Appendix C

June 18, 2015 SHPO Response Letter

Matt S.

Department of Economic and Community Development

Connecticut
still revolutionary

June 18, 2015

Mr. Matthew Sanford
Milone & MacBroom, Inc.
99 Realty Drive
Cheshire, CT 06410

RECEIVED
JUN 22 2015
MILONE AND MACBROOM

Subject: Beacon Falls Energy Park (MMI #1103-87-16.2)
Beacon Falls, Connecticut.

Dear Mr. Sanford:

The State Historic Preservation Office (SHPO) is in receipt of your request for our comments on the potential effects of the referenced project on historic properties received on May 12, 2015. The request for comments is in support of a proposal to the Connecticut Department of Energy and Environmental Protection (DEEP). SHPO understands that the proposed unstaffed facility will generate energy through the use of fuel cells. The energy park will occupy 23.8 acres at the southeast corner of Lopus and Gruber Roads.

There are no archeological sites or properties listed on the National Registers of Historic Places recorded within or in the immediate vicinity of the project area. The project parcel is comprised primarily of Udorthents-Pit complex soils. During the past 40 years, the site was mined for sand and gravel. Although this office considers this area to be archeologically sensitive, the proposed project facility is within existing disturbed footprints. Based on the information provided to our office, it is SHPO's opinion that no historic properties will be affected by this undertaking as described.

SHPO appreciates the opportunity to review and comment upon this project. These comments are provided in accordance with Section 106 of the National Historic Preservation Act, as amended, and the Connecticut Environmental Policy Act. For additional information, please contact Catherine Labadia, Staff Archeologist, at (860) 256-2764 or catherine.labadia@ct.gov.

Sincerely,

Mary B. Dunne

Mary B. Dunne
Deputy State Historic Preservation Officer

Appendix D

July 23, 2015 Inland Wetland and
Watercourse Impact Assessment

Engineering, Planning,
Landscape Architecture
and Environmental Science

MILONE & MACBROOM®

July 23, 2015

Mr. Richard Audette
O & G Industries
112 Main Street
Torrington, CT 06790

RE: Inland Wetland and Watercourse Impact Assessment
Beacon Falls Energy Park
Beacon Falls, Connecticut
MMI #1103-87-2

Dear Mr. Audette:

This letter has been prepared to supplement the wetland delineation report for the above-referenced project site and serves as the inland wetland and watercourse impact assessment associated with the construction of a 63.3 MW fuel cell energy park located in Beacon Falls, Connecticut. As you may recall, wetlands on this project site were delineated on April 20, 2015 by Matthew Sanford, a certified soil scientist. The only wetland and/or watercourse delineated on site was a large pond located along the southern portion of the site. Over the past few months, the project design team has developed a project plan for this site.

The existing pond has several important functions and values including supporting a warm-water fishery, providing wildlife habitat, sediment filtration, and nutrient retention.

Existing Pond - July 2015

Wetland impacts may be characterized as either direct or indirect. Direct impacts may be temporary or permanent and typically include construction-related activities such as clearing, grading, filling, and drainage installation. Indirect impacts to wetlands occur due to disturbances in adjoining areas such as shading, clearing, rerouting of surface water or groundwater, discharge of runoff, and upland erosion.

The use of sound engineering practices during design and careful attention to best management practices during construction can protect wetlands and watercourses from negative impacts.

The proposed stormwater management plan and erosion control plan both contain a series of measures designed to protect nearby wetland resources. Erosion controls will be installed in accordance with the Connecticut Council on Soil and Water Conservation *Connecticut Guidelines for Soil Erosion and Sediment Control*. Construction will take place in accordance with all applicable sections of the State of Connecticut, Department of Transportation's Standard Specifications for Roads, Bridges and Incidental Construction (Form 816), specifically Section 1.10 Environmental Compliance and "Best Management Practices."

Direct Wetland Impacts

As evidenced by the submitted plans, the energy park does not directly impact a wetland and/or watercourse.

Indirect Wetland Impacts

The greatest risk of indirect wetland impacts occurs during the preliminary construction phases when clearing and grubbing occurs. Soil erosion must be contained at all times until final grading is complete and the site has been permanently stabilized by vegetation. The erosion control plan that has been prepared for this project site meets or exceeds the standards specified in the latest version (2002) of the Connecticut *Erosion Control Guidelines*. For the most part, the site is flat, which makes the installation, monitoring, and maintenance of erosion controls easier.

Drainage is being collected, treated, and released in a manner that is designed to prevent off-site water quality impacts. Best Management Practices (BMPs) in accordance with the Connecticut Department of Environmental Protection's *Stormwater Quality Manual* (2004), including grassed swales and water quality infiltration basins to filter surface runoff, are being utilized. The existing soils (sands) on this site are highly conducive to infiltration and, therefore, offer prime opportunities to infiltrate stormwater and wastewater into the soils and groundwater. This allows stormwater and wastewater to reach natural ambient temperatures before discharging into the pond via groundwater.

Stormwater Basin 210 has the closest clearing and grading activity along the pond. Clearing and grading are proposed approximately 15 feet away from the southeast portion of the pond. The clearing and grading activities are associated with the construction of the stormwater basin's emergency spillway/swale. This area will be stabilized using New England Wildlife/Conservation seed mix. The location of the spillway was selected because there is an existing natural or man-made swale/rill located along this section of the pond. The design team elected to reuse this discharge point for the development of this site. As stated previously, proper sediment and erosion control measures will be installed upgradient from the pond edge to protect the water quality within the pond during construction.

Overall, the proposed energy park will not adversely impact inland wetlands and/or watercourses.

If you have any questions regarding this wetland and watercourse impact assessment letter, please do not hesitate to call me at (203) 271-1773.

Very truly yours,

MILONE & MACBROOM, INC.

Matthew J. Sanford, MS, PWS, Associate
Lead Environmental Scientist

1103-87-2-jl2315-ltr

Appendix E

Contractor Contact Information

Contractor Contact Information:

Richard Audette
Director of the Power Division
O&G Industries, Inc.
112 Wall Street
Torrington, CT 06790
Office 860-489-9261
Direct 860-626-6453
Cell 860-459-1518

Matthew Tobin
Engineering Manager
112 Wall Street
Torrington, CT 06790
Direct 860-626-6476
Cell 860-309-3096

Appendix F

January 2016 Noise Assessment Report

Beacon Falls Energy Park
Noise Assessment Report

Prepared for
Beacon Falls Energy, LLC

Prepared by
TRC Environmental Corporation
41 Spring Street
New Providence, NJ 07974

January 2016

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1.0 INTRODUCTION

TRC Environmental Corporation ("TRC") conducted a technical noise assessment of the proposed Beacon Falls Energy Park (the "Project") that would be located at a former sand and gravel mine owned by O&G Industries. The Project will include 15 DFC3000 Fuel Cell Energy modules, 5 HEFC Fuel Cell Energy modules and one Ormat heat recovery system. The total Project output potential is approximately 63 MW. The property is bordered by residential uses to the west, north and northeast. Commercial and industrial land uses are located to the east and south of the site.

The noise assessment consisted of two parts: an ambient noise monitoring program in the vicinity of the Project in order to characterize the existing noise environment; and a detailed noise modeling study/impact evaluation of the proposed Project. The background ambient noise monitoring program was conducted on July 21-22, 2015. Modeled Project noise levels were compared against the State of Connecticut Noise Standard and the Town of Beacon Falls Noise Ordinance to determine compliance, and further evaluated against the existing minimum ambient noise levels. The results of the noise assessment are summarized in this report.

2.0 GENERAL INFORMATION ON NOISE

Noise is defined as unwanted sound. Excessive noise can cause annoyance and adverse health effects. Annoyance can include sleep disturbance and speech interference. It can also distract attention and make activities more difficult to perform (EPA, 1978).

The range of pressures that cause the vibrations that create noise is large. Noise is therefore measured on a logarithmic scale, expressed in decibels (dB). The frequency of a sound is the "pitch". The unit for frequency is hertz (Hz), or cycles per second. Most sounds are composed of a composite of frequencies. The human ear can usually distinguish frequencies from 20 Hz (low frequency) to about 20,000 Hz (high frequency), although people are most sensitive to frequencies between 500 and 4000 Hz. The individual frequency bands can be combined into one overall dB level.

Noise is typically measured on the A-weighted scale (dBA). The A-weighting scale has been shown to provide a good correlation with the human response to sound and is the most widely used descriptor for community noise assessments (Harris, 1991). The faintest sound that can be heard by a healthy ear is about 0 dBA, while an uncomfortably loud sound is about 120 dBA. In order to provide a frame of reference, some common sound levels are listed below.

- Pile Driver at 100 feet 90 to 100 dBA
- Chainsaw at 30 feet 90 dBA
- Truck at 100 feet 85 dBA
- Noisy Urban Environment 75 dBA
- Lawn Mower at 100 feet 65 dBA
- Average Speech 60 dBA
- Average Office 50 dBA
- Rural Residential During the Day 40 dBA
- Quiet Suburban nighttime 35 dBA
- Soft Whisper at 15 feet 30 dBA

Common terms used in this noise analysis are defined below.

L_{eq} — The equivalent noise level over a specified period of time (i.e., 1-hour). It is a single value of sound that includes all of the varying sound energy in a given duration.

Statistical Sound Levels — The A-weighted sound level exceeded a certain percentage of the time. The L_{90} is the sound level exceeded 90 percent of the time and is often considered the background or residual noise level. The L_{10} is the sound level exceeded 10 percent of the time and is a measurement of intrusive sounds, such as aircraft overflight.

3.0 APPLICABLE STANDARDS/GUIDELINES

3.1 State of Connecticut

The State of Connecticut has a detailed noise standard which is applicable to the proposed Project (Section 22a-69 of the Connecticut Department of Energy & Environmental Protection portion of the Regulations of Connecticut State Agencies). The standard limits noise from a source, as measured at certain Noise Zones when emitted from other Noise Zones. These Zones include the following:

- Class A - Generally residential, hotels, hospitals and other sensitive areas.
- Class B - Commercial areas
- Class C - Industrial uses

It should be emphasized that the noise standards are expressed as noise attributable to a specific source at a receptor and that the total noise measured at a given location (i.e., source plus background) may be greater than that which is attributable to a specific source. The proposed facility is an industrial use in an industrially zoned area (Class C). The nearest noise sensitive areas are the residential uses on Gruber Road (Class A). As such, the applicable portion of the noise standard is a source located in a Class C area, and the measured noise level from that source at a Class A area. Summarized below are the noise limits for this scenario.

Class C source emitting to a Class A receiver

Daytime	Nighttime
61 dBA	51 dBA

Nighttime is defined in the standard as the hours between 10 p.m. to 7 a.m. A second limit is applicable to the nearest industrial property line, which is the State of Connecticut Department of Transportation Metro North Railroad line to the east of the proposed site. Facility noise at this location would be limited to 70 dBA at any hour of the day.

The allowable level is reduced by 5 dBA if the proposed source emits prominent discrete tones. Prominent discrete tones are defined in 22a-69 as acoustic energy which produces a one-third octave band sound pressure level greater than that of either adjacent one-third octave band and which exceeds the arithmetic average of the two adjacent one-third octave bands by the following amounts shown in Table 1.

Table 1 Prominent Discrete Tone Determination			
One-Third Octave Band Center Frequency (Hz)	**dB**	**One-Third Octave Band Center Frequency (Hz)**	**dB**
100	16	1250	4
125	14	1600	4
160	12	2000	3
200	11	2500	3
250	9	3150	3
315	8	4000	3
400	7	5000	4
500	6	6300	4
630	6	8000	5
800	5	10000	6
1000	4		

For areas where the existing background noise levels (not including noise from the regulated source) already exceed the allowable limits, the regulated source would not be deemed to be causing excessive noise if the noise emitted by the regulated source is not greater than 5 dBA above background levels, with an absolute upper limit of 80 dBA.

3.2 Town of Beacon Falls

The Town of Beacon Falls has a noise ordinance called the Ordinance Regarding Noise. The ordinance contains the same numerical sound level limits applicable to the Project as the State of Connecticut noise standard. The ordinance also limits construction activities to the hours of 7 am to 8 pm weekdays and Saturdays. No construction activity is permitted on Sundays and legal holidays.

3.3 Ability to Perceive Changes in Noise and Noise Impact Potential

The ability of the average person to perceive increases in noise has been documented. In general, an increase of 3 dBA or less is considered to be barely perceptible, while an increase of 5 dBA is considered to be noticeable. A 10 dBA increase is perceived as a doubling of the sound.

The potential for noise impacts is also dependent on whether the increase occurs over an existing low level of sound or over an existing high level of sound. For example, the sound level in a library or a very quiet office is typically 30 dBA to 35 dBA. If that sound level were increased to 40 dBA to 45 dBA, it would be perceived as a doubling of the sound, but it would not be loud. On the other hand, the sound level 50 feet from a major freeway is typically 75 dBA to 80 dBA. Increasing that level by 10 dBA would also be perceived as a doubling of the sound, but would be more noticeable and would be much more of an impact because the sound level would be very high. This is further supported by noise impact criteria utilized by the Federal Transit Administration in their guidance document "Transit Noise and Vibration Impact Assessment" (FTA, 2006). Their guidance shows that no noise impact is expected when existing noise levels are low (less than 43 dBA), and increases of up to 10 dBA occur due to a new project.

4.0 EXISTING CONDITIONS

The land uses immediately bordering the site consist of a combination of residential, industrial, and commercial uses. The nearest residences are located to the west on Gruber Road, approximately 500 feet from the center of the proposed Project. Additional residential uses are located to the north on Lopus Road and to the northeast on Railroad Avenue. Commercial and industrial uses are located to the east and south.

4.1 Ambient Monitoring

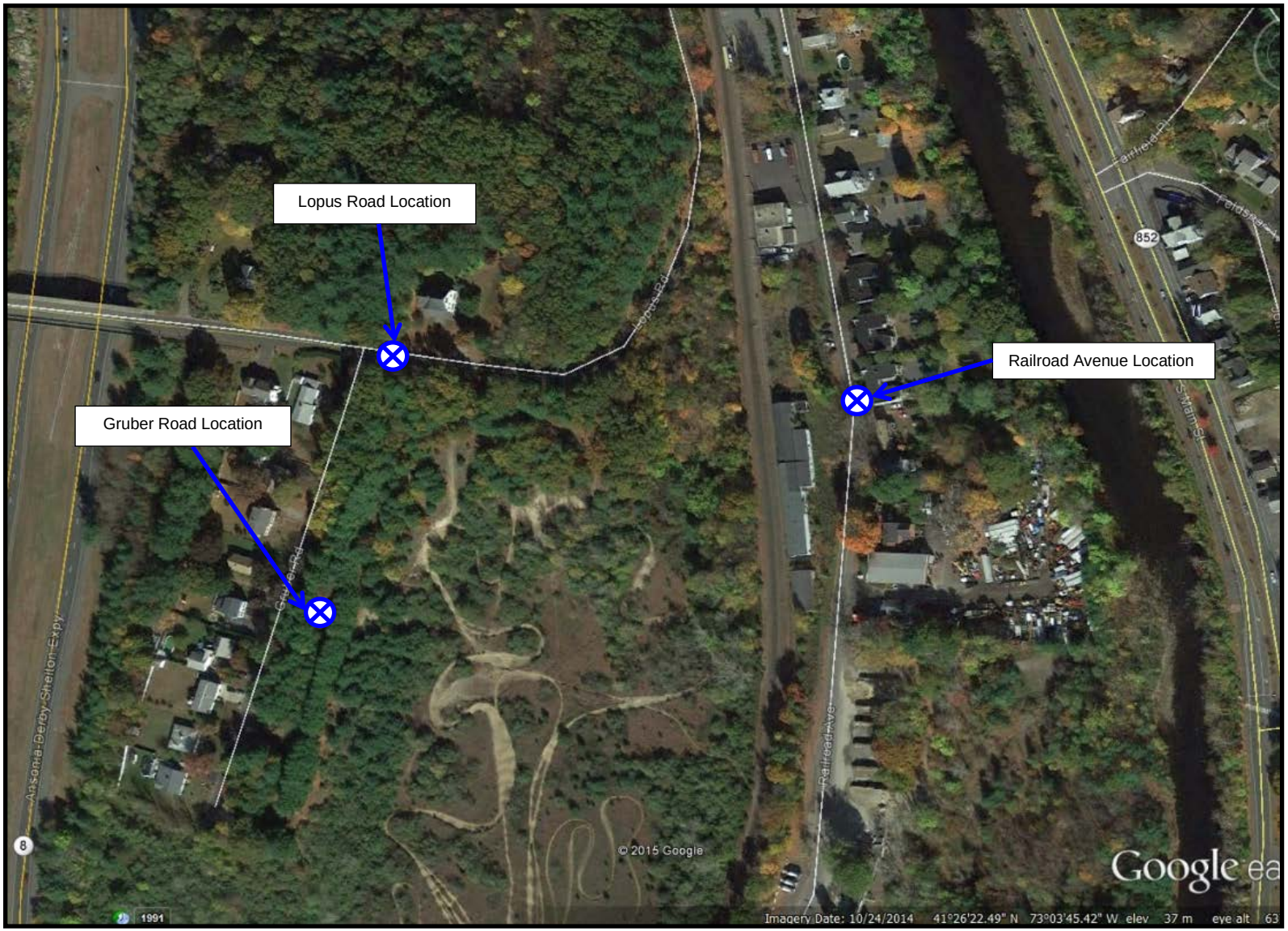
TRC conducted an ambient noise monitoring program for the proposed Project on July 21-22, 2015 at three residential areas bordering the site. The noise monitoring program was conducted in order to establish existing conditions in the area. A figure depicting the site area and the selected noise monitoring locations is provided as Figure 1.

Meteorological conditions during the noise measurement program included temperatures that ranged from 88 degrees F during the day to 62 degrees F at night. Winds were generally from the south and southwest, ranging from calm to about 3 miles per hour (mph). Somewhat stronger winds, ranging from 5 to 10 mph occurred during the daytime hours of July 22, 2015. A brief period of rain showers occurred at approximately 7 pm on July 21, 2015, lasting approximately 45 minutes. Roads were completely dry by 9:30 that evening.

The existing noise environment during daytime hours at the Gruber Road and Lopus Road locations is dominated by traffic noise from Route 8. Noise from passing cars and trucks on Lopus Road was also noted at the Lopus Road location. At the Railroad Avenue location, noise from passing cars and trucks was the dominant noise source, as well as traffic noise from Route 8. Other sounds that were noted during the day, to a much lesser degree, were natural sounds such as birds and rustling leaves.

At night, Route 8 traffic noise was the predominant source of noise at all locations. Additional sounds noted at night included a passing train, faint residential air conditioners, and some rustling leaves. Little to no insect noise was noted during either the daytime or nighttime hours.

Figure 1: Site Area Map and Noise Monitoring Locations



4.1.1 Continuous Noise Monitoring

A RION NL-31 integrating sound level meter was utilized for continuous monitoring at the Gruber Road location. The meter meets the requirements for ANSI S1.4-1983 Type 1 or better sound level meters. The meter microphone was fitted with a windscreen in order to reduce wind generated noise, and mounted on a small pole in the wooded area approximately 50 feet east of Gruber Road as shown on Figure 1. The meter was programmed to measure and store data in 1-minute increments during the period. The data summary from this monitoring program is presented graphically in Figure 2. The data set was further tabulated into hourly averages and is presented in Table 2.

The State of Connecticut noise standard considers the L_{90} sound level as the background sound level. A review of the plots in Figure 2 reveals that existing L_{90} noise levels at the Gruber Road location ranged from about 35 dBA at night, up to about 50 dBA during the day. L_{eq} levels, which include all of the sounds present, were higher, ranging from about 35 dBA to 55 dBA. Measured noise levels at night are more variable than during the day, due to periodic brief lulls in the ambient sound that occurs as Route 8 traffic noise varies depending on traffic volumes. Some brief periods of lower sound levels did occur as reflected in the one minute averages presented in Figure 2. The spike in sound levels from approximately 7 pm to 7:30 pm is due to the aforementioned rain showers that occurred.

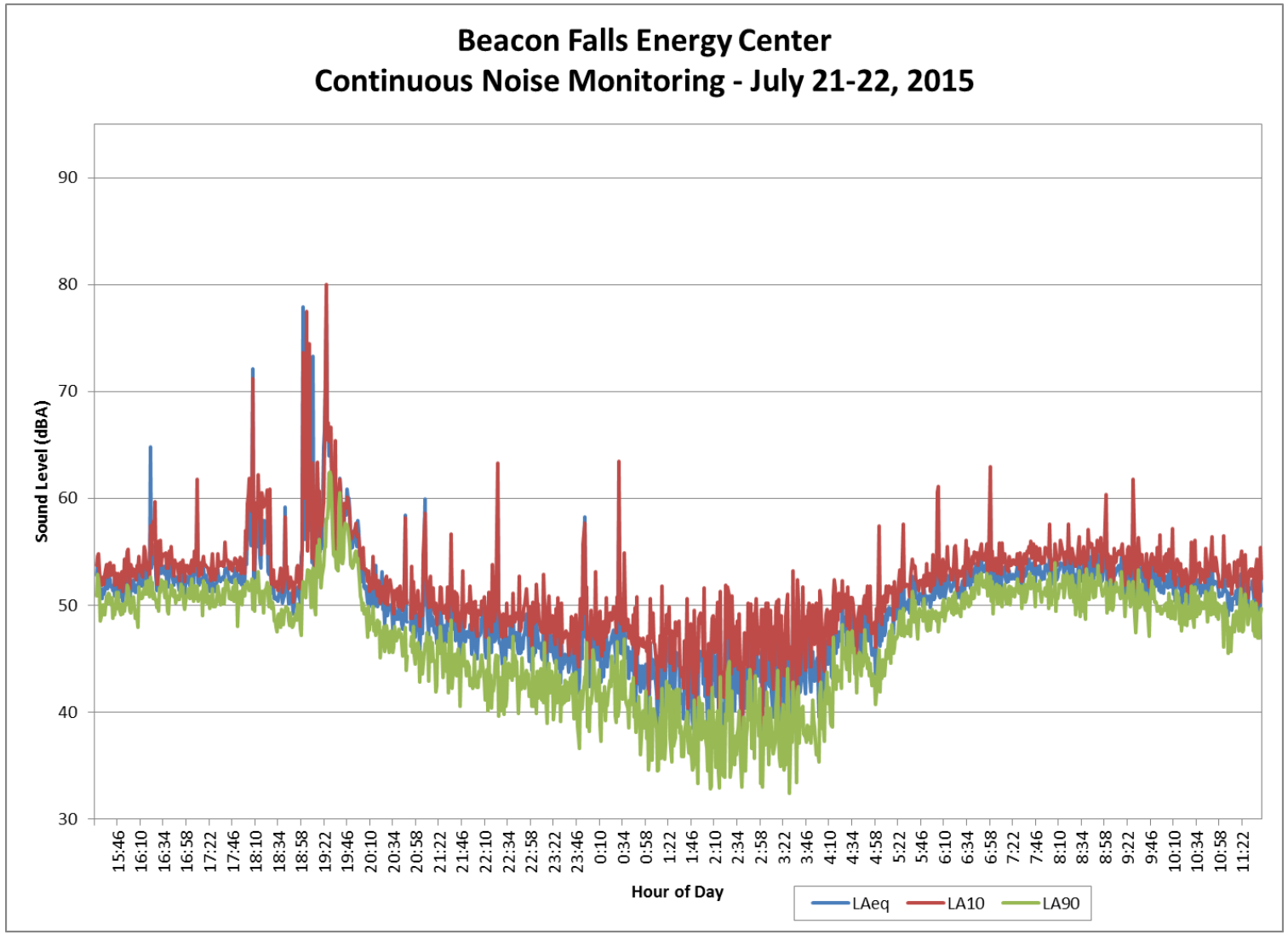
The tabulated hourly data (Table 2) reveals hourly L_{eq} noise levels ranging from about 44 dBA at night, up to about 54 dBA during the day. The higher L_{eq} levels that occurred at hours 2000 and 2100 were due to the rain showers, and are not typical sound levels for the area.

Table 2
Summary of Hourly Background Measured Noise Levels (dBA)

Date	Hour Ending	L_{eq}	L_{90}	L_{10}
July 21, 2015	16	52.2	50.6	53.4
	17	53.7	51.0	54.4
	18	52.8	51.0	54.2
	19	61.9 (1)	50.2 (1)	60.1 (1)
	20	64.6 (1)	56.0 (1)	66.5 (1)
	21	50.6	47.4	51.9
	22	49.1	45.0	50.9
	23	48.2	43.4	50.8
	24	47.1	42.2	49.2
July 22, 2015	1	47.1	41.9	50.3
	2	43.7	38.9	47.0
	3	43.8	39.0	47.3
	4	44.4	39.1	48.1
	5	47.1	44.2	49.4
	6	50.4	47.9	52.3
	7	52.9	50.8	54.9
	8	53.0	51.3	54.4
	9	53.5	51.6	55.0
	10	52.8	50.8	54.4
	11	51.9	49.8	53.6
	Maximum	53.7	51.6	55.0
	Minimum	43.7	38.9	47.0

(1) Rain showers occurred. These data are not utilized in the analysis.

Figure 2: Continuous Ambient Noise Monitoring



4.1.2 Ambient Short-Term Measurements

Short-term monitoring (15 minutes in duration at each location) was conducted during the day and twice late at night during the monitoring program. This short-term monitoring was conducted with a RION NL-52 precision integrating sound level meter and octave band analyzer. The NL-52 meets ANSI S1.4-1983 requirements for precision Type 1 sound level meters. The microphone was fitted with a windscreen to reduce any wind generated noise and mounted at a height of approximately five feet above the ground. The instrument was configured to measure and store the L_{eq}, L_{90}, L_{10}, L_{max} and L_{min} one-third octave band levels. The meter was calibrated at the beginning and at the end of the measurement period with a Bruel & Kjaer model 4231 calibrator. Both the meter and calibrator had been certified traceable to NIST standards by a calibration laboratory within one year of the testing program.

A summary of the overall A-weighted $L_{90,}$ $L_{eq\ and}$ L_{10} data measured during the ambient program is presented in Table 3 below. The short-term data at the Gruber Road location correlates well with the minimum hourly sound levels from the continuous meter at the same location (Table 2)

Table 3
Measured Ambient Noise Level Data (dBA)

Location	Daytime			Nighttime		
	L_{eq}	L_{10}	L_{90}	L_{eq}	L_{10}	L_{90}
Gruber Road	56.0	57.4	53.9	47.5	50.3	41.9
				46.5	49.8	40.2
Lopus Road	57.1	54.1	47.5	44.4	48.0	36.1
				44.2	48.0	35.3
Railroad Avenue	64.2	61.6	45.4	59.9	55.8	42.1
				37.9	41.1	35.7

The data presented in Tables 2 and 3 reveal that low ambient (L_{90}) noise levels currently exist during the late night hours, ranging from 35 dBA to 40 dBA at all locations. The measured L_{eq} levels, which include all sounds present, were higher, ranging from 38 dBA to 60 dBA. Higher ambient levels occurred during the day due to increased vehicular traffic on Route 8 and local roads, and other increased activity.

5.0 NOISE MODELING

5.1 Methodology

Computer noise modeling was conducted utilizing the CadnaA noise model (DataKustik, 2014). This very powerful 3-dimensional model maps the noise contours of the overall Project in accordance with a variety of standards, primarily VDI 2714 Outdoor Sound Propagation and ISO 9613 (ISO, 1996). The software is designed to take into account spreading losses, ground and atmospheric effects, shielding from terrain, barriers and buildings, and reflections from surfaces. These model capabilities are especially important in an area such as the Project site, as the effects of the local terrain can be accounted for. Site specific GIS topographic data were obtained and incorporated into the model.

The Project consists of 20 fuel cells, which includes 15 DFC3000 fuel cells and 5 HEFC fuel cells. The HEFC fuel cells have slightly more components than the DFC3000 fuel cells. Each fuel cell has several noise generating components that include the following:

- DFC3000 or HEFC Module
- Fresh Air Blower
- Discharge Piping
- Air Heater
- Chiller
- Transformer

A single Ormat heat recovery system will also be included in the Project. The Ormat contains the following noise generating components:

- Air Cooled Condenser
- Turbine
- Generator
- Piping
- Feed Pumps

In addition, the Project will contain a switchyard with a main step-up transformer.

Sound level data for each fuel cell component and the Ormat were obtained directly from Fuel Cell Energy. Noise emission data for the main step up transformer were developed using standard NEMA sound ratings for the proposed transformer MVA rating (40/53/66 MVA).

The modeling considered hemispherical spreading and atmospheric absorption for this analysis. Standard conditions of 50° F and 70 percent relative humidity were assumed. The ground was set to partially absorptive. In order to remain conservative in the analysis, no credit was taken for tree foliage.

Modeling receptors were chosen at specific residential locations near the Project site. An initial noise model was prepared, utilizing the standard design and noise emissions data for the fuel cells. The results of this model indicated that Project related sound levels would exceed the State of Connecticut and Town of Beacon Falls noise standard limits for nighttime hours at some residential locations.

The Project therefore opted for Fuel Cell Energy's low noise option design. This design includes enclosures for some fuel cell components, and a silencer on the fresh air blower. The model was revised to include the low noise data sources. In addition to selecting the low noise option, the Project also opted to install a sound barrier wall along Gruber Road to further reduce sound levels in that neighborhood. The sound barrier wall would be located approximately 50 to 100 feet from the eastern edge of Gruber Road, and would extend approximately 900 feet from north to south.

5.2 Noise Modeling Results and Compliance with Noise Standards

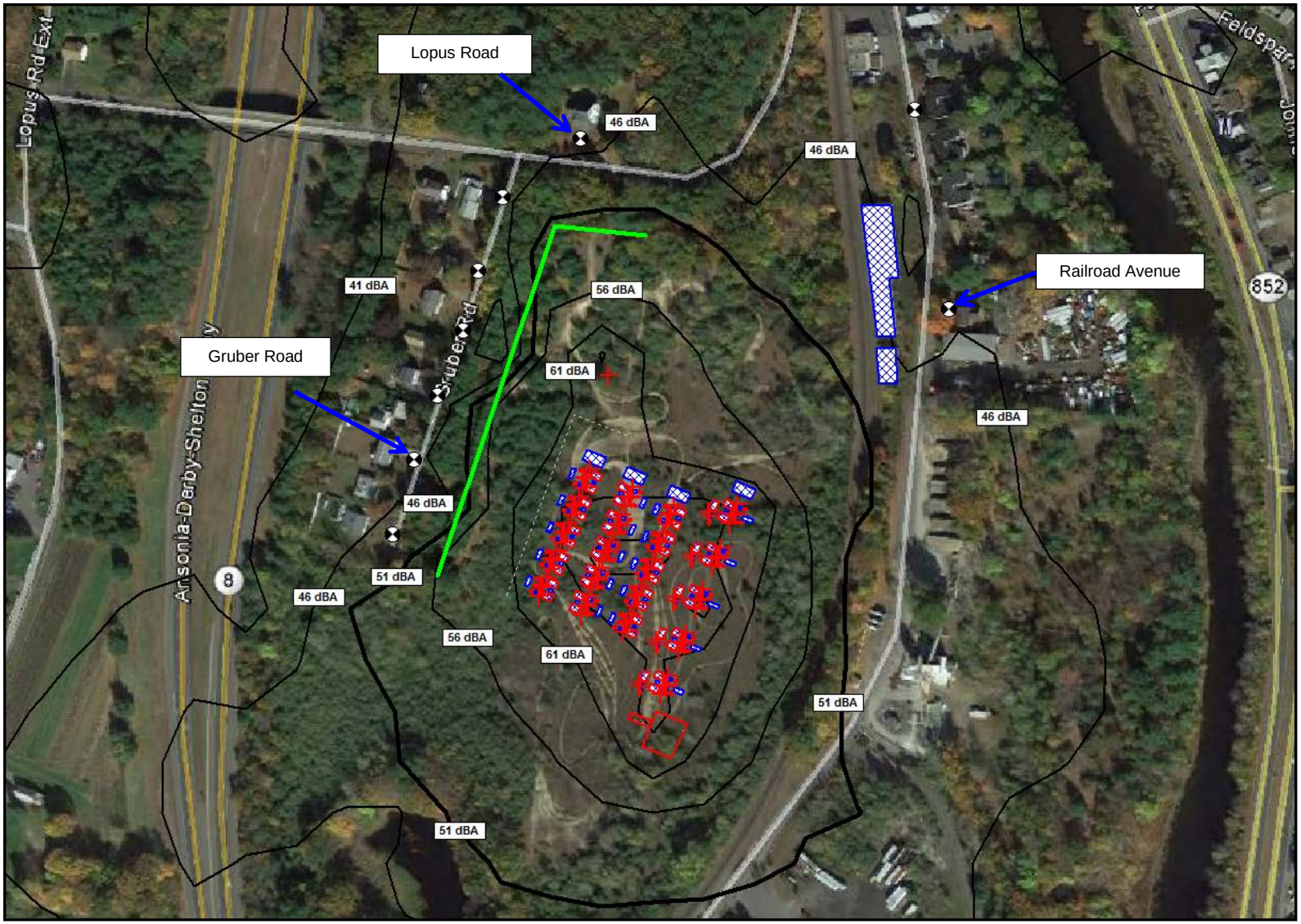
The noise modeling results for each residential location, with the low noise design option and the proposed sound barrier wall included, are presented in Table 4. A noise contour map, depicting the modeled noise levels in the area surrounding the Project, is provided as Figure 3.

Table 4
Noise Modeling Results (dBA)

Location	Modeled Project Sound Level	State of Connecticut and Town of Beacon Falls Nighttime Noise Standard
Gruber Road	44 to 47 (1)	51
Lopus Road	46	51
Railroad Avenue	44 to 45 (1)	51

(1) Modeled levels reflect the results at multiple residences on Gruber Road and Railroad Avenue

Figure 3: Noise Contour Map



The data in Table 4 reveal that Project sound levels will be below 51 dBA at all residential locations. The Project is therefore projected to be in compliance with the State of Connecticut noise standard and the Town of Beacon Falls noise ordinance limits for nighttime hours.

5.3 Projected Increase Over Existing Ambient Levels

Table 5 provides the modeled sound levels for the Project with the low noise option and the proposed sound barrier wall, the existing minimum late night ambient (L_{90}) sound levels, and the subsequent increase in noise anticipated to occur with Project operation.

Table 5
Noise Modeling Results Compared to Existing Ambient Noise Levels (dBA)

Location	Modeled Project Noise Level	Existing Minimum Measured Nighttime L_{90} Level	Total Future Noise Level	Increase Over Existing Minimum Nighttime Level
Gruber Road	44 to 47	39	45 to 48	6 to 9
Lopus Road	46	35	46	11
Railroad Avenue	44 to 45	36	45 to 46	9 to 10

The existing ambient L_{90} data presented in Table 6 reflect the lowest sound level measured at each location. The L_{90} is the sound level in the absence of extraneous sources (it is the lull in sound levels that is heard when intermittent traffic and other intermittent sources are not present). Because minimum ambient L_{90} noise levels are so low at night, the data presented in Table 6 reveal that during the quietest hours, noise levels at the most proximate residential locations will increase by between 6 dBA and 11 dBA, even though the modeled Project related sound levels are below the nighttime noise level limits in the standards. As noted previously, a 10 dBA increase is perceived as a doubling of the sound level. As was also noted, however, a doubling of a low ambient level is less significant than a doubling of a high ambient level.

As noted above, the projected increases are for the quietest hours of the night. During other hours of the night and especially during the day, ambient levels are much higher (45 dBA or more as shown in Table 3). During daytime hours, Project noise levels will be at or below ambient levels, with little to no increases to these higher ambient levels.

It is not practical and likely not possible to make the Project sources completely inaudible at all locations under all ambient conditions. The goal of a project such as this should be to minimize the potential for noise impacts to the extent practical.

5.4 Discrete Tone Noises

It was not possible to model the potential for prominent discrete tone noise, since this would require 1/3 octave band data, which were not available. Further, the CadnaA model is not designed to model 1/3 octave band data. Observations conducted at another fuel cell site with the standard design did not reveal the presence of any audible tonal sounds. It is expected that the Project low noise design features will act to further reduce the possibility of tonal sounds.

6.0 REFERENCES

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Appendix G

NDDB Final Determination No.: 201609163 with the
Field Habitat Assessment Report

Connecticut Department of

ENERGY &
ENVIRONMENTAL
PROTECTION

June 22, 2015

Corey Pelletier
Milone & MacBroom, Inc.
99 Realty Drive
Cheshire, CT 06410
cpelletier@mminc.com

Project: Preliminary Site Assessment for Construction of Beacon Falls Energy Park on Lopus Road in Beacon Falls, Connecticut
NDDB Preliminary Assessment No.: 201503256

Dear Corey,

I have reviewed Natural Diversity Data Base maps and files regarding the area delineated on the map provided for the preliminary site assessment for the proposed construction of Beacon Falls Energy Park located on Lopus Road in Beacon Falls, Connecticut. According to our records there are historic populations of state-listed species that occur within or very close to the boundaries of this property. I have attached the list to this letter. Please be advised that this is a preliminary review and not a final determination. A more detailed review will be necessary to move forward with any subsequent environmental permit applications submitted to DEEP for the proposed project. This letter cannot be used or submitted with your permit applications at DEEP. If you submit another NDDB review request to be used for DEEP permits please let us know how you will protect the state-listed species from being impacted by this project. This preliminary assessment is good for one year.

Natural Diversity Data Base information includes all information regarding critical biological resources available to us at the time of the request. This information is a compilation of data collected over the years by the Department of Energy and Environmental Protection's Natural History Survey and cooperating units of DEEP, private conservation groups and the scientific community. This information is not necessarily the result of comprehensive or site-specific field investigations. Consultations with the Data Base should not be substitutes for on-site surveys required for environmental assessments. Current research projects and new contributors continue to identify additional populations of species and locations of habitats of concern, as well as, enhance existing data. Such new information is incorporated into the Data Base as it becomes available. The result of this review does not preclude the possibility that listed species may be encountered on site and that additional action may be necessary to remain in compliance with certain state permits.

Please contact me if you have further questions at (860) 424-3592, or dawn.mckay@ct.gov . Thank you for consulting the Natural Diversity Data Base.

Sincerely,

Dawn M. McKay

Dawn M. McKay
Environmental Analyst 3

Species List for NDDB Request

Scientific Name	Common Name	State Status
Vascular Plant		
Blephilia ciliata	Downy wood-mint	SC*
Hydrophyllum virginianum	Virginia waterleaf	SC
Platanthera hookeri	Hooker's orchid	SC*
Vertebrate Animal		
Toxostoma rufum	Brown thrasher	SC
Heterdon platirhrinos	Hognose Snake	SC

E = Endangered, T = Threatened, SC = Special Concern, * Extirpated

Connecticut Department of
Energy & Environmental Protection
Bureau of Natural Resources
Wildlife Division

CPPU USE ONLY
App #:_____
Doc #:_____
Check #: No fee required
Program: Natural Diversity Database **Endangered Species**
Hardcopy _____ **Electronic** _____

Request for Natural Diversity Data Base (NDDB) State Listed Species Review

Please complete this form in accordance with the instructions (DEEP-INST-007) to ensure proper handling of your request.
There are no fees associated with NDDB Reviews.

Part I: Preliminary Screening & Request Type

Before submitting this request, you must review the most current Natural Diversity Data Base "State and Federal Listed Species and Significant Natural Communities Maps" found on the DEEP website. These maps are updated twice a year, usually in June and December.

Does your site, including all affected areas, fall in an NDDB Area according to the map instructions:

☒ Yes ☐ No **Enter the date** of the map reviewed for pre-screening: **December 2014**

This form is being submitted for a :

☒ *New* NDDB request ☐ *Renewal/Extension* of a NDDB Request, ***without*** *modifications and within* ***one year*** *of issued NDDB determination* (no attachments required) [*CPPU Use Only - NDDB-Listed Species Determination #* 1736]	☐ *New* **Safe Harbor Determination** (optional) must be associated with an application for a GP for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities ☐ *Renewal/Extension* of an existing Safe Harbor Determination ☐ With modifications ☐ Without modifications (no attachments required) [*CPPU Use Only - NDDB-Safe Harbor Determination #* 1736]
Enter NDDB Determination Number for Renewal/Extension:	Enter Safe Harbor Determination Number for Renewal/Extension:

Part II: Requester Information

***If the requester is a corporation, limited liability company, limited partnership, limited liability partnership, or a statutory trust, it must be registered with the Secretary of State. If applicable, the name shall be stated **exactly** as it is registered with the Secretary of State. Please note, for those entities registered with the Secretary of State, the registered name will be the name used by DEEP. This information can be accessed at the Secretary of the State's database CONCORD.*
(www.concord-sots.ct.gov/CONCORD/index.jsp)

If the requester is an individual, provide the legal name (include suffix) in the following format: First Name; Middle Initial; Last Name; Suffix (Jr, Sr., II, III, etc.).

If there are any changes or corrections to your company/facility or individual mailing or billing address or contact information, please complete and submit the Request to Change company/Individual Information to the address indicated on the form.

1. Requester*

Company Name: **Milone & MacBroom, Inc.**

Contact Name: **Corey Pelletier**

Address: **99 Realty Drive**

City/Town: **Cheshire** State: **CT** Zip Code: **06410**

Business Phone: **203-271-1773** ext.

E-mail: **cpelletier@mminc.com

**By providing this email address you are agreeing to receive official correspondence from the department, at this electronic address, concerning this request. Please remember to check your security settings to be sure you can receive emails from "ct.gov" addresses. Also, please notify the department if your e-mail address changes

a) Requester can best be described as:

☐ Individual ☐ Federal Agency ☐ State agency ☐ Municipality ☐ Tribal

☒ *business entity (* if a business entity complete i through iii):

i) Check type ☒ corporation ☐ limited liability company ☐ limited partnership
☐ limited liability partnership ☐ statutory trust ☐ Other:

ii) Provide Secretary of the State Business ID #: 0160851 This information can be accessed at the Secretary of the State's database (CONCORD). (www.concord-sots.ct.gov/CONCORD/index.jsp)

iii) ☐ Check here if your business is **NOT** registered with the Secretary of State's office.

b) Acting as (Affiliation), pick one:

☐ Property owner ☒ Consultant ☐ Engineer ☐ Facility owner ☐ Applicant

☐ Biologist ☐ Pesticide Applicator ☐ Other representative:

2. List Primary Contact to receive Natural Diversity Data Base correspondence and inquiries, if different from requester.

Company Name:

Contact Person: Title:

Mailing Address:

City/Town: State: Zip Code:

Business Phone: ext.

**E-mail:

Part III: Site Information

This request can only be completed for one site. A separate request must be filed for each additional site.

1. SITE NAME AND LOCATION

Site Name or Project Name: **Beacon Falls Energy Park**

Town(s): **Beacon Falls**

Street Address or Location Description:
Lopus Road, Beacon Falls, CT

Size in acres, or site dimensions: **23.97 acres**

Latitude and longitude of the center of the site in decimal degrees (e.g., 41.23456 -71.68574):

Latitude: **73.064543** Longitude: **41.437529**

Method of coordinate determination (check one):

☐ GPS ☐ Photo interpolation using CTECO map viewer ☒ Other (specify): **ArcGIS**

2a. Describe the current land use and land cover of the site.

Inactive resource extraction area. Site is vegetated with native xeric plant species and non-native invasives.

b. Check all that apply and enter the size in acres or % of area in the space after each checked category.

☐ Industrial/Commercial _____ ☐ Residential _____ ☒ Forest 24%

☐ Wetland _____ ☒ Field/grassland 30% ☐ Agricultural _____

☒ Water 6% ☐ Utility Right-of-way _____

☐ Transportation Right-of-way _____ ☒ Other (specify): **Scrub-shrub 40%**

Part IV: Project Information

1. PROJECT TYPE:

Choose Project Type: Utility construction/modification , If other describe: _____

2. Is the subject activity limited to the maintenance, repair, or improvement of an existing structure within the existing footprint? ☐ Yes ☒ No If yes, explain.

Part IV: Project Information (continued)

3. Give a detailed description of the activity which is the subject of this request and describe the methods and equipment that will be used. Include a description of steps that will be taken to minimize impacts to any known listed species.

   Creation of the Beacon Falls Energy Park

4. If this is a renewal or extension of an existing Safe Harbor request *with* modifications, explain what about the project has changed.

5. Provide a contact for questions about the project details if different from Part II primary contact.

   Name:

   Phone:

   E-mail:

Part V: Request Requirements and Associated Application Types

Check *one* box from either Group 1, Group 2 *or* Group 3, indicating the appropriate category for this request.

Group 1. If you check one of these boxes, complete Parts I – VII of this form and submit the required attachments A and B.

- ☐ Preliminary screening was negative but an NDDB review is still requested
- ☐ Request regards a municipally regulated or unregulated activity (no state permit/certificate needed)
- ☒ Request regards a preliminary site assessment or project feasibility study
- ☐ Request relates to land acquisition or protection
- ☐ Request is associated with a *renewal* of an existing permit, with no modifications

Group 2. If you check one of these boxes, complete Parts I – VII of this form and submit required attachments A, B, *and* C.

- ☐ Request is associated with a *new* state or federal permit application
- ☐ Request is associated with modification of an existing permit
- ☐ Request is associated with a permit enforcement action
- ☐ Request regards site management or planning, requiring detailed species recommendations
- ☐ Request regards a state funded project, state agency activity, or CEPA request

☐ **Group 3.** If you are requesting a **Safe Harbor Determination**, complete Parts I-VII and submit required attachments A, B, and D. Safe Harbor determinations can only be requested if you are applying for a GP for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

If you are filing this request as part of a state or federal permit application(s) enter the application information below.

Permitting Agency and Application Name(s): _____

State DEEP Application Number(s), if known: _____

State DEEP Enforcement Action Number, if known: _____

State DEEP Permit Analyst(s)/Engineer(s), if known: _____

Is this request related to a previously submitted NDDB request? ☐ Yes ☐ No

If yes, provide the previous NDDB Determination Number(s), if known: _____

Part VI: Supporting Documents

Check each attachment submitted as verification that *all* applicable attachments have been supplied with this request form. Label each attachment as indicated in this part (e.g., Attachment A, etc.) and be sure to include the requester's name, site name and the date. **Please note that Attachments A and B are required for all new requests and Safe Harbor renewals/extensions with modifications.** Renewals/Extensions with no modifications do not need to submit any attachments. Attachments C and D are supplied at the end of this form.

☒ Attachment A:	**Overview Map:** an 8 1/2" X 11" print/copy of the relevant portion of a USGS Topographic Quadrangle Map clearly indicating the exact location of the site.
☒ Attachment B:	**Detailed Site Map:** fine scaled map showing site boundary and area of work details on aerial imagery with relevant landmarks labeled. (Site and work boundaries in GIS [ESRI ArcView shapefile, in NAD83, State Plane, feet] format can be substituted for detailed maps, see instruction document)
☐ Attachment C:	**Supplemental Information, Group 2 requirement (attached, DEEP-APP-007C)** ☐ Section i: Supplemental Site Information and supporting documents ☐ Section ii: Supplemental Project Information and supporting documents
☐ Attachment D:	**Safe Harbor Report Requirements, Group 3 (attached, DEEP-APP-007D)**

Part VII: Requester Certification

The requester *and* the individual(s) responsible for actually preparing the request must sign this part. A request will be considered incomplete unless all required signatures are provided.

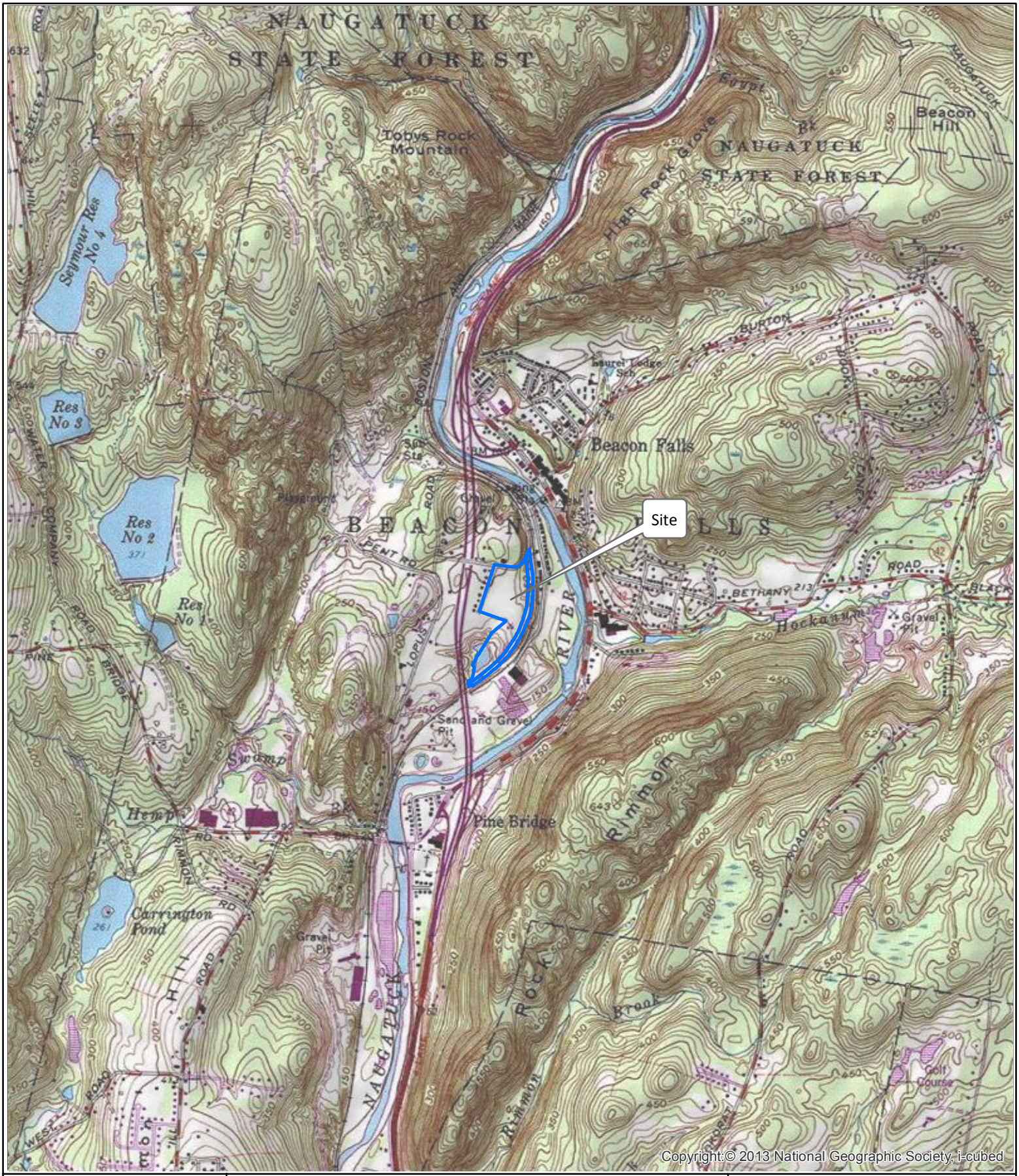
"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that based on reasonable investigation, including my inquiry of the individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief."

Corey Pelletier	5/8/15
Signature of Requester (a typed name will substitute for a handwritten signature)	Date
Corey Pelletier	Env. Analyst
Name of Requester (print or type)	Title (if applicable)
Signature of Preparer (if different than above)	Date
Name of Preparer (print or type)	Title (if applicable)

Note: Please submit the completed Request Form and all Supporting Documents to:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENERGY & ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Or email request to: deep.nddbrequest@ct.gov



SOURCE(S):
ESRI USA Topo Maps

Attachment A: Natural Diversity Data Base Map

LOCATION:
Beacon Falls, CT

N

Beacon Falls Energy Park

MXD: Y:\1103-87\Maps\NDDB.mxd

Map By: CMP
MMI#: 1103-87
Original: 5/8/2015
Revision: 4/16/2015
Scale: 1 inch = 2,000 feet

MILONE & MACBROOM
99 Realty Drive Cheshire, CT 06410
(203) 271-1773 Fax: (203) 272-9733
www.miloneandmacbroom.com

SOURCE(S): BING Aerial Imagery CT DEEP NDDB Layer	**Attachment B: Natural Diversity Data Base Map**	**LOCATION:** **Beacon Falls, CT**
N **Beacon Falls Energy Park** **MXD: Y:\1103-87\Maps\NDDB-2.mxd**	**Map By:** CMP **MMI#:** 1103-87 **Original:** 5/8/2015 **Revision:** 4/16/2015 **Scale:** 1 inch = 850 feet	MILONE & MACBROOM **99 Realty Drive Cheshire, CT 06410** **(203) 271-1773 Fax: (203) 272-9733** **www.miloneandmacbroom.com**

Appendix H

Analysis of Best Available Control Technology
(DEEP-NSR-APP-214a)

Attachment G: Analysis of Best Available Control Technology (DEEP-NSR-APP-214a) and Attachments G1 (DEEP-NSR-APP-214b) and G3 (DEEP-NSR-APP-214d)

Attachment G - Control Technology Analysis

G.1. Introduction

G.1.1 Project Description

Beacon Falls Energy Park, LLC has proposed to construct the Beacon Falls Energy Park (the Project), a nominal 63.3 megawatt (MW) base-load fuel cell project in Beacon Falls, Connecticut. The Project will occupy approximately 8 acres of a 25.0 acres plot of land currently owned by O&G Industries (O&G) and located between Connecticut Route 8 and Railroad Avenue. The Project consists of the following:

- 5 FuelCell Energy, Inc. high efficiency fuel cell (HEFC) fuel cell plants, each rated at approximately 3.7 MW
- 15 FuelCell Energy, Inc. DFC3000 fuel cell plants, each rated at approximately 2.8 MW
- 1 ORMAT Energy Converter System, rated at approximately 4.7 MW, and consisting of Organic Rankine Cycle (ORC) preheater and vaporizer heat recovery units, a vapor turbine, a generator, and a condenser
- Switchyard facilities

Each of the 20 fuel cell plants will contain two (DFC3000) or three (HEFC) fuel cell modules, each consisting of four “stacks” of fuel cells, and will be equipped with an air heater with a maximum heat input of 11.2 million British thermal units per hour (MMBtu/hr). The air heater will only operate when the fuel cells are idle, or when a fuel cell module is not operating at a sufficient power level to maintain its required minimum temperature. Note that all MMBtu values are expressed as the higher heating value (HHV), unless otherwise indicated. For natural gas, the lower heating value (LHV) is 90% of the HHV. It is expected that the fuel cells will operate continuously. The Project will use natural gas exclusively as fuel.

G.1.2 Purpose

This Attachment provides the control technololgy analyis for the Project. A facility’s control technology requirements depend on the the potential to emit (PTE) of the facility and its individual sources, and the attainment status relative to the National Ambient Air Quality Standards (NAAQS) of the region in which the facility is located.

G.2. BACT / LAER Applicability to the Project

In Connecticut, BACT is required if a project meets one or more of the following three criteria:

(1) Regulations of Connecticut State Agencies (RCSA) 22a-174-3a(j)(1)(A) and (B) state that BACT is required for an air pollutant from a Prevention of Significant Deterioration (PSD) new major stationary source[1] whose potential to emit (PTE) is greater than its significant emission rate (SER) thresholds, or an air pollutant from a major modification whose PTE increase is greater than its SER. For some pollutants, BACT may also apply to a precursor pollutant whose PTE exceeds its significant emission rate[2] (SER).

(2) RCSA 22a-174-3a(j)(1)(C) and (D) state that BACT is required for an air pollutant from a new emission unit with an uncontrolled PTE of 15 tons per year (tpy) or more, or a modified emission unit with such an uncontrolled PTE increase.

(3) RCSA 22a-174-3a(j)(1)(F) states that BACT is required for a new stationary source with potential greenhouse gas (GHG) as carbon dioxide equivalents (CO_2e) emissions of 100,000 tpy or more and potential GHG mass emissions of 100 tpy or more and, from such a source, potential emissions of each air pollutant with emissions equal to or greater than its SER.

Table 1 shows the PTE of 10 tpy for particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$), particulate matter with an aerodynamic diameter less than or equal to 10 microns (PM_{10}), volatile organic compounds (VOC), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), carbon dioxide (CO_2) and carbon dioxide equivalents (CO_2e). BACT applicability is summarized as follows:

(1) With respect to the first criterion, as can be seen in Table 1, for no air pollutant does the uncontrolled PTE exceed the PSD major source threshold.

(2) With respect to the second criterion, each of the Project's 20 proposed fuel cell plants is a separate emission unit. As can be seen in Table 1, for no air pollutant[3] does the uncontrolled PTE exceed the 15 tpy threshold for BACT.

(3) With respect to the third criterion, as can be seen in Table 1, GHG emissions as CO_2e exceed 100,000 tpy and GHG mass emissions as CO_2 exceed 100 tpy; therefore, BACT is required for CO_2e.

Lowest Achievable Emission Rate (LAER) is part of non-attainment new source review (NNSR). RCSA 22a-174-3a(l)(3)(A) states that a LAER determination is required for i) each non-attainment air pollutant for which the subject source is a new major modification or new major stationary

[1] The major source threshold is 100 tpy for $PM_{2.5}$, PM_{10}, VOC, NO_2, SO_2, or CO.
[2] 10 tpy for $PM_{2.5}$, 15 tpy for PM_{10}, 25 tpy for VOC, 40 tpy for SO_2 and NO_2, 100 tpy for CO, and 75,000 tpy for CO_2e.
[3] Note that the definition of "air pollutant" at RCSA 22a-174.22.1(5) excludes CO_2.

source, and (ii) each air pollutant which would cause or contribute to a violation of a NAAQS in an adjacent non-attainment area. The Project is not subject to NNSR, and LAER does not apply.

G.3. Definition of BACT

RCSA 22a-174-1.(16) states that BACT, "…means an emission limitation, including a limitation on visible emissions, based upon the maximum degree of reduction for each applicable air pollutant emitted from any proposed stationary source or modification which the commissioner, on a case-by-case basis, determines is achievable in accordance with section 22a-174-3a of the Regulations of Connecticut State Agencies. BACT may include, without limitation, the application of production processes, work practice standards or available methods, systems, and techniques, including fuel cleaning or treatment, the use of clean fuels, or innovative techniques for the control of such air pollutant".

BACT is determined using a top-down analysis as described in the Northeast States for Coordinated Air Use Management (NESCAUM) BACT Guideline and the U.S. Environmental Protection Agency (EPA) New Source Review Workshop Manual[4]. The steps involved are as follows:

1. Identify, for the emissions unit in question, all available control options. BACT determinations for permitted emission sources can be obtained from the EPA RACT / BACT / LAER Clearinghouse (RBLC)[5] and the CT DEEP BACT database[6].
2. Evaluate the technical feasibility, based on physical, chemical, and engineering principles, of the identified control options. Eliminate from further consideration technically infeasible control options.
3. Rank, with the most effective control alternative at the top, the control alternatives not eliminated in step 2. The list should include:
    - Control efficiencies (percent pollutant removed)
    - Expected emission rate
    - Expected emissions reduction
    - Economic impacts
    - Environmental impacts

[4]. New Source Review Workshop Manual - Prevention of Significant Deterioration and Nonattainment Area Permitting, U.S. EPA Draft October 1990.
[5]. http://cfpub.epa.gov/RBLC/, accessed 10/22/15 and 11/21/15
[6]. http://www.ct.gov/deep/cwp/view.asp?a=2684&q=461080, accessed 10/20/15

- Energy impacts

4. Evaluate the most effective controls and document the results. If the applicant accepts the top alternative and there are no outstanding issues regarding collateral environmental impacts, the analysis is ended and the results are proposed as BACT.

G.4. BACT for GHG as CO_2e

G.4.1 CO_2e Formation

The CO_2e emissions from fuel cells consist primarily of CO_2. Small amounts of methane (CH_4) and nitrous oxide (N_2O) may be emitted. CH_4 and N_2O emission factors for natural gas combustion are provided by a number of references (e.g., 40 CFR 98 Subpart C). Adjusted for their global warming potential, CH_4 and N_2O together account for less than 1% of the CO_2e. Natural gas is not combusted in a fuel cell. Nevertheless, any substantive CO_2e control measure must be a CO_2 control measure.

G.4.2 CO_2e Control Options

G.4.2.1 Fuel Cells

Thermally Efficient Equipment

Fuel cells are electrochemical devices that combine fuel with oxygen (O_2) from the ambient air to produce electricity, and heat, and water. The electrochemical process is a direct form of fuel-to-energy conversion, and is much more efficient than conventional heat engine approaches. There are many types of fuel cells, but they all consist of an anode, a cathode, and an electrolyte that allows positively charged hydrogen (H^+) ions to move between the two sides of the fuel cell. The anode and cathode contain catalysts that cause the fuel to undergo oxidation reactions that generate H^+ ions and electrons. The H^+ ions are drawn through the electrolyte after the reaction. At the same time, electrons are drawn from the anode to the cathode through an external circuit, producing direct current electricity. At the cathode, H^+ ions, electrons, and O_2 react to form water (H_2O).

Although most fuel cell technologies use hydrogen gas (H_2) for fuel, a Direct Fuel Cell (DFC) uses hydrocarbons as fuel. Fuel and air reactions for the molten carbonate DFC occur at the anode and cathode, which are porous nickel (Ni) catalysts. The cathode side receives O_2 from the surrounding air. As can be seen in Figure 1, H_2 is created in the fuel cell through a reforming process reaction between the hydrocarbon fuel and steam. The H_2 is then consumed electrochemically in a reaction with carbonate electrolyte ions that produces water and electrons. A DFC power plant consists of the fuel cells arranged in stacks and modules to provide

the required system voltage and power and the equipment needed to provide the proper gas flow and power conversion, which is referred to as Balance of Plant (BOP). The power plant process is illustrated in Figure 2.

A nation-wide list of fuel cell plants and their efficiencies could not be found. The California Stationary Fuel Cell Collaborative states on its website[7], "As of October 1, 2014, there were active or publicly announced stationary fuel cell installations in more than half of California's 58 counties. These installations represent more than 100 megawatts of installed capacity… Depending on the fuel cell type and the application, the systems operate at fuel-to-electricity efficiencies of 30 to 50 percent, and overall efficiencies in excess of 80 percent."

When new, the nominal thermal efficiency of an HEFC plant is 59%, with ± 2% uncertainty. Over the life of the fuel cell modules, 10% degradation of the heat rate is predicted and the resulting nominal thermal efficiency is 53.1%. When new, the nominal thermal efficiency of a DFC3000 power plant is 47% with ± 2% uncertainty. With heat recovery, the nominal thermal efficiency of the new DFC3000 power plant increases to approximately 50.1%. With 10% degradation of heat rate over the life of the fuel cell modules, the expected thermal efficiency of a DFC3000 power plant drops to 42.3%. With heat recovery, the expected thermal efficiency of the fully degraded DFC3000 power plant increases to approximately 47%. Note that these efficiencies are based on the LHV.

[7] http://casfcc.org/STATIONARY_FC_MAP/ accessed 1/10/16.

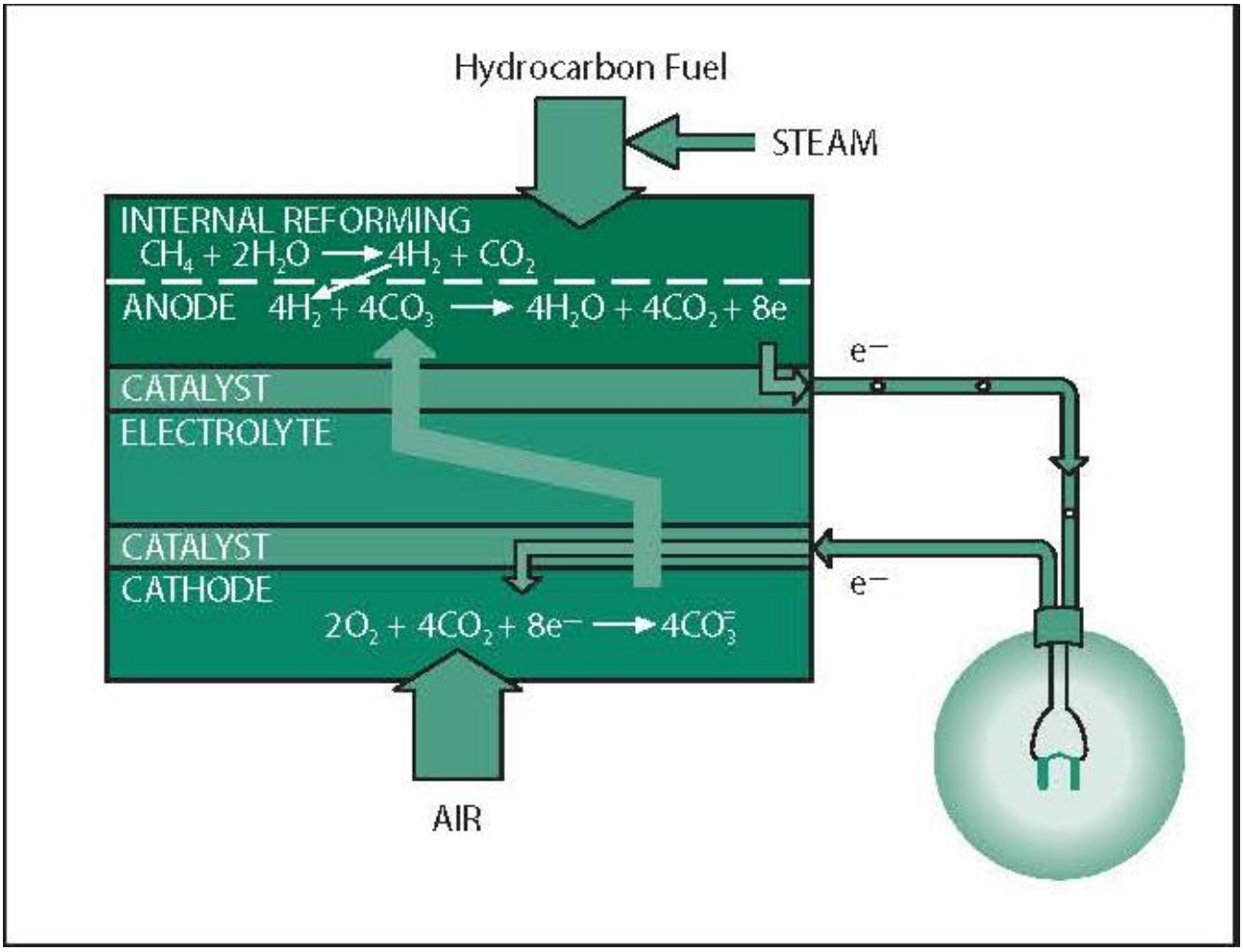


Figure 1. DFC Process Diagram

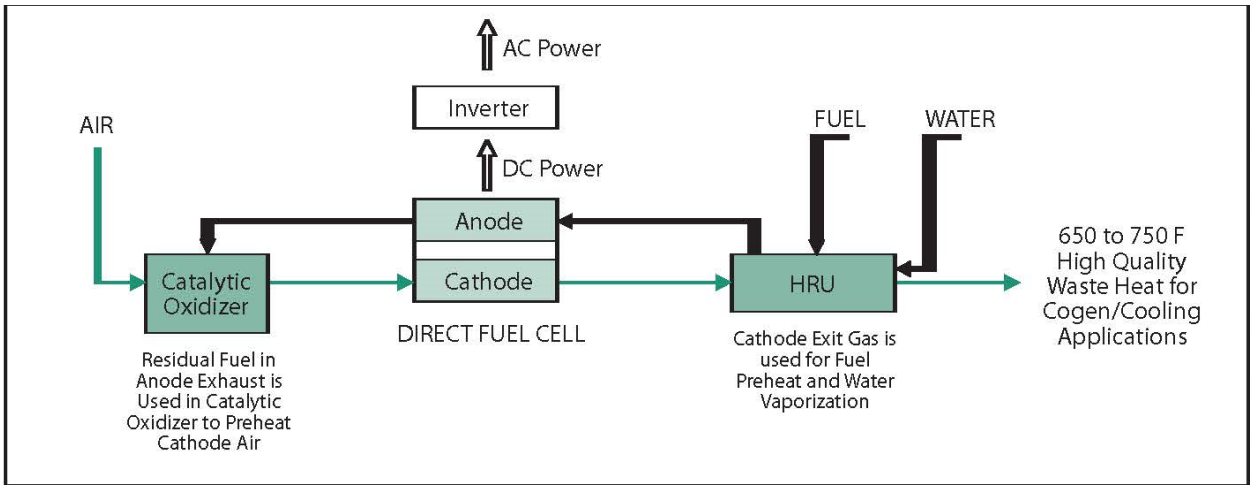


Figure 2: Molten Carbonate DFC Block Diagram

Clean Fuels

Hydrogen fuel has essentially no carbon content. However, hydrogen fuel is not available at the proposed Project site. Today, 95% of the hydrogen produced in the United States is made by natural gas reforming in large central plants, which release CO_2 in the production process[8].

Pipeline natural gas has the lowest carbon content of all hydrocarbon fuels. Per unit of energy content, natural gas contains approximately 28% less carbon than diesel fuel and 45% less carbon than coals typically used for electrical energy production in the United States.

Good Practices

Good practices, including proper maintenance and operation of the fuel cells, will promote energy efficiency and low emissions per unit of output.

Carbon Capture and Sequestration (CCS)

CCS involves three steps, CO_2 capture, CO_2 transport, and CO_2 sequestration. Available CO_2 technologies include the following:

- In post-combustion capture, the fuel is burned in air, and the CO_2 is scrubbed from the exhaust stream. Only a fraction of the CO_2e is captured in this manner. Post-combustion capture consumes a large amount of energy due to the concentration of CO_2 in the combustion exhaust gas.
- In oxy-fuel firing, the fuel is burned in O_2 instead of air, along with cooled flue gas that is recirculated and injected into the combustion chamber. The flue gas consists of mainly CO_2 and water vapor; the latter is condensed and removed from the gas stream. Essentially 100% of the CO_2 is captured in this manner. An O_2 generation plant or a large supply of O_2 is required.

Following the capture of CO_2, it must be compressed and transported to a suitable location for sequestration. It is reasonable to assume that typically such transport would be via a pipeline, which is the practice for CO_2 used for enhanced oil and gas recovery.

CO_2 sequestration is the injection of CO_2 into deep underground formations and its permanent storage therein. These formations are often a mile or more beneath the surface, and consist of porous rock that holds the CO_2. Overlying these formations are impermeable, non-porous layers of rock that trap the CO_2 and prevent it from migrating upward. The geological formations that sequester the CO_2 must be far below fresh water so they cannot contaminate groundwater. The

[8] http://energy.gov/eere/fuelcells/hydrogen-production-natural-gas-reforming accessed 1/10/16.

geological formations suitable for CO_2 sequestration include saline aquifers, depleted oil or gas reservoirs, and unmineable coal beds. Connecticut and surrounding areas do not contain geological formations suitable for CO_2 sequestration[9].

On February 3, 2010, President Obama established the Interagency Task Force on Carbon Capture and Storage (ITFCCS), composed of 14 executive departments and federal agencies. In its final report[10] the ITFCCS concluded, "Current technologies could be used to capture CO_2 from new and existing fossil energy power plants; however, they are not ready for widespread implementation primarily because they have not been demonstrated at the scale necessary to establish confidence for power plant application." Thus, CCS is not a technically feasible technology for this application.

G.4.2.2Fuel Cell Heaters

Clean Fuels

Pipeline natural gas has the lowest carbon content of all hydrocarbon fuels. Per unit of energy content, natural gas contains approximately 28% less carbon than diesel fuel and 45% less carbon than coals typically used for electrical energy production in the United States.

Good Combustion Practices

Good practices, including proper maintenance and operation of the fuel cell heaters, will promote energy efficiency and low emissions per unit of output.

G.4.3. Review of RBLC and Other BACT Databases

Fuel cells are not listed in BACT databases. In 2013 Dominion Bridgeport Fuel Cell entered service in Bridgeport Connecticut. It has a rated output of 14.9 MW from its five DFC3000 fuel cell plants with heat recovery[11], which is equivalent to the performance expected for the Project's DFC3000 fuel cell power plants. The efficiency of the Project's HEFC power plants will be greater than this.

The RBLC contains listings for miscellaneous boilers, furnaces, and heaters (source category code 19.600). The only control measures listed are use of clean fuels and good combustion practices, or the equivalent thereof.

---

[9] North American Carbon Storage Atlas 2012, First Edition. See pages 16 through 19. http://www.netl.doe.gov/File%20Library/Research/Carbon-Storage/NACSA2012.pdf. Accessed 1/10/16.

[10] Report of the Interagency Task Force on Carbon Capture and Storage, August 2010, See page 50. http://energy.gov/fe/downloads/ccstf-final-report. Accessed 1/10/16.

[11] https://www.dom.com/corporate/what-we-do/electricity/generation/fossil-fueled-power-stations/dominion-bridgeport-fuel-cell Accessed 1/10/16.

G.4.4 Rank Control Technologies

G.4.4.2Fuel Cells

The feasible CO_2e control technologies for fuel cells are ranked as follows:

1. Thermally efficient equipment
2. Clean fuels
3. Good practices

G.4.4.2Fuel Cell Heaters

The feasible CO_2e control technologies for fuel cells are ranked as follows:

1. Clean fuels
2. Good combustion practices

G.4.5 Select BACT

G.4.5.1 Fuel Cells

Table G-2 provides calculations of the CO_2 in pound per megawatt hour (lb/MW-hr). Note that these emissions are for the fuel cell only, and do not include the fuel cell air heaters. This performance will be achieved using thermally efficient equipment (direct fuel cell technology incorporating heat recovery) using clean fuel (natural gas) and good practices (operation in accordance with manufacturer specifications) is selected as BACT. These are the top-ranked and most effective technologies.

G.4.5.2 Fuel Cell Heaters

The expected CO_2 emissions are 117 lb/MMBtu. Any permit limit should be based on 120 lb/MMBtu to account for variation in natural gas. This performance will be achieved using thermally efficient equipment, good combustion practices, and clean fuel (natural gas), the top-ranked and most effective technologies.

Table G.1: Project PTE Emissions							
Pollutant	**Emissions (tpy) (1 unit)**				**Emissions (tpy) (20 units)**		
	HEFC	**DFC3000**	**Air Heater**	**Fuel Cell Plant[1]**	**Fuel Cells**	**Air Heaters**	**Fuel Cell Plants[1]**
Criteria Pollutants							
$PM_{2.5}$	3.69E-04	2.56E-04	0.37	0.37	5.69E-03	7.46	7.46
PM_{10}	3.69E-04	2.56E-04	0.37	0.37	5.69E-03	7.46	7.46
SO_2	0.07	0.06	0.03	0.07	1.32	0.61	1.32
NO_x	0.18	0.13	0.83	0.83	2.84	16.68	16.68
CO	1.85	1.28	1.36	1.85	28.45	27.47	28.45
VOC	0.37	0.26	0.68	0.68	5.69	13.73	13.73
Greenhouse Gases							
CO_2	13,877	12,086	5,744	13,877	250,669	114,874	250,669

1. When a fuel cell operates at full power, the associated air heater will not operate and vice versa.

Table G.2: CO_2 Pound per Megawatt-hour (lb/MW-hr) Calculation*

CO_2 (lb/MW-hr) = 3.412 MMBtu/MW-hr x (efficiency)$^{-1}$ x (LHV/HHV)$^{-1}$ x 53.02 kg/MMBtu x 2.205 lb/kg

Power	Output (MW)		No. of	Thermal Efficiency		
Constituent	new	degraded	Units	new	degraded	uncertainty
DCF3000	2.80	2.52	15	47.0%	42.3%	±2%
HEFC	3.70	3.33	5	59.0%	53.1%	±2%
ORMAT	3.30	4.70	1			
Parasitic	(0.50)	(0.50)	1			

LHV/HHV	0.90	for natural gas
MMBtu/MWh	3.412	units conversion
kg CO_2/MMBtu	53.02	40 CFR Part 98 Subpart C Table C–1
kg/lb	2.205	units conversion

Component	Status	Specified Efficiency w/o Heat Recovery	Heat Recovery Efficiency Addition	Nominal Efficiency	Nominal CO_2 Emisssions (lb/MW-hr)	CO_2 Emissions Uncertainty (lb/MW-hr)
DFC3000	New	47.0%	-	47.0%	943	+42 / -38
DFC3000	Degraded	42.3%	-	42.3%	1,048	+52 / -47
DFC3000	New	47.0%	3.1%	50.1%	884	+39 / -36
DFC3000	Degraded	42.3%	4.7%	47.0%	943	+47 / -43
HEFC	New	59.0%	-	59.0%	751	+26 / -25
HEFC	Degraded	53.1%	-	53.1%	835	+33 / -30
Energy Park	New	50.1%	-	50.1%	884	+37 / -34
Energy Park	Degraded	45.1%	-	45.1%	982	+46 / -42
Energy Park	New	50.1%	2.3%	52.4%	845	+36 / -33
Energy Park	Degraded	45.1%	3.5%	48.6%	912	+43 / -39

* Note that these emissions are for the fuel cells only, and do not include the fuel cell air heaters.

Attachment G: Analysis of Best Available Control Technology (BACT)

(Complete this form for each pollutant for which BACT must be incorporated. Duplicate this form as necessary.)

Complete this form in accordance with the instructions (DEEP-NSR-INST-214) to ensure the proper handling of your application. Print or type unless otherwise noted.

Applicant Name: Beacon Falls Energy Park, LLC

Unit No.: Fuel Cell Plants 1 - 20

Unit Description: 5 HEFC fuel cell plants and 15 DFC3000 fuel cell plants

Pollutant: CO2

Part I. Identify All Control Technologies/ Options

List all available control systems that have practical potential for application to this type of unit.

To ensure a sufficiently broad and comprehensive search of control alternatives, references other than the RBLC data should be investigated and documented. These references include: DEEP BACT Database, EPA/State air quality permits, control equipment vendors, trade associations, international agencies or companies, technical papers or journals.

Source	Facility	Control Technology	Reference
DFC3000 fuel cell plant	Dominion Bridgeport Fuel Cell Energy Park	1. Thermally efficient equipment 2. Clean fuels 3. Good practices	State of the States: Fuel Cells in America 2014 5th Edition, U.S. Department of Energy, December 2014, page 21

Part II. Rank All Control Options by Technical Feasibility and Control Effectiveness

List all Control Options considered in Part I and identify which options are technically feasible. First list the technically feasible control options in descending order of Overall Pollution Reduction Efficiency and then list the technically infeasible options. If a control option is determined to be technically infeasible, specify the reason in the Comments/Rationale column. DO NOT list the Post-BACT Emissions Rate, Emissions Reduction, and the Overall Pollution Reduction Efficiency (%) for technically infeasible control options. Technically infeasibility should be based on physical, chemical, and engineering principles that would preclude the successful use of the control option on the emissions unit under review. In addition, complete *Attachment G1: Background Search – Existing BACT determinations (DEEP-NSR-APP-214b)* to provide more detailed information regarding each of the technically feasible options listed below. (Duplicate this page as necessary)

Baseline Emissions Rate (tpy):

BACT Option	Technically Feasible? (Yes/No)	Allowable Emissions Rate	Emissions Reduction (tpy)	Overall Pollution Reduction Efficiency (%)	Comments/Rationale
Thermally efficient equipment	yes	See narrative Table G-2			Thermal efficiency is inherent to the process
Clean fuels	yes	See narrative Table G-2			The fuel cells will use natural gas, which has the lowest carbon content of any fuel
Good practices	yes	See narrative Table G-2			Fuel cells will be operated in accordance with manufacture's specifications and best practices

Part III. Economic Impacts/Cost Effectiveness

Is the proposed BACT the top control option ☒ Yes ☐ No If Yes, go to Part IV

Complete *Attachment G2: Cost/Economic Impact Analysis*, DEEP-NSR-APP-214c for each technically feasible BACT options listed in Part II for which economic impacts are to be considered before filling this Part.

Provide the following economic information for each of the BACT options with completed *Attachment G2: Cost/Economic Impact Analysis*, DEEP-NSR-APP-214c.

BACT Option	Total Annualized Cost (TAC, $/year)	Cost Effectiveness ($/ton)		Comments/Rationale
		Average	Incremental (optional)	

Part IV. Environmental Impact Analysis

Provide the following information regarding environmental impacts for each of the technically feasible BACT options listed in Part II. If the BACT option chosen is the top control option, the environmental impact analysis should be done for that option only.

BACT Option	Toxics Impact		Adverse Impact		Comments/Rationale
	Yes/No	amount/ton	Yes/No	amount/ton	
1. Thermally efficient equipment 2. Clean fuels 3. Good practices	yes	see MASC analysis	no	see MASC analysis	see MASC calculation

Part V. Energy Impact Analysis

Provide the following information regarding energy impacts for each of the technically feasible BACT options listed in Part II. If the BACT option chosen is the top control option, the energy impact analysis should be done for that option only.

Baseline (specify units): The parasitic loads for the plant will be 500 kw

BACT Option	Incremental Increase Over Baseline (specify units)	Comments/Rationale
Thermally efficient equipment	0 kw	Thermal efficiency is inherent to the process, , which requires no additional energy
Clean fuels	0 kw	The fuel cells will use natural gas, which has the lowest carbon content of any fuel, which requires no additional energy
Good practices	0 kw	Fuel cells will be operated in accordance with manufacturer's specifications and best practices, which requires no additional energy

Part VI. BACT Recommendation

BACT Option Recommended: thermally efficient equipment, clean fuels, and good practices

Justification: The project will use the same technology as Dominion Bridgeport Fuel Cell Park, which has been cited by EPA Administrator Gina McCarthy as as a model project. See http://energy.agwired.com/2014/10/16/epa-admin-mccarthy-visits-fuelcell-energy/

Part VII. Additional Forms/Attachments

Indicate the number of each type of form included as part of this BACT analysis.

Number of Forms	Form Number	Form Name	Mandatory?
1	DEEP-NSR-APP-214b	Attachment G1: Background Search – Existing BACT Determinations	Yes
0	DEEP-NSR-APP-214c	Attachment G2: Cost/Economic Impact Analysis	Yes, for each economic consideration
1	DEEP-NSR-APP-214d	Attachment G3: Summary of Best Available Control Technology	Yes

Additional Attachments:

Attachment G1: Background Search – Existing BACT Determinations

Applicant Name: Beacon Falls Energy Park, LLC

Unit No.: Units 1 through 20

Unit Description: Fuel Cells

Pollutant: CO2

BACT Option: Thermally efficient equipment, clean fuels, and good practices

Complete this form in accordance with the instructions (DEEP-NSR-INST-214) to ensure the proper handling of your application. Print or type unless otherwise noted.

Complete this form for each existing BACT or LAER determination found for a unit which is the same or similar to the subject unit. LAER determinations may be considered BACT in some instances.

To ensure a sufficiently broad and comprehensive search of control alternatives, sources other than the RBLC data should be investigated and documented. These sources include: DEEP BACT Database, EPA/State air quality permits, control equipment vendors, trade associations, international agencies or companies, technical papers or journals.

Indicate if BACT or LAER Determination: ☐ **BACT** ☐ **LAER**	
Source	Dominion Bridgeport Fuel Cell Energy Park
Facility/Location	Brideport, CT
Permitting Authority	CT DEEP
Permit No.	not applicable
Capacity (specify units)	14.9 MW
BACT/LAER Determination	BACT LAER was not required. But this project has been cited as a model project. http://energy.agwired.com/2014/10/16/epa-admin-mccarthy-visits-fuelcell-energy/
Compliance Achieved? (Yes/No)	not applicable
Method of Compliance Determination	not applicable
Actions Taken for Noncompliance	not applicable
Baseline Emissions Rate (specify units)	not applicable
Allowable Emissions Rate (specify units)	not applicable
Emissions Reduction Potential (%)	not applicable
Cost Effectiveness ($/ton removed)	not applicable
Reference	State of the States: Fuel Cells in America 2014 5th Edition, U.S. Department of Energy, December 2014, page 21

Attachment G3: Summary of Best Available Control Technology Reviews

Complete this form in accordance with the instructions (DEEP-NSR-INST-214) to ensure the proper handling of your application. Print or type unless otherwise noted.

List each emissions unit subject to the BACT requirements. For each emissions unit listed, indicate the Emissions Unit number and all pollutants that are subject to the BACT requirements. *Attachment G: Analysis of Best Available Control Technology* (DEEP-NSR-APP-214a) should be completed for each emissions unit-pollutant combination listed in this table.

		Pollutants Subject to BACT									
Unit Description	**Unit Number**	**PM**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**NO_X**	**CO**	**VOC**	**GHG**	**Other** (please specify)	
5 HEFC Fuel Cell Plants	U1 - U5	☐	☐	☐	☐	☐	☐	☐	☒	☐	
15 DFC3000 Fuel Cell Plants	U6 - U20	☐	☐	☐	☐	☐	☐	☐	☒	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
		☐	☐	☐	☐	☐	☐	☐	☐	☐	
Baseline Project Emissions Total in tons per year (tpy):									250,669		**Comments:**
Allowable Project Emissions Total in tons per year (tpy):									250,669		

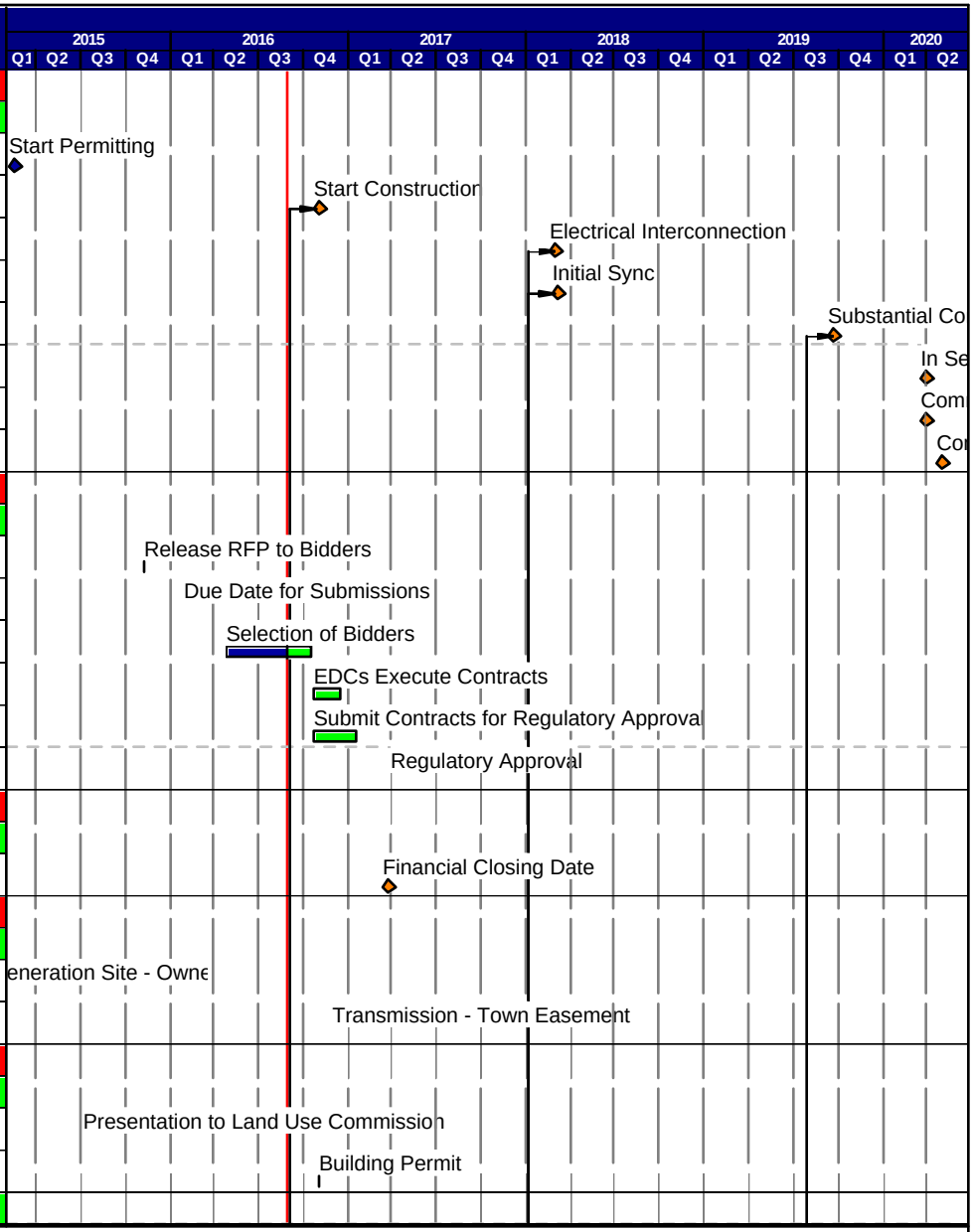
Appendix I

Infrastructure Decommissioning Plan
(to be provided upon completion)

Appendix J

Project Schedule

Act ID	Description	Orig Dur	Early Start	Early Finish
02 - Major Milestones				
200	Start Permitting	0	16FEB15 A	
202	Start Construction	0	01NOV16	
210	Electrical Interconnection	0		02MAR18
206	Initial Sync	0	05MAR18	
212	Substantial Completion (Commercial Operation)	0		23SEP19
204	In Service Date (FCM Obligation)	0	01APR20 *	
214	Commissioning (FCM Obligation)	0		01APR20 *
208	Commercial Operation (FCM Obligation)	0	01MAY20 *	
10 - Facility Contracts				
30 - RFP				
046	Release RFP to Bidders	1	12NOV15 A	12NOV15 A
048	Due Date for Submissions	1	28JAN16 A	28JAN16 A
076	Selection of Bidders	128	26APR16 A	21OCT16
078	EDCs Execute Contracts	60	21OCT16 *	19DEC16
088	Submit Contracts for Regulatory Approval	68	21OCT16 *	24JAN17
134	Regulatory Approval	1	31MAR17 *	31MAR17
12 - Financing				
040	Financial Closing Date	0	24MAR17 *	
14 - Acquisition of Real Property Rights				
138	Generation Site - Owned	1	01JAN15 A	01JAN15 A
140	Transmission - Town Easement	1	30NOV16 *	30NOV16
04 - Federal, State of Local Permits				
20 - Local				
002	Presentation to Land Use Commission	1	07JUL15 A	07JUL15 A
004	Building Permit	5	01NOV16 *	07NOV16
22 - State				



Start date	19FEB15
Finish date	30APR20
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Beacon Falls, CT
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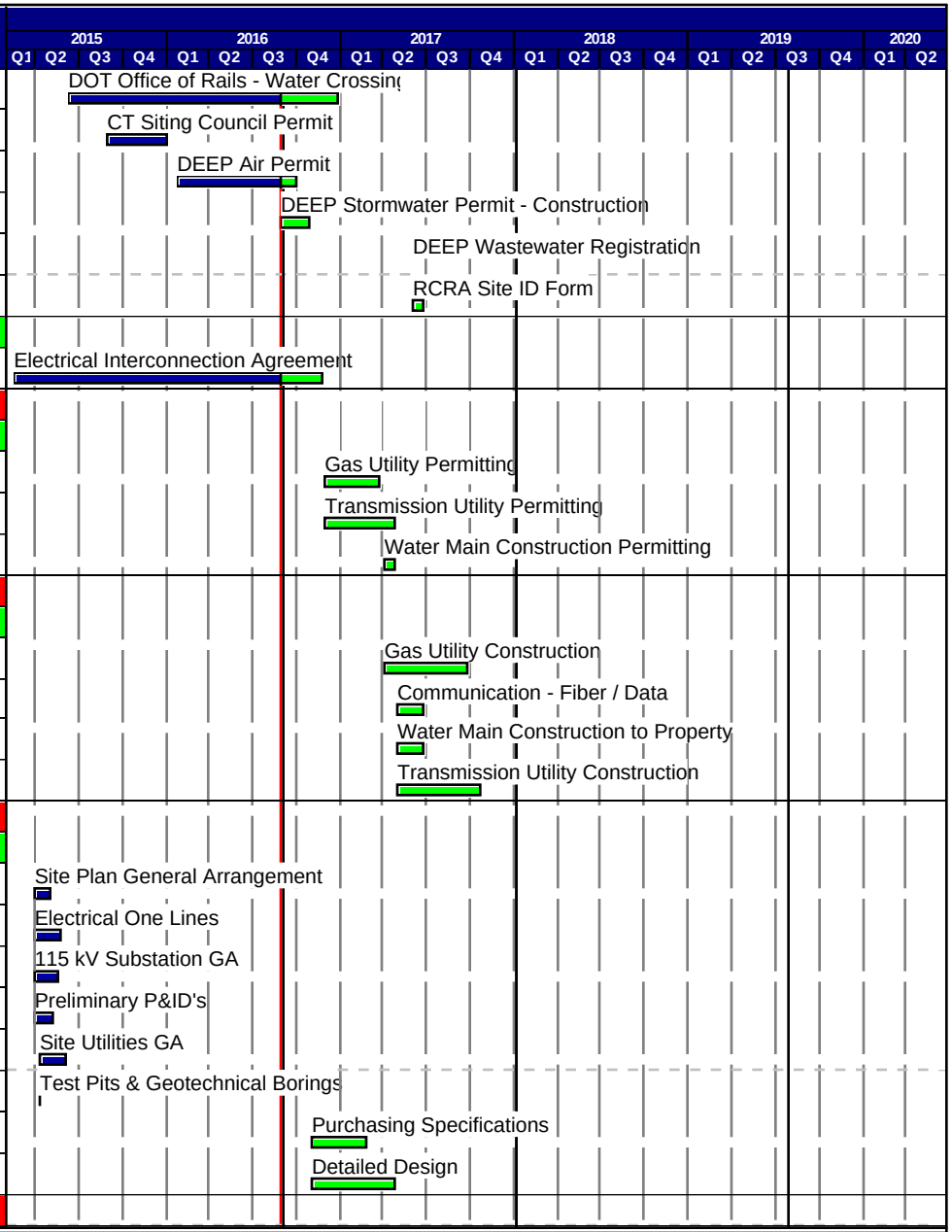
Act ID	Description	Orig Dur	Early Start	Early Finish
018	DOT Office of Rails - Water Crossing	442	12JUN15 A	31DEC16
008	CT Siting Council Permit	92	31AUG15 A	07JAN16 A
024	DEEP Air Permit	182	27JAN16 A	07OCT16
006	DEEP Stormwater Permit - Construction	45	30AUG16 A	31OCT16
016	DEEP Wastewater Registration	1	01JUN17 *	01JUN17
026	RCRA Site ID Form	22	01JUN17 *	30JUN17
24 - Regional / Federal				
014	Electrical Interconnection Agreement	466	16FEB15 A	01DEC16
06 - Off Site Utility Permitting				
020	Gas Utility Permitting	87	01DEC16 *	31MAR17
028	Transmission Utility Permitting	109	01DEC16 *	02MAY17
022	Water Main Construction Permitting	20	03APR17 *	28APR17
08 - Off Site Utility Construction				
030	Gas Utility Construction	129	03APR17 *	29SEP17
038	Communication - Fiber / Data	45	01MAY17 *	30JUN17
042	Water Main Construction to Property	45	01MAY17 *	30JUN17
044	Transmission Utility Construction	129	01MAY17 *	27OCT17
15 - Engineering				
056	Site Plan General Arrangement	31	30MAR15 A	11MAY15 A
058	Electrical One Lines	46	30MAR15 A	01JUN15 A
064	115 kV Substation GA	51	30MAR15 A	26MAY15 A
072	Preliminary P&ID's	1	01APR15 A	13MAY15 A
074	Site Utilities GA	41	13APR15 A	08JUN15 A
050	Test Pits & Geotechnical Borings	22	15APR15 A	17APR15 A
052	Purchasing Specifications	87	01NOV16 *	01MAR17
054	Detailed Design	129	01NOV16 *	28APR17
20 - Procurement - Purchase, Fabricate, Deliver				



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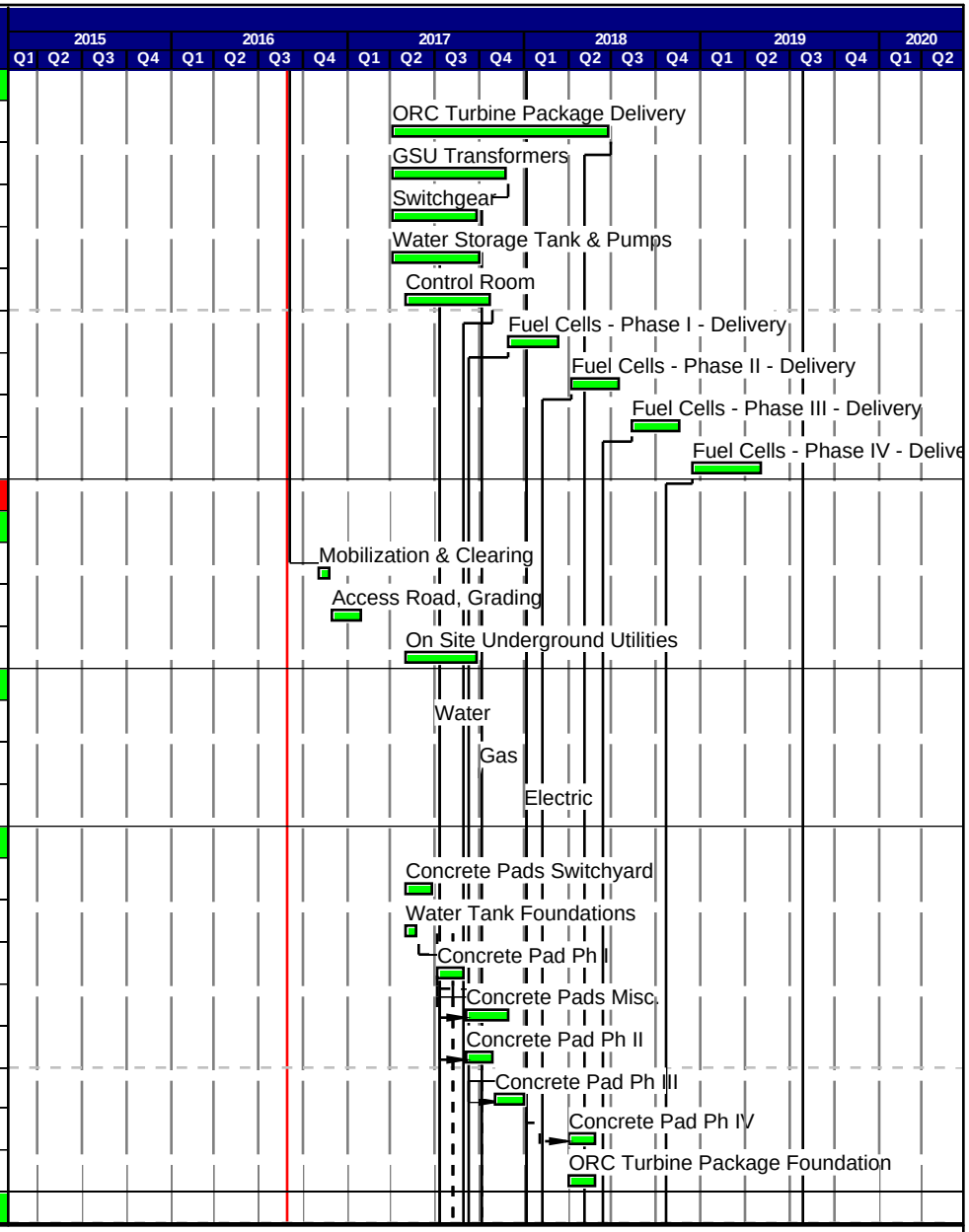
Act ID	Description	Orig Dur	Early Start	Early Finish
065	ORC Turbine Package Delivery	322	03APR17 *	29JUN18
066	GSU Transformers	172	03APR17 *	29NOV17
068	Switchgear	129	03APR17 *	29SEP17
144	Water Storage Tank & Pumps	130	03APR17 *	02OCT17
070	Control Room	128	01MAY17 *	26OCT17
060	Fuel Cells - Phase I - Delivery	75	01DEC17 *	19MAR18
061	Fuel Cells - Phase II - Delivery	74	06APR18 *	19JUL18
062	Fuel Cells - Phase III - Delivery	76	10AUG18 *	23NOV18
063	Fuel Cells - Phase IV - Delivery	100	14DEC18 *	06MAY19
25 - Construction				
02 - Site				
080	Mobilization & Clearing	22	01NOV16 *	30NOV16
146	Access Road, Grading	44	01DEC16 *	31JAN17
082	On Site Underground Utilities	108	01MAY17 *	28SEP17
04 - Utility Connections				
118	Water	1	30JUN17 *	30JUN17
148	Gas	1	02OCT17 *	02OCT17
094	Electric	1	02JAN18 *	02JAN18
06 - Foundations				
114	Concrete Pads Switchyard	42	01MAY17 *	27JUN17
150	Water Tank Foundations	20	01MAY17 *	26MAY17
084	Concrete Pad Ph I	44	03JUL17 *	01SEP17
116	Concrete Pads Misc.	66	01SEP17 *	01DEC17
108	Concrete Pad Ph II	44	04SEP17	02NOV17
110	Concrete Pad Ph III	44	03NOV17 *	05JAN18
112	Concrete Pad Ph IV	44	02APR18 *	31MAY18
152	ORC Turbine Package Foundation	44	02APR18 *	31MAY18
08 - Equipment Installation				



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Progress point
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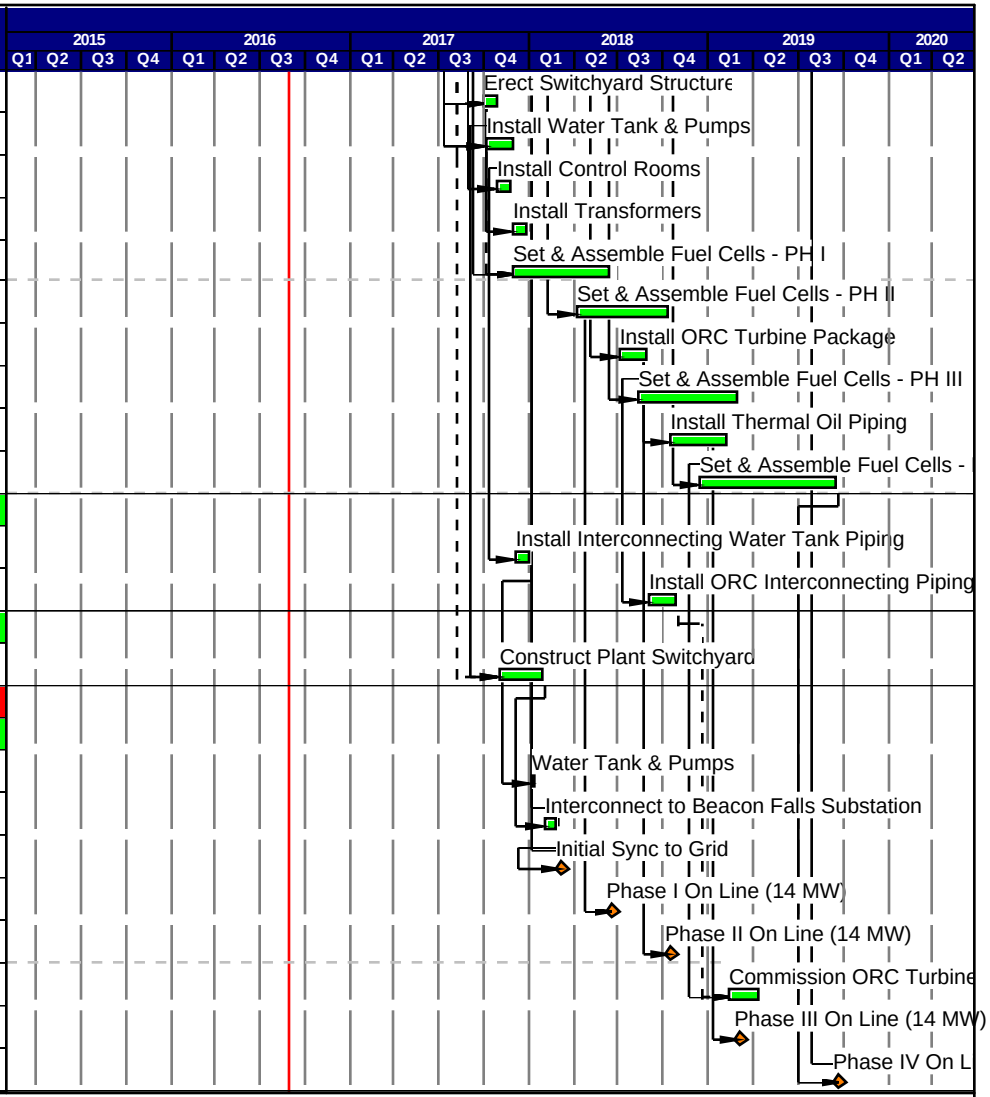
Act ID	Description	Orig Dur	Early Start	Early Finish
156	Erect Switchyard Structures	22	02OCT17	31OCT17
154	Install Water Tank & Pumps	45	03OCT17	04DEC17
160	Install Control Rooms	23	27OCT17	28NOV17
158	Install Transformers	22	30NOV17	02JAN18
086	Set & Assemble Fuel Cells - PH I	141	01DEC17	19JUN18
090	Set & Assemble Fuel Cells - PH II	136	06APR18	15OCT18
162	Install ORC Turbine Package	44	02JUL18	31AUG18
092	Set & Assemble Fuel Cells - PH III	146	10AUG18	05MAR19
164	Install Thermal Oil Piping	85	16OCT18	13FEB19
106	Set & Assemble Fuel Cells - PH IV	199	14DEC18	23SEP19
09 - Mechanical				
098	Install Interconnecting Water Tank Piping	20	05DEC17	03JAN18
104	Install ORC Interconnecting Piping	42	03SEP18	30OCT18
10 - Electrical - Switchyard				
102	Construct Plant Switchyard	64	01NOV17	31JAN18
30 - Equipment Testing & Commissionong				
166	Water Tank & Pumps	11	04JAN18	18JAN18
124	Interconnect to Beacon Falls Substation	22	01FEB18	02MAR18
168	Initial Sync to Grid	0	05MAR18	
126	Phase I On Line (14 MW)	0		19JUN18
128	Phase II On Line (14 MW)	0		15OCT18
122	Commission ORC Turbine Package	43	14FEB19	15APR19
130	Phase III On Line (14 MW)	0		05MAR19
132	Phase IV On Line (18.5 MW)	0		23SEP19



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