductwork of the combustion turbines to reduce high-frequency (spectral) compressor and turbine blade aerodynamic noise; silencers installed on fans providing ventilation air for the combustion turbine enclosure compartments; low-noise air cooled condensers and closed cooling water heat exchangers; combustion turbine exhaust diffuser noise walls; combustion turbine exhaust noise attenuated via the SCR/HRSG units and high-performance exhaust stack silencers; auxiliary boiler FD fan intake silencer banks; low-noise GSU transformers; acoustical shrouds over the HRSG transition ducts; buildings enclosing the auxiliary boiler, gas compressors, boiler feed water pumps and water treatment equipment; and acoustically louvered ventilation openings for the auxiliary boiler and generation buildings.

During CREC commissioning, the Engineering, Procurement and Construction (EPC) Contractor for the project will conduct a noise level performance test to confirm that CREC noise levels comply with EFSB performance standards for noise.

6.0 References

BL - Berglund, B., and Lindvall, T (Eds.), 1995, Community Noise, Archives of the Center for Sensory Research

CN - Cowen, J.P. 1994, Handbook of Environmental Acoustics. Van Nostrand Reinhold, New York.

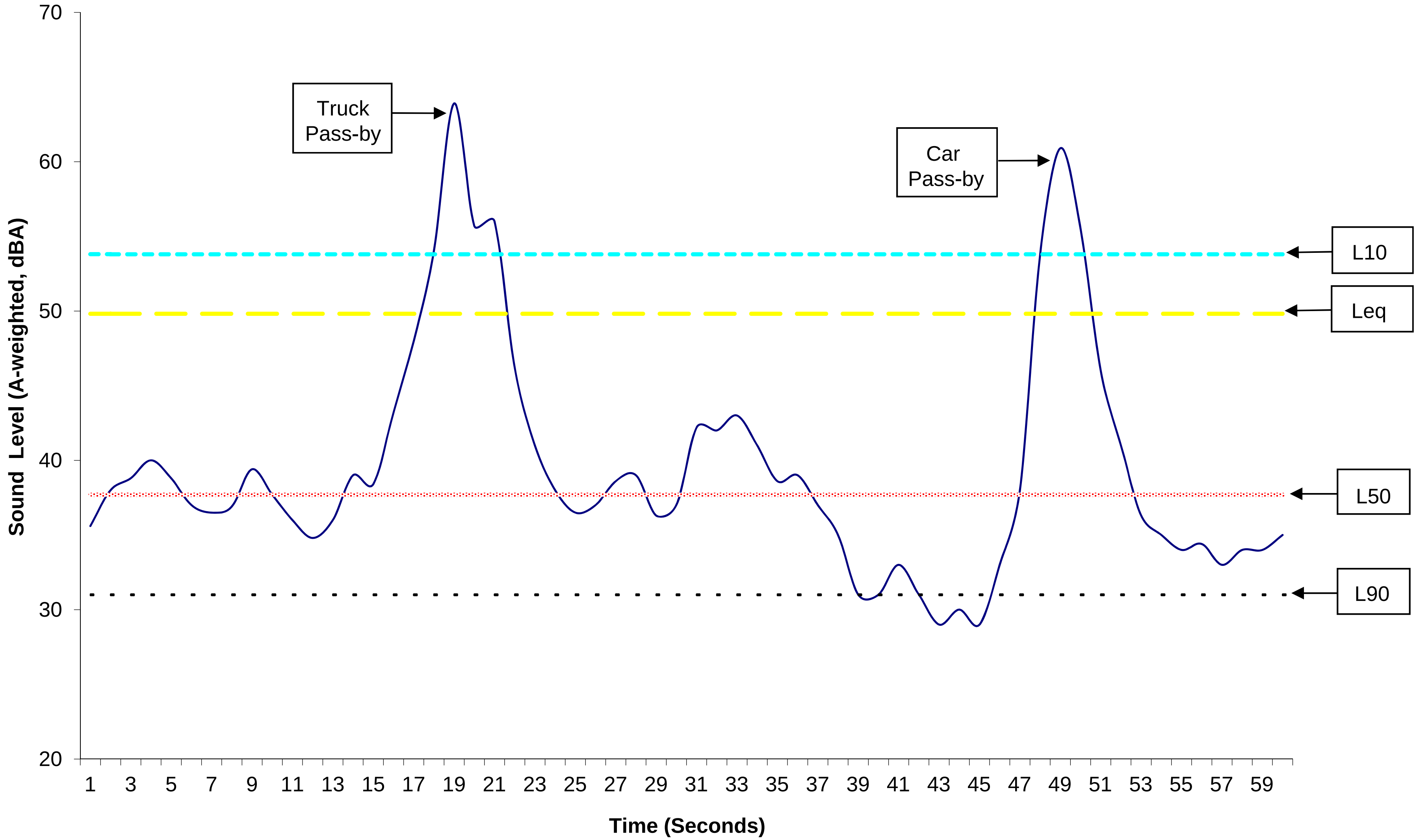
EEI - Edison Electric Institute, 1978, Electric Power Plant Environmental Noise Guide

EPA – US Environmental Protection Agency, 1974, Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.

SoundPLAN – Braunstein + Berndt GmbH, Acoustical Modeling Software, Version 7.3, (1986-2015)

WHO - World Health Organization (WHO) 1999. Guidelines for Community Noise. World Health Organization, Geneva, Switzerland.

Percentile Sound Level Analysis

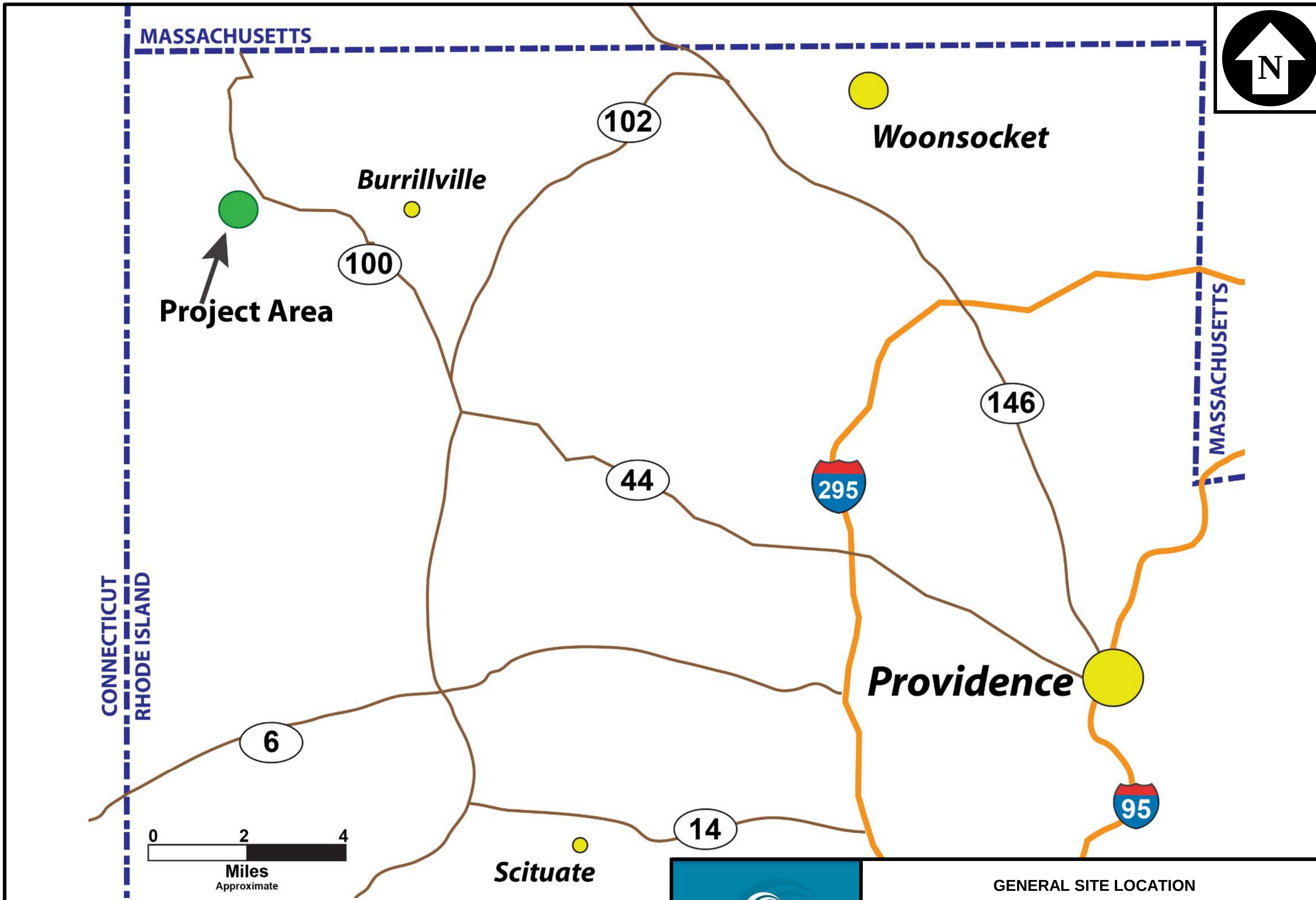


Michael Theriault ACOUSTICS INC
NOISE CONTROL CONSULTING SERVICES

EXAMPLE PERCENTILE ANALYSIS

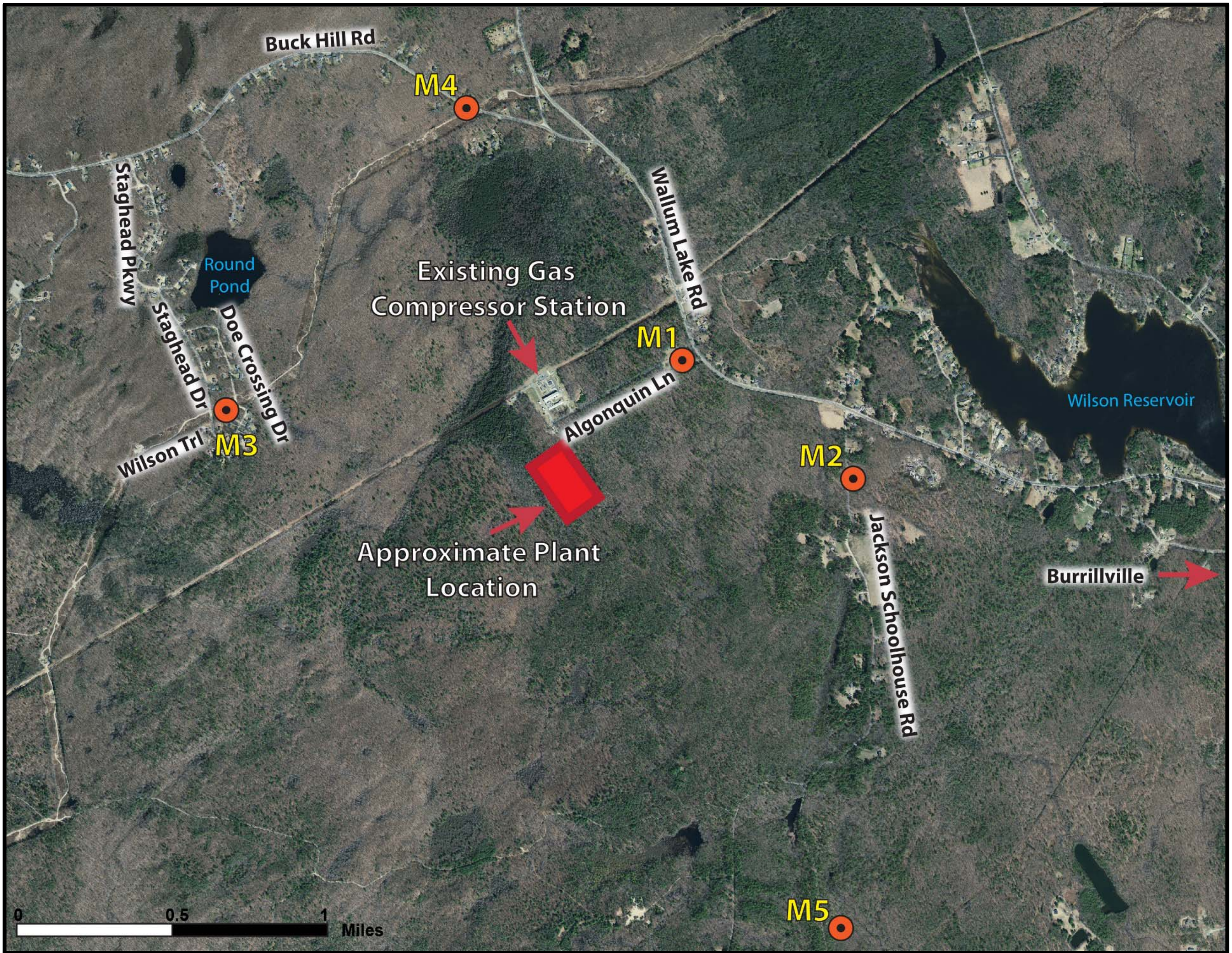
CLEAR RIVER ENERGY CENTER
BURRILLVILLE, RHODE ISLAND

FIGURE 1	**PROJECT NO. 1955**



Michael Theriault INC
ACOUSTICS
NOISE CONTROL CONSULTING SERVICES

GENERAL SITE LOCATION	
CLEAR RIVER ENERGY CENTER BURRILLVILLE, RHODE ISLAND	
FIGURE 2	PROJECT NO. 1955

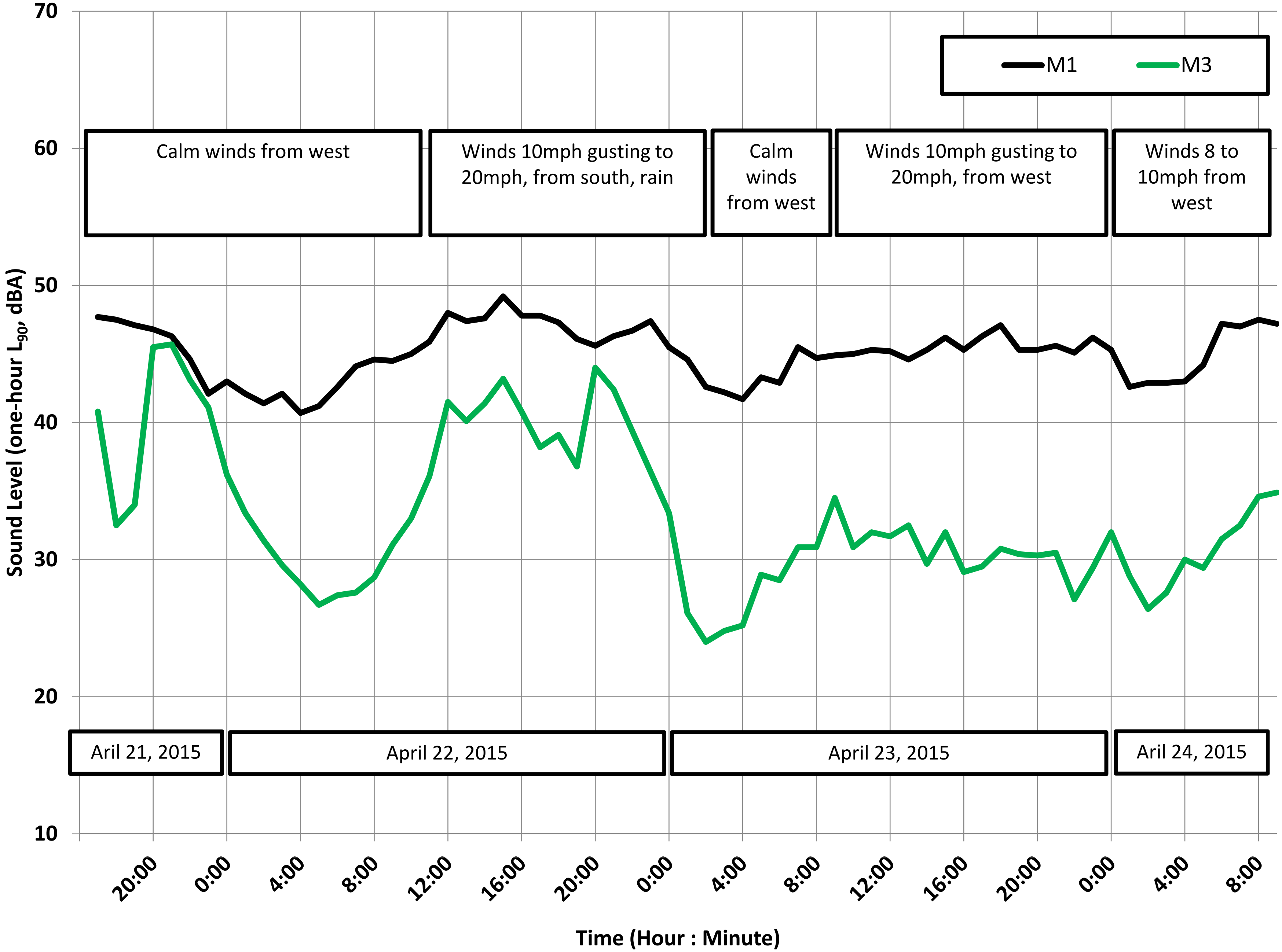


Michael Theriault Acoustics Inc
Noise Control Consulting Services

MEASUREMENT LOCATIONS

CLEAR RIVER ENERGY CENTER
BURRILLVILLE, RHODE ISLAND

FIGURE 3	PROJECT NO. 1955

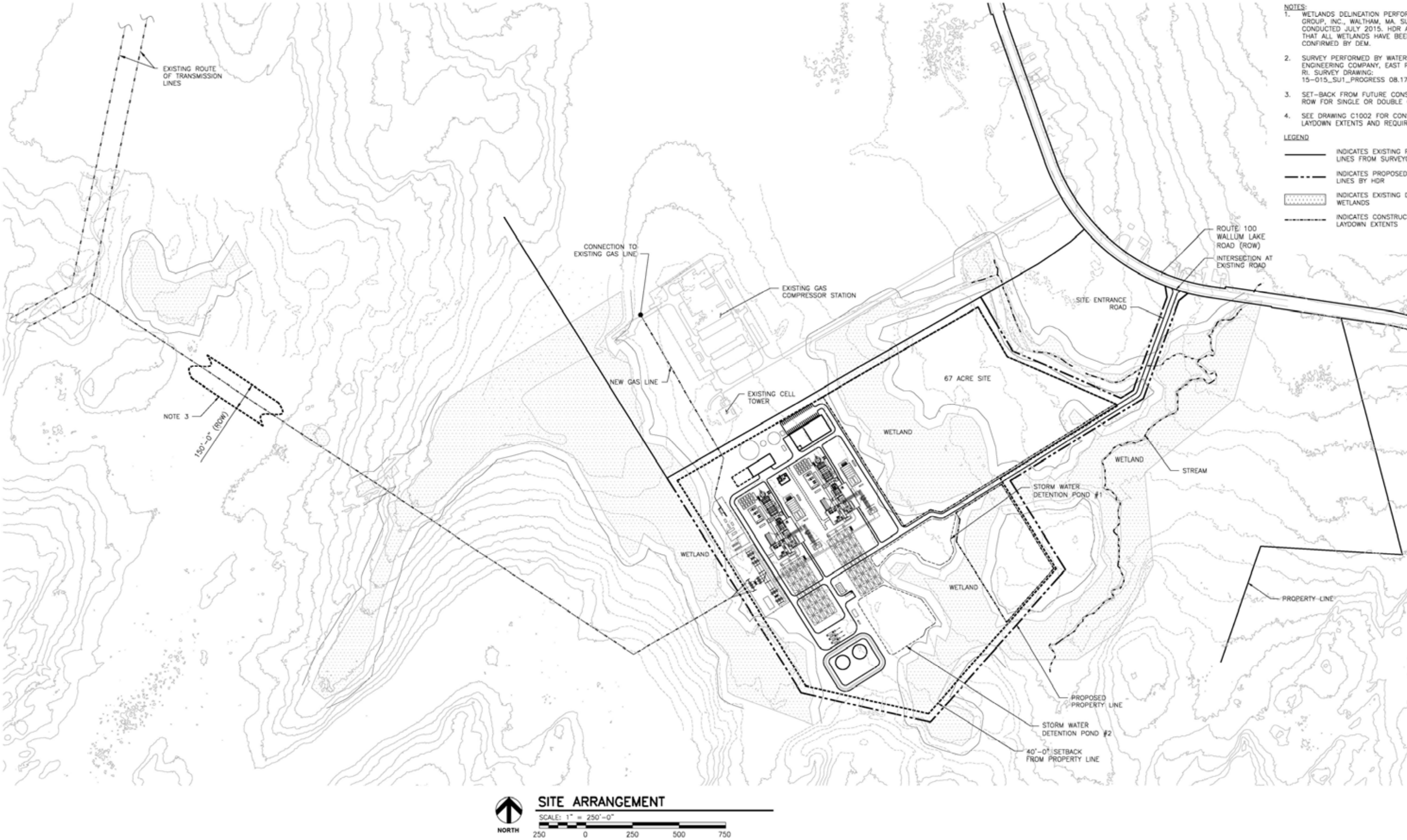


Michael Theriault Inc
ACOUSTICS
NOISE CONTROL CONSULTING SERVICES

AMBIENT NOISE LEVEL MEASUREMENTS LONG-TERM MONITORING RESULTS	
CLEAR RIVER ENERGY CENTER BURRILLVILLE, RHODE ISLAND	
FIGURE 4	PROJECT NO. 1955

NOTES:
1. WETLANDS DELINEATION PERFORMED BY ESS GROUP, INC., WALTHAM, MA. SURVEY CONDUCTED JULY 2015. HDR ASSUMES THAT ALL WETLANDS HAVE BEEN CONFIRMED BY DEM.
2. SURVEY PERFORMED BY WATERMAN ENGINEERING COMPANY, EAST PROVIDENCE, RI. SURVEY DRAWING: 15-015_SU1_PROGRESS 08.17.15.DWG
3. SET-BACK FROM FUTURE CONSTRUCTION. ROW FOR SINGLE OR DOUBLE CIRCUIT.
4. SEE DRAWING C1002 FOR CONSTRUCTION LAYDOWN EXTENTS AND REQUIREMENTS.

LEGEND
- INDICATES EXISTING PROPERTY LINES FROM SURVEYOR
- INDICATES PROPOSED PROPERTY LINES BY HDR
- INDICATES EXISTING DELINEATED WETLANDS
- INDICATES CONSTRUCTION LAYDOWN EXTENTS



HDR
HDR Engineering, Inc.

ISSUE	DATE	DESCRIPTION	DWN	ENGR	CHK	APPV
O	15 SEP15	REVISED FUEL OIL STORAGE AREA	EDC	–	–	–
N	11 SEP 15	AIR MODELING & WETLANDS PERMIT UPDATE	EDC	–	–	–
M	09 SEP 15	AIR MODELING & WETLANDS PERMIT	EDC	–	–	–
L	02 SEP 15	NOISE MODELING	EDC	–	–	–
K	24 AUG 15	REVISED SITE ARRANGEMENT	EDC	–	–	–
J	21 JUL 15	UPDATED WETLAND BOUNDARIES	J_B	–	–	–
I	30 JUN 15	ADDED REVISED SUBSTATION	PVJ	–	–	–
H	20 MAY 15	CCW HEAT EXCHANGER & ACCESS ROAD REVISION	J_B	–	–	–

PRELIMINARY NOT FOR CONSTRUCTION OR RECORDING

INVENERGY, LLC
CLEAR RIVER ENERGY CENTER

7HA.02 SINGLE SHAFT SITE ARRANGEMENT

FILENAME C1000-0GA-238926.dwg
SCALE AS NOTED
SHEET 238926-0GA-C1000

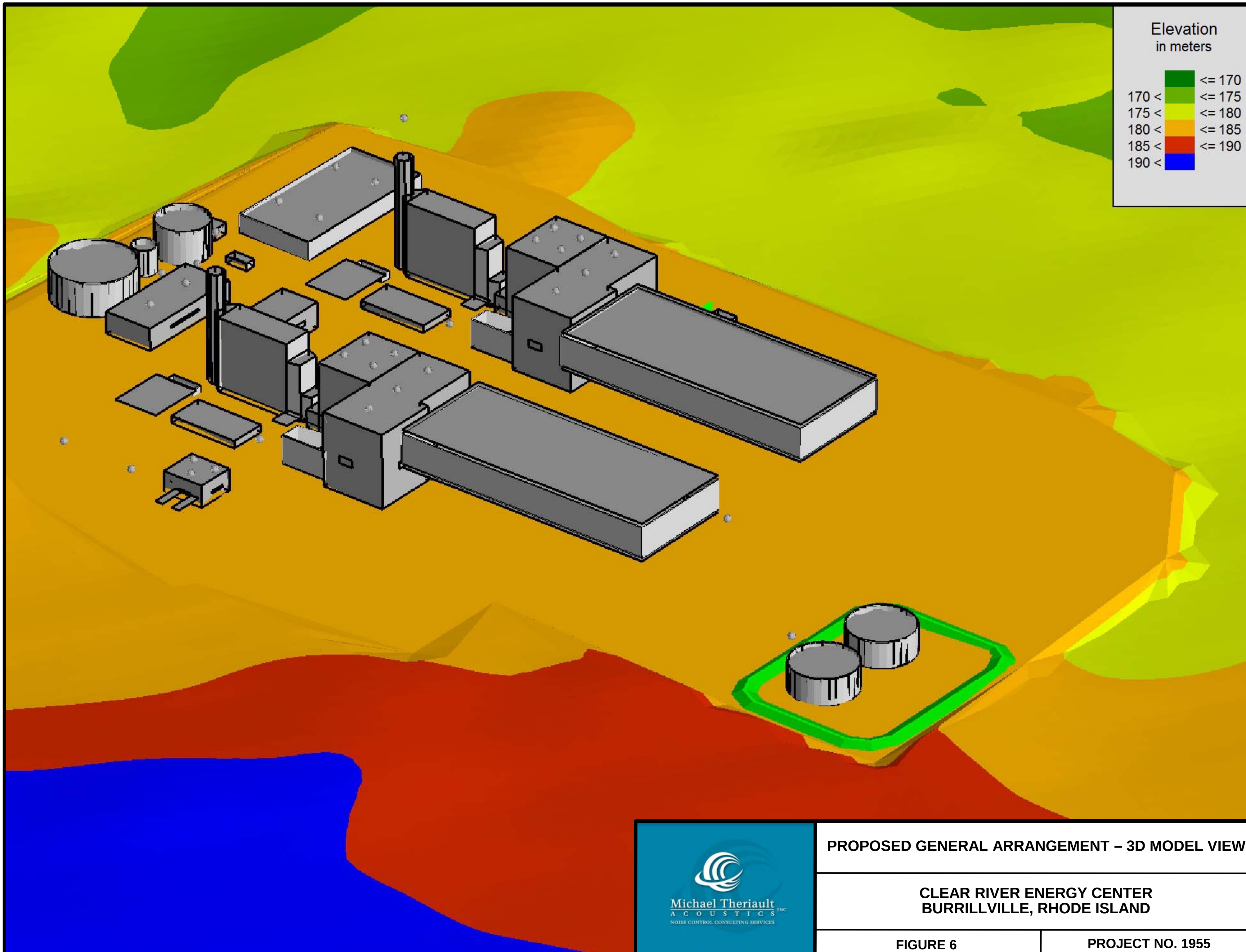
Michael Theriault Acoustics Inc
NOISE CONTROL CONSULTING SERVICES

PROPOSED GENERAL ARRANGEMENT

CLEAR RIVER ENERGY CENTER
BURRILLVILLE, RHODE ISLAND

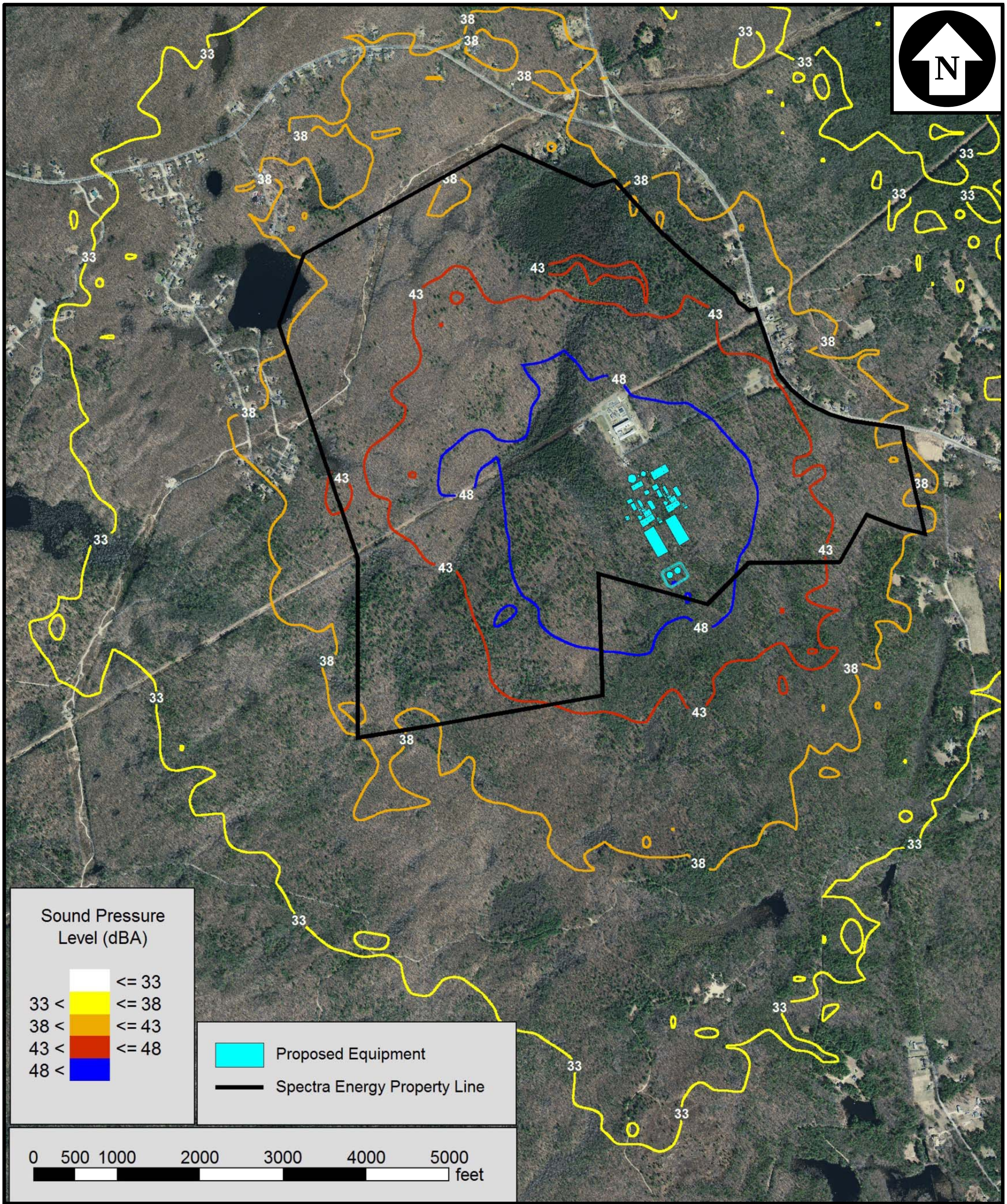
FIGURE 5

PROJECT NO. 1955



Michael Theriault Inc
ACOUSTICS
NOISE CONTROL CONSULTING SERVICES

PROPOSED GENERAL ARRANGEMENT – 3D MODEL VIEW	
CLEAR RIVER ENERGY CENTER **BURRILLVILLE, RHODE ISLAND**	
FIGURE 6	**PROJECT NO. 1955**



Michael Theriault Acoustics Inc
Noise Control Consulting Services

PREDICTED NOISE LEVEL CONTOURS WITH PROPOSED ACOUSTICAL DESIGN

CLEAR RIVER ENERGY CENTER
BURRILLVILLE, RHODE ISLAND

FIGURE 7	PROJECT NO. 1955

Appendix

N1	Burrillville Noise Ordinance
N2	Noise Survey Meteorological Conditions
N3	Equipment Specifications
N4	Equipment Calibration Certificates
N5	Short-Term Noise Level Measurements
N6	Construction Noise Level Modeling Results
N7	Operation Noise Level Modeling Results
N8	Adding Decibels

N1 Burrillville Noise Ordinance

ARTICLE II. - NOISE

Sec. 16-31. - Findings; statement of policy.

(a) The town council hereby finds and declares that:

(1) Excessive noise is a serious hazard to the public health, safety and welfare and the quality of life.

(2) A substantial body of science and technology exists by which excessive noise can be substantially abated without serious inconvenience to the public.

(3) Certain of the noise-producing equipment in this community is essential to the quality of life and should be allowed to continue at reasonable levels with responsible regulation.

(4) Each person has a right to an environment reasonably free from noise which jeopardizes health or welfare or unnecessarily degrades the quality of life.

(b) It is the declared policy of the town to promote an environment free from excessive noise, otherwise properly called noise pollution, which unnecessarily jeopardizes the public health, safety and welfare and degrades the quality of the lives of the residents of this community, without unduly prohibiting, limiting or otherwise regulating the function of certain noise-producing equipment which is not amenable to such controls and yet is essential to the quality of life in the community.

(Ord. of 1-22-2003(2), § I)

Sec. 16-32. - Purpose, title and scope of article.

(a) *Purpose.* The purpose of this article is to establish standards for the control of noise pollution in the town by setting maximum permissible sound levels for various activities to protect the public health, safety and general welfare.

(b) *Title.* This article may be cited as the "Noise Ordinance" of the town.

(c) *Scope.* This article shall apply to the control of all noise originating within the limits of the town, except when:

(1) The facility generating the noise has been granted a permit or license by a federal and/or state agency and the authorization to operate within set noise limits; or

(2) Such noise has been granted an exemption or special use permit pursuant to sections 16-36 or 16-48

(Ord. of 1-22-2003(2), § II)

Sec. 16-33. - Definitions.

The following words, terms and phrases, when used in this article, shall have the meanings ascribed to them in this section, except where the context clearly indicates a different meaning. Definitions of technical terms used in this article, which are not defined in this section, shall be obtained from publications of acoustical terminology issued by ANSI or its successor body.

Ambient sound level means the noise associated with a given environment, exclusive of intruding noises from isolated identifiable sources.

ANSI means the American National Standards Institute or its successor body.

A-scale (dBA) means the sound level in decibels measured using the A-weight or network as specified in ANSI Standard 1.4-1983 for sound level meters. The level is designated dB(A) or dBA.

Construction means any and all activity necessary or incidental to the erection, assembly, alteration, installation, repair of equipment of buildings, roadways, or utilities, including land clearing, grading, excavating and filling.

Decibel (dB) means a logarithmic and dimensionless unit of measure often used in describing the amplitude of sound, equal to 20 times the logarithm to the base ten of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).

Demolition means any dismantling, intentional destruction or removal of structures, utilities, public or private right-of-way surfaces or similar property.

Dwelling unit means a building or portion thereof regularly used for residential occupancy.

Dynamic braking device means a device used primarily on trucks and buses to convert the motor from an internal combustion engine to an air compressor for the purposes of vehicle braking without the use of wheel brakes.

Emergency work means work made necessary to restore property to a safe condition following a public calamity, work to restore public utilities or work required to protect persons or property from imminent exposure to danger.

Impulsive sound means sound of short duration, usually less than one second, with an abrupt onset and rapid decay. Examples of sources of impulsive sound include explosions, dropforge impacts and the discharge of firearms.

Lot means any tract or parcel of land owned by or under the lawful control of one distinct ownership. The lot line or boundary is an imaginary line at ground level which separates a lot and its vertical extension owned by one entity from that owned by another.

Mixed use means a dwelling unit or school located in a commercial or an industrial zone.

Motorboat. See *Watercraft*.

Motor vehicle means any motor-operated vehicle licensed for use on the public highways, but not including a motorcycle.

Narrow band sound means a sound characterized by normal listeners as having a predominant pitch or series of pitches; sound described by such listeners as "whine," "hiss," "toot," or "wail"; or a sound whose frequencies occupy an octave band or less.

Noise control office means the town department having responsibility for the enforcement of this article.

Noise disturbance means any sound which exceeds the dB(A) level for such sound set out in this article.

Nonconforming use means a use of a structure, building or land which was established as a permitted use and which has been lawfully continued pursuant to the zoning code of the town, but which is not a permitted use in the zone in which it is now located.

Off-road recreational vehicle means any motor vehicle, including road vehicles, but excepting watercraft, used off public roads for recreational purposes.

Physical characteristics of sound means the steady, impulsive or narrow band property of a sound, the level of sound and the extent to which it exceeds the background sound level.

Plainly audible means any sound for which the information content is unambiguously communicated to the listener, such as, but not limited to, understandable spoken speech, comprehension of whether a voice is raised or normal or comprehensible rhythms.

Powered model vehicle means self-propelled airborne, waterborne or landborne model plane, vessel or vehicle, which is not designed to carry a person, including, but not limited to, any model airplane, boat, car or rocket.

Public right-of-way means any street, avenue, highway, boulevard, alley, easement or public space which is owned by or controlled by a public government entity.

Public space means any real property, including any structure thereon, which is owned or controlled by a governmental entity.

Real property boundary means an imaginary line along the ground surface, and its vertical extension, which separates the real property owned by one person from that owned by another person, but not including intrabuilding real property divisions.

Receiving land use means the use or occupancy of the property which received the transmission of sound.

Residential property means any property on which is located a building or structure used wholly or partially for living or sleeping purposes. Residential property shall include hotels and motels.

Sound means oscillation in pressure, particle displacement, particle velocity or other physical parameter, in a medium with internal forces that cause compression and rarefaction of that medium. The description of sound may include any characteristic of such sound, including duration, intensity and frequency.

Sound level meter means an instrument which includes a microphone, amplifier, RMS detector, integrator or time averager, output or play meter, and weighting networks used to measure sound pressure levels, which complies with ANSI Standard 1.4-1983.

Sound pressure means the instantaneous difference between the actual pressure and the average or barometric pressure at a given point in space, as produced by sound energy.

Sound pressure level means 20 times the logarithm to the base ten of the ratio of the RMS sound pressure to the reference pressure to the reference pressure of 20 micronewtons per square meter (20 x 10-6N/m'). The sound pressure level is denoted SPL and is expressed in decibels.

Special use permit means as specified in the town zoning ordinance.

Steady sound means a sound whose level remains essentially constant (+ or - 5dB) during the measurement period with the sound level meter.

Tone means any sound which can be distinctly heard as a single pitch or set of single pitches. For the purposes of this article, a tone shall exist if an octave-band analysis indicates any octave band five dB or more over both the band above and below.

Unnecessary, excessive or offensive noise means any sound or noise conflicting with criteria, standards or levels set forth in this article for permissible noises.

Used and *occupied* include the words "intended, designed or arranged to be" used or occupied.

Watercraft means any contrivance used, or capable of being used, as a means of transportation or recreation on water.

Zoning districts means those districts established by the zoning ordinance of the town and indicated on the official zoning map.

(Ord. of 1-22-2003(2), § III)

Cross reference— Definitions generally, § 1-2

Sec. 16-34. - Penalty for violation.

(a) Any person found to have violated the terms of this article shall be punished in accordance with section 1-6

(b) The penalty for violation of any section of this article shall be up to the maximum allowed by state law for municipalities to impose on ordinance violations as follows:

  (1) The first offense shall be punished by the issuance of an order to cease and desist the violation and by a fine of up to $100.00.

  (2) The second and all subsequent offenses shall be punished by the issuance of an order to cease and desist the violation and fine of up to $500.00.

(c) Each noise disturbance shall be considered a separate offense.

(Ord. of 1-22-2003(2), §§ IV, XX)

Sec. 16-35. - Exceptions from article provisions.

(a) The provisions of this article shall not apply to:

  (1) The emission of sound for the purpose of alerting persons to the existence of an emergency or resulting from any authorized emergency vehicle when responding to an emergency call or acting in time of emergency;

  (2) The emission of sound in the performance of emergency work;

  (3) The unamplified human voice, except those activities prohibited in section 16-37

  (4) Agricultural activities, excluding those involving the ownership or possession of animals or birds on parcels of five acres or more;

  (5) The emission of sound in the performance of military operations, excluding travel by individuals to or from military duty;

  (6) The emission of sound in the discharge of weapons or in fireworks displays licensed by the town, from 7:00 a.m. to 10:00 p.m.; and

  (7) The emission of sound in the operation of snow removal equipment at any time.

(b) The emission of sound relative to permitted construction and demolition, earthmoving, utilizing internal combustion engines, motors, and normal maintenance activities are:

  (1) Allowed during normal Eastern Standard Time: activities between the hours of 7:00 a.m. and 6:00 p.m.

  (2) Allowed during Daylight Savings Time: activities between the hours of 7:00 a.m. and 8:30 p.m.

  (3) Prohibited at any hour on Sunday.

(Ord. of 1-22-2003(2), § V)

Sec. 16-36. - Temporary exemptions.

Upon good cause shown by the owner, operator or other responsible party of any excessive noise source, the director of public safety or designee shall have the power to grant a temporary exemption from this article, conditioned upon the installation of needed noise control equipment, facilities, modifications or other mitigation and noise abatement measures to achieve compliance with this article within a reasonable and sufficient period of time, but in no event beyond the date of the next available zoning board meeting. Upon good cause shown, the public safety director also may issue a temporary exemption, not to exceed five consecutive days for special events, if application is made at least 24 hours prior to the event. No entity shall be entitled to more than three such exemptions in any one calendar year.

(Ord. of 1-22-2003(2), § VI)

Sec. 16-37. - Noise disturbances prohibited generally.

(a) No person shall make, continue or cause to be made or continued, except as permitted in this article, any noise or sound which constitutes a noise disturbance. In the absence of specific maximum noise levels, a noise level must exceed the ambient noise level by five dB(A) or more, when measured at the nearest property line or, in the case of a multifamily residential building, when measured anywhere in one dwelling unit with respect to a noise emanating from another dwelling unit or from common space in the same building, in order to constitute a noise disturbance.

(b) This section shall apply to the use or occupancy of any lot or structure thereon and to the noise produced thereby but shall not apply to the intermittent or occasional use, during the daytime, of homeowner's light residential outdoor equipment or commercial service equipment.

(Ord. of 1-22-2003(2), § VII)

Sec. 16-38. - Measurement of sound.

(a) *Generally; tests for noise disturbances.* In addition to the definition established in section 16-33, the factors which shall be considered in determining whether a noise disturbance exists shall include, but shall not be limited to, the following:

    (1) The volume and intensity of the background noise, if any;

    (2) The proximity of the noise to residential sleeping facilities;

    (3) The nature and zoning of the area within which the noise emanates;

    (4) The density of inhabitation of the area within which the noise emanates;

    (5) The time of the day or night the noise occurs;

    (6) The duration of the noise;

    (7) Whether the noise is recurrent, intermittent or constant; and

    (8) Whether the noise is produced by a commercial or noncommercial activity.

(b) *Classification of use districts.* It is unlawful to project a sound or noise, from one property into another, within the boundary of a use district which exceeds either the limiting noise spectra set forth in table I in section 16-39, or exceeds the ambient noise level by more than five decibels.

    (1) *Noise level limits.* Sound or noise projecting from one use district into another use district with a different noise level limit shall not exceed the limits of each district into which the noise is projected.

    (2) *Measurement of noise.*

        a. The measurement of sound or noise shall be made with a sound level meter and whole octave band analyzer meeting the standards prescribed by the American National Standards Association. All sound measurements shall be for a minimum duration of five consecutive minutes. The instruments shall be maintained in calibration and good working order. Octave band corrections may be employed in meeting the response specification. A calibration check shall be made of the system at the time of any noise measurement. Measurements recorded shall be taken so as to provide a proper representation of the noise source. The microphone during measurement shall be positioned so as not to create any unnatural enhancement or diminution of the measured noise. A windscreen for the microphone shall be used when required. Traffic, aircraft and other transportation noise sources and other background noises shall not be considered in taking measurements except where such background noise interferes with the primary noise being measured.

b. The slow meter response of the noise level meter shall be used in order to best determine that the average amplitude has not exceeded the limiting noise spectra set forth in table I in section 16-39

c. The measurement shall be made at the property line of the property on which such noise is generated, or perceived, as appropriate five feet above ground.

d. In the case of an elevated or directional sound or noise source, compliance with the noise limits is to be maintained at any elevation at the boundary.

(Ord. of 1-22-2003(2), § VIII)

Sec. 16-39. - Maximum permissible sound levels by receiving land use.

(a) With the exception of sound levels elsewhere specifically authorized or allowed in this article or exempted by this article or by special use permit, the following are the maximum permissible sound levels allowed at or within the real property boundary of a receiving land use:

Table I

Zoning District Noise Standard

Maximum Allowable Octave Band Sound Pressure Levels[1]

	Residential		Business Limited & General		Commercial Industrial
Octave Band Center Frequency of all Measurement (HZ)>	Daytime	All Other Times	Daytime	All Other Times	Any time
31.5	61	53	66	58	68
63	60	52	65	57	67
125	56	48	61	53	63
250	54	44	59	49	59
500	50	40	55	45	55
1000	47	37	52	42	52
2000	43	33	48	38	48
4000	39	29	44	34	44
8000	38	28	43	33	43

Single number Equivalent	53 dB(A)	43 dB(A)	58 dB(A)	48 dB(A)	58 dB(A)

[1]Unless otherwise noted, values given in the following table are dB, i.e., no adjustments for "A" or "C" weighting.

(b) For any source of sound which emits a tone, the maximum sound-pressure level limits and single-number equivalents set forth in subsection (a) of this section shall be reduced by five dB.

(c) Exceptions to table I are activities covered in sections 16-35 and 16-36

(Ord. of 1-22-2003(2), § IX)

Sec. 16-40. - Emergency signaling devices.

(a) No person shall operate or permit the intentional sounding outdoors of any fire, burglar, vehicle, or civil defense alarm, siren whistle or similar stationary emergency signaling device, except for emergency purposes or for testing or monitoring, as provided in subsection (b) of this section.

(b) Testing of a stationary signaling device shall occur at the same time of day each time the test is performed, but not before 8:00 a.m. or after 6:00 p.m. Any such testing shall use only the minimum cycle test time.

(Ord. of 1-22-2003(2), § X)

Sec. 16-41. - Specific prohibited acts.

The following actions are prohibited only when causing a noise disturbance as defined in this chapter:

(1) *Hawkers and peddlers.* No person shall create a noise disturbance by offering for sale or selling anything by shouting or outcry across a real property boundary. The provisions of this section shall not be construed to prohibit the selling by outcry of merchandise, food and beverages at licensed sporting events, parades, fairs, circuses or other similar licensed public entertainment events.

(2) *Vehicle or motorboat repairs or testing.* No person shall repair, rebuild, modify or test any motor vehicle, motorcycle or motorboat in such a manner as to cause a noise disturbance across a real property boundary.

(3) *Horns, signaling devices, etc.* The sounding of any horn or signaling device on any automobile, motorcycle, streetcar or other vehicle on any street or public place of the city, except as a danger warning.

(4) *Loudspeakers, amplifiers for advertising.* The using, operating or permitting to be played, used or operated of any radio receiving device, musical instrument, phonograph, loudspeaker, sound amplifier, or other machine or device for the producing or reproducing of sound which is broadcast upon the public streets for the purpose of commercial advertising or attracting the attention of the public to any building or structure.

(5) *Yelling, shouting, etc.* Yelling, shouting, hooting, whistling, or singing on the public streets, particularly between the hours of 11:00 p.m. and 7:00 a.m.

(6) *Exhausts.* The discharge into the open air of the exhaust of any steam engine, stationary internal combustion engine, motorboat, or motor vehicle, except through a muffler or other device which will effectively prevent loud or explosive noises therefrom.

(7) *Defect in vehicle or load.* The use of any automobile, motorcycle or vehicle so out of repair, so loaded

or in such condition as to create a noise disturbance.

(8) *Loading, unloading, opening boxes.* The creation of a noise disturbance in connection with loading or unloading any vehicle or the opening and destruction of bales, boxes, crates and containers.

(9) *Schools, courts, churches, hospitals.* The creation of any noise disturbances on any street adjacent to any school, institution of learning, church or court while the school, institution of learning, church or court are in use, or adjacent to any hospital, provided that conspicuous signs are displayed in such streets indicating that such is a school, hospital or court street.

(Ord. of 1-22-2003(2), § XI)

Sec. 16-42. - Musical instruments and similar devices.

No person shall operate, play or permit the operation of any musical instrument, phonograph or other machine or device for the production or reproduction of sound, including but not limited to any stereo, radio, television, musical instrument or other noise making device for the producing or reproducing of sound within a motor vehicle, using or operating such instrument, or device and such persons who are voluntarily listeners thereto or in such manner as to constitute a noise disturbance. In addition, the operation of any such instrument, phonograph, television, machine or device between the hours of 11:00 p.m. and 7:00 a.m. in such a manner as to be plainly audible at a distance of 50 feet from the building structure or vehicle in which it is located shall be a violation of this section; provided, that nothing contained in this section shall prohibit performances by the ringing of bells in a tower, or by a band or orchestra in a hall, building or in the open air that is otherwise in compliance with local ordinances.

(Ord. of 1-22-2003(2), § XII)

Sec. 16-43. - Motorized vehicles.

(a) No person shall operate the engine providing motive power, or any auxiliary engine, of a motor vehicle with a manufacturer's gross vehicle weight rating 10,000 pounds or more for a consecutive period longer than 20 minutes while such vehicle is standing and located within 150 feet of property zoned and used for residential purposes, if the sound level emitted by the motor vehicle exceeds the maximum permissible sound levels as prescribed by table II in this section, except where such vehicle is standing within a completely enclosed structure. This section shall not apply to delivery or pickup vehicles that require the operation of the engine to unload or load their vending loads.

(b) No person shall operate, within the speed limits specified in this section, either a motor vehicle or a combination of vehicles of a type subject to registration, at any time or under any condition of grade, load, acceleration or deceleration in such a manner as to exceed the noise limit listed in table II in this section for the category of motor vehicle, based on the legal speed limit, posted or not, of the road or way on which such vehicles are operated. Such noise shall be measured at a distance of not more than 50 feet from the centerline of travel under test procedures established by subsection (a) of this section. If the distance of the measuring instrument from the centerline of travel is less than 50 feet, such listed noise limits shall be corrected to reflect the equivalent noise limits for the actual distance.

TABLE II

Noise Limit in Relation to the Legal Speed Limit

		35 mph or less	Over 35 mph

(1)	Any motor vehicle with a manufacturer's gross vehicle weight rating 10,000 pounds or more and any combination of vehicles towed by such motor vehicle	86 dBA	90 dBA
(2)	Any motorcycle	82 dBA	82 dBA
(3)	Any other motor vehicle and any combination of motor vehicles towed by such motor vehicle	75 dBA	75 dBA

This section applies to the total noise from a vehicle or combination of vehicles and shall not be construed as limiting or precluding the enforcement of any other provision of this Code relating to motor vehicle muffler or noise control.

(c) Every motor vehicle and motorboat shall at all times be equipped with a muffler in good working order and in constant operation to prevent noise which exceeds the dB(A) levels set forth in table II in this section. No person shall use a muffler cutout, bypass or similar device upon a motor vehicle.

(d) No person shall modify the exhaust system of a motor vehicle or motorcycle by installation of a muffler or bypass and no person shall operate a motor vehicle or motorcycle which has been so modified if the sound level emitted by the motor vehicle exceeds the maximum permissible sound levels as prescribed by table II in this section.

(e) No person shall operate a recreational vehicle or permit the operation of one or more recreational vehicles, individually or in a group or in an organized racing event, on public or private property, in such a manner as to create a noise disturbance across a real boundary.

(Ord. of 1-22-2003(2), § XIII)

Sec. 16-44. - Construction.

(a) *Exceptions.* This article shall not apply to:

(1) Emergency work or repair work performed by and for government entities or public service utilities

or their agents; or

(2) Work for which a special use permit has been obtained under section 16-48

(b) *Restrictions.* The use of domestic power tools or equipment is subject to the noise levels set forth in table I in section 16-39

(Ord. of 1-22-2003(2), § XIV)

Sec. 16-45. - Animals and birds.

No person shall own, possess or harbor any animal or bird which frequently or for a continued duration emits sound that is native to the species, which sound exceeds the dB(A) levels as set forth in table I in section 16-39.

(Ord. of 1-22-2003(2), § XV)

Sec. 16-46. - Implementation, administration and enforcement.

(a) This article shall be implemented, administered and enforced by the town police department or any other town department or division designated by the director of public safety.

(b) The provisions of this article which prohibits a person from making or continuing noise disturbances, or causing the noise disturbances to be made or continued, across a real property boundary, shall be enforced by the police department or any other town department or division as designated by the director of public safety.

(c) To implement and enforce this article, the police department, or any duly designated town agency, shall have the power to:

(1) Conduct research, monitoring and other studies related to sound;

(2) Conduct programs of public education regarding the causes, effects and general methods of abatement and control of noise as well as the actions prohibited by this article and the procedures for reporting violations;

(3) Coordinate the noise control activities of all town departments;

(4) Review public and private projects, including those subject to mandatory review or approval by other departments, for compliance with this article, if these projects are likely to cause sound in violation of this article;

(5) Prepare recommendations for consideration by the town council, after publication of notice and after a public hearing.

(Ord. of 1-22-2003(2), § XVI)

Sec. 16-47. - Departmental actions.

All departments and agencies of the town shall carry out their programs in furtherance of the policies set forth in this article.

(Ord. of 1-22-2003(2), § XVII)

Sec. 16-48. - Special use permits.

(a) *Designated.* The zoning board of review, established pursuant to G.L. 1956, § 45-24-57(vii) is hereby designated as the board of appeal and relief from this article.

(b) *Authority.* The zoning board of review, acting pursuant to G.L. 1956, § 45-24-57(vii), shall have the authority, consistent with this section, to grant special use permits after a public hearing.

(c) *Application.* Any person seeking a special use permit under this section shall file an application with the zoning board of review. The application shall contain information which demonstrates that bringing the source of sound or activity for which the special use permit is sought into compliance with this article would constitute an unreasonable hardship on the applicant, on the community or on other persons.

(d) *Application fee.* All applications shall be subject to any applicable application fee and shall be in accordance with provisions for a special use permit as set forth in the town zoning ordinances.

(e) *Grant, denial or revocation.*

(1) In determining whether to grant or deny an application, or revoke a special use permit previously granted, the zoning board of review shall balance the hardship to the applicant, the community and other persons if the special use permit is not allowed, against the adverse impact on the health, safety and welfare of persons affected, the adverse impact on property affected, and any other adverse impact, if the special use permit is allowed. The zoning board may grant the relief as applied for if it finds that:

a. Additional time is necessary for the applicant to alter or modify his activity or operation to comply with this section; or

b. The activity, operation or noise source will be of temporary duration, and cannot be done in a manner that would comply with other subsections of this section; and

c. No other reasonable alternative is available to the applicant.

(2) Applicants for special use permits and persons contesting special use permits may be required to submit any information that the zoning board of review may reasonably require. In granting or denying an application or in revoking a special use permit previously granted, the zoning board of review shall place on public file a copy of the decision in the land evidence records of the town stating the reasons for granting, denying or revoking the special use permit.

(f) *Conditions.* The special use permit shall be granted by notice to the applicant containing all conditions necessary to minimize adverse effects upon the community or the surrounding neighborhood, including a time limit on the permitted activity. The special use permit shall not become effective until all conditions are agreed to by the applicant. Noncompliance with any condition of the special use permit shall terminate it and subject that person to those provisions of this article regulating the source of sound or activity for which the special use permit was granted.

(g) *Modification of permit.* Determination of modification of a granted special use permit shall also be made in accordance with the rules and procedures set forth in this section.

(h) *Expiration.* The special use permit shall automatically expire when the specific use for which it was granted is discontinued for a period of six months.

(Ord. of 1-22-2003(2), § XVIII)

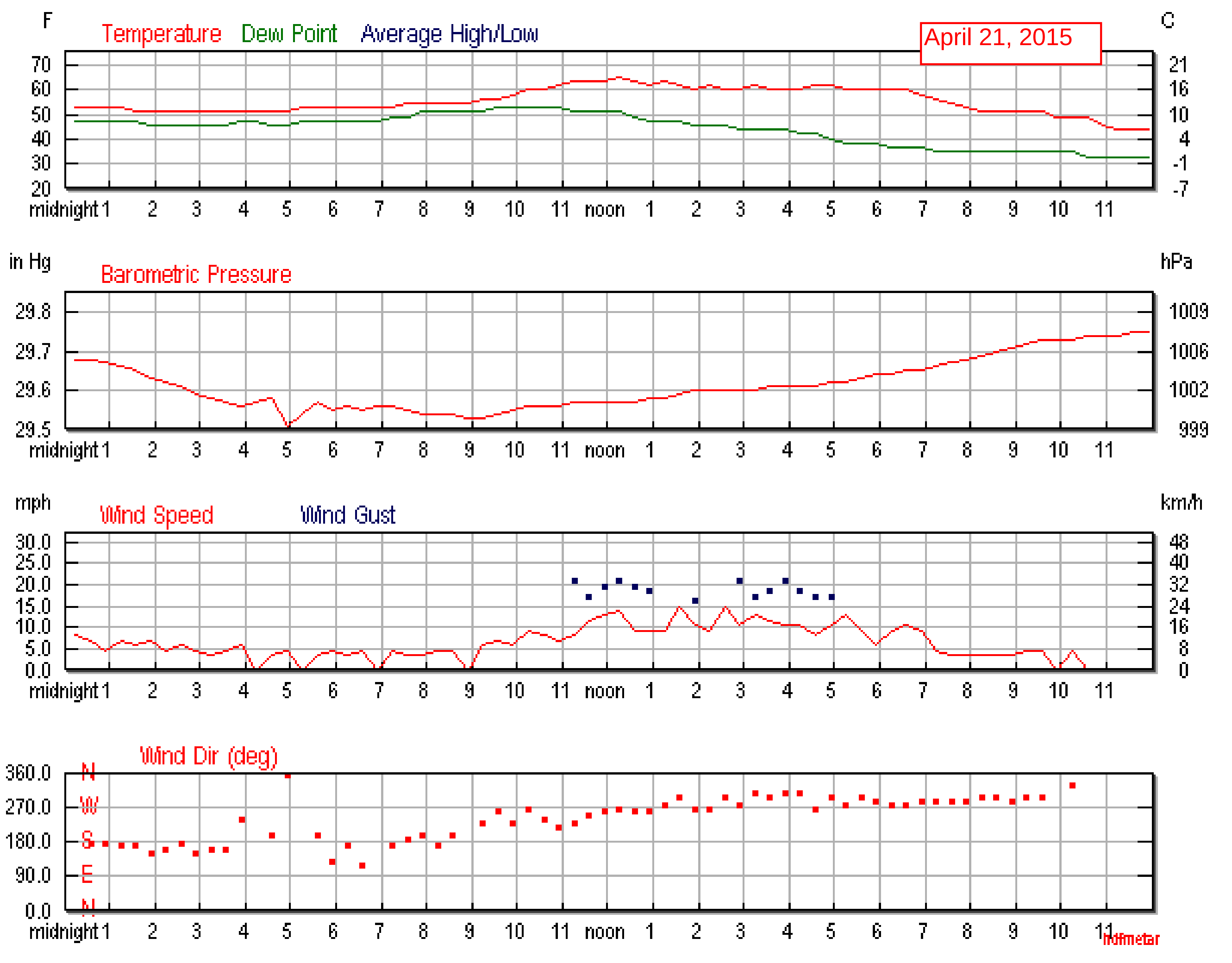
Sec. 16-49. - Jurisdiction.

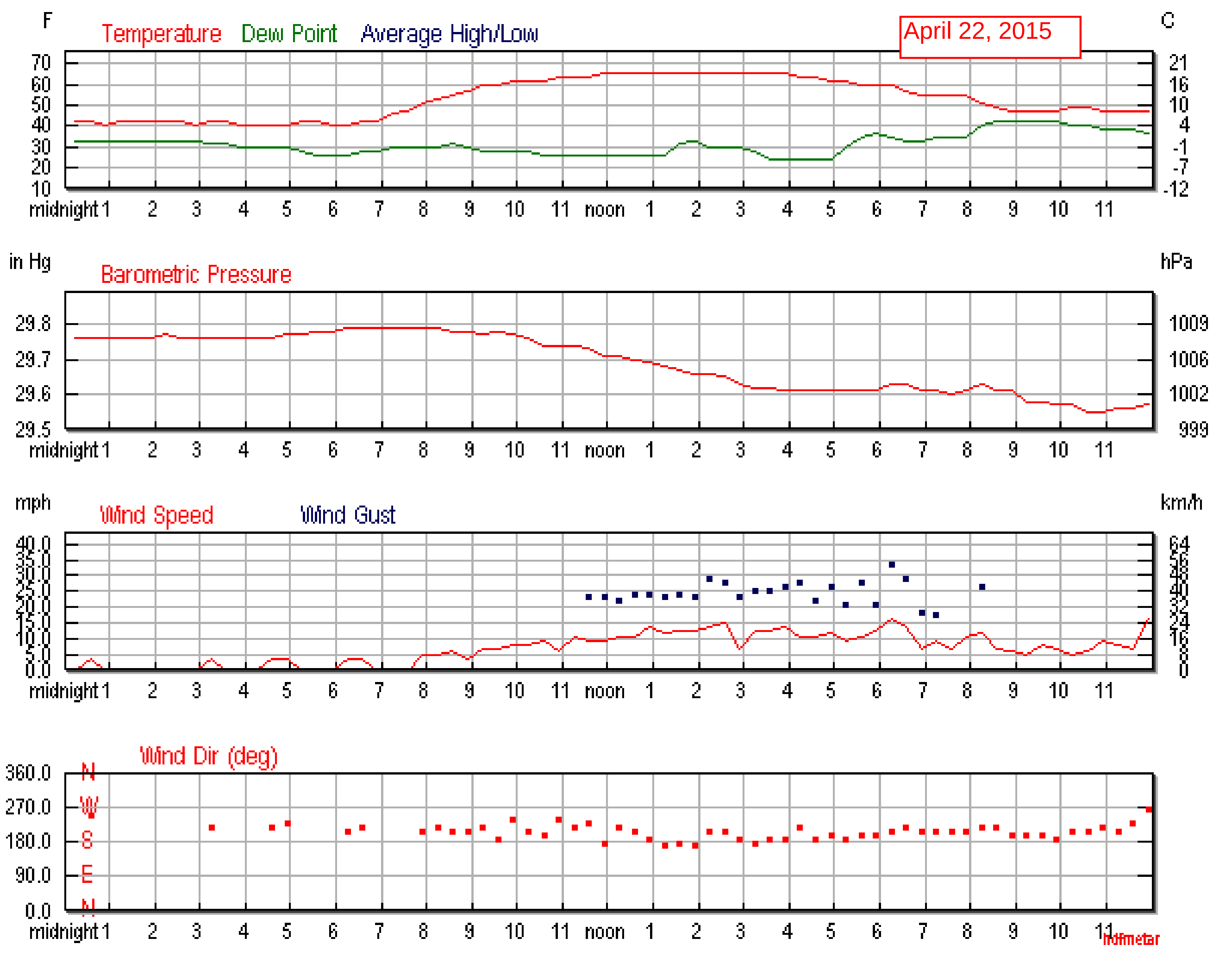
Jurisdiction of offenses under this section shall be in the municipal court of the town, or in the district court in the absence of any municipal court for the town.

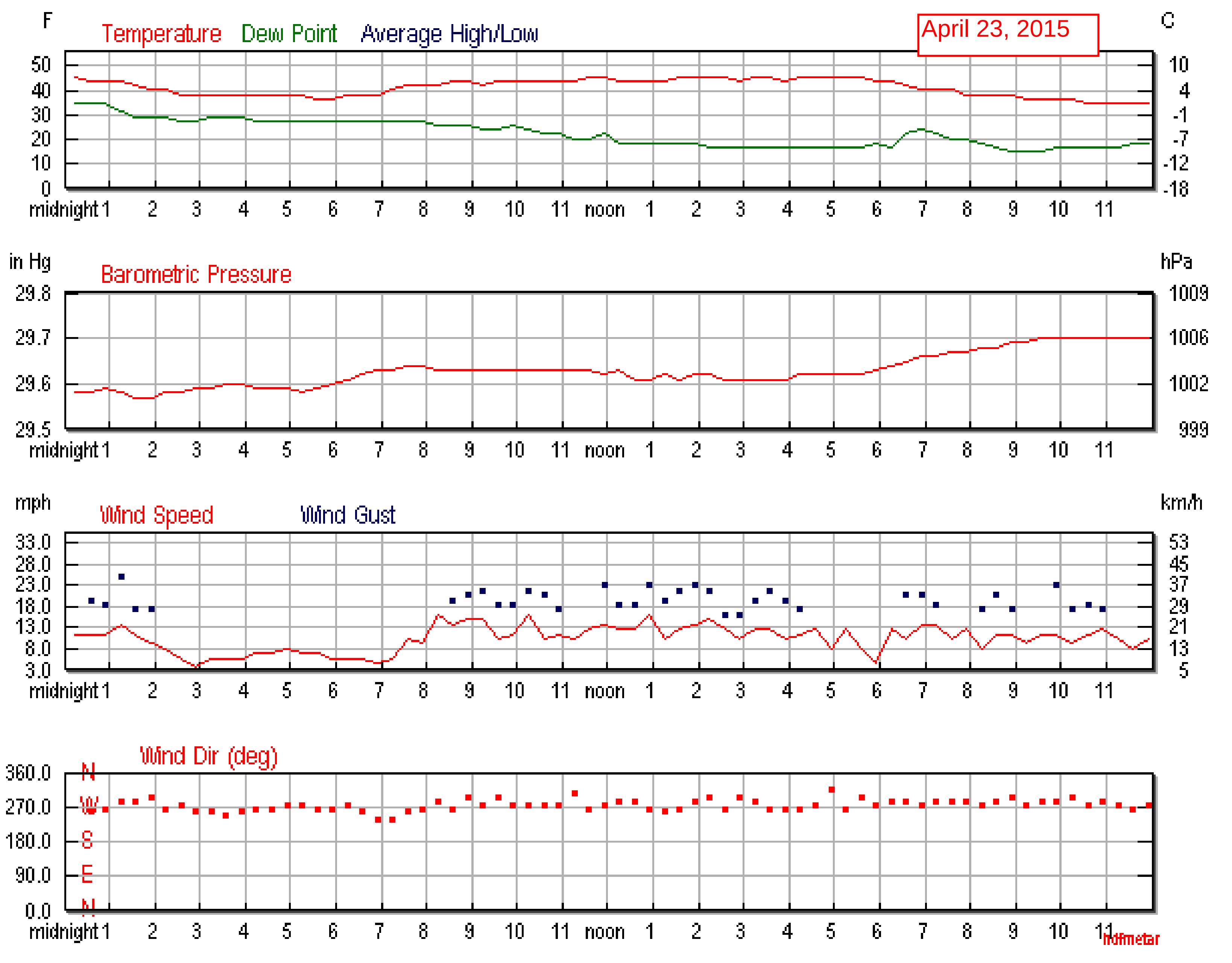
(Ord. of 1-22-2003(2), § XXI)

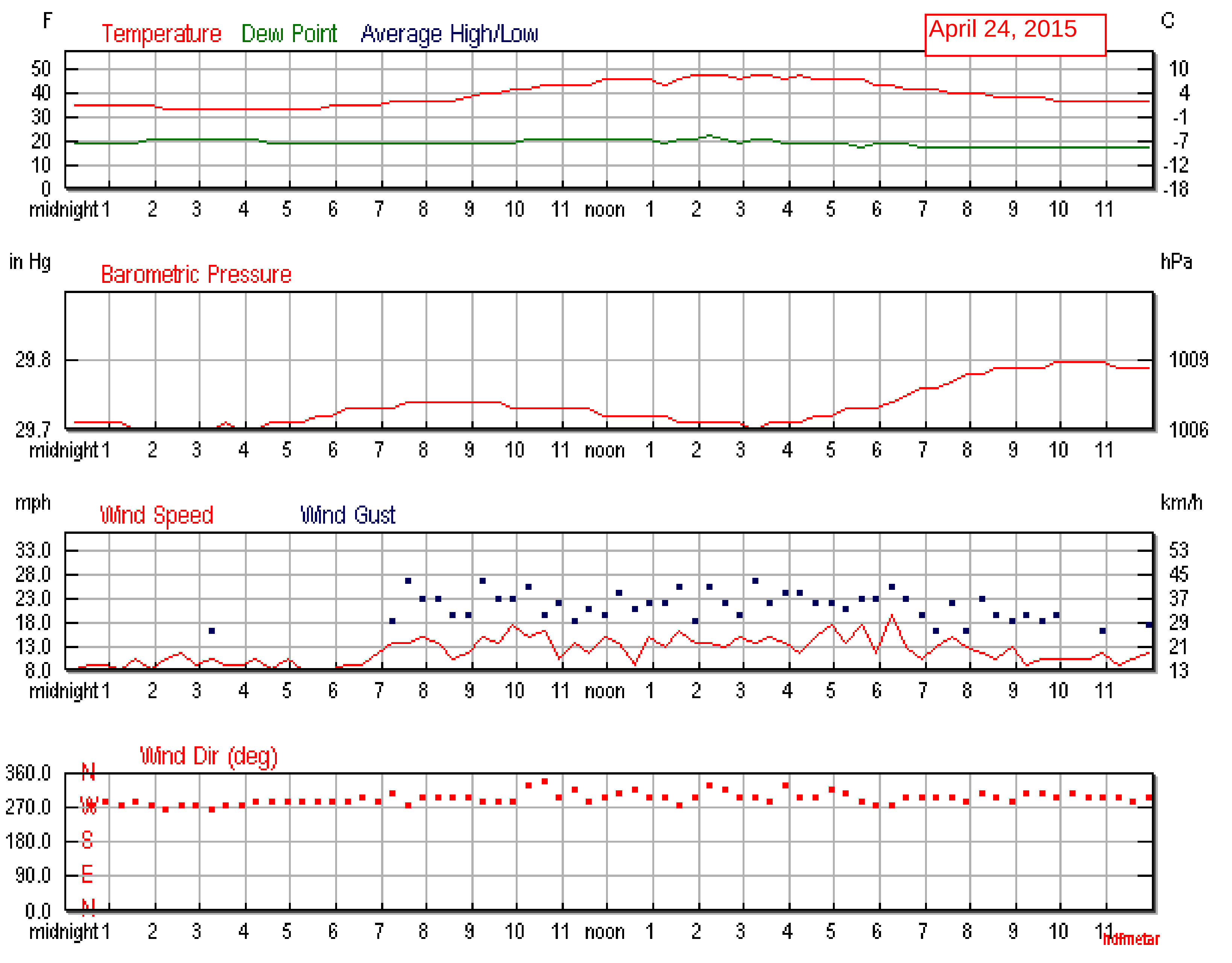
Secs. 16-50—16-60. - Reserved.

N2 Noise Survey Meteorological Conditions


April 21, 2015
F
C
Temperature
Dew Point
Average High/Low
70
60
50
40
30
20
21
16
10
4
-1
-7
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
in Hg
hPa
Barometric Pressure
29.8
29.7
29.6
29.5
1009
1006
1002
999
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
mph
km/h
Wind Speed
Wind Gust
30.0
25.0
20.0
15.0
10.0
5.0
0.0
48
40
32
24
16
8
0
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
Wind Dir (deg)
360.0
270.0
180.0
90.0
0.0
N
W
S
E
N
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
Indimetar


April 22, 2015
F
C
Temperature
Dew Point
Average High/Low
70
60
50
40
30
20
10
21
16
10
4
-1
-7
-12
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
in Hg
hPa
Barometric Pressure
29.8
29.7
29.6
29.5
1009
1006
1002
999
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
mph
km/h
Wind Speed
Wind Gust
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
64
56
48
40
32
24
16
8
0
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
Wind Dir (deg)
360.0
270.0
180.0
90.0
0.0
N
W
S
E
N
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
Indimetar


April 23, 2015
F
C
Temperature
Dew Point
Average High/Low
50
40
30
20
10
0
10
4
-1
-7
-12
-18
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
in Hg
hPa
Barometric Pressure
29.8
29.7
29.6
29.5
1009
1006
1002
999
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
mph
km/h
Wind Speed
Wind Gust
33.0
28.0
23.0
18.0
13.0
8.0
3.0
53
45
37
29
21
13
5
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
Wind Dir (deg)
360.0
270.0
180.0
90.0
0.0
N
W
S
E
N
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
Indimetar



April 24, 2015
F
C
Temperature
Dew Point
Average High/Low
50
40
30
20
10
0
10
4
-1
-7
-12
-18
midnight 1 2 3 4 5 6 7 8 9 10 11 noon 1 2 3 4 5 6 7 8 9 10 11
in Hg
hPa
Barometric Pressure
29.8
29.7
1009
1006
mph
km/h
Wind Speed
Wind Gust
33.0
28.0
23.0
18.0
13.0
8.0
53
45
37
29
21
13
Wind Dir (deg)
360.0
270.0
180.0
90.0
0.0
N
W
S
E
N
Indimetar

N3 Equipment Specifications

Model 831
Sound Level Meter

Applications:

- Class 1 sound measurements to the latest international standards
- Environmental noise assessment and monitoring
- Reverberation time measurement and building acoustics
- Tonality
- Occupational noise evaluation
- HPD selection
- Noise reduction validation
- Product quality control
- NVH correlation
- In-Situ sound power measurements
- Code enforcement

Features:

- IEC 61672-1:2013, ANSI S1.4-2014 Class 1 integrating sound level meter
- Real-time frequency analysis in 1/1 and 1/3 octave bands, compliant with IEC 61260:2001 and ANSI S1.11-2004 Class 1
- Large, high-resolution screen, easily readable in bright sunlight
- Robust battery life (24 hours on 4 X AA Lithium batteries)
- Simplified system and measurement set-up through a “mobile phone like” interface
- Lightweight, ergonometric design
- Soft keypad for 1-handed operation
- Standard USB interface
- Dynamic range in excess of 120 dB
- Logging of broadband and spectral data to obtain time, measurement and event histories on the instrument
- Sound recording in .wav format for event, manual or time-based trigger
- Utility software included for set-up, archiving, export and reporting
- Supplied with heavy-duty Pelican® carrying case

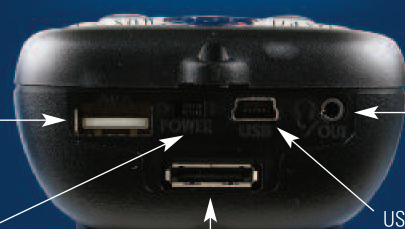


Fig.1
Model 831 Layout

Model 831 Standards, Features & Specifications

Standards Met by Model 831		
The Model 831 meets the specifications of the following standards:		
Sound Level Meter Standards		
IEC61672-1 Ed. 2.0 (2013-09) Class 1, Group X		
IEC60651 Ed 1.2 (2001) plus Amendment 1 (1993-02) and Amendment 2 (2000-10) Type 1, Group X		
IEC60804 (2000-10) Type 1, Group X		
ANSI S1.4-2014 Type 1		
Octave Filter Standards (Option 831- OB3)		
IEC61260 Ed. 1.0 (1995-08) plus Amendment 1 (2001-09), 1/1 and 1/3 octave bands, Class 1, Group X, all filters		
ANSI S1.11-2004 Class 1		
Personal Noise Dosimeter Standards (Option 831-IH)		
IEC61252 Ed. 1.1 (2002-03) Type 1		
ANSI S1.25-1991 Class 1		
Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use		
2006/95/EC Low Voltage Safety Directive		
IEC 61010-1 Ed. 3.0 (2010-06)		
EMC Immunity and Emission		
2004/08/EC EMC Directive		
IEC 61326-1 Ed. 2.0 (2012-07)		
IEC 61672-1 Ed. 2.0 (2013-09)		
FCC Title 47 CRF Part 15, Class B		
Model 831 General Features and Characteristics		
Class 1 Precision Integrating Sound Level Meter with real-time 1/1 and 1/3 octave filters		
Non-Volatile Memory		
High contrast 1/8th VGA LCD display with white LED backlight; sunlight readable		
Icon-driven graphic user interface		
Soft rubber backlit keys		
Large dynamic range		
Time weightings: Slow, Fast, Impulse, Integration and Peak simultaneously (AnyData)		
Frequency weightings: A, C, Z simultaneously (AnyData)		
1/1 and 1/3 octave frequency analysis available		
Voice message annotation and sound recording		
Ln statistics (L0.01 through L99.9 available)		
SLM Utility-G3 software available for set-up, control and high speed data download with export to Excel®		
Multi-tasking processor allows measuring while viewing data or transferring data		
Data Secure feature saves data to permanent memory every minute		
AC/DC outputs to recorder		
Long battery life; > 16 hours continuous measurement		
Multiple language support: English, German, Italian, Spanish, Portuguese, Swedish, French & Turkish		
Field-upgradable firmware: keeps instrument current with the latest measurement features		
Two-year limited warranty		
Sound Level Meter Specifications		
Averaging (Integration method)	Linear or Exponential	
RMS Time Weighting	Slow, Fast or Impulse	
Frequency Weightings	A, C or Z	
Peak Detector Frequency Weighting	A, C or Z	
Gain	0 dB or +20 dB	
Exchange Rates	3, 4, 5, or 6 dB with optional 831-IH	
Sample Rate	51,200 Hz	
Peak Rise Time	30 μs	
Physical Characteristics		
Length with Microphone and Preamplifier	11.35 in	29.0 cm
Length, Instrument Body Only	8.8 in	22.4 cm
Width	2.8 in	7.1 cm
Depth	1.6 in	4.1 cm
Weight with Batteries, No Preamplifer or Microphone	13.6 oz	390 g
Weight with Batteries, Preamplifer and Microphone	1.2 lb	550 g

General Specifications	
Reference level	114.0 dB re. 20 μPa
Reference level range	Single large range for SLM Normal for OBA option, Gain 0 dB
Reference frequency	1000 Hz
Reference direction	0° is perpendicular to the microphone diaphragm
Temperature	≤ ± 0.5 dB error between +14 to +122 °F (-10 to 50 °C)
Storage temperature	-4 to 158 °F (-20 to 70 °C)
Humidity	≤ ± 0.5 dB error from 30% to 90% relative humidity at 104 °F (40 °C)
Equivalent Microphone Impedance	12 pF for Larson Davis 1/2 in microphone
Range Level Error (OBA option)	≤ ± 0.1 dB relative to the reference range
Digital Display Update Rate	Four times per second (0.25 sec between updates). First display indication is available 0.25 seconds after initiation of a measurement.
Effect of an Extension Cable	None (up to 200 ft or 61 m with EXCxxx cable)
Electrostatic Discharges	The instrument is not adversely affected by electrostatic discharges
Extended Weather Options	-40 to +158 °F (-40 to +70 °C) operation with CER-831-E
Resolution Specifications	
Levels	0.1 dB
Dose	0.1%
Elapsed time	0.1 second
Real time clock	1 second
Calendar	Through 31 Dec 2100
Integration Time	
Time Averaged Levels and Sound Exposure Levels (s)	
Minimum	0.1 second
Maximum with Daily Autostore Enabled	Unlimited
Maximum with Daily Autostore Disabled	> 23 days with error < 0.5 dB
Dosimeter Metrics: TWA, Dose (s)	
Minimum	0.1 second
Maximum	Unlimited
Ln Statistics	
Number of selectable parameters	6 in xx.xx% format, visible on the Model 831
Storage of Complete Table	0.1 dB Steps
Spectral Statistics	Requires Octave Analysis option (831-OB3)
Markers	
Number of Markers	10
Prenamed Markers	5: Truck, Automobile, Motorcycle, Aircraft, Exclude
Link Marker to Automatic Sound Recording	Yes, requires Sound Recording option (831-SR)
Back Erase	
Back Ease Time	5 or 10 seconds
Supported Modes	Manual
Measurement Control Modes	
Available Modes	Manual Stop, Timed Stop, Stop when Stable, Continuous, Single Block Timer, Daily Block Timer
Timed Stop	Time in hh:mm:ss
Stop When Stable	Delta level in xx.x dB and time in hh:mm:ss
Continuous with Daily Auto-Store	1, 2, 4, 6, 12, 24, 48, 96 or 144 files per day, automated file numbering "yymmddnn.LD0"
Continuous Restart on Power Failure	Automatic if powered by 12VDC
Single Block Timer	Start date and time to End data and time
Daily Block Timer	Up to 3 blocks with each start and end date, blocks can cross date line
Clock Stability	
< 1 sec in 24 hours, at 75 °F (+24 °C)	
< 10 sec in 30 days, at -40 to +158 °F (-40 to +70 °C)	
Digital Voice Annotation	
Annotate Recordings	Use headset (ACC003) or measurement microphone
Recording Sample Rate	8 ksps
Listening Options	On the Model 831 or using processing software for .wav files

AC/DC Output, Power Supply, Memory Retention, Broadband Noise Level & Preamplifiers

PRM831
Preamplifier

377B02
Microphone

General Specifications (Continued)

AC/DC Output	
Jack	2.5 mm (3/32 in), see CBL139 cable
AC Output Voltage Range	± 2.3 Vpeak maximum output, 0.5 mV to 1.6 Vrms sine
AC Output Recommended Load	Headset with ≥ 16 Ω speaker impedance
DC Output Voltage Scale	10 mV per dB, 0 V for 0 dB, 1 V for 100 dB
DC Output Frequency & Time Weighting	Follows SLM Settings: A, C or Z and S, F or I
Tee-off Preamplifier Signal Alternative	Use ADP015 and EXC006
Power Supply	
Batteries	4-AA (LR6) NiMH, 1.5 V Lithium or Alkaline cells (supplied with 2500 mAh NiMH)
External Power (5 V from USB)	USB Mini-B connector to * USB interface from computer * PSA029 AC to DC power adaptor * USB Hub * PSA031 12 VDC to USB adaptor
External Power	Power through I/O connector: 10 to 15.5 VDC Use cable CBL140, CBL154 or Model 831-INT Interface Unit
Operating Time on 1.5 V Lithium	> 24 hours with power save options, 1 sec Leq logging
Power Consumption with PRM831	1.1 W (backlight off, running)
Memory Retention	
Data Memory	Non-volatile flash memory, backup performed every minute
Real-time Clock	≥ 10 minutes with batteries removed

Broadband Noise Levels

Self-generated Electrical Noise

Weighting	0 dB Gain		20 dB Gain	
	Typical (dB)	Max (dB)	Typical (dB)	Max (dB)
A	13	15	6	10
C	15	22	12	16
Z	22	25	19	26

Self-generated Total Noise

Weighting	0 dB Gain		20 dB Gain	
	Typical (dB)	Max (dB)	Typical (dB)	Max (dB)
A	18	19	17	17
C	18	23	17	19
Z	23	26	21	26

Note: Combination of the electronic noise and the thermal noise of the 377B02 microphone at 68 °F (20 °C) measured in a sealed cavity and vibration isolated with an averaging time of 60 seconds.Electronic noise of the instrument with an ADP090 (12 pF) in place of the microphone highest anticipated self-generated noise.

Model 831 Preamplifier Specification (PRM831)

Frequency response with respect to the response at 1 kHz with 1 Vrms input and 12 pF equivalent microphone.

8 Hz to 16 Hz	+0.1, -0.2 dB
16 Hz to 100 kHz	+0.1, -0.1 dB
Lower -3 dB limit	< 1.5 Hz
Attenuation	0.1 dB (typical)
Input Impedance	10 G Ω / 0.16 pF
Output Impedance	50 Ω
Maximum Output	28 Vpp 143 dB peak for microphones with 50 mV/Pa sensitivity
Maximum Output Current	12 mA peak
Harmonic Distortion	< -70 dBC with 8 Vrms output at 1 kHz
Output Slew Rate	2 V per µs (typical)
Electronic Noise With 12 pF Equivalent Microphone	1.8 µV typical A-weighted (2.4 µV max) 4.3 µV typical Flat 20 Hz to 20 kHz (5.0 µV max)
Power Supply Voltage	15 to 36 V
DC Output Level	≈1/2 power supply voltage
Power Supply Current	1.9 mA (typical)
Temperature Sensitivity	< ±0.05 dB from +14 to +176 °F (-40 to +80 °C)
Humidity Sensitivity	< ±0.05 dB from 0 to 90% RH, non-condensing at +122 °F (+50 °C)
Dimensions (D x L)	0.50 x 2.88 in (12.7 x 73 mm)
Microphone Thread	11.7 mm - 60 UNS (0.4606 in - 60 UNS)
Cable Driving Capability	The Model 831 SLM (10 Vrms output signal) to 20 kHz with 200 ft (61 m) cable
Test Conditions	All values are at 73 °F (23 °C), 50% RH, 35 V supply, 10 ft (3 m) cable and equivalent microphone of 12 pF unless otherwise stated
Output Connector	Switchcraft TA5M (5-pin male)
Compatibility (to IEC61094-4)	Use with 1/2 in microphone, typical 50 mV/Pa sensitivity

Model 831 with PRM831 and 377B02 Microphone

		0 dB Gain	20 dB Gain
Dynamic Range	A	18 - 140 dB	17 - 120 dB
	C	18 - 140 dB	17 - 120 dB
	Z	23 - 140 dB	21 - 120 dB
Measurement Range [1]	A	28 - 140 dB	26 - 120 dB
	C	29 - 140 dB	27 - 120 dB
	Z	35 - 140 dB	34 - 120 dB
Linearity Range [2]	A	≥ 115 dB 24 to 140 dB	≥ 101 dB 19 to 120 dB
	C	≥ 114 dB 25 to 140 dB	≥ 96 dB 23 to 120 dB
	Z	≥ 106 dB 32 to 140 dB	≥ 86 dB 32 to 120 dB
Peak Range	A	66 - 143 dB	46 - 123 dB
	C	66 - 143 dB	46 - 123 dB
	Z	77 - 143 dB	59 - 123 dB
Max Level	SPL	140 dB	120 dB
	PEAK	143 dB	123 dB

Notes

[1] As defined in IEC 61672-1. Microphone and electrical self-noise included. [2] As defined in ANSI S1.4-1983. Electrical Measurements.

Permanent Outdoor Preamplifiers and Microphones

Model 426A12
Model PRM2103

Larson Davis Model 820

Larson•Davis Incorporated
1681 West 820 North
Provo, UT 84601-1341
(801) 375-0177
www.lardav.com

Type

The Larson•Davis Model 820 with attached PRM 828 preamp and Model 2541 microphone is a combination Type 1 precision integrating sound level meter and statistical data logger. The Model 820 can also be used with any of the Larson•Davis 1/2" condenser microphones. They may also be used with any Larson•Davis 1/4" or 1" microphones provided they are used with an ADP011 (1/4"to 1/2"preamp adapter) or an ADP008 (1" to1/2" preamp adapter) attached to the PRM 828. The Model 820 polarization voltage can be set to either 200V or 28V.

Standards Met

- ANSI S1.4-1983 Type 1
- ANSI S1.25-1991 Type 1
- IEC 651 Type 1
- IEC 804 Type 1
- Directive 86/188/EEC
- Directive IEC/TC-29

Larson Davis Model CAL200

Larson•Davis Incorporated
1681 West 820 North
Provo, UT 84601-1341
(801) 375-0177
www.lardav.com

Type

The Larson Davis Model CAL200 is a Class 1 microphone calibrator intended for the Larson Davis 1/2" or 1/4" diameter microphones. The CAL200 provides a choice of calibration sound pressure levels, 94.0 and 114.0 dB (switch selectable) at a frequency of 1 kHz.

Specifications

Calibration Sound Pressure Level	94.0 and 114.0 dB re: 20 µPa (±0.2dB) @ 1013 millibars and 23° C,and 50% relative humidity.
Equivalent free-field level	-.015dB for 1/2" free-field microphones.
Frequency	1 kHz ±1%
Harmonic Distortion	<2%
Stability	±0.1 dB after 2 seconds
Barometric Pressure Range	650 to 1080 mbar SPL will be within ±0.3 dB.
Temperature Range	SPL variation ±0.3 dB (typically 0.005 dB/° C) Frequency variation ±2% over the range -10 to 50° C
Humidity Range	SPL variation < ±0.3 dB over the range 10 to 90% relative humidity Frequency variation ±2% over the range 10 to 90% relative humidity
Storage Temperature	-40 to 60.0° C
Storage Humidity	0 to 99% relative humidity (non-condensing)
Effective Volume of Calibrator & Microphone	3.48 cm^3 (0.21 in^3)
Battery	9 V NEDA 1604A or IEC 6LR61 With sufficient battery voltage, calibrator will run (after releasing ON button) for 1 to 1.5 minutes before automatic shutdown. With insufficient battery voltage, calibrator will not remain ON after release of button.
Traceability	Utilize the Larson Davis 1/2" Model 2559 or 2560 precision condenser microphone in conjunction with other traceable measuring instruments to estalish traceabiity of the output level and frequency of the Model CAL200.
Standards met	ANSI S1.40-1984 - Specification for Acoustic Calibrators IEC60942-2003 Class 1 - Sound Calibrators.
CE	CE-mark indicates compliance with: EMC Directive.
EMC Emission	EN 50081-1: Generic emission standard . Part 1: Residential, commerical and light industry.
EMC Immunity	EN 50082-2: Generic immunity standard. Part 2: Industrial environment.

N4 Equipment Calibration Certificates

Calibration Certificate

Certificate Number 2015003032

Customer:
Hankard Environmental
211 East Verona Avenue
Verona, WI 53593, United States

Model Number	831	***Procedure Number***	D0001.8384		
Serial Number	0001720	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	6 Apr 2015		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	6 Apr 2016		
		Temperature	22.93	°C	± 0.01 °C
Description	Larson Davis Model 831	***Humidity***	50.9	%RH	± 0.5 %RH
		Static Pressure	85.22	kPa	± 0.03 kPa

Evaluation Method ***Tested with:***
PRM831, S/N 012520
377B02, S/N 109122

Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.11 (R2009) Class 1
IEC 61260:2001 Class 1	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
SRS DS360 Ultra Low Distortion Generator	07/08/2014	07/08/2015	006311
Hart Scientific 2626-S Humidity/Temperature Sensor	05/16/2014	05/16/2015	006943
Larson Davis CAL200 Acoustic Calibrator	08/06/2014	08/06/2015	007027
Larson Davis Model 831	03/05/2015	03/05/2016	007182
1/2 inch Microphone - P - 0V	03/11/2014	03/11/2015	007185
Larson Davis CAL291 Residual Intensity Calibrator	09/26/2014	09/26/2015	007287

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result

1000 Hz

As Received Level: 113.97
Adjusted Level: 114.01

-- End of measurement results--

Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using S-time-weighted sound level

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.16	-0.20	-1.20	0.80	0.21	Pass
1000	0.12	0.00	-0.70	0.70	0.21	Pass
8000	-2.28	-3.00	-5.50	-1.50	0.21	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
Low Range, 20 dB gain	63.71

-- End of measurement results--

-- End of Report--

Signatory: *Ron Harris*

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ilac-MRA ACCREDITED Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

Calibration Certificate

Certificate Number 2015003007

Customer:
Hankard Environmental
211 East Verona Avenue
Verona, WI 53593, United States

Model Number	PRM831	***Procedure Number***	D0001.8383		
Serial Number	012520	***Technician***	Ron Harris		
Test Results	**Pass**	***Calibration Date***	3 Apr 2015		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	3 Apr 2016		
		Temperature	23.16	°C	± 0.01 °C
Description	Larson Davis 1/2" Preamplifier for Model 831 Type 1	***Humidity***	49.8	%RH	± 0.5 %RH
		Static Pressure	87.23	kPa	± 0.03 kPa

Evaluation Method Tested electrically using a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 μPa assuming a microphone sensitivity of 50.0 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Sound Level Meter / Real Time Analyzer	11/05/2014	11/05/2015	001150
Hart Scientific 2626-S Humidity/Temperature Sensor	05/16/2014	05/16/2015	006943
Agilent 34401A DMM	08/28/2014	08/28/2015	007165
SRS DS360 Ultra Low Distortion Generator	11/13/2014	11/13/2015	007167

PCB PIEZOTRONICS
A PCB GROUP COMPANY

Certificate of Calibration and Conformance

Certificate Number 2015-199604

Instrument Model 820, Serial Number 1378, was calibrated on 6 Apr 2015. The instrument meets factory specifications per Procedure D0001.8160, ANSI S1.4 1983, IEC 651-Type 1 1979, and IEC 804-Type 1 1985.

Instrument found to be in calibration as received: NO
Date Calibrated: 6 Apr 2015
Calibration due: 6 Apr 2016

Calibration Standards Used

MANUFACTURER	MODEL	SERIAL NUMBER	INTERVAL	CAL. DUE	TRACEABILITY NO.
Larson Davis	LDSigGn/2209	0589 / 0103	12 Months	16 Dec 2015	2014-197129

Reference Standards are traceable to the National Institute of Standards and Technology (NIST)

Calibration Environmental Conditions

Temperature: 24 ° Centigrade

Relative Humidity: 26 %

Affirmations

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the U.S. National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at Provo Engineering & Manufacturing Center. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. A one year calibration is recommended, however calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of the issuer.

See "As Received" data.
Tested with PRM828 S/N 2534.

Signed: Nick Rasmussen
Technician: Nick Rasmussen

Provo Engineering and Manufacturing Center, 1681 West 820 North, Provo, Utah 84601
Toll Free: 888.258.3222 Telephone: 716.926.8243 Fax: 716.926.8215
ISO 9001-2008 Certified

Calibration Certificate

Certificate Number 2015003313

Customer:

Hankard Environmental
211 East Verona Avenue
Verona, WI 53593, United States

Model Number	377B41	***Procedure Number***	D0001.8387		
Serial Number	100347	***Technician***	Abraham Ortega		
Test Results	**Pass**	***Calibration Date***	2 Apr 2015		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	2 Apr 2016		
Description	1/2 inch Microphone - FF - 200V	***Temperature***	23.9	°C	± 0.01 °C
		Humidity	32.0	%RH	± 0.5 %RH
		Static Pressure	101.49	kPa	± 0.03 kPa

Evaluation Method Tested electrically using an electrostatic actuator.

Compliance Standards Compliant to Manufacturer Specifications.

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Sound Level Meter / Real Time Analyzer	07/21/2014	07/21/2015	001230
Microphone Calibration System	09/03/2014	09/03/2015	001233
1/2" Preamplifier	12/11/2014	12/11/2015	001274
Agilent 34401A DMM	12/04/2014	12/04/2015	001329
Larson Davis CAL250 Acoustic Calibrator	01/05/2015	01/05/2016	003030
1/2" Preamplifier	12/11/2014	12/11/2015	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	09/11/2014	09/11/2015	006507
1/2 inch Microphone - RI - 200V	07/25/2014	07/25/2015	006511
1/2 inch Microphone - RI - 200V	08/12/2014	08/12/2015	006519
Larson Davis 1/2" Preamplifier 7-pin LEMO	09/11/2014	09/11/2015	006530
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/14/2014	08/14/2015	006531

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

ACCREDITED Cert. #3622.01

LARSON DAVIS
A PCB PIEZOTRONICS DIV.

PCB PIEZOTRONICS
A PCB GROUP COMPANY

Certificate of Calibration and Conformance

Certificate Number 2015-199605

Instrument Model PRM828, Serial Number 2534, was calibrated on 6 Apr 2015. The instrument meets factory specifications per Procedure D0001.8135.

Instrument found to be in calibration as received: YES
Date Calibrated: 6 Apr 2015
Calibration due: 6 Apr 2016

Calibration Standards Used

MANUFACTURER	MODEL	SERIAL NUMBER	INTERVAL	CAL. DUE	TRACEABILITY NO.
Agilent Technologies	34401A	MY47030867	12 Months	20 May 2015	6538637
Larson Davis	LDSigGn / 2209	0249 / 0124	12 Months	10 Jun 2015	2014-192113

Reference Standards are traceable to the National Institute of Standards and Technology (NIST)

Calibration Environmental Conditions

Temperature: 24 ° Centigrade

Relative Humidity: 26 %

Affirmations

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the U.S. National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at Provo Engineering & Manufacturing Center. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. A one year calibration is recommended, however calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of the issuer.

"As Received" data is the same as shipped data.

Signed: Nick Rasmussen

Technician: Nick Rasmussen

Provo Engineering and Manufacturing Center, 1681 West 820 North, Provo, Utah 84601
Toll Free: 888.258.3222 Telephone: 716.926.8243 Fax: 716.926.8215
ISO 9001-2008 Certified

PCB PIEZOTRONICS
A PCB GROUP COMPANY

Certificate of Calibration and Conformance

Certificate Number 2015-199608

Instrument Model 820, Serial Number 1590, was calibrated on 6 Apr 2015. The instrument meets factory specifications per Procedure D0001.8160, ANSI S1.4 1983, IEC 651-Type 1 1979, and IEC 804-Type 1 1985.

Instrument found to be in calibration as received: YES
Date Calibrated: 6 Apr 2015
Calibration due: 6 Apr 2016

Calibration Standards Used

MANUFACTURER	MODEL	SERIAL NUMBER	INTERVAL	CAL. DUE	TRACEABILITY NO.
Larson Davis	LDSigGn / 2209	0249 / 0124	12 Months	10 Jun 2015	2014-192113

Reference Standards are traceable to the National Institute of Standards and Technology (NIST)

Calibration Environmental Conditions

Temperature: 24 ° Centigrade

Relative Humidity: 26 %

Affirmations

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the U.S. National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at Provo Engineering & Manufacturing Center. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. A one year calibration is recommended, however calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of the issuer.

"As Received" data is the same as shipped data.
Tested with PRM828 S/N 2478.

Signed: Nick Rasmussen
Technician: Nick Rasmussen

Provo Engineering and Manufacturing Center, 1681 West 820 North, Provo, Utah 84601
Toll Free: 888.258.3222 Telephone: 716.926.8243 Fax: 716.926.8215
ISO 9001-2008 Certified

Calibration Certificate

Certificate Number 2015003314

Customer:
Hankard Environmental
211 East Verona Avenue
Verona, WI 53593, United States

Model Number	377A60	***Procedure Number***	D0001.8387		
Serial Number	101579	***Technician***	Abraham Ortega		
Test Results	**Pass**	***Calibration Date***	2 Apr 2015		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	2 Apr 2016		
Description	1/2 inch Microphone - RI - 200V	***Temperature***	23.9	°C	± 0.01 °C
		Humidity	31.9	%RH	± 0.5 %RH
		Static Pressure	101.41	kPa	± 0.03 kPa

Evaluation Method Tested electrically using an electrostatic actuator.

Compliance Standards Compliant to Manufacturer Specifications.

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005.
Test points marked with a ‡ do not fall within this laboratory's scope of accreditation.

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Sound Level Meter / Real Time Analyzer	07/21/2014	07/21/2015	001230
Microphone Calibration System	09/03/2014	09/03/2015	001233
1/2" Preamplifier	12/11/2014	12/11/2015	001274
Agilent 34401A DMM	12/04/2014	12/04/2015	001329
Larson Davis CAL250 Acoustic Calibrator	01/05/2015	01/05/2016	003030
1/2" Preamplifier	12/11/2014	12/11/2015	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	09/11/2014	09/11/2015	006507
1/2 inch Microphone - RI - 200V	07/25/2014	07/25/2015	006511
1/2 inch Microphone - RI - 200V	08/12/2014	08/12/2015	006519
Larson Davis 1/2" Preamplifier 7-pin LEMO	09/11/2014	09/11/2015	006530
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/14/2014	08/14/2015	006531

PCB PIEZOTRONICS
A PCB GROUP COMPANY

Certificate of Calibration and Conformance

Certificate Number 2015-199609

Instrument Model PRM828, Serial Number 2478, was calibrated on 6 Apr 2015. The instrument meets factory specifications per Procedure D0001.8135.

Instrument found to be in calibration as received: YES
Date Calibrated: 6 Apr 2015
Calibration due: 6 Apr 2016

Calibration Standards Used

MANUFACTURER	MODEL	SERIAL NUMBER	INTERVAL	CAL. DUE	TRACEABILITY NO.
Agilent Technologies	34401A	MY47030867	12 Months	20 May 2015	6538637
Larson Davis	LDSigGn / 2209	0249 / 0124	12 Months	10 Jun 2015	2014-192113

Reference Standards are traceable to the National Institute of Standards and Technology (NIST)

Calibration Environmental Conditions

Temperature: 24 ° Centigrade

Relative Humidity: 26 %

Affirmations

This Certificate attests that this instrument has been calibrated under the stated conditions with Measurement and Test Equipment (M&TE) Standards traceable to the U.S. National Institute of Standards and Technology (NIST). All of the Measurement Standards have been calibrated to their manufacturers' specified accuracy / uncertainty. Evidence of traceability and accuracy is on file at Provo Engineering & Manufacturing Center. An acceptable accuracy ratio between the Standard(s) and the item calibrated has been maintained. This instrument meets or exceeds the manufacturer's published specification unless noted.

The collective uncertainty of the Measurement Standard used does not exceed 25% of the applicable tolerance for each characteristic calibrated unless otherwise noted.

The results documented in this certificate relate only to the item(s) calibrated or tested. A one year calibration is recommended, however calibration interval assignment and adjustment are the responsibility of the end user. This certificate may not be reproduced, except in full, without the written approval of the issuer.

"As Received" data is the same as shipped data.

Signed: Nick Rasmussen

Technician: Nick Rasmussen

Provo Engineering and Manufacturing Center, 1681 West 820 North, Provo, Utah 84601
Toll Free: 888.258.3222 Telephone: 716.926.8243 Fax: 716.926.8215
ISO 9001-2008 Certified

Calibration Certificate

Certificate Number 2015002955

Customer:

Hankard Environmental
211 East Verona Avenue
Verona, WI 53593, United States

Model Number	CAL200	***Procedure Number***	D0001.8386		
Serial Number	9194	***Technician***	Scott Montgomery		
Test Results	**Pass**	***Calibration Date***	1 Apr 2015		
Initial Condition	AS RECEIVED same as shipped	***Calibration Due***	1 Apr 2016		
		Temperature	24	°C	± 0.3 °C
Description	Larson Davis CAL200 Acoustic Calibrator	***Humidity***	37	%RH	± 3 %RH
		Static Pressure	101.4	kPa	± 1 kPa

Evaluation Method The data is aquired by the insert voltage calibration method using the reference microphone's open circuit sensitivity. Data reported in dB re 20 μPa.

Compliance Standards Compliant to Manufacturer Specifications per D0001.8190 and the following standards:
IEC 60942:2003 ANSI S1.40-2006

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the SI through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2005. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2008.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Agilent 34401A DMM	09/04/2014	09/04/2015	001021
Sound Level Meter / Real Time Analyzer	04/07/2014	04/07/2015	001051
Microphone Calibration System	08/20/2014	08/20/2015	005446
1/2" Preamplifier	10/09/2014	10/09/2015	006506
Larson Davis 1/2" Preamplifier 7-pin LEMO	08/20/2014	08/20/2015	006507
1/2 inch Microphone - RI - 200V	07/25/2014	07/25/2015	006511
Pressure Transducer	05/03/2014	05/03/2015	007205

Output Level

Nominal Level [dB]	Pressure [kPa]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
94	101.4	94.02	93.80	94.20	0.14	Pass
114	101.1	114.04	113.80	114.20	0.13	Pass

-- End of measurement results--

Frequency

Nominal Level [dB]	Pressure [kPa]	Test Result [Hz]	Lower limit [Hz]	Upper limit [Hz]	Expanded Uncertainty [Hz]	Result
94	101.4	1,000.24	990.00	1,010.00	0.20	Pass
114	101.1	1,000.23	990.00	1,010.00	0.20	Pass

-- End of measurement results--

Total Harmonic Distortion + Noise (THD+N)

Nominal Level [dB]	Pressure [kPa]	Test Result [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
94	101.4	0.37	0.00	2.00	0.25	Pass
114	101.1	0.40	0.00	2.00	0.25	Pass

-- End of measurement results--

Level Change Over Pressure

Tested at: 114 dB, 24 °C, 37 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
108.0	108.0	0.01	-0.30	0.30	0.04	Pass
101.3	101.0	0.00	-0.30	0.30	0.04	Pass
92.0	92.1	0.01	-0.30	0.30	0.04	Pass
83.0	83.1	0.00	-0.30	0.30	0.04	Pass
74.0	74.1	-0.05	-0.30	0.30	0.04	Pass
65.0	65.0	-0.17	-0.30	0.30	0.04	Pass

-- End of measurement results--

Frequency Change Over Pressure

Tested at: 114 dB, 24 °C, 37 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [Hz]	Lower limit [Hz]	Upper limit [Hz]	Expanded Uncertainty [Hz]	Result
108.0	108.0	0.00	-10.00	10.00	0.20	Pass
101.3	101.0	0.00	-10.00	10.00	0.20	Pass
92.0	92.1	0.00	-10.00	10.00	0.20	Pass
83.0	83.1	0.00	-10.00	10.00	0.20	Pass
74.0	74.1	-0.01	-10.00	10.00	0.20	Pass
65.0	65.0	-0.01	-10.00	10.00	0.20	Pass

-- End of measurement results--

Larson Davis, a division of PCB Piezotronics, Inc
1681 West 820 North
Provo, UT 84601, United States
716-684-0001

Total Harmonic Distortion + Noise (THD+N) Over Pressure

Tested at: 114 dB, 24 °C, 37 %RH

Nominal Pressure [kPa]	Pressure [kPa]	Test Result [%]	Lower limit [%]	Upper limit [%]	Expanded Uncertainty [%]	Result
108.0	108.0	0.39	0.00	2.00	0.25	Pass
101.3	101.0	0.40	0.00	2.00	0.25	Pass
92.0	92.1	0.41	0.00	2.00	0.25	Pass
83.0	83.1	0.43	0.00	2.00	0.25	Pass
74.0	74.1	0.45	0.00	2.00	0.25	Pass
65.0	65.0	0.47	0.00	2.00	0.25	Pass

-- End of measurement results--

Signatory: *Scott Montgomery*

N5 Short-Term Noise Level Measurements

Clear River Energy Center

Short-term ambient noise measurement details

	Night 1	Day 1	Night 2	Day 2
Date (2015)	22-Apr	21-Apr	24-Apr	22-Apr
Time	12:13 to 02:19	16:28 to 18:46	12:03 to 02:07	10:34 to 12:42
Temperature (DegF)	45 to 50	60	35	65
Relative Humidity	65	50	50	30
Cloud Cover	Clear	Partly cloudy	Partly cloudy	Clear
Wind Speed (mph)	Calm	Calm to 3	3 to 11	2 to 10
Wind direction (from)	West	West	West	South
Precipitation	None	None	None	Very light flurries

Clear River Energy Center

Short-term ambient noise measurement results

M1			Octave Band Center Frequency (Hertz)									
		Overall (dBA)	31 (dB)	63 (dB)	125 (dB)	250 (dB)	500 (dB)	1000 (dB)	2000 (dB)	4000 (dB)	8000 (dB)	Start time
L_{eq}	Night 1	45	58	60	51	45	45	37	28	19	13	2015/04/22 1:59:08
L_{10}	Night 1	46	61	62	52	47	46	39	28	19	12	
L_{90}	Night 1	44	54	56	48	43	43	36	25	16	12	
L_{eq}	Night 2	48	68	67	60	47	45	41	37	32	31	2015/04/24 0:52:57
L_{10}	Night 2	49	70	70	62	49	47	41	33	22	15	
L_{90}	Night 2	44	65	60	55	43	40	35	21	11	12	
L_{eq}	Day 1	52	71	68	63	54	49	46	39	28	18	2015/04/21 18:26:16
L_{10}	Day 1	56	74	71	65	56	53	51	44	32	19	
L_{90}	Day 1	46	67	62	59	41	35	32	20	15	12	
L_{eq}	Day 2	53	69	72	64	52	49	47	40	28	18	2015/04/22 12:22:41
L_{10}	Day 2	55	72	76	67	55	52	51	44	32	21	
L_{90}	Day 2	48	63	63	58	45	42	39	30	16	12	

M2			Octave Band Center Frequency (Hertz)									
		Overall (dBA)	31 (dB)	63 (dB)	125 (dB)	250 (dB)	500 (dB)	1000 (dB)	2000 (dB)	4000 (dB)	8000 (dB)	Start time
L_{eq}	Night 1	41	51	51	41	39	43	35	25	20	12	2015/04/22 0:38:05
L_{10}	Night 1	44	54	53	43	41	45	38	27	21	12	
L_{90}	Night 1	38	46	47	36	36	39	30	21	17	12	
L_{eq}	Night 2	40	49	48	41	40	39	35	27	17	13	2015/04/24 1:47:16
L_{10}	Night 2	42	52	51	45	43	41	37	29	19	13	
L_{90}	Night 2	36	44	42	36	35	35	31	20	12	12	
L_{eq}	Day 1	50	58	64	54	50	48	47	38	29	23	2015/04/21 17:34:47
L_{10}	Day 1	48	61	67	53	46	46	43	34	26	17	
L_{90}	Day 1	36	54	58	44	31	29	29	19	12	12	
L_{eq}	Day 2	52	59	57	53	49	48	49	40	28	19	2015/04/22 10:59:03
L_{10}	Day 2	46	61	59	52	47	43	40	34	27	19	
L_{90}	Day 2	37	53	48	43	36	34	31	22	13	12	

M3			Octave Band Center Frequency (Hertz)									
		Overall (dBA)	31 (dB)	63 (dB)	125 (dB)	250 (dB)	500 (dB)	1000 (dB)	2000 (dB)	4000 (dB)	8000 (dB)	Start time
L_{eq}	Night 1	34	40	34	30	23	23	21	29	30	13	2015/04/22 1:31:32
L_{10}	Night 1	36	42	36	32	23	21	18	31	32	12	
L_{90}	Night 1	32	36	29	26	18	17	14	26	28	12	
L_{eq}	Night 2	36	54	47	40	37	34	31	24	18	14	2015/04/24 0:03:19
L_{10}	Night 2	38	56	49	43	39	36	33	26	19	16	
L_{90}	Night 2	32	43	41	36	32	31	27	18	13	12	
L_{eq}	Day 1	36	52	52	39	36	34	30	24	20	14	2015/04/21 16:28:42
L_{10}	Day 1	38	54	55	41	39	37	32	25	21	15	
L_{90}	Day 1	27	46	47	31	22	21	19	13	13	12	
L_{eq}	Day 2	44	60	56	49	45	43	40	33	25	18	2015/04/22 11:49:31
L_{10}	Day 2	48	61	58	51	49	46	42	36	28	20	
L_{90}	Day 2	38	49	48	43	38	36	32	23	16	13	

M4			Octave Band Center Frequency (Hertz)									
		Overall (dBA)	31 (dB)	63 (dB)	125 (dB)	250 (dB)	500 (dB)	1000 (dB)	2000 (dB)	4000 (dB)	8000 (dB)	Start time
L_{eq}	Night 1	51	50	53	63	52	46	47	42	30	18	2015/04/22 1:04:29
L_{10}	Night 1	47	50	53	46	40	39	44	38	26	17	
L_{90}	Night 1	33	42	46	37	31	29	25	20	17	12	
L_{eq}	Night 2	51	53	59	59	48	45	48	42	30	27	2015/04/24 0:29:41
L_{10}	Night 2	43	55	56	45	41	38	39	34	23	17	
L_{90}	Night 2	30	47	48	35	29	27	24	16	12	12	
L_{eq}	Day 1	50	56	57	52	50	47	47	41	29	18	2015/04/21 18:02:25
L_{10}	Day 1	55	59	60	54	53	51	51	45	33	21	
L_{90}	Day 1	36	51	48	37	25	29	31	24	14	12	
L_{eq}	Day 2	51	62	66	55	47	46	48	41	30	20	2015/04/22 11:23:18
L_{10}	Day 2	50	64	70	56	48	46	47	40	30	21	
L_{90}	Day 2	40	53	58	47	38	36	32	22	14	12	

M5			Octave Band Center Frequency (Hertz)									
		Overall (dBA)	31 (dB)	63 (dB)	125 (dB)	250 (dB)	500 (dB)	1000 (dB)	2000 (dB)	4000 (dB)	8000 (dB)	Start time
L_{eq}	Night 1	45	42	39	35	35	34	31	38	42	16	2015/04/22 0:13:46
L_{10}	Night 1	48	41	40	31	30	31	31	41	45	15	
L_{90}	Night 1	39	33	32	24	23	27	28	30	35	12	
L_{eq}	Night 2	44	48	50	45	39	39	40	36	30	25	2015/04/24 1:21:04
L_{10}	Night 2	44	45	44	39	38	39	41	36	24	14	
L_{90}	Night 2	36	38	36	32	30	32	33	24	15	12	
L_{eq}	Day 1	52	56	62	62	55	49	46	40	35	25	2015/04/21 17:09:44
L_{10}	Day 1	44	55	58	48	44	41	39	34	29	18	
L_{90}	Day 1	33	43	44	34	25	27	29	24	17	12	
L_{eq}	Day 2	45	53	51	47	44	42	42	36	25	16	2015/04/22 10:34:03
L_{10}	Day 2	47	51	48	46	46	43	44	40	28	17	
L_{90}	Day 2	35	41	38	33	31	32	32	24	16	12	

N6 Construction Noise Level Modeling Results

Clear River Energy Center - Receiver Sound Levels
Construction Noise Analysis

Source	SPL dB(A)
Receiver M1 - Wallum Lake Road	
03 - Steel Erection	48.6
01 - Grading and Excavation	48.6
02 - Concrete Pouring	44.6
04 - Equipment Installation	43.6
05 - Finishing	38.6
Receiver M2 - Jackson Schoolhouse Road (East)	
03 - Steel Erection	53.0
01 - Grading and Excavation	53.0
02 - Concrete Pouring	49.0
04 - Equipment Installation	48.0
05 - Finishing	43.0
Receiver M3 - Doe Crossing Drive	
01 - Grading and Excavation	41.2
03 - Steel Erection	41.2
02 - Concrete Pouring	37.2
04 - Equipment Installation	36.2
05 - Finishing	31.2
Receiver M4 - Buck Hill Road	
03 - Steel Erection	47.0
01 - Grading and Excavation	47.0
02 - Concrete Pouring	43.0
04 - Equipment Installation	42.0
05 - Finishing	37.0
Receiver M5 - Jackson Schoolhouse Road (South)	
01 - Grading and Excavation	37.3
03 - Steel Erection	37.3
02 - Concrete Pouring	33.3
04 - Equipment Installation	32.3
05 - Finishing	27.3

Clear River Energy Center - Source List
Construction Noise Analysis

Source	SrcType	PWL dB(A)	Spectrum	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
01 - Grading and Excavation	Point	123.5	01 Grading and Excavation	108.8	112.9	113.4	116.8	119.0	115.2	112.0
02 - Concrete Pouring	Point	119.5	02 Concrete Pouring	104.8	108.9	109.4	112.8	115.0	111.2	108.0
03 - Steel Erection	Point	123.5	03 Steel Erection	108.8	112.9	113.4	116.8	119.0	115.2	112.0
04 - Equipment Installation	Point	118.5	04 Equipment Installation	103.8	107.9	108.4	111.8	114.0	110.2	107.0
05 - Finishing	Point	113.5	05 Finishing	98.8	102.9	103.4	106.8	109.0	105.2	102.0

Clear River Energy Center - Mean Propogation
Construction Noise Analysis

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
Receiver M1 - Wallum Lake Road												
01 - Grading and Excavation	123.5	123.5	0.0	0.0	695.6	-67.8	2.7	-7.4	-2.4	0.0	0.0	48.6
02 - Concrete Pouring	119.5	119.5	0.0	0.0	695.6	-67.8	2.7	-7.4	-2.4	0.0	0.0	44.6
03 - Steel Erection	123.5	123.5	0.0	0.0	695.4	-67.8	2.7	-7.4	-2.4	0.0	0.0	48.6
04 - Equipment Installation	118.5	118.5	0.0	0.0	695.7	-67.8	2.7	-7.4	-2.4	0.0	0.0	43.6
05 - Finishing	113.5	113.5	0.0	0.0	695.5	-67.8	2.7	-7.4	-2.4	0.0	0.0	38.6
Receiver M2 - Jackson Schoolhouse Road (East)												
01 - Grading and Excavation	123.5	123.5	0.0	0.0	894.2	-70.0	2.7	0.0	-3.2	0.0	0.0	53.0
02 - Concrete Pouring	119.5	119.5	0.0	0.0	894.4	-70.0	2.7	0.0	-3.2	0.0	0.0	49.0
03 - Steel Erection	123.5	123.5	0.0	0.0	894.1	-70.0	2.7	0.0	-3.2	0.0	0.0	53.0
04 - Equipment Installation	118.5	118.5	0.0	0.0	894.4	-70.0	2.7	0.0	-3.2	0.0	0.0	48.0
05 - Finishing	113.5	113.5	0.0	0.0	894.0	-70.0	2.7	0.0	-3.2	0.0	0.0	43.0
Receiver M3 - Doe Crossing Drive												
01 - Grading and Excavation	123.5	123.5	0.0	0.0	1394.6	-73.9	2.8	-6.9	-4.3	0.0	0.0	41.2
02 - Concrete Pouring	119.5	119.5	0.0	0.0	1394.4	-73.9	2.8	-6.9	-4.3	0.0	0.0	37.2
03 - Steel Erection	123.5	123.5	0.0	0.0	1394.7	-73.9	2.8	-6.9	-4.3	0.0	0.0	41.2
04 - Equipment Installation	118.5	118.5	0.0	0.0	1394.5	-73.9	2.8	-6.9	-4.3	0.0	0.0	36.2
05 - Finishing	113.5	113.5	0.0	0.0	1394.8	-73.9	2.8	-6.9	-4.3	0.0	0.0	31.2
Receiver M4 - Buck Hill Road												
01 - Grading and Excavation	123.5	123.5	0.0	0.0	1543.1	-74.8	2.9	0.0	-4.7	0.0	0.0	47.0
02 - Concrete Pouring	119.5	119.5	0.0	0.0	1542.9	-74.8	2.9	0.0	-4.7	0.0	0.0	43.0
03 - Steel Erection	123.5	123.5	0.0	0.0	1543.0	-74.8	2.9	0.0	-4.7	0.0	0.0	47.0
04 - Equipment Installation	118.5	118.5	0.0	0.0	1543.1	-74.8	2.9	0.0	-4.7	0.0	0.0	42.0
05 - Finishing	113.5	113.5	0.0	0.0	1543.2	-74.8	2.9	0.0	-4.7	0.0	0.0	37.0
Receiver M5 - Jackson Schoolhouse Road (South)												
01 - Grading and Excavation	123.5	123.5	0.0	0.0	1908.4	-76.6	2.8	-7.6	-4.8	0.0	0.0	37.3
02 - Concrete Pouring	119.5	119.5	0.0	0.0	1908.6	-76.6	2.8	-7.6	-4.8	0.0	0.0	33.3
03 - Steel Erection	123.5	123.5	0.0	0.0	1908.5	-76.6	2.8	-7.6	-4.8	0.0	0.0	37.3
04 - Equipment Installation	118.5	118.5	0.0	0.0	1908.4	-76.6	2.8	-7.6	-4.8	0.0	0.0	32.3
05 - Finishing	113.5	113.5	0.0	0.0	1908.3	-76.6	2.8	-7.6	-4.8	0.0	0.0	27.3

N7 Operation Noise Level Modeling Results

Clear River Energy Center - Receiver Sound Levels
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Name	SPL dB(A)
M1 - Wallum Lake Road	42.9
M2 - Jackson Schoolhouse Road (East)	41.0
M3 - Doe Crossing Drive	39.7
M4 - Buck Hill Road	41.1
M5 - Jackson Schoolhouse Road (South)	33.7

Clear River Energy Center - Receiver Sound Levels
Baseload Operation Noise Analysis - C-Weight - Proposed Acoustical Design

Name	SPL dB(C)
M1 - Wallum Lake Road	62.0
M2 - Jackson Schoolhouse Road (East)	60.7
M3 - Doe Crossing Drive	58.4
M4 - Buck Hill Road	60.6
M5 - Jackson Schoolhouse Road (South)	54.4

Clear River Energy Center - Receiver Spectra
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

31Hz dB	63Hz dB	125Hz dB	250Hz dB	500Hz dB	1kHz dB	2kHz dB	4kHz dB	8kHz dB
Receiver M1 - Wallum Lake Road								
60.2	59.6	54.6	44.8	37.8	34.3	27.3	11.2	-46.5
Receiver M2 - Jackson Schoolhouse Road (East)								
59.6	58.3	51.6	42.3	37.2	33.2	25.0	4.4	
Receiver M3 - Doe Crossing Drive								
57.6	55.5	49.7	42.7	35.9	32.0	23.4	-5.7	
Receiver M4 - Buck Hill Road								
59.2	58.5	51.3	43.9	36.6	33.1	23.0	-14.0	
Receiver M5 - Jackson Schoolhouse Road (South)								
53.8	51.8	45.0	36.7	28.9	22.4	8.0	-35.8	

Michael Theriault Acoustics, Inc
401 Cumberland Avenue, Suite 1205
Portland, ME 04101
(207) 799-0140

SoundPLAN 7.3

Clear River Energy Center - Source List
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	SrcType	KO-Wall	Size m,m²	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
ACC 1 Bottom	106.8	Area	0	4676.61	68.4	84.6	94.7	98.5	101.5	102.1	97.5	91.8	83.6
ACC 1 Top	106.8	Area	0	4676.21	68.4	84.6	94.7	98.5	101.5	102.1	97.5	91.8	83.6
ACC 2 Bottom	106.8	Area	0	4742.08	68.4	84.6	94.7	98.5	101.5	102.1	97.5	91.8	83.6
ACC 2 Top	106.8	Area	0	4742.08	68.4	84.6	94.7	98.5	101.5	102.1	97.5	91.8	83.6
Ammonia Forwarding Pump	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9
Ammonia Injection Skid 1	98.1	Point	0		51.6	75.8	79.9	87.4	89.8	92.0	92.2	91.0	84.9
Ammonia Injection Skid 2	98.1	Point	0		51.6	75.8	79.9	87.4	89.8	92.0	92.2	91.0	84.9
Aux Boiler Building - East Side	86.6	Area	3	172.98	68.0	75.2	83.3	81.8	77.2	67.4	57.6	51.4	41.3
Aux Boiler Building - North Side	87.1	Area	3	190.43	68.4	75.6	83.7	82.2	77.6	67.8	58.0	51.8	41.7
Aux Boiler Building - Roof	89.2	Area	0	308.54	70.5	77.7	85.8	84.3	79.7	69.9	60.1	53.9	43.8
Aux Boiler Building - South Side	87.1	Area	3	191.04	68.4	75.6	83.7	82.2	77.6	67.8	58.0	51.8	41.7
Aux Boiler Building - West Side	86.7	Area	3	173.55	68.0	75.2	83.3	81.8	77.2	67.4	57.6	51.4	41.3
Aux Boiler Building Vent Louvers - North	86.0	Area	3	12.00	58.9	69.6	76.7	78.2	80.6	78.8	76.0	74.8	72.7
Aux Boiler Building Vent Louvers - South	86.0	Area	3	12.00	58.9	69.6	76.7	78.2	80.6	78.8	76.0	74.8	72.7
Aux Boiler FD Fan Inlet	95.9	Point	0		56.9	68.6	80.6	87.1	92.5	90.8	83.0	77.7	62.6
Aux Transformer 1 - Side 1	82.0	Area	3	19.21	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 1 - Side 2	82.0	Area	3	15.27	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 1 - Side 3	82.0	Area	3	19.13	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 1 - Side 4	82.0	Area	3	15.15	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 1 - Top	82.0	Area	0	32.39	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 2 - Side 1	82.0	Area	3	19.21	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 2 - Side 2	82.0	Area	3	15.27	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 2 - Side 3	82.0	Area	3	19.13	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 2 - Side 4	82.0	Area	3	15.15	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
Aux Transformer 2 - Top	82.0	Area	0	32.39	39.2	58.4	70.5	73.0	78.4	75.6	71.8	66.6	57.5
BFW Pump Enclosure 1-Side 1	93.5	Area	3	45.08	70.0	80.7	87.7	90.3	83.7	80.9	78.1	69.9	61.8
BFW Pump Enclosure 1-Side 2	96.3	Area	3	87.36	72.9	83.6	90.6	93.1	86.6	83.8	81.0	72.8	64.7
BFW Pump Enclosure 1-Side 3	93.5	Area	3	45.25	70.1	80.7	87.8	90.3	83.7	80.9	78.1	69.9	61.8
BFW Pump Enclosure 1-Side 4	96.3	Area	3	87.09	72.9	83.6	90.6	93.1	86.5	83.8	81.0	72.8	64.6
BFW Pump Enclosure 1-Top	103.3	Area	0	437.73	79.9	90.6	97.6	100.1	93.6	90.8	88.0	79.8	71.7
BFW Pump Enclosure 2-Side 1	93.5	Area	3	45.70	70.1	80.8	87.8	90.3	83.7	81.0	78.2	70.0	61.8
BFW Pump Enclosure 2-Side 2	96.4	Area	3	88.10	73.0	83.6	90.6	93.2	86.6	83.8	81.0	72.8	64.7
BFW Pump Enclosure 2-Side 3	93.5	Area	3	45.31	70.1	80.7	87.8	90.3	83.7	81.0	78.2	69.9	61.8

Clear River Energy Center - Source List
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	SrcType	KO-Wall	Size m,m²	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
BFW Pump Enclosure 2-Side 4	96.3	Area	3	87.17	72.9	83.6	90.6	93.1	86.5	83.8	81.0	72.8	64.6
BFW Pump Enclosure 2-Top	103.4	Area	0	443.01	80.0	90.6	97.7	100.2	93.6	90.9	88.1	79.8	71.7
CCW Heat Exchanger 1	107.0	Area	0	433.20	68.6	84.8	94.9	98.7	101.7	102.3	97.7	92.0	83.8
CCW Heat Exchanger 2	107.0	Area	0	433.20	68.6	84.8	94.9	98.7	101.7	102.3	97.7	92.0	83.8
Condensate Pumps 1	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9
Condensate Pumps 2	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9
CTG 1 - Lube Oil Module	104.8	Area	0	62.01	64.1	79.8	85.8	92.3	96.8	99.0	99.2	98.0	87.9
CTG 1 - Turbine Compartment Vent Fan	103.8	Point	0		62.1	75.8	93.8	92.3	94.8	95.0	95.2	99.0	93.9
CTG 2 - Lube Oil Module	104.8	Area	0	61.91	64.1	79.8	85.8	92.3	96.8	99.0	99.2	98.0	87.9
CTG 2 - Turbine Compartment Vent Fan	103.8	Point	0		62.1	75.8	93.8	92.3	94.8	95.0	95.2	99.0	93.9
CTG Air Inlet 1	107.1	Area	0	222.41	81.1	87.8	86.8	82.3	82.8	88.0	97.2	106.0	96.9
CTG Air Inlet 2	107.1	Area	0	222.41	81.1	87.8	86.8	82.3	82.8	88.0	97.2	106.0	96.9
CTG Air Inlet Duct 1 - North	99.9	Area	0	38.26	72.1	80.8	84.8	91.3	89.8	83.0	98.2	85.0	57.9
CTG Air Inlet Duct 1 - South	99.9	Area	0	38.55	72.1	80.8	84.8	91.3	89.8	83.0	98.2	85.0	57.9
CTG Air Inlet Duct 2 - North	99.9	Area	0	38.26	72.1	80.8	84.8	91.3	89.8	83.0	98.2	85.0	57.9
CTG Air Inlet Duct 2 - South	99.9	Area	0	38.55	72.1	80.8	84.8	91.3	89.8	83.0	98.2	85.0	57.9
CTG Building 1 - East Facade	73.5	Area	3	691.22	58.8	66.5	69.5	67.0	62.5	58.7	56.9	54.7	43.6
CTG Building 1 - North Facade	79.4	Area	3	852.55	64.7	72.4	75.4	72.9	68.4	64.6	62.8	60.6	49.5
CTG Building 1 - Roof	73.4	Area	0	665.84	58.7	66.3	69.4	66.9	62.3	58.5	56.7	54.5	43.4
CTG Building 1 - West Facade	78.7	Area	3	710.93	64.0	71.6	74.6	72.2	67.6	63.8	62.0	59.8	48.7
CTG Building 1 Vent Louvers - East	82.1	Area	3	18.00	49.5	58.6	63.7	63.2	68.6	71.9	75.1	79.8	68.7
CTG Building 1 Vent Louvers - North	82.1	Area	3	18.00	49.5	58.6	63.7	63.2	68.6	71.9	75.1	79.8	68.7
CTG Building 2 - East Facade	73.6	Area	3	695.52	58.9	66.5	69.5	67.1	62.5	58.7	56.9	54.7	43.6
CTG Building 2 - North Facade	79.4	Area	3	852.55	64.7	72.4	75.4	72.9	68.4	64.6	62.8	60.6	49.5
CTG Building 2 - Roof	73.4	Area	0	671.06	58.7	66.4	69.4	66.9	62.3	58.6	56.8	54.5	43.4
CTG Building 2 - West Facade	78.7	Area	3	716.14	64.0	71.6	74.7	72.2	67.6	63.9	62.1	59.8	48.7
CTG Building 2 Vent Louvers - East	82.1	Area	3	18.00	49.5	58.6	63.7	63.2	68.6	71.9	75.1	79.8	68.7
CTG Building 2 Vent Louvers - North	82.1	Area	3	18.00	49.5	58.6	63.7	63.2	68.6	71.9	75.1	79.8	68.7
CTG Exhaust Diffuser 1 - East	104.2	Area	3	56.41	70.1	78.8	84.8	86.3	94.8	96.0	99.2	100.0	85.9
CTG Exhaust Diffuser 1 - West	104.2	Area	3	56.57	70.1	78.8	84.8	86.3	94.8	96.0	99.2	100.0	85.9
CTG Exhaust Diffuser 2 - East	104.2	Area	3	56.41	70.1	78.8	84.8	86.3	94.8	96.0	99.2	100.0	85.9
CTG Exhaust Diffuser 2 - West	104.2	Area	3	56.57	70.1	78.8	84.8	86.3	94.8	96.0	99.2	100.0	85.9
Demin Water Pump	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9

Clear River Energy Center - Source List
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	SrcType	KO-Wall	Size m,m²	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Duct Burner Skid 1	110.0	Point	0		63.5	87.7	91.8	99.3	101.7	103.9	104.1	102.9	96.8
Duct Burner Skid 2	110.0	Point	0		63.5	87.7	91.8	99.3	101.7	103.9	104.1	102.9	96.8
Emergency Diesel Generator - Side 1	8.2	Area	3	28.52	-64.9	-51.2	-28.2	-9.7	-1.2	4.0	4.2	-3.0	-14.1
Emergency Diesel Generator - Side 2	8.2	Area	3	27.33	-64.9	-51.2	-28.2	-9.7	-1.2	4.0	4.2	-3.0	-14.1
Emergency Diesel Generator - Top	8.2	Area	0	43.18	-64.9	-51.2	-28.2	-9.7	-1.2	4.0	4.2	-3.0	-14.1
Fire Pump Building - Roof	-6.2	Area	0	51.47	-31.4	-15.2	-11.1	-9.6	-18.2	-24.0	-29.8	-36.0	-39.1
Fire Pump Building - Side 1	-7.8	Area	3	35.87	-32.9	-16.7	-12.6	-11.1	-19.7	-25.5	-31.3	-37.5	-40.6
Fire Pump Building - Side 2	-8.5	Area	3	29.97	-33.7	-17.5	-13.4	-11.9	-20.5	-26.3	-32.1	-38.3	-41.4
Fire Pump Building - Side 3	-7.8	Area	3	35.87	-32.9	-16.7	-12.6	-11.1	-19.7	-25.5	-31.3	-37.5	-40.6
Fire Pump Building - Side 4	-8.5	Area	3	29.97	-33.7	-17.5	-13.4	-11.9	-20.5	-26.3	-32.1	-38.3	-41.4
Fuel Gas Dewpoint Heater	98.0	Point	0		54.2	65.3	63.5	68.8	68.6	73.6	82.5	80.7	97.8
Fuel Gas Metering and Regulating Station	98.0	Point	0		-50.0	-36.8	-26.7	68.8	76.2	84.4	95.6	93.4	83.3
Gas Aftecooler 1	98.0	Area	0	37.34	57.3	73.0	79.0	85.5	90.0	92.2	92.4	91.2	81.1
Gas Aftecooler 2	98.0	Area	0	37.34	57.3	73.0	79.0	85.5	90.0	92.2	92.4	91.2	81.1
Gas Compressor Bldg Louvers - E	105.7	Area	3	6.00	62.8	82.5	89.6	96.1	98.5	99.7	98.9	97.7	93.6
Gas Compressor Bldg Louvers - N	105.7	Area	3	6.00	62.8	82.5	89.6	96.1	98.5	99.7	98.9	97.7	93.6
Gas Compressor Bldg Louvers - S	105.7	Area	3	6.00	62.8	82.5	89.6	96.1	98.5	99.7	98.9	97.7	93.6
Gas Compressor Bldg Louvers - W	105.7	Area	3	6.00	62.8	82.5	89.6	96.1	98.5	99.7	98.9	97.7	93.6
Gas Compressor Building - East Side	98.5	Area	3	150.89	73.3	89.5	93.6	95.1	86.5	80.7	74.9	68.7	65.6
Gas Compressor Building - North Side	98.1	Area	3	137.06	72.9	89.1	93.2	94.7	86.1	80.3	74.5	68.3	65.2
Gas Compressor Building - Roof	101.0	Area	0	268.60	75.8	92.0	96.1	97.6	89.0	83.2	77.4	71.2	68.1
Gas Compressor Building - South Side	98.1	Area	3	137.12	72.9	89.1	93.2	94.7	86.1	80.3	74.5	68.3	65.2
Gas Compressor Building - West Side	98.5	Area	3	150.73	73.3	89.5	93.6	95.1	86.5	80.7	74.9	68.7	65.6
GSU 1 - Side 1	94.0	Area	3	67.39	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 1 - Side 2	94.0	Area	3	39.49	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 1 - Side 3	94.0	Area	3	67.51	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 1 - Side 4	94.0	Area	3	39.63	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 1 - Top	94.0	Area	0	127.76	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 2 - Side 1	94.0	Area	3	67.39	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 2 - Side 2	94.0	Area	3	39.49	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 2 - Side 3	94.0	Area	3	67.51	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 2 - Side 4	94.0	Area	3	39.63	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5
GSU 2 - Top	94.0	Area	0	127.76	51.2	70.4	82.5	85.0	90.4	87.6	83.8	78.6	69.5

Clear River Energy Center - Source List
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	SrcType	KO-Wall	Size m,m²	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
HRSG 1 - Body - Side 1	101.6	Area	3	954.10	72.1	89.8	98.8	96.3	87.8	89.0	83.2	66.0	46.9
HRSG 1 - Body - Side 2	101.6	Area	3	953.80	72.1	89.8	98.8	96.3	87.8	89.0	83.2	66.0	46.9
HRSG 1 - Exhaust Stack	104.3	Point	0		68.1	89.8	99.8	100.3	92.8	95.0	83.2	76.0	68.9
HRSG 1 - Piping and Valves	98.5	Line	0	48.17	66.1	83.8	92.8	94.3	90.8	90.0	79.2	70.0	60.9
HRSG 1 - Stack Walls - Side 1	84.4	Area	3	117.42	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - Stack Walls - Side 2	84.4	Area	3	104.66	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - Stack Walls - Side 3	84.4	Area	3	119.71	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - Stack Walls - Side 4	84.4	Area	3	113.50	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - Stack Walls - Side 5	84.4	Area	3	108.80	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - Stack Walls - Side 6	84.4	Area	3	122.32	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - Stack Walls - Side 7	84.4	Area	3	109.60	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - Stack Walls - Side 8	84.4	Area	3	114.09	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 1 - T1 - Side 1	87.8	Area	3	47.24	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
HRSG 1 - T1 - Side 2	87.8	Area	3	48.58	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
HRSG 1 - T2 - Side 1	87.8	Area	3	124.25	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
HRSG 1 - T2 - Side 2	87.8	Area	3	129.88	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
HRSG 2 - Body - Side 1	101.6	Area	3	954.10	72.1	89.8	98.8	96.3	87.8	89.0	83.2	66.0	46.9
HRSG 2 - Body - Side 2	101.6	Area	3	953.80	72.1	89.8	98.8	96.3	87.8	89.0	83.2	66.0	46.9
HRSG 2 - Exhaust Stack	104.3	Point	0		68.1	89.8	99.8	100.3	92.8	95.0	83.2	76.0	68.9
HRSG 2 - Piping and Valves	98.5	Line	0	48.30	66.1	83.8	92.8	94.3	90.8	90.0	79.2	70.0	60.9
HRSG 2 - Stack Walls - Side 1	84.4	Area	3	117.42	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - Stack Walls - Side 2	84.4	Area	3	104.66	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - Stack Walls - Side 3	84.4	Area	3	119.71	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - Stack Walls - Side 4	84.4	Area	3	113.50	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - Stack Walls - Side 5	84.4	Area	3	108.80	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - Stack Walls - Side 6	84.4	Area	3	122.32	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - Stack Walls - Side 7	84.4	Area	3	109.60	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - Stack Walls - Side 8	84.4	Area	3	114.09	54.5	73.7	80.8	80.3	73.7	65.9	47.1	39.9	32.8
HRSG 2 - T1 - Side 1	87.8	Area	3	49.97	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
HRSG 2 - T1 - Side 2	87.8	Area	3	51.45	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
HRSG 2 - T2 - Side 1	87.8	Area	3	124.25	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
HRSG 2 - T2 - Side 2	87.8	Area	3	129.88	72.1	82.8	84.8	79.3	67.8	67.0	56.2	33.0	9.9
Rooftop Vent Fan - Admin 1	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9

Clear River Energy Center - Source List
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	SrcType	KO-Wall	Size m,m²	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Rooftop Vent Fan - Admin 2	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - Admin 3	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - Admin 4	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - CTG Bldg 1	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - CTG Bldg 2	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - CTG Bldg 3	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - CTG Bldg 4	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - CTG Bldg 5	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - CTG Bldg 6	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - Gas Compressor Bldg 1	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - Gas Compressor Bldg 2	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - Gas Compressor Bldg 3	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - STG Bldg 1	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - STG Bldg 2	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - STG Bldg 3	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - STG Bldg 4	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - STG Bldg 5	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - STG Bldg 6	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - Water Treatment Bldg1	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Rooftop Vent Fan - Water Treatment Bldg2	87.8	Point	0		55.6	68.8	74.9	78.4	80.8	82.0	81.2	77.0	74.9
Scanner Cooling Air Blower 1	98.1	Point	0		51.6	75.8	79.9	87.4	89.8	92.0	92.2	91.0	84.9
Scanner Cooling Air Blower 2	98.1	Point	0		51.6	75.8	79.9	87.4	89.8	92.0	92.2	91.0	84.9
Service Transformer 1	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Transformer 2	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Transformer 3	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Transformer 4	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Transformer 5	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Transformer 6	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Transformer 7	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Transformer 8	80.0	Point	0		37.2	56.4	68.5	71.0	76.4	73.6	69.8	64.6	55.5
Service Water Pump	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9
Steam Turbine Bldg 1 - East Facade	86.2	Area	3	672.02	69.6	79.2	81.3	81.8	75.2	67.5	61.7	51.4	48.3
Steam Turbine Bldg 1 - North Facade	86.9	Area	3	796.89	70.3	80.0	82.0	82.5	75.9	68.2	62.4	52.2	49.1

Clear River Energy Center - Source List
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	SrcType	KO-Wall	Size m,m²	31 Hz	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz
Steam Turbine Bldg 1 - Roof	84.3	Area	0	1354.63	67.6	77.3	79.3	79.8	73.3	65.5	59.7	49.5	46.4
Steam Turbine Bldg 1 - South Facade 1	86.9	Area	3	790.14	70.3	79.9	82.0	82.5	75.9	68.2	62.4	52.1	49.0
Steam Turbine Bldg 1 - South Facade 2	78.9	Area	3	123.68	62.2	71.9	73.9	74.4	67.9	60.1	54.3	44.1	41.0
Steam Turbine Bldg 1 - South Facade 3	87.3	Area	3	855.90	70.6	80.3	82.3	82.8	76.3	68.5	62.7	52.5	49.4
Steam Turbine Bldg 1 - West Facade	86.9	Area	3	796.43	70.3	80.0	82.0	82.5	75.9	68.2	62.4	52.2	49.0
Steam Turbine Bldg 2 - East Facade	86.2	Area	3	672.02	69.6	79.2	81.3	81.8	75.2	67.5	61.7	51.4	48.3
Steam Turbine Bldg 2 - North Facade	86.9	Area	3	796.89	70.3	80.0	82.0	82.5	75.9	68.2	62.4	52.2	49.1
Steam Turbine Bldg 2 - Roof	84.3	Area	0	1354.63	67.6	77.3	79.3	79.8	73.3	65.5	59.7	49.5	46.4
Steam Turbine Bldg 2 - South Facade 1	86.9	Area	3	790.14	70.3	79.9	82.0	82.5	75.9	68.2	62.4	52.1	49.0
Steam Turbine Bldg 2 - South Facade 2	78.9	Area	3	123.68	62.2	71.9	73.9	74.4	67.9	60.1	54.3	44.1	41.0
Steam Turbine Bldg 2 - South Facade 3	87.3	Area	3	855.90	70.6	80.3	82.3	82.8	76.3	68.5	62.7	52.5	49.4
Steam Turbine Bldg 2 - West Facade	86.9	Area	3	796.43	70.3	80.0	82.0	82.5	75.9	68.2	62.4	52.2	49.0
STG Building 1 Vent Louvers - East	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
STG Building 1 Vent Louvers - South 1	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
STG Building 1 Vent Louvers - South 2	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
STG Building 1 Vent Louvers - West	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
STG Building 2 Vent Louvers - East	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
STG Building 2 Vent Louvers - South 1	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
STG Building 2 Vent Louvers - South 2	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
STG Building 2 Vent Louvers - West	82.3	Area	3	18.00	55.4	66.5	70.5	73.1	76.5	75.7	74.9	71.7	68.6
Vacuum Pumps 1	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9
Vacuum Pumps 2	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9
Waste Water Pump	93.1	Point	0		46.6	70.8	74.9	82.4	84.8	87.0	87.2	86.0	79.9
Water Treatment Building - East Side	79.4	Area	3	185.50	54.2	70.4	74.5	76.0	67.4	61.6	55.8	49.6	46.5
Water Treatment Building - North Side	82.7	Area	3	395.28	57.5	73.7	77.8	79.3	70.7	64.9	59.1	52.9	49.8
Water Treatment Building - Roof	86.3	Area	0	917.27	61.1	77.3	81.4	82.9	74.3	68.5	62.7	56.5	53.4
Water Treatment Building - South Side	82.7	Area	3	397.73	57.5	73.7	77.8	79.3	70.7	64.9	59.1	52.9	49.8
Water Treatment Building - West Side	79.4	Area	3	186.05	54.2	70.4	74.5	76.0	67.4	61.6	55.8	49.6	46.5
WTB Ventilation Louvers - North Side	90.0	Area	3	16.00	47.1	66.8	73.9	80.4	82.8	84.0	83.2	82.0	77.9
WTB Ventilation Louvers - South Side	90.0	Area	3	16.00	47.1	66.8	73.9	80.4	82.8	84.0	83.2	82.0	77.9

Clear River Energy Center - Mean Propogation
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
Receiver M1 - Wallum Lake Road												
ACC 1 Bottom	106.8	70.1	0.0	0.0	790.9	-69.0	0.4	-1.7	-2.7	-7.9	0.0	26.0
ACC 1 Top	106.8	70.1	0.0	0.0	791.7	-69.0	0.4	-5.1	-2.3	-7.1	0.0	23.7
ACC 2 Bottom	106.8	70.0	0.0	0.0	709.0	-68.0	0.3	-0.3	-2.6	-8.1	0.0	28.2
ACC 2 Top	106.8	70.0	0.0	0.0	709.6	-68.0	0.3	-3.2	-2.4	-7.8	0.0	25.7
Ammonia Forwarding Pump	93.1	93.1	0.0	0.0	755.6	-68.6	3.1	-7.9	-4.2	0.0	0.0	15.6
Ammonia Injection Skid 1	98.1	98.1	0.0	0.0	711.0	-68.0	3.0	-21.6	-1.7	0.0	0.0	9.8
Ammonia Injection Skid 2	98.1	98.1	0.0	0.0	606.3	-66.6	2.5	-7.3	-3.7	0.0	0.0	22.9
Aux Boiler Building - East Side	86.6	64.3	0.0	3.0	669.2	-67.5	1.2	-5.0	-0.6	0.0	0.0	17.7
Aux Boiler Building - North Side	87.1	64.3	0.0	3.0	677.1	-67.6	1.2	-3.6	-0.5	0.0	0.0	19.6
Aux Boiler Building - Roof	89.2	64.3	0.0	0.0	678.6	-67.6	2.0	-6.6	-0.5	0.0	0.0	16.5
Aux Boiler Building - South Side	87.1	64.3	0.0	3.0	679.9	-67.6	1.2	-8.6	-0.4	0.0	0.0	14.7
Aux Boiler Building - West Side	86.7	64.3	0.0	3.0	687.9	-67.7	1.3	-15.3	-0.3	0.0	0.0	7.6
Aux Boiler Building Vent Louvers - North	86.0	75.2	0.0	3.0	676.6	-67.6	1.9	-3.8	-1.8	0.0	0.0	17.6
Aux Boiler Building Vent Louvers - South	86.0	75.2	0.0	3.0	680.5	-67.6	1.9	-9.6	-1.2	0.0	0.0	12.5
Aux Boiler FD Fan Inlet	95.9	95.9	0.0	0.0	667.8	-67.5	1.4	-4.4	-2.3	0.0	2.5	25.7
Aux Transformer 1 - Side 1	82.0	69.2	0.0	3.0	718.3	-68.1	2.2	-26.8	-1.8	0.0	3.3	-6.2
Aux Transformer 1 - Side 2	82.0	70.2	0.0	3.0	714.5	-68.1	2.2	-26.5	-1.7	0.0	1.6	-7.4
Aux Transformer 1 - Side 3	82.0	69.2	0.0	3.0	716.7	-68.1	2.2	-26.6	-1.7	0.0	3.4	-5.7
Aux Transformer 1 - Side 4	82.0	70.2	0.0	3.0	720.6	-68.1	2.2	-26.8	-1.8	0.0	3.0	-6.5
Aux Transformer 1 - Top	82.0	66.9	0.0	0.0	717.5	-68.1	2.0	-26.1	-1.6	0.0	3.3	-8.5
Aux Transformer 2 - Side 1	82.0	69.2	0.0	3.0	618.1	-66.8	1.7	-11.0	-1.2	0.0	5.7	13.4
Aux Transformer 2 - Side 2	82.0	70.2	0.0	3.0	614.2	-66.8	1.5	-5.5	-2.0	0.0	0.2	12.4
Aux Transformer 2 - Side 3	82.0	69.2	0.0	3.0	616.2	-66.8	1.7	-6.5	-1.9	0.0	0.4	11.8
Aux Transformer 2 - Side 4	82.0	70.2	0.0	3.0	620.1	-66.8	1.8	-14.8	-1.0	0.0	5.3	9.4
Aux Transformer 2 - Top	82.0	66.9	0.0	0.0	617.1	-66.8	1.3	-6.0	-1.7	0.0	3.2	12.0
BFW Pump Enclosure 1-Side 1	93.5	76.9	0.0	3.0	754.4	-68.5	1.7	-25.8	-0.8	0.0	0.0	3.1
BFW Pump Enclosure 1-Side 2	96.3	76.9	0.0	3.0	744.0	-68.4	1.7	-24.9	-0.7	0.0	0.0	7.1
BFW Pump Enclosure 1-Side 3	93.5	76.9	0.0	3.0	748.4	-68.5	1.7	-24.5	-0.6	0.0	0.0	4.6
BFW Pump Enclosure 1-Side 4	96.3	76.9	0.0	3.0	758.7	-68.6	1.7	-25.4	-0.7	0.0	0.0	6.3
BFW Pump Enclosure 1-Top	103.3	76.9	0.0	0.0	751.3	-68.5	1.5	-24.0	-0.6	0.0	0.0	11.8
BFW Pump Enclosure 2-Side 1	93.5	76.9	0.0	3.0	650.4	-67.3	1.6	-25.7	-0.7	0.0	0.0	4.5

Clear River Energy Center - Mean Propogation
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
BFW Pump Enclosure 2-Side 2	96.4	76.9	0.0	3.0	639.4	-67.1	1.6	-24.6	-0.5	0.0	0.6	9.3
BFW Pump Enclosure 2-Side 3	93.5	76.9	0.0	3.0	643.4	-67.2	1.6	-24.8	-0.6	0.0	14.6	20.1
BFW Pump Enclosure 2-Side 4	96.3	76.9	0.0	3.0	654.1	-67.3	1.6	-25.5	-0.6	0.0	4.1	11.5
BFW Pump Enclosure 2-Top	103.4	76.9	0.0	0.0	647.1	-67.2	1.4	-21.1	-0.4	0.0	3.0	18.9
CCW Heat Exchanger 1	107.0	80.6	0.0	0.0	747.7	-68.5	2.2	-8.1	-2.1	-6.4	0.0	24.1
CCW Heat Exchanger 2	107.0	80.6	0.0	0.0	641.5	-67.1	1.8	-5.8	-2.3	-6.9	1.2	27.9
Condensate Pumps 1	93.1	93.1	0.0	0.0	751.0	-68.5	3.2	-26.4	-2.9	0.0	0.0	-1.6
Condensate Pumps 2	93.1	93.1	0.0	0.0	666.7	-67.5	3.0	-11.0	-2.4	0.0	0.0	15.2
CTG 1 - Lube Oil Module	104.8	86.9	0.0	0.0	741.1	-68.4	2.9	-26.4	-3.6	0.0	0.0	9.3
CTG 1 - Turbine Compartment Vent Fan	103.8	103.8	0.0	0.0	739.3	-68.4	3.2	-7.4	-5.1	0.0	0.0	26.1
CTG 2 - Lube Oil Module	104.8	86.9	0.0	0.0	637.6	-67.1	2.4	-19.3	-2.3	0.0	0.3	18.9
CTG 2 - Turbine Compartment Vent Fan	103.8	103.8	0.0	0.0	636.6	-67.1	2.9	-7.7	-4.4	0.0	0.0	27.6
CTG Air Inlet 1	107.1	83.7	0.0	0.0	768.2	-68.7	3.3	-25.9	-5.0	0.0	0.1	10.9
CTG Air Inlet 2	107.1	83.7	0.0	0.0	665.3	-67.5	2.8	-23.9	-3.7	0.0	0.1	15.0
CTG Air Inlet Duct 1 - North	99.9	84.1	0.0	0.0	748.7	-68.5	2.7	-24.8	-2.6	0.0	3.4	10.2
CTG Air Inlet Duct 1 - South	99.9	84.1	0.0	0.0	749.9	-68.5	2.7	-25.2	-2.7	0.0	1.2	7.4
CTG Air Inlet Duct 2 - North	99.9	84.1	0.0	0.0	646.0	-67.2	2.2	-22.6	-2.1	0.0	5.2	15.5
CTG Air Inlet Duct 2 - South	99.9	84.1	0.0	0.0	647.4	-67.2	2.2	-24.8	-2.5	0.0	3.0	10.6
CTG Building 1 - East Facade	73.5	45.1	0.0	3.0	717.5	-68.1	1.5	-3.9	-0.5	0.0	0.0	5.5
CTG Building 1 - North Facade	79.4	50.1	0.0	3.0	728.2	-68.2	1.5	-6.2	-0.3	0.0	0.0	9.2
CTG Building 1 - Roof	73.4	45.1	0.0	0.0	731.9	-68.3	3.1	-7.7	-0.6	0.0	0.2	0.1
CTG Building 1 - West Facade	78.7	50.1	0.0	3.0	745.1	-68.4	1.5	-15.8	-0.2	0.0	0.0	-1.3
CTG Building 1 Vent Louvers - East	82.1	69.6	0.0	3.0	716.5	-68.1	2.2	-12.4	-4.5	0.0	0.0	2.4
CTG Building 1 Vent Louvers - North	82.1	69.6	0.0	3.0	720.2	-68.1	2.2	-16.1	-3.6	0.0	0.2	-0.3
CTG Building 2 - East Facade	73.6	45.1	0.0	3.0	614.9	-66.8	1.2	-1.9	-0.6	0.0	0.0	8.5
CTG Building 2 - North Facade	79.4	50.1	0.0	3.0	624.9	-66.9	1.2	-2.4	-0.6	0.0	0.4	14.2
CTG Building 2 - Roof	73.4	45.1	0.0	0.0	629.2	-67.0	3.0	-7.4	-0.5	0.0	0.3	1.8
CTG Building 2 - West Facade	78.7	50.1	0.0	3.0	642.2	-67.1	1.2	-13.9	-0.2	0.0	0.0	1.7
CTG Building 2 Vent Louvers - East	82.1	69.6	0.0	3.0	613.8	-66.8	1.8	0.0	-8.3	0.0	0.0	11.9
CTG Building 2 Vent Louvers - North	82.1	69.6	0.0	3.0	617.0	-66.8	1.8	0.0	-8.3	0.0	1.8	13.6
CTG Exhaust Diffuser 1 - East	104.2	86.7	0.0	3.0	727.0	-68.2	3.2	-27.0	-4.8	0.0	1.7	12.1
CTG Exhaust Diffuser 1 - West	104.2	86.7	0.0	3.0	738.6	-68.4	3.2	-27.6	-5.2	0.0	1.4	10.7

Clear River Energy Center - Mean Propogation
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
CTG Exhaust Diffuser 2 - East	104.2	86.7	0.0	3.0	623.7	-66.9	2.8	-19.1	-3.7	0.0	1.5	21.9
CTG Exhaust Diffuser 2 - West	104.2	86.7	0.0	3.0	635.2	-67.0	2.9	-25.1	-3.2	0.0	0.8	15.5
Demin Water Pump	93.1	93.1	0.0	0.0	654.4	-67.3	3.0	-16.8	-1.7	0.0	0.0	10.3
Duct Burner Skid 1	110.0	110.0	0.0	0.0	756.7	-68.6	3.1	-27.8	-4.0	0.0	0.0	12.7
Duct Burner Skid 2	110.0	110.0	0.0	0.0	652.7	-67.3	2.8	-11.9	-2.5	0.0	0.0	31.2
Emergency Diesel Generator - Side 1	8.2	-6.4	0.0	3.0	646.3	-67.2	3.3	-26.3	-3.1	0.0	10.9	-71.3
Emergency Diesel Generator - Side 2	8.2	-6.2	0.0	3.0	641.6	-67.1	3.3	-23.1	-2.7	0.0	0.9	-77.6
Emergency Diesel Generator - Top	8.2	-8.2	0.0	0.0	644.0	-67.2	3.5	-20.4	-2.6	0.0	7.6	-71.0
Fire Pump Building - Roof	-6.2	-23.3	0.0	0.0	630.6	-67.0	2.1	-6.2	-0.5	0.0	0.0	-77.7
Fire Pump Building - Side 1	-7.8	-23.3	0.0	3.0	633.8	-67.0	1.8	-11.0	-0.3	0.0	0.0	-81.3
Fire Pump Building - Side 2	-8.5	-23.3	0.0	3.0	630.7	-67.0	1.8	-6.2	-0.4	0.0	0.0	-77.4
Fire Pump Building - Side 3	-7.8	-23.3	0.0	3.0	627.2	-66.9	1.7	-6.4	-0.5	0.0	0.0	-76.9
Fire Pump Building - Side 4	-8.5	-23.3	0.0	3.0	630.3	-67.0	1.8	-6.4	-0.5	0.0	0.0	-77.7
Fuel Gas Dewpoint Heater	98.0	98.0	0.0	0.0	794.4	-69.0	3.9	-28.8	-15.6	0.0	0.0	-11.5
Fuel Gas Metering and Regulating Station	98.0	98.0	0.0	0.0	788.4	-68.9	3.9	-9.6	-8.7	0.0	0.0	14.7
Gas Aftecooler 1	98.0	82.3	0.0	0.0	809.7	-69.2	3.1	-27.7	-4.1	0.0	0.0	0.1
Gas Aftecooler 2	98.0	82.3	0.0	0.0	811.7	-69.2	3.1	-27.5	-4.0	0.0	0.0	0.4
Gas Compressor Bldg Louvers - E	105.7	98.0	0.0	3.0	787.7	-68.9	2.9	-27.0	-3.0	0.0	0.0	12.7
Gas Compressor Bldg Louvers - N	105.7	98.0	0.0	3.0	794.8	-69.0	2.9	-27.1	-3.2	0.0	0.0	12.4
Gas Compressor Bldg Louvers - S	105.7	98.0	0.0	3.0	796.2	-69.0	2.9	-27.6	-3.6	0.0	0.0	11.5
Gas Compressor Bldg Louvers - W	105.7	98.0	0.0	3.0	803.2	-69.1	2.9	-27.6	-3.6	0.0	0.0	11.4
Gas Compressor Building - East Side	98.5	76.7	0.0	3.0	787.8	-68.9	1.7	-15.2	-0.3	0.0	0.0	18.7
Gas Compressor Building - North Side	98.1	76.7	0.0	3.0	793.5	-69.0	1.7	-16.0	-0.3	0.0	0.0	17.4
Gas Compressor Building - Roof	101.0	76.7	0.0	0.0	795.5	-69.0	2.2	-17.9	-0.4	0.0	0.0	15.9
Gas Compressor Building - South Side	98.1	76.7	0.0	3.0	797.7	-69.0	1.7	-19.0	-0.3	0.0	0.0	14.4
Gas Compressor Building - West Side	98.5	76.7	0.0	3.0	803.1	-69.1	1.7	-20.9	-0.4	0.0	0.0	12.9
GSU 1 - Side 1	94.0	75.7	0.0	3.0	723.1	-68.2	2.1	-26.5	-1.8	0.0	0.0	2.7
GSU 1 - Side 2	94.0	78.0	0.0	3.0	714.7	-68.1	2.1	-25.5	-1.6	0.0	0.0	4.0
GSU 1 - Side 3	94.0	75.7	0.0	3.0	720.1	-68.1	2.1	-25.6	-1.6	0.0	0.0	3.9
GSU 1 - Side 4	94.0	78.0	0.0	3.0	728.6	-68.2	2.1	-26.5	-1.8	0.0	0.0	2.7
GSU 1 - Top	94.0	72.9	0.0	0.0	721.6	-68.2	2.4	-24.3	-1.4	0.0	0.0	2.5
GSU 2 - Side 1	94.0	75.7	0.0	3.0	624.0	-66.9	1.5	-13.2	-1.2	0.0	0.0	17.3

Clear River Energy Center - Mean Propogation
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
GSU 2 - Side 2	94.0	78.0	0.0	3.0	615.5	-66.8	1.2	-1.4	-2.6	0.0	0.0	27.5
GSU 2 - Side 3	94.0	75.7	0.0	3.0	620.5	-66.8	1.4	-4.3	-2.4	0.0	0.0	25.0
GSU 2 - Side 4	94.0	78.0	0.0	3.0	629.1	-67.0	1.6	-16.9	-1.0	0.0	0.0	13.8
GSU 2 - Top	94.0	72.9	0.0	0.0	622.1	-66.9	2.2	-7.0	-1.7	0.0	0.0	20.7
HRSG 1 - Body - Side 1	101.6	71.8	0.0	3.0	731.5	-68.3	0.5	-16.2	-0.3	0.0	0.0	20.3
HRSG 1 - Body - Side 2	101.6	71.8	0.0	3.0	719.3	-68.1	0.5	-3.3	-0.6	0.0	0.0	33.1
HRSG 1 - Exhaust Stack	104.3	104.3	0.0	0.0	724.6	-68.2	-0.5	0.0	-0.9	-5.1	0.0	29.6
HRSG 1 - Piping and Valves	98.5	81.7	0.0	0.0	744.1	-68.4	0.8	-14.2	-0.5	0.0	0.0	16.2
HRSG 1 - Stack Walls - Side 1	84.4	63.7	0.0	3.0	721.2	-68.2	0.1	-4.7	-0.5	0.0	0.0	14.1
HRSG 1 - Stack Walls - Side 2	84.4	64.2	0.0	3.0	719.3	-68.1	0.2	-1.8	-0.5	0.0	1.6	18.7
HRSG 1 - Stack Walls - Side 3	84.4	63.6	0.0	3.0	719.0	-68.1	0.2	-2.3	-0.6	0.0	0.1	16.6
HRSG 1 - Stack Walls - Side 4	84.4	63.9	0.0	3.0	720.2	-68.1	0.2	-2.4	-0.6	0.0	0.0	16.5
HRSG 1 - Stack Walls - Side 5	84.4	64.0	0.0	3.0	722.5	-68.2	0.1	-7.9	-0.4	0.0	0.0	10.9
HRSG 1 - Stack Walls - Side 6	84.4	63.5	0.0	3.0	724.4	-68.2	0.1	-10.4	-0.3	0.0	0.0	8.5
HRSG 1 - Stack Walls - Side 7	84.4	64.0	0.0	3.0	724.8	-68.2	0.1	-10.8	-0.3	0.0	0.0	8.2
HRSG 1 - Stack Walls - Side 8	84.4	63.8	0.0	3.0	723.5	-68.2	0.1	-12.1	-0.4	0.0	0.0	6.8
HRSG 1 - T1 - Side 1	87.8	71.1	0.0	3.0	734.3	-68.3	2.9	-16.3	-0.2	0.0	0.0	8.9
HRSG 1 - T1 - Side 2	87.8	71.0	0.0	3.0	726.8	-68.2	2.9	-8.9	-0.2	0.0	0.0	16.4
HRSG 1 - T2 - Side 1	87.8	66.9	0.0	3.0	734.6	-68.3	2.2	-15.5	-0.1	0.0	0.0	9.1
HRSG 1 - T2 - Side 2	87.8	66.7	0.0	3.0	724.1	-68.2	2.2	-6.4	-0.2	0.0	0.0	18.2
HRSG 2 - Body - Side 1	101.6	71.8	0.0	3.0	627.1	-66.9	0.2	-15.5	-0.3	0.0	0.0	22.1
HRSG 2 - Body - Side 2	101.6	71.8	0.0	3.0	615.0	-66.8	0.3	-1.2	-0.6	0.0	0.0	36.3
HRSG 2 - Exhaust Stack	104.3	104.3	0.0	0.0	620.3	-66.8	-0.2	0.0	-0.8	-5.1	0.0	31.4
HRSG 2 - Piping and Valves	98.5	81.7	0.0	0.0	640.0	-67.1	0.5	-9.4	-0.7	0.0	0.6	22.4
HRSG 2 - Stack Walls - Side 1	84.4	63.7	0.0	3.0	616.5	-66.8	0.0	-3.8	-0.4	0.0	0.0	16.4
HRSG 2 - Stack Walls - Side 2	84.4	64.2	0.0	3.0	614.5	-66.8	0.0	-1.0	-0.4	0.0	0.0	19.2
HRSG 2 - Stack Walls - Side 3	84.4	63.6	0.0	3.0	614.1	-66.8	0.0	-1.0	-0.4	0.0	0.0	19.2
HRSG 2 - Stack Walls - Side 4	84.4	63.9	0.0	3.0	615.3	-66.8	0.0	-1.0	-0.4	0.0	0.0	19.2
HRSG 2 - Stack Walls - Side 5	84.4	64.0	0.0	3.0	617.5	-66.8	0.0	-4.7	-0.4	0.0	0.0	15.4
HRSG 2 - Stack Walls - Side 6	84.4	63.5	0.0	3.0	619.5	-66.8	0.0	-7.8	-0.3	0.0	0.0	12.4
HRSG 2 - Stack Walls - Side 7	84.4	64.0	0.0	3.0	620.0	-66.8	0.0	-9.1	-0.3	0.0	0.0	11.2
HRSG 2 - Stack Walls - Side 8	84.4	63.8	0.0	3.0	618.8	-66.8	0.0	-11.4	-0.3	0.0	0.0	8.9

Clear River Energy Center - Mean Propogation
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
HRSG 2 - T1 - Side 1	87.8	70.8	0.0	3.0	630.8	-67.0	2.5	-10.4	-0.1	0.0	0.0	15.8
HRSG 2 - T1 - Side 2	87.8	70.7	0.0	3.0	623.6	-66.9	2.6	-6.0	-0.3	0.0	0.1	20.3
HRSG 2 - T2 - Side 1	87.8	66.9	0.0	3.0	631.0	-67.0	1.9	-11.1	-0.1	0.0	0.0	14.5
HRSG 2 - T2 - Side 2	87.8	66.7	0.0	3.0	620.7	-66.8	1.9	-2.9	-0.3	0.0	0.0	22.7
Rooftop Vent Fan - Admin 1	87.8	87.8	0.0	0.0	578.2	-66.2	2.5	-3.3	-4.8	0.0	0.0	16.0
Rooftop Vent Fan - Admin 2	87.8	87.8	0.0	0.0	611.0	-66.7	2.7	-7.4	-2.7	0.0	0.0	13.7
Rooftop Vent Fan - Admin 3	87.8	87.8	0.0	0.0	581.0	-66.3	2.5	-3.4	-4.8	0.0	0.0	15.8
Rooftop Vent Fan - Admin 4	87.8	87.8	0.0	0.0	614.1	-66.8	2.7	-7.5	-2.8	0.0	0.0	13.5
Rooftop Vent Fan - CTG Bldg 1	87.8	87.8	0.0	0.0	736.4	-68.3	3.0	-6.4	-2.7	0.0	0.0	13.3
Rooftop Vent Fan - CTG Bldg 2	87.8	87.8	0.0	0.0	724.8	-68.2	2.9	-5.8	-2.7	0.0	0.0	14.1
Rooftop Vent Fan - CTG Bldg 3	87.8	87.8	0.0	0.0	728.3	-68.2	2.9	-0.7	-4.5	0.0	0.0	17.3
Rooftop Vent Fan - CTG Bldg 4	87.8	87.8	0.0	0.0	633.1	-67.0	2.7	-7.5	-2.8	0.0	0.0	13.2
Rooftop Vent Fan - CTG Bldg 5	87.8	87.8	0.0	0.0	626.6	-66.9	2.7	-1.5	-4.5	0.0	0.0	17.6
Rooftop Vent Fan - CTG Bldg 6	87.8	87.8	0.0	0.0	623.0	-66.9	2.7	-1.6	-4.5	0.0	0.0	17.5
Rooftop Vent Fan - Gas Compressor Bldg 1	87.8	87.8	0.0	0.0	790.7	-69.0	3.1	-15.2	-1.6	0.0	0.0	5.2
Rooftop Vent Fan - Gas Compressor Bldg 2	87.8	87.8	0.0	0.0	800.0	-69.1	3.1	-17.8	-1.5	0.0	0.0	2.6
Rooftop Vent Fan - Gas Compressor Bldg 3	87.8	87.8	0.0	0.0	793.7	-69.0	3.1	-19.8	-1.5	0.0	0.0	0.6
Rooftop Vent Fan - STG Bldg 1	87.8	87.8	0.0	0.0	665.8	-67.5	2.8	-7.5	-2.9	0.0	0.0	12.8
Rooftop Vent Fan - STG Bldg 2	87.8	87.8	0.0	0.0	633.4	-67.0	2.7	-2.1	-5.1	0.0	0.0	16.3
Rooftop Vent Fan - STG Bldg 3	87.8	87.8	0.0	0.0	649.6	-67.2	2.7	-7.4	-2.8	0.0	0.0	13.1
Rooftop Vent Fan - STG Bldg 4	87.8	87.8	0.0	0.0	735.5	-68.3	2.9	-6.3	-2.7	0.0	0.0	13.5
Rooftop Vent Fan - STG Bldg 5	87.8	87.8	0.0	0.0	768.4	-68.7	3.0	-7.6	-3.1	0.0	0.0	11.4
Rooftop Vent Fan - STG Bldg 6	87.8	87.8	0.0	0.0	752.2	-68.5	3.0	-7.7	-3.1	0.0	0.0	11.5
Rooftop Vent Fan - Water Treatment Bldg1	87.8	87.8	0.0	0.0	700.5	-67.9	3.0	-7.7	-3.0	0.0	0.0	12.1
Rooftop Vent Fan - Water Treatment Bldg2	87.8	87.8	0.0	0.0	680.5	-67.6	3.0	-7.2	-2.7	0.0	0.0	13.2
Scanner Cooling Air Blower 1	98.1	98.1	0.0	0.0	720.0	-68.1	3.0	-25.3	-2.2	0.0	0.0	5.6
Scanner Cooling Air Blower 2	98.1	98.1	0.0	0.0	616.5	-66.8	2.5	-7.1	-3.7	0.0	1.1	24.2
Service Transformer 1	80.0	80.0	0.0	0.0	697.1	-67.9	2.1	-23.9	-1.1	0.0	2.3	-8.5
Service Transformer 2	80.0	80.0	0.0	0.0	692.1	-67.8	2.1	-24.3	-1.1	0.0	2.5	-8.6
Service Transformer 3	80.0	80.0	0.0	0.0	592.7	-66.4	1.4	-4.8	-2.4	0.0	4.1	11.8
Service Transformer 4	80.0	80.0	0.0	0.0	587.8	-66.4	1.2	-4.3	-2.4	0.0	2.1	10.2
Service Transformer 5	80.0	80.0	0.0	0.0	714.3	-68.1	2.2	-26.3	-1.6	0.0	4.1	-9.7

Clear River Energy Center - Mean Propogation
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
Service Transformer 6	80.0	80.0	0.0	0.0	716.0	-68.1	2.2	-26.3	-1.6	0.0	4.1	-9.7
Service Transformer 7	80.0	80.0	0.0	0.0	612.5	-66.7	1.4	-4.2	-2.6	0.0	2.0	9.9
Service Transformer 8	80.0	80.0	0.0	0.0	614.6	-66.8	1.4	-4.2	-2.6	0.0	2.0	9.9
Service Water Pump	93.1	93.1	0.0	0.0	679.5	-67.6	3.1	-24.8	-2.0	0.0	0.0	1.8
Steam Turbine Bldg 1 - East Facade	86.2	57.9	0.0	3.0	724.0	-68.2	1.2	-6.3	-0.3	0.0	0.0	15.6
Steam Turbine Bldg 1 - North Facade	86.9	57.9	0.0	3.0	760.9	-68.6	1.2	-9.3	-0.3	0.0	0.0	13.0
Steam Turbine Bldg 1 - Roof	84.3	52.9	0.0	0.0	752.0	-68.5	2.8	-7.4	-0.5	0.0	0.1	10.8
Steam Turbine Bldg 1 - South Facade 1	86.9	57.9	0.0	3.0	768.4	-68.7	1.2	-14.5	-0.2	0.0	0.0	7.7
Steam Turbine Bldg 1 - South Facade 2	78.9	57.9	0.0	3.0	755.3	-68.6	1.2	-13.0	-0.2	0.0	0.0	1.3
Steam Turbine Bldg 1 - South Facade 3	87.3	57.9	0.0	3.0	740.9	-68.4	1.2	-15.8	-0.2	0.0	0.0	7.0
Steam Turbine Bldg 1 - West Facade	86.9	57.9	0.0	3.0	777.4	-68.8	1.3	-17.1	-0.2	0.0	0.0	5.1
Steam Turbine Bldg 2 - East Facade	86.2	57.9	0.0	3.0	622.6	-66.9	0.9	-0.9	-0.4	0.0	0.0	22.0
Steam Turbine Bldg 2 - North Facade	86.9	57.9	0.0	3.0	658.5	-67.4	1.0	-9.4	-0.2	0.0	0.0	13.9
Steam Turbine Bldg 2 - Roof	84.3	52.9	0.0	0.0	650.5	-67.3	2.7	-7.2	-0.5	0.0	0.4	12.4
Steam Turbine Bldg 2 - South Facade 1	86.9	57.9	0.0	3.0	667.6	-67.5	1.0	-11.8	-0.2	0.0	0.0	11.5
Steam Turbine Bldg 2 - South Facade 2	78.9	57.9	0.0	3.0	654.2	-67.3	0.9	-9.2	-0.2	0.0	0.0	6.0
Steam Turbine Bldg 2 - South Facade 3	87.3	57.9	0.0	3.0	639.8	-67.1	0.8	-8.7	-0.2	0.0	0.1	15.2
Steam Turbine Bldg 2 - West Facade	86.9	57.9	0.0	3.0	675.4	-67.6	1.0	-16.6	-0.2	0.0	0.0	6.6
STG Building 1 Vent Louvers - East	82.3	69.8	0.0	3.0	724.3	-68.2	1.4	-13.4	-1.0	0.0	0.0	4.1
STG Building 1 Vent Louvers - South 1	82.3	69.8	0.0	3.0	768.7	-68.7	1.5	-20.4	-1.3	0.0	0.0	-3.5
STG Building 1 Vent Louvers - South 2	82.3	69.8	0.0	3.0	742.2	-68.4	1.4	-21.1	-1.3	0.0	0.0	-4.1
STG Building 1 Vent Louvers - West	82.3	69.8	0.0	3.0	776.3	-68.8	1.5	-23.3	-1.6	0.0	0.0	-6.8
STG Building 2 Vent Louvers - East	82.3	69.8	0.0	3.0	623.1	-66.9	1.0	0.0	-2.9	0.0	0.0	16.5
STG Building 2 Vent Louvers - South 1	82.3	69.8	0.0	3.0	667.5	-67.5	1.2	-18.8	-1.0	0.0	0.0	-0.7
STG Building 2 Vent Louvers - South 2	82.3	69.8	0.0	3.0	641.2	-67.1	1.1	-15.1	-1.1	0.0	0.0	3.1
STG Building 2 Vent Louvers - West	82.3	69.8	0.0	3.0	674.1	-67.6	1.2	-23.0	-1.5	0.0	0.0	-5.5
Vacuum Pumps 1	93.1	93.1	0.0	0.0	749.6	-68.5	3.2	-27.0	-3.1	0.0	0.0	-2.3
Vacuum Pumps 2	93.1	93.1	0.0	0.0	665.4	-67.5	3.0	-9.6	-3.0	0.0	0.0	16.0
Waste Water Pump	93.1	93.1	0.0	0.0	667.0	-67.5	3.1	-26.8	-2.8	0.0	0.9	0.0
Water Treatment Building - East Side	79.4	56.7	0.0	3.0	668.3	-67.5	1.5	-6.3	-0.5	0.0	0.0	9.7
Water Treatment Building - North Side	82.7	56.7	0.0	3.0	688.2	-67.7	1.5	-4.5	-0.5	0.0	0.0	14.5
Water Treatment Building - Roof	86.3	56.7	0.0	0.0	690.2	-67.8	2.2	-6.9	-0.6	0.0	0.0	13.3

Clear River Energy Center - Mean Propogation
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	PWL dB(A)	PWL/unit dB(A)	Tone dB	Non-Sphere dB	Distance m	Spreading dB	Ground Effect dB	Ins. Loss dB	Air dB	Directivity dB	Reflection dB	SPL dB(A)
Water Treatment Building - South Side	82.7	56.7	0.0	3.0	690.9	-67.8	1.5	-15.0	-0.3	0.0	0.0	4.1
Water Treatment Building - West Side	79.4	56.7	0.0	3.0	713.1	-68.1	1.6	-16.1	-0.3	0.0	0.0	-0.5
WTB Ventilation Louvers - North Side	90.0	78.0	0.0	3.0	687.0	-67.7	2.6	-5.2	-2.9	0.0	0.0	19.7
WTB Ventilation Louvers - South Side	90.0	78.0	0.0	3.0	694.5	-67.8	2.6	-22.8	-2.1	0.0	2.5	5.5

Clear River Energy Center - Source Contribution
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	SPL
Receiver M1 - Wallum Lake Road	
HRSG 2 - Body - Side 2	36.30
HRSG 1 - Body - Side 2	33.13
HRSG 2 - Exhaust Stack	31.35
Duct Burner Skid 2	31.17
HRSG 1 - Exhaust Stack	29.61
ACC 2 Bottom	28.22
CCW Heat Exchanger 2	27.87
CTG 2 - Turbine Compartment Vent Fan	27.58
GSU 2 - Side 2	27.45
CTG 1 - Turbine Compartment Vent Fan	26.11
ACC 1 Bottom	26.01
ACC 2 Top	25.72
Aux Boiler FD Fan Inlet	25.68
GSU 2 - Side 3	24.96
Scanner Cooling Air Blower 2	24.17
CCW Heat Exchanger 1	24.13
ACC 1 Top	23.67
Ammonia Injection Skid 2	22.94
HRSG 2 - T2 - Side 2	22.71
HRSG 2 - Piping and Valves	22.40
HRSG 2 - Body - Side 1	22.10
Steam Turbine Bldg 2 - East Facade	21.98
CTG Exhaust Diffuser 2 - East	21.90
GSU 2 - Top	20.67
HRSG 2 - T1 - Side 2	20.33
HRSG 1 - Body - Side 1	20.30
BFW Pump Enclosure 2-Side 3	20.13
WTB Ventilation Louvers - North Side	19.71
Aux Boiler Building - North Side	19.62
HRSG 2 - Stack Walls - Side 3	19.18
HRSG 2 - Stack Walls - Side 4	19.16

Clear River Energy Center - Source Contribution
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	SPL
HRSG 2 - Stack Walls - Side 2	19.16
BFW Pump Enclosure 2-Top	18.95
CTG 2 - Lube Oil Module	18.85
HRSG 1 - Stack Walls - Side 2	18.74
Gas Compressor Building - East Side	18.70
HRSG 1 - T2 - Side 2	18.23
Aux Boiler Building - East Side	17.75
Aux Boiler Building Vent Louvers - North	17.64
Rooftop Vent Fan - CTG Bldg 5	17.55
Rooftop Vent Fan - CTG Bldg 6	17.48
Gas Compressor Building - North Side	17.44
Rooftop Vent Fan - CTG Bldg 3	17.31
GSU 2 - Side 1	17.28
HRSG 1 - Stack Walls - Side 3	16.65
STG Building 2 Vent Louvers - East	16.53
HRSG 1 - Stack Walls - Side 4	16.45
Aux Boiler Building - Roof	16.45
HRSG 2 - Stack Walls - Side 1	16.41
HRSG 1 - T1 - Side 2	16.39
Rooftop Vent Fan - STG Bldg 2	16.28
HRSG 1 - Piping and Valves	16.20
Vacuum Pumps 2	15.98
Rooftop Vent Fan - Admin 1	15.95
Gas Compressor Building - Roof	15.94
Rooftop Vent Fan - Admin 3	15.79
HRSG 2 - T1 - Side 1	15.78
Steam Turbine Bldg 1 - East Facade	15.60
Ammonia Forwarding Pump	15.55
CTG Air Inlet Duct 2 - North	15.55
CTG Exhaust Diffuser 2 - West	15.53
HRSG 2 - Stack Walls - Side 5	15.43
Condensate Pumps 2	15.22

Clear River Energy Center - Source Contribution
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	SPL
Steam Turbine Bldg 2 - South Facade 3	15.15
CTG Air Inlet 2	15.04
Fuel Gas Metering and Regulating Station	14.71
Aux Boiler Building - South Side	14.66
Water Treatment Building - North Side	14.47
HRSG 2 - T2 - Side 1	14.46
Gas Compressor Building - South Side	14.41
CTG Building 2 - North Facade	14.18
HRSG 1 - Stack Walls - Side 1	14.11
Rooftop Vent Fan - CTG Bldg 2	14.07
Steam Turbine Bldg 2 - North Facade	13.89
GSU 2 - Side 4	13.75
Rooftop Vent Fan - Admin 2	13.66
CTG Building 2 Vent Louvers - North	13.63
Rooftop Vent Fan - Admin 4	13.52
Rooftop Vent Fan - STG Bldg 4	13.45
Aux Transformer 2 - Side 1	13.36
Rooftop Vent Fan - CTG Bldg 1	13.33
Water Treatment Building - Roof	13.32
Rooftop Vent Fan - Water Treatment Bldg2	13.21
Rooftop Vent Fan - CTG Bldg 4	13.17
Rooftop Vent Fan - STG Bldg 3	13.13
Steam Turbine Bldg 1 - North Facade	12.99
Gas Compressor Building - West Side	12.85
Rooftop Vent Fan - STG Bldg 1	12.76
Gas Compressor Bldg Louvers - E	12.72
Duct Burner Skid 1	12.67
Aux Boiler Building Vent Louvers - South	12.49
HRSG 2 - Stack Walls - Side 6	12.45
Steam Turbine Bldg 2 - Roof	12.44
Aux Transformer 2 - Side 2	12.41
Gas Compressor Bldg Louvers - N	12.37

Clear River Energy Center - Source Contribution
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	SPL
Rooftop Vent Fan - Water Treatment Bldg1	12.14
CTG Exhaust Diffuser 1 - East	12.11
Aux Transformer 2 - Top	11.98
CTG Building 2 Vent Louvers - East	11.90
Service Transformer 3	11.84
Aux Transformer 2 - Side 3	11.80
BFW Pump Enclosure 1-Top	11.79
BFW Pump Enclosure 2-Side 4	11.55
Gas Compressor Bldg Louvers - S	11.52
Rooftop Vent Fan - STG Bldg 6	11.49
Steam Turbine Bldg 2 - South Facade 1	11.47
Gas Compressor Bldg Louvers - W	11.42
Rooftop Vent Fan - STG Bldg 5	11.39
HRSG 2 - Stack Walls - Side 7	11.16
HRSG 1 - Stack Walls - Side 5	10.95
CTG Air Inlet 1	10.88
Steam Turbine Bldg 1 - Roof	10.75
CTG Exhaust Diffuser 1 - West	10.74
CTG Air Inlet Duct 2 - South	10.63
Demin Water Pump	10.31
Service Transformer 4	10.20
CTG Air Inlet Duct 1 - North	10.19
Service Transformer 7	9.94
Service Transformer 8	9.89
Ammonia Injection Skid 1	9.80
Water Treatment Building - East Side	9.66
Aux Transformer 2 - Side 4	9.39
BFW Pump Enclosure 2-Side 2	9.33
CTG 1 - Lube Oil Module	9.27
CTG Building 1 - North Facade	9.17
HRSG 1 - T2 - Side 1	9.07
HRSG 1 - T1 - Side 1	8.95

Clear River Energy Center - Source Contribution
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	SPL
HRSG 2 - Stack Walls - Side 8	8.86
HRSG 1 - Stack Walls - Side 6	8.52
CTG Building 2 - East Facade	8.47
HRSG 1 - Stack Walls - Side 7	8.15
Steam Turbine Bldg 1 - South Facade 1	7.72
Aux Boiler Building - West Side	7.57
CTG Air Inlet Duct 1 - South	7.37
BFW Pump Enclosure 1-Side 2	7.07
Steam Turbine Bldg 1 - South Facade 3	7.04
HRSG 1 - Stack Walls - Side 8	6.80
Steam Turbine Bldg 2 - West Facade	6.60
BFW Pump Enclosure 1-Side 4	6.33
Steam Turbine Bldg 2 - South Facade 2	6.03
Scanner Cooling Air Blower 1	5.56
WTB Ventilation Louvers - South Side	5.48
CTG Building 1 - East Facade	5.47
Rooftop Vent Fan - Gas Compressor Bldg 1	5.20
Steam Turbine Bldg 1 - West Facade	5.09
BFW Pump Enclosure 1-Side 3	4.61
BFW Pump Enclosure 2-Side 1	4.53
STG Building 1 Vent Louvers - East	4.15
Water Treatment Building - South Side	4.10
GSU 1 - Side 2	3.95
GSU 1 - Side 3	3.86
STG Building 2 Vent Louvers - South 2	3.15
BFW Pump Enclosure 1-Side 1	3.09
GSU 1 - Side 1	2.70
GSU 1 - Side 4	2.68
Rooftop Vent Fan - Gas Compressor Bldg 2	2.61
GSU 1 - Top	2.55
CTG Building 1 Vent Louvers - East	2.37
CTG Building 2 - Roof	1.83

Clear River Energy Center - Source Contribution
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	SPL
Service Water Pump	1.79
CTG Building 2 - West Facade	1.67
Steam Turbine Bldg 1 - South Facade 2	1.27
Rooftop Vent Fan - Gas Compressor Bldg 3	0.62
Gas Aftecooler 2	0.41
CTG Building 1 - Roof	0.11
Gas Aftecooler 1	0.10
Waste Water Pump	-0.05
CTG Building 1 Vent Louvers - North	-0.28
Water Treatment Building - West Side	-0.48
STG Building 2 Vent Louvers - South 1	-0.74
CTG Building 1 - West Facade	-1.32
Condensate Pumps 1	-1.57
Vacuum Pumps 1	-2.31
STG Building 1 Vent Louvers - South 1	-3.53
STG Building 1 Vent Louvers - South 2	-4.06
STG Building 2 Vent Louvers - West	-5.54
Aux Transformer 1 - Side 3	-5.72
Aux Transformer 1 - Side 1	-6.22
Aux Transformer 1 - Side 4	-6.53
STG Building 1 Vent Louvers - West	-6.85
Aux Transformer 1 - Side 2	-7.39
Aux Transformer 1 - Top	-8.46
Service Transformer 1	-8.46
Service Transformer 2	-8.60
Service Transformer 5	-9.70
Service Transformer 6	-9.71
Fuel Gas Dewpoint Heater	-11.46
Emergency Diesel Generator - Top	-70.98
Emergency Diesel Generator - Side 1	-71.32
Fire Pump Building - Side 3	-76.88
Fire Pump Building - Side 2	-77.38

Clear River Energy Center - Source Contribution
Baseload Operation Noise Analysis - A-Weight - Proposed Acoustical Design

Source	SPL
Emergency Diesel Generator - Side 2	-77.60
Fire Pump Building - Roof	-77.68
Fire Pump Building - Side 4	-77.72
Fire Pump Building - Side 1	-81.30

Michael Theriault Acoustics, Inc.
401 Cumberland Avenue, Suite 1205
Portland, ME 04101
(207) 799-0140

N8 Adding Decibels

"Rule of Thumb"
Decibel Addition

Difference Between Two Sound Levels	**Decibel(s) to Add to Higher Level**
0 to 1	3
2 to 3	2
4 to 9	1
10 or more	0

Decibel Addition Example 1

- Two pieces of equipment each produce 53 dBA at 400 feet. The total sound level is:

  - Step 1   53 dBA - 53 dBA = 0

  - Step 2   53 dBA + 3 dBA = 56

Appendix F

EMF ANALYSIS - CREC TRANSMISSION LINE

Exponent
17000 Science Drive
Suite 200
Bowie, MD 20715

telephone 301-291-2500
facsimile 301-291-2599
www.exponent.com

October 27, 2015

George Bacon
ESS Group, Inc.
100 Fifth Avenue, 5^{th} Floor
Waltham, MA 02451

Subject: Clear River Energy Center
Exponent Project No. 1507086.000

Dear Mr. Bacon:

At the request of ESS Group, Inc. (ESS), Exponent has evaluated the electric and magnetic field (EMF) levels associated with the operation of the Clear River Energy Center (CREC) transmission line. It is Exponent's understanding that the transmission line is to connect the CREC gas-fired combined-cycle electric generating facility proposed to be located in the Town of Burrillville, Rhode Island, within the property of an existing gas compressor, to National Grid's Sherman Road Substation.

To deliver the electricity generated by the CREC project to the nearby substation, a new 345-kilovolt (kV) transmission line is proposed to be constructed within the existing National Grid right-of-way (ROW) for approximately 6 miles to the existing Sherman Road Substation. On this 6-mile ROW, the CREC Line (and two existing adjacent National Grid transmission lines) will be constructed in two separate configurations as shown in Figure 1.

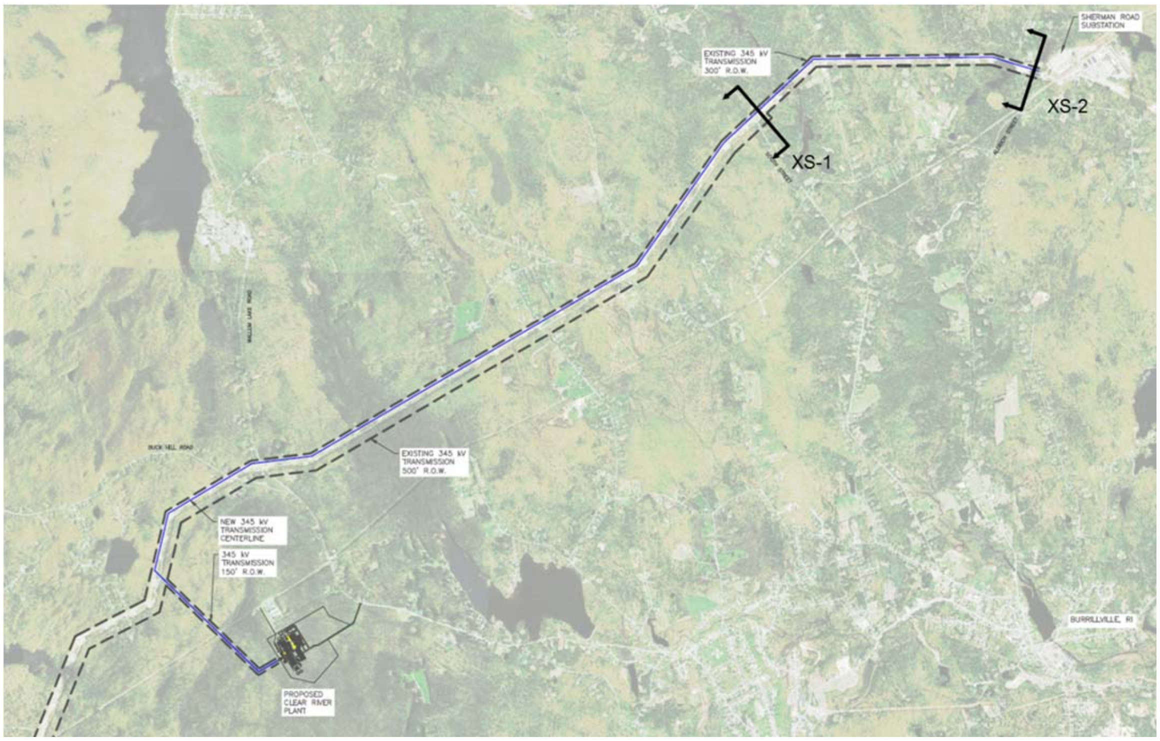


Figure 1. Map of the CREC Line showing the location of the two sections of the proposed route.

In the first route section (XS-1, approximately 4.4 miles long), two existing 345-kV National Grid transmission lines (Lines 341 and 347) are situated on a 500-foot wide ROW. The 345-kV CREC Line is proposed to be constructed on H-frame structures approximately 200 feet from the eastern ROW edge and 85 feet east of the existing centerline of the 347 Line as shown in Figure 2.

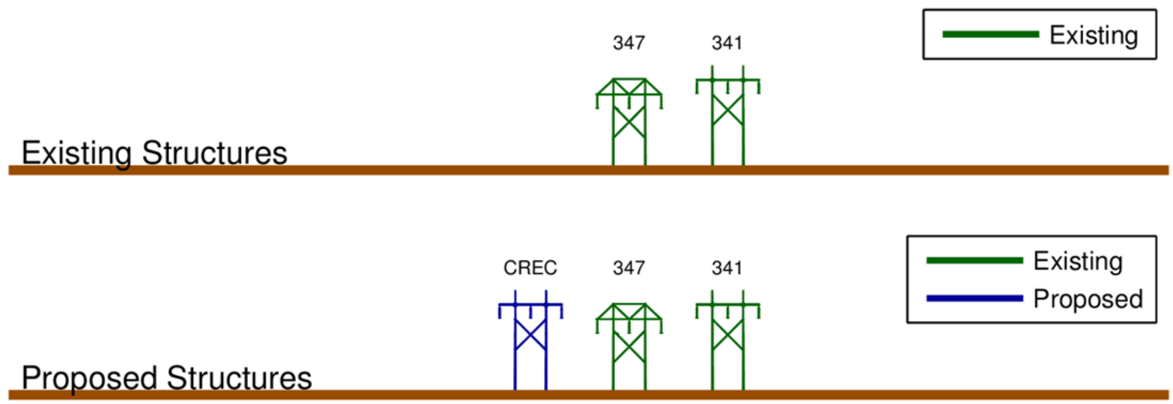


Figure 2. Configuration of existing and proposed Lines in XS-1 (View facing South).

In the second section of the route (XS-2, approximately 1.6 miles long) the existing 341 Line will be rebuilt on a new set of vertical delta monopoles 73 feet west of the existing centerline and 57 feet from the west ROW edge. The existing 347 Line will be shifted west and will be installed on the existing (to be vacated) H-frame towers currently supporting the 341 Line. Finally, the CREC Line will be constructed on a new set of H-frame structures, placed at the same centerline as the existing 347 Line as shown in Figure 3.

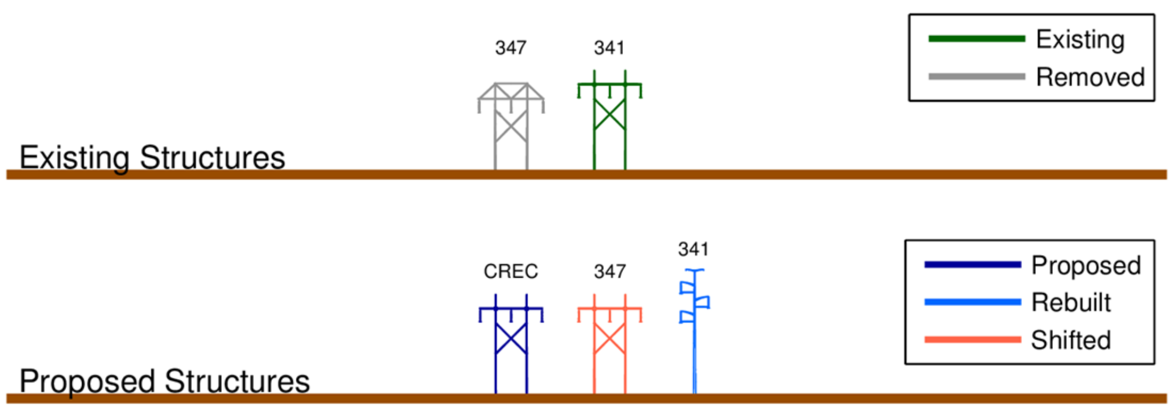


Figure 3. Configuration of existing and proposed Lines in XS-2 (View facing South).

The following sections provide background information on EMF; a description of the methodology used to calculate EMF levels; and a discussion of the relevant guidelines and standards for EMF levels. Finally, the calculated EMF values are summarized and compared to relevant guidelines and standards.

Electric and Magnetic Fields

Transmission lines, distribution lines, household appliances and equipment in our homes, workplaces, and other locations (i.e., any source of electricity) produce both electric fields and magnetic fields. Most electricity in North America is transmitted as alternating current (AC) at a frequency of 60 Hertz (Hz), i.e., it changes direction and magnitude in a continuous cycle that repeats 60 times per second. The fields from these AC sources are commonly referred to as power-frequency or extremely low frequency (ELF) EMF.[1]

Electric Fields

Electric fields are created by the voltage on the conductors of transmission lines. The strength of project-related electric fields in this report is expressed in units of kilovolts per meter (kV/m), which is equal to 1,000 volts per meter (V/m). Virtually all objects are conductive—including fences, shrubbery, and buildings—and thus can block electric fields. In general, the intensity of an electric field diminishes with increasing distance from the source and in the case of transmission lines that decrease is typically in proportion to the square of the distance from the conductors, so the electric-field level decreases rapidly with distance. As the voltage increases, the electric-field level increases; and is independent of the current flow on the line.

Magnetic Fields

Magnetic fields are created by current that flows in transmission line conductors. The strength of magnetic fields in this report is expressed as magnetic flux density in units of milligauss (mG), where 1 Gauss (G) = 1,000 mG. Magnetic fields are not blocked by conductive object as are electric fields; however, similar to electric fields, the intensity of magnetic fields diminishes with increasing distance from the source. In the case of transmission lines, magnetic fields also generally decrease with distance from the conductors in proportion to the square of the distance.

Magnetic fields depend on the current flowing in transmission line conductor, whereas electric fields depend on the voltage on the conductors. Since the current flow varies depending upon the patterns of power demand on the bulk transmission system, the current, expressed in units of amperes (A), and the magnetic field it generates, also varies. As the demand for electricity varies on a given day, throughout a week, or over the course of months and even years the magnetic field varies. Therefore, current flow is often described as annual peak load (producing the highest magnetic-field level that might occur for a few hours or days during the year) and annual average load (a good prediction of the magnetic field on any randomly selected day of the year).

---

[1] The EMF described in this report are quasi-static (non-propagating) fields, not to be confused with higher frequency electromagnetic fields (e.g., fields produced by mobile phones).

Phase optimization

Where two or more transmission lines share a ROW, the level of EMF will depend on the specific arrangement of the conductors of each circuit. In many circumstances the field levels at the ROW edge (or elsewhere) can be minimized by a careful selection of these phases in a phase-optimization analysis.[2] In the present case, variations of the CREC Line phasing were considered (though the contributions of all three transmission lines were considered in all calculations). The optimal phasing for both sections of the proposed CREC Line that minimizes the magnetic field at the edges of the ROW is C-B-A (from west to east) and this phasing was applied when computing the EMF levels for the proposed configuration.

Methodology

To characterize the potential effect of the proposed operation of the new CREC Line on the existing levels of EMF, Exponent modeled the levels of these parameters under existing and proposed conditions. EMF levels associated with line operations under various projected loading scenarios were calculated using computer algorithms developed by the Bonneville Power Administration, an agency of the U.S. Department of Energy, which have been shown to accurately predict field levels near transmission lines.[3] The inputs to the program for the existing and proposed transmission lines were provided by the ESS, and include the voltage, current flow, phasing, and conductor geometries of the lines, as well as their configurations and loading.

ESS also provided Exponent with average and peak loading for the existing transmission lines, as well as peak loading for the proposed CREC Line. According to ESS, the new CREC Line will be among the most efficient gas-fired generation plants in New England and as such is expected to operate near full capacity the majority of the time. Therefore, the CREC Line has been modeled at only peak loading while the existing 341 and 347 Lines were modeled both at average and peak levels. The loading scenarios for all lines are shown in Table 1.[4]

---

[2] Phase optimization is one of the ways to minimize EMF levels consistent with recommendations to apply low cost measures to minimize magnetic fields (see e.g., World Health Organization. Environmental Health Criteria 238: Extremely Low Frequency (ELF) Fields. Geneva, Switzerland: World Health Organization, 2007).

[3] Bonneville Power Administration (BPA). Corona and Field Effects Computer Program. Portland, OR: Bonneville Power Administration, 1991.

[4] The generating capacity of the CREC Project is 1080 Megawatts.

Table 1. Loading summary of modeled transmission lines

		Line Voltage			
		Average		Peak	
Line	**Voltage**	**MW**	**MVAR**	**MW**	**MVAR**
341	345	72.6	18	-429.4	11.2
347	345	344.2	36.8	-434.8	72.6
CREC	345	--	--	1080	0.0

Based on these data, Exponent calculated magnetic-field levels at 1 meter (3.28 feet) above ground as the root-mean-square value of the field at each location along a transect perpendicular to the transmission line's centerline in accordance with IEEE Std. C95.3.1-2010 and IEEE Std. 644-1994.[5] All transmission and distribution line voltages were assumed to be in phase; both electric fields and magnetic fields were calculated as the resultant of x, y, and z field vectors; EMF levels were calculated along profiles perpendicular to lines at the mid-span point of lowest conductor sag (i.e., closest to the ground); and the conductors were assumed to be located on flat terrain and at maximum sag for the entire distance between structures.

For electric fields, the same line configurations used to calculate magnetic fields were included in the models and a 5% overvoltage condition was assumed for all lines to ensure that the calculated values represent the maximum expected electric field for each of the route sections analyzed.

Standards and Guidelines

Neither the federal government nor the state of Rhode Island has enacted standards for EMF from transmission lines or other sources.

Some other states have statutes or guidelines that apply to fields produced by new transmission lines, but these are not health-based guidelines. New York and Florida, for example, have limits on EMF

[5] Institute of Electrical and Electronics Engineers (IEEE). IEEE Standard Procedures for Measurement of Power Frequency Electric and Magnetic Fields from AC Power Lines (ANSI/IEEE Std. 644-1994). New York: IEEE, 1994; Institute of Electrical and Electronics Engineers (IEEE). IEEE Recommended Practice for Measurements and Computations of Electric, Magnetic, and Electromagnetic Fields with Respect to Human Exposure to Such Fields, 0 Hz to 100 kHz (IEEE Std. C95.3.1-2010). New York: IEEE, 2010.

that were designed to limit fields from new transmission lines to levels produced by existing transmission lines (i.e., to maintain the *status quo*).[6]

More relevant than the various state-enacted guidelines are exposure limits recommended by scientific organizations that were developed to protect health and safety based on scientific reviews and risk assessments. These exposure limits are based on extensive weight-of-evidence reviews and evaluations of relevant health research and are designed to prevent acute, short-term biological responses such as perception, annoyance, and the stimulation of nerves and tissue that can occur at very high EMF exposure levels to which the general public would not exposed.

The International Committee on Electromagnetic Safety (ICES) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP) have developed standards and guidelines to assess levels of EMF acceptable for safe public exposure. The EMF Reference Levels set by these organizations at a frequency of 60 Hz to ensure compliance with Basic Restrictions are summarized in Table 2 below.[7]

Table 2. Reference Levels for whole body exposure to 60-Hz fields: general public

Organization	Magnetic Fields	Electric Fields
ICNIRP	2,000 mG	4.2 kV/m
ICES	9,040 mG	5 kV/m 10 kV/m*

* This is an exception within transmission line ROWs because people do not spend a substantial amount of time in ROWs, and very specific conditions are needed before a response is likely to occur (i.e., a person must be well insulated from ground and must contact a grounded conductor) (ICES, p. 27).[7]

[6] Florida Department of Environmental Regulation (FDER). Electric and Magnetic Fields. Chapter 17-274: FDER, 1989; Florida Department of Environmental Protection (FDEP). Electric and Magnetic Fields. Chapter 62-814: FDEP, 1996; New York Public Service Commission (NYPSC). Opinion No. 78-13. Opinion and Order Determining Health and Safety Issues, Imposing Operating Conditions, and Authorizing, in Case 26529, Operation Pursuant to those Conditions: NYPSC, 1978; New York Public Service Commission (NYPSC). Statement of Interim Policy on Magnetic Fields of Major Transmission Facilities. Cases 26529 and 26559 Proceeding on Motion of the Commission: NYPSC, 1990.

[7] International Committee on Electromagnetic Safety (ICES). IEEE Standard for Safety Levels with Respect to Human Exposure to Electromagnetic Fields 0 to 3 kHz. Piscataway, NJ: IEEE, 2002; International Commission on Non-ionizing Radiation Protection (ICNIRP). Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz to 100 kHz). Health Phys 99: 818-836, 2010.

Results

Magnetic Fields

Calculations at various locations on and beyond the ROW are summarized in Table 3 for both sections. Graphical results of magnetic field calculations are shown for XS-1 in Figure 2 and for XS-2 in Figure 3. As expected, the addition of the heavily-loaded CREC Line to the ROW increases the maximum magnetic-field level on the ROW as well as at the ROW edges. The edge of ROW magnetic-field level in XS-1 where the ROW is very wide, however, remains 12 mG or less under average loading conditions. The maximum magnetic-field level under average loading on the XS-2 ROW is similar to that of XS-1, but the narrower ROW width in XS-2 results in a higher magnetic-field level, primarily on the eastern side of the ROW (65 mG) when the CREC Line is operating. It is important to note, however, that even with the addition of the heavily loaded CREC Line that the magnetic-field levels are all well below the Reference Levels recommended by ICES and ICNIRP.

Table 3. Magnetic-field levels (mG) calculated at peak loading of the CREC Line and average loading and peak loading of the 341 and 347 Lines

			Distance from Centerline of ROW				
Section	**Loading**	**Condition**	**East ROW Edge -100 ft**	**East ROW Edge**	**Max on ROW**	**West ROW Edge**	**West ROW Edge +100 ft**
XS-1	Average	Existing	1.0	1.8	116	1.9	1.1
		Proposed	5.0	12	365	4.3	2.3
	Peak	Existing	0.5	1.1	171	8.2	2.0
		Proposed	6.4	14	342	3.8	1.6
XS-2	Average	Existing	4.5	21	116	1.9	1.1
		Proposed	13	65	366	5.9	1.6
	Peak	Existing	3.5	22	171	8.2	2.0
		Proposed	19	79	336	46	14

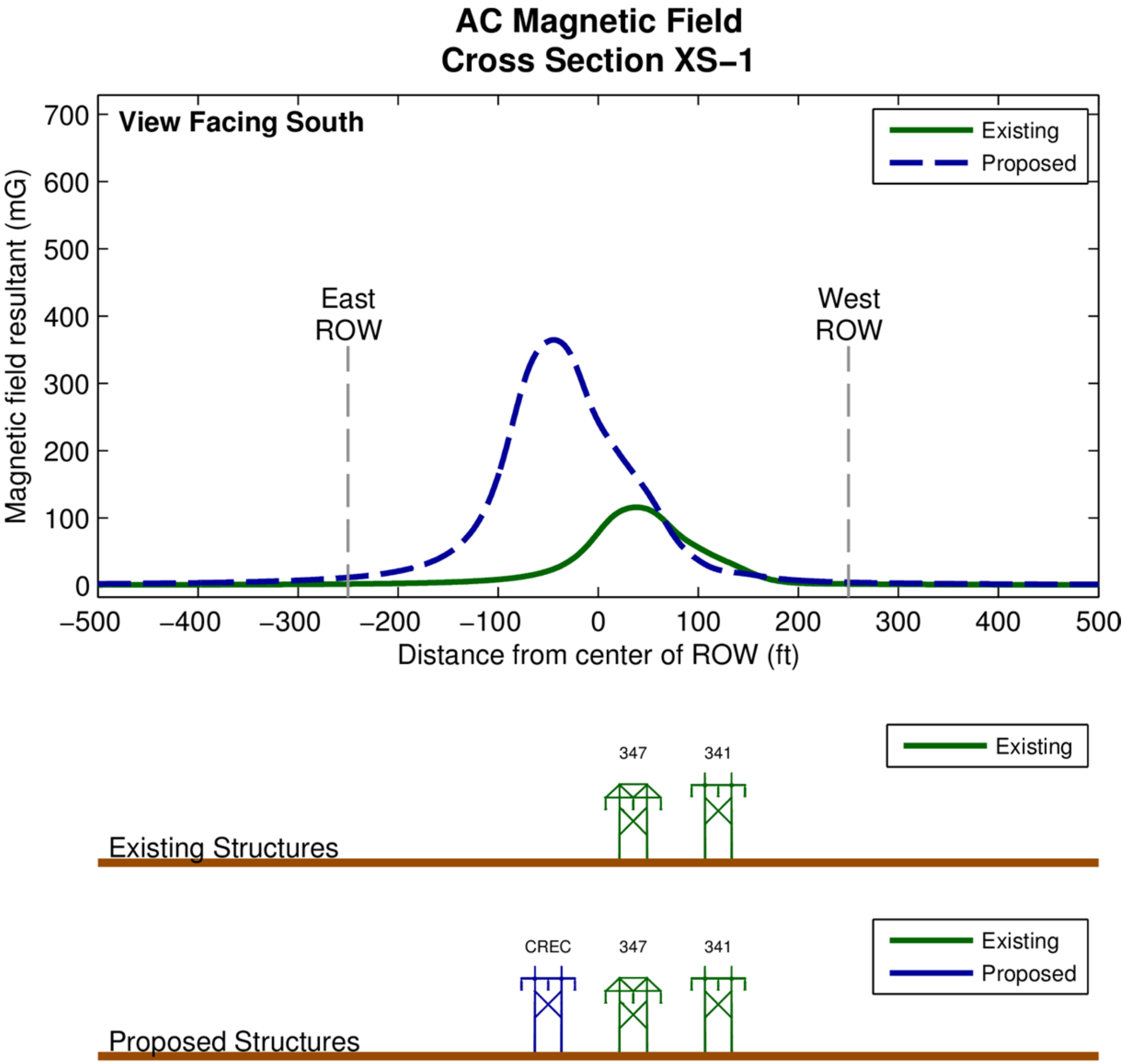


Figure 4. Calculated magnetic-field level at average loading for both existing and proposed conditions in XS-1.

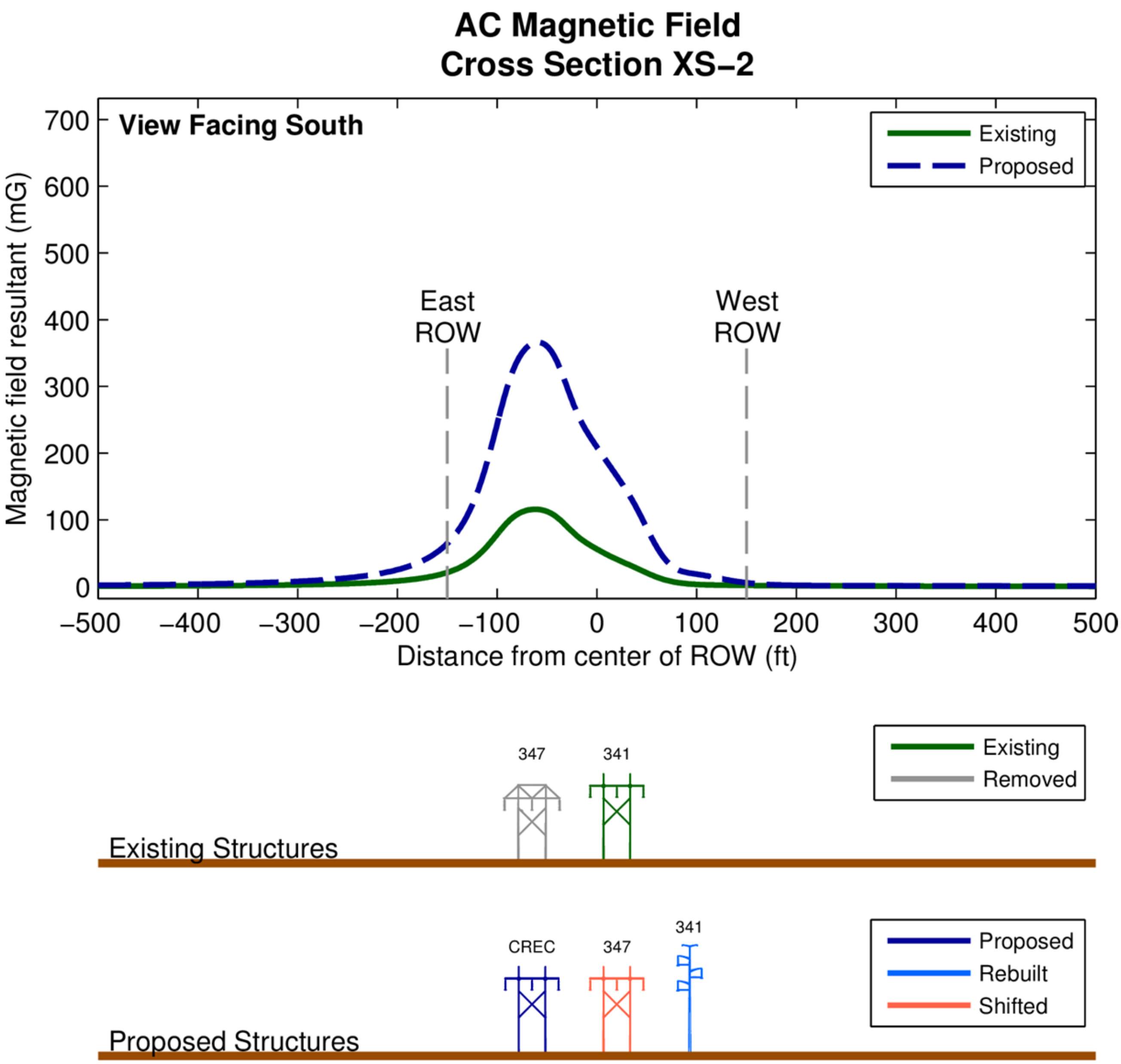


Figure 5. Calculated magnetic-field level at average loading for both existing and proposed conditions in XS-2.

Electric Fields

Calculations of the electric field at various locations on and beyond the ROW are summarized in Table 4 for both sections. Graphical results of electric-field calculations are shown for XS-1 in Figure 6 and for XS-2 in Figure 7. As can be seen in Table 4 both the maximum electric-field level on the ROW as well as the edge of ROW electric-field level stays largely unchanged as a result of this project. The exception to this is the increase in the electric-field level on the western ROW edge in XS-2 where the 341 Line is rebuilt closer to the ROW edge. Both before and after construction, however, the edge-of-ROW electric-field level is calculated to be 1.5 kV/m or less in both sections. At the edge of the ROW, all electric field levels are well below the Reference Levels recommended by ICES and ICNIRP.[8]

Table 4. Electric field levels (kV/m) with all lines operating at maximum voltage

		Distance from Centerline of ROW				
Section	**Condition**	**East ROW Edge -100 ft**	**East ROW Edge**	**Max on ROW**	**West ROW Edge**	**West ROW Edge +100 ft**
XS-1	Existing	0.02	0.05	7.5	0.39	0.02
	Proposed	0.04	0.11	7.5	0.38	0.04
XS-2	Existing	0.14	1.2	7.5	0.39	0.14
	Proposed	0.13	1.2	7.7	1.5	0.13

[8] The maximum electric-field level on the ROW is higher than the specified Reference Level for ICNIRP, but is relatively unchanged from existing conditions and, furthermore, with further analysis would be below ICNIRP Basic Restriction levels in tissue (the actual exposure limits) calculated by methods such as described by Kavet et al., in: The relationship between anatomically correct electric and magnetic field dosimetry and published electric and magnetic field exposure limits. Radiat Prot Dosimetry 152: 279-295, 2012.

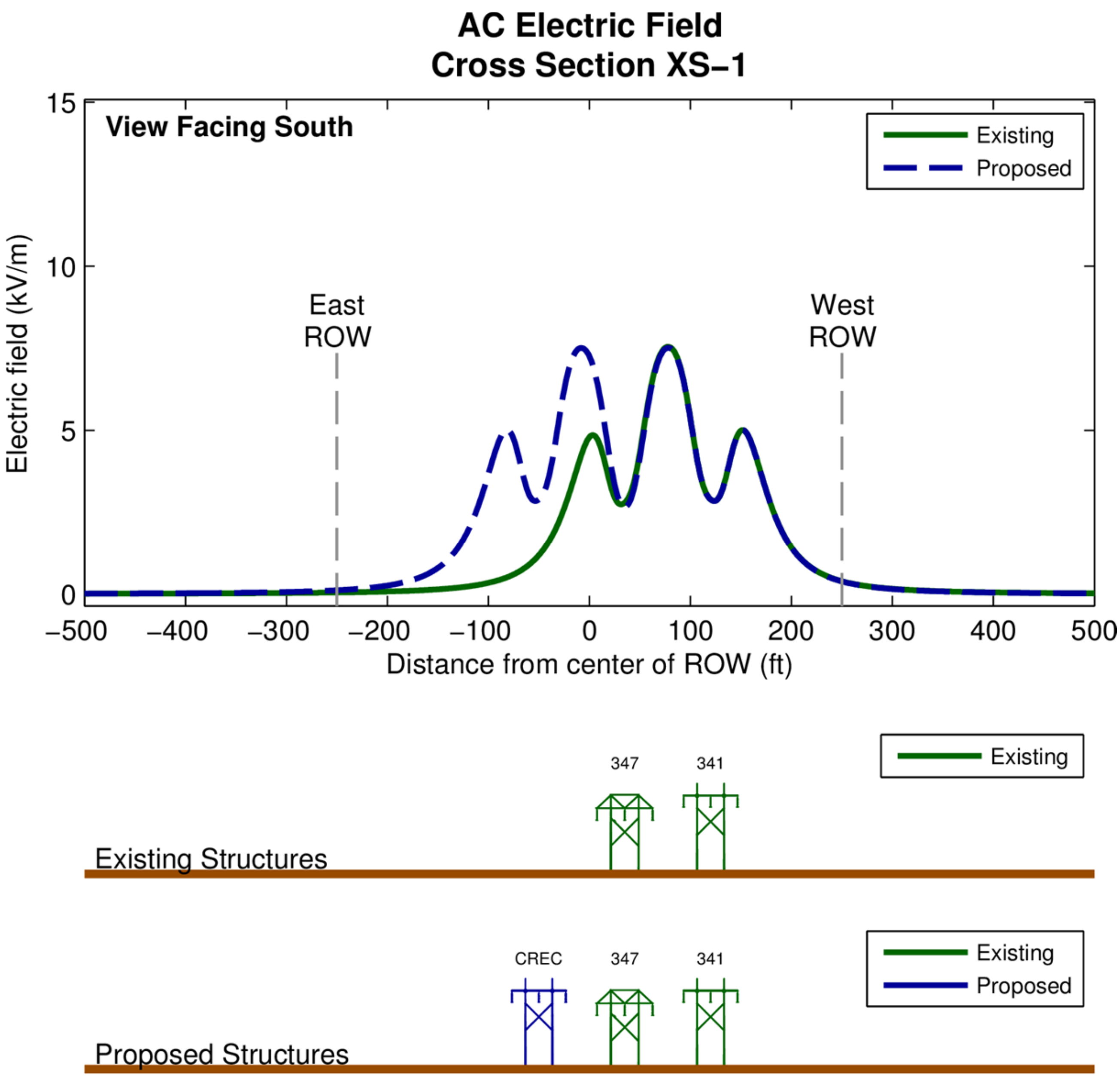


Figure 6. Calculated electric-field level for both existing and proposed conditions in XS-1.

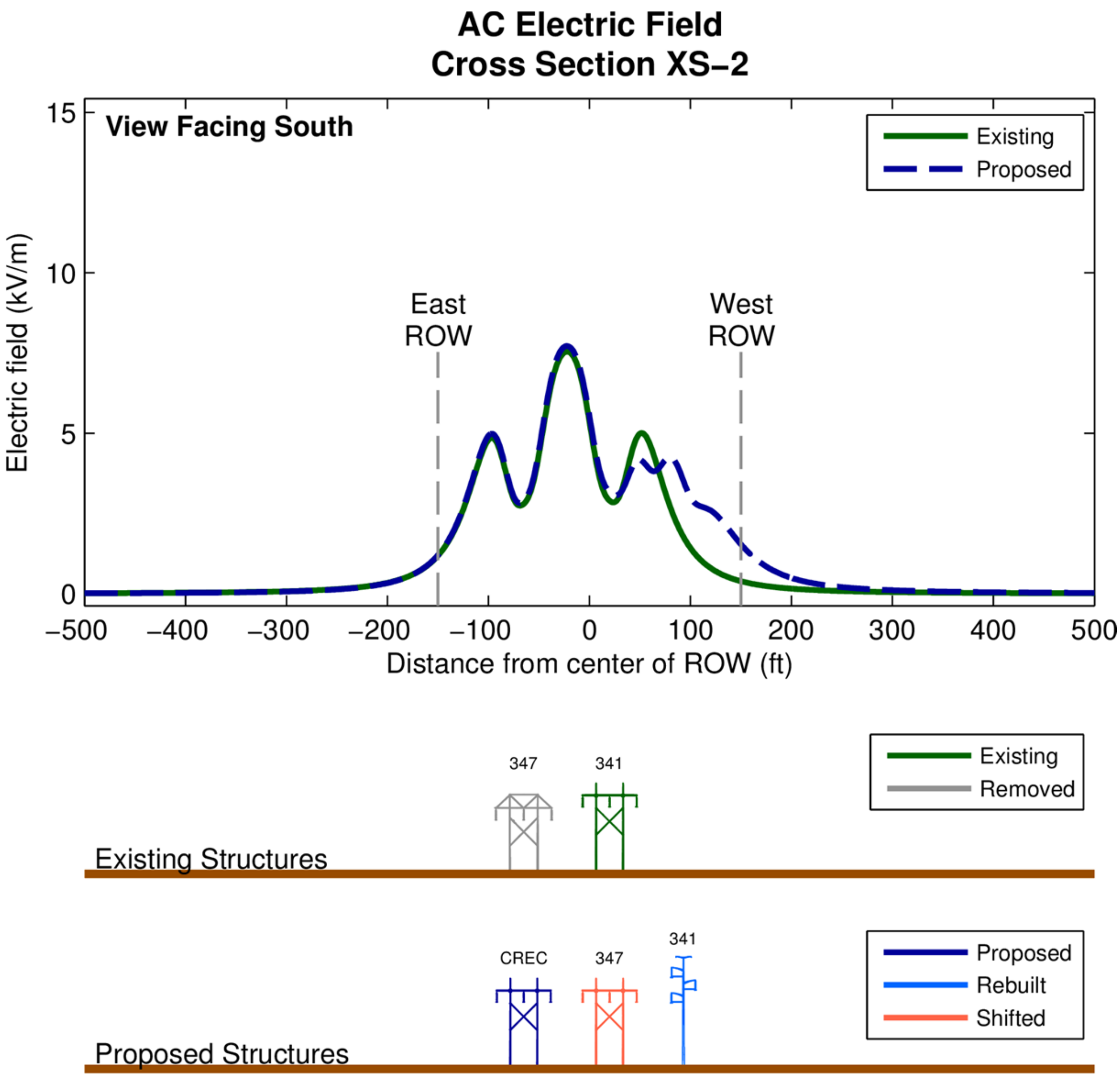


Figure 7. Calculated electric-field level for both existing and proposed conditions in XS-2

Conclusions

The new CREC is planned to be among the most efficient gas-fired generation plants in New England and as such is expected to operate near full capacity the majority of the time. Therefore, the loading on the CREC Line, and hence magnetic-field levels in both sections, were calculated to increase when the two existing lines are operating at average or peak loading. The new CREC Line, however, will be near to the center of the ROW and the selection of optimal phasing for minimizing magnetic-field levels at the ROW edges serves to limit this increase. The new CREC Line is not calculated to significantly increase the electric-field level at the ROW edge in XS-1 because of the very wide ROW in that section. In XS-2, however, the rebuilding of the 341 Line nearer the west ROW edge is expected to increase electric-field levels on the western side of the ROW to a level similar to the eastern edge of the ROW under existing conditions.

Magnetic-field levels are all calculated to be well below Reference Levels recommended by ICES and ICNIRP. At the ROW edge and beyond where people are more likely to spend significant amounts of time electric-field levels are also well below ICES and ICNIRP Reference Levels. On the ROW, particularly beneath both the existing and proposed transmission lines, the electric-field level is calculated to be higher than the ICNRIP Reference Level but with further analysis can be shown to be well below ICNIRP Basic Restriction levels using methods like that described by Kavet et al.[9]

Limitations

At the request of ESS, Exponent modeled the levels of EMF associated with the proposed energy center. This report summarizes work performed to date and presents the findings resulting from that work. In the analysis, we have relied on geometry, material data, usage conditions, specifications, and various other types of information provided by the client. ESS has confirmed to Exponent that the data provided to Exponent are not subject to Critical Energy Infrastructure Information restrictions. We cannot verify the correctness of this input data, and rely on ESS for the data's accuracy. Although Exponent has exercised usual and customary care in the conduct of this analysis, the responsibility for the design and operation of the project remains fully with the client.

The findings presented herein are made to a reasonable degree of engineering and scientific certainty. Exponent reserves the right to supplement this report and to expand or modify opinions based on review of additional material as it becomes available, through any additional work, or review of additional work performed by others.

---

[9] Kavet R, Dovan T, Reilly JP. The relationship between anatomically correct electric and magnetic field dosimetry and published electric and magnetic field exposure limits. Radiat Prot Dosimetry 152: 279-295, 2012.

The scope of services performed during this investigation may not adequately address the needs of other users of this report for purposes unrelated to project permitting, and any re-use of this report or its findings, conclusions, or recommendations presented herein are at the sole risk of the user. The opinions and comments formulated during this assessment are based on observations and information available at the time of the investigation. No guarantee or warranty as to future life or performance of any reviewed condition is expressed or implied

If you have any questions or require additional information, please do not hesitate to contact me at 301-291-2519 or bcotts@exponent.com.

Sincerely,

Benjamin Cotts, Ph.D.
Managing Engineer

Appendix G

Visual Resources

Table 1
Inventory of Aesthetic Resources

	Resource Name	State	Type of Resource	Distance From Project	Bare Earth	Vegetation
Rhode Island						
1	Harrisville Historic District	RI	Historic District	3.5	***Yes***	***Yes***
2	Eagle Peak School	RI	Historic Structure	1.9	No	No
3	Howard; Ebenezer; House	RI	Historic Structure	3.6	No	No
4	Bridgeton School	RI	Historic Structure	2.0	***Yes***	***Yes***
5	A. Paine Farm	RI	Historic Structure	2.9	***Yes***	No
6	Brown Angell Farm/Singleton Farm	RI	Historic Structure	2.7	***Yes***	No
7	Clarkville School	RI	Historic Structure	3.4	***Yes***	No
8	D. Smith House	RI	Historic Structure	3.2	***Yes***	No
9	House	RI	Historic Structure	4.2	***Yes***	No
10	J. Millard House/Barksfield	RI	Historic Structure	1.3	***Yes***	No
11	Logee Whiting House	RI	Historic Structure	2.6	***Yes***	No
12	Pascoag Grammar School	RI	Historic Structure	2.5	***Yes***	No
13	Pascoag H.D./Sayles Hse/Calvary/First Ba	RI	Historic Structure	2.7	***Yes***	No
14	Rueben Keach House; 66 Central St.	RI	Historic Structure	4.9	***Yes***	No
15	S. Eddy House	RI	Historic Structure	3.2	***Yes***	No
16	Sweets Hill H.D.	RI	Historic Structure	4.9	***Yes***	No
17	Taft; Moses; House	RI	Historic Structure	1.8	***Yes***	No
18	Young Sherman House	RI	Historic Structure	3.8	***Yes***	No
19	Bowdish Reservoir	RI	Rhode Island Scenic Area	2.5	***Yes***	***Yes***
20	Town Farm Rd./Wilson Reservoir	RI	Rhode Island Scenic Area	0.8	***Yes***	***Yes***
21	Wallum Lake	RI	Rhode Island Scenic Area	1.5	***Yes***	***Yes***
22	Round Pond	RI	Rhode Island Scenic Area	0.9	***Yes***	No
23	Sheldon Rd.	RI	Rhode Island Scenic Area	4.7	***Yes***	No
24	Wakefield Rd./Croft Farm	RI	Rhode Island Scenic Area	1.4	***Yes***	No
25	Black Hut Managment Area	RI	State Conservation Land	4.4	***Yes***	No
26	Bowdish Reservoir Dam	RI	State Conservation Land	2.5	***Yes***	No
27	Durfee Hill Management Area	RI	State Conservation Land	2.9	***Yes***	No
28	Kwandrans	RI	State Conservation Land	3.2	***Yes***	No
29	Nipmuc Flowage Land	RI	State Conservation Land	3.4	***Yes***	No
30	Northwest Management Area	RI	State Conservation Land	0.8	***Yes***	No
31	Pascoag Rail Trail	RI	State Conservation Land	2.8	***Yes***	No
32	Round Top Management Area	RI	State Conservation Land	3.6	***Yes***	No
33	Sprague Farm	RI	State Conservation Land	3.8	***Yes***	No
34	Wakefield Pond Access Area	RI	State Conservation Land	1.7	***Yes***	No
35	George Washington Campground	RI	State Recreation	2.5	***Yes***	No
36	George Washington Management Area	RI	State Recreation	0.0	***Yes***	***Yes***
37	Houser Memorial Field	RI	State Recreation	2.1	***Yes***	***Yes***
38	Whitemill Park	RI	State Recreation	1.8	***Yes***	***Yes***
39	Wilson Reservoir	RI	State Recreation	0.8	***Yes***	***Yes***
40	Burlingame Reservoir	RI	State Recreation	2.9	***Yes***	No

Table 1
Inventory of Aesthetic Resources

	Resource Name	State	Type of Resource	Distance From Project	Bare Earth	Vegetation
41	Burrillville Glocester Youth Soccer	RI	State Recreation	4.3	***Yes***	No
42	Burrillville High School	RI	State Recreation	4.7	***Yes***	No
43	Callahan School	RI	State Recreation	3.6	***Yes***	No
44	Clarkville Pond	RI	State Recreation	3.1	***Yes***	No
45	Lake Washington	RI	State Recreation	3.2	***Yes***	No
46	Mowry Pond	RI	State Recreation	4.9	***Yes***	No
47	Pascoag Reservoir	RI	State Recreation	3.0	***Yes***	***Yes***
48	Peck Pond / Pulaski Park	RI	State Recreation	3.0	***Yes***	No
49	Sherman Farm	RI	State Recreation	3.8	***Yes***	No
50	Shore	RI	State Recreation	0.9	***Yes***	No
51	Steere Farm Elementary School	RI	State Recreation	4.3	***Yes***	No
52	Town Common / Bicentennial Park	RI	State Recreation	3.9	***Yes***	No
53	Union Pond Fishing Access	RI	State Recreation	2.6	***Yes***	No
54	Veterans Memorial Park	RI	State Recreation	2.4	***Yes***	No
55	Pascoag Fire District Wellfield	RI	Local Conservation Lands	2.6	***Yes***	***Yes***
56	Wallum Lake	RI	Local Conservation Lands	0.8	***Yes***	***Yes***
57	Bicentennial Park	RI	Local Conservation Lands	3.9	***Yes***	No
58	Blanchard Memorial Management Area	RI	Local Conservation Lands	3.4	***Yes***	No
59	Buck Hill Assocation	RI	Local Conservation Lands	0.8	***Yes***	No
60	Buck Hill Management Area	RI	Local Conservation Lands	1.7	***Yes***	No
61	Burrillville Land Trust	RI	Local Conservation Lands	0.9	***Yes***	No
62	Burrillville Recreation Area	RI	Local Conservation Lands	4.7	***Yes***	No
63	Crestwood Development	RI	Local Conservation Lands	2.8	***Yes***	No
64	Edward D. Vock Conservation Area	RI	Local Conservation Lands	1.1	***Yes***	No
65	Factory Mutual Gift	RI	Local Conservation Lands	4.2	***Yes***	No
66	Fiddlers Green	RI	Local Conservation Lands	4.0	***Yes***	No
67	Harrisville Fire District	RI	Local Conservation Lands	4.1	***Yes***	No
68	Harrisville Fire District	RI	Local Conservation Lands	4.1	***Yes***	No
69	Hawkins Pond	RI	Local Conservation Lands	3.5	***Yes***	No
70	Hemlock Farm	RI	Local Conservation Lands	4.2	***Yes***	No
71	Hidden Shores	RI	Local Conservation Lands	3.0	***Yes***	***Yes***
72	Pascoag Fire District 1	RI	Local Conservation Lands	2.4	***Yes***	No
73	Pascoag Fire District 2	RI	Local Conservation Lands	0.9	***Yes***	No
74	Pulaski	RI	Local Conservation Lands	0.7	***Yes***	No
75	Rolling Meadows	RI	Local Conservation Lands	3.6	***Yes***	No
76	Spring Lake	RI	Local Conservation Lands	4.5	***Yes***	No
77	Williams Mills	RI	Local Conservation Lands	4.2	***Yes***	No
78	Marshall-Hopkins-Potter Lot	RI	Cemetery	2.3	***Yes***	***Yes***
79	Prouty - Bishop	RI	Cemetery	3.0	***Yes***	***Yes***
80	St Patrick'S Cemetery 1	RI	Cemetery	3.1	***Yes***	***Yes***
81	St Patrick'S Cemetery 2	RI	Cemetery	2.9	***Yes***	***Yes***

Table 1
Inventory of Aesthetic Resources

	Resource Name	State	Type of Resource	Distance From Project	Bare Earth	Vegetation
82	Wilson Lot	RI	Cemetery	1.5	***Yes***	***Yes***
83	Albee-Paine	RI	Cemetery	2.8	***Yes***	No
84	Aldrich Lot	RI	Cemetery	3.9	***Yes***	No
85	Amaziah Harris Lot	RI	Cemetery	3.8	***Yes***	No
86	Angell Lot	RI	Cemetery	1.0	***Yes***	No
87	Arnold Lot	RI	Cemetery	4.4	***Yes***	No
88	Bardine Lot	RI	Cemetery	4.1	***Yes***	No
89	Bowdish	RI	Cemetery	3.4	***Yes***	No
90	Brown - Millard Lot	RI	Cemetery	1.3	***Yes***	No
91	Brown Lot	RI	Cemetery	4.4	***Yes***	No
92	Capt James Reynolds Lot	RI	Cemetery	3.6	***Yes***	No
93	Cary-Ballou Lot	RI	Cemetery	4.2	***Yes***	No
94	Clark Sherman Lot	RI	Cemetery	2.3	***Yes***	No
95	Croff-Lewis Lot	RI	Cemetery	2.4	***Yes***	No
96	Dea Timothy Dean Lot	RI	Cemetery	1.6	***Yes***	No
97	Eddy Lot	RI	Cemetery	2.9	No	No
98	Eddy-Aldrich	RI	Cemetery	3.4	No	No
99	Elder William Bowen Lot	RI	Cemetery	2.4	***Yes***	No
100	Elger Lot	RI	Cemetery	2.9	***Yes***	No
101	Harris - White - Darling	RI	Cemetery	4.5	***Yes***	No
102	Harris Lot	RI	Cemetery	3.7	***Yes***	No
103	Harrisville Cemetery	RI	Cemetery	3.8	***Yes***	No
104	Hicks-Smith Lot	RI	Cemetery	0.7	***Yes***	No
105	Howard Lot	RI	Cemetery	0.3	***Yes***	No
106	Humes Lot	RI	Cemetery	1.4	***Yes***	No
107	Irons Lot	RI	Cemetery	3.0	***Yes***	No
108	Jonathan Lackey Lot	RI	Cemetery	2.1	***Yes***	No
109	Lee Lot	RI	Cemetery	4.8	***Yes***	No
110	Logee Lot	RI	Cemetery	2.7	***Yes***	No
111	Logee Lot	RI	Cemetery	2.1	***Yes***	No
112	Logee Lot	RI	Cemetery	2.6	***Yes***	No
113	Martin Smith Lot	RI	Cemetery	3.0	***Yes***	No
114	Mathewson-Ross Lot	RI	Cemetery	3.0	***Yes***	No
115	Morey - Ross	RI	Cemetery	4.9	***Yes***	No
116	Mowry Lot	RI	Cemetery	3.6	***Yes***	No
117	Mt St Charles Cemetery	RI	Cemetery	4.4	***Yes***	No
118	Paine Lot	RI	Cemetery	3.7	No	No
119	Paine Lot	RI	Cemetery	3.0	***Yes***	No
120	Pascoag Cemetery	RI	Cemetery	2.8	***Yes***	No
121	Payne - Phillips - Sayles	RI	Cemetery	2.4	***Yes***	No
122	Rev Moab Paine Lot	RI	Cemetery	2.8	***Yes***	No

Table 1
Inventory of Aesthetic Resources

	Resource Name	State	Type of Resource	Distance From Project	Bare Earth	Vegetation
123	Rhodes-Gleason Lot	RI	Cemetery	3.8	***Yes***	No
124	Richmond Lot 1	RI	Cemetery	3.9	***Yes***	No
125	Richmond Lot 2	RI	Cemetery	3.4	***Yes***	No
126	Robbins-Lapham Lot	RI	Cemetery	3.3	No	No
127	Ross Lot 1	RI	Cemetery	1.8	***Yes***	No
128	Ross Lot 2	RI	Cemetery	1.5	***Yes***	No
129	Samuel Smith Lot	RI	Cemetery	3.7	No	No
130	Sayles - Eddy Lot	RI	Cemetery	3.4	***Yes***	No
131	Sayles Cook Lot	RI	Cemetery	2.6	***Yes***	No
132	Sayles Lot	RI	Cemetery	0.5	***Yes***	No
133	Sherman-Burlingame Lot	RI	Cemetery	3.9	No	No
134	Shippee Lot	RI	Cemetery	4.9	***Yes***	No
135	Smith Lot	RI	Cemetery	4.3	***Yes***	No
136	Smith Lot	RI	Cemetery	5.0	***Yes***	No
137	Smith-Taft Lot	RI	Cemetery	4.4	***Yes***	No
138	Steere Lot 1	RI	Cemetery	4.2	***Yes***	No
139	Steere Lot 2	RI	Cemetery	4.2	***Yes***	No
140	Taft Loft 1	RI	Cemetery	4.7	***Yes***	No
141	Taft Lot 2	RI	Cemetery	3.9	***Yes***	No
142	Taft-Baker Lot	RI	Cemetery	2.0	***Yes***	No
143	Unknown Lot	RI	Cemetery	4.9	***Yes***	No
144	Uriah Mowry Lot	RI	Cemetery	2.0	***Yes***	No
145	Vallett Lot	RI	Cemetery	3.6	***Yes***	No
146	Whipple Lot	RI	Cemetery	1.8	***Yes***	No
147	Young Lot	RI	Cemetery	3.8	***Yes***	No
148	Young-White Lot	RI	Cemetery	5.0	***Yes***	No
149	Zebede Williams Lot	RI	Cemetery	2.6	***Yes***	No
150	Unknown Lot	RI	Cemetery	4.6	***Yes***	No
151	Unknown Lot	RI	Cemetery	3.3	***Yes***	No
152	Unknown Lot	RI	Cemetery	3.3	***Yes***	No
153	Unknown Lot	RI	Cemetery	4.3	***Yes***	No
154	Unknown Lot	RI	Cemetery	4.7	***Yes***	No
Massachusetts						
155	South Douglas	MA	Historic District	2.6	No	No
156	Dyer Camps	MA	Historic District	2.9	***Yes***	No
157	Levi Brown House	MA	Historic Structure	3.9	No	No
158	Asahel Aldrich Barn	MA	Historic Structure	3.3	No	No
159	Douglas State Forest	MA	State Recreation	2.9	***Yes***	***Yes***
160	Blackstone Valley Beagle Club	MA	State Recreation	3.2	No	No
161	Tinkerville Brook Conservation Area	MA	Local Conservation Land	2.6	No	No

Table 1
Inventory of Aesthetic Resources

	Resource Name	State	Type of Resource	Distance From Project	Bare Earth	Vegetation
Connecticut						
162	East Putnam	CT	State Recreation	3.9	No	No
163	Elmwood Hill	CT	State Recreation	3.0	No	No
164	Thompson Raceway	CT	State Recreation	2.9	No	No
165	Raceway Golf Course	CT	State Recreation	3.4	No	No
166	Brandy Hill	CT	State Recreation	4.0	***Yes***	***Yes***
167	Fort Hill	CT	State Recreation	3.9	***Yes***	***Yes***
168	Quaddick Mtn	CT	State Recreation	3.3	***Yes***	***Yes***
169	Quaddick	CT	State Recreation	3.0	No	No
170	Quaddick State Forest	CT	Local Conservation Land	1.4	No	No
171	Quaddick State Reservoir	CT	Local Conservation Land	2.4	No	No
172	Quaddick State Park	CT	Local Conservation Land	2.1	No	No
173	East Thompson	CT	Local Conservation Land	3.2	No	No
174	Dike Cemetery	CT	Cemetery	3.4	***Yes***	No
175	Munyan Cemetery	CT	Cemetery	3.5	No	No

Appendix H

PHASE I ARCHEOLOGICAL SURVEY

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Since 1987

Corporate Office
1318 Main Street
Cincinnati OH
45202-7614
513.287.7700
f 513.287.7703

Mid-Atlantic Office
1705 East Main Street
Richmond VA
23223
804.644.0656
f 804.643.8119

Northeast & Caribbean Office
The Plant
60 Valley Street
Suite 103
Providence RI
02909
401.273.9900
f 401.273.9944

Indiana Branch Office
101 W. Kirkwood
Suite 207
Bloomington IN
47404
812.339.7300
f 812.339.7900

Kentucky Branch Office
10056 Lower River Road
Rabbit Hash KY
41005
859.795.1832
f 859.795.1790

September 14, 2015

Mike Feinblatt
ESS Group, Inc.
10 Hemingway Drive
East Providence RI 02915

Re: Preliminary Management Summary, Invenergy, LLC, Rhode Island Energy Center, Phase I Archaeological Intensive Survey, Burrillville, Providence County, Rhode Island

Dear Mr. Feinblatt:

This preliminary management summary presents the results of the Gray & Pape, Inc. (Gray & Pape) Phase I archaeological intensive survey of the proposed Invenergy, LLC Rhode Island Energy Center (Figure 1). This project was conducted for ESS Group, Inc. (ESS).

Because the proposed project is permitted through the United States Army Corps of Engineers (USACE), the project must be in compliance with legislation and regulations concerning the impact to archaeological properties from federally-funded or permitted activities. These include Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. 306108), the National Environmental Policy Act of 1969 (PL 91-990, 42 USC 4321), Executive Order 11593, 1971 (16 USC 470), Procedures for the Protection of Historic and Cultural Properties (36 CFR 800), and the Archaeological and Historic Preservation Act of 1974 (PL 93-291). It is expected that the Rhode Island Historical Preservation and Heritage Commission (RIHPHC) will review the project under Section 106, in consultation with the USACE. Protection of historic and archaeological resources in Rhode Island is overseen by the RIHPHC, the office of the State Archaeologist and the State Historic Preservation Officer. State legislation dealing with the protection of historic and archaeological resources is covered under Rhode Island General Laws 42-45. All tasks associated with this project will be undertaken in accordance with the standards outlined in the Secretary of the Interior's Standards and Guideline for Archaeology and Historic Preservation (48 FR 44716 1983) and the RIHPHC Performance Standards and Guidelines for Archaeology in Rhode Island (2013).

Project Boundaries and Description

The proposed project consists of construction footprints, access road impacts, and utility line rights-of-way within a 12.1-hectare (ha) (30-acre [ac.] parcel located in the west-central portion of the town of Burrillville, on the west side of Wallum Lake Road

(State Route 100). Archaeological survey was conducted specifically within proposed impact locations (Figure 2) within the 12.1-ha (30-ac.) parcel and included:

- Access Road – 682 m (2238 ft.) in length
- Gas Line – 266 m (873 ft.) in length
- 345 kV Line (800') – 244 m (800 ft.) in length
- 345 kV Line (2,500') – 762 m (2,500 ft.) in length
- Substation – 0.8 ha (2.1 ac.)
- Switchyard – 0.4 ha (1.1 ac.)
- Power Block – 6.2 ha (15.4 ac.)

Preliminary research into the published and unpublished literature regarding archaeological projects near the proposed Rhode Island Energy Center by Gray & Pape staff suggested the project area had the potential to contain Native American archaeological sites. Specifically, previous archaeological surveys at the adjacent Burrillville Compressor Station identified one Native American site to the southwest of the existing facility (the Algonquin Lane Native American site, RI 2568), and a second site was identified adjacent to the access road to the compressor station (the Wallum Lake Road site, RI 2569). Gray & Pape received State Archaeologist permit #15-13 on August 5, 2015 to complete this survey. This memo presents the preliminary results of this survey.

Methodology

General field testing methods consisted of the excavation of shovel test pits (STPs) at 10.0 m (32.8 ft.) intervals. A 10.0-m (32.8-ft.) arbitrary grid was established over each of the survey areas. Shovel test pits measured 50 by 50 centimeters (cm) (20 by 20 inches [in.]) square. They were excavated 10 cm (3.9 in.) into the C horizon, typically no greater than 80 cm (32 in.) below ground surface. All soil was screened through 1/4-inch hardware cloth to assure the recovery of artifacts. The stratigraphy observed was recorded using the Gray & Pape field recordation system. Photographs of representative STPs and general view photographs of the project area were taken to document the stratigraphy and current land use.

Project personnel in the field for the intensive survey included Principal Investigator Dr. Christopher Donta, Field Director Kimberly Smith, and Archaeologists Michelle Pope, Jessica Jay, Ian Miller, Erin Sullivan, Rhea Fuller, and Samantha Savory. The field survey was conducted between August 18 and August 27, 2015.

Survey Results

The general project area is located largely within the flood plain of Iron Mine Brook and Dry Ann Brook and within many delineated wetland boundaries (see Figure 1). However, the Substation survey area is located mostly within an upland setting, though its northern and eastern boundaries are sloping in those directions. The northernmost portions of the power block and switchyard and the proposed gas line are located on a terrace and do not appear to have been disturbed by flooding events as seen in the southern portions. The far eastern portion of the access road is also located on a terrace. Though the project area is located within and adjacent to wetland areas, the general project area's location adjacent to previously identified Native American sites, and its proximity to the historically settled village of Pascoag, Burrillville, Rhode Island, suggested the area had a high potential to yield Native American and historical cultural materials. Each survey area is discussed below pertaining to the number of STPs excavated and materials recovered.

Access Road

The proposed access road is located immediately adjacent to Wallum Lake Road and generally follows an existing gravel and earth road. This survey area measures approximately 682 m (2,238 ft.) in length and 15 m (50 ft.) in width. The far eastern portion of the proposed access road does not follow the existing one, and as a result, 16 STPs were excavated in this portion (STPs A-1 through A-16), four more than originally proposed (Figures 2-4). The STP soil profiles exhibited an eroded or modified Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony soil series. Specifically, the A horizon consisted of a very dark grayish brown (10YR 3/2) fine sandy loam extending to approximately 8 cm (3 in.) below ground surface. This A horizon overlaid a Bw1 comprised of a dark yellowish brown (10YR 4/4) fine sandy loam that extended no greater than 17 cm (7 in.) below ground surface. This Bw1 overlaid a Bw2, also a dark yellowish brown (10YR 4/4) that extended between 30 and 50 cm (12 and 20 in.) below ground surface and overlaid the C horizon. The C horizon was comprised of a light olive brown (2.5Y 5/4) gravelly fine sandy loam. Excavation halted 10 cm (4 in.) into the C horizon. No Native American or historical cultural deposits were identified within the proposed access road. No further survey is recommended.

Gas Line

The proposed gas line is located immediately north of the power block survey area and immediately south of the existing Burrillville Compressor Station. This survey area measures approximately 266 m (873 ft.) in length and 15 m (50 ft.) in width. The northern portion of the proposed gas line extended into a fenced off area that has recently been heavily disturbed by the construction of a gravel lot (Plate 1). As a result, a total of three STPs were excavated (STPs A-1 through A-3), 12 less than originally proposed (Figure 5). The STP soil profiles exhibited an eroded or modified Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony soil series. Specifically, the A horizon consisted of a very dark grayish brown (10YR 3/2) fine sandy loam extending to approximately 8 cm (3 in.) below ground surface. This A horizon overlaid a Bw1 comprised of a dark yellowish brown (10YR 4/4) fine sandy loam that extended no greater than 13 cm (5 in.) below ground surface. This Bw1 overlaid a Bw2, also a dark yellowish brown (10YR 4/4), that extended between 39 and 64 cm (15 and 25 in.)

below ground surface and overlaid the C horizon. The C horizon was comprised of a light olive brown (2.5Y 5/4) gravelly fine sandy loam. Excavation halted 10 cm (4 in.) into the C horizon. No Native American or historical cultural deposits were identified within the proposed gas line survey area. No further survey is recommended.

345 kV Line (800')

The survey area measures approximately 244 m (800 ft.) in length and 15 m (50 ft.) in width. This proposed kV Line connects the substation survey area to the west and the switchyard survey area to the east and is generally sloping upwards to the west. Given the progressive slope of the survey area, four STPs were excavated (A-1 through A-4), the same as was originally proposed (Figure 6). The STP soil profiles exhibited soils consistent with the Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony; Sutton fine sandy loam, 0 to 3 percent slopes; and Canton fine sandy loam, 3 to 15 percent slopes, rocky. Shovel Test Pits A-2, A-3, and A-4 exhibited soils similar to the Canton soils and consisted of black (10YR 2/1) sandy loam A horizon that extended to approximately 9 cm (4 in.) below ground surface. It overlaid a yellowish brown (10YR 5/6) fine sandy loam Bw horizon that extended to 16 cm (6 in.) below ground surface. This Bw horizon overlaid a light olive gray (5Y 6/2) gravelly sandy loam C horizon. Excavation halted 10 cm (4 in.) into the C horizon.

Shovel Test Pit A-1 exhibited soils consistent with the Ridgebury Series. The A horizon was a black (10YR 2/1) fine sandy loam that extended to approximately 10 cm (4 in.) below ground surface). It overlaid a brown (10YR 4/3) sandy loam Bw horizon that extended to approximately 44 cm (17 in.) below ground surface. This overlaid a gray (5Y 5/1) gravelly sandy loam C horizon. Excavation halted 10 cm (4 in.) into the C horizon. No Native American or historical cultural deposits were identified within the proposed 345 kV line survey area. No further survey is recommended.

345 kV Line (2500')

The proposed 345 kV Line is located immediately west of the substation survey area and extends to the National Grid transmission line to the west, along Wilson Trail. This survey area measures approximately 762 m (2,500 ft.) in length and 15 m (50 ft.) in width. This proposed kV line spans wetlands and upland areas, starting with steep slope in the eastern portion which stops in a wetland area near Dry Ann Brook, then continues westward gently running up slope towards the transmission line. Shovel Test Pits were not excavated in areas of slope, wetlands or standing ground surface water, modern disturbances (e.g. transmission line or extant gas line running south of the extant compressor station), and areas of bedrock at surface. As a result, a total of 31 STPs (A-1 through A-15 and Structure STPs A-1 through A-3, B-1 through B-3, C-1 through C-3, D-1, D-2, and Judgmentals 1-4) were excavated within or immediately adjacent to this survey area, 12 more than originally proposed (Figures 7-9). The STP soil profiles exhibited soils consistent with the Ridgebury, Leicester, and Whitman soils, 0 to 8 percent slopes, extremely stony. The soil profiles typically consisted of very dark grayish brown (10YR 3/2) to black (10YR 2/1) fine sandy loam A horizon that extended to approximately 10 cm (4 in.) below ground surface. This overlaid a brown (10YR 4/3) extremely gravelly sandy loam Bw horizon that extended to approximately 35 cm (14 in.) below ground surface. This B horizon overlaid a gray (5Y 5/1) gravelly sandy loam C horizon. Excavation halted 10 cm (4 in.) into the C horizon. There were several STPs where excavation was halted in the B horizon due to a great number of rocks and impenetrable rocky soil.

The original transect of shovel tests A-1 through A-15 did not yield cultural material. However, upon the identification of nearby structural foundation remains immediately west of the proposed 345 kV Line, additional STPs were excavated (Figure 10), two of which yielded historical cultural material. The soil profiles in the structural STPs were very similar to the A transect soil profiles, with exception to the STPs nearest to the foundation remains, which exhibited an overburden of B horizon on top of the intact A horizon. This overburden is due to the excavated soils from within the foundation having been placed on top of the ground adjacent to it.

The foundation remains identified consist of a dry laid stacked stone foundation measuring approximately 3 m (15 ft.) by 3 m (15 ft.) square (Plate 2). Several cut stone stairs were identified in the southwest corner of the foundation. A cut stone lintel (likely a front door step) was located on the north wall in the center portion at ground surface. Parts of an Eddy & Corse cast iron stove were present on the ground surface immediately east of the foundation (Plate 3). This particular stove appears to have been made between 1869 and 1876. Nearby STP C-2 yielded three clinched late-cut nails, and STP Judgmental 3, located immediately west of the stone foundation and within a dug out earthen bermed area, yielded more than 50 fragments of miscellaneous metal. Based upon initial research, the structure does not appear to be mapped on any available historical plat maps of the area. The architectural remains, including nails, and the wood stove fragments suggest it may be the remains of an ephemeral cabin site constructed in the mid-nineteenth century. Given the presence of the structure and the lack of full investigations concerning the site, Gray & Pape recommends further work or avoidance of the cabin site location and a surrounding 15 m (50 ft.) buffer area. The remaining portion of the proposed 345 kV Line yielded no cultural material and no further survey is recommended.

Substation

The proposed substation is located in the northwest portion of the 12.1 ha (30-ac.) parcel. It is immediately south of the 345 kV Line (2,500 ft.) and north of the 345 kV Line (800 ft.). The substation is located in an upland setting with the northeastern and eastern portions heavily sloping to the east towards Dry Ann Brook and associated wetlands. The central portion of the survey area exhibited glacial erratics and bedrock at ground surface, prohibiting testing in these areas. The substation survey area measures approximately 0.8 ha (2.1 ac.). In total, 26 STPs were excavated within the substation survey area, six more than originally proposed (Figure 11). The STP soil profiles were consistent with the mapped Ridgebury, Leicester, and

Whitman soils, 0 to 8 percent slopes, extremely stony. The soil profiles typically consisted of very dark grayish brown (10YR 3/2) to black (10YR 2/1) fine sandy loam A horizon that extended to approximately 10 cm (4 in.) below ground surface. This overlaid a brown (10YR 4/3) extremely gravelly sandy loam Bw horizon that extended to approximately 35 cm (14 in.) below ground surface. This B horizon overlaid a gray (5Y 5/1) gravelly sandy loam C horizon. Excavation halted 10 cm (4 in.) into the C horizon. There were several STPs where excavation was halted in the B horizon due to the great number of rocks and impenetrable rocky soil. No Native American or historical cultural deposits were identified within the proposed substation survey area. No further survey is recommended.

SWITCHYARD

The proposed switchyard is located in the central portion of the 12.1 ha (30-ac.) parcel. It is immediately west of the power block survey area and measures approximately 0.4 ha (1.1 ac.). It spans a wetland area in the southern portion to an upland setting with large glacial erratics and bedrock outcrops in the northern portion. In total, six STPs were excavated within the substation survey area, the same as was originally proposed (Figure 12). The STP soil profiles exhibited an eroded or modified Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony soil series. Specifically, the A horizon consisted of a very dark grayish brown (10YR 3/2) fine sandy loam extending to approximately 8 cm (3 in.) below ground surface. This A horizon overlaid a Bw1 comprised of a dark yellowish brown (10YR 4/4) fine sandy loam that extended no greater than 22 cm (9 in.) below ground surface. This Bw1 overlaid a Bw2, also a dark yellowish brown (10YR 4/4) that extended between 32 and 44 cm (13 and 17 in.) below ground surface and overlaid the C horizon. The C horizon was comprised of a light olive brown (2.5Y 5/4) gravelly fine sandy loam. Excavation halted 10 cm (4 in.) into the C horizon. No Native American or historical cultural deposits were identified within the proposed switchyard survey area. No further survey is recommended.

POWER BLOCK

The proposed power block is located in the central portion of the 12.1 ha (30-ac.) parcel. It is immediately east of the switchyard survey area and measures approximately 0.4 ha (1.1 ac.). It spans a wetland area in the southern portion to an upland setting with large glacial erratics and bedrock outcrops in the northern portion. In total, 147 STPs were excavated within the substation survey area, 18 STPs less than was originally proposed (Figures 13-15). The STP soil profiles exhibited an eroded or modified Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony soil series. Specifically, the A horizon consisted of a very dark grayish brown (10YR 3/2) fine sandy loam extending to approximately 8 cm (3 in.) below ground surface. This A horizon overlaid a Bw1 comprised of a dark yellowish brown (10YR 4/4) fine sandy loam that extended no greater than 22 cm (9 in.) below ground surface. This Bw1 overlaid a Bw2, also a dark yellowish brown (10YR 4/4) that extended between 32 and 44 cm (13 and 17 in.) below ground surface and overlaid the C horizon. The C horizon was comprised of a light olive brown (2.5Y 5/4) gravelly fine sandy loam. Excavation halted 10 cm (4 in.) into the C horizon. A single Native American artifact, a fragment of quartzite shatter was recovered from ST D-35 in the northeastern portion of the power block survey area. Additional radial shovel tests were excavated at 5-m (16-ft.) intervals in each cardinal direction around the positive STP (Plate 4). These were all negative. Therefore, this is considered an isolated find.

Shovel Test Pits C-11 and D-8, located in the central eastern portion of the power block survey area also yielded cultural material; however, these were historical artifacts. Shovel Test Pit C-11 yielded a fragment of table glass, light aqua in color. Shovel Test Pit D-8 yielded three fragments of window glass measuring between 2.36 and 2.44 mm in thickness. According to Moir (1983) these likely date between 1910 and 1920. Though surrounding shovel tests yielded no cultural material, fragments of metal buckets, car doors dating to the mid nineteenth century, and miscellaneous metal was visible on the ground surface in this area (Plate 5). A structure is mapped in this location on the 1870 Beers map of Rhode Island, though a property owner is not listed. Though Native American material was recovered in ST D-35, the paucity and the lack of diagnostic materials suggest this isolated find lacks the ability to provide significant information pertaining to the Native American settlement or use of this area of Rhode Island. The historical materials recovered in ST C-11 and D-8 provide very little information on the historical occupation of the site area. The general site location near these two STPs appears to have been heavily disturbed by flooding events and possible razing and grading of the property. The paucity of materials and lack of intact structural remains suggest this site does not have the potential to aid in our understanding of historical settlement of the area. As such, no further survey is recommended for the power block survey area.

Summary and Recommendations

Seven survey areas were subjected to a Phase I archaeological intensive survey as part of this project. Two survey areas yielded historical and Native American cultural material. These are the power block and the 345 kV line (800 ft.) survey areas. The 345 kV line (800 ft.) survey area yielded historical structural remains likely associated with an ephemeral cabin dating to the mid-nineteenth century. Limited testing has been conducted within this site locale due to portions of it being outside the boundaries of the survey area. Gray & Pape recommends additional testing within a 15-m (50-ft.) buffer of this site or avoidance, given the site's potential to aid in understanding nineteenth century settlement in this region of Rhode Island.

A single piece of quartzite shatter was recovered from ST D-35 in the northeastern portion of the power block survey area and a small historical artifact scatter comprised of glass fragments and metal was identified in the southeast portion of the power block near STPs C-11 and D-8. Gray & Pape recommends no further work at either of these site locales due to the paucity of materials and lack of diagnostic materials.

A full report regarding the combined efforts of the background research and archaeological intensive survey is in preparation.

Thank you for your time and consideration.

Sincerely,

Christopher Donta, Ph.D.
Senior Principal Investigator
GRAY & PAPE, INC.
cdonta@graypape.com
413.992.7593

Plate 1. Fenced in area and gravel lot within the proposed gas line survey area.

Plate 2. Dry laid, stacked, stone foundation found along 345 kV line (2,500 ft.).

Plate 3. Eddy & Corse, cast iron stove door part, dating between circa 1869 and 1876.

Plate 4. General view near STP D-35, facing west.

Plate 5. General view near STPs C-11 and D-8, facing west.
Note the metal objects on the ground surface.

LEGEND

New 345 KV Line

15-m (50-ft.) Survey Corridor

Survey Areas

Shovel Test Pits

ST- Negative

0 10 20 Meters

0 25 50 Feet

N W E S

Rhode Island Energy Center
345 kV Line (2,500')
Survey Area
(East 1/3)

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 9

9/13/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\15_69901_345kVLine_2500ft_Survey_Area_EastThird.mxd

Created in ArcGIS 10.3.1 for Gray & Pape Project 15-67002.004

9/13/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\15_69901_345kVLine_2500ft_Survey_Area_Structure.mxd

LEGEND

New 345 KV Line

15-m (50-ft.) Survey Corridor

Structural Foundation

Shovel Test Pits

ST- Negative

ST- Positive, Historical

0 10 20 Meters

0 25 50 Feet

N W E S

Rhode Island Energy Center
345 kV Line (2,500')
Survey Area

Historical Structure Location

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 10

Created in ArcGIS 10.3.1 for Gray & Pape Project 15-67002.004

LEGEND

New 345 KV Line

15-m (50-ft.) Survey Corridor

Survey Areas

Shovel Test Pits

ST- Negative

0 10 20 Meters

0 25 50 Feet

N W E S

Rhode Island Energy Center SubstationSurvey Area

GRAY & PAPE, INC.

ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 11

LEGEND

New 345 KV Line

Survey Areas

Shovel Test Pits

ST- Negative

0 10 20 Meters

0 25 50 Feet

N
W E
S

Rhode Island Energy Center
Switchyard Survey Area

GRAY & PAPE, INC.

Figure 12

LEGEND

Access Road

Survey Areas

Shovel Test Pits

ST- Negative

ST- Positive, Historical

0 10 20 Meters

0 25 50 Feet

N W E S

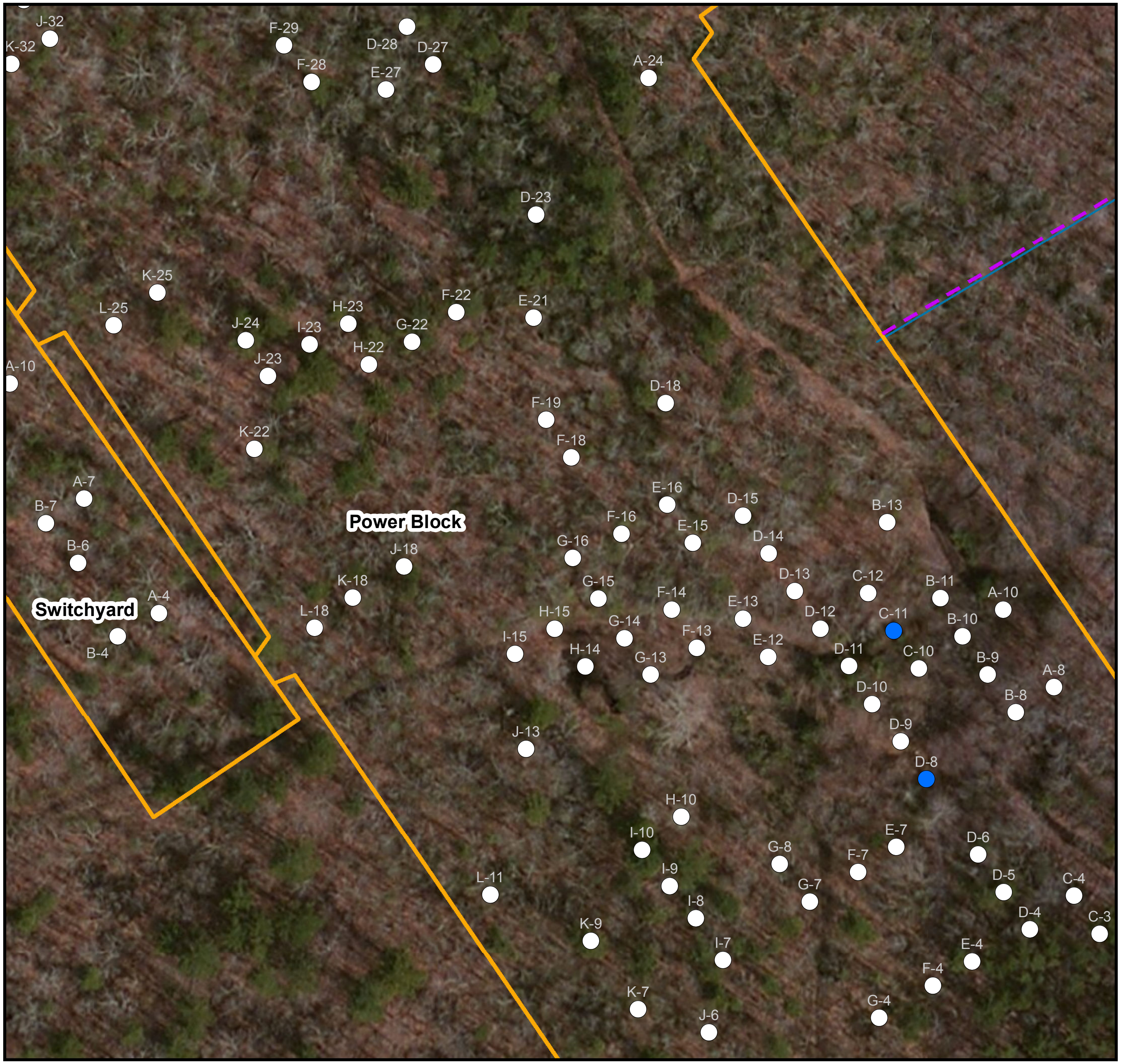
Rhode Island Energy Center
Power Block Survey Area
(South 1/3)

GRAY & PAPE, INC.

Figure 13

9/13/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\15_69901_Power_Block_SurveyArea_SouthThird.mxd

Created in ArcGIS 10.3.1 for Gray & Pape Project 15-67002.004



LEGEND

Access Road

Survey Areas

Shovel Test Pits

ST- Negative

ST- Positive, Historical

0 10 20 Meters

0 25 50 Feet

N W E S

Rhode Island Energy Center
Power Block Survey Area
(Middle 1/3)

GRAY & PAPE, INC.

Figure 14

9/13/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\15_69901_Power_Block_SurveyArea_NorthThird.mxd

LEGEND

New Gas Line

15-m (50-ft.) Survey Corridor

Survey Areas

Shovel Test Pits

ST- Negative

ST- Positive, Native American

0 10 20 Meters

0 25 50 Feet

Rhode Island Energy Center
Power Block Survey Area
(North1/3)

GRAY & PAPE, INC.

Figure 15

Created in ArcGIS 10.3.1 for Gray & Pape Project 15-67002.004

Corporate Office
1318 Main Street
Cincinnati OH
45202-7614
513.287.7700
f 513.287.7703

Mid-Atlantic Office
1705 East Main Street
Richmond VA
23223
804.644.0656
f 804.643.8119

Northeast & Caribbean Office
The Plant
60 Valley Street
Suite 103
Providence RI
02909
401.273.9900
f 401.273.9944

Indiana Branch Office
101 W. Kirkwood
Suite 207
Bloomington IN
47404
812.339.7300
f 812.339.7900

Kentucky Branch Office
10056 Lower River Road
Rabbit Hash KY
41005
859.795.1832
f 859.795.1790

October 14, 2015

Mike Feinblatt
ESS Group, Inc.
10 Hemingway Drive
East Providence RI 02915

Re: Addendum to the Preliminary Management Summary, Invenergy, LLC, Clear River Energy Center, Archaeological Intensive Survey, Burrillville, Rhode Island

Dear Mr. Feinblatt:

This is an addendum to the preliminary management summary presents the results of the Gray & Pape, Inc., Phase I archaeological intensive survey of the proposed Invenergy, LLC, Clear River Energy Center (Figure 1). This project was conducted for ESS Group, Inc.

Because the proposed project is permitted through the United States Army Corps of Engineers (USACE), the project must be in compliance with legislation and regulations concerning the impact to archaeological properties from federally-funded or permitted activities. These include Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. 306108), the National Environmental Policy Act of 1969 (PL 91-990, 42 USC 4321), Executive Order 11593, 1971 (16 USC 470), Procedures for the Protection of Historic and Cultural Properties (36 CFR 800), and the Archaeological and Historic Preservation Act of 1974 (PL 93-291). It is expected that the Rhode Island Historical Preservation and Heritage Commission (RIHPHC) will review the project under Section 106, in consultation with the USACE. Protection of historic and archaeological resources in Rhode Island is overseen by the RIHPHC, the office of the State Archaeologist and the State Historic Preservation Officer. State legislation dealing with the protection of historic and archaeological resources is covered under Rhode Island General Laws 42-45. All tasks associated with this project will be undertaken in accordance with the standards outlined in the Secretary of the Interior's Standards and Guideline for Archaeology and Historic Preservation (48 FR 44716 1983) and the RIHPHC Performance Standards and Guidelines for Archaeology in Rhode Island (2013).

Project Boundaries and Description

The proposed project consists of construction footprints, access road impacts, and utility line rights-of-way within a 12.1-hectare (ha) (30-acre [ac.] parcel located in the west-central portion of the town of Burrillville, on the west side of Wallum Lake Road

(State Route 100). Archaeological survey was conducted specifically within proposed impact locations (Figure 2) within the 12.1-ha (30-ac.) parcel and included:

- Access Road – 682 m (2238 ft.) in length
- Gas Line – 266 m (873 ft.) in length
- 345 kV Line (800') – 244 m (800 ft.) in length
- 345 kV Line (2,500') – 762 m (2,500 ft.) in length
- Substation – 0.8 ha (2.1 ac.)
- Switchyard – 0.4 ha (1.1 ac.)
- Power Block – 6.2 ha (15.4 ac.)

This addendum includes areas that were added to the original project area after the initial Phase 1 survey had occurred. This includes:

- Three separate expansion areas of the central Substation/Switchyard/Power Block area:
    - Area 1- 0.28 ha (0.68 ac.)
    - Area 2- 0.40 ha (0.98 ac.)
    - Area 3- 1.93 ha (4.78 ac.)
- An addition to Storm Water Detention Pond #2- 0.16 ha (0.40 ac.)
- The addition of Storm Water Detention Pond #3- 0.52 ha (1.28 ac.)
- And an Area 4 east of Storm Water Detention Pond #3- 1.92 ha (4.75 ac.)

Preliminary research into the published and unpublished literature regarding archaeological projects near the proposed Clear River Energy Center by Gray & Pape staff suggested the project area had the potential to contain Native American archaeological sites. Specifically, previous archaeological surveys at the adjacent Burrillville Compressor Station identified one Native American site to the southwest of the existing facility (the Algonquin Lane Native American site, RI 2568), and a second site was identified adjacent to the access road to the compressor station (the Wallum Lake Road site, RI 2569). Gray & Pape received State Archaeologist permit #1573 on August 5, 2015 to complete this survey. Initial testing of the project occurred from August 18-27, 2015, after which changes to the project footprint were made. This memo presents the preliminary results of additional testing conducted for changes to the project layout.

Methodology

General field testing methods consisted of the excavation of shovel tests (STs) at 10.0 m (32.8 ft.) intervals. A 10.0-m (32.8-ft.) arbitrary grid was established over each of the survey areas. Shovel tests measured 50 by 50 centimeters (cm) (20 by 20 inches [in.]) square. They were excavated 10 cm (3.9 in.) into the C horizon, typically no greater than 80 cm (32 in.) below ground surface. All soil was screened through 1/4-inch hardware cloth to assure the recovery of artifacts. The stratigraphy observed was recorded using the Gray & Pape field recordation system. Photographs of representative STs and general view photographs of the project area were taken to document the stratigraphy and current land use.

Project personnel in the field for the intensive survey included Principal Investigator Dr. Christopher Donta, Field Director Nathan Scholl, and Archaeologists Albert Armstrong, Ian Miller, Michelle Pope, and Erin Sullivan. The field survey for the additional testing was conducted between October 4 and October 9, 2015.

Survey Results

The general project area is located on a terrace-like ridge, which is situated between the flood plains of Iron Mine Brook and Dry Ann Brook (see Figure 1). However, the eastern, southern, and western boundaries of the project area are delineated as wetlands, the boundaries of which have likely increased and decreased at different periods of time in the past. The project area is located mostly within an upland setting, though its boundaries are generally found to be sloping. The project area in general has been heavily logged, as evidenced by many small to large push-piles and ditches created via these activities. Though the project area is located within and adjacent to wetland areas, the general project area's location adjacent to previously identified Native American sites, and its proximity to the historically settled village of Pascoag, Burrillville, Rhode Island, suggested the area had a high potential to yield Native American and historical cultural materials. Each survey area is discussed below pertaining to the number of STs excavated and materials recovered.

Substation/Switchyard/Power Block Expansion areas

The proposed substation, switchyard, power block area is located in the central portion of the 12.1 ha (30-ac.) parcel (Figure 2). It spans a wetland area in the southern portion to an upland setting with large glacial erratics and bedrock outcrops in the northern portion. The three expanded areas (Areas 1, 2 and 3) total 2.61 ha (6.45 ac.). A total of 74 STs were excavated within the three expansion areas (Figures 3-5). The STP soil profiles exhibited an eroded or modified Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony soil series. Specifically, the A horizon consisted of a very dark grayish brown (10YR 3/2) fine sandy loam extending to approximately 10 cm (4 in.) below ground surface. This A horizon overlaid a Bw1 comprised of a dark yellowish brown (10YR 4/4) fine sandy loam that extended no greater than 30 cm (12 in.) below ground surface. This Bw1 underlain by a Bw2, also a dark yellowish brown (10YR 4/6) that extended between 30 and 64 cm (12 and 25 in.) below ground surface and overlaid the C horizon. The C horizon was comprised of a light olive brown (2.5Y 5/4) gravelly fine sandy loam. Excavation halted 10 cm (4 in.) into the C horizon or if an impasses created by rocks or roots was encountered. No Native American or historical cultural deposits were identified within the proposed switchyard survey area. No further survey is recommended.

Storm Water Detention Pond #2 Extension

The proposed switchyard is located in the southern portion of the 12.1 ha (30-ac.) parcel (Figure 2). It is immediately south of the substation, switchyard, power block area and measures approximately 0.16 ha (0.40 ac.). It is directly bordered on the east and south by active wetland areas. The eastern part of this area slopes into these wetlands. A visual inspection of this area proved it to be heavily disturbed as evidenced by the many push-piles observed there. While disturbed soils were confirmed, no STs were excavated in this area. No Native American or historical cultural deposits were identified within the proposed switchyard survey area. No further survey is recommended.

Storm Water Detention Pond #3

This storm water pond is located in the southeastern portion of the 12.1 ha (30-ac.) parcel (Figure 2). It is south of the substation, switchyard, power block area and measures approximately 0.52 ha (1.28 ac.). It is directly bordered on the north, east, and south by active wetland areas. A visual inspection of this area proved it to be heavily disturbed as evidenced by the many push-piles and ditches observed there. A total of two STs were excavated within the storm water detention pond #3 survey area (Figure 6) as there was only a small section of the survey area that appeared relatively undisturbed; and only one of these exhibited a undisturbed profile. The STP soil profiles exhibited an eroded or heavily modified Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony soil series. Specifically, the A horizon consisted of a very dark grayish brown (10YR 3/2) fine sandy loam extending to approximately 12 cm (5 in.) below ground surface. This A horizon overlaid a Bw1 comprised of a dark yellowish brown (10YR 4/4) fine sandy loam that extended no greater than 22 cm (9 in.) below ground surface. This Bw1 overlaid a Bw2, also a dark yellowish brown (10YR 4/6), a loamy sand that at deepest extended to 53 cm (21 in.) below ground surface and overlaid the C horizon. The C horizon was comprised of a light gray (10YR 7/1) gravelly fine sand. Excavation halted 10 cm (4 in.) into the C horizon. No Native American or historical cultural deposits were identified within the proposed switchyard survey area. No further survey is recommended.

Southeastern Workspace/ Area 4

The Area 4 workspace is located in the southeastern portion of the 12.1 ha (30-ac.) parcel (Figure 2). It is south of the substation, switchyard, power block area and measures approximately 1.92 ha (4.75 ac.). It is directly bordered on the north, east, south, and west by active wetland areas. Approximately the northern half of this survey areas was located in an active wetland. The eastern border of this area falls into a wetlands drainage head. A visual inspection of this area proved it to be minimally disturbed by logging activities as evidenced by relatively few push-piles. A total of 58 STs were excavated within this workspace survey area (Figure 7). The STP soil profiles exhibited a sometimes eroded or modified Woodbridge fine sandy loam, 0 to 8 percent slopes, very stony soil series. Specifically, the A horizon consisted of a very dark grayish brown (10YR 3/2) fine sandy loam extending to approximately 12 cm (5 in.) below ground surface. This A horizon overlaid a Bw1 comprised of a dark yellowish brown (10YR 4/4) fine sandy loam that extended no greater than 33 cm (13 in.) below ground surface. This Bw1 overlaid a Bw2, also a dark yellowish brown (10YR 4/6), a loamy sand that extended at its greatest depth to 75 cm (30 in.) below ground surface and overlaid the C horizon. The C horizon was comprised of a light gray (10YR 7/1) gravelly fine sand. Excavation halted 10 cm (4 in.) into the C horizon.

Shovel tests ST TT-1 and ST WW-2 in the southwestern portion of the workspace survey area produced Native American artifacts (Figure 8). Additional radial shovel tests were excavated at 5-m (16-ft.) and 10-m (32-ft.) intervals around the positive STs. ST TT-1 radial 10 m south proved to be positive for Native American artifacts as well. A total of six Native American artifacts, all lithic debitage, or the waste products of making or reworking stone tools, were recovered from this survey area (Table 1). This site is located on a higher surface than the surrounding landform, which is located just east of an active wetland area. The landform appears to be a remnant dune, which likely formed shortly after the last glacial period. This site was designated the Iron Mine Brook Dune Site (Plate 1).

Table 1. Artifacts recovered from the Iron Mine Brook Dune site.

Test Pit No.	Total Depth of Testing (CM BS)	Results			
		Depth (CM BS)	Soil Horizon	Type	Count
ST TT-1	68	20-30	Bw1	Quartzite flakes	2
		30-40	Bw1	Quartzite flakes	2
ST TT-1 Radial 10 m south	70	16-26	Bw2	Quartz flake	1
ST WW-2	66	10-20	Bw1	Quartz flake	1
Total		**6**			

Little can be inferred about the Iron Mine Brook Dune site at this time, other than that it is a location where stone tools were worked and possibly used. The purpose of a Phase I survey is to merely identify the presence or absence of archaeological sites, and this level of survey is not useful in elucidating the details of the nature of archaeological sites. Therefore, the age of the site is not known, nor is it possible to tell what activities took place at this location. Additional survey would be required to ascertain such details.

Summary and Recommendations

Six additional survey areas were subjected to a Phase I archaeological intensive survey as part of this project, during which 126 STs were excavated. One survey area yielded Native American cultural material: the unnamed southeastern workspace, Area 4. Gray & Pape recommends avoidance of the Iron Mine Brook Dune site. If site avoidance is not possible, additional testing should be conducted at this site, given the site's potential to aid in understanding nineteenth century settlement in this region of Rhode Island. Such additional testing would require further consultation with the RIHPHC.

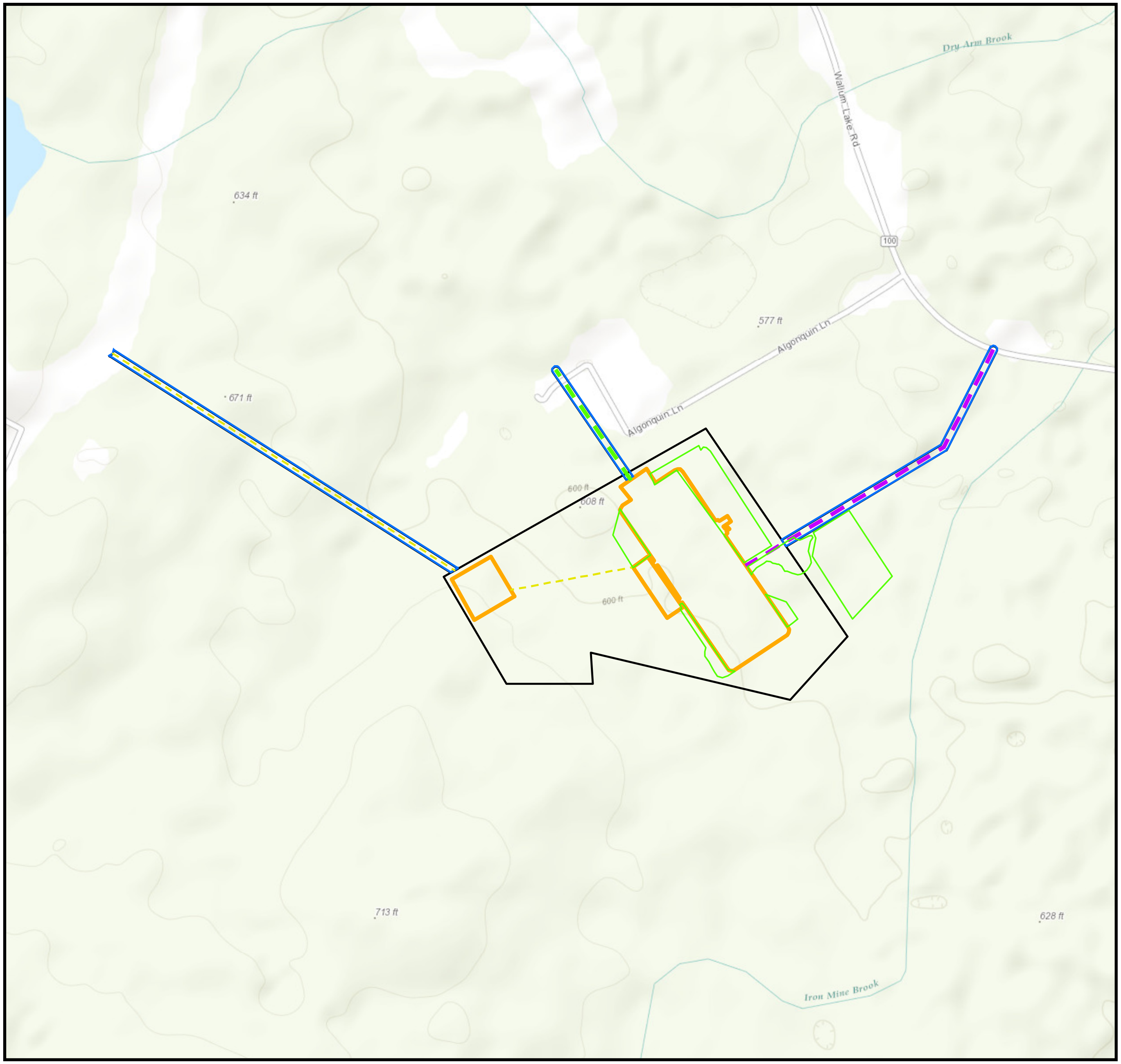
A full report regarding the combined efforts of the background research and archaeological intensive survey is in preparation.

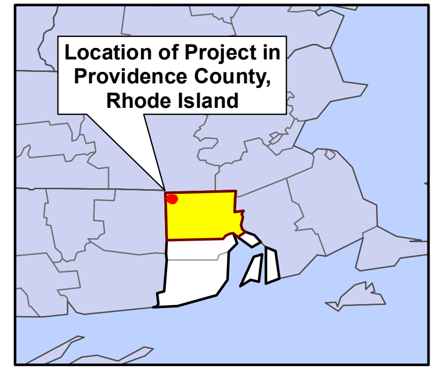
Thank you for your time and consideration.

Sincerely,

Christopher Donta, Ph.D.
Senior Principal Investigator
GRAY & PAPE, INC.
cdonta@graypape.com
413.992.7593

Plate 1. General View of the Iron Mine Brook Dune Site, view southwest.





LEGEND

- Access Road
- New 345 KV Line
- New Gas Line
- 15-m (50-ft.) Survey Corridor
- Survey Areas
- Addendum Survey Areas
- 12.1-ha (30-ac.) Parcel

0 100 200 Meters

0 500 1000 Feet

N E S W

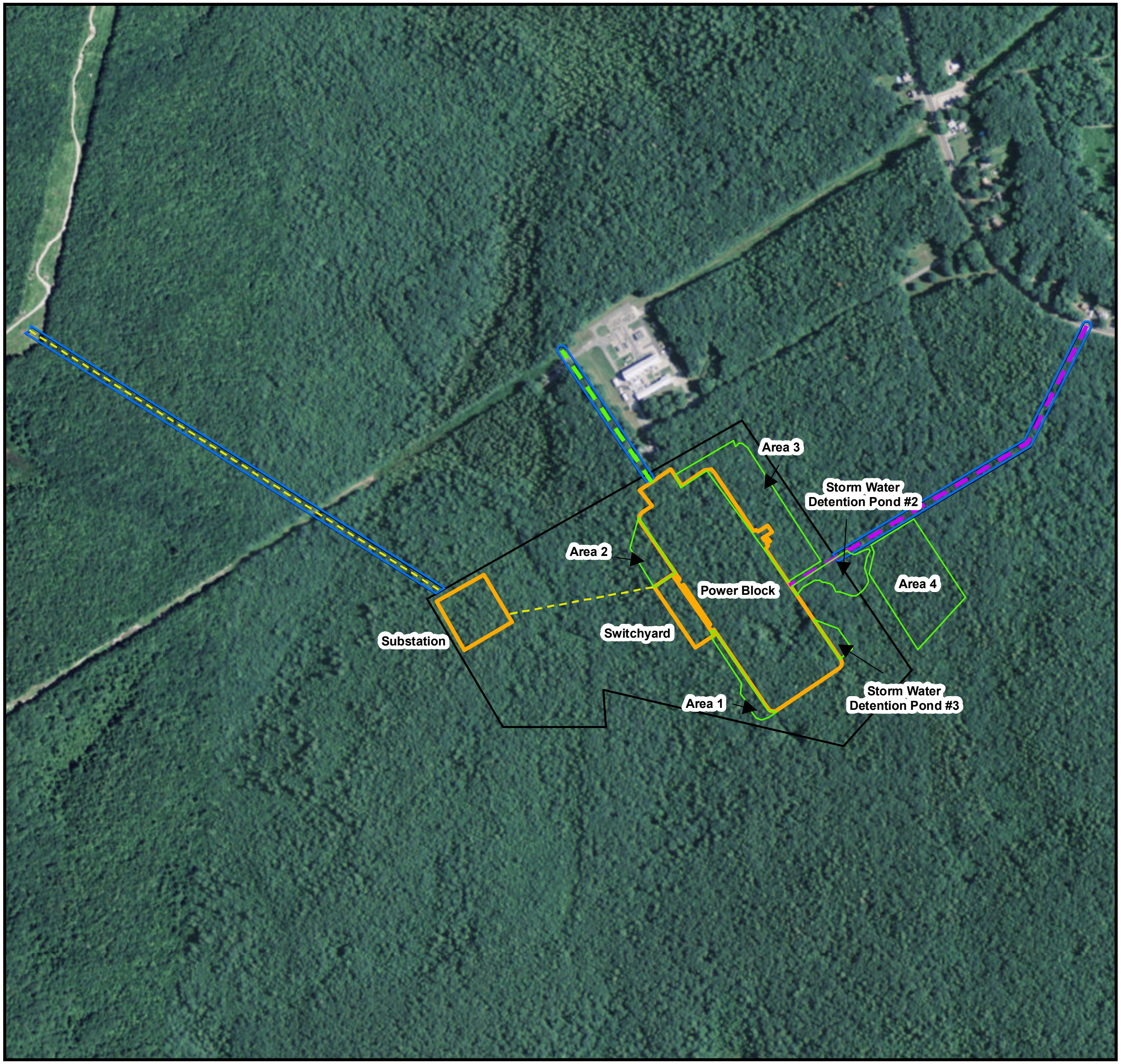
Overview of the
Clear River Energy Center
Burrillville, Providence County,
Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY - HISTORY - HISTORIC PRESERVATION

Figure 1

10/14/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\Addendum Memo\15-69901_Figure1_AddendumLocation_Map1.mxd

Gray & Pape Project 15-69901.001



LEGEND

- Access Road
- New 345 KV Line
- New Gas Line
- 15-m (50-ft.) Survey Corridor
- Survey Areas
- Addendum Survey Areas
- 12.1-ha (30-ac.) Parcel

0 100 200 Meters

0 250 500 Feet

N
W E
S

Overview of the
Clear River Energy Center
Burrillville, Providence County,
Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 2

10/14/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\Addendum Memo\15-69901_Figure2_SurveyMaps.mxd

Gray & Pape Project 15-69901.001

LEGEND

Survey Areas

Addendum Survey Areas

12.1-ha (30-ac.) Parcel

Shovel Tests

ST - Positive - Historical

ST- Negative

0 10 20 Meters

0 50 100 Feet

N W E S

Area 1 Survey Results
Clear River Energy Center
Burrillville, Providence County,
Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 3

10/14/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\Addendum Memo\15-69901_Figure3_Area1_Results.mxd

Gray & Pape Project 15-69901.001

LEGEND

New 345 KV Line
Survey Areas
Addendum Survey Areas
12.1-ha (30-ac.) Parcel

Shovel Tests

ST- Negative

0 5 10 Meters

0 25 50 Feet

N
W E
S

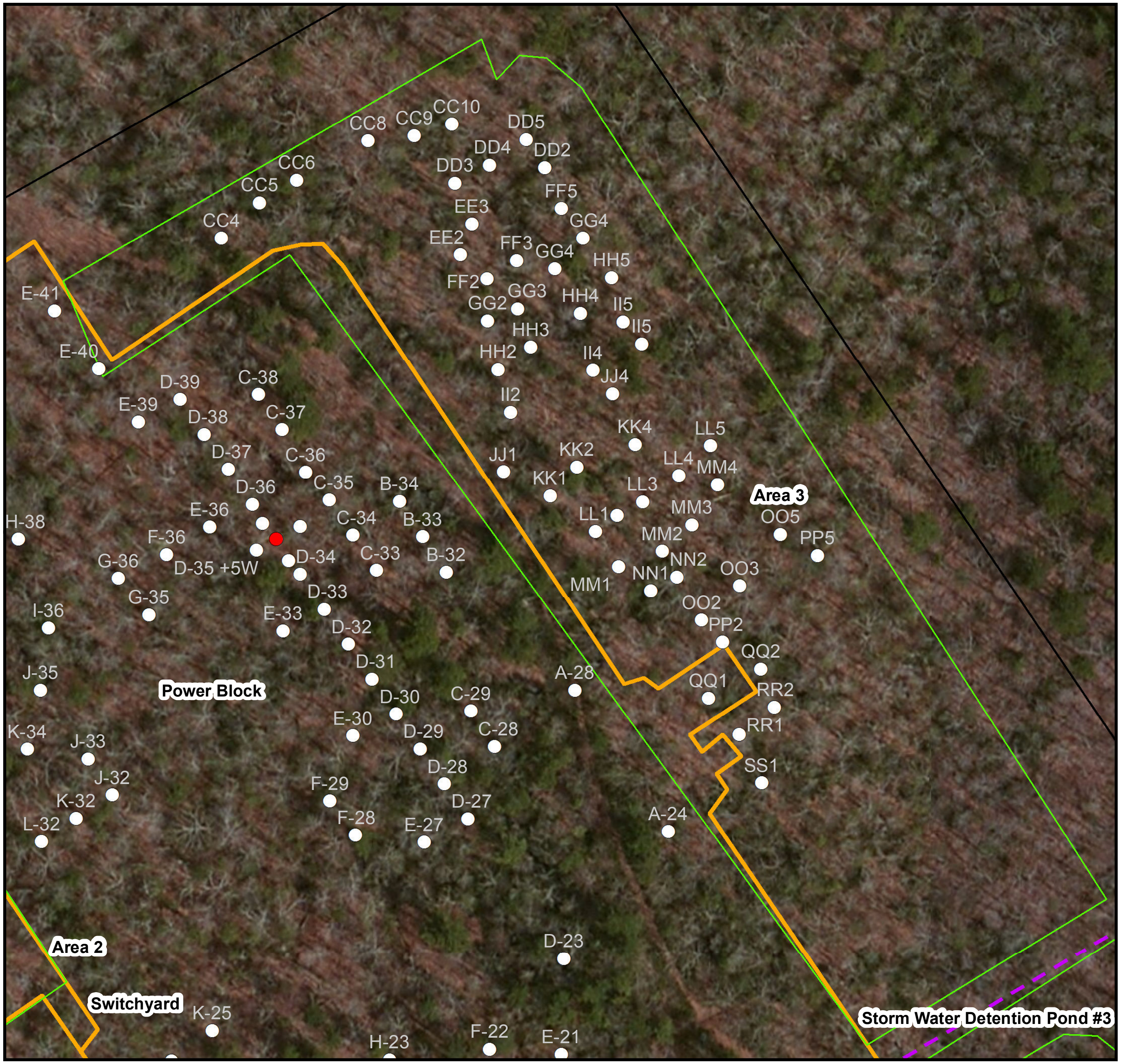
Area 2 Survey Results
Clear River Energy Center
Burrillville, Providence County,
Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 4

10/14/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\Addendum Memo\15-69901_Figure4_Area2_Results.mxd

Gray & Pape Project 15-69901.001



LEGEND

- Access Road
- Survey Areas
- Addendum Survey Areas
- 12.1-ha (30-ac.) Parcel

Shovel Tests

- ST - Positive - Native American
- ST- Negative

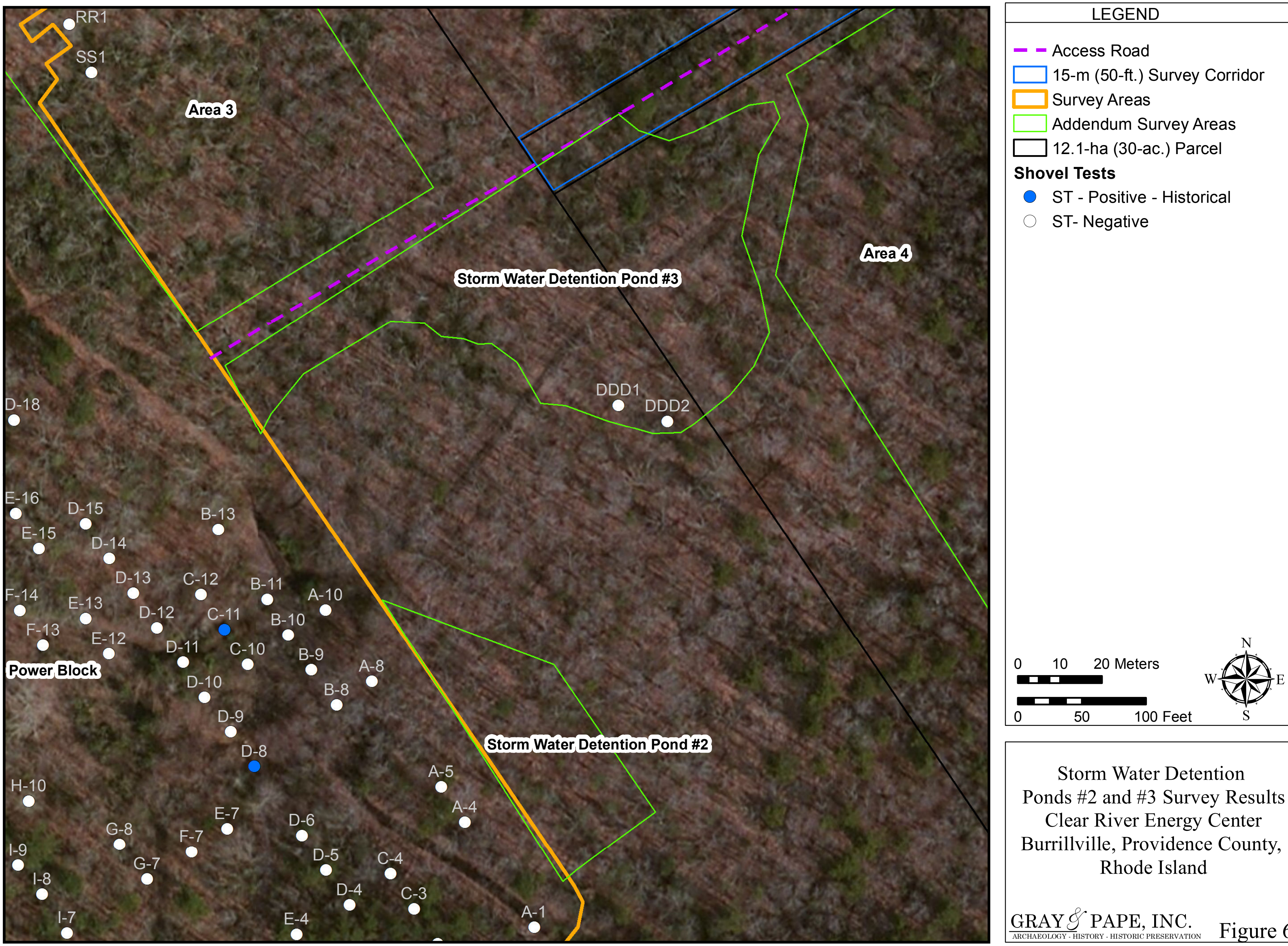
Area 3 Survey Results
Clear River Energy Center
Burrillville, Providence County,
Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 5

10/14/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\Addendum Memo\15-69901_Figure5_Area3_Results.mxd

Gray & Pape Project 15-69901.001

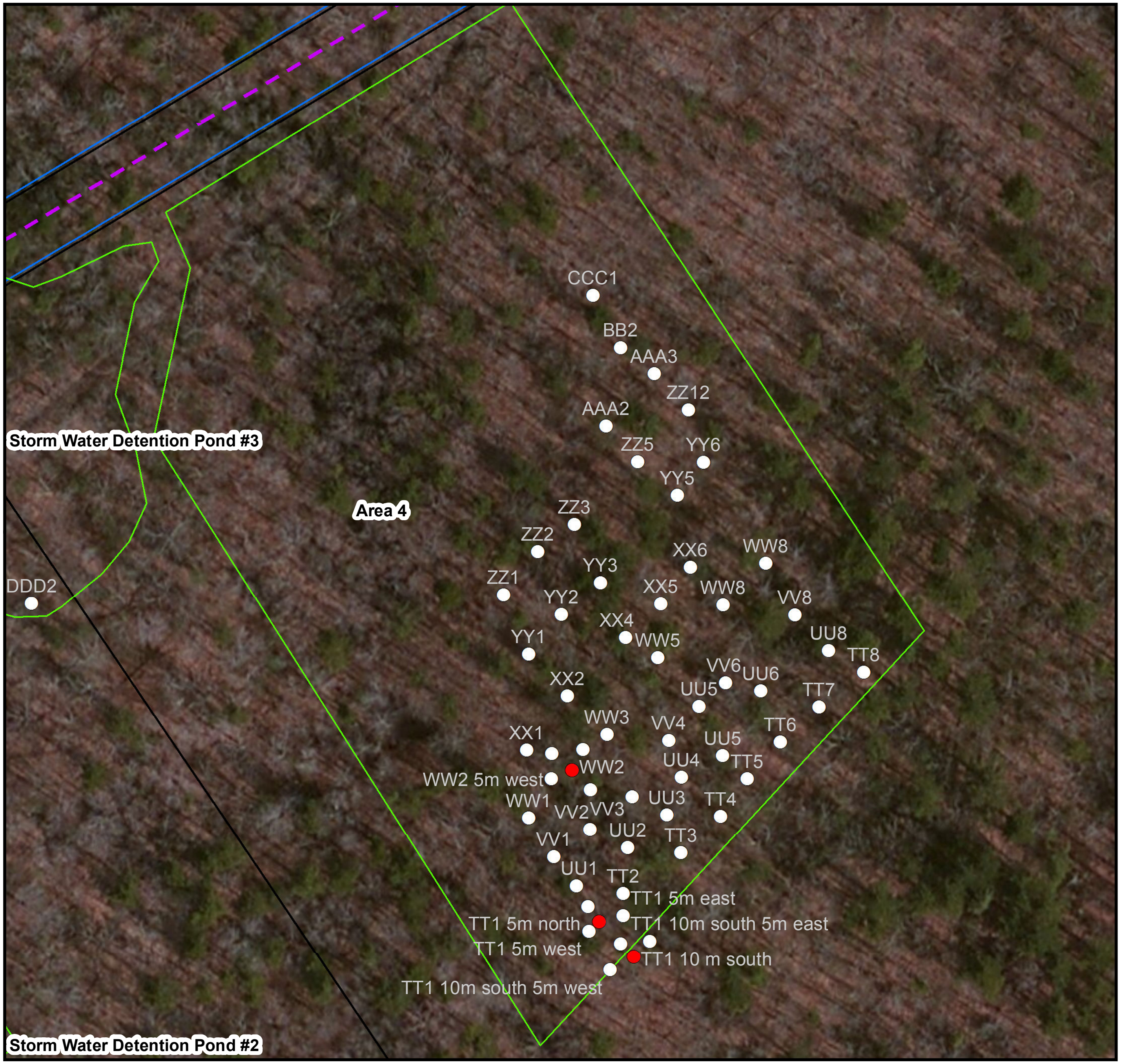


Storm Water Detention Ponds #2 and #3 Survey Results
Clear River Energy Center
Burrillville, Providence County, Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY · HISTORY · HISTORIC PRESERVATION

Figure 6

Gray & Pape Project 15-69901.001



LEGEND

Shovel Tests

- ST - Positive - Native American
- ST- Negative
- Addendum Survey Areas
- Access Road
- 15-m (50-ft.) Survey Corridor
- 12.1-ha (30-ac.) Parcel

0 10 20 Meters

0 50 100 Feet

N E S W

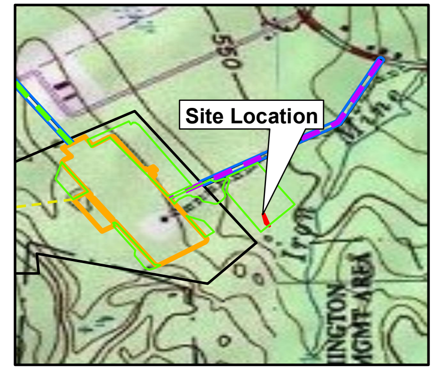
Area 4 Survey Results
Clear River Energy Center
Burrillville, Providence County,
Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY - HISTORY - HISTORIC PRESERVATION

Figure 7

10/14/2015 M:\00_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\Addendum Memo\15-69901_Figure7_Area4_Results.mxd

Gray & Pape Project 15-69901.001



LEGEND

Shovel Tests

- ST - Positive - Native American
- ST- Negative
- Addendum Survey Areas
- Iron Mine Brook Dune Site

0 2 4 Meters

0 10 20 Feet

N W E S

Iron Mine Brook Dune Site
Clear River Energy Center
Burrillville, Providence County, Rhode Island

GRAY & PAPE, INC.
ARCHAEOLOGY - HISTORY - HISTORIC PRESERVATION

Figure 8

10/14/2015 M:\100_Projects_Yearly\2015\15-69901\Working_GIS\00_Projects\001 Report\Addendum Memo\15-69901_Figure8_Site_Results.mxd

Gray & Pape Project 15-69901.001

Appendix I

Burrillville Sewer Commission Letter of Support

BURRILLVILLE SEWER COMMISSION

POST OFFICE BOX 71
HARRISVILLE, R.I. 02830
TELEPHONE: 401/568-6296
FAX: 401/568-9464

September 14, 2015

Invenergy LLC
Mr. John Niland
Director Business Development
1 S. Wacker Drive – Suite 1900
Chicago IL 60606

RE: Clear River Energy Center

Dear Mr. Niland:

The Commission would like to thank you for your presentation at their meeting of September 8, 2015 regarding Invenergy's proposed power plant off Wallum Lake Road in Burrillville.

In your presentation you stated that Invenergy is exploring the possibility of connecting the facility to the Town's Public Sanitary Sewer System. Before proceeding with discussions with RI Department of Environmental Management your company wanted to first determine if this was a viable alternative and if the Burrillville Sewer Commission would consider this option as a possibility.

Based on the limited information that was provided to the Commission at this time, the Commission felt that this proposal may be a viable option contingent upon your company receiving all of the necessary approvals from the State, Town and the Sewer Commission.

The Commission looks forward to working with Invenergy on this new project.

Should you have any questions, please do not hesitate to contact this office.

Sincerely,

(For the)Burrillville Sewer Commission

William Andrews

William Andrews
Chairman
Burrillville Sewer Commission

Appendix J

APPLICATION REQUIREMENTS

Rules of Practice and Procedure

Application Requirements

SECTION	APPLICATION REQUIREMENT	LOCATION
1.6 (a)	*Statement - All applications shall be in writing and shall clearly state the nature of the activity for which a Board license is sought and a factual and legal basis for the Board's authority to grant a Board license.*	**Section 1.2** Jurisdiction of the Rhode Island Energy Facility Siting Board
1.6 (b)(1)	*The exact legal name of the applicant, if the applicant is a corporation, trust, association or other organized group, the state or territory under the laws of which the applicant was created or organized, the location of the applicant's principal place of business, and the names of all states where the applicant is authorized to do business.*	**Section 2.1** The Applicant
1.6 (b)(2)	*The name, title and post office address of one person to whom correspondence or communication in regard to the application is to be addressed. The Board will serve, where required, all notices, orders and other papers upon the person so named and such service shall be deemed to be service upon the applicant*	**Section 2.2** Primary Contacts
1.6 (b)(3)	*Identification of the proposed owner(s) of the facility, including identification of all affiliates of the proposed owners, as such term is defined in Section 39-3-27 of the Rhode Island General Laws.*	**Section 2.1** The Applicant
1.6 (b)(4)	*A detailed description of the proposed facility including its function and operating characteristics, and complete plans as to all structures, including, where applicable, underground construction, transmission facilities, cooling systems, pollution control systems and fuel storage facilities associated with the proposed location for the project.*	**Section 3.0** Project Description and Support Facilities
1.6 (b)(5)	*Site plan for each proposed location for the project.*	**Section 3.4** Site Plan
1.6 (b)(6)	*The total land area involved.*	**Section 3.3** Land Area
1.6 (b)(7)	*Project cost.*	**Section 4.1** Project Cost
1.6 (b)(8)	*Proposed dates for beginning of construction, completion of construction and commencement of service.*	**Section 4.2** Project Schedule
1.6 (b)(9)	*Where applicable, estimated number of facility employees.*	**Section 5.1** Economic Benefits
1.6 (b)(10)	*Proposed financing for construction and operation of the facility.*	**Section 4.3** Financing Plan
1.6 (b)(11)	*Where applicable, required support facilities, e.g. road, gas, electric, water, telephone, and an analysis of the availability of the facilities and/or resources to the project.*	**Section 3.9** Identification of Support Facilities and Accessibility

Rules of Practice and Procedure

Application Requirements

SECTION	APPLICATION REQUIREMENT	LOCATION
1.6 (b)(12)	*A detailed description and analysis of the impact, including cumulative impact for facilities other than transmission lines, of the proposed facility on the physical and social environment on and off site, together with a detailed description of all environmental characteristics of the proposed site and a summary of all studies prepared and relied upon in connection therewith. In the case of transmission facilities, such description and analysis shall include a review of the current independent scientific research pertaining to electromagnetic fields (EMF) and shall provide data on the anticipated levels of EMF exposure and potential health risks associated with this exposure.*	**Section 6.0** Assessment of Environmental Impacts
1.6(b)(13)	*All studies and forecasts, complete with information, data, methodology and assumptions of which they are based, on which the applicant intends to rely in showing the need for the proposed facility under the statewide master construction plan submitted annually.*	**Section 3.2** Purpose and Function
1.6(b)(14)	*Complete detail as to the estimated construction costs of the proposed facility, the projected maintenance and operation costs, the estimated unit cost of energy to be produced by the proposed facility, where applicable, and the expected methods of financing the facility. For transmission lines, the applicant shall also provide estimated costs to the community such as safety and public health issues, storm damage and power outages, and estimated costs to businesses and homeowners due to power outages.*	**Section 4.1** Project Cost
1.6(b)(15)	*A complete life-cycle management plan for the proposed facility, including measures for protecting the public health and safety and the environment during the facility's operations, including plans for the handling and disposal of wastes from the facility at the end of its useful life.*	**Section 9.0** Life Cycle Management Plan
1.6(b)(16)	*A study of the alternatives to the proposed facility, including alternatives as to energy sources, methods of energy production and transmission and sites for the facility, together with the reasons for the applicant's rejection of such alternatives. The study shall include estimates of facility costs and unit energy costs of alternatives considered.*	**Section 10.0** Study of Alternatives
1.6(b)(17)	*identification of Federal agencies which may exercise licensing authority over any aspect of the facility.*	**Section 11.1** Identification of Federal Agencies with Jurisdiction
1.6(b)(18)	*Identification of state and local government agencies which may exercise licensing authority over any aspect of the facility or which could exercise licensing authority over any aspect of the facility absent the Act.*	**Section 11.2** Identification of State and Local Agencies with Jurisdiction

Rules of Practice and Procedure

Application Requirements

SECTION	APPLICATION REQUIREMENT	LOCATION
1.6(b)(19)	*Identification of foreign governmental agencies which must issue licenses that may affect any aspect of the facility.*	**Section 11.3** Identification of Foreign Agencies with Jurisdiction
1.6(b)(20)	*All pertinent information regarding filings for licenses made with federal, state, local foreign governmental agencies including the nature of the license sought, copies of the applicable statutes or regulations, and copies of all documents filed in compliance with the National Environmental Policy Act, the date of filing and the expected date of decision.*	**Section 11.4** Pertinent Information for Local, State, and Federal Licenses
1.6(b)(21)	*Where applicable, the applicant must provide evidence to show that the project conforms with the Rhode Island Energy Coordinating Council's policy statement entitled Rhode Island's Options for Electric Generation dated August, 1989, including any revisions or any successor to that document which may replace it as state policy.*	**Section 8.0** Conformance with Rhode Island Energy Policy