System Impact Study
For
WED Coventry, LLC & WED Coventry Two, LLC
Piggy Lane.
Coventry, RI 02816

2-1500 kW Three-Phase, Converter Based Synchronous Wind Turbine Generators

Interconnection to National Grid's 12.47 kV System

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Executive Summary

National Grid ("the Company") has completed the Impact Study, for the interconnection of the WED Energy, LLC, the ("Interconnecting Customer" or "IC"), proposed total 3000 kW comprised of two (2) 1500 kW Wind Turbine Facilities ("the Facilities") to its 12.47 kV distribution system ("the Projects") and presents the conclusions of the study herein. The requirements specified are exclusive to this project and are based upon the information submitted by the IC at the time the Interconnection Applications ("IA") were submitted. Any further design changes made by the IC post IA without National Grid's knowledge, review, and/or approval will render the findings of this report null and void.

Pursuant to R.I.P.U.C. No. 2078 requirements, the proposed Facility is an Independent Power Producer ("IPP") consisting of two (2) 1500 kW (AC) ("WIND TURBINE") renewable systems. The Facilities will be located at Piggy Lane, Coventry, RI 02816 and will be connected on the customer's side of new primary metering points at the points of common coupling (PCC) on the 54F1 circuit ("Point of Interconnection" or "POI").

The purpose of this study was to:

- Conduct, as applicable, steady-state, stability, short circuit, and extreme contingency analyses and perform assessments of reliability performance of the Company's Electric Power System ("EPS") within the area of interconnection, with and without the proposed Facility, in accordance and applicable with reliability standards and study practices, and in compliance with the applicable codes, standards, and guidelines listed in Section 5.1 of the Company's *Electric System Bulletin No. 756 Appendix C: Distributed Generation Connected to National Grid Distribution Facilities Per The Massachusetts Standards for Interconnecting Distributed Generation ("ESB756D")* to determine the incremental impact and any potential adverse impacts associated with the interconnection of the Facility to the EPS.

- Determine any System Modifications required.

- Develop a planning grade cost estimate of facilities required to interconnection the Facility to the EPS.

- Provide a report describing the results of the Impact Study.

The study determined the interconnection of the Facility to be feasible with certain operating conditions. The necessary System Modifications include, but be not limited to, the installation of zero sequence overvoltage protection and Direct Transfer Trip, (DTT) at Coventry 54

substation, two new 12.47 kV primary services with metering at each Point of Common Coupling ("PCC"), and installation of a pole top recloser and load break switch between each PCC and POI. The PCC shall be at the Interconnection Customer's deadend structures on the customer's side of each of the two primary metering points, and the POI shall be at pole 49-12 off Piggy Lane.

Cost Estimates

The total estimated planning grade cost of the work associated with the interconnection of the Facility, is **$1,126,540.00** +/-25%, and includes:

System Modifications to Company EPS $907,000
Engineering, design, construction and testing for revenue
Metering, feeder modifications, reclosers, disconnect switches,
And remote stations modifications

Interconnecting Customer Interconnection Facilities ("ICIF") $22,400
Engineering review and acceptance, and compliance
Verification of the ICIFs including all required drawings
And equipment spec reviews, relay settings, and construction
And testing assistance by engineering

Tax Liability[1] $197,140
Applied to all capital associated with System Modifications

This planning grade estimate will be deemed withdrawn if not accepted by the Customer within ninety (90) calendar days of receipt of the study. **Additional costs will be involved when the required pole work takes place in Verizon Maintenance Areas and/or special environmental permitting is required. The costs associated with Verizon's work will be billed directly to the customer from Verizon. It will be the responsibility of the customer to obtain any and all easements and required permitting for work that takes place on private property.**

Estimated Schedule

The estimated duration for the Company to complete construction of the System Modifications is 18-24 months, however, the schedule driver can be impacted by unknown factors over which the company has no control. The schedule driver may be impacted by the need for

[1] The estimated tax liability was calculated using the rate at the time the estimate was completed (11.29%). Actual costs shall be reflective of the tax liability rate at the time of invoicing.

special permitting and remediation required for construction adjacent wetlands and a registered superfund site.

The interconnection schedule is contingent on the Interconnecting Customer's successful compliance with the requirements outlined in this report and timely completion of its obligations as defined in *ESB756D, Exhibit 2: Company Requirements for Projects Not Eligible for the Simplified Process*. The schedule for the Company's work shall be addressed during the development, or after the execution, of the Interconnection Agreement.

1.0 Introduction

WED Energy, LLC has requested a Distributed Generation interconnection for two (2) 1500 kW, 3000 KW total, Converter based, Synchronous Wind Turbine, renewable systems to an electrical circuit in National Grid's EPS. The Interconnection Customer's proposed In-Service date included in the Interconnection Application dated January 3, 2012 is October, 2013, however, the requested in service date is not binding.

In accordance with the R.I.P.U.C. NO. 2078 tariff, the Company has completed an Impact Study to determine the scope of the required modifications to its EPS and/or the Facility for providing the requested interconnection service.

1.1 Study Objective

The primary objectives of this Impact Study are to:

1. Identify the System Modifications necessary for the Project to reliably interconnect to the Company's system[2];

2. Identify deficiencies in the proposed Facility;

3. Identify operating restrictions;

4. Identify and describe the equipment, engineering, procurement, construction, installation, testing and commissioning work, needed to build the System Modifications and integrate them with the Interconnecting Customer's Interconnection Facilities ("ICIF");

5. Provide good faith planning grade cost estimates, within a tolerance of +/- 25%, for the System Modifications identified in Objective #1 and engineering review and acceptance of the ICIFs; and

[2]Draft design and settings may require a detailed study at a later phase in the process.

6. Provide a good faith estimate of the time required to complete the construction and installation of the System Modifications.

2.0 Project Description

2.1 Facility

As depicted in the Interconnecting Customer's Site Diagram and One Line Diagrams (*Appendix A Site Diagrams and One- Lines, Figures: 2, 3, & 4, respectively*), there will be two 1500 kW sites, for a total of 3000 kW. Each site will consist of:

Site 1 WED (RI-14319785)

- (1) Goldwind GW82-1500, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to a 1600 kVA 690V/12.47 kV step up transformer with delta primary and wye-grounded secondary windings. The output of the step up transformer is connected to a 1600 kVA 12.47 kV/12.47 kV isolation transformer with wye reactively grounded primary and delta secondary windings. A pad mounted 15 kV class neutral reactor is also connected to the neutral of the isolation transformer.
- The output of the isolation transformer is connected to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The output of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

Site 2 WEDII (RI-14462941)

- (1) Goldwind GW82-1500, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to a 1600 kVA 690V/12.47 kV step up transformer with delta primary and wye-grounded secondary windings. The output of the step up transformer is connected to a 1600 kVA 12.47 kV/12.47 kV isolation transformer with wye reactively grounded primary and delta secondary windings. A pad mounted 15 kV class neutral reactor is also connected to the neutral of the isolation transformer.
- The output of the isolation transformer is connected to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.

- The output of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

The facilities will export power as they are proposed to be independent power producers. Once all documentation have been received, National Grid will issue a request for bidirectional meters that are adequate for net metering.

2.2 Service Configuration

The proposed location of the Facilities are normally served by National Grid's 7.2/12.47 kV three-phase, 4 wire, multi grounded wye, effectively-grounded EPS.

Based on the Project design at the time the study was performed, the Interconnection Facilities shall consist of a 3-phase line extension from pole 49-12, off Piggy Lane, Coventry, RI onto the property and to two (2) PCCs, one for RI-14319785 and one for RI-14462941. Pole 49-12 off Piggy Lane will be considered the POI for both projects. The line extension will be constructed by National Grid, and shall consist of seven (7) poles, approximately 700' of line, two (2) load break switches, two (2) pole-top reclosers, and two (2) primary metering assemblies, and all associated equipment to be located on the private property. (*See Appendix B-Interconnection Configuration & EPS Modifications*, *Figure 5: POI & PCC Configuration)*. The area of the proposed POI and PCC is near wetlands and a registered superfund site, additional permitting and special soil remediation methods may be required.

In accordance with the National Grid Specifications for Electrical Installations ("ESB 750 Series"), the Interconnection Customer shall install the deadend pole directly after each primary metering assembly, and the Company shall frame it, deadend its conductors, and install anchors and guys. On each deadend pole, the Interconnection Customer shall install a gang operated disconnect on the pole, and complete connections from the switch to the Company's conductors. (Additional detail is provided in ESB756D, Section 5.4.1.3 and Exhibit 7.)

The Point of Common Coupling (PCC) will be designated as the Customer side of the aforementioned connections. National Grid will install bi-

directional meters once all required documentation has been received. The Company's Design Personnel will determine the exact location of the Company's facilities and the customer's dead end pole. The Interconnecting Customer shall be responsible for obtaining all easements required for the line extension in accordance with the Company's requirements.

2.3 Area EPS

This area is normally supplied by National Grid's 54F1 feeder that originates out of National Grid's Coventry substation, a 12,470 V multigrounded and effectively grounded distribution feeder.

There are three sets of line fuses between the POI and substation, Pole 49 Perry Hill Rd, Pole 38 Perry Hill Rd, and Pole 35 Old Summit Rd. For an interconnection of this size, these single phase line fuses will cause coordination problems and must be replaced with reclosers. For this project the Line fuses on pole 49 Perry Hill Rd will be replaced with a recloser on pole 49-50 Piggy Lane, the line fuses on pole 38 Perry Hill Rd will be removed, and the fuses on pole 35 Old Summit Rd will be replaced by a recloser at the same location and a fused cutout (40K) will be installed on pole 50 Perry Hill Rd. (*See Appendix B- Interconnection Configuration & EPS Modifications*, *Figure 6: 54F1 Modifications)*.

The ability to generate is contingent on the proposed DG Facility being served by the 54F1 feeder during normal operating conditions. Under abnormal operating conditions, or if it is not supplied by the 54F1 feeder, it is not guaranteed that the DG Facility will be allowed to operate.

The current 54F1 characteristics are as follows:

- The daytime loading on 54F1 feeder has varied between a peak of 9.3 MVA and a minimum of 2.5 MVA, at time of expected maximum generation, over the past year.

- Total aggregate generation interconnected/in-process on the 54F1 feeder is 1500 kW including this application at this time.

- The 54F1 feeder is regulated by single phase regulators located within the substation and has no additional voltage regulators installed outside the substation between the POI and the substation.

- The 54F1 has five (5) existing line reclosers installed outside the substation. One (1) is installed between the POI and the substation feeder breaker.

- The 54F1 feeder has 1800 kVAR of capacitance installed outside the substation.

Location	Size (kVAR)	Control
P 107 Hill Farm Rd / Coventry	600	T/V
P 63 Victory Hwy / Coventry	600	T/V
P 577 Flat river Rd / Coventry	600	T/V

Table 1 - 54F1 Capacitor Locations

No capacitor modifications are required as a result of this interconnection.

2.4 Revenue Metering Requirements

If not already provided, the Interconnecting Customer shall provide a telecommunication line to National Grid's revenue meters in accordance with ESB756D, Section 5.4.2. The Customer should provide an analog /POTS (Plain Old Telephone Service) phone line to each National Grid owned revenue meter location. The phone line must be capable of direct inward dial without human intervention or interference from other devices such as fax machines, etc. National Grid will specify, test, install, and own the voltage and current transformers necessary to meet the metering requirements for this project. (See *Appendix C - Outdoor Meter Installations, Figures 7- 8: Revenue Meter Phone Line Installation Guide)*

The Interconnecting Customer is responsible for all costs associated with the line construction

3.0 Power Flow Analysis

The power flow analysis was substantially performed using CYMDIST. A model of the 54F1 circuit was developed based on data extracted from the National Grid GIS and field verified on March, 2013.

The analysis considered cases at minimum and peak load, at time of expected maximum generation for the following cases:

- The 54F1 in a normal configuration Peak load of 9.3 MVA @ 94% PF Lagging

- The 54F1 in normal configuration Min load of 2.5 MVA @ 99 % PF Leading.

3.1 General Loading Analysis

An analysis of the feeder loading, with and without the wind turbine system operating, was performed and demonstrated that the addition of the DG Facility will not create thermal loading problems on the 54F1 circuit, or at Coventry Substation. Specifically, no conductor, or transformer overloads occur. All National Grid owned mainline conductor and distribution facilities are thermally large enough to accommodate the added capacity from the 1500 kW Wind Turbine facility.

3.2 Reverse Power Flow

The possibility of the Facility causing reverse power flow into the Company's EPS was reviewed. At peak export (i.e., 1500 kW), the excess generation from the Facility will be absorbed by the 54F1 circuit.

3.3 Voltage Analysis

The supply circuits are regulated and therefore the Company is obligated to hold voltages at customer service points to defined limits in ANSI Standard C84.1- 2006. The Wind Turbine interconnections shall not contribute to greater than a 3.0% change in voltage on the EPS under any conditions.

In summary, there are no reports of overvoltage conditions on the Company's EPS with the generation interconnection site at full power during studied cases.

The Company will not be held liable for any power quality issues that may develop with any customers as result of the interconnection of this generation.

3.4 Flicker Analysis

The *IEEE Recommended Practice for Measurement and Limits of Voltage Fluctuations and Associated Light Flicker on AC Power Systems*, IEEE Std. 1453-2004 provides guidance on flicker and voltage fluctuations.

Based upon the Flicker Data received on January 16, 2014, the predicted flicker and voltage fluctuations are expected to be acceptable.

4.0 Short Circuit and Protection Analysis Company Facilities

The Company performed a protection review of WED Energy, LLC proposed interconnection of a 1500 kW Wind Turbine, converter based generator to the 54F1, a 12.47 kV distribution circuit served from Coventry Substation. This review will identify EPS enhancements that are necessary to complete the interconnection project and its ability to meet R.I.P.U.C. NO. 2078 interconnection tariff and the requirements of The Company's ESB 756D. The protection impact study will address the following items:

4.1 Temporary Over-Voltages on Transmission Supply

Detailed analysis of the load to generation match on the Coventry T1 supply transformer, which supplies the 54F1 circuit, during minimum load and maximum generation conditions indicates that both facilities combined poses significant risk of causing temporary over-voltage condition to develop on the 23 kV system. Consequently, zero sequence overvoltage protection will be required to be installed on the 23 kV side of the Coventry, 23 kV- 12.47 kV Grd-Y/7.2 kV, supply transformer (T1).

4.2 Fault Current Contributions

Tables 2 & 3 summarize the generation effect on fault current levels at each PCC for Facility 1 and Facilities 1 & 2 combined, respectively. These fault currents are within existing equipment ratings and will not upset existing device coordination on the feeder. The customer is responsible for ensuring that their own equipment is rated to withstand the available fault current according to the NEC and National Grid ESB 750, which specifies that the fault current should be no more than 80% of the device interrupting rating.

Fault Duty Pre and Post Project
RI -14319785 With 15 Ohm Neutral grounding Reactor

Pre-Project:			Post-Project				
Fault Location	Fault Type	Pre-Project Amps	Post-Project Amps	*Δ%	System Impedance @ PCC Post Project		
12.47 kV Substation Bus	Line to Grd	4039	4113	1.83%	Positive Sequence Impedance (Ω)	Negative Sequence Impedance (Ω)	Zero Sequence Impedance (Ω)
	Three Phase	3443	3530	2.53%			
12.47 kV PCC RI-14319785	Line to Grd	NA	900	NA	1.248+j4.079	2.988+j 6.074	4.191+j11.611

	Three Phase	NA	1191	NA			
*Δ% = (Post-Pre)/Pre							

Table 2 - Fault Current Levels (in amperes) Facility 1 (RI-14319785)

Fault Duty Pre and Post Project RI -14319785 & RI - 14462941 Combined 15 ohm Neutral Grounding Reactor on each Isolation Transformer							
Pre-Project:			Post-Project				
Fault Location	Fault Type	Pre-Project Amps	Post-Project Amps	*Δ%	System Impedance @ PCC Post Project		
					Positive Sequence Impedance (Ω)	Negative Sequence Impedance (Ω)	Zero Sequence Impedance (Ω)
12.47 kV Substation Bus	Line to Grd	4039	4167	3.17%			
	Three Phase	3443	3610	4.85%			
12.47 kV PCC RI-14319785	Line to Grd	NA	1038	NA	0.704+j3.017	2.996+j6.079	2.778+j9.631
	Three Phase	NA	1288	NA			
12.47 kV PCC RI-14462941	Line to Grd	NA	1009	NA	0.761+3.092	3.160+j6.208	2.899+j9.949
	Three Phase	NA	1256	NA			
*Δ% = (Post-Pre)/Pre							

Table 3 Fault Current Levels (in Amperes) Facilities 1 & 2 Combined (RI-14319785 & RI-14462941 Combined)

The 12.47 kV system impedance shown at the PCC and is in ohms. The value is taken from the model developed using ASPEN Oneliner. The model was based on the proposed installation of a neutral grounding reactor with an impedance of 15 ohms on the primary neutral of each of the customer's proposed 1600 kVA, 12470V Y – 12470V Delta isolation transformers, each with a 5% impedance, where, each is in series with a 12470 V Delta - 690 V Grd-Y/ 398 V generator step-up transformer, each with an impedance of 6%. Refer to (*Appendix A Site Diagrams and One-Lines, Figures: 2, 3, & 4, respectively*). If a different configuration is used other than that depicted in the one-line of record, provided for evaluation, the Short Circuit and Protection Analysis will need to be re-evaluated.

The customer is responsible for ensuring that their equipment is rated to withstand the available fault current.

5.0 Protection Analysis Customer Facilities

The protection review consisted of a review of customer's transformer connection and protection scheme and assessment of protection and transfer trip requirements. This Facility shall comply with the relevant provisions of R.I.P.U.C. NO. 2078 Dec 2009 and requirements of ESB-756D, as applicable. Please note that applicable sections of ESB-756D are referenced for information purposes and may not comprise the entirety of applicable sections. The key requirements for this Project include, but are not limited to:

5.1 Disconnect Switch

Per ESB 756D, Section 5.6 & R.I.P.U.C. NO. 2078: The Facility shall provide a disconnect switch (or comparable device mutually agreed upon by the Parties) at the point of Facility interconnection that can be opened for isolation. The switch shall be in a location easily accessible to Company personnel at all times. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum generator output and be capable of being locked open, tagged, and grounded on the Company side by Company personnel. The Company shall exercise such right in accordance with Section 7.0 of the interconnection tariff.

The Customer's one-line shows the required disconnect switch and meets the requirement. The Customer must provide the Company with 24/7 unlimited access and control of this switch.

5.2 Unintentional islanding

Inverters/converters shall be in compliance with ESB 756D 5.7.10.1 Photovoltaic Generation and R.I.P.U.C. NO. 2078 section 4.2.1 General requirements, where all inverters must be IEEE 1547 compliant and UL-1741 certified inverters shall be equipped with an internal anti islanding scheme and active under voltage (27), over voltage (59), zero sequence over voltage (59N), under frequency (81U) and over frequency (81O) relays.

The Goldwind converters are not UL 1741-2005/ IEEE1547 compliant. Analysis indicates that there is likely ability for these facilities to remain in operation in excess of 2 seconds should and islanding condition develop.

5.3 Direct Transfer Tripping

Refer to section 5.2 above, a direct transfer tripping system, if one is required by either the Interconnecting Customer or by the Company, shall use equipment generally accepted for use by the Company and shall, at the option of the Company, use dual channels.

DTT will be required for this interconnection, the requirements are as follows:

- National Grid's Standard is model S00763PF which uses the Guard Before Trip feature for DTT applications.

- The generator breaker should be tripped for relay/breaker Loss of Potential (LOP), Relay failure, loss of Guard signal, and receive the trip signal. Relay failure, LOP and loss of guard signal should have a 30s delay to trip the breaker. This is to avoid nuisance tripping due to the system transients.

- Since National Grid does not specify the relay type, any timer that is equivalent to an ABB RXKL1 is acceptable.

- When the order actually takes place, both the transmitter and receiver should be ordered from RFL as a package.

- Even if there are different orders for the transmitter and the receiver, the receiver order from the customer and the transmitter order from National Grid, RFL needs to be informed of this to insure that the two devices will talk to each other. RFL will test them together before shipping to National Grid/customer.

- National Grid will also specify all trip and guard frequencies. National Grid uses default settings of the groups 3 and 5 to set the guard and trip frequencies.

    - Group 3:
      Tone 1 Tx: 1540Hz (trip) 1690Hz (Guard)
      Tone 1 Rx: 2030Hz (Trip) 1880Hz (Guard)

    - Group 5:
      Tone 2 Tx: 2220 Hz (Trip) 2370 Hz (Guard)
      Tone 2 Rx: 2710Hz (Trip) 2560 Hz (Guard)

5.4 Interconnection Interrupting Device

In accordance with ESB 756D, Sections 5.7.2 and 5.7.10.1

The Customer's one-line meets the above requirement.

5.5 Synchronizing Devices

The project is inverter/converter based, not applicable.

5.6 Transformers

The Company reserves the right to specify the winding connections for the transformer between the Company's voltage and the Facility's voltage (Interface Transformer) as well as whether it is to be grounded or ungrounded at the Company's voltage. **Refer to ESB-756D section 5.7.**

This project has two proposed facilities, each with a 1600 kVA, 12.47 kV, reactively grounded Wye, primary, with a fully insulated and isolated neutral with a 12.47 kV Delta secondary, with an impedance of 5.0%, isolation transformer, in series with a 1600 kVA, 12.47 kV, Delta primary, with a 690 V Grd-Y /398 V secondary, with an impedance of 6.0% generator step-up, (GSU), transformer.

The proposed configurations are acceptable provided each isolation transformer is grounded through its own 15 ohm neutral grounding reactor.

5.7 Voltage Relays

Voltage relays shall be frequency compensated to provide a uniform response in the range of 40 to 70 Hz. Refer to ESB 756D section 5.7.6. For a primary wye (high side) / delta (low side) transformer, requires voltage sensing on the delta winding. This can be accomplished using wye-grounded / wye-grounded VTs connected to the delta.

The existing one line depicts primary voltage sensing on the wye primary of each isolation transformer, where (27, 59, & 51C 51GC elements), on each SEL 351A relay control each primary main breaker at each facility. The one-line does not meet the requirement. Voltage sensing must be placed on the delta winding

5.8 Overcurrent Relays

Per section 5.7.8 of the ESB 756D Overcurrent protection is required on the high side of the DG Customer's interface transformer to detect faults on the Company's EPS. Voltage controlled overcurrent elements (51C) are required for both phase and ground. At a minimum, these relays shall utilize voltage sensing via Yg-Yg VTs on the transformer's secondary or primary to detect the single line-to-ground faults on either the primary or secondary sides of the transformer. The 51C elements shall trip the high side/or low side interrupting device. Typical 51C pickup setting are generally less than rated generation output and in this application the use of **US Extremely inverse (U4) TCC is preferred** .

The one-line shows the required 51C elements, however, the settings must be altered (Pickups lowered) to meet the above requirements.

5.9 Protective Relay Hard-Wire Requirement:

Unless authorized otherwise by the Company, protective relays must be hardwired to the device they are tripping. Further, interposing computer or programmable logic controller or the like is not permitted in the trip chain between the relay and the device being tripped.

The customer's one-line must be updated to meet these requirements.

5.10 Protective Relaying Redundancy

Refer to ESB 756D converter-based WIND TURBINE Generator Equal or Above 500k. The relays at the inverter terminal shall provide the redundant protection for voltage and frequency elements. However, the relay equipped for overcurrent protection has no redundancy, National Grid requires that the relay alarm contact should be wired to trip the switchgear when the relay fails, not in service or the DC supply voltage to the relay is lost. There will be 2s time delay in tripping the switchgear. A timer needs to be added to the switchgear's trip circuit or the internal relays must be programmed to include the delay.

An updated stamped one-line must be submitted satisfying this requirement.

5.11 Protective Relay Supply

Refer to ESB 756D section 5.7.10.4. Where protective relays are required in this Section, their control circuits shall be DC powered from a battery and battery charger system. Solid state relays shall be self-powered, or DC powered from a battery and battery charger system. If the Facility uses a

Company-acceptable non-latching interconnection contactor, AC powered relaying may be allowed provided the relay and its method of application are fail safe, meaning that if the relay fails or if the voltage and/or frequency of its AC power source deviate from the relay's design requirements for power, the relay or a separate fail-safe power monitoring relay acceptable to the Company will trip the generator, after a 2 second time delay, by opening the coil circuit of the interconnection contactor.

The relay control power has not been shown to be battery powered, a new one-line must be submitted that meets the requirement.

5.12 Current Transformers ("CT")

Refer to ESB 750C section 5.7.4.1. CT ratios and accuracy classes shall be chosen such that secondary current is less than 5 amperes and transformation errors are consistent with Company practices.

The one-line shows 300:5 CTs and meets requirement.

5.13 Voltage Sensing and Voltage Transformers ("VT")s and Connections

Transformer options based on the selected transformer configuration to detect the Under Voltage, and provide voltage detection for a voltage controlled over current (51C) element. Refer to ESB 756D sections 5.7.4.2 and 5.7.8. For a primary wye-reactively grounded isolation transformer with a secondary delta transformer in series with a delta primary – wye grounded secondary generator step-up transformer: At a minimum, wye-grounded - wye-grounded VTs shall be installed on the transformer's delta to detect line to ground faults. If it is within the relay's capability, the relay may be direct connected to the transformer delta.

The one-line shows 60:1 VTs configured Y grounded – Y grounded, connected to the primary wye of the isolation transformer, but lacks the required Y grounded – Y grounded VTs on the delta windings of the isolation and GSU transformers. A new one-line must be submitted that meets this requirement.

5.14 High-Speed Protection

The Facility may be required to use high-speed protection if time-delayed protection would result in degradation in the existing sensitivity or speed of the protection systems on the Company's EPS.

High speed protection is not required.

5.15 Service Entrance Equipment

The Interconnection Customer shall furnish, install, own, and maintain service entrance equipment in accordance with applicable requirements set forth in ESB 750, Section 5, and ESB756D, Section 5.4.1.3 and Exhibit 7.

The Customer's project one-line meets the above requirement.

5.16 Surge-Withstand capability

The interconnection system shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Standard C62.41.2-2002 or IEEE Standard C37.90.1-2002 as applicable.

5.17 Additional Requirement

The R.I.P.U.C. No. 2078, requires that, the Distributed Resources (DR) cease to energize the area EPS within 2 seconds, refer to IEEE1547 and UL1741. The Interconnection system's response to abnormal frequencies. Section 4.2.3.2.1 requires that NPCC Directory 12 Figure 1 Curve "Standards for Setting Underfrequency Trip Protection for Generators" for the Eastern Interconnection be followed. It is important that clearing time should be the time that the relay trips plus breaker operating time.

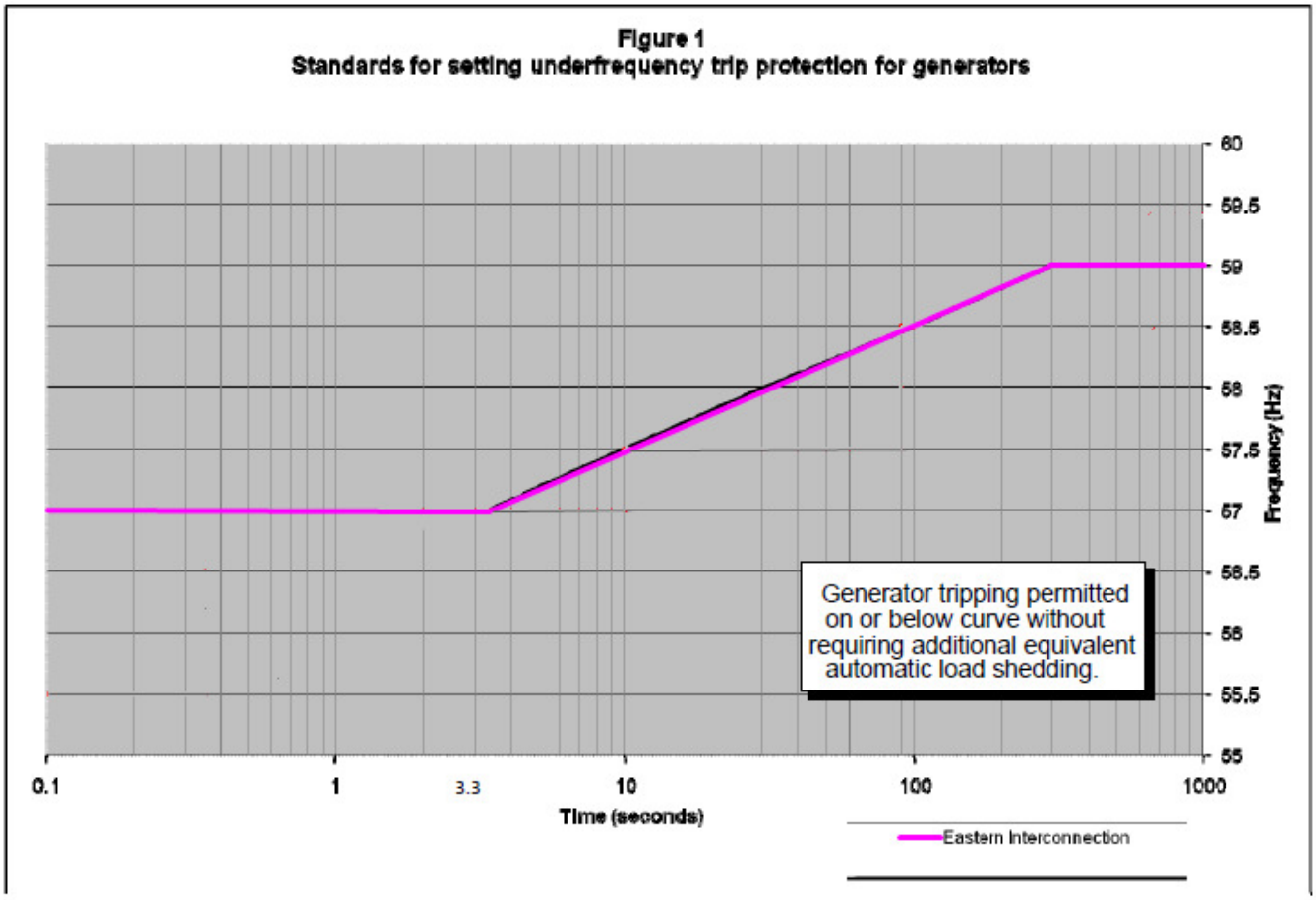

Figure 1: NPCC Directory 12 Figure 1 Curve

The under frequency setting points should also comply with the NPCC standard for setting under frequency trip protection. Per the NPCC Directory 12 Figure 1Curve, if the setting falls above the curve, there must be an equivalent amount of load shed when tripped, which in this case cannot be done and therefore the 81 under frequency must be set on or below the curve. Per NPCC Directory 12 Figure 1 Curve for the Eastern Interconnection:

The inverters/converters', and or, generator's internal relays shall also meet the NPCC Directory 12 Figure 1 Curve requirements for the Eastern Interconnection.

The IC must submit a PE stamped one-line that provides the inverters' internal relay settings.

The submitted settings for the generators' internal settings do not meet the requirements of Figure 1 above and a new PE stamped one-line with corrected settings must be submitted for review and approval.

5.18 Protection Scheme Assessment

The customer must submit a PE stamped one line which includes the required redundant relay settings, inverter internal relay settings, and meets all the requirements specified within this document, to the Company for review and approval before an interconnection application can move forward.

6.0 Telemetry and Telecommunications

The IC is an Independent Power Producer (IPP) and consequently no RTU is required.

7.0 Inspection, Compliance Verification, Customer Testing, and Energization Requirements

7.1 Inspections and Compliance Verification

For this study, the DG Facility is deemed as an Independent Power Producer pursuant to applicable RI state jurisdictional requirements. A municipal electrical inspection approval certificate from the local authority having jurisdiction is required of the DG Customer's facilities (i.e. primary service entrance conduit, primary switchgear, wiring, and generation equipment). The Company must receive the DG Customer's Draft set of installation drawings, equipment data, and test plan for the functional verification tests at least four (4) weeks before the Company's field audit.

The DG Customer shall adhere to all other Company related verification and compliance requirements as set forth in the applicable ESB 750 series documents. These and documented acceptance testing requirements of these facilities will be specified during the Draft design review of the Project prior to the Company's field audit and energization.

7.2 Testing and Commissioning

The Interconnection Customer shall submit initial relay settings to the Company no later than twenty-one (21) calendar days following the Company's acceptance of the Facility's service connection's Draft MA state licensed professional engineer sealed design. If changes/updates are necessary, the Company will notify the Interconnection Customer three (3) business days after the initial relay settings were received, and the Interconnection Customer shall submit the revised settings within seven (7) calendar days from such notification. Within three (3) business days of receipt of the proposed Draft relay settings, the Company shall provide comments on and/or acceptance of the settings. If the process must continue beyond the above evolution due to errors in the relay settings, the Company retains the right to extend the Testing and Commissioning process, as needed, to ensure the Draft relay settings are correct.

Assuming no major issues occurring with the relay settings, the Interconnection Customer shall submit a Testing and Commissioning Plan (TCP) to the Company for review and acceptance, no later than forty-five (45) calendar days following the Company's acceptance of the Facilities Draft design. The TCP must be Finalized, including Company acceptance, no later than six (6) weeks prior to functional testing.

7.3 Energization and Synchronization

The "Generator Disconnect Switch" at the interconnection point shall remain "open" until successful completion of the Company's field audit and witness testing. Prior to the start of construction, the DG Customer shall designate an Energization Coordinator (EC), and prepare and submit an Energization Plan (EP) to the Company for review and comment. The energization schedule shall be submitted to the Company and communicated with the Company's local Regional Control Center at least two (2) weeks in advance of proposed energization. Further details of the EP and synchronization requirements will be specified during the Draft design review of the Project.

The DG Customer shall submit as-built design drawings to the Company 90 days following commercial operation of their DG Facility.

8.0 Cost Estimates

The non-binding good faith cost planning grade estimate for the Company's work associated with the interconnection of this Facility to the EPS, as identified in this report, is **$1,126,540.00** +/-25%, and includes:

RI-14319785 & 14462941						
National Grid Work Item	Conceptual Cost +/-25% Planning Grade Cost Estimate not including Tax Liability				Associated Tax Liability $ @ Applied to capital	Total Customer Costs includes Tax Liability on Capital Portion
System Modifications NECO	Pre-Tax Total $	Capital	O&M	Removal	22.58%	Total $
54F1 Modifications Install reclosers on pole 49-50 Piggy Ln and pole 35 Logbridge Rd Install Loadbreak on pole 38 Perry Hill	$133,000.00	$127,000.00	$6,000.00	$0.00	$28,680.00	$161,680.00
Install zerosequency OV protection on Covetry 23- 12.47 kV Grd-Y /7.2 kV supply transformer and DTT on 54F1 feeder recloser	$491,000.00	$463,000.00	$28,000.00	$0.00	$104,550.00	$595,550.00
Build 3 Phase line extension from Pole 31 onto customer property, included in this work is the installation of (1) Loadbreak switch , (1) recloser, and (1) Primary Metering assembly. Also includes pole replacements P30, P31, & P32 Reynolds Rd	$283,000.00	$283,000.00	$0.00	$0.00	$63,910.00	$346,910.00
SUBTOTAL System Modifications NECO	**$907,000.00**	**$873,000.00**	**$34,000.00**	**$0.00**	**$197,140.00**	**$1,104,140.00**
Interconnecting Customer Interconnection Facilities ("ICIF")	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.58%**	**Total $**
Witness Testing	$5,000.00	$0.00	$5,000.00	$0.00	$0.00	$5,000.00
EMS Integration	$5,600.00	$0.00	$5,600.00	$0.00	$0.00	$5,600.00
Program Management	$1,800.00	$0.00	$1,800.00	$0.00	$0.00	$1,800.00
Review and Implementation of protective device settings	$10,000.00	$0.00	$10,000.00	$0.00	$0.00	$10,000.00
SUBTOTAL	**$22,400.00**	**$0.00**	**$22,400.00**	**$0.00**	**$0.00**	**$22,400.00**
	Pre-Tax Total $	**Capital**	**O&M**	**Removal**	**Tax Liability**	**Total $**
TOTALS	**$929,400.00**	**$873,000.00**	**$56,400.00**	**$0.00**	**$197,140.00**	**$1,126,540.00**

Table 4 - Cost Estimates

This **$1,126,540.00 +/- 25%total** planning grade estimate is based on information provided by the Interconnecting Customer for the study, and is prepared using historical cost data from similar projects. The associated tax effect liability included is the result of an IRS rule, which states that all costs for construction collected by

National Grid, as well as the value of donated property, are considered taxable income.[3]

This estimate is valid for ninety (90) calendar days from the issuance of this report. If the Interconnection Customer elects to proceed with this project after the ninety (90) calendar days, a revised estimate may be required.

9.0 Conclusion

The project was found to be feasible. It will be allowed to interconnect with certain modifications and additions to the local National Grid distribution Electric Power System (EPS) the Interconnecting Customer's equipment. The estimated planning grade cost for the Company's work associated with the Project is **$1,126,540.00** +/- 25%.

The present interconnection configuration and protection scheme submitted for review must be modified to meet National Grid's specific protection requirements. The customer must submit a PE stamped electrical one-line along with the required relay settings, that meets all the requirements specified within this document, to National Grid for review and approval, before an interconnection application can move forward.

A Detailed Study with +/- 10% estimates may be required if the total project cost, less tax liability, is greater than $500,000. The Company shall issue a Detailed Study Agreement for execution if required.

A milestone schedule shall be included in the Interconnection Agreement and shall be reflective of the tasks identified in ESB756D, Exhibit 2. Upon execution of the Interconnection Agreement, and prior to advancing the project, the Interconnecting Customer shall provide a detailed project schedule, inclusive of the Exhibit 2 tasks referenced above. After completion of Draft design and all associated applications, fees, permitting and easement requirements are satisfied, System Modifications for this Project will be placed in queue for construction.

If an Interconnecting Customer fails to meet the R.I.P.U.C. No 2078, Section 3.4 Time Frames and does not provide the necessary information required by the Company within the longer of 15 days or half the time allotted to the Company to perform a given step, or as extended by mutual agreement, then the Company may terminate the application and the Interconnecting Customer must re-apply.

[3] Actual charges shall include the tax rate in effect at the time the charges are incurred.

Note: Authorization for parallel operation will not be issued without a fully executed Interconnection Agreement, receipt of the necessary insurance documentation, and successful completion of the Company approved witness testing. Such authorization shall be provided in writing.

10.0 Revision History

Version	Date	Description of Revision
1.0	04/17/14	Final for RI-14319785/14462941, WED & WEDII Energy, LLC

Appendix A IC Site and One-line Diagrams

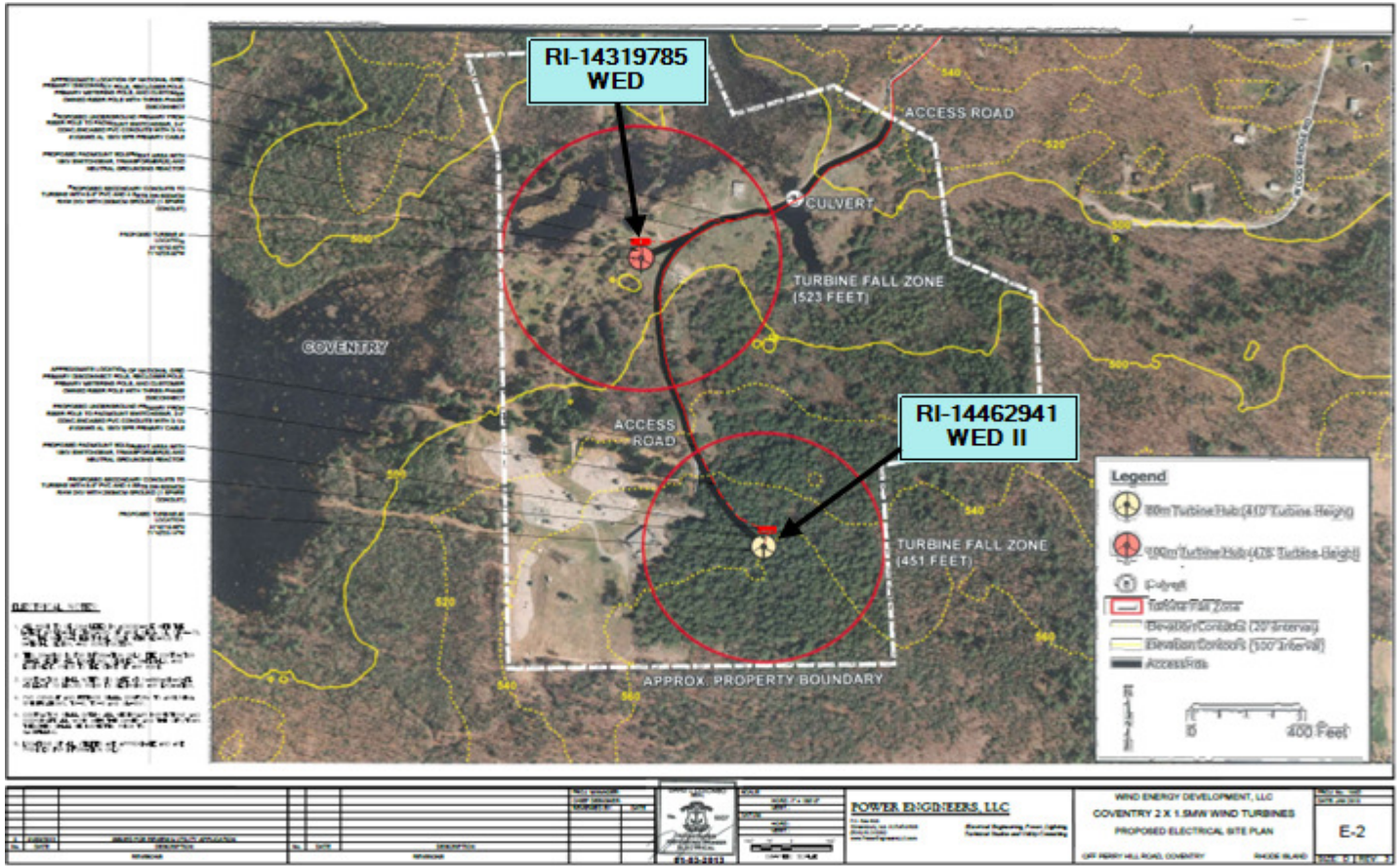

Figure 2: Site Diagram

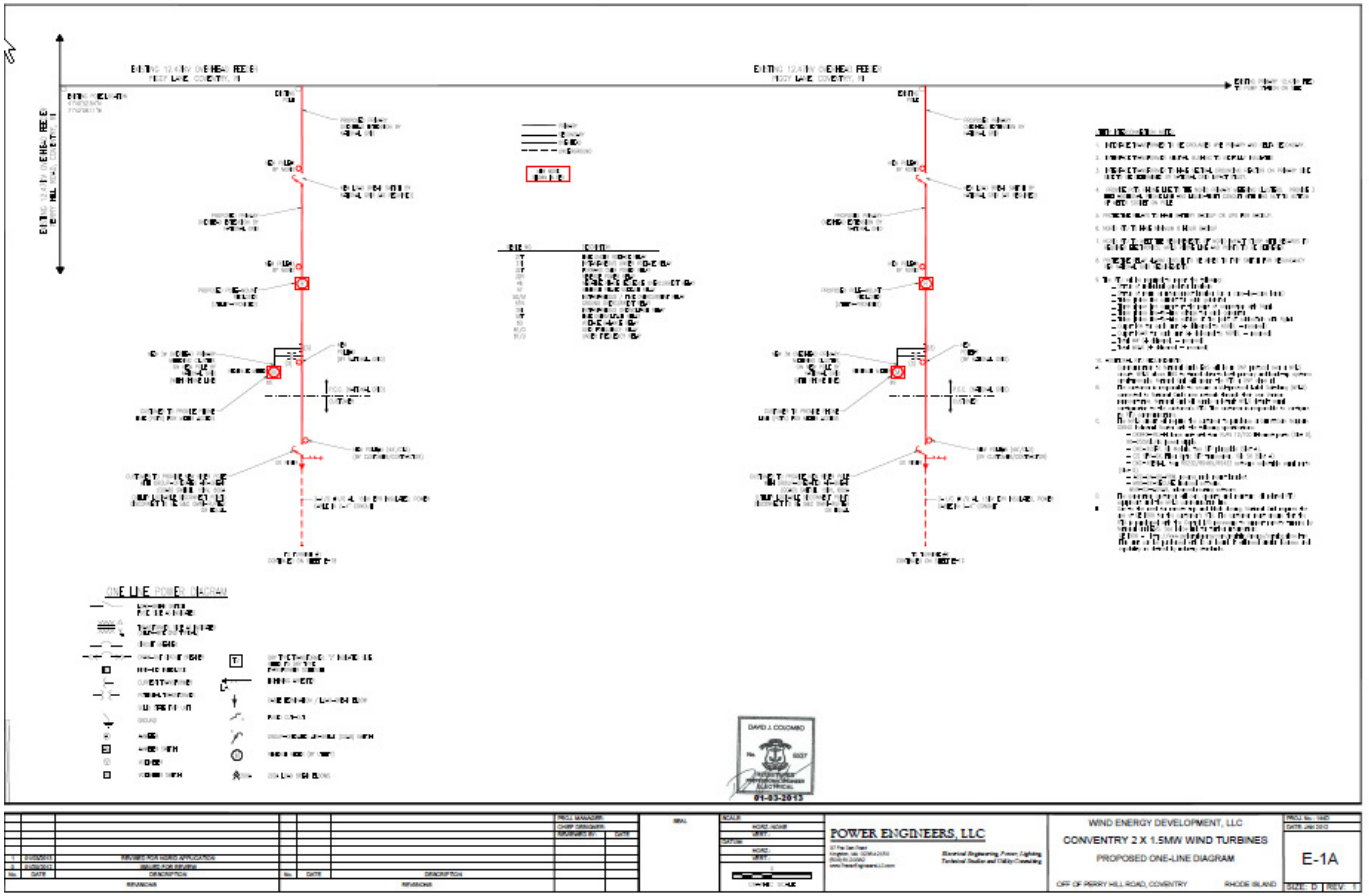

Figure 3: Project One-Line

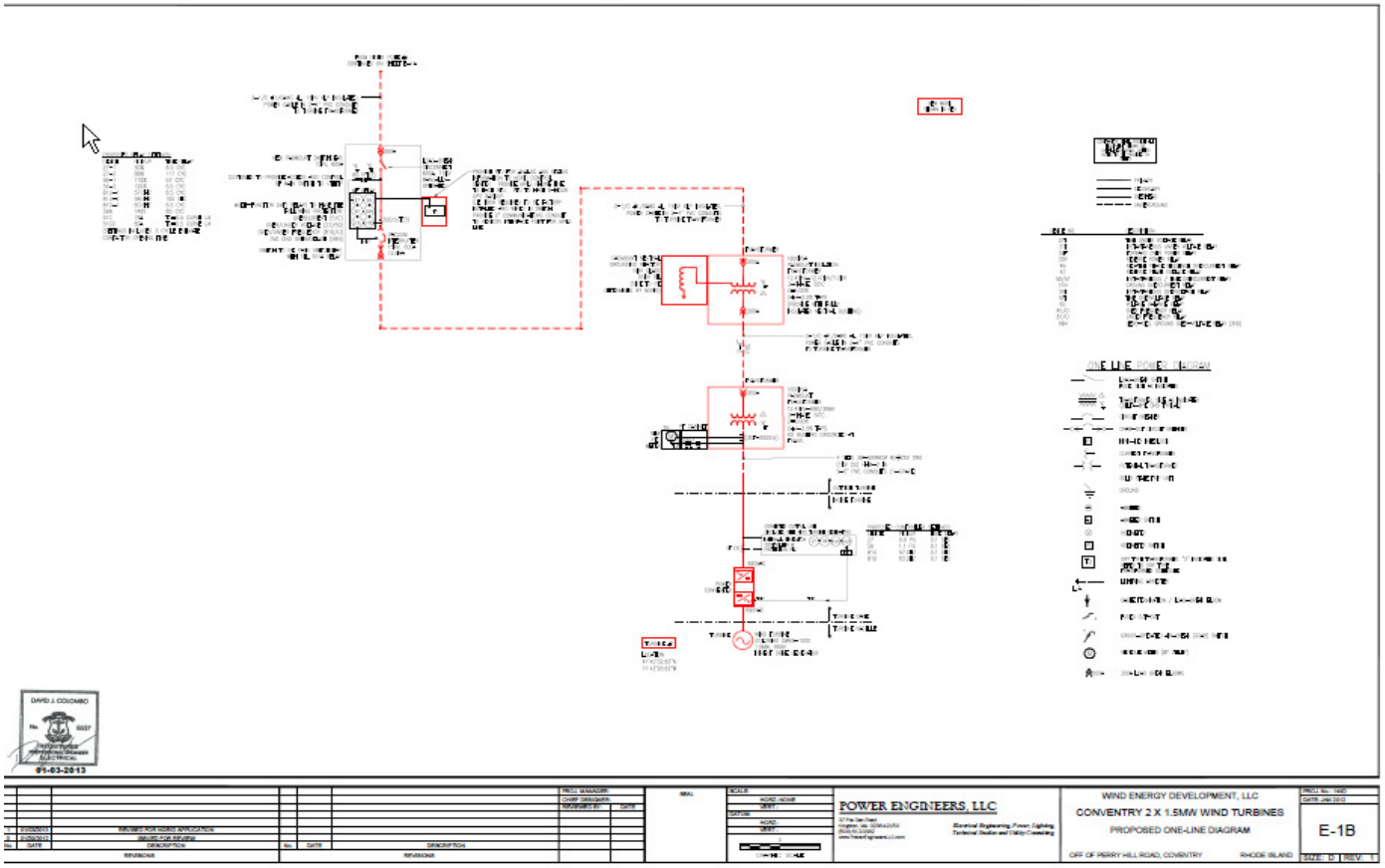

Figure 4: Project One-Line

Appendix B Interconnection Configuration & EPS Modifications

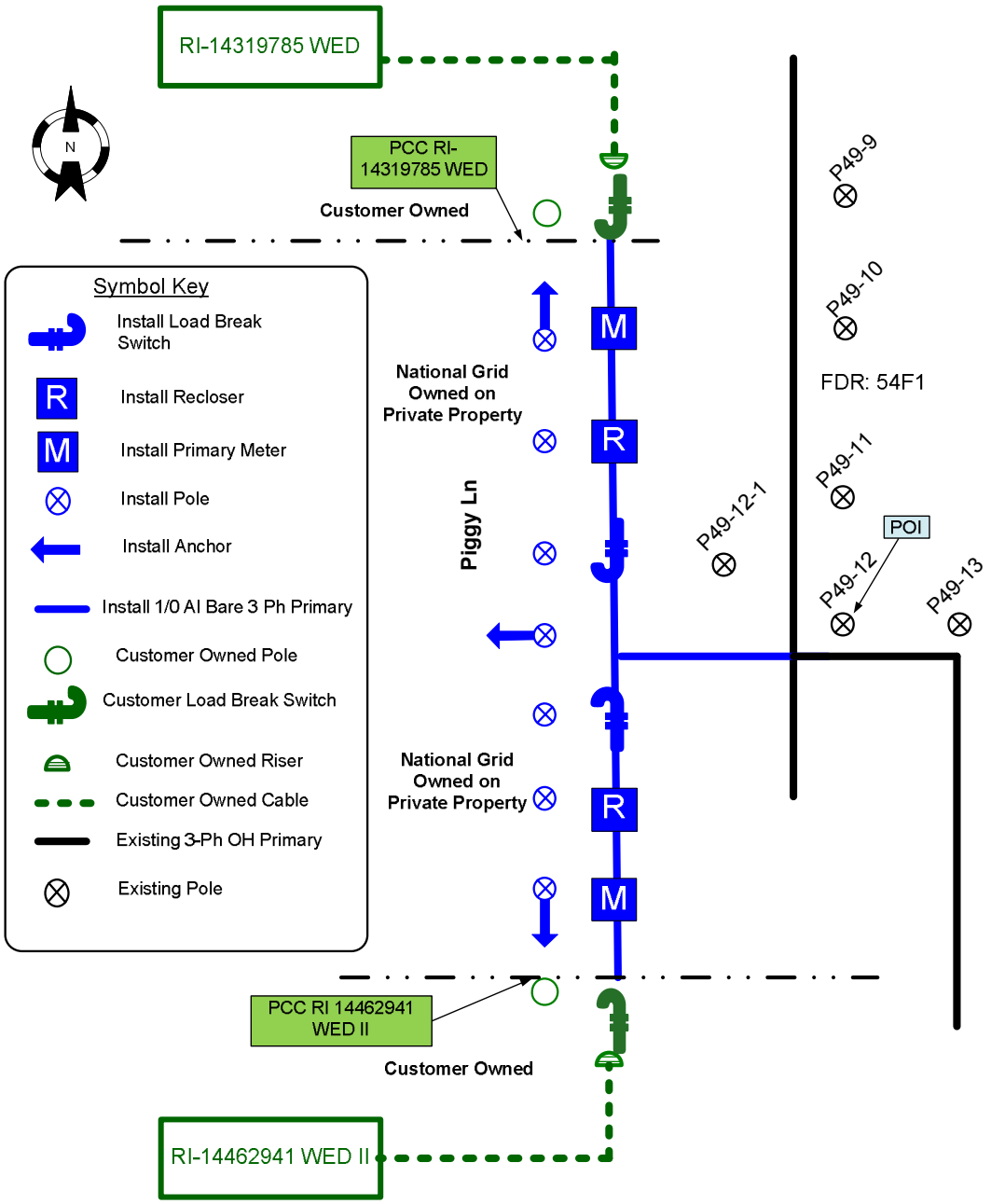

Figure 5: POI – PCC Configuration

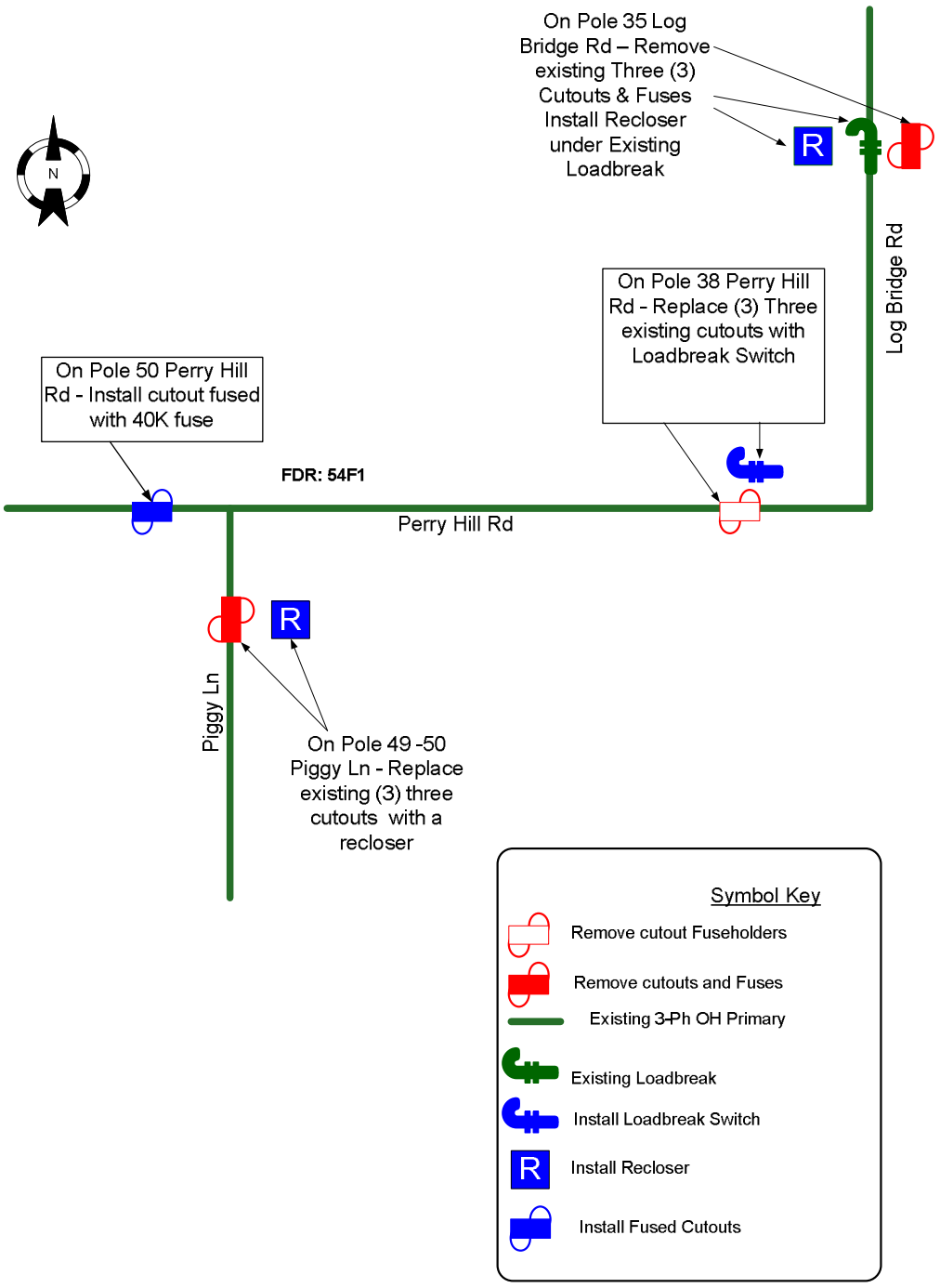

Figure 6: 54F1 Modifications

Appendix C Outdoor Meter Installations

REVENUE METERING PHONE LINE INSTALLATION GUIDE

An analog phone line to National Grid's revenue meter shall be provided by the Customer. The analog phone line must be capable of direct inward dial without human intervention or interference from other devices such as fax machines, etc. The phone line can be a phone (extension) off the customers PBX phone system, or it may be a separate dedicated phone line as provided by the Telephone Company. The following is to be used as a guide, please contact the Company if additional information is required. The most common installations are outlined below, Wall mounted Meter Installation, Outdoor Padmount Transformer Meter Installation, and Outdoor Pole Mounted Meter Installation.

1) WALL MOUNTED METER INSTALLATION
If the meter is wall mounted indoor or outdoor the customer shall provide a telephone line within 12" of the meter socket and additional equipment as described and shown below in figures 1A & 1B. National Grid will connect the meter to the customer provided phone line.

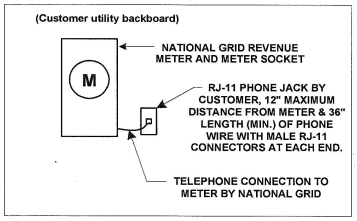

Figure 1A – Indoor Meter Installation
not to scale

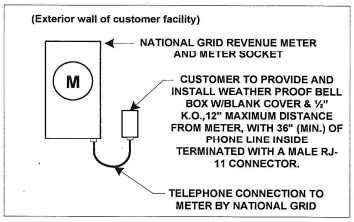

Figure 1B – Outdoor Meter Installation
not to scale

2) OUTDOOR PADMOUNT TRANSFORMER METER INSTALLATION
If the meter is mounted outside on the secondary compartment of the padmount transformer as shown below the conduit shall stub up and roughly line up with the bottom or side knock out of the meter socket and terminate into a weatherproof box or fitting. A liquid tight flexible conduit whip with end bushing and locknut of sufficient length to reach and terminate at the knockout location of the meter socket with three feet of telephone wire coiled (and terminated with a male RJ-11 connector) at its end shall be connected to the weatherproof box or fitting. National Grid will connect the conduit whip to the meter socket and terminate the telephone wire to the meter (see figure 2 below).

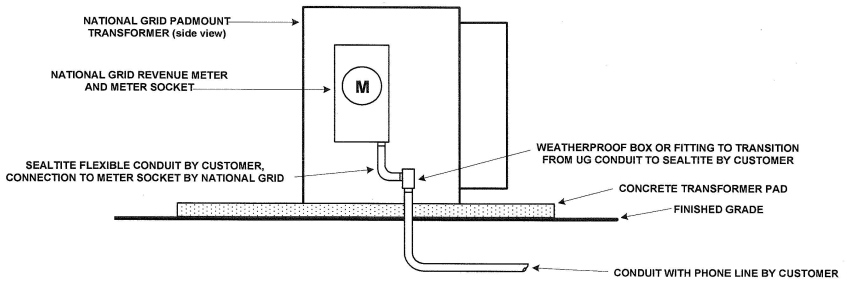

Figure 2 – Outdoor Padmount Transfomer Meter Installation
not to scale

Figure 7: Revenue Meter Phone Line Installation Guide (1 of 2)

3) OUTDOOR POLE MOUNTED METER INSTALLATION
If the meter is located outdoor on a Company owned utility pole as part of a primary metering installation the Customer will install and connect a phone line from the Telephone Company provided termination interface box, the line shall be terminated with a RJ-11 male connector and be of sufficient length to reach the meter socket and create a drip loop, as well as additional line for final connection to the meter. The customer is responsible for the Telephone Company phone line installation. (see figure 3 below).

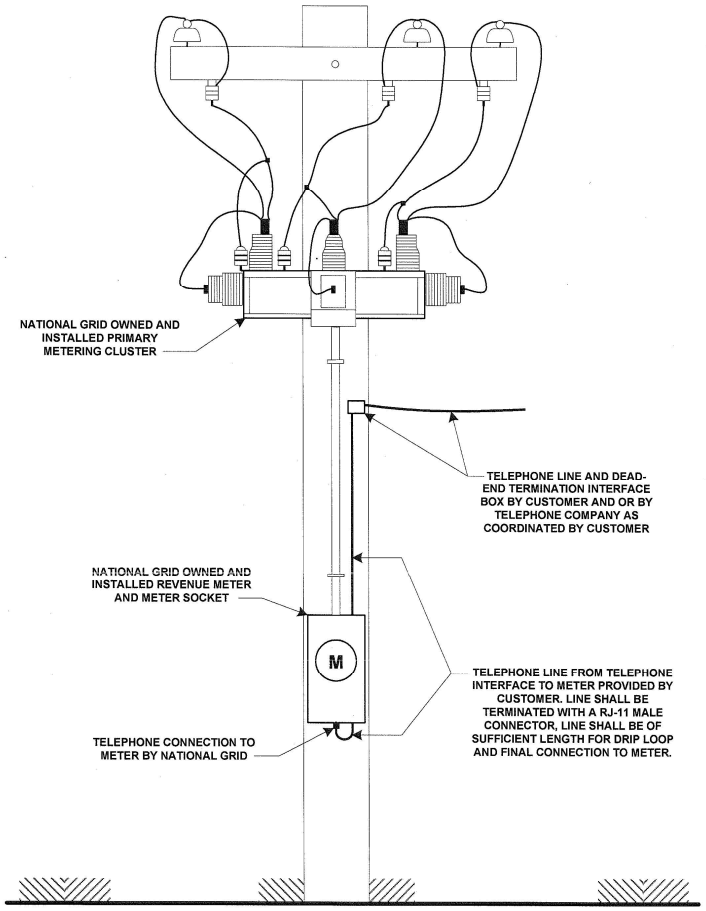

Figure 3 – Outdoor Pole Mounted Meter Installation
not to scale

Figure 8: Revenue Meter Phone Line Installation Guide 2 of 2

EXHIBIT B

System Impact Study
For
WED Coventry One, LLC, WED Coventry Two, LLC, WED Coventry Three, LLC, WED Coventry Four, LLC, WED Coventry Five, LLC and WED Coventry Six, LLC(WED Coventry One-Six)
Coventry, RI 02816

Ten-1500 kW Three-Phase, Converter Based Synchronous Wind Turbine Generators

Interconnection to National Grid's 12.47 kV System

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Executive Summary

National Grid ("the Company") has completed a Combined Impact Study for Renewable DG (ISRDG), for the interconnection of the WED Coventry One-Six, the ("Interconnecting Customers" or "IC"), proposed total 15,000 kW, comprised of ten (10) 1500 kW Wind Turbine Facilities ("the Facilities") to its 12.47 kV distribution system ("the Projects") at six separate Points of Interconnection (POI) and presents the conclusions of the study herein. This study was done outside of the Standard Process procedures in the Company's Standards for Connecting Distributed Generation (RIPUC 2078) as agreed to by the ("Interconnecting Customer" or "IC") in an agreement dated 8/15/2014. This agreement combined the six Applications into one combined study, rather than study each interconnection application separately. The requirements specified are exclusive to this project and are based upon the information submitted by the IC at the time the Interconnection Applications ("IA") were submitted.

The proposed Facilities are Independent Power Producers ("IPP") consisting of ten (10) 1500 kW (AC) ("WIND TURBINE") renewable systems. The Facilities will be located at Piggy Lane, Flat Fiver Road, and Victory Highway Coventry, RI 02816 and proposed to be connected on the customer's side of new primary metering points at the points of common coupling (PCC) on the 54F1 and 63F6 circuits ("Point of Interconnection" or "POI").

WED 1 (RI-14319785), WED 2 (RI-14462941), WED 3 (RI-15640455), WED 4 (RI-15772951), WED 5 (RI-17599370) and WED 6 (RI-17600293).

The purpose of this study was to:

- Conduct, as applicable, steady-state, stability, short circuit, and extreme contingency analyses and perform assessments of reliability performance of the Company's Electric Power System ("EPS") within the area of interconnection, with and without the proposed Facility, in accordance and applicable with reliability standards and study practices, and in compliance with the applicable codes, standards, and guidelines listed in Section 5.1 of the Company's *Electric System Bulletin No. 756 Appendix D: Distributed Generation Connected to National Grid Distribution Facilities Per The Rhode Island Standards for Interconnecting Distributed Generation ("ESB756D")* to determine the incremental impact and any potential adverse impacts associated with the interconnection of the Facility to the EPS.

- If possible, determine any System Modifications required.

- Develop planning grade cost estimates of the required facilities for interconnection of those Facilities found capable to be interconnected to the EPS.

- Provide a report describing the results of the Impact Study.

- Provide additional detail concerning any recommended further study.

The study determined the interconnection of 7 of the 10 proposed Facilities to be feasible with system upgrades as outlined further in the report. All ten wind turbines cannot be interconnected without further information concerning proposed changes in turbine operation and a study to determine required upgrades and costs once possible changes in operation have been reviewed.

This study was able to conclude that (See Appendix D for Long Term Dynamics (LTD) results):

- With the circuits in their current state, no major reconductoring of the main line.
    - No more than one wind turbine can be connected to the 54F1 circuit without causing voltage excursions which cross the ANSI A Range (both high and low).
    - No wind turbines can be connected to the 63F6 circuit without causing voltage excursions which cross the ANSI A Range (both high and low).
- Reconductoring the main line of the 54F1, from the Piggy Lane POI to the Coventry Substation with 795Al conductor.
    - No more than 3 wind turbines can be connected at the Piggy Lane Location.
- Reconductoring the main line of the 63F6, from the Victory Highway POI to the Hopkins Hill Substation with 795AL conductor:
    - All four wind turbines can be connected.
- If the Customer is able to provide calculated wind turbine output data but with lower power ramp rates, (1kW/sec, 5kW/sec, 10kW/sec) National Grid can reevaluate these cases with additional study, based upon the previously submitted Mach 26, 2014 documented wind speeds. This data can be used to reevaluate the LTD cases to determine if the voltage and power quality issues can be mitigated. The data provided to National Grid for this study had a wide range of ramp rates, reaching roughly 150 kW/sec
    - The under voltage excursions may be difficult to avoid when the wind turbines cut out due to overspeed or for other control scenarios, so further analysis combined with changes in turbine operations will likely be required.
- Each wind turbine interconnection point requires Direct Transfer Tripping (DTT). A risk of islanding analysis was previously performed for the 54F1 POI's and the IC

requested that a risk of islanding study on the 63F6 POI's not be conducted as it was projected that DTT would most likely be required.

- Also, zero sequence over voltage protection (3V0) is required at the Coventry Substation if more than one wind turbine is connected, and will be required at Hopkins Hill Substation for any number of wind turbines connected.

In order to review the possible mitigation scenarios for these voltage concerns, additional study is required to determine the required scope and cost estimate for interconnection. There are multiple options which are viable but more study time is required to properly vet them.

Previously, a System Impact Study was completed on 4/17/2014 for WED 1 and WED 2, with one wind turbine at each site. That study is considered to be superseded by the results of this current study.

Cost Estimates for the reconductoring options and substation costs are included in Appendix A.

1.0 Introduction

WED Coventry One-Six has requested the interconnection for ten (10) 1500 kW, 15,000 kW total, converter based, synchronous wind turbine, renewable systems to two electrical circuits in National Grid's EPS.

In accordance with the R.I.P.U.C. NO. 2078 tariff, the Company has completed an Impact Study to determine the scope of the required modifications to its EPS and/or the Facility for providing the requested interconnection service.

1.1 Study Objective

The primary objectives of this Impact Study are to:

1. If possible, identify the System Modifications necessary for the Project to reliably interconnect to the Company's system[1];

2. If possible, identify deficiencies in the proposed Facility;

3. If possible, identify operating restrictions;

[1]May require additional study at a later phase in the process.

4. If possible, identify and describe the equipment, engineering, procurement, construction, installation, testing and commissioning work, needed to build the System Modifications and integrate them with the Interconnecting Customer's Interconnection Facilities ("ICIF");

5. If possible, provide additional detail in terms of scope of additional required study to determine final system modifications, cost estimates, and construction timelines for the interconnection of all or some proposed facilities.

2.0 Project Description

2.1 Facility

As depicted in the Interconnecting Customer's Site Diagram and One Line Diagrams (*Appendix A Site Diagrams and One- Lines*), there will be ten 1500 kW sites, for a total of 15,000 kW.

The Customer has requested six sites with various number of wind turbines at each group. The proposal was for six wind turbines (four different sites) to be connected to the 54F1 circuit, and four wind turbines (two different sites) to be connected to the 63F6 circuit. Over the course of the impact study, multiple configurations were adjusted according to various Customer requests, and the descriptions below incorporate the final agreed upon locations and proposals.

54F1 (Coventry)

Site 1 WED 1 (RI-14319785)

- (1) Vensys SDL, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to the low voltage side of a 1600 kVA 690V/12.47 kV interface transformer with ungrounded wye primary and wye-grounded secondary windings. The primary side of the interface transformer is connected to a 150 kVA 12.47 kV/480V grounding transformer with wye grounded primary and delta secondary windings.
    - Grounding Transformer: X/R=3.58, Z=1.0746+j3.853PU on transformer base.

- The primary sides of the interface and grounding transformers are connected in parallel to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

Site 2 WED 2 (RI-14462941)

- (3) Vensys SDL, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generators. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to the low voltage side of a 1600 kVA 690V/12.47 kV interface transformer with ungrounded wye primary and wye-grounded secondary windings. The primary side of the interface transformers are connected to a 150 kVA 12.47 kV/480V grounding transformer with wye grounded primary and delta secondary windings.
    - Grounding Transformer: X/R=3.58, Z=1.0746+j3.853PU on transformer base.
- The primary sides of the interface and grounding transformers are connected in parallel to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

Site 3 WED 3 (RI-15640455)

- (1) Vensys SDL, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to the low voltage side of a 1600 kVA 690V/12.47 kV interface transformer with ungrounded wye primary and wye-grounded secondary windings. The primary side of the interface transformer is connected to a 150 kVA 12.47 kV/480V

grounding transformer with wye grounded primary and delta secondary windings.
    - Grounding Transformer: X/R=3.58, Z=1.0746+j3.853PU on transformer base.
- The primary sides of the interface and grounding transformers are connected in parallel to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

Site 4 WED 4 (RI-15772951)

- (1) Vensys SDL, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to a 1600 kVA 690V/12.47 kV interface transformer with ungrounded wye primary and wye-grounded secondary windings. The primary side of the interface transformer is connected to a 150 kVA 12.47 kV/480V grounding transformer with wye grounded primary and delta secondary windings.
    - Grounding Transformer: X/R=3.58, Z=1.0746+j3.853PU on transformer base.
- The primary sides of the interface and grounding transformers are connected in parallel to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

63F6 (Hopkins Hill)

Site 5 WED 5 (RI-17599370)

- (1) Vensys SDL, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.

- The output of the power converter is connected to a 1600 kVA 690V/12.47 kV interface transformer with ungrounded wye primary and wye-grounded secondary windings. The primary side of the interface transformer is connected to a 150 kVA 12.47 kV/480V grounding transformer with wye grounded primary and delta secondary windings.
    - Grounding Transformer: X/R=3.58, Z=1.0746+j3.853PU on transformer base.
- The primary sides of the interface and grounding transformers are connected in parallel to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

Site 6 WED 6 (RI-17600293)

- (3) Vensys SDL, 1500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generators. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to a 1600 kVA 690V/12.47 kV interface transformer with ungrounded wye primary and wye-grounded secondary windings. The primary side of the interface transformers are connected to a 150 kVA 12.47 kV/480V grounding transformer with wye grounded primary and delta secondary windings.
    - Grounding Transformer: X/R=3.58, Z=1.0746+j3.853PU on transformer base.
- The primary sides of the interface and grounding transformers are connected in parallel to a 15 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a pole mounted, gang operated three phase, 15 kV class, 600A, lockable, load break switch. The Pole Mounted disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

2.2 Service Configuration

The proposed locations of the Facilities are normally served by National Grid's 7.2/12.47 kV three-phase, 4 wire, multi grounded wye, effectively-grounded 54F1 and 63F6 circuits.

During the course of this study, various proposed POI locations were revised at the request of the customer. Prior to the start of any additional study the IC will be required to provide final POI's that remain unchanged until the completion of any additional study in order to meet agreed upon timelines.

All wind turbines are proposed for private property, a minimum 1000' off of the public way, therefore there is no concern for violation of required minimum fall down zones.

54F1 (Coventry):

Site 1 WED 1 (RI-14319785)
The proposed location for WED 1 is to be connected to the existing OH facilities, pole 49-12 Piggy Lane.

Site 2 WED 2 (RI-14462941)
The proposed location for WED 2 is to be connected to the existing OH facilities currently installed at the intersection of Piggy Lane and Perry Hill Rd, near pole 49-1.

Site 3 WED 3 (RI-15640455)
The proposed location for WED 3 is to be connected to the existing OH facilities currently installed at Flat River Road, pole 566.

Site 4 WED 4 (RI-15772951)
The proposed location for WED 4 is to be connected to the existing OH facilities currently installed at Flat River Road, pole 572-50.

63F6 (Hopkins Hill):

Site 5 WED 5 (RI-17599370)
The proposed location for WED 5 is to be connected to the existing OH facilities currently installed at Victory Highway, pole 141.

Site 6 WED 6 (RI-17600293)
The proposed location for WED 6 is to be connected to the existing OH facilities currently installed at Victory Highway, pole 141.

2.3 Area EPS

54F1

This circuit originates out of National Grid's Coventry substation, a 12,470 V multigrounded and effectively grounded distribution feeder.

The current 54F1 characteristics are as follows:

- The daytime loading on the feeder has varied between a peak of 9.3 MVA and a minimum of 2.5 MVA.
- Total aggregate generation interconnected/in-process on the feeder, excluding this project, is 0 kW at this time.
- The feeder is regulated by single phase voltage regulators located within the substation and has no additional voltage regulators installed outside the substation between the POI and the substation.
- The feeder has five (5) existing line reclosers installed outside the substation. One (1) is installed between the POI and the substation feeder breaker.
- The feeder has 1200 kVAR of capacitance installed outside the substation.

Location	Size (kVAR)	Control
P 63 Victory Hwy / Coventry	600	T/V
P 577 Flat river Rd / Coventry	600	T/V

Table 1 - 54F1 Capacitor Locations

The four sites proposed for the 54F1 circuit are all approximately 35,000 ft from the substation, with a mixture of large and small conductor between the POIs and the substation breaker.

63F6

This circuit originates out of National Grid's Hopkins Hill substation, a 12,470 V multigrounded and effectively grounded distribution feeder.

The current 63F6 characteristics are as follows:

- The daytime loading on the feeder has varied between a peak of 8.9 MVA and a minimum of 1.7 MVA.
- Total aggregate generation interconnected on the feeder is 2,036 kW.
    - A 2MW PV Plant is located close to the proposed POI, on Plain Meetinghouse Road.
- The feeder is regulated by single phase voltage regulators located within the substation. Additionally, there are voltage regulators installed outside the substation. One set located between the POI and the substation, on Poles 63-65 Victory Highway, near the intersection of Victory Highway and Nooseneck Road. There are also 3 single phase regulators on Poles 24-26 Nooseneck Road, and 3 single phase regulators on Pole 47, 47-50 and 48 Plain Meetinghouse Rd.
- The feeder has seven (7) existing line reclosers installed outside the substation. Two (2) are installed between the POI and the substation feeder breaker, both located on Victory Highway (Poles 114 and 60).
- The feeder has 3600 kVAR of capacitance installed outside the substation.

Location	Size (kVAR)	Control
P 15 Victory Highway / Coventry	900	Manual
P 29 Victory Hwy / W. Greenwich	600	T/V
P 4 Nooseneck Hill Rd / W. Greenwich	600	Manual
P 72 Nooseneck Hill Rd / W.	600	T/V

Greenwich P 12 New Long Tpke / Richmond	900	Manual

Table 2 – 63F6 Capacitor Locations

The two sites proposed for the 63F6 circuit are all approximately 65,000 ft from the substation, with a mixture of large and small conductor between the POIs and the substation breaker.

3.0 Power Flow Analysis

The power flow analysis was substantially performed using CYMDIST. A model of the 54F1 and 63F6 circuits were developed based on data extracted from the National Grid GIS and field verified.

The analysis considered cases at minimum and peak load, at time of expected maximum generation for the following cases:

- The 54F1 in a normal configuration Peak load of 9.3 MVA @ 94% PF Lagging
- The 54F1 in normal configuration Min load of 2.5 MVA @ 99 % PF Leading.
- The 63F6 in a normal configuration Peak load of 8.9 MVA @ 98% PF Lagging.
- The 63F6 in normal configuration Min load of 1.7 MVA @ 98 % PF Lagging.

3.1 General Loading Analysis

An analysis of the feeder loading, with and without the wind turbine system operating, was performed and demonstrated that the addition of the DG Facility would create thermal loading problems on the 54F1 circuit. 4/0 AL and 1/0 AL conductor between WED 1, 2, 3 and 4 and Coventry Substation must be upgraded to accommodate the total amount of generation.

- 1/0AL along Perry Hill, ~1,500 ft, replaced with 477 AL Spacer
- 4/0AL along Flat River Road, 13,000 ft, replace with 477 Spacer

These conductor improvements are for thermal requirements only, due to the small wire size and amount of generation. These upgraded conductors were not sufficient to alleviate the voltage issues noted further in this document.

There were no thermal loading problems found on the 63F6 circuit.

3.2 Long Term Dynamics Voltage Analysis

The intent of this analysis was to perform a Long Term Dynamic, (LTD) analysis for the Wind Energy Development (WED) wind turbines to observe how the potential power fluctuations may impact the power quality, voltage drop/rise, voltage regulation, thermal capabilities, flicker conditions and operational effect of the area EPS. The analysis observed whether potential power fluctuations and voltage changes at the POIs and the nearby mainline were maintained within the required ANSI "A" range (+/- 5% of nominal), by the voltage regulation equipment on the circuit.

The CYME, Long Term Dynamic module was used for the assessment of the impact the proposed wind turbines would have on the area EPS. The analysis was run for a 24 hour period at a 10 second iteration rate. The customer provided, 24 hour, 6 second sample rate, power output data for the existing North Kingston, RI, wind turbine, collected on March 26, 2014 was utilized for the analysis because it appears to represent volatile wind turbine output for a windy gusty day. For modeling purposes the wind turbines where run at 100% power factor for all the cases and the original WT output curve was capped at 100% of the generator's rated output of 1,500 kW.

See the Appendix D at the end of this report for the complete results of this analysis, including figures for various modeling cases.

This analysis concluded that, without any major modifications to the EPS, no more than one wind turbine can be connected to the 54F1 without creating voltage issues, and no wind turbines could be connected to the 63F6 circuit.

Circuit configurations are based on existing EPS without any upgrades, unless the thermal limits were reached, and then the conductor was upgraded to the appropriate size to satisfy the anticipated maximum generation, and was not upgraded to attempt to mitigate any voltage swings. These particular cases are outlined the attached report.

The report in Appendix D reviews potential mitigating solutions to some of the voltage issues, but those additional methods require further analysis to determine the best and final approach. Some possible solutions are:

- Reconductoring all mainline between POIs and the Substations with much larger conductor.
- Bringing a sub-transmission circuit (23kV or 34.5kV) to the POIs and interconnection the generation to those sources.

- Providing new generation data, based on the wind speeds measured in the provided generation data which was used for this study, at much lower, locked ramp rates (1kW, 5kW, 10kW).

3.3 Final Load Flow Analysis

Additional study is required to determine the method through which the Customer and the Company wish to move forward with interconnection of all of the proposed wind turbines. This study has determined that all 10 cannot be interconnected and therefore, additional information, or design proposals are required to interconnect the more than the determined amount wind turbines, or some of the project must be removed from consideration and the final analysis completed.

3.4 Power Quality

As required by the tariff, National Grid maintains voltage and frequency to its electric customers and as such, customers cannot cause disturbances to the electric supply system or to other National Grid customers. Based on the data provided by the IC for their wind turbine generators, our analyses showing the distributed generation exceeding our design standard voltage of ANSI C84.1 Range A would indicate a disturbance effect. As with any electric customer under the tariff, any disturbance must be mitigated and corrected by the customer causing the disturbance. See sections 3.12 and 10 in National Grid's Electric System Bulletin (ESB) No. 750 and section 6.2 in ESB 756 Appendix D for more information.

The Company will not be held liable for any power quality issues that may develop with the IC's facilities as result of the interconnection of this generation. If power quality conditions develop, the Company reserves the right to have the facility operate at reduced power levels, and/or, reduced power factor, or, disconnect the facility, until such time the power quality conditions can be mitigated.

4.0 Short Circuit and Protection Analysis Company Facilities

4.1 Temporary Over-Voltages on Transmission Supply

Detailed analysis of the load to generation match on the Coventry T1 supply transformer, which supplies the 54F1 circuit, during minimum load and

maximum generation conditions indicates that the proposed facilities pose significant risk of causing temporary over-voltage condition to develop on the 23 kV system. Consequently, zero sequence overvoltage protection will be required to be installed on the 23 kV side of the Coventry, 23 kV- 12.47 kV Grd-Y/7.2 kV, supply transformer (T1). However, interconnecting only one wind turbine onto the circuit will not require 3Vo protection.

Detailed analysis of the load to generation match on the Hopkins Hill T2 supply transformer, which supplies the 63F6 circuit, and T1 backup transformer, during minimum load and maximum generation conditions, indicates that the proposed facilities pose significant risk of causing temporary over-voltage condition to develop on the 34.5 kV system. Consequently, zero sequence overvoltage protection will be required to be installed on the 34.5 kV side of the Hopkins, 34.5 kV- 12.47 kV Grd-Y/7.2 kV, supply transformer (T2) and backup transformer (T1).

4.2 Unintentional islanding

Inverters/Converters shall be in compliance with ESB 756D 5.7.10.1 and R.I.P.U.C. NO. 2078 section 4.2.1 General requirements, where all inverters/Converters must be IEEE 1547 compliant and UL-1741 certified inverters shall be equipped with an internal anti islanding scheme and active under voltage (27), over voltage (59), zero sequence over voltage (59N), under frequency (81U) and over frequency (81O) relays.

The Vensys converters are not UL 1741-2005/ IEEE1547 listed and do not have any active islanding detection functionality. Analysis indicates that there is likely ability for these facilities to remain in operation in excess of 2 seconds should an islanding condition develop.

Therefore, any interconnection of one or more wind turbines will require a Direct Transfer Tripping scheme. See 4.3 below for more details. If the Customer wants to further analyze this requirement, or propose any additional protection schemes, it will require further time and study to determine their ability to satisfy National Grid's requirements, and may delay the project.

4.3 Direct Transfer Tripping

Refer to section 4.2 above, a direct transfer tripping system, if one is required by either the Interconnecting Customer or by the Company, shall use equipment generally accepted for use by the Company and shall, at the option of the Company, use dual channels.

DTT will be required for this interconnection, the requirements are as follows:

- National Grid's Standard RFL is model S00763PF which uses the Guard Before Trip feature for DTT applications.

- The generator breaker should be tripped for relay/breaker Loss of Potential (LOP), Relay failure, loss of Guard signal, and receive the trip signal. Relay failure, LOP and loss of guard signal should have a 30s delay to trip the breaker. This is to avoid nuisance tripping due to the system transients.

- Since National Grid does not specify the relay type, any timer that is equivalent to an ABB RXKL1 is acceptable.

- When the order actually takes place, both the transmitter and receiver should be ordered from RFL as a package.

- Even if there are different orders for the transmitter and the receiver, the receiver order from the customer and the transmitter order from National Grid, RFL needs to be informed of this to insure that the two devices will talk to each other. RFL will test them together before shipping to National Grid/customer.

- National Grid will also specify all trip and guard frequencies. National Grid uses default settings of the groups 3 and 5 to set the guard and trip frequencies.

    - Group 3:
      Tone 1 Tx: 1540Hz (trip) 1690Hz (Guard)
      Tone 1 Rx: 2030Hz (Trip) 1880Hz (Guard)

    - Group 5:
      Tone 2 Tx: 2220 Hz (Trip) 2370 Hz (Guard)

Tone 2 Rx: 2710Hz (Trip) 2560 Hz (Guard)

4.4 Final Protection Review/Coordination

Final review of the Customer's proposed system, from a protection point of view will be completed and any further requirements outlined once the Customer decides how to move forward. This includes final determination of effective grounding, changes to protective devices on National Grid's EPS, and any required coordination changes.

5.0 Conclusion

This Combined ISRDG has determined that it is possible to interconnect 7 out of the 10 wind turbines proposed for interconnection at six POI's by IC. Additional study and information will be required if the IC chooses to explore interconnecting all of the 15,000kW of wind turbine generation as originally proposed.

Note: Authorization for parallel operation will not be issued without a fully executed Interconnection Agreement, receipt of the necessary insurance documentation, and successful completion of the Company approved witness testing. Such authorization shall be provided in writing.

6.0 Revision History

Version	Date	Description of Revision
1.0	12/18/14	Final: WED Coventry 1, 2, 3, 4, 5 & 6, LLC

Appendix A Cost Estimates and Scope

54F1: Three Wind Turbines on Piggy Lane

The necessary System Modifications for three wind turbine to be connected at Piggy Lane include but are not limited to:

- WED 1 PCC: A new 12.47 kV primary metering installation, ahead of the Point of Common Coupling, with a new bidirectional meter, recloser, loadbreak switch, 3 phase line extension, new POI, Pole #49-12 Piggy Lane, and necessary conductor and equipment to extend 3 phase primary down to the PCC from the POI.

- WED 2 PCC: A new 12.47 kV primary metering installation, ahead of the Point of Common Coupling, with a new bidirectional meter, recloser, loadbreak switch, 3 phase line extension, new POI, Pole #49 Piggy Lane, and necessary conductor and equipment to extend 3 phase primary down to the PCC from the POI. Remove fuses at Pole #49, add new Fuses to Pole #50.

- The customer is required to clear trees and vegetation as required and to provide a suitable means of access to the company's equipment.

- Reconductor approximately 6 miles of mainline OH line to 795 AL.

- Install reclosers on pole 49-50 Piggy Ln and pole 35 Logbridge Rd Install Loadbreak on pole 38 Perry Hill

- Install two Direct Transfer Trip circuits from Coventry Substation to the Customer's generator breakers and install 3Vo protection on the 23kV side of the Coventry Substation Transformer.

Cost Estimates (for 3 WT at Piggy Lane):

The total estimated planning grade cost of the work associated with the interconnection of the Facility, is **$5,166,918.00**+/-25%, and includes:

System Modifications to Company EPS $4,209,188.00

Engineering, design, construction and testing for revenue Metering, feeder modifications, reclosers, disconnect switches,

And remote stations modifications

Interconnecting Customer Interconnection Facilities ("ICIF") $20,600.00
Engineering review and acceptance, and compliance
Verification of the ICIFs including all required drawings
And equipment spec reviews, relay settings, and construction
And testing assistance by engineering

Tax Liability[2] $937,130.00
Applied to all capital associated with System Modifications

This planning grade estimate will be deemed withdrawn if not accepted by the Customer within ninety (90) calendar days of receipt of the study. **Additional costs may be involved if the required pole work takes place in Verizon Maintenance Areas. These costs will be billed directly to the customer from Verizon.**

Estimated Schedule:

The time line for construction will be addressed once the exact scope of the Project and the required infrastructure modifications to the EPS can be determined. The schedule driver can be impacted by unknown factors over which the company has no control. **Verizon pole sets are dependent upon Verizon's schedule. The Company has no control over Verizon's work schedule. It will be the responsibility of the customer to obtain any and all easements and required permitting for work that takes place on private property.**

The interconnection schedule is contingent on the Interconnecting Customer's successful compliance with the requirements outlined in this report and timely completion of its obligations as defined in *ESB756D, Exhibit 2: Company Requirements for Projects Not Eligible for the Simplified Process*. The schedule for the Company's work shall be addressed during the development, or after the execution, of the Interconnection Agreement.

[2] The estimated tax liability was calculated using the rate at the time the estimate was completed (22.84%). Actual costs shall be reflective of the tax liability rate at the time of invoicing.

WED - 3 Wind Turbines at Piggy Lane						
National Grid Work Item	**Conceptual Cost +/-25% Planning Grade Cost Estimate not including Tax Liability**				**Associated Tax Liability $ @ Applied to capital**	Total Customer Costs includes Tax Liability on Capital Portion
System Modifications NECO	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.84%**	**Total $**
Reconductor 6 miles of Main Line Primary with 795 Spacer Cable	$3,312,000.00	$3,245,760.00	$26,496.00	$39,744.00	$741,340.00	$4,053,340.00
WED 1 interconnection -Build 3 Phase line extension from Pole 49-12 Piggy Ln onto customer property, included in this work is the installation of (1) Loadbreak switch , (1) recloser, and (1) Primary Metering assembly.	$102,188.00	$102,188.00	$0.00	$0.00	$23,340.00	$125,528.00
WED 2 interconnection -Build 3 Phase line extension from Pole 49 Piggy Ln onto private property, included in this work is the installation of (1) Loadbreak switch , (1) recloser, and (1) Primary Metering assembly. Move Pole 49 fuses.	$145,000.00	$145,000.00	$0.00	$0.00	$33,120.00	$178,120.00
Coventry Substation: Install two sets DTT on 54F1 feeder recloser, 3V0 on TR#1, upgrade voltage regulator controls	$650,000.00	$610,000.00	$30,000.00	$10,000.00	$139,330.00	$789,330.00
SUBTOTAL System Modifications NECO	**$4,209,188.00**	**$4,102,948.00**	**$56,496.00**	**$49,744.00**	**$937,130.00**	**$5,146,318.00**
Interconnecting Customer Interconnection Facilities ("ICIF")	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.84%**	**Total $**
Witness Testing	$5,000.00	$0.00	$5,000.00	$0.00	$0.00	$5,000.00
EMS Integration	$5,600.00	$0.00	$5,600.00	$0.00	$0.00	$5,600.00
Review and Implementation of protective device settings	$10,000.00	$0.00	$10,000.00	$0.00	$0.00	$10,000.00
SUBTOTAL	**$20,600.00**	**$0.00**	**$20,600.00**	**$0.00**	**$0.00**	**$20,600.00**
	Pre-Tax Total $	**Capital**	**O&M**	**Removal**	**Tax Liability**	**Total $**
TOTALS	**$4,229,788.00**	**$4,102,948.00**	**$77,096.00**	**$49,744.00**	**$937,130.00**	**$5,166,918.00**

63F6: Four Wind Turbines on Victory Highway

The necessary System Modifications for four wind turbines to be connected at Victory Highway include but are not limited to:

- WED 5 PCC: A new 12.47 kV primary metering installation, ahead of the Point of Common Coupling, with a new bidirectional meter, recloser, loadbreak switch, 3 phase line extension, new POI, Pole #141 Victory Highway, and necessary conductor and equipment to extend 3 phase primary down to the PCC from the POI.

- WED 6 PCC: A new 12.47 kV primary metering installation, ahead of the Point of Common Coupling, with a new bidirectional meter, recloser, loadbreak switch, 3 phase line extension, new POI, Pole #141 Victory Highway, and necessary conductor and equipment to extend 3 phase primary down to the PCC from the POI.

- The customer is required to clear trees and vegetation as required and to provide a suitable means of access to the company's equipment.

- Reconductor approximately 10 miles of mainline OH line to 795 AL.

- Install two Direct Transfer Trip circuits from Hopkins Hill Substation to the Customer's generator breakers and install 3Vo protection on the 34.5kV side of the Substation Transformers.

Cost Estimates (for 4 WT at Victory Highway):

The total estimated planning grade cost of the work associated with the interconnection of the Facility, is **$7,592,626.00**+/-25%, and includes:

System Modifications to Company EPS $6,188,376.00
Engineering, design, construction and testing for revenue Metering, feeder modifications, reclosers, disconnect switches, And remote stations modifications

Interconnecting Customer Interconnection Facilities ("ICIF") $20,600.00
Engineering review and acceptance, and compliance Verification of the ICIFs including all required drawings And equipment spec reviews, relay settings, and construction And testing assistance by engineering

Tax Liability[3] $1,383,650.00

Applied to all capital associated with System Modifications

This planning grade estimate will be deemed withdrawn if not accepted by the Customer within ninety (90) calendar days of receipt of the study. **Additional costs may be involved if the required pole work takes place in Verizon Maintenance Areas. These costs will be billed directly to the customer from Verizon.**

Estimated Schedule:

The time line for construction will be addressed once the exact scope of the Project and the required infrastructure modifications to the EPS can be determined. The schedule driver can be impacted by unknown factors over which the company has no control. **Verizon pole sets are dependent upon Verizon's schedule. The Company has no control over Verizon's work schedule. It will be the responsibility of the customer to obtain any and all easements and required permitting for work that takes place on private property.**

The interconnection schedule is contingent on the Interconnecting Customer's successful compliance with the requirements outlined in this report and timely completion of its obligations as defined in *ESB756D, Exhibit 2: Company Requirements for Projects Not Eligible for the Simplified Process*. The schedule for the Company's work shall be addressed during the development, or after the execution, of the Interconnection Agreement.

[3] The estimated tax liability was calculated using the rate at the time the estimate was completed (22.84%). Actual costs shall be reflective of the tax liability rate at the time of invoicing.

WED - 4 Wind Turbines at Victory Highway

National Grid Work Item	Conceptual Cost +/-25% Planning Grade Cost Estimate not including Tax Liability				Associated Tax Liability $ @ Applied to capital	Total Customer Costs includes Tax Liability on Capital Portion
System Modifications NECO	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.84%**	**Total $**
Reconductor 10 miles of Main Line Primary with 795 Spacer Cable	$5,520,000.00	$5,409,600.00	$44,160.00	$66,240.00	$1,235,560.00	$6,755,560.00
WED 5 interconnection -Build 3 Phase line extension from Pole 141 Victory Highway onto customer property, included in this work is the installation of (1) Loadbreak switch , (1) recloser, and (1) Primary Metering assembly.	$102,188.00	$102,188.00	$0.00	$0.00	$23,340.00	$125,528.00
WED 6 interconnection -Build 3 Phase line extension from Pole 141 Victory Highway onto customer property, included in this work is the installation of (1) Loadbreak switch , (1) recloser, and (1) Primary Metering assembly.	$102,188.00	$102,188.00	$0.00	$0.00	$23,340.00	$125,528.00
Hopkins Hill Substation: Install two sets DTT on 63F6 feeder recloser, 3V0 on TR#1 and TR#2, upgrade voltage regulator controls	$464,000.00	$444,000.00	$20,000.00	$0.00	$101,410.00	$565,410.00
SUBTOTAL System Modifications NECO	**$6,188,376.00**	**$6,057,976.00**	**$64,160.00**	**$66,240.00**	**$1,383,650.00**	**$7,572,026.00**
Interconnecting Customer Interconnection Facilities ("ICIF")	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.84%**	**Total $**
Witness Testing	$5,000.00	$0.00	$5,000.00	$0.00	$0.00	$5,000.00
EMS Integration	$5,600.00	$0.00	$5,600.00	$0.00	$0.00	$5,600.00
Review and Implementation of protective device settings	$10,000.00	$0.00	$10,000.00	$0.00	$0.00	$10,000.00
SUBTOTAL	**$20,600.00**	**$0.00**	**$20,600.00**	**$0.00**	**$0.00**	**$20,600.00**
	Pre-Tax Total $	**Capital**	**O&M**	**Removal**	**Tax Liability**	**Total $**
TOTALS	**$6,208,976.00**	**$6,057,976.00**	**$84,760.00**	**$66,240.00**	**$1,383,650.00**	**$7,592,626.00**

Appendix B IC Site and One-line Diagrams

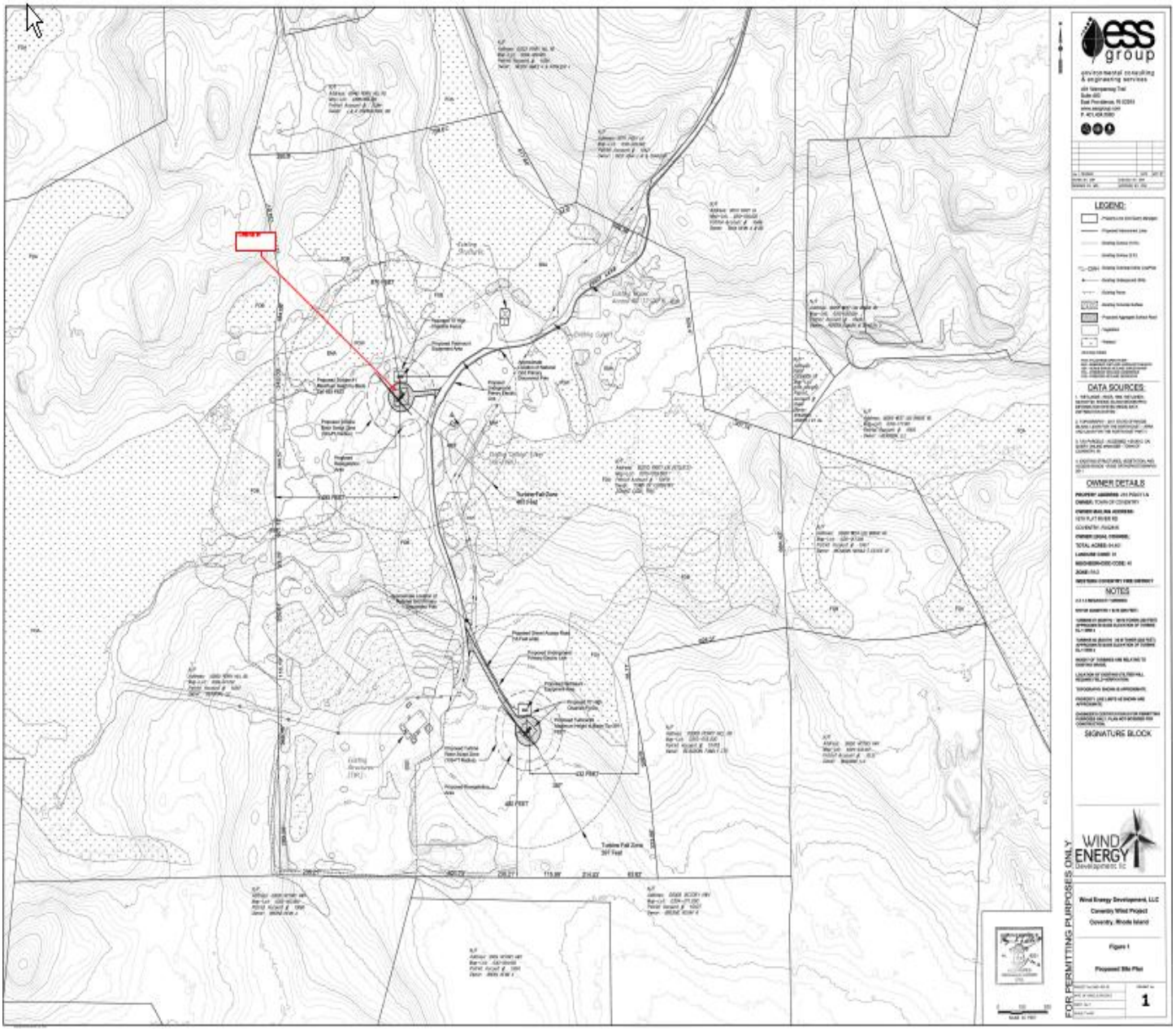

Figure 1: WED 1, Site Plan

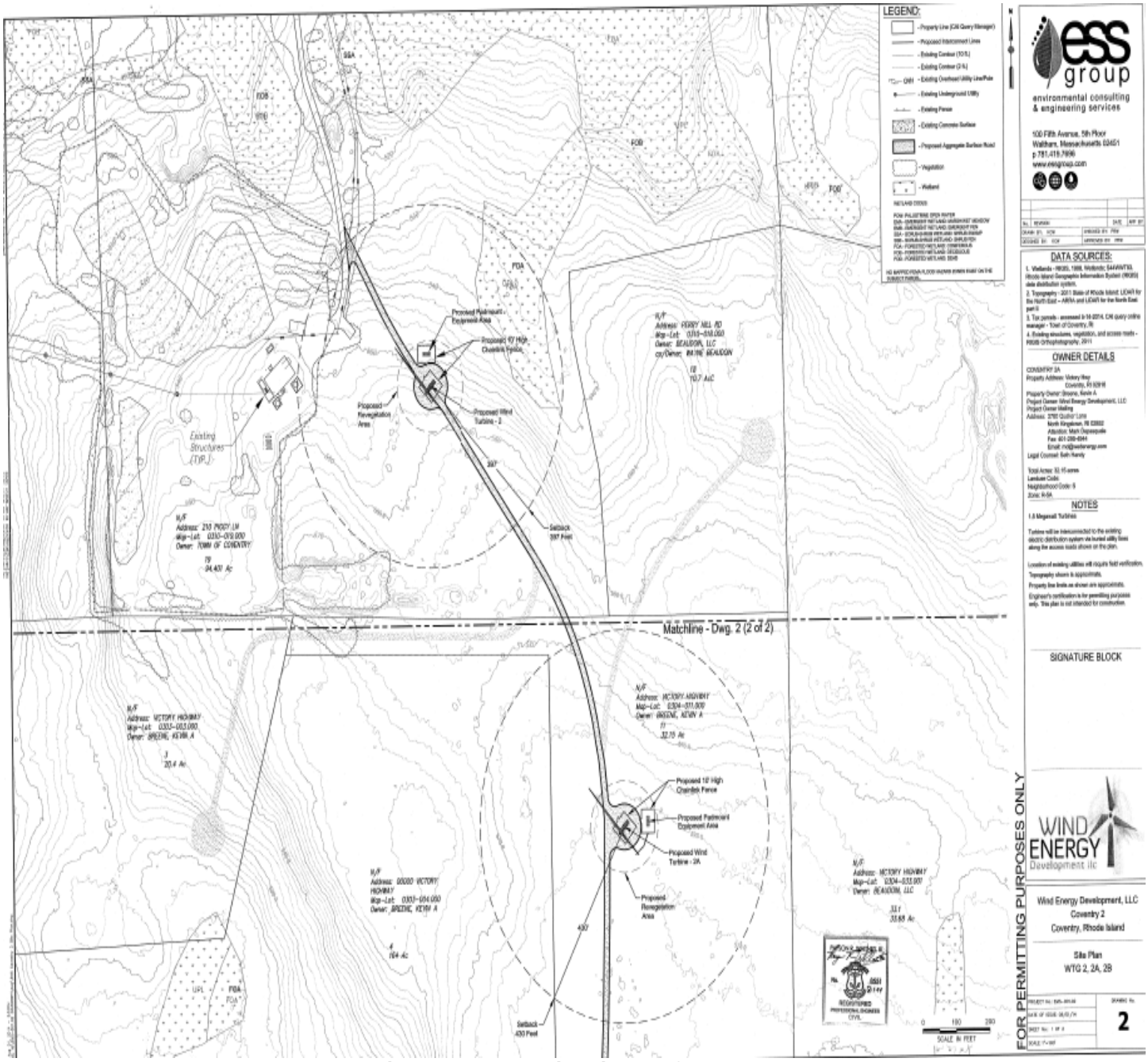

Figure 2: WED 2 Site Plan, 1 of 2

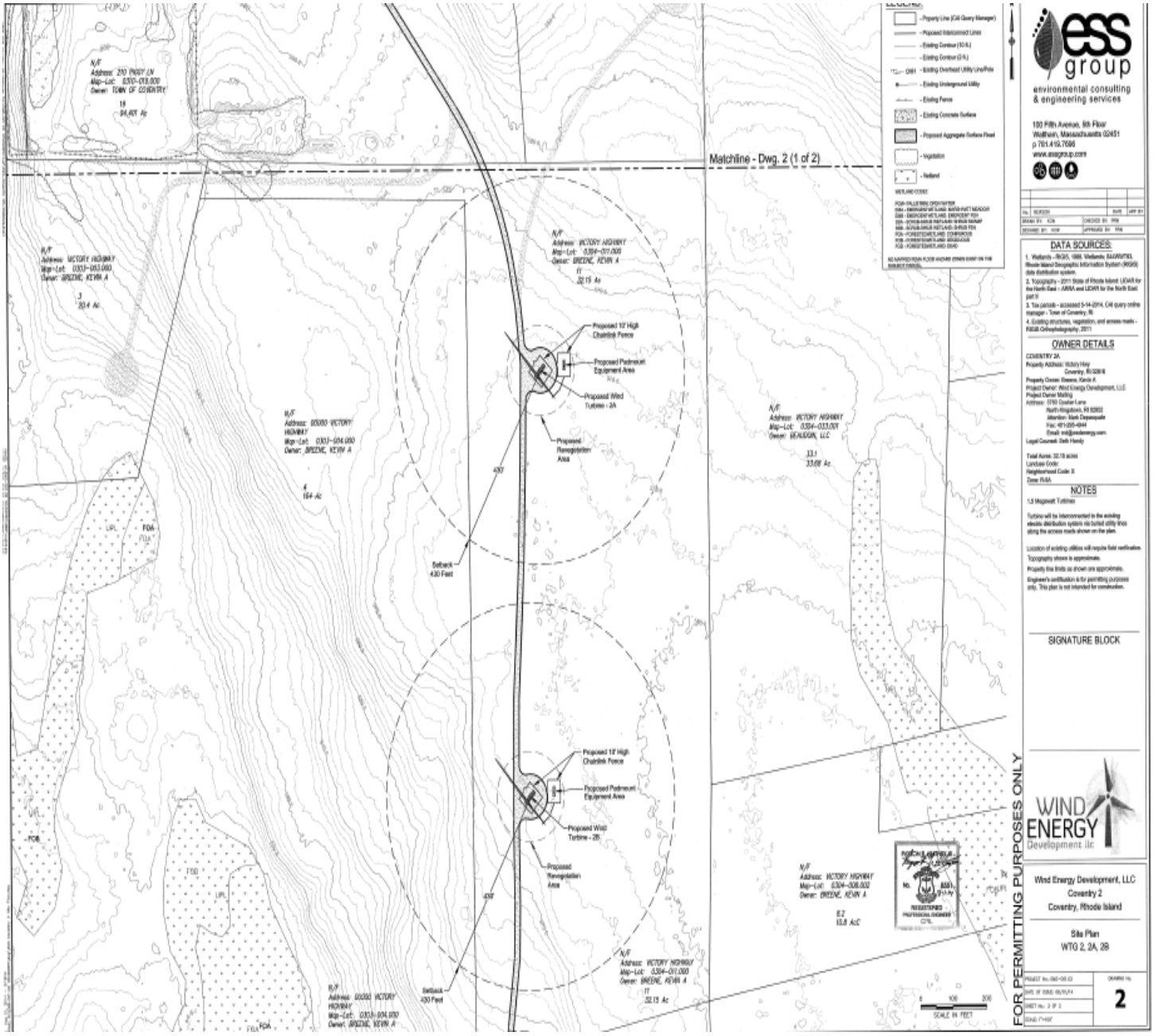

Figure 3: Wed 2 Site Plan, 2 of 2

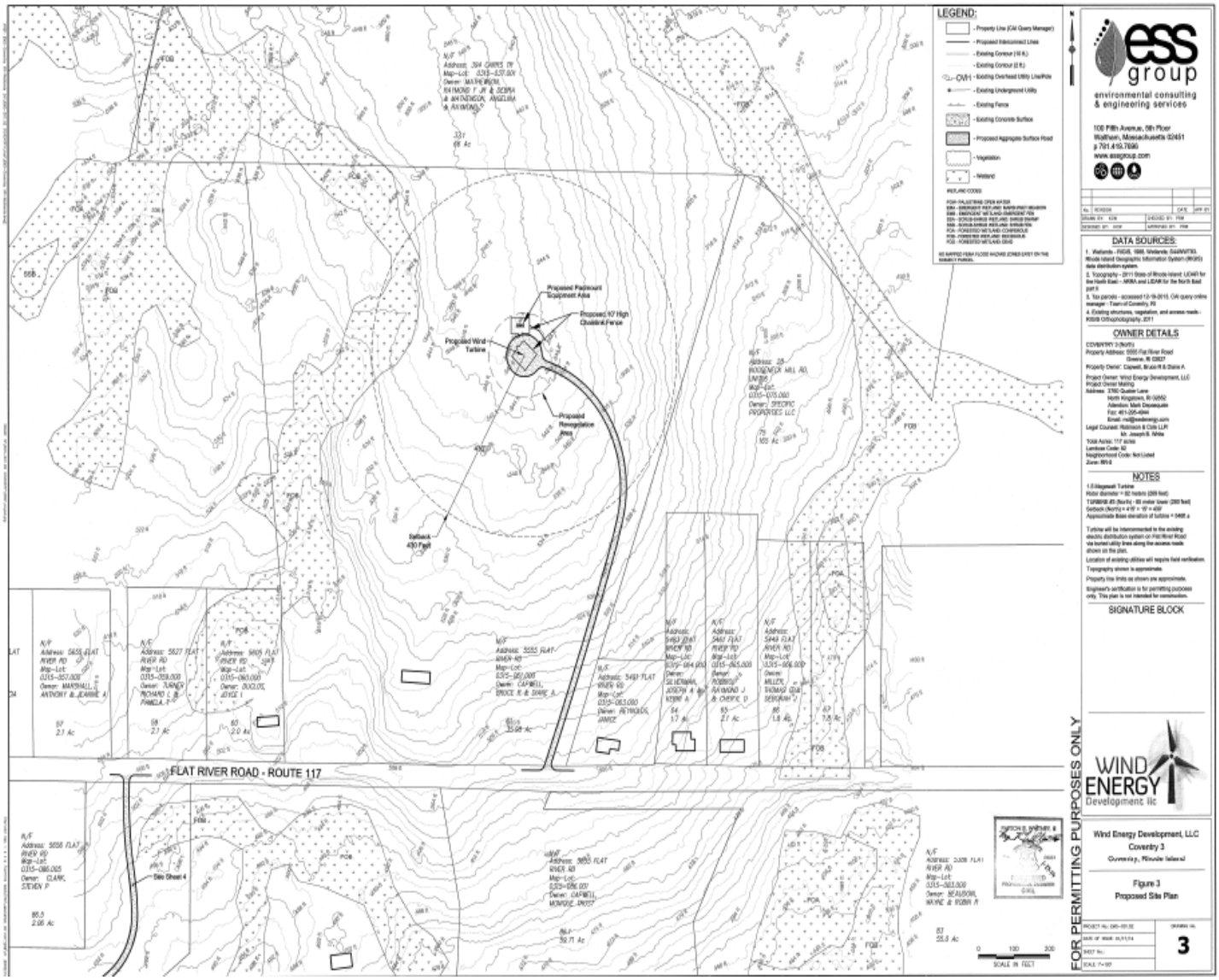

Figure 4: WED 3 Site Plan

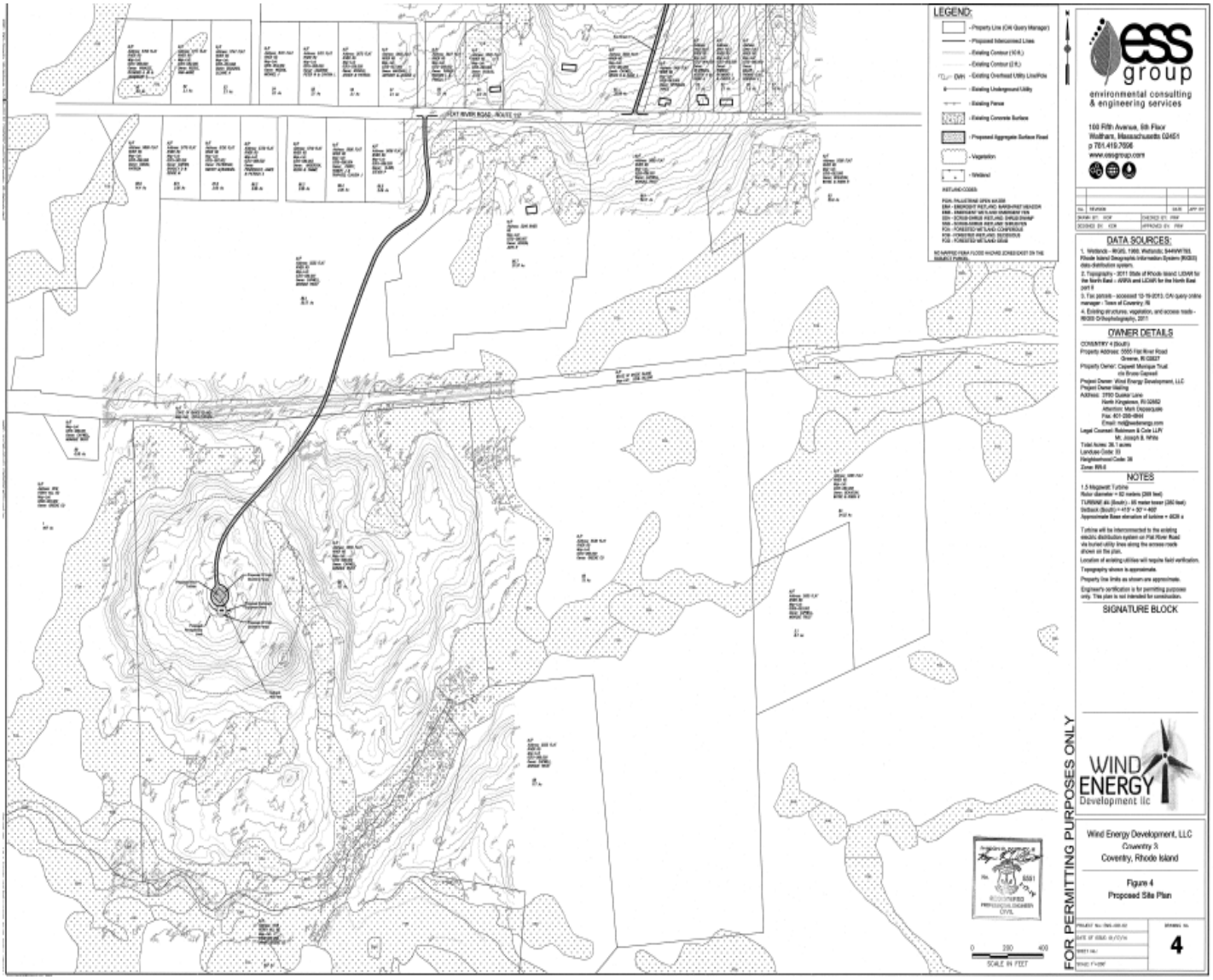

Figure 5: WED 4 Site Plan

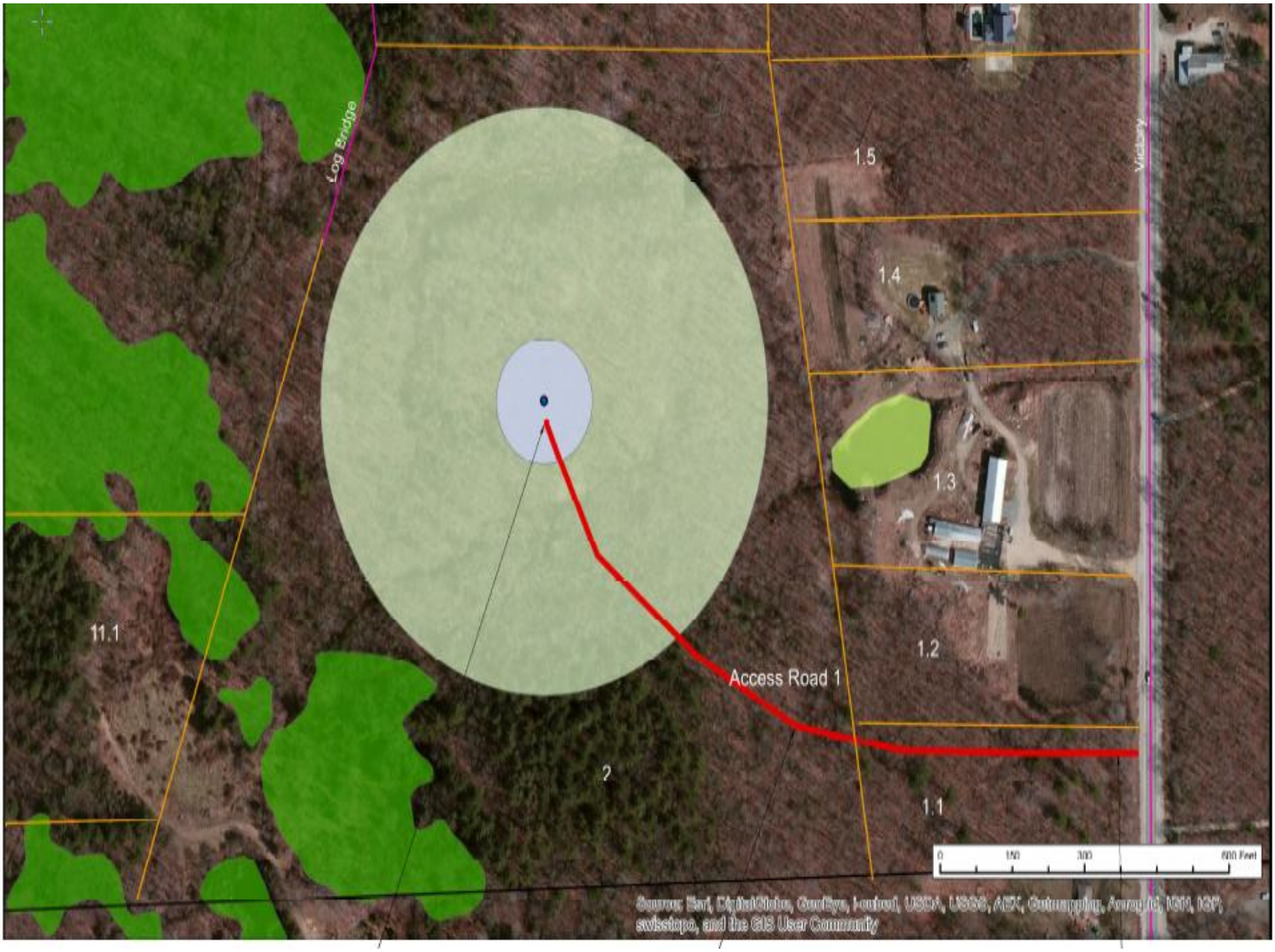

Figure 6: WED 5 Site Plan

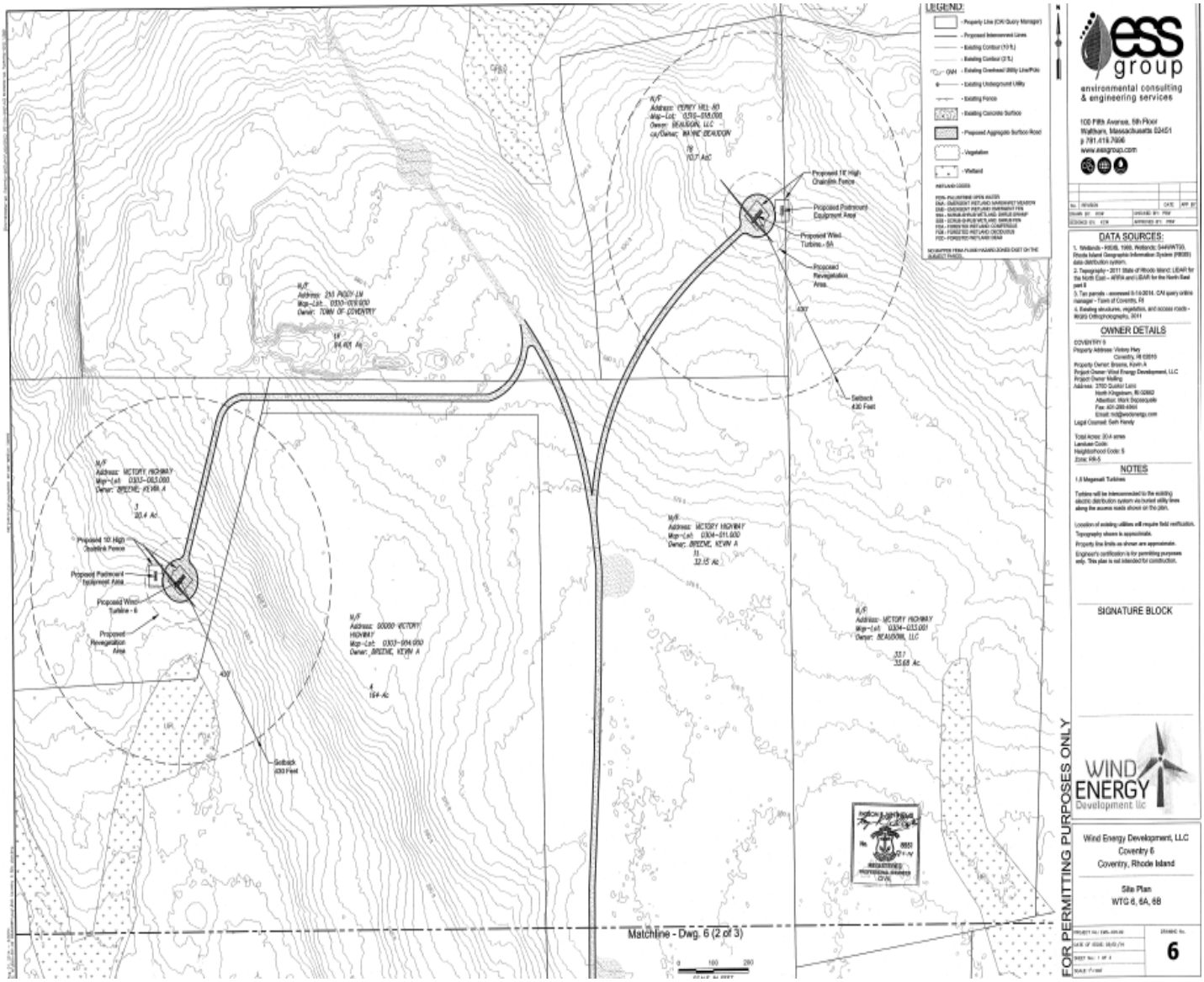

Figure 7: WED 6 Site Plan, 1 of 2

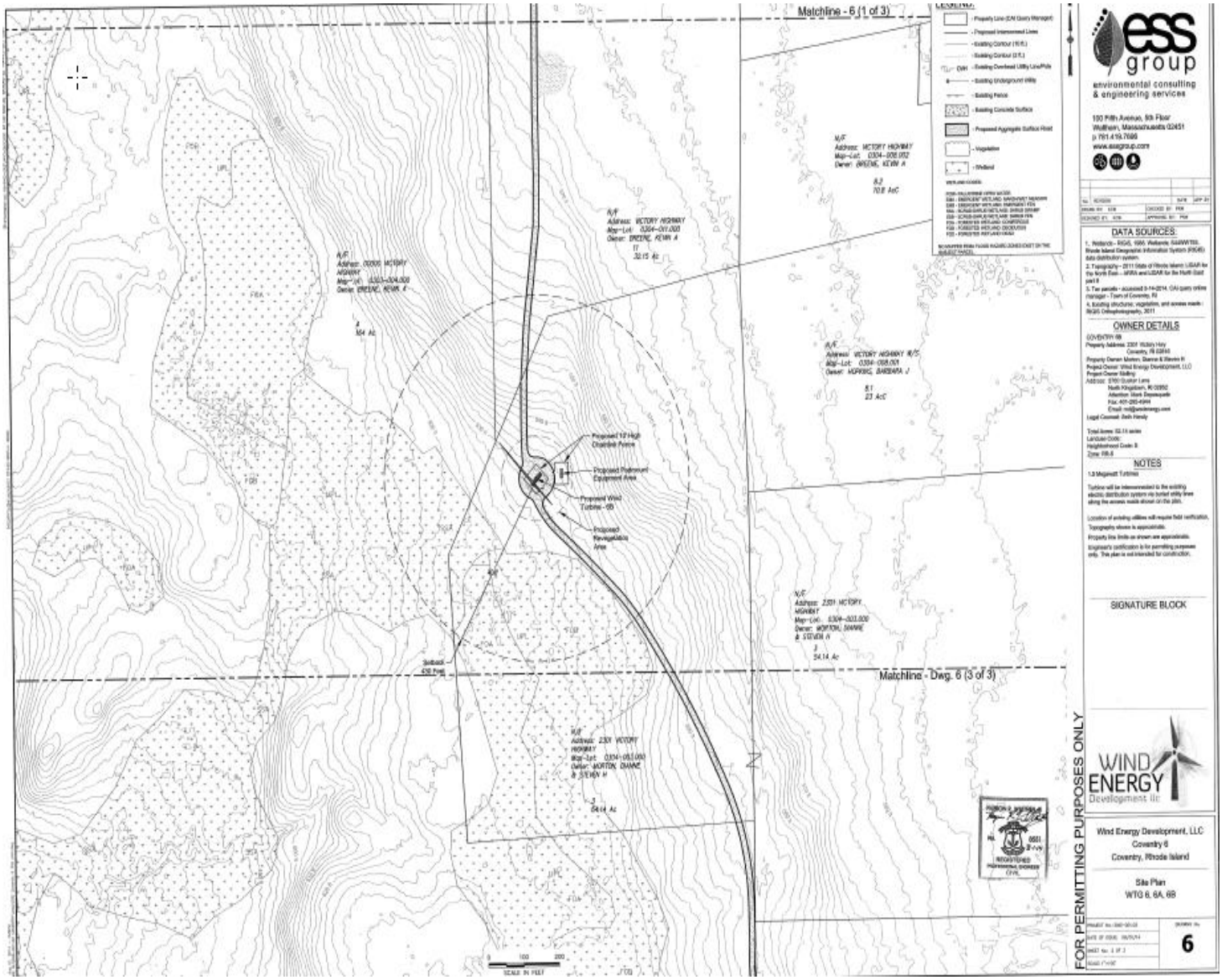

Figure 8: WED 6 Site Plan, 2 of 2

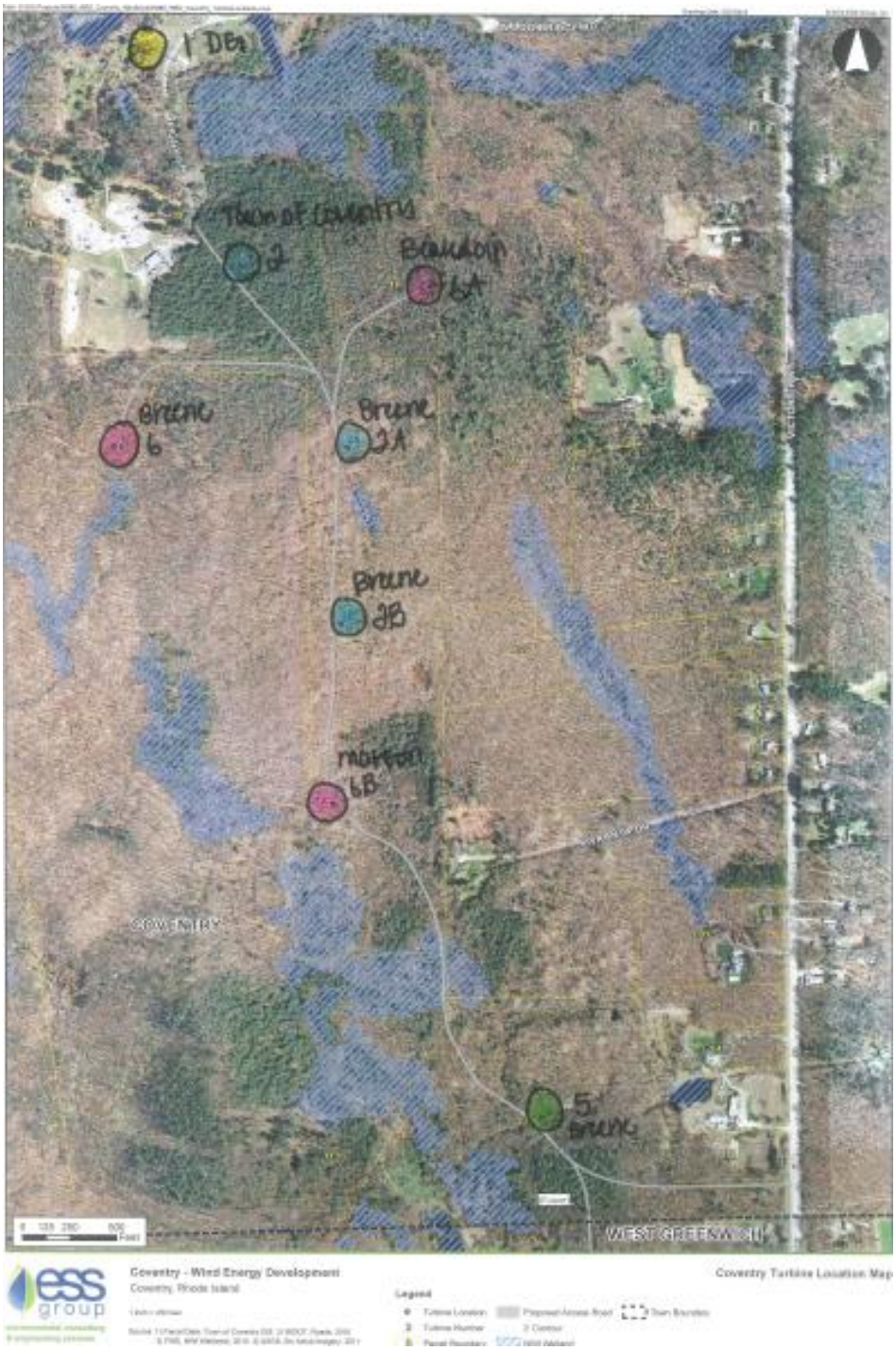

Figure 9: WED 1,2, 5, & 6 - Site Plan

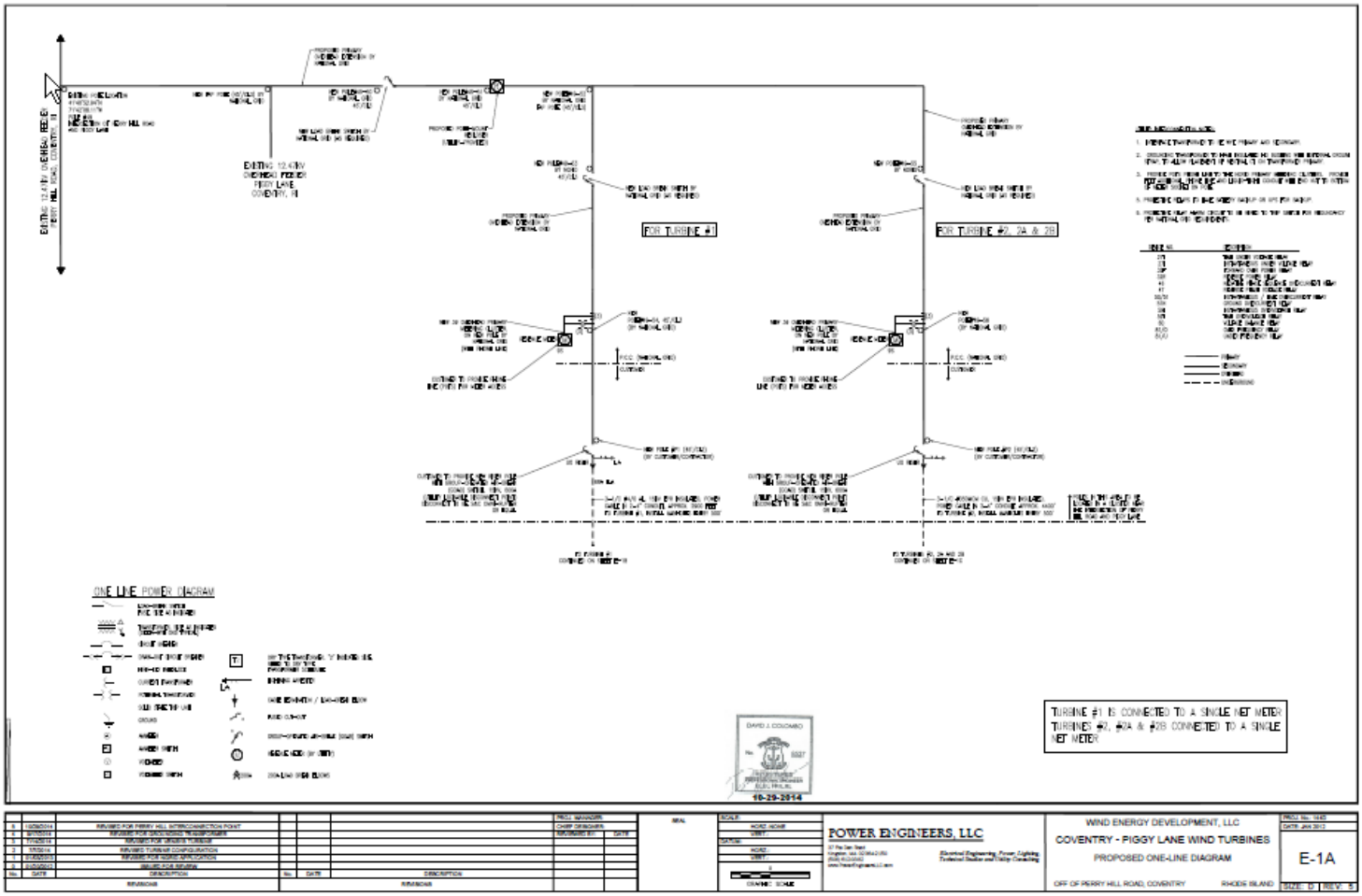

Figure 10: WED 1 & WED 2 One - Line, 1 of 3

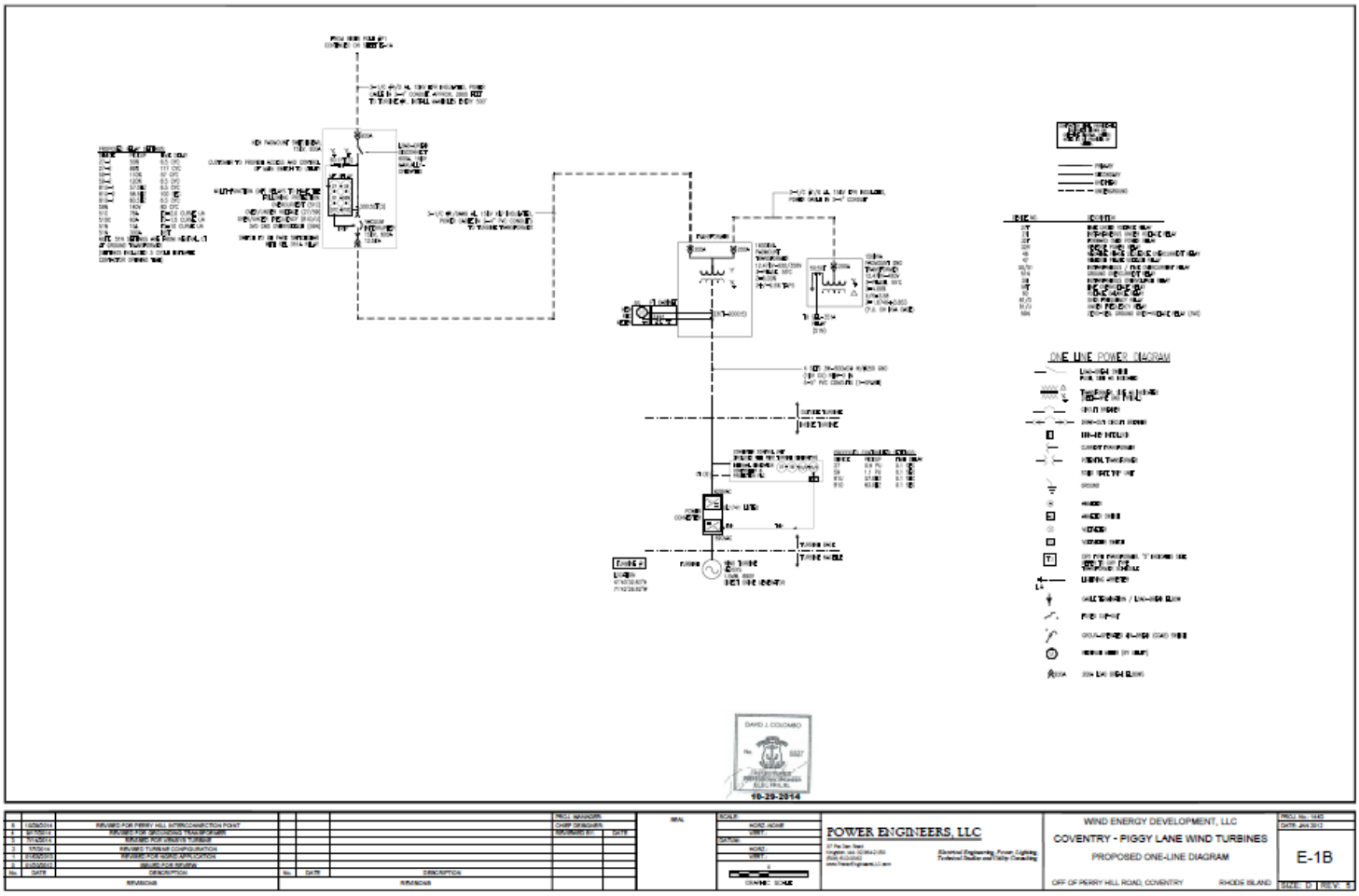

Figure 11: WED 1 & WED 2 One - Line, 2 of 3

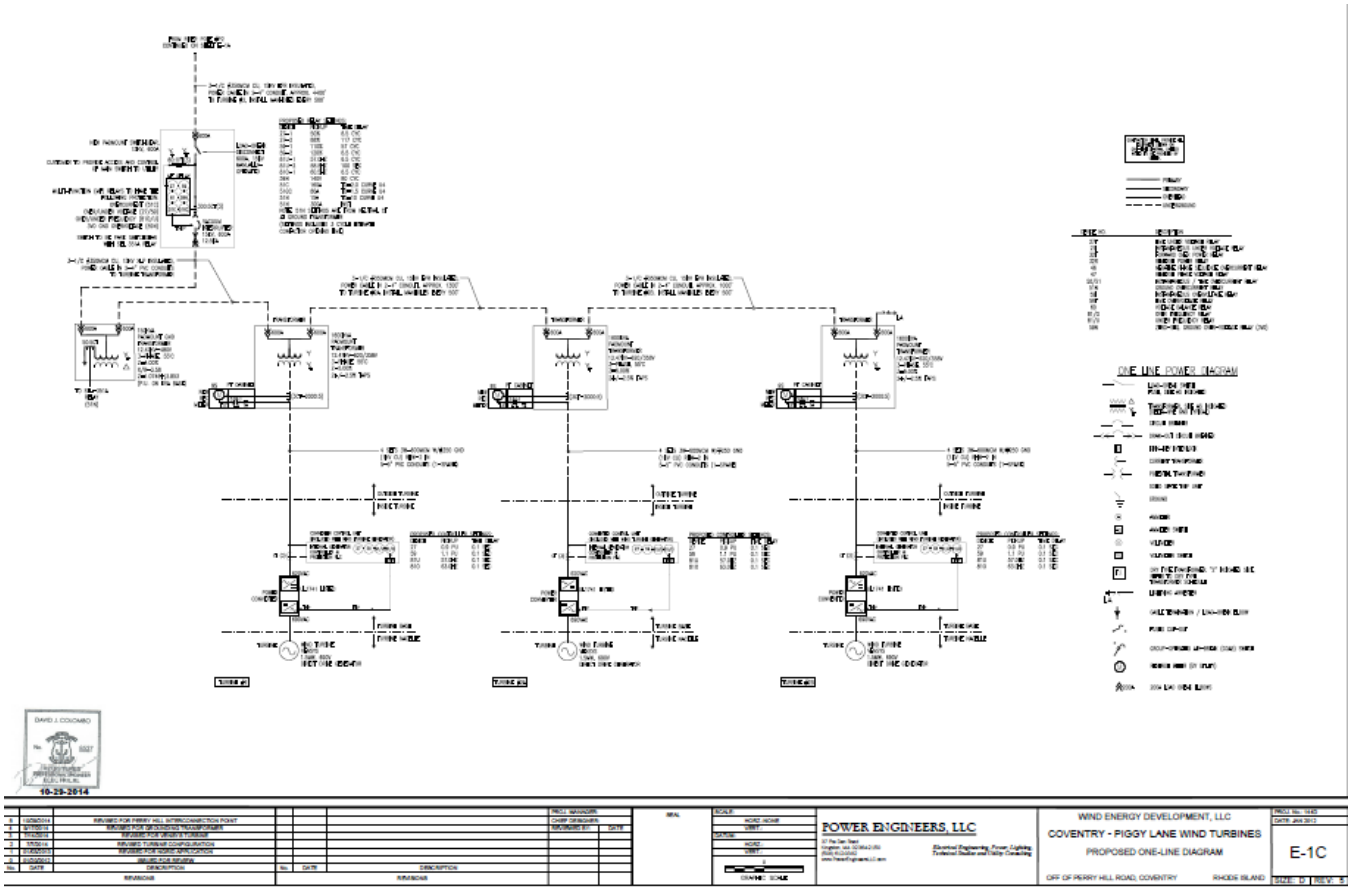

Figure 12: WED 1 & WED 2 One - Line, 2 of 3

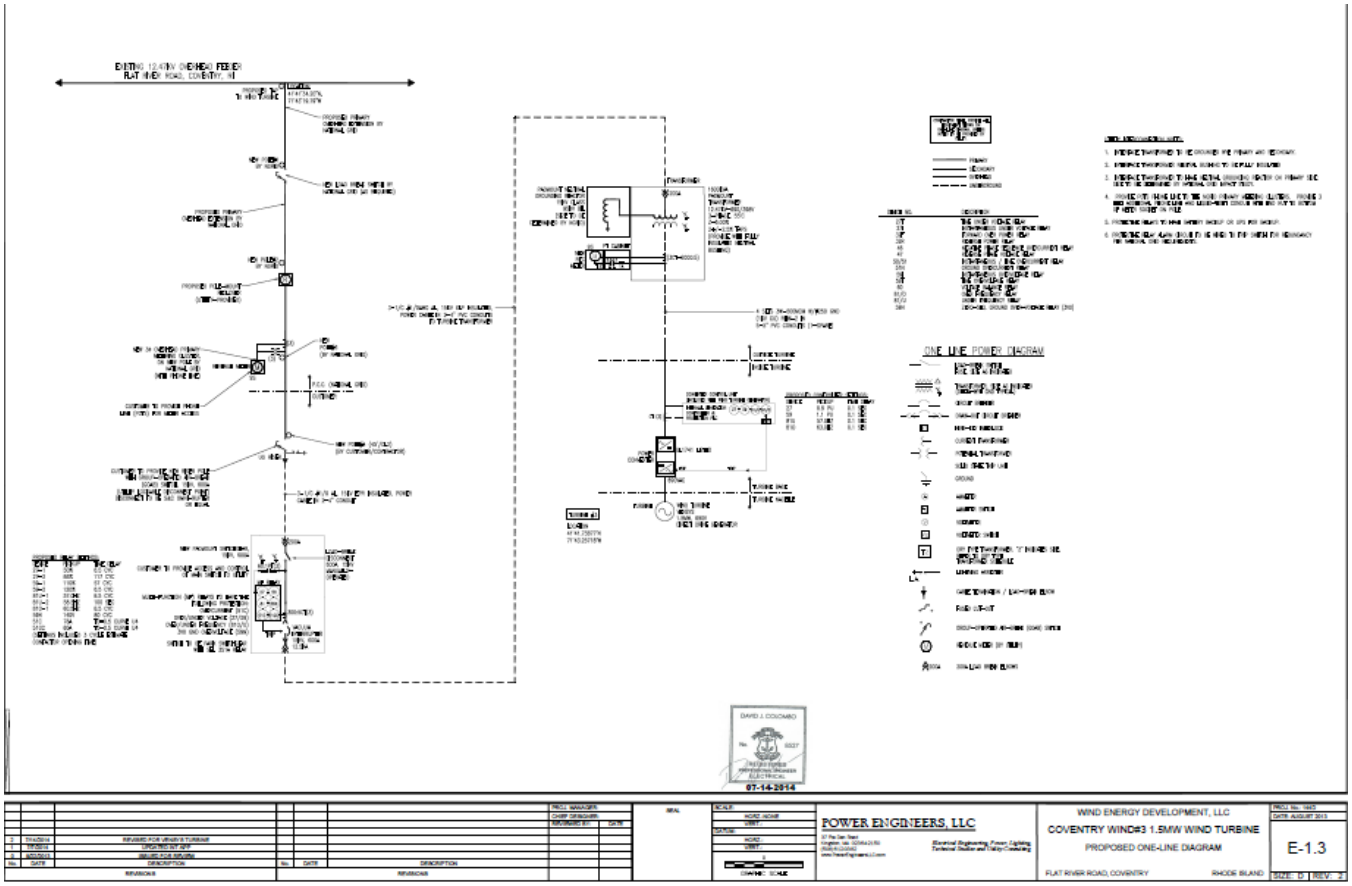

Figure 13: WED 3 One-Line

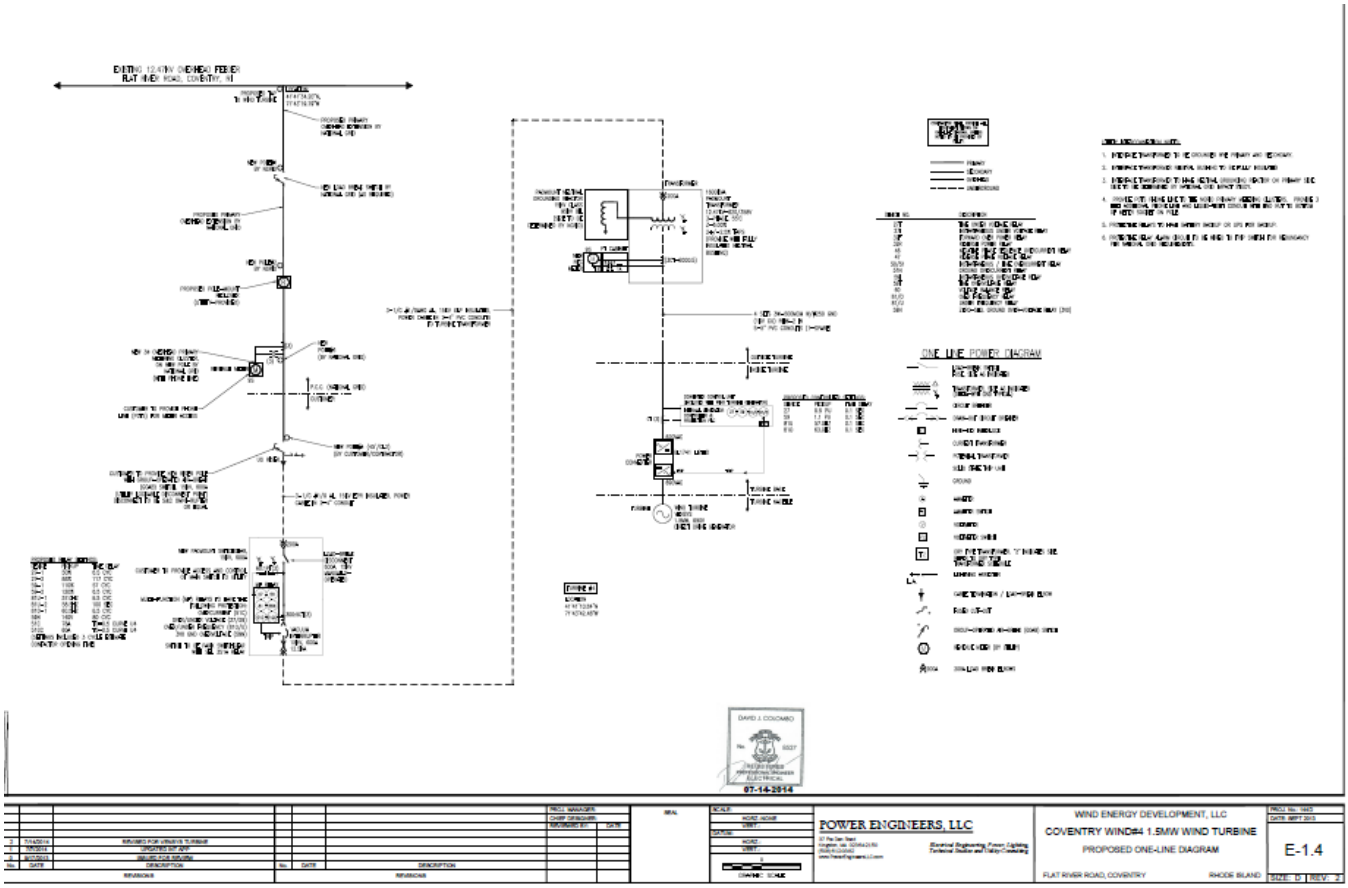

Figure 14: WED 4 One-line

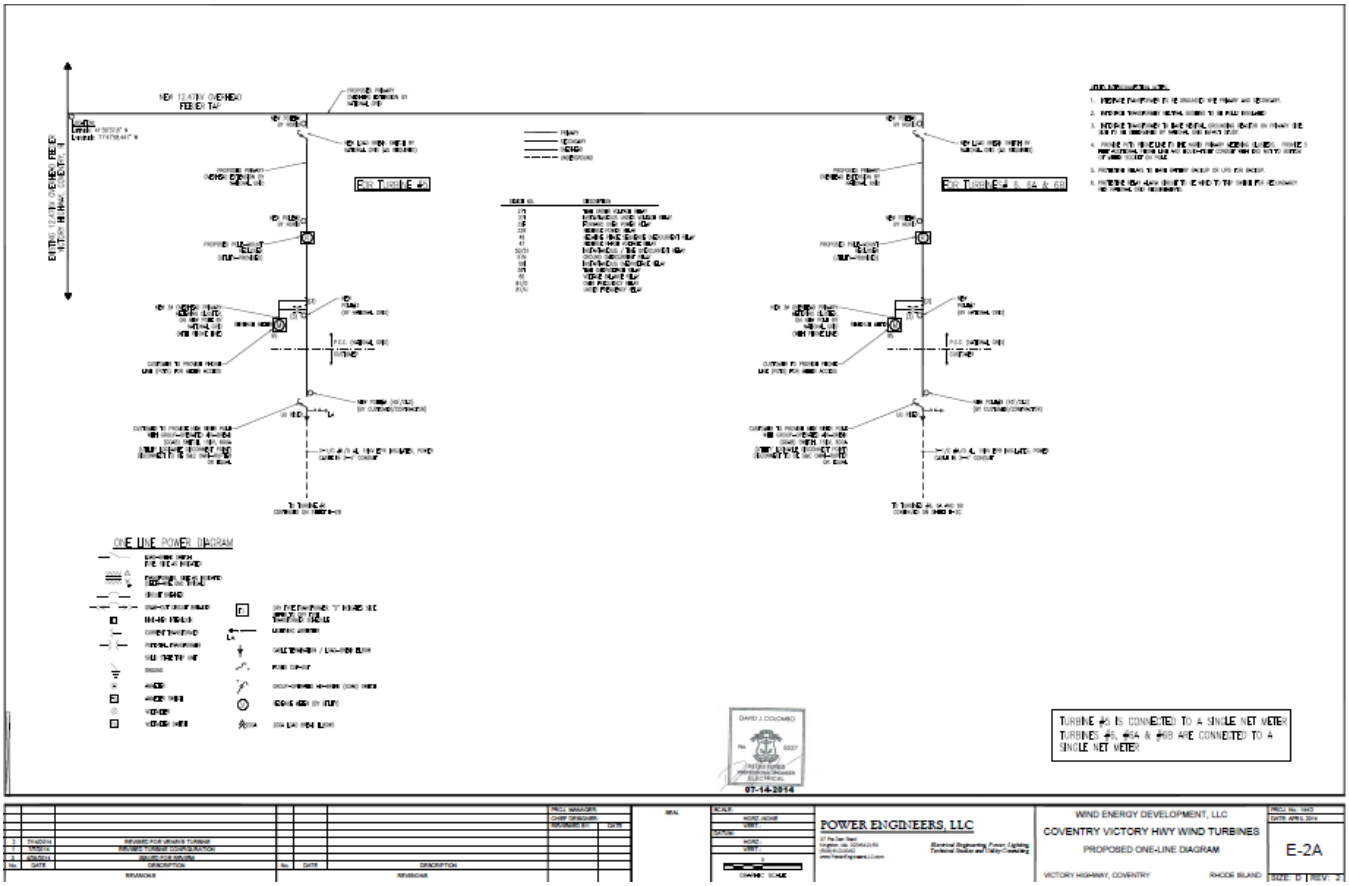

Figure 15: WED 5 & 6 One-line, 1 of 3

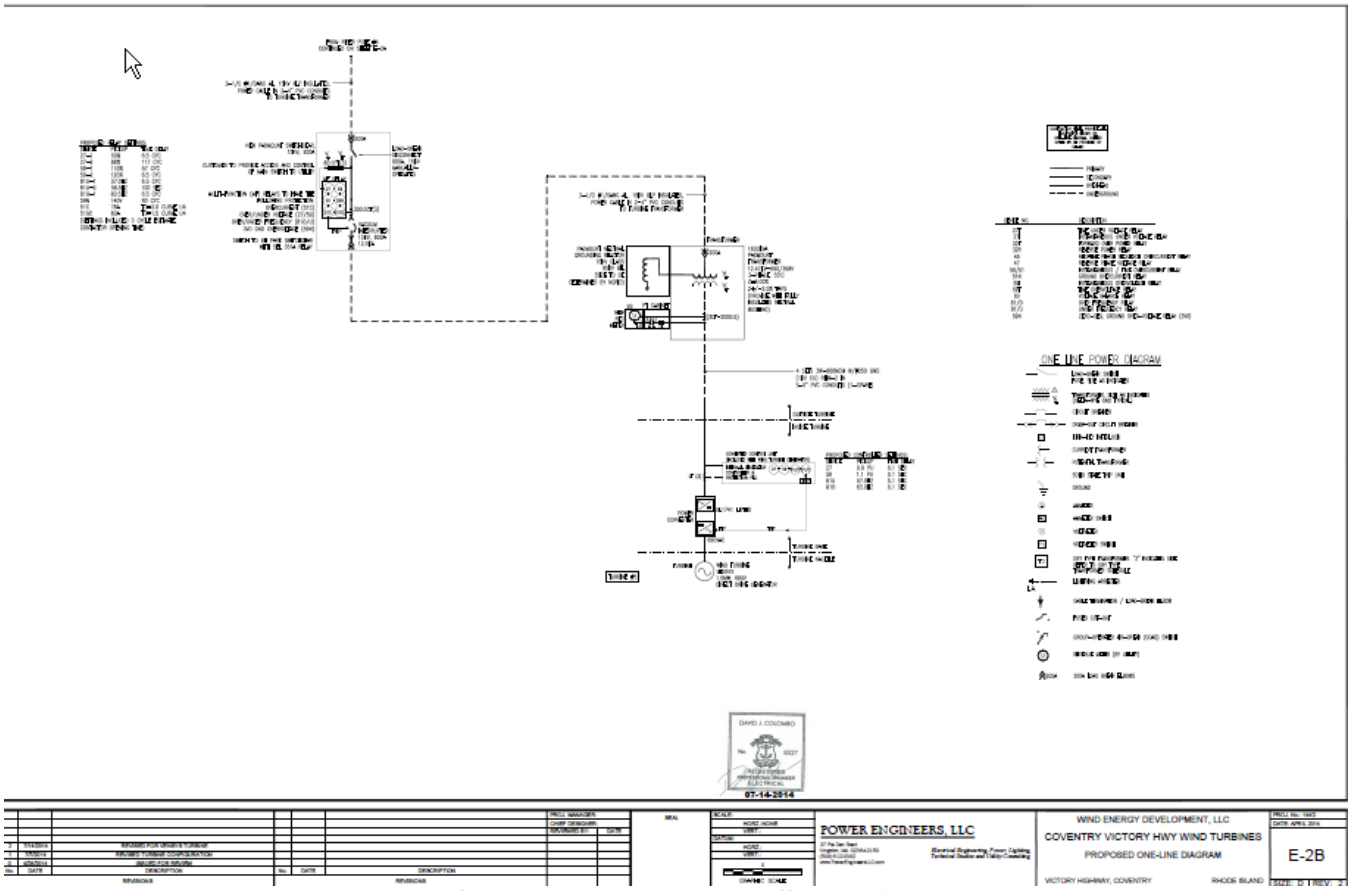

Figure 16: WED 5 & 6 One-line, 2 of 3

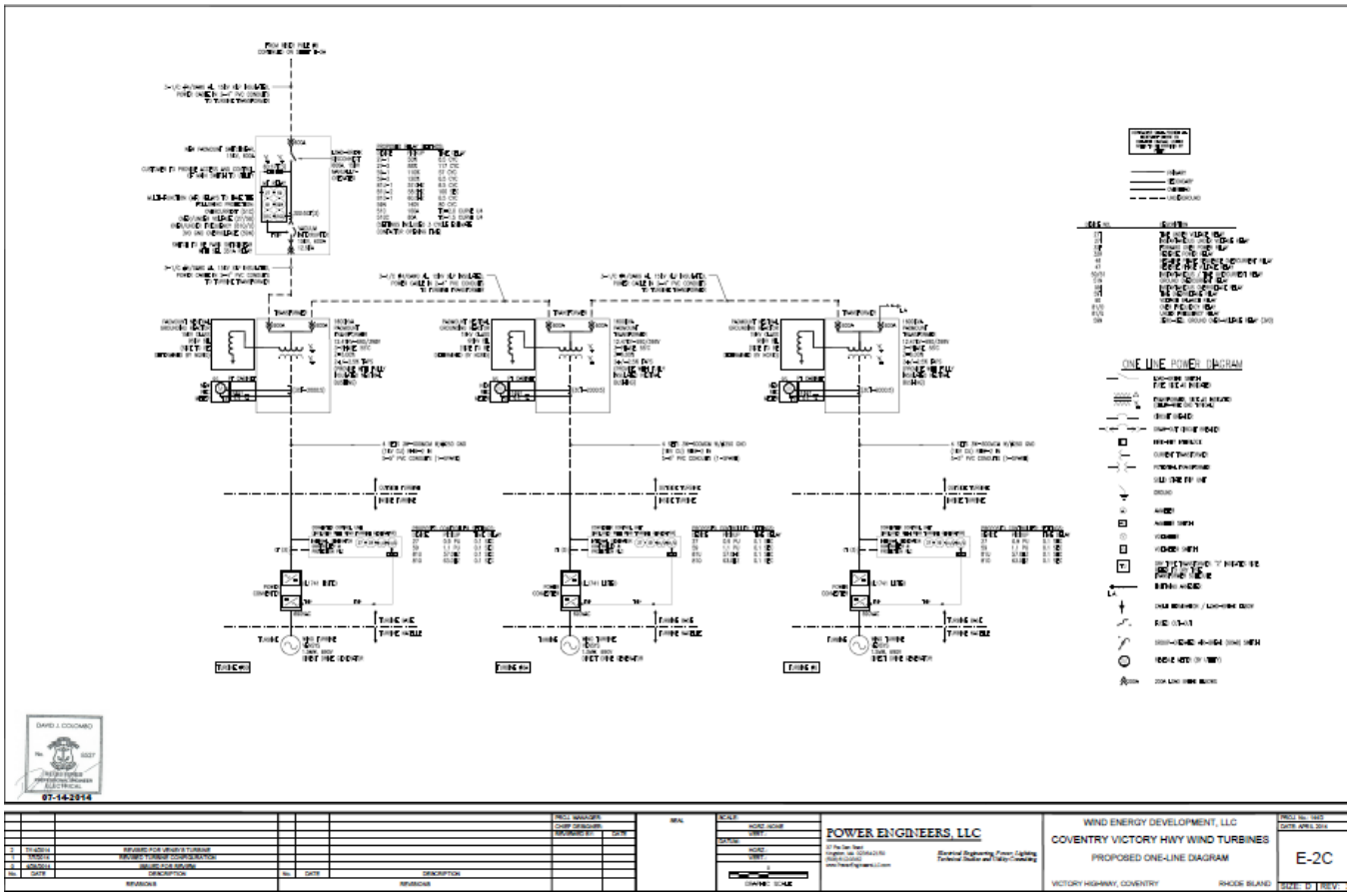

Figure 17: WED 5 & 6 One-line, 3 of 3

Appendix C Existing EPS Configurations

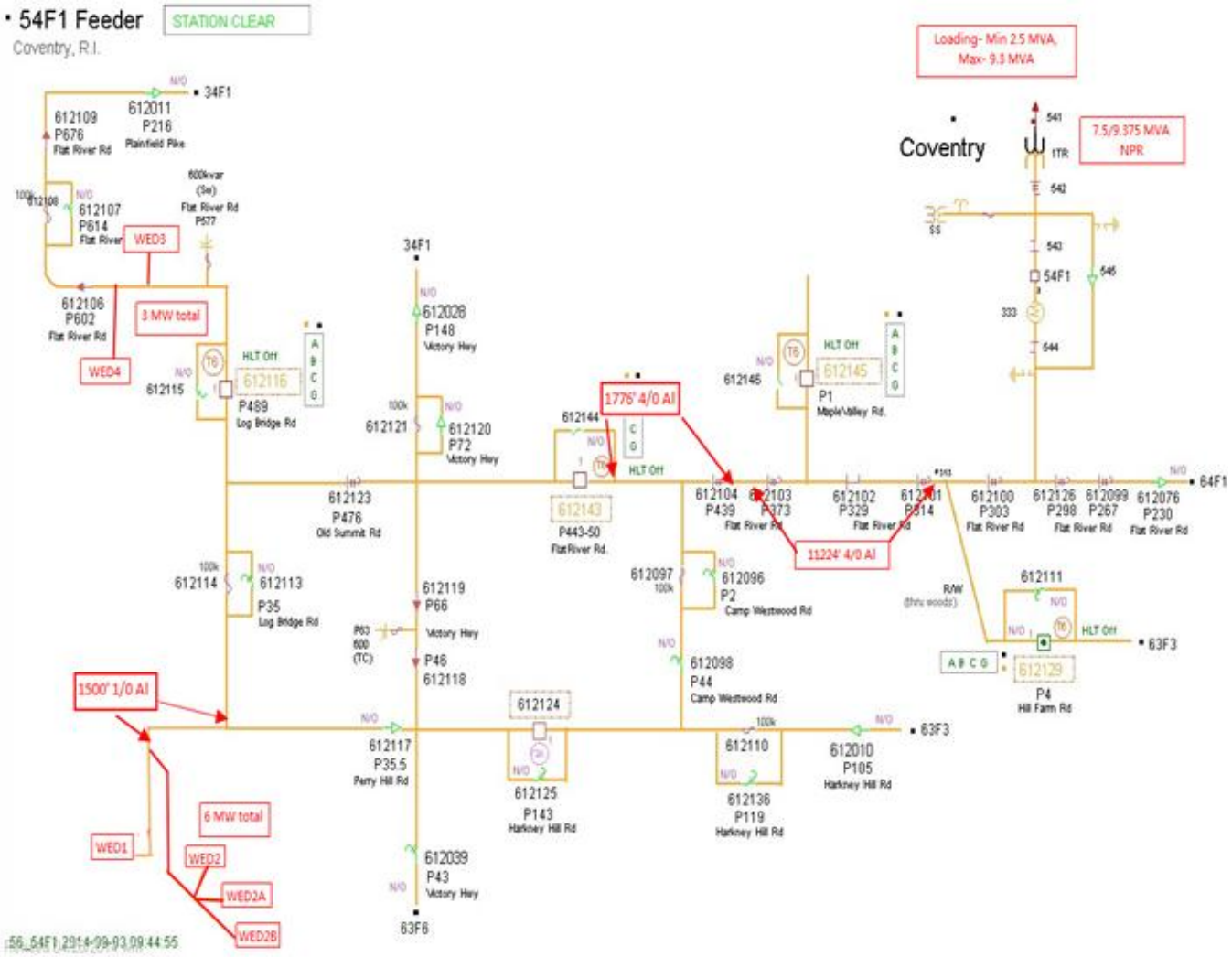

Figure 18: 54F1 EPS

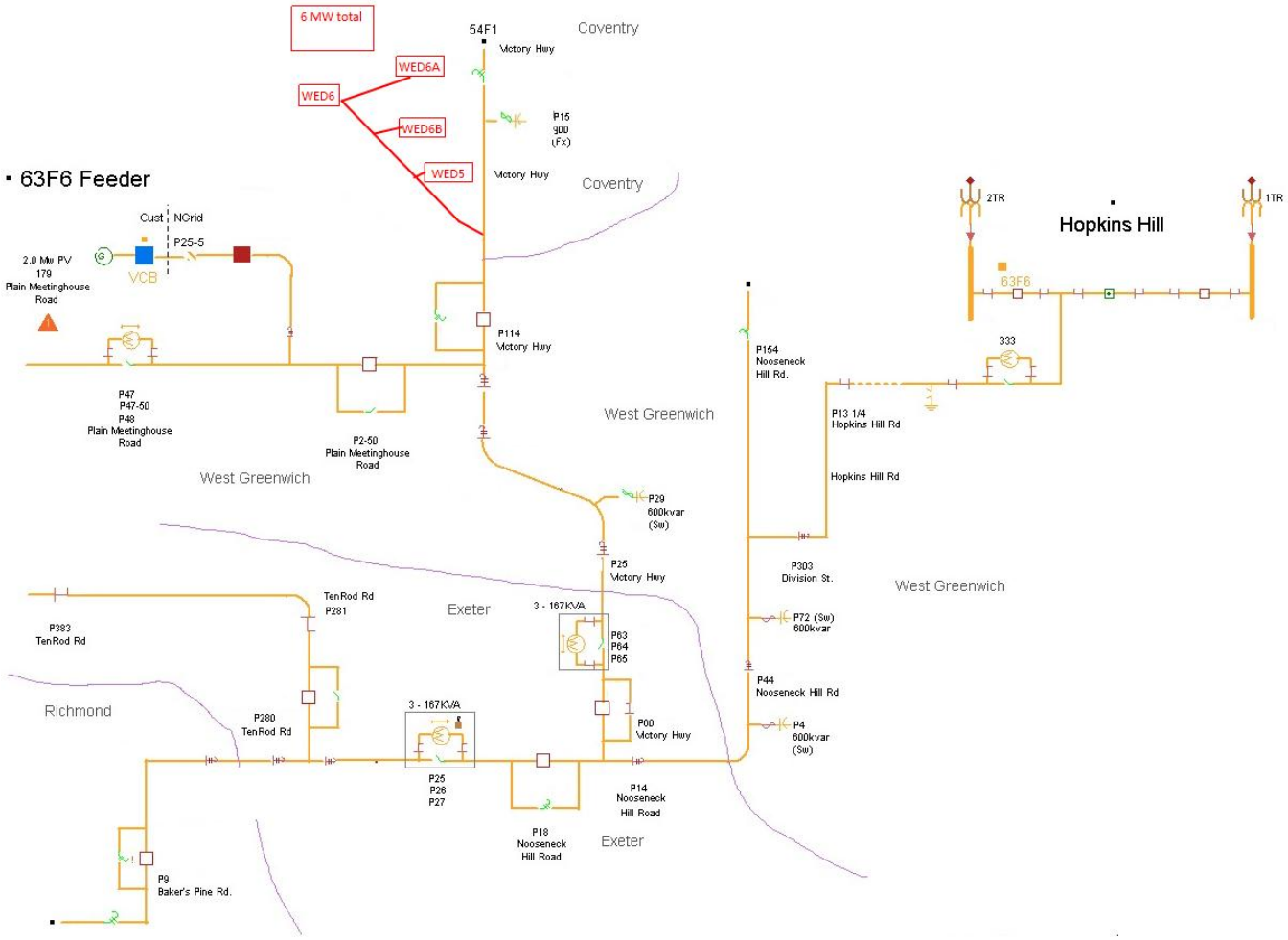

Figure 19: 63F6 EPS

Appendix D Long Term Dynamics Results

TO: CALEB GEORGE

FROM: NICK REIS

SUBJECT: WED – LONG TERM DYNAMIC (LTD) ANALYSIS OF POWER QUALITY

DATE: DECEMBER 12, 2014

CC: JOHN KENNEDY

Scope

The intent of this analysis was to perform a Long Term Dynamic, (LTD) analysis for the Wind Energy Development (WED) #1, 2, 2A, 2B, 3 and 4 wind turbines proposed to be interconnected on to the Coventry 54F1 circuit and the WED 5, 6, 6A, and 6B wind turbines proposed to be interconnected on to the Hopkins Hill 63F6 circuit to observe how the potential power fluctuations may impact the power quality, voltage drop/rise, voltage regulation, thermal capabilities, flicker conditions and operational effect of the area EPS. The analysis observed whether potential power fluctuations and voltage changes at the POIs and the nearby mainline were maintained within the required ANSI "A" range (+/- 5% of nominal), by the voltage regulation equipment on the circuit. This analysis was performed in accordance with R.I.P.U.C. NO. 2078, section 4.1.1 Voltage Regulation, which states:
"The DR [distributed resource] shall not actively regulate the voltage at the PCC [unless required by NEPOOL's operating procedures]. The DR shall not cause the Area EPS service voltage at other Local EPSs to go outside the requirements of ANSI C84.1-1995, Range A.". This in depth analysis was completed for the Coventry 54F1 interconnection at Piggy Lane POI for WED 1, 2, 2A and 2B, the Flat River Rd POI for WED 3 and 4, and for the Hopkins Hill, 63F6 interconnection for the Victory Hwy POI for WED 5, 6, 6A, and 6B.

Modeling Assumptions

The CYME, Long Term Dynamic module was used for the assessment of the impact the proposed wind turbines would have on the area EPS. The analysis was run for a 24 hour period at a 10 second iteration rate. The customer provided, 24 hour, 6 second sample rate, power output data for the existing North Kingston, RI, wind turbine, collected on March 26, 2014 was utilized for the analysis because it appears to represent volatile wind turbine output for a windy gusty day. For modeling purposes the wind turbines where run at 100% power factor for all the cases and the original WT output curve was capped at 100% of the generator's rated output of 1,500 kW. See figure 1 below:

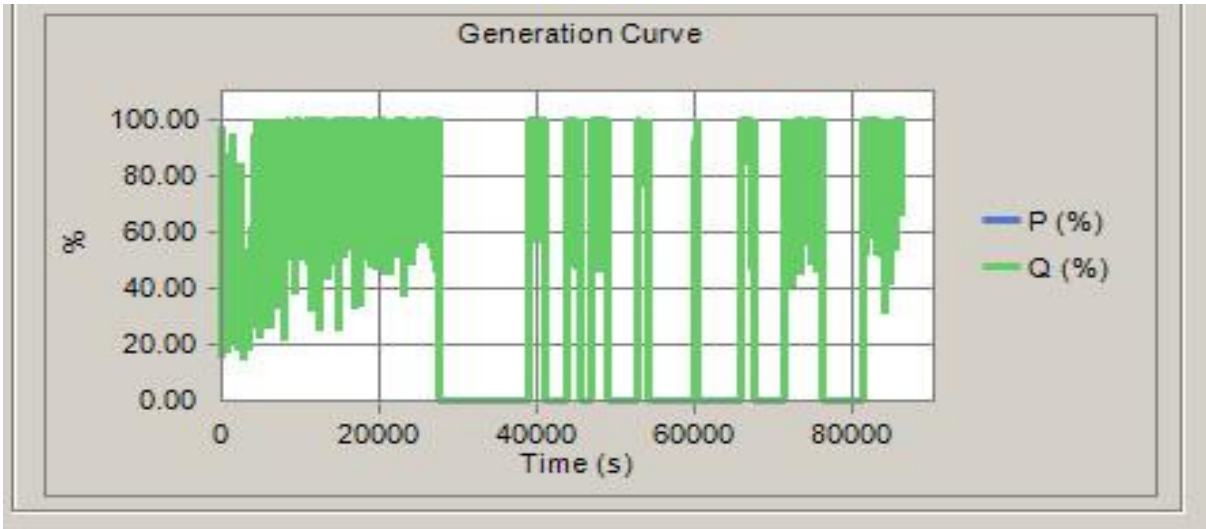

Figure 1: NK Wind Turbine Output for March 26, 2014, 6 sec sample rate

The 63F6 and 54F1 serve the same geographic area and have the same customer and load mix. Since no telemetered load data is available for the 54F1, the available 63F6, 2012 peak load data, with a 6 second sample rate was used as the load curve used for the LTD analysis for both the 54F1 and 63F6 circuits. Refer to figure 2 below:

Figure 2: Load Curve

Circuit configurations are based upon the both the existing circuit main line configuration and also on the previous Steady State load flow analysis performed using the CYME DIST load flow module, where it was determined that existing overhead conductor on the 54F1 that was less than 336 Al in size between the POIs at Piggy Ln and Flat River Rd and Coventry Substation, would be required to be upgraded to 477 Al conductor to meet thermal requirements of the proposed interconnection of six, 1,500 kW wind turbines. Optimal settings for the voltage regulation devices where determined during prior Steady State load flow analysis of both circuit peak and minimum loading cases, for scenarios where all wind turbines and no wind turbines are in

operation. The customer design data is based upon the most recent one-lines provided and the customer's primary conductor data provided on November 26, 2014.

LTD Analysis for Coventry 54F1

Several scenarios where run for the Coventry 54 F1 circuit, where no wind turbines, one wind turbine, two wind turbines, three wind turbines, four wind turbines, five, and six wind turbines where in operation. The Voltage profiles have been plotted at the POIs for the Piggy Lane, WED 1, 2, 2A, and 2B wind turbines, bus 207816714, and the Flat River POI, bus 2534, for the WED 3 and 4 turbines.

Figure 3 below shows the expected voltage profiles at the POIs without any wind turbines interconnected with the existing circuit main line configuration, where up to 9 substation regulator tap change operations are expected for a 24 hour period.

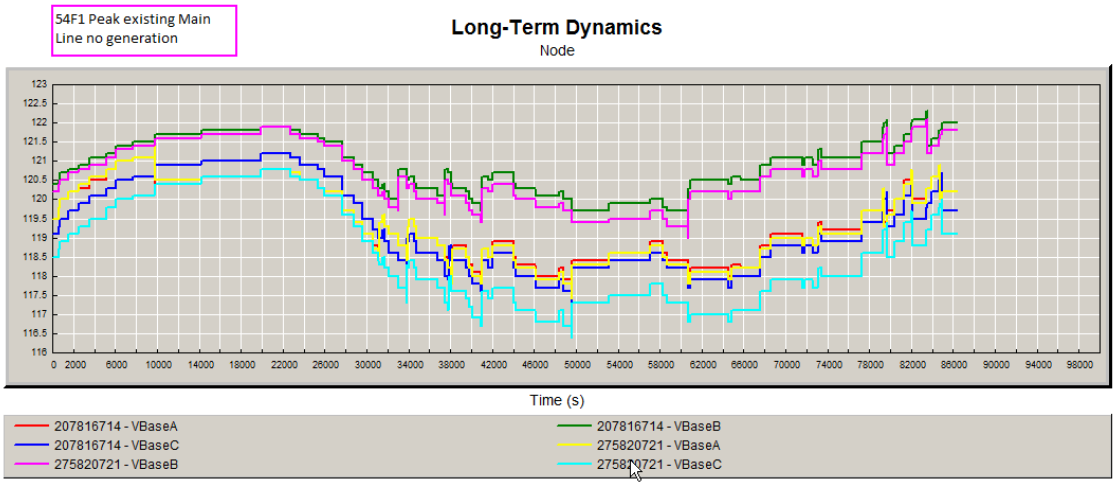

Figure 3: Voltage profile no Wind Turbines in Service

The LTD model was again run with one wind turbine in service at the Piggy Ln POI and then subsequently with one wind turbine in service at the Flat River POI, refer to Figures 4 and 5. The Circuit has the existing main line configuration. Up to 26 regulator tap changes are now expected for a 24 hour period.

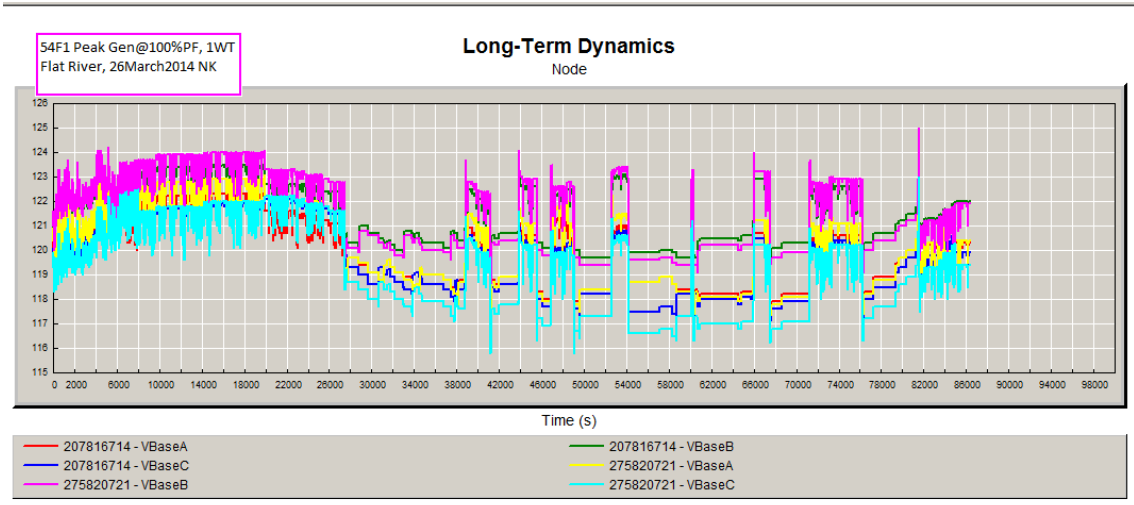

Figure 4: 1 WT on 54F1 in service at Piggy Lane POI

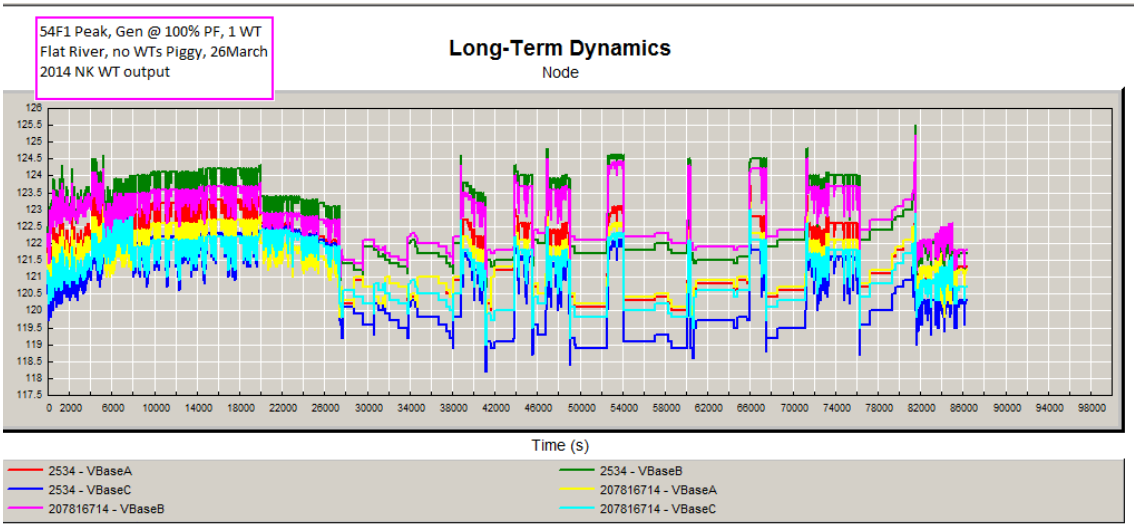

Figure 5: 1 WT on 54F1 in service at Flat River POI

The figures 4 and 5, voltage plots indicate that for only one wind turbine in service on the 54F1, at either the Piggy Lane or Flat River POIs, the POI voltage will remain in the required ANSI A range.

The model was run with two Wind turbines in service on the 54F1, where both wind turbines are first at the Piggy Ln POI and then both where at The Flat River POI, and again where there is one wind turbine at Piggy Ln and one wind turbine at Flat River, refer to figures 6, 7, 8 respectively. The Circuit has the existing main line configuration.

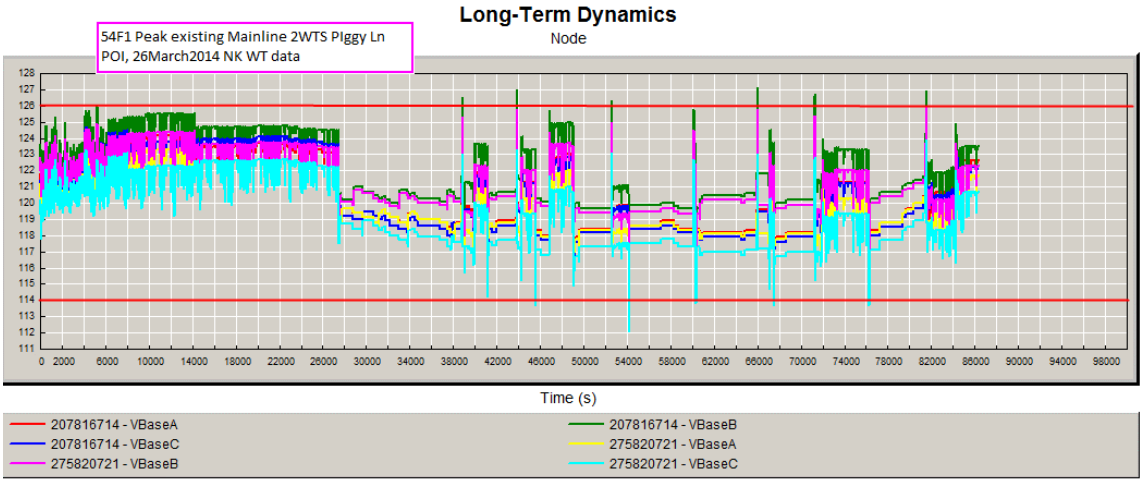

Figure 6: 2 WTs in serve on 54F1, both at Piggy Ln POI

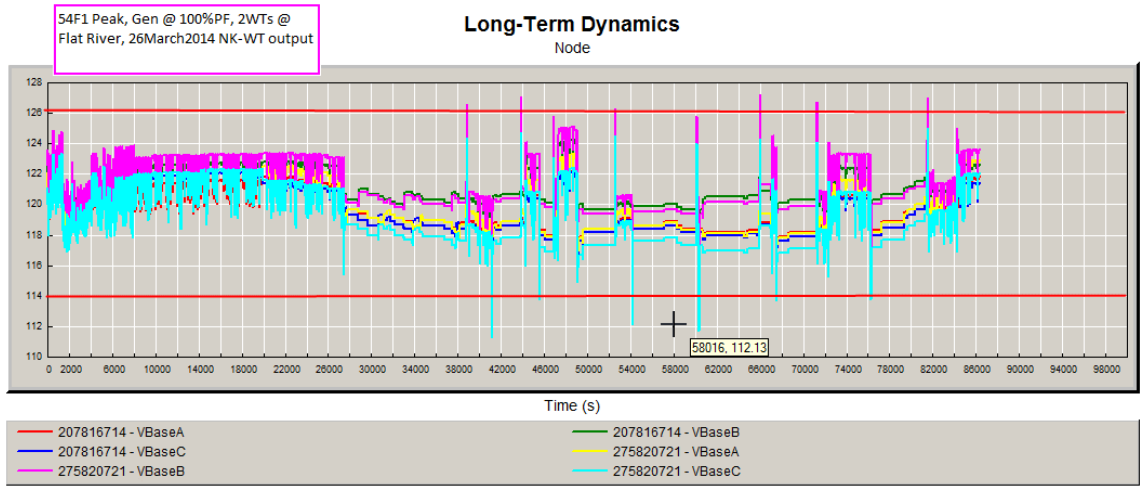

Figure 7: 2 WTs in service on the 54F1, both at Flat River POI

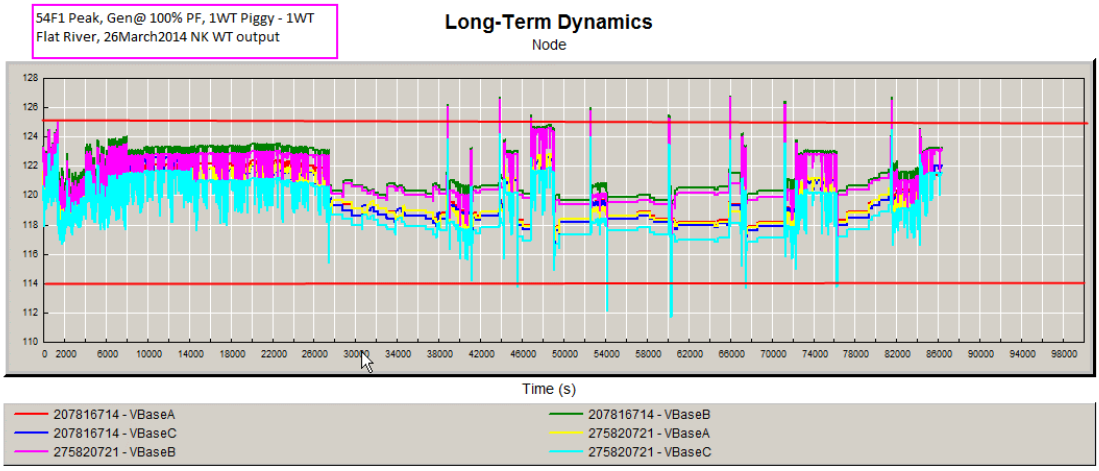

Figure 8: 1 WT at Piggy Ln and 1 WT at Flat River

The figures 6, 7, and 8 voltage plots of the POIs indicate that with 2 wind turbines in service at either the Piggy Ln or Flat River POIs the voltage profiles at either POIs will exceed the ANSI A range. Note that in figure 6, the voltage profile of the corresponding Flat River POI where the wind turbines are not in service, also exceeds ANSI A range, this indicates the voltage profile of the entire feeder is negatively affected by the interconnection of only two wind turbines at Piggy Ln. It is predicted the Coventry Substation regulator will have in excess of 20 tap change operations for a 24 hour period.

The model was run with a total of three wind turbines in service on the 54F1 where two are in service at the Piggy Ln POI and one is in service at the Flat River POI. The Circuit has the existing main line configuration. The results are shown in figure 9.

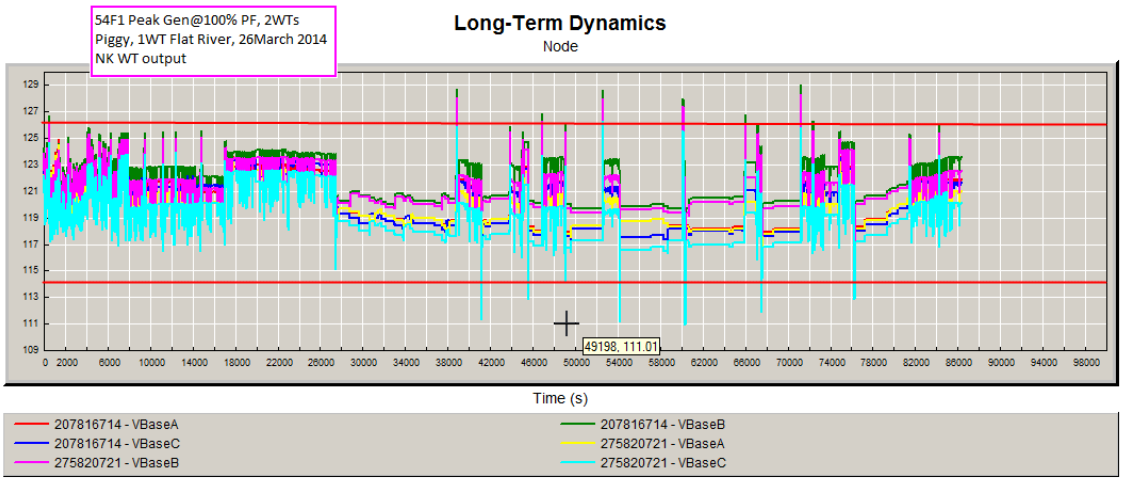

Figure 9: 3 WTs on the 54F1 in service, 2 WTs at Piggy Ln and 1 WT at Flat River POIs

The figure 9 voltage plots of the POIs indicate that three wind turbines in service on the 54F1 will cause voltage excursions outside the ANSI A range. It is predicted the Coventry Substation regulator will have in excess of 40 tap change operations for a 24 hour period. The thermal limit of the existing 1/0 Al overhead conductor on Perry Hill Road has been reached and must be upgraded to allow for any additional wind turbines to be interconnected at the Piggy Ln POI. The thermal limit of the existing 4/0 Al overhead main line on Flat River Rd has been exceeded by the installation of the three wind turbines.

The model was run with a total of three wind turbines in service on the 54F1 where one is in service at the Piggy Ln POI and two are in service at the Flat River POI. The Circuit has the existing main line configuration. The results are shown in figure 10.

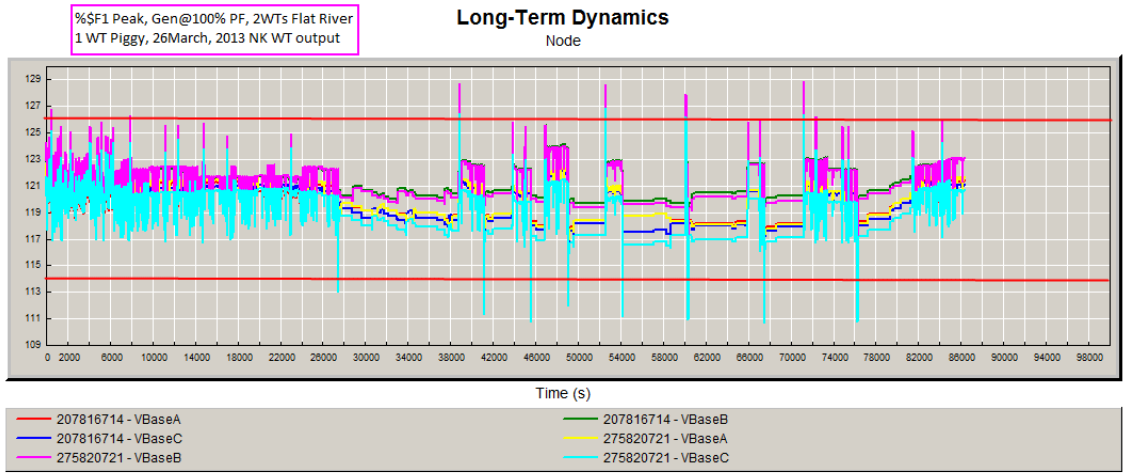

Figure 10: 3 WTs on the 54F1 in service, 1 WT at Piggy Ln and 2 WT at Flat River POIs

The figure 10 voltage plots of the POIs again indicate that three wind turbines in service on the 54F1 will cause voltage excursions outside the ANSI A range. It is predicted the Coventry Substation regulator will have up to 40 tap change operations for a 24 hour period. The thermal limit of the existing 4/0 Al overhead main line on Flat River Rd has been exceeded by the installation of the three wind turbines.

Figure 11 shows the results of four wind turbines in service on the 54F1, two at Piggy and two at Flat River POIs. The 1/0 Al on Perry Hill down to the POI on Piggy Ln has been upgrade to 477 Al because the thermal limit of the existing 1/0 Al overhead conductor has been reached. The existing 4/0 Al overhead line conductor between the POIs and the substation on Flat River Road was upgraded because its thermal limit has been exceeded by the four wind turbines now connected to the 54F1.

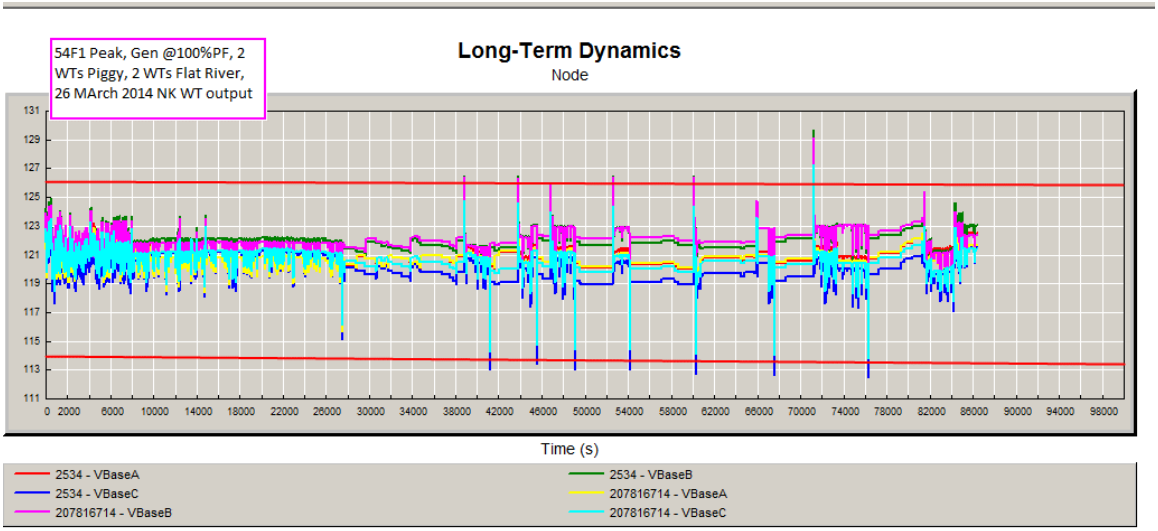

Figure 11: 4 WTs in service on the 54F1, 2 at Piggy Ln and 2 at Flat River POIs

Figure 11 shows that with four wind turbines in service on the 54F1, two at Piggy and two at Flat River POIs, voltage will exceed the ANSI A range limits. It is predicted the Coventry Substation regulator will have in excess of 70 tap change operations for a 24 hour period.

The model was run with a total of five wind turbines in service on the 54F1, where three are in service at the Piggy Ln POI and two are in service at the Flat River POI. The results are shown in figure 12. The 1/0 Al on Perry Hill down to the POI on Piggy Ln has been upgrade to 477 Al because the thermal limit of the existing 1/0 Al overhead conductor has been exceeded. The existing 4/0 Al overhead line conductor between the POIs and the substation on Flat River Road was upgraded because its thermal limit has been exceeded by the five wind turbines now connected to the 54F1.

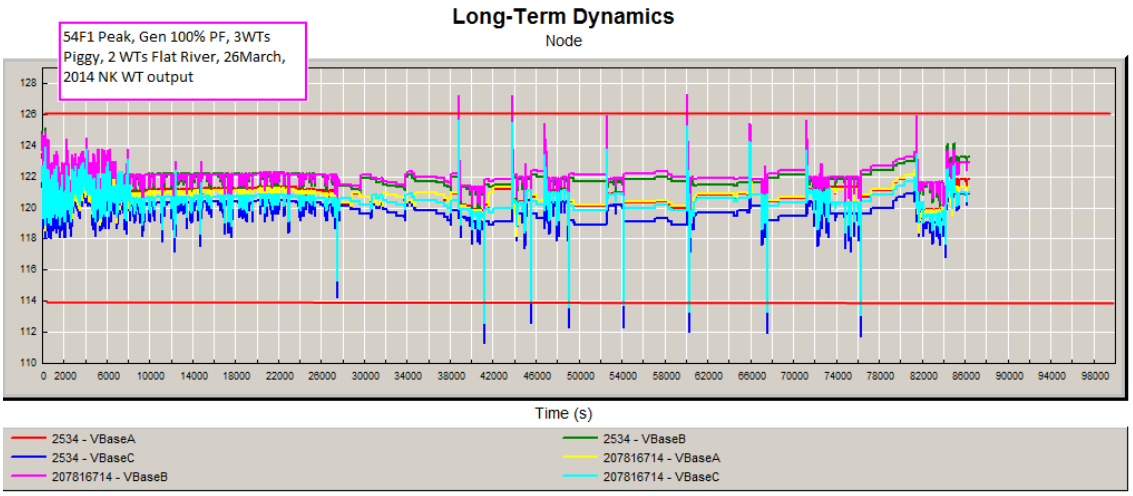

Figure 12: 5 WTs in service on the 54F1, 3 at Piggy Ln and 2 at Flat River POIs

Figure 12 indicates that five wind turbines in service will result in voltage excursions outside the ANSI A range. It is predicted the Coventry Substation regulator will have in excess of 80 tap change operations for a 24 hour period.

The model was run with a total of six wind turbines in service on the 54F1, where four are in service at the Piggy Ln POI and two are in service at the Flat River POI. The results are shown in figure 13, below. The 1/0 Al on Perry Hill down to the POI on Piggy Ln has been upgrade to 477 Al because the thermal limit of the existing 1/0 Al overhead conductor has been exceeded. The existing 4/0 Al overhead line conductor between the POIs and the substation on Flat River Road was upgraded because its thermal limit has been exceeded by the six wind turbines now connected to the 54F1.

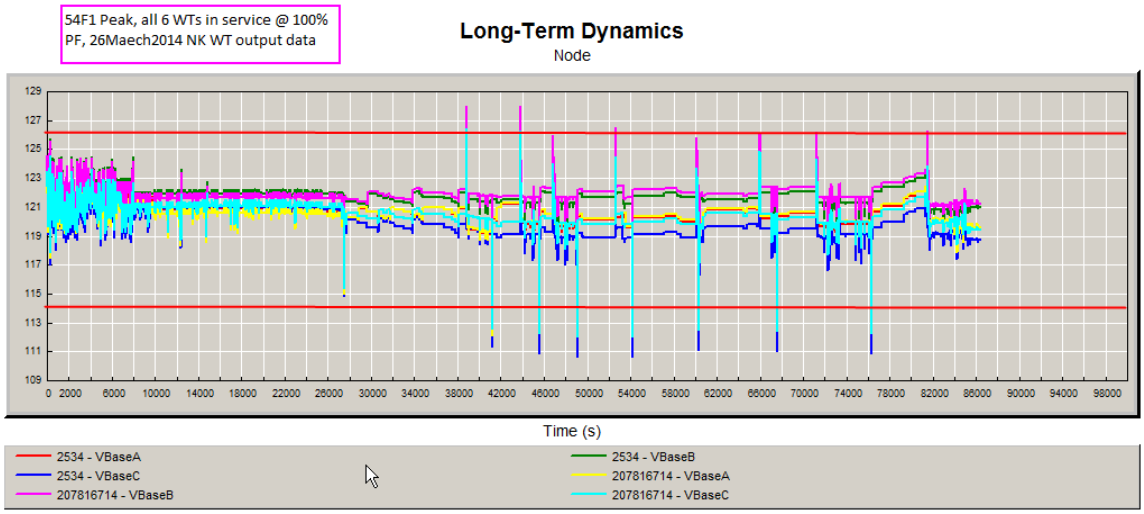

Figure 13: 6WTS in service on 54F1, 4 WTs at Piggy Ln and 2 WTs at Flat River POIs

Figure 13 indicates that six wind turbines in service will result in voltage excursions outside the ANSI A range. It is predicted the Coventry Substation regulator will have in excess of 100 tap change operations for a 24 hour period.

The model was run with a total of six wind turbines in service on the 54F1, where four are in service at the Piggy Ln POI and two are in service at the Flat River POI. All overhead conductor less than 477 Al in size between the POIs and the substation was upgraded to 477 Al. The results are shown in figure 14.

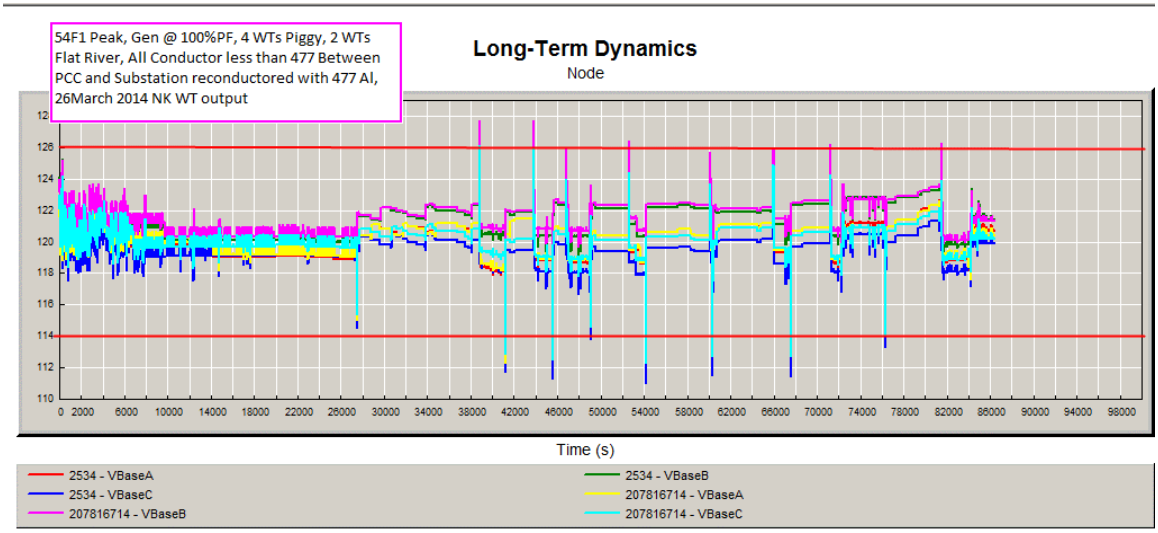

Figure 14: 6WTs in service on 54F1 all mainline smaller that 477A from POIs to Sub upgraded to 477Al

Figure 14 indicates that upgrading all conductor less than 477 Al in size from the POIs to the substation, with 6 wind turbines in service will still result in voltage excursions outside the ANSI A range. It is predicted the Coventry Substation regulator will have in excess of 100 tap change operations for a 24 hour period.

The model was run with a total of six wind turbines in service on the 54F1, where four are in service at the Piggy Ln POI and two are in service at the Flat River POI. All overhead conductor between the POIs and the substation was upgraded to 795 Al. The results are shown in figure 15.

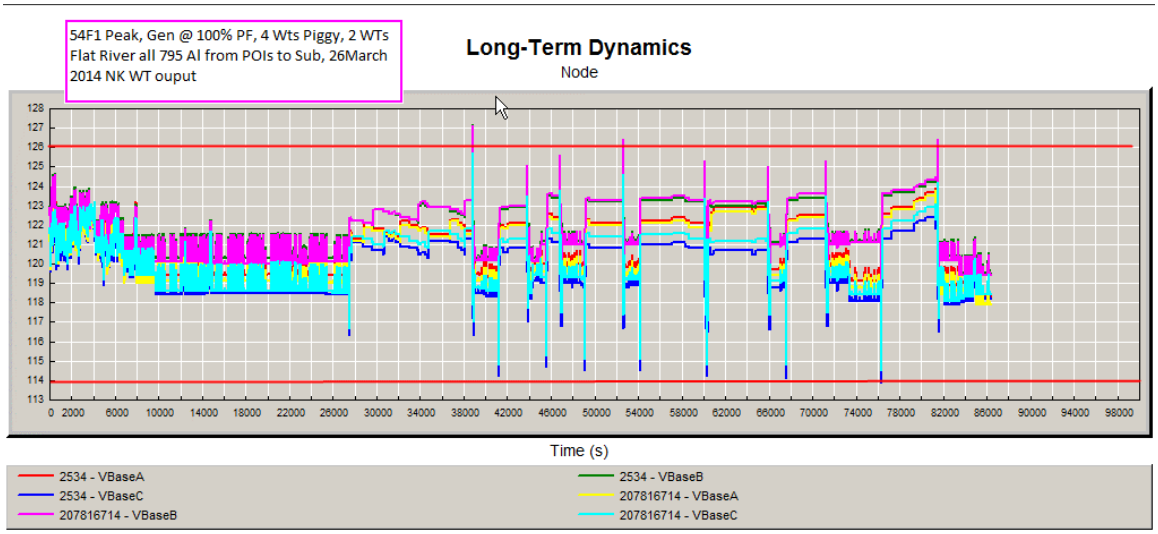

Figure 15: 6 WTs in service on 54F1, all Main Line from POIs to substation replaced with 795Al

Upgrading all conductor to 795 Al from the POIs to the substation with 6 wind turbines in service will still result in voltage excursions outside the ANSI A range. It is predicted the

Coventry Substation regulator will have in excess of 100 tap change operations for a 24 hour period.

Figure 16 below show the results of reconductoring all main line from the Piggy Lane POI to Coventry Substation with 795 Al, approximately 6 circuit miles, where two wind turbines are in service at the Piggy Lane POI.

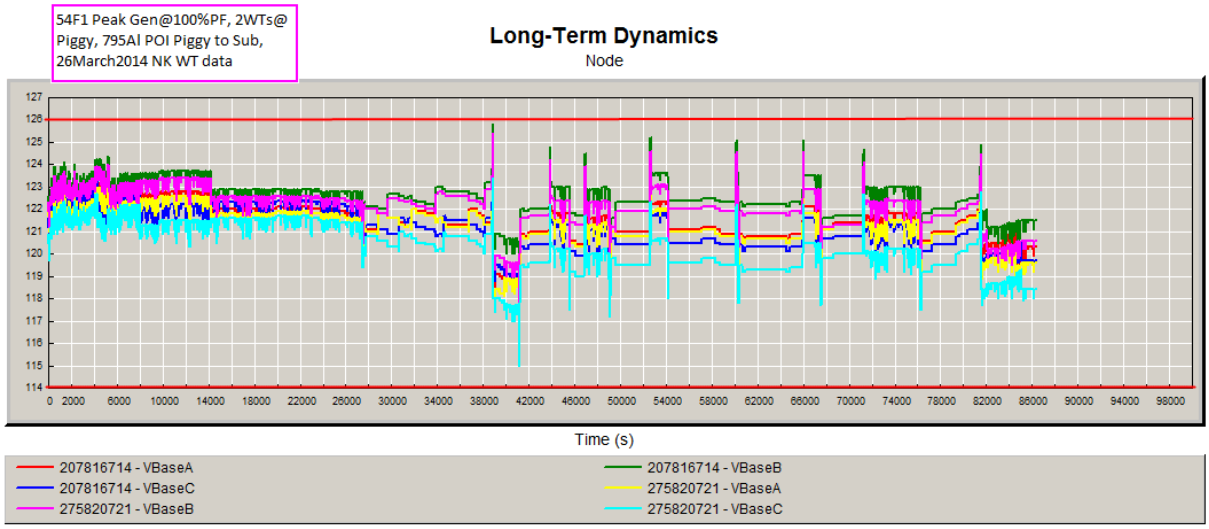

Figure 16: 2 WTs in service on 54F1 at Piggy Ln, all Main Line from Piggy Ln POI to substation replaced with 795Al

Figure 16 shows that two wind turbines can be interconnected onto the 54F1, at the Piggy Lane POI, when all main line primary, approximately 6 miles, from the POI to Coventry substation is upgraded to 795 Al. Tap Changer operations are expected to be less than 40 operations in a 24 hour period and flicker is predicted to be under the border line of irritation.

Figure 17 below show the results of reconductoring all main line from the Piggy Lane POI to Coventry Substation with 795 Al, approximately 6 circuit miles, where three wind turbines are in service at the Piggy Lane POI.

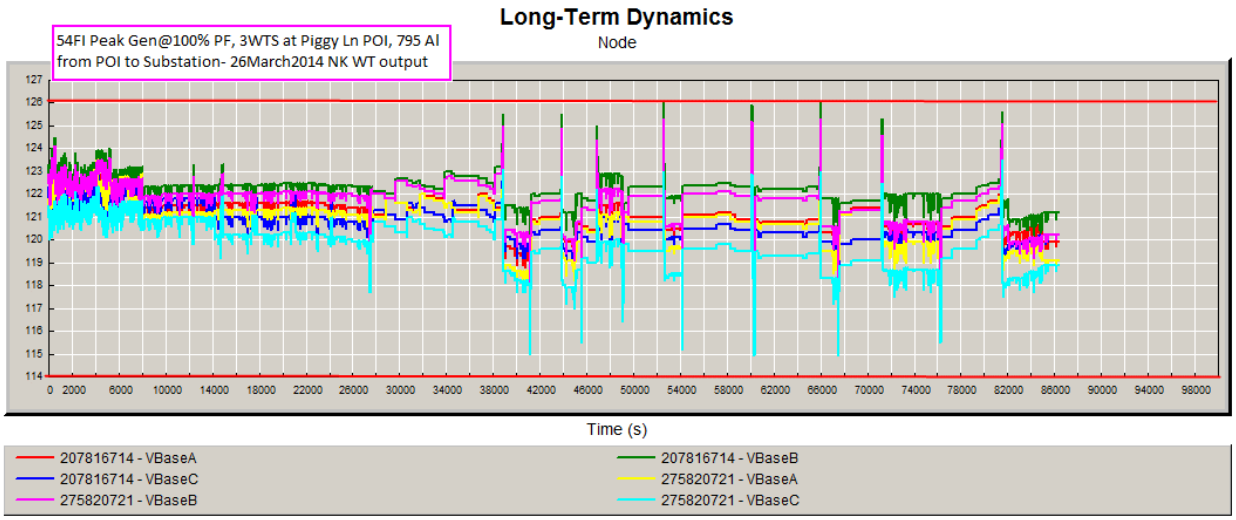

Figure 17: 3 WTs in service on 54F1 at Piggy Ln, all Main Line from Piggy Ln POI to substation replaced with 795Al

Figure 17 shows that three wind turbines can be interconnected onto the 54F1, at the Piggy Lane POI, when all main line primary from the POI to Coventry substation is upgraded to 795 Al. Tap Changer operations are expected to be less than 50 operations in a 24 hour period and flicker is predicted to be under the border line of irritation.

Figure 18, below, shows a combination of 2 wind turbines at Piggy Lane and one wind turbine at Flat River, three wind turbines total interconnected onto the 54F1, where all main line primary from both the Piggy Ln and Flat River POIs to Coventry substation, approximately 6 miles, is upgraded to 795 Al.

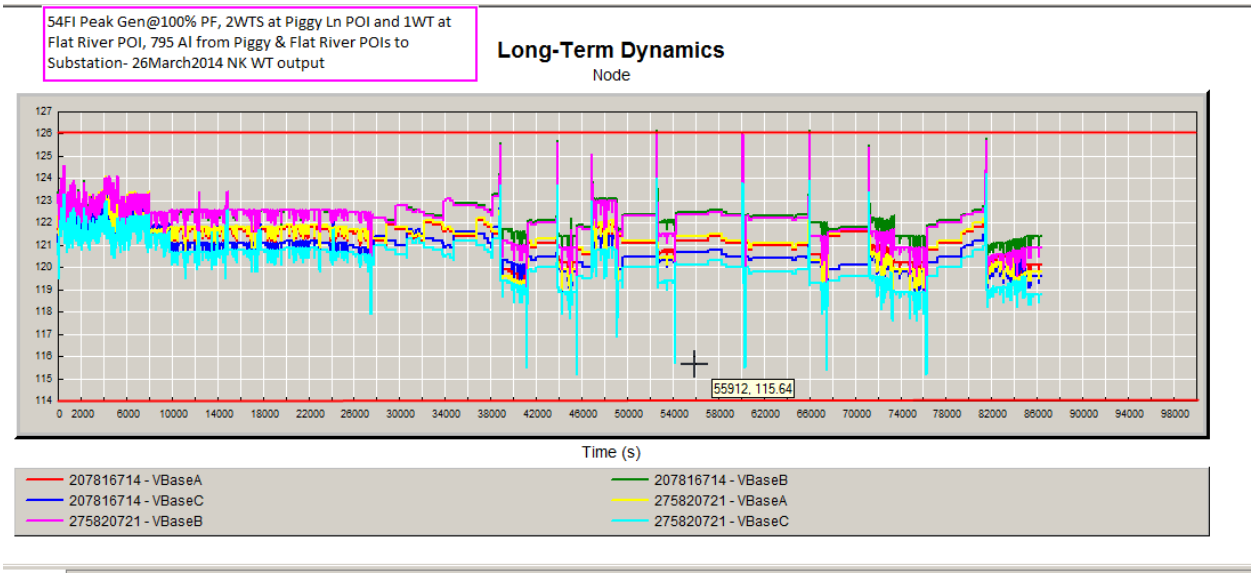

Figure 18:3 WTs in service on 54F1 2WTs @ Piggy Ln, 1WT @ Flat River, all Main Line from both POIs to substation replaced with 795Al

Figure 18, above, shows that there are now voltage excursions above the ANSI A range. The combination of 2 wind turbines at Piggy Lane and one wind turbine at Flat River, three wind turbines total interconnected onto the 54F1, where all main line primary from both the Piggy Ln and Flat River POIs to Coventry substation is upgraded to 795 Al, is not acceptable.

The results of the LTD 54F1 interconnection evaluation indicate that more than one wind turbine, with the same operating characteristics as the North Kingstown wind turbine, connected onto the 54F1 feeder will result in power quality issues, where the feeder voltage is forced outside the mandated ANSI-A range. Feeder voltage will remain inside the ANSI A range with a maximum of three wind turbines interconnected at Piggy Lane, if all main line from the wind turbines to the substation is upgraded to 795 Al, which is approximately 6 circuit miles. Any other combination of wind turbine interconnections will force the feeder voltage outside of the mandated ANSI A range. Regulator tap change operations will also increase in orders of magnitude over what is currently expected for a typical peak loading day. The thermal limit of the existing 4/0 Al overhead main line on Flat River Rd has been exceeded by the installation of three or more wind turbines. The thermal limit of the 1/0 Al conductor on Piggy Ln and Perry Hill will be reached by the interconnection of two wind turbines on the Piggy Lane POI.

LTD Analysis for Coventry 63F6

Several scenarios where run for the Hopkins Hill 63F6 circuit, where no wind turbines, one wind turbine, two wind turbines, three wind turbines, and four wind turbines where in operation. The Voltage profiles have been plotted at the POI for Victory Hwy, WED 5, 6, 6A, and 6B wind turbines.

Figure 19, below, shows the expected voltage profile at the POI without any wind turbines interconnected. The existing line regulators upstream of the POI are expected to have up to 12 operations and the 63F6 substation regulators are expected to have up to 6 operations within a 24 hour period.

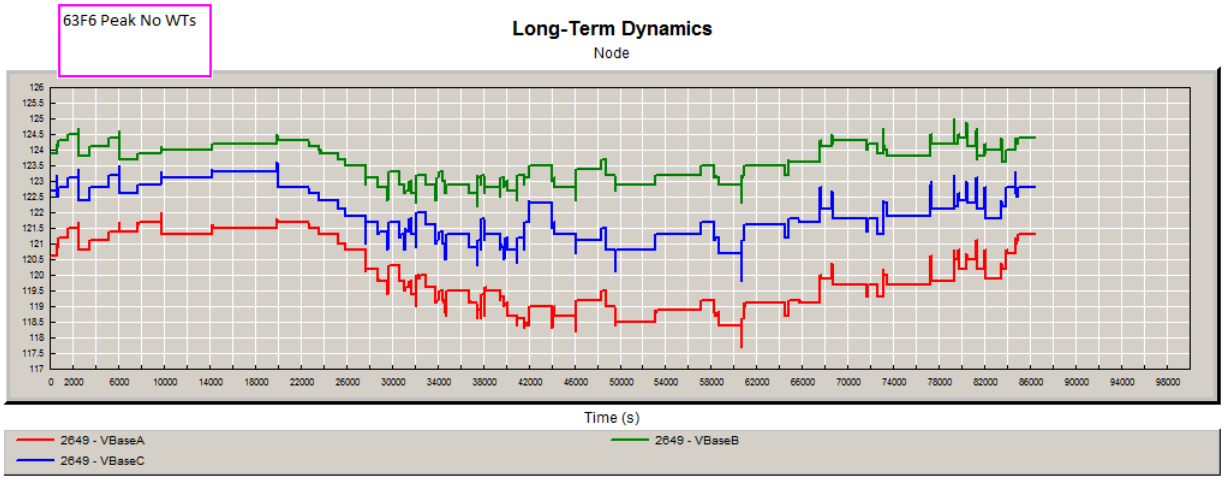

Figure 19: 63F6 no WTs in service

Figure 20, below, shows the expected voltage profiles at the POI with one wind turbine in service.

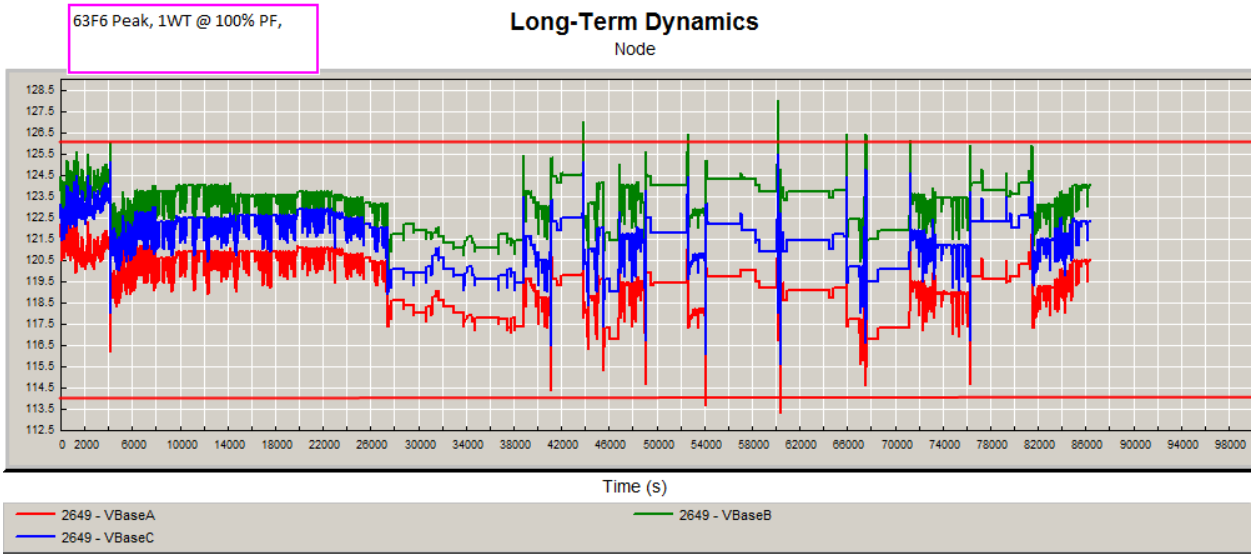

Figure 20: 63F6, 1 WT in service

The voltage plot of figure 20 shows there are voltage excursions outside the ANSI A range with one wind turbine interconnected to the 63F6. The existing line regulators upstream of the POI are expected to have in excess of 30 operations and the 63F6 substation regulators are expected to have up to 9 operations within a 24 hour period.

Figures 21, 22, and 23, respectively, shows the expected voltage profiles at the POI with two, three, and then four wind turbines in service.

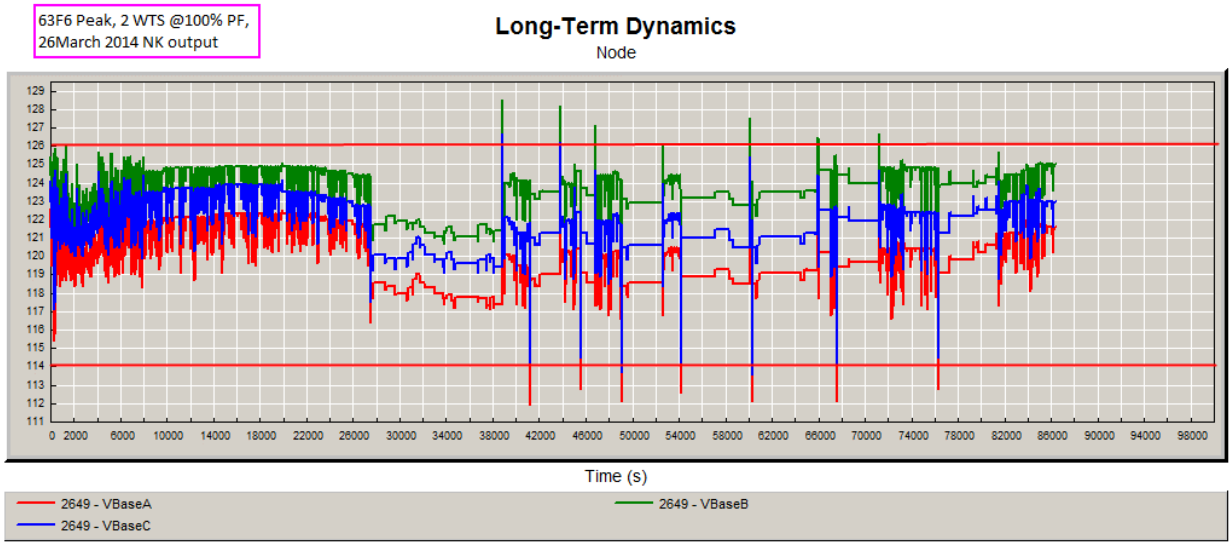

Figure 21: 63F6, 2 WTs in service

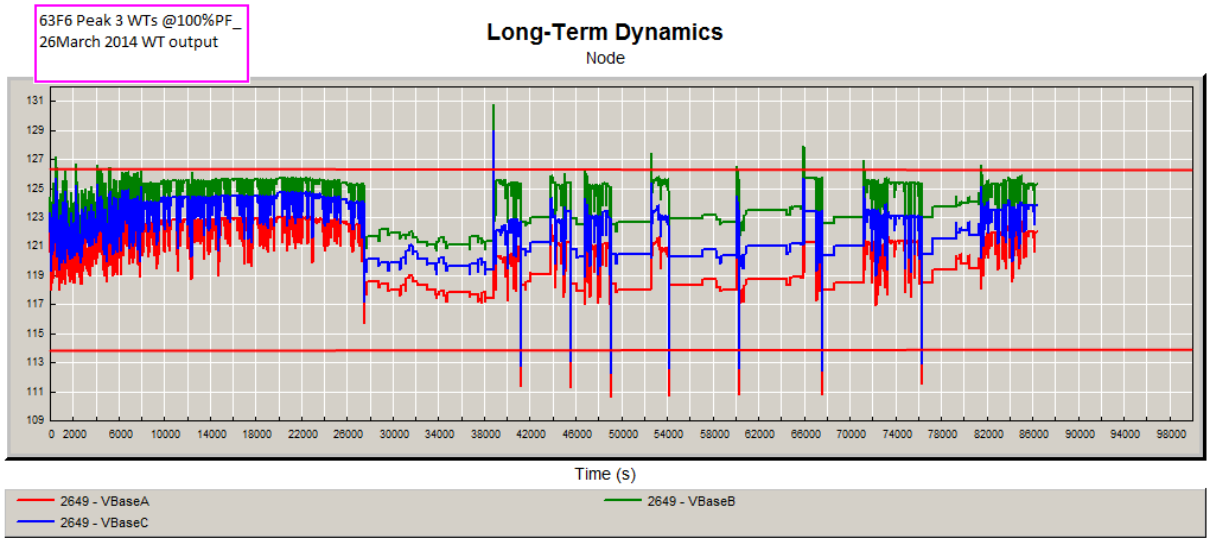

Figure 22: 63F6, 3 WTs in service

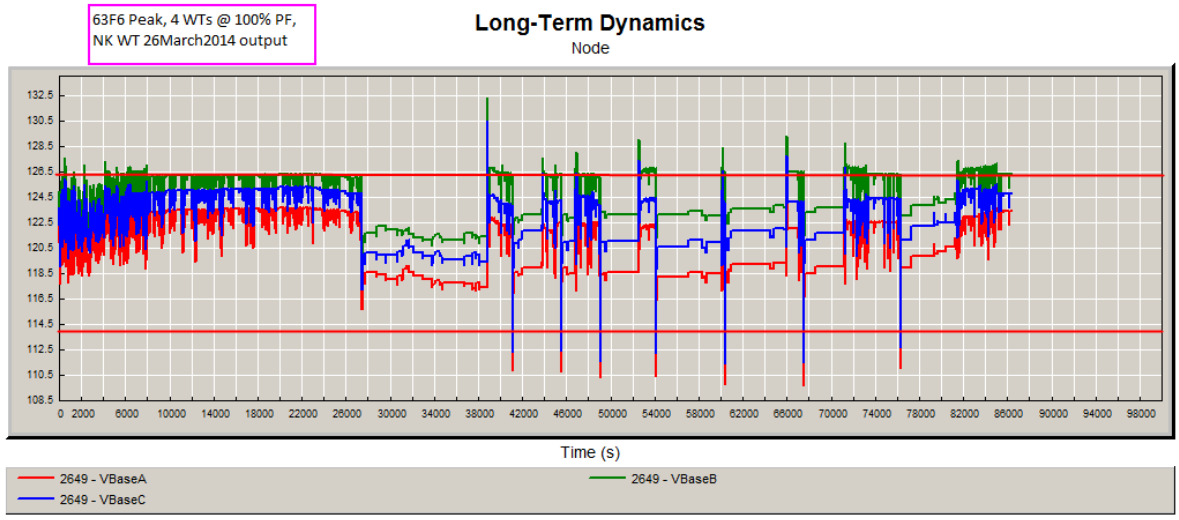

Figure 23: 63F6, 4 WTs in service

Figures 21, 22, and 23 show that the addition of more wind turbines only exasperates the voltage regulation issue on the 63F6. The existing line regulators upstream of the POI are expected to have up to 12 operations and the 63F6 substation regulators are expected to have up to 6 operations within a 24 hour period. With four wind turbines in service the existing line regulators upstream of the POI are expected to have up to 60 operations and the 63F6 substation regulators are expected to have up to 6 operations within a 24 hour period.

In an effort to reduce the impedance between the POI and Hopkins Hill substation, the 63F6 was reconfigured, by installing a new 5 mile 477 Al overhead main line From Hopkins Hill Rd, down

Weaver and Sharps St in West Greenwich, RI, to Victory Hwy, this would essentially cut the distance in circuit feet on the 63F6, from the POI on Victory Hwy, to Hopkins Hill Substation, from 13 miles down to 10 miles. Figure 24 shows two wind turbines interconnected, figure 25 shows four wind turbines interconnected.

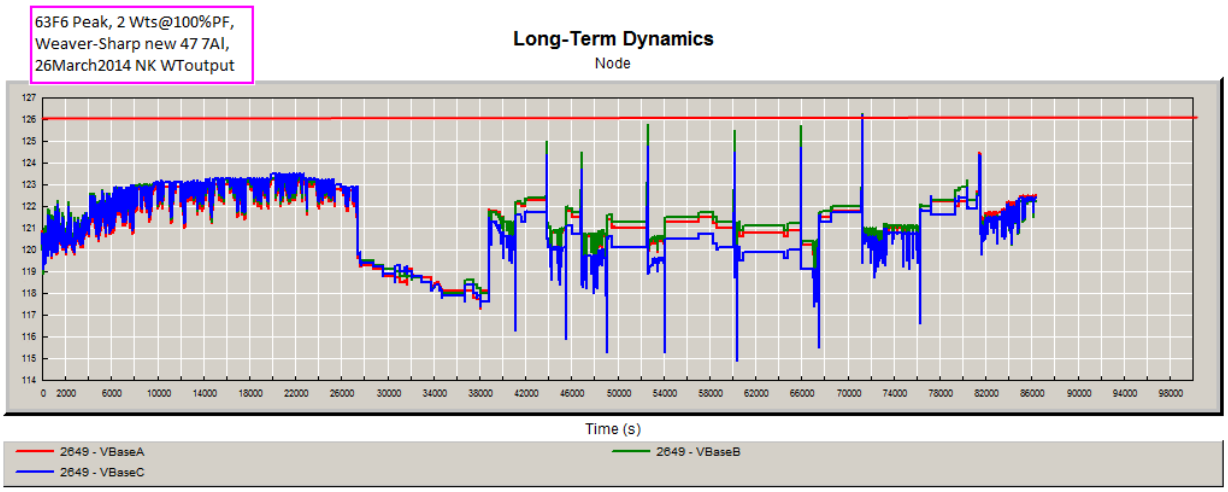

Figure 24: 63F6, 2 WTs in service, New 477 Al Main line down Weaver and Sharps

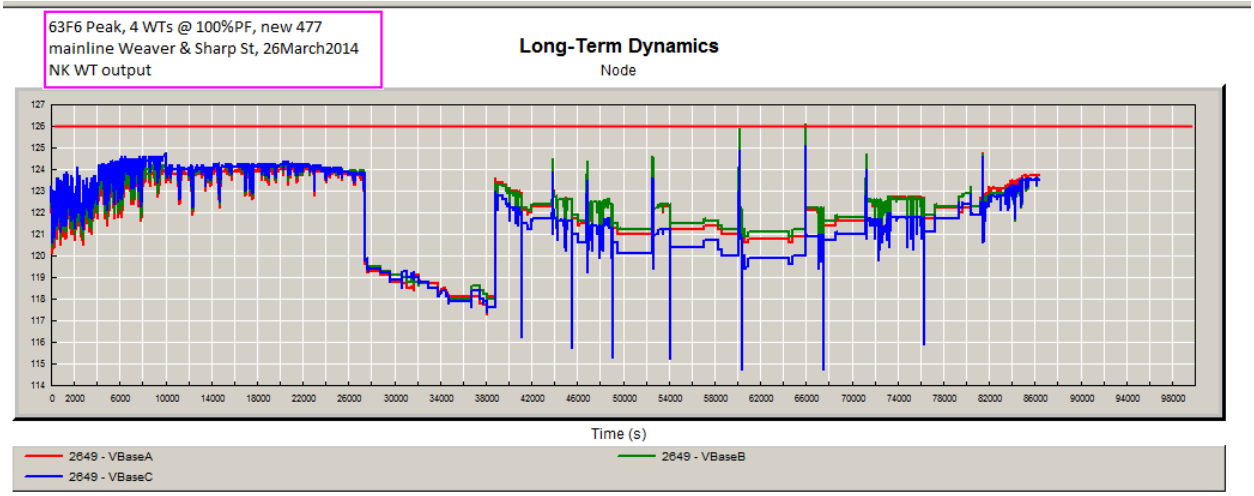

Figure 25: 63F6, 4 WTs in service, New 477 AL Main line down Weaver and Sharps

The voltage plots of figures 24 and 24 indicate that reconfiguration of the 63F6 with 5 miles of new 477 Al mainline will not completely relieve the voltage regulations issues associated with interconnecting either two or four wind turbines at the Victory Hwy POI. With four wind turbines in service the existing line regulators upstream of the POI are expected to have up to 20 operations and the 63F6 substation regulators are expected to have up to 4 operations within a 24 hour period.

Figure 26 shows the results if the 63F6 was reconfigured, by installing a new 10 mile 795 Al main line from Hopkins Hill Substation, down Hopkins Hill Rd, down Weaver and Sharps St, to Victory Hwy. Four wind turbines are interconnected at the Victory Hwy POI for this case.

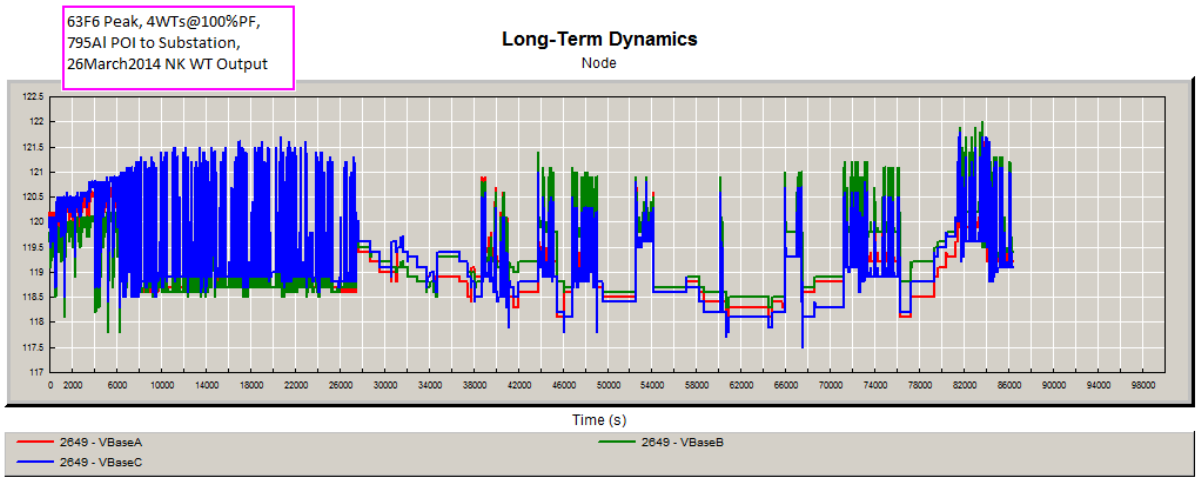

Figure 26: 63F6, 4 WTs, New 795 Main Line from Hopkins Hill Sub to POI

Figure 26 shows that by reconductoring and reconfiguring the 63F6 with 795 Al from the substation, down Hopkins Hill Rd, Weaver and Sharps St, to the Victory Hwy POI, four wind turbines can be connected to the 63F6 at the Victory Hwy POI with no voltage regulation or power quality issues. With four wind turbines in service the existing line regulators upstream of the POI are expected to have in excess of 90 operations and the 63F6 substation regulators are expected to have up to 7 operations within a 24 hour period.

The results of the LTD 63F6 interconnection evaluation indicate not even one wind turbine, with the same operating characteristics as the North Kingstown wind turbine, can be interconnected onto the 63F6 without power quality and voltage regulation issues developing. However, if the 63F6 is reconductored and reconfigured with 795 Al from the Substation to the Victory Hwy POI, via a new shorter route, all four wind turbines can be interconnected without any expected power quality and voltage regulation issues. Even with this upgrade the existing line regulators up stream of the POI will increase their operation within a 24 hour period by seven times.

Conclusions of LTD Evaluations on the Coventry 54F1 and Hopkins Hill 63F6

The Coventry 54F1

The LTD analysis utilizing the North Kingstown wind turbine output for March 26, 2014, indicates only one wind turbine can be interconnected onto the Coventry 54F1 feeder at either the Piggy Ln or Flat River Rd POI without causing noticeable voltage regulation and power quality issues for other customers on the 54F1 circuit. The thermal limit of the existing 4/0 Al overhead main line on Flat River Rd has been exceeded by the installation of three or more wind turbines. The thermal limit of the 1/0 Al conductor on Piggy Ln and Perry Hill will be reached by the interconnection of two wind turbines on the Piggy Lane POI.

Three wind turbines are possible at Piggy Lane if approximately 6 circuit miles of main line conductor, from the Piggy Lane POI to Coventry substation, is reconductored with 795 Al. This major system upgrade will not allow the interconnection of the entire combination of six wind turbines, two at the Flat River POI and four off the Piggy Ln POI without significant voltage excursions outside the ANSI A range. Regulator tap change operations will be excessive, over ten times what is currently expected for a typical peak loading day. Such an increase in mechanism operation will result in significant loss of life and increased wear of the contacts and increased maintenance costs.

Hopkins Hill 63F6

The LTD analysis utilizing the North Kingstown wind turbine output for March 26, 2014, indicates even one wind turbine connected at the Victory Hwy POI will result in voltage regulation and power quality issues. The only solution that allows the interconnection of all four wind turbines at the Victory Hwy POI without any detrimental impact to voltage regulation and power quality is a reconfiguration and reconductoring of the 63F6 with 795 Al, down a new Main Line circuit path. Regulator tap change operations on the upstream line regulators will still be excessive, over seven times what is currently expected for a typical peak loading day. Such an increase in mechanism operation will result in significant loss of life and increased wear of the contacts and increased maintenance costs.

Recommendations

Any wind turbines that have power output ramp rates similar to the existing North Kingstown wind turbine are not acceptable for the proposed WED, 1, 2, 2A, 2B, 3, and 4 projects proposed for the Coventry 54F1 or the WED 5, 6, 6A, and 6B projects proposed for the Hopkins Hill 63F6. Consequently, several options are available to the interconnecting customer to consider.

- Down size the project to one wind turbine interconnected onto the 54F1.
- Reconductor the 54F1, from the substation to the Piggy Lane POI, with 6 miles of 795 Al, to allow the interconnection of up to three wind turbines.
- Significant upgrades to the 63F6 are required, 10 miles of new 795 Al Mainline, to allow for four, or possibly more wind turbines to be interconnected.
- Explore another means of interconnecting the wind turbines to the Company EPS, such as a subtransmission or transmission level interconnection.
- Provide calculated wind turbine output data, to reevaluate these cases, based upon the Mach 26, 2014 documented wind speeds, but with lower power ramp rates. This data can be used to reevaluate the LTD cases to determine if the voltage and power quality issues can be mitigated. The caveat with this option is that the energy produced by the lower ramp rate may be significantly less than what is currently expected and consequently the economics of the projects may need to be reevaluated.

EXHIBIT C

System Impact Study
For WED LLC
RI-14318785 – One, (1), 1,500 kW, three Phase, Converter Based Synchronous, Wind Turbine, WED1
RI-14462941 - Three, (3), 1,500 kW, three Phase, Converter Based Synchronous, Wind Turbines,WED 2
RI-15640455 - One, (1), 1,500 kW, three Phase, Converter Based Synchronous, Wind Turbine,WED 3,
RI-15772951 - One, (1), 1,500 kW, three Phase, Converter Based Synchronous, Wind Turbine,WED 4,
RI-17599370 - One, (1), 1,500 kW, three Phase, Converter Based Synchronous, Wind Turbine,WED 5
RI-17600293- Three, (3), 1,500 kW, three Phase, Converter Based Synchronous, Wind Turbines,WED 6

Various Locations in Coventry, RI 02816

Ten, 1,500 kW, Three-Phase, Converter Based, Synchronous Wind Turbine Generators, 15,000 kW total

Interconnection to National Grid's 23 kV System

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Executive Summary

National Grid ("the Company") has completed a Combined Impact Study for Renewable DG (ISRDG), for the interconnection of the WED LLC, the ("Interconnecting Customers" or "IC"), proposed total 15,000 kW, comprised of ten (10) 1,500 kW Wind Turbine Facilities ("the Facilities") to its 23 kV sub-transmission system ("the Projects") at six separate Points of Interconnection (POI) and presents the conclusions of the study herein. This study was done outside of the Standard Process procedures in the Company's Standards for Connecting Distributed Generation (RIPUC 2078) as agreed to by the IC and the Company during a meeting held on January 15th, 2015. The requirements specified are exclusive to this project and are based upon the information submitted by the IC to date.

The proposed Facilities are Independent Power Producers ("IPP") consisting of ten (10)1,500 kW (AC) ("WIND TURBINE") renewable systems. The Facilities will be located at West Log Bridge Rd and Flat River Rd Coventry, RI 02816 and proposed to be connected on the customer's side of six new primary metering points, at the points of common coupling (PCC) at various locations on the Company's 2232 circuit.

WED 1 (RI-14319785), WED 2 (RI-14462941), WED 3 (RI-15640455), WED 4 (RI-15772951), WED 5 (RI-17599370) and WED 6 (RI-17600293).

The purpose of this study was to:

- Conduct, as applicable, steady-state, stability, short circuit, and extreme contingency analyses and perform assessments of reliability performance of the Company's Electric Power System ("EPS") within the area of interconnection, with and without the proposed Facility, in accordance and applicable with reliability standards and study practices, and in compliance with the applicable codes, standards, and guidelines listed in Section 5.1 of the Company's *Electric System Bulletin No. 756 Appendix D: Distributed Generation Connected to National Grid Distribution Facilities Per The Rhode Island Standards for Interconnecting Distributed Generation ("ESB756D")* to determine the incremental impact and any potential adverse impacts associated with the interconnection of the Facility to the EPS.

- Determine any System Modifications required.

- Develop planning grade cost estimates of the required facilities for interconnection of those Facilities found capable to be interconnected to the EPS.

- Provide a report describing the results of the Impact Study.

- Provide additional detail concerning any recommended further study.

The study determined the interconnection of the Facilities to be feasible with certain operating conditions. The necessary System Modifications include but are not limited to:

- An extension of the 2232 circuit
    - Overbuild on the existing 54F1 circuit (~5.8 Miles):
        - West from Pole 9003 to Pole 486 Log Bridge Rd. This route runs mainly along Flat River Road, with a small segment at the end along Old Summit Road.
        - North from Pole 486 Log Bridge Rd to Flat River Road, and then West along Flat River road to Pole 572-50 to the POIs for WED 3 and WED 4.
        - South from Pole 486 Log Bridge Rd, along Log Bridge, then continuing down West Log Bridge to the last Pole on this road, Pole 16.
    - Brand new construction/extension of the 2232 (~1.7 Miles):
        - South from Pole 16 West Log Bridge to the POIs for WED 2, WED 6 the final POI for WED5.

- Six new 23 kV primary metering installation services, ahead of the Points of Common Coupling, with new bidirectional meters, reclosers, loadbreak switches, and necessary conductor and equipment to extend 3 phase primary down to the PCCs from the POIs.

- Along the path of the new services for each wind turbine, and the new 23 kV primary along the West Log Bridge Road extension, the customer is required to clear trees and vegetation as required and to provide a suitable means of access to the company's equipment. This section of public roadway is to be brought up to the current standards to handle heavy duty vehicular traffic, as well as maintained year round for 24/7 access to Company equipment.

- Significant tree trimming/tree clearing is potentially required in order to upgrade existing distribution equipment (for instance Log Bridge Road). To complete possible vegetation management, Town/land owner approval is required. If this approval is not received the line extension route may have to be revised to accommodate. This will be determined during the work management design.

- The customer is required to provide all required easements for new poles on private property along the proposed path of construction. Final locations will be determined during the work management design and may be relocated from their current proposed locations.

- The wind turbine machines should operate at no greater than 100% to -99% (absorbing VARs) power factor. To do otherwise may create voltage excursions and power quality problems for the 2232 circuit.

    - This is based upon the expected turbine generator output as provided by Vensys, the turbine manufacturer. Operation other than the expected results may require additional study at a later date and new operational requirements if power quality issues arise once the system is brought online and operational.

- Once the wind turbine machines are online and generating, the Customer is required to submit periodic generation data (every three months for the first year) for National Grid's review in order to discern if the machines are in fact operating as expected and required. This data should be for the wind turbine system as a whole.

- Final site plans and one lines, addressing all comments within this document, are required prior to issuing the Interconnection Service Agreement.

Cost Estimates:

The total estimated planning grade cost of the work associated with the interconnection of the Facility, is **$5,366,600.00**+/-25%, and includes:

System Modifications to Company EPS $4,532,600.00
Engineering, design, construction and testing for revenue Metering, feeder modifications, reclosers, disconnect switches, And remote stations modifications

Interconnecting Customer Interconnection Facilities ("ICIF") $15,000.00
Engineering review and acceptance, and compliance Verification of the ICIFs including all required drawings And equipment spec reviews, relay settings, and construction And testing assistance by engineering

Tax Liability[1] $819,000.00

Applied to all capital associated with System Modifications

This planning grade estimate will be deemed withdrawn if not accepted by the Customer within ninety (90) calendar days of receipt of the study. **Additional costs may be involved if the required pole work takes place in Verizon Maintenance Areas. These costs will be billed directly to the customer from Verizon.**

Estimated Schedule:

The estimated duration for the Company to complete construction of the System Modifications is 17-20 months, however, the schedule driver can be impacted by unknown factors over which the company has no control. **Verizon pole sets are dependent upon Verizon's schedule. The Company has no control over Verizon's work schedule. It will be the responsibility of the customer to obtain any and all easements and required permitting for work that takes place on private property, as well as secure the new roadway construction of the expansion of West Log Bridge Road.**

The schedule driver may be impacted by the ability to have planned outages to allow work to take place on the supply system. Outages will be contingent on the ability to support the load normally supplied by affected circuits. The schedule can also be impacted by unknown factors over which the Company has no control, such as inclement weather.

The interconnection schedule is contingent on the Interconnecting Customer's successful compliance with the requirements outlined in this report and timely completion of its obligations as defined in *ESB756D, Exhibit 2: Company Requirements for Projects Not Eligible for the Simplified Process*. The schedule for the Company's work shall be addressed during the development, or after the execution, of the Interconnection Service Agreement.

1.0 Introduction

WED LLC has requested the interconnection of ten, (10), 1,500 kW, 15,000 kW total, converter based, synchronous wind turbine, renewable systems onto to a 23 kV circuit in National Grid's.

[1] The estimated tax liability was calculated using the rate at the time the estimate was completed (22.84%). Actual costs shall be reflective of the tax liability rate at the time of invoicing.

In accordance with the R.I.P.U.C. NO. 2078 tariff, the Company has completed an Impact Study to determine the scope of the required modifications to its EPS and/or the Facility for providing the requested interconnection service.

1.1 Study Objective

The primary objectives of this Impact Study are to:

1. If possible, identify the System Modifications necessary for the Project to reliably interconnect to the Company's system[2];
2. If possible, identify deficiencies in the proposed Facility;
3. If possible, identify operating restrictions;
4. If possible, identify and describe the equipment, engineering, procurement, construction, installation, testing and commissioning work, needed to build the System Modifications and integrate them with the Interconnecting Customer's Interconnection Facilities ("ICIF");
5. If possible, provide additional detail in terms of scope of additional required study to determine final system modifications, cost estimates, and construction timelines for the interconnection of all or some proposed facilities.

2.0 Project Description

2.1 Facility

As depicted in the Interconnecting Customer's Site Diagram and One Line Diagrams (*Appendix A Site Diagrams and One- Lines*), there will be ten, (10),1,500 kW wind turbines, for a total of 15,000 kW.

WED 1 (RI-14319785)

[2]May require additional study at a later phase in the process.

- (1) Vensys SDL, 1,500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to the low voltage side of a 1600 kVA 23 kV ungrounded wye primary / 620V/323V grounded-wye secondary (Z=6%, assumed X/R=5) interface transformer.
    - NOTE: The grounding transformer is no longer required and should be removed from the one line diagram.
- The primary side of the interface transformer is connected to a 25 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a gang operated three phase, 15 kV class, 600A, lockable, load break switch. The disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

WED 2 (RI-14462941)

- (3) Vensys SDL, 1,500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of each power converter is connected to the low voltage side of a 1600 kVA 23 kV ungrounded wye primary / 620V/323V grounded-wye secondary (Z=6%, assumed X/R=5) interface transformer.
    - NOTE: The grounding transformer is no longer required and should be removed from the one line diagram.
- The primary side of each of the three, (3), interface transformers is connected in parallel to one, (1), 25 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a gang operated three phase, 15 kV class, 600A, lockable, load break switch. The disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

WED 3 (RI-15640455)

- (1) Vensys SDL, 1,500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.

- The output of the power converter is connected to the low voltage side of a 1600 kVA 23 kV ungrounded wye primary / 620V/323V grounded-wye secondary (Z=6%, assumed X/R=5) interface transformer.
    - NOTE: The grounding transformer is no longer required and should be removed from the one line diagram.
- The primary side of the interface transformer is connected to a 25 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a gang operated three phase, 15 kV class, 600A, lockable, load break switch. The disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

WED 4 (RI-15772951)

- (1) Vensys SDL, 1,500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to the low voltage side of a 1600 kVA 23 kV ungrounded wye primary / 620V/323V grounded-wye secondary (Z=6%, assumed X/R=5) interface transformer.
    - NOTE: The grounding transformer is no longer required and should be removed from the one line diagram.
- The primary side of the interface transformer is connected to a 25 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a gang operated three phase, 15 kV class, 600A, lockable, load break switch. The disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

WED 5 (RI-17599370)

- (1) Vensys SDL, 1,500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of the power converter is connected to the low voltage side of a 1600 kVA 23 kV ungrounded wye primary / 620V/323V grounded-wye secondary (Z=6%, assumed X/R=5) interface transformer.

  - NOTE: The grounding transformer is no longer required and should be removed from the one line diagram.
- The primary side of the interface transformer is connected to a 25 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a gang operated three phase, 15 kV class, 600A, lockable, load break switch. The disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

WED 6 (RI-17600293)

- (3) Vensys SDL, 1,500 kW 690V, direct drive permanent magnet, synchronous, converter based, wind turbine generator. The generator output leads to a 690V AC to 620V AC power converter.
- The output of each power converter is connected to the low voltage side of a 1600 kVA 23 kV ungrounded wye primary / 620V/323V grounded-wye secondary (Z=6%, assumed X/R=5) interface transformer.
  - NOTE: The grounding transformer is no longer required and should be removed from the one line diagram.
- The primary side of each of the three, (3), interface transformers is connected in parallel to one, (1),25 kV class, 600A vacuum interrupter controlled by a SEL 351A multi-function relay.
- The high side of the vacuum breaker is connected to a gang operated three phase, 15 kV class, 600A, lockable, load break switch. The disconnect switch will connect to National Grid's Electric Power System (EPS) through a pole mounted primary metering assembly.

2.2 Service Configuration

The proposed locations of the Facilities are normally served by National Grid's 7.2/12.47 kV three-phase, 4 wire, multi grounded wye, effectively-grounded 54F1 and 63F6 circuits.

However, based on the results of the previous impact study, the 12.47kV system was not adequate to interconnection all 10 wind turbines, which is the Customer's primary concern.

Analysis has determined that the best alternative will be to extend, the 2232 circuit, a 23kV sub-transmission circuit, to the facilities.

Based on the Project design at the time the study was performed, the Interconnection Facilities shall consist of a 3-phase,23 kV, overhead primary line extension from Pole # 9003, Flat River Road, Coventry RI onto private property, and to the PCC at each wind turbine location. (See Appendix B). The total distance of the new 2232 circuit extension is approximately 7.5 miles, from the new Tap point to each new PCC (six in total). The majority of the line extension will be overbuild on the existing 54F1 12,47kV circuit, fed from Coventry Substation. There will be new solitary 23 kV, line construction along West Log Bridge road, from the last pole of the Company's existing equipment to the WED 5 PCC. A new recloser and load break switch are required at the tap point of the 2232.

The Point of Common Coupling (PCC) will be designated as the Customer side of the aforementioned connection. National Grid will install bi-directional meters once all required documentation has been received. The Company's Distribution Design department will determine the exact location of the Company's facilities and the customer's dead end pole on private property. The Interconnecting Customer shall be responsible for obtaining all easements required for the line extension in accordance with the Company's requirements. The Customer is required to obtain all required permitting needed for National Grid to install its facilities on private property. The customer is required to grade the area of the proposed facilities, clear trees and vegetation as required, and to provide a suitable means of direct unencumbered access to the company's equipment along a plowed driveway or road.

The Customer shall provide unencumbered direct access to the Company's switch, meters, and recloser along a plowed, accessible driveway or road, where the equipment is not behind the customer's or any third party's locked gate.

All wind turbines are proposed for private property, a minimum 1000' off of the public way, therefore there is no concern for violation of required minimum fall down zones.

2.3 Area EPS

The ability to generate is contingent on the proposed DG Facility being served by the 2232circuit during normal operating conditions. Under abnormal operating conditions, or if it is not supplied by the 2232 circuit, it is not guaranteed that the DG Facility will be allowed to operate. Additionally, if one, (1), of the two, (2), supply stations for the 2232 are out of service, the generator may not be allowed to operate.

2232

This circuit is in a network configuration, with supply out of National Grid's Drumrock and Johnston substations. As it is a 3-phase, 3-wire 23kV sub-transmission circuit it is not effectively grounded and unregulated.

The current characteristics are as follows:

- The daytime loading on the system has varied between a peak of 15 MVA and a minimum of 3.8 MVA.
- Total aggregate generation interconnected/in-process on the feeder, excluding this project, is 0 kW at this time.
- The circuit is un-regulated and has no additional voltage regulators installed outside the substation between the POI and the substation.
- There are two, (2) existing line reclosers on 2232 line, between the proposed generation and the supply stations.
- There are Dispatch controlled capacitor banks at the Coventry, Hope and Drumrock Substations. The area voltage and power factor are actively monitored by Dispatch.

2.4 Revenue Metering Requirements

If not already provided, the Interconnecting Customer shall provide a telecommunication line to National Grid's revenue meters in accordance with ESB756D, Section 5.4.2. The Customer should provide an analog/POTS (Plain Old Telephone Service) phone line to each National Grid owned revenue meter location. The phone line must be capable of direct inward dial without human intervention or interference from other devices such as fax machines, etc. National Grid will specify, test, install, and own the voltage and current transformers necessary to meet the metering requirements for this project. See *Appendix C Figures 7 and 8– (Revenue Meter Phone Line Installation Guide)*

3.0 Steady State Power Flow Analysis

The power flow analysis was substantially performed using CYMDIST. A model of the 2232 circuit was developed based on data extracted from the National Grid GIS and field verified.

Additional load flow analysis was completed using PSS/E. Data was used from current Distribution Planning models and field verified.

The analysis considered cases at minimum and peak load, at time of expected maximum generation, including contingency analysis of the loss of either supply line (from Drumrock or Johnston).

3.1 General Loading Analysis

An analysis of the circuit loading, with and without the wind turbine system operating, was performed and demonstrated that the addition of the DG Facility will not create thermal loading problems on the 2232 circuit, or at either supply Substation. Specifically, no conductor, or transformer overloads occur as a result of this interconnection. All National Grid owned mainline conductor and distribution facilities are thermally large enough to accommodate the added capacity of the 15MW facility, as long as the wind turbines operate as proposed and are limited to 100% to -99% power factor.

Under certain contingency scenarios, where either the Drumrock or Johnston supply side of the 2232 is lost, some overvoltage (OV) conditions may occur but is unlikely. National Grid's dispatch will have the ability to remove the generation from operating if this scenario occurs at their discretion.

3.2 Reverse Power Flow

The possibility of the Facility causing reverse power flow into the Company's EPS was reviewed. At peak export (i.e., 15 MW), it is unlikely that any excess generation from the Facility will flow through the sub-transmission system and into transmission system. All excess power from the DG will be absorbed by the area electric power system (EPS) at various substations.

3.3 Voltage Analysis

The 2232 supply circuit is unregulated but the design of the EPS voltages at customer service points are within defined limits of +/- 5% in ANSI Standard C84.1- 2006.

The Customer is responsible for designing and sizing its own on site distribution system and cabling to the generator to account for any voltage rise/drop on its system due to generation. It was noted that over voltage conditions may occur on the low voltage (690V) side of the customer's transformers during peak and light loads, assuming maximum power output from each generator. These results are based on the cable sizes shown on the customer's one lines. This condition will have no impact on National Grid's EPS, however the customer's equipment and operation may be affected.

The Company will not be held liable for any power quality issues that may affect the EPS or other customers as result of the interconnection of this project's generation.

3.4 Long Term Dynamics Voltage Analysis

The intent of this analysis was to perform a Long Term Dynamic, (LTD) analysis for the Wind Energy Development (WED) wind turbines to observe how the potential power fluctuations may impact the power quality, voltage drop/rise, voltage regulation, thermal capabilities, flicker conditions and operational effect of the area EPS. The analysis observed whether potential power fluctuations and voltage changes at the POIs and the nearby mainline

were maintained within the required ANSI "A" range (+/- 5% of nominal), by the voltage regulation equipment on the circuit.

The CYME, Long Term Dynamic module was used for the assessment of the impact the proposed wind turbines would have on the area EPS. The analysis was run for a 24 hour period at a 10 second iteration rate. The customer provided, 24 hour, 6 second sample rate, power output data for the existing North Kingston, RI, wind turbine, collected on March 26, 2014 was utilized for the analysis because it appears to represent volatile wind turbine output for a windy gusty day. This data was further edited based on an agreed upon set of assumptions and resubmitted on 1/19/2015.

- During turbulent events, the WTs are capped at 1,400kW each (16.3 RPM).
- After a turbine trips, each is locked at 20kW/s ramp up rates to further prevent voltage excursions on the line. This data includes a tripping event for the turbines.
- Certain abnormal tripping events were removed from the original data (due to maintenance on the day the data was captured).
- Reactive power contributions based on a certain power Factor limit
    - P=0-50%, power Factor = 100%
    - P=50-100%, power Factor = adjustable, -95% was first submitted, -99% data was also created.
- Each generator has a staggered set of data, starting with WED 1. WED 2 has the same curve shifted by 30s and the same goes for each, from WED 1 to WED 6B.

This analysis concluded that, without any major modifications to the EPS, all wind turbines can be connected to the 2232 without creating voltage issues.

Additionally, voltage flicker should not be an issue on the 2232 system, or the various distribution feeders from nearby substations supplied by the 2232, namely Hope, Arctic and Coventry. These were also modeled, with their specific voltage regulators in service.

4.0 Short Circuit and Protection Analysis Company Facilities

4.1 Temporary Over-Voltages on Transmission Supply

Based upon the winding configuration of the supply transformers at Drumrock and Johnston substations, zero sequence overvoltage protection (3V0) will not be required at those substations for this Project. Temporary over voltages during faults on the transmission system should not develop on account of this project.

4.2 Fault Current Contributions

Table 2 summarizes the generation effect on fault current levels at the PCC. These fault currents are within existing equipment ratings and will not upset existing device coordination on the feeder. The customer is responsible for ensuring that their own equipment is rated to withstand the available fault current according to the NEC and National Grid ESB 750, which specifies that the fault current should be no more than 80% of the device interrupting rating.

Fault Duty Pre and Post Project

Pre-Project:			Post- Project:				
Fault Location	Fault Type	Amps/Pre	Amps/ Post	*Δ%	System Impedance @ PCC Post Project		
23kV Drumrock Substation Bus	Line to Grd	22520	22598	0.35%			
	Three Phase	41488	41703	0.52%			
23kV Hope Substation Bus	Line to Grd	2572	2622	1.94%			
	Three Phase	6199	6421	3.58%			
23kV PCC WED 1	Line to Grd	N/A	1010	N/A	Z-positive - Units = Ω	Z-negative - Units = Ω	Z-zero - Units = Ω
	Three Phase	N/A	2208	N/A	3.48+j5.52	2.64+j6.83	7.17+j28.36
23kV PCC WED 2, 2A, 2B	Line to Grd	N/A	984	N/A	Z-positive - Units = Ω	Z-negative - Units = Ω	Z-zero - Units = Ω
	Three Phase	N/A	2134	N/A	3.67+j5.67	2.81+j7.04	7.51+j29.02
23kV PCC WED 3	Line to Grd	N/A	972	N/A	Z-positive - Units = Ω	Z-negative - Units = Ω	Z-zero - Units = Ω
	Three Phase	N/A	2009	N/A	4.2+j5.76	3.52+j6.97	8.1+j28.56
23kV PCC WED 4	Line to Grd	N/A	972	N/A	Z-positive - Units = Ω	Z-negative - Units = Ω	Z-zero - Units = Ω
	Three Phase	N/A	2007	N/A	4.2+j5.76	3.52+j6.97	8.1+j28.56
23kV PCC WED 5	Line to Grd	N/A	930	N/A	Z-positive - Units = Ω	Z-negative - Units = Ω	Z-zero - Units = Ω
	Three Phase	N/A	1958	N/A	4.18+j6.06	3.32+j7.46	8.34+j30.25
23kV PCC WED 6, 6A, 6B	Line to Grd	N/A	998	N/A	Z-positive - Units = Ω	Z-negative - Units = Ω	Z-zero - Units = Ω
	Three Phase	N/A	2179	N/A	3.53+j5.59	2.67+j6.93	7.29+j28.69

*Δ% = (Post-Pre)/Pre

The 23 kV system impedance shown at the PCC is in ohms. The value is taken from the model developed using ASPEN Oneliner. The model was based on the proposed installation as described in Section 2.1. If a different

configuration, and/or transformer winding configuration, or impedances are used, the Short Circuit and Protection Analysis will need to be re-evaluated at additional expense to the IC.

The protection analysis did indicate that a line to ground fault, in the vicinity of any of the PCCs, will result in overvoltage on the unfaulted phases in excess 1.40 PU of the nominal Line to ground voltage.

5.0 Protection Analysis Customer Facilities

The protection review consisted of a review of customer's transformer connection and protection scheme and assessment of protection and transfer trip requirements. This Facility shall comply with the relevant provisions of R.I.P.U.C. NO. 2078 Dec 2009 and requirements of ESB-756D, as applicable. Please note that applicable sections of ESB-756D are referenced for information purposes and may not comprise the entirety of applicable sections. The key requirements for this Project include, but are not limited to:

5.1 Disconnect Switch

Per ESB 756D, Section 5.6 & R.I.P.U.C. NO. 2078: The Facility shall provide a disconnect switch (or comparable device mutually agreed upon by the Parties) at the point of Facility interconnection that can be opened for isolation. The switch shall be in a location easily accessible to Company personnel at all times. The switch shall be gang operated, have a visible break when open, be rated to interrupt the maximum generator output and be capable of being locked open, tagged, and grounded on the Company side by Company personnel. The Company shall exercise such right in accordance with Section 7.0 of the interconnection tariff.

The Customer's one-line meets this requirement. The customer shall provide the Company with 24/7 unlimited access, for access and control of this switch. The Customer shall provide direct access to the switch along an accessible driveway or road, such that it is not behind the customer's locked gate. If the disconnect switch is required behind the customer's locked gate, double locking, where both the Company's and Customer's locks shall be employed, will be required.

5.2 Unintentional islanding

Inverters/Converters shall be in compliance with ESB 756D5.7.10.1 and R.I.P.U.C. NO. 2078section 4.2.1 General requirements, where all inverters/Converters must be IEEE 1547 compliant and UL-1741 certified inverters shall be equipped with an internal anti islanding scheme and active under voltage (27), over voltage (59), zero sequence over voltage (59N), under frequency (81U) and over frequency (81O) relays.

The Vensys converters are not UL 1741-2005/ IEEE1547listed and do not have any active islanding detection functionality.

However, due to the nature of the 2232 circuit, it is extremely unlikely that the wind turbine system will be islanded with load (as there are two supply substations). Dispatch has the discretion to take the generation system offline and lock out of service is one of two supply's must come offline for maintenance, in order to prevent accidental islanding of the 23kV EPS during an N-1 contingency.

5.3 Direct Transfer Tripping

Refer to section 4.2 above, a direct transfer tripping system, is not required for this interconnection.

5.4 Interconnection Interrupting Device

In accordance with ESB 756D, Sections 5.7.2 and 5.7.10.1 for a primary Wye- secondary Wye interface transformer, the interrupting device shall be installed on either side of the transformer.

The Customer's one-line shows an unknown make/model 600A 25kV main breaker controlled by a SEL-351A multifunction relay. The one line has the required interrupter but lacks the make and model number of the device. A new RI PE stamped one-line must be provided that has the required information must be clearly stated on it.

5.5 Transformers

The Company reserves the right to specify the winding connections for the transformer between the Company's voltage and the Facility's voltage (Interface Transformer) as well as whether it is to be grounded or ungrounded at the Company's voltage. **Refer to ESB-756D section 5.7.**

Additionally, the interface transformers must have two, (2), - 2.5% primary taps above and below the nominal kV rating.

The interconnecting circuit is 23 kV, 3wire, Not Effectively Grounded.

Each wind turbine connects, to a 1,500 kVA,23kV, ungrounded wye primary –620 V Grd-Y/ 358 V secondary interface transformer, which is acceptable.

It is recommended that should the IC utilize a Wye primary it have a fully rated winding and fully insulated and isolated neutral bushing to be able to withstand temporary overvoltage conditions that could develop for certain fault conditions that can occur on the Company EPS.

High side delta, low side Yg transformers are also acceptable.

5.6 Voltage relays

Voltage relays shall be frequency compensated to provide a uniform response in the range of 40 to 70 Hz. Refer to ESB 756D section 5.7.6.

The one line meets this requirement. The one lines show Yg-Yg VTs, 60:1 ratio on the 23kV side of the transformers.

Additionally, 59N protection is required on the high side of each transformer, using Yg-Yg VTs and must trip the high side interrupting device.

The customer's one line meets these requirements.

5.7 Overcurrent Relays

Per section 5.7.8 of the ESB 756D Overcurrent protection is required on the high side of the DG Customer's interface transformer to detect faults on the Company's EPS. Separate Voltage Controlled Overcurrent elements (51C Phase) and (51C Ground) are required. At a minimum, these relays shall utilize voltage sensing via 3 phase wye-grounded / wye-grounded VTs and 3 phase current sensing CTs. The 51C elements shall trip the interrupting device.

The one line meets this requirement; each interconnection utilizes an SEL-351A multifunction relay and 51C phase and ground enabled. Final settings

will be determined during the Witness Testing portion of the interconnection once all equipment is finalized.

5.8 Protective Relay Hard-Wire Requirement

Unless authorized otherwise by the Company, protective relays must be hardwired to the device they are tripping. Further, interposing computer or programmable logic controller or the like is not permitted in the trip chain between the relay and the device being tripped.

The customer's one-line meets these requirements.

5.9 Protective Relaying Redundancy

Refer to ESB 756D Inverter-based PV Generator Equal or Above 500k. The relays at the converter terminal shall provide the redundant protection for voltage and frequency elements. However, the relay equipped for overcurrent protection has no redundancy, National Grid requires that the relay alarm contact should be wired to trip the switchgear when the relay fails, not in service or the DC supply voltage to the relay is lost. There will be 2s time delay in tripping the switchgear. A timer needs to be added to the switchgear's trip circuit or the internal relays must be programmed to include the delay.

An updated PE stamped one-line must be submitted satisfying this requirement.

5.10 Protective Relay Supply

Refer to ESB 756D section 5.7.10.4. Where protective relays are required in this Section, their control circuits shall be DC powered from a battery and battery charger system. Solid state relays shall be self-powered, or DC powered from a battery and battery charger system. If the Facility uses a Company-acceptable non-latching interconnection contactor, AC powered relaying may be allowed provided the relay and its method of application are fail safe, meaning that if the relay fails or if the voltage and/or frequency of its AC power source deviate from the relay's design requirements for power, the relay or a separate fail-safe power monitoring relay acceptable to the Company will trip the generator, after a 2 second time delay, by opening the coil circuit of the interconnection contactor.

A new PE stamped one-line must be provided that shows the battery and charger system powered by an auxiliary transformer with the proper primary voltage.

5.11 Current Transformers ("CT")

Refer to ESB 756D section 5.7.4.1. CT ratios and accuracy classes shall be chosen such that secondary current is less than 5 amperes and transformation errors are consistent with Company practices.

The one-line shows 300:5 ampere CTs, located at the 25kV interrupting device and meets this requirement.

5.12 Voltage Sensing and Voltage Transformers ("VT")s and Connections

Transformer options based on the selected transformer configuration to detect the Under Voltage, line to ground faults, and provide voltage detection for a voltage controlled over current (51C) element. Refer to ESB 756D sections 5.7.4.2 and 5.7.8.

The customer's one line meets this requirement.

5.13 High-Speed Protection

The Facility may be required to use high-speed protection if time-delayed protection would result in degradation in the existing sensitivity or speed of the protection systems on the Company's EPS.

High speed protection is not required.

5.14 Service Entrance Equipment

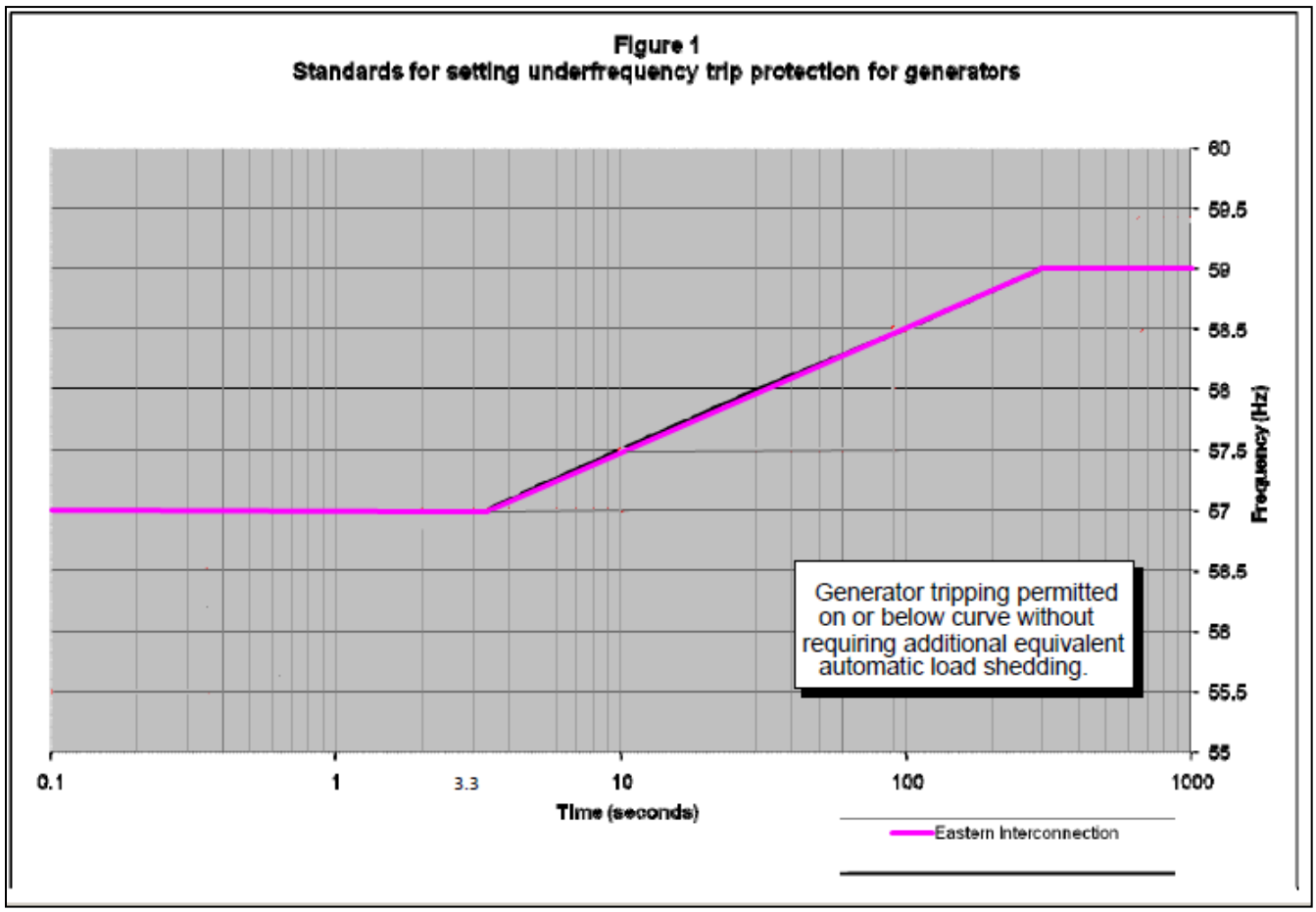
The Interconnection Customer shall furnish, install, own, and maintain service entrance equipment in accordance with applicable requirements set forth in ESB 750, Section 5, and ESB756D, Section 5.4.1.3 and Exhibit 7.

5.15 Surge-Withstand capability

The interconnection system shall have the capability to withstand voltage and current surges in accordance with the environments defined in IEEE Standard C62.41.2-2002 or IEEE Standard C37.90.1-2002 as applicable.

5.16 Additional Requirement

R.I.P.U.C. No. 2078 requires that the Distributed Resources (DR) cease to energize the area EPS within 2 seconds, refer to IEEE1547 and UL1741. The Interconnection system's response to abnormal frequencies, Section 4.2.3.2.1 requires that NPCC Directory 12 Figure 1 Curve "Standards for Setting Underfrequency Trip Protection for Generators" for the Eastern Interconnection be followed. It is important that clearing time should be the time that the relay trips plus breaker operating time.



The under frequency setting points should also comply with the NPCC standard for setting under frequency trip protection. Per the NPCC Directory 12 Figure 1Curve, if the setting falls

above the curve, there must be an equivalent amount of load shed when tripped, which in this case cannot be done. Therefore the 81 under frequency must be set on or below the NPCC Directory 12 Figure 1 Curve for the Eastern Interconnection.

The converters' internal relays shall also meet the NPCC Directory 12 Figure 1 Curve requirements for the Eastern Interconnection.

Also the converters internal relays should match those set in the SEL-351A relay for voltage and frequency. The settings shown on the one line do not.

5.17 Protection Scheme Assessment

The customer must submit a PE stamped one line which includes the required redundant relay settings, inverter internal relay settings, and meets all the requirements specified within this document, to the Company for review and approval before an interconnection application can move forward.

6.0 Telemetry and Telecommunications

Refer to ESB 756D section 6.4. The Company requires real time monitoring and reporting of generation data for this project per the recommendations of IEEE 1547.3 IEEE Guide for Monitoring, Information Exchange, and Control of Distributed Resources Interconnected with Electric Power Systems.

Each of the facilities in this Project is an IPP and therefore National Grid does not require a RTU.

The Interconnecting Customer (IC) is advised to communicate with ISO-New England for any telemetry requirement as ISO-NE may require real-time monitoring between ISO-NE EMS and the DG site. The IC shall refer to the ISO-NE website and ISO-NE customer service help desk for details.

7.0 Inspection, Compliance Verification, Customer Testing, and Energization Requirements

7.1 Inspections and Compliance Verification

For this study, the DG Facility is deemed as an Independent Power Producer pursuant to applicable RI state jurisdictional requirements. A municipal electrical

inspection approval certificate from the local authority having jurisdiction is required of the DG Customer's facilities (i.e. primary service entrance conduit, primary switchgear, wiring, and generation equipment). The Company must receive the DG Customer's final set of installation drawings, equipment data, and test plan for the functional verification tests at least four (4) weeks before the Company's field audit.

The DG Customer shall adhere to all other Company related verification and compliance requirements as set forth in the applicable ESB 750 series documents. These and documented acceptance testing requirements of these facilities will be specified during the final design review of the Project prior to the Company's field audit and energization.

7.2 Testing and Commissioning

The Interconnection Customer shall submit initial relay settings to the Company no later than twenty-one (21) calendar days following the Company's acceptance of the Facility's service connection's final MA state licensed professional engineer sealed design. If changes/updates are necessary, the Company will notify the Interconnection Customer three (3) business days after the initial relay settings were received, and the Interconnection Customer shall submit the revised settings within seven (7) calendar days from such notification. Within three (3) business days of receipt of the proposed final relay settings, the Company shall provide comments on and/or acceptance of the settings. If the process must continue beyond the above evolution due to errors in the relay settings, the Company retains the right to extend the Testing and Commissioning process, as needed, to ensure the final relay settings are correct.

Assuming no major issues occurring with the relay settings, the Interconnection Customer shall submit a Testing and Commissioning Plan (TCP) to the Company for review and acceptance, no later than forty-five (45) calendar days following the Company's acceptance of the Facilities final design. The TCP must be finalized, including Company acceptance, no later than six (6) weeks prior to functional testing.

7.3 Energization and Synchronization

The "Generator Disconnect Switch" at the interconnection point shall remain "open" until successful completion of the Company's field audit and witness testing. Prior to the start of construction, the DG Customer shall designate an Energization Coordinator (EC), and prepare and submit an Energization Plan (EP) to the Company for review and comment. The energization schedule shall be submitted to the Company and communicated with the Company's local Regional Control Center at least two (2) weeks in advance of proposed energization. Further details of the EP and synchronization requirements will be specified during the final design review of the Project.

The DG Customer shall submit as-built design drawings to the Company 90 days following commercial operation of their DG Facility.

8.0 Cost Estimates

The non-binding good faith cost planning grade estimate for the Company's work associated with the interconnection of this Facility to the EPS, as identified in this report, is **$5,366,600.00**+/-25%, and includes:

National Grid Work Item	Conceptual Cost +/-25% Planning Grade Cost Estimate not including Tax Liability				Associated Tax Liability $ @ Applied to capital	Total Customer Costs includes Tax Liability on Capital Portion
System Modifications	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.84%**	**Total $**
Build 3 Phase line extension from Pole 9003 Flat River Road, 7.5 Miles to the six wind turbine generator sites	$4,075,000.00	$3,129,000.00	$509,000.00	$437,000.00	$715,000.00	$4,790,000.00
Six new primary metered services, each with new poles, conductor, load break switch, recloser and primary meter	$452,000.00	$452,000.00	$0.00	$0.00	$104,000.00	$556,000.00
EMS Integration	$5,600.00	$0.00	$5,600.00	$0.00	$0.00	$5,600.00
SUBTOTAL	**$4,532,600.00**	**$3,581,000.00**	**$514,600.00**	**$437,000.00**	**$819,000.00**	**$5,351,600.00**
Interconnecting Customer Interconnection Facilities ("ICIF")	**Pre-Tax Total $**	**Capital**	**O&M**	**Removal**	**22.84%**	**Total $**
Witness Testing	$15,000.00	$0.00	$15,000.00	$0.00	$0.00	$15,000.00
SUBTOTAL	**$15,000.00**	**$0.00**	**$15,000.00**	**$0.00**	**$0.00**	**$15,000.00**
	Pre-Tax Total $	**Capital**	**O&M**	**Removal**	**29.55%**	**Total $**
Totals	**$4,547,600.00**	**$3,581,000.00**	**$529,600.00**	**$437,000.00**	**$819,000.00**	**$5,366,600.00**

Note: Authorization for parallel operation will not be issued without a fully executed Interconnection Service Agreement, receipt of the necessary insurance documentation, and successful completion of the Company approved witness testing. Such authorization shall be provided in writing.

This **$5,366,600.00 +/- 25% total** planning grade estimate is based on information provided by the Interconnecting Customer for the study, and is prepared using historical cost data from similar projects. The associated tax effect liability included is the result of an IRS rule, which states that all costs for construction collected by National Grid, as well as the value of donated property, are considered taxable income.

This estimate is valid for ninety (90) calendar days from the issuance of this report. If the Interconnection Customer elects to proceed with this project after the ninety (90) calendar days, a revised estimate may be required.

A 2014 tax rate of 22.84% is expected to apply to contributions in aid of construction ("CIAC") payments received by Narragansett Electric Company from the Interconnecting Customer for construction completed in 2014. The calculation of the tax gross-up adder is included in this cost estimate on the basis of tax guidance published by the Internal Revenue Service, but tax rates and decisions are ultimately subject to IRS discretion. By signing this agreement, the Interconnecting Customer understands and agrees that the tax has been estimated for convenience and that the Interconnecting Customer remains liable for all tax due on CIAC payments, payable upon the Company's demand.

9.0 Conclusion

The project was found to be feasible. It will be allowed to interconnect with certain modifications and additions to the local National Grid distribution Electric Power System (EPS) the Interconnecting Customer's equipment. The estimated planning grade cost for the Company's work associated with the Project is **$5,366,600.00** +/- 25%.

The present interconnection configuration and protection scheme submitted for review must be modified to meet National Grid's specific protection requirements. The customer must submit a PE stamped electrical one-line along with the required relay settings, that meets all the requirements specified within this document, to National Grid for review and approval, before an interconnection application can move forward.

A milestone schedule shall be included in the Interconnection Agreement and shall be reflective of the tasks identified in ESB756D, Exhibit 2. Upon execution of the Interconnection Agreement, and prior to advancing the project, the Interconnecting Customer shall provide a detailed project schedule, inclusive of the Exhibit 2 tasks referenced above. After completion of final design and all associated applications, fees, permitting and easement requirements are satisfied, System Modifications for this Project will be placed in queue for construction.

If an Interconnecting Customer fails to meet the R.I.P.U.C. No 2078, Section 3.4 Time Frames and does not provide the necessary information required by the Company within the longer of 15 days or half the time allotted to the Company to perform a given

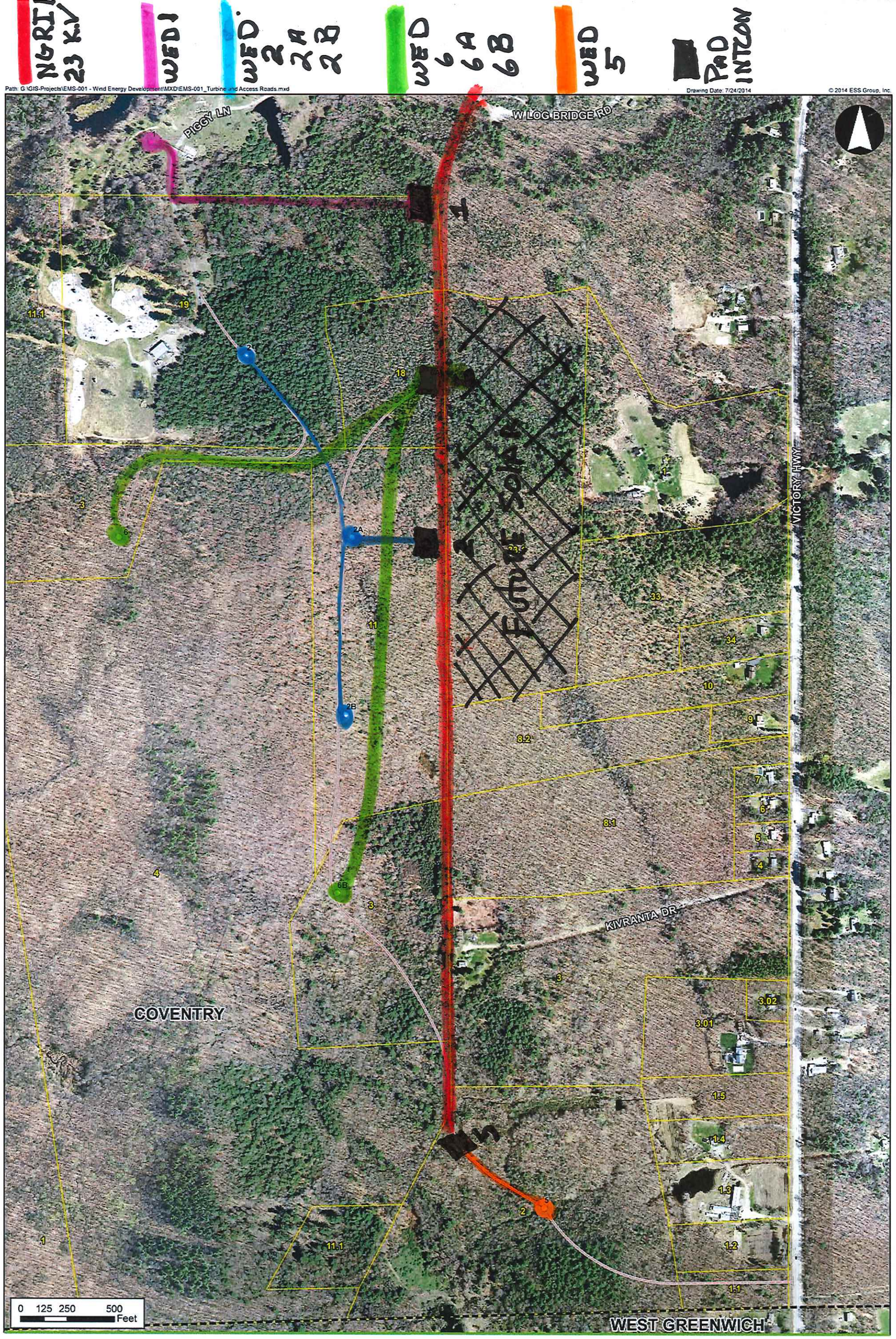
step, or as extended by mutual agreement, then the Company may terminate the application and the Interconnecting Customer must re-apply.

Note: Authorization for parallel operation will not be issued without a fully executed Interconnection Agreement, receipt of the necessary insurance documentation, and successful completion of the Company approved witness testing. Such authorization shall be provided in writing.

10.0 Revision History

Version	Date	Description of Revision
1.0	2/18/14	Final: WED Coventry 1, 2, 3, 4, 5&6, LLC, 23kV

Appendix A IC Site and One-line Diagrams



Coventry - Wind Energy Development
Coventry, Rhode Island

1 inch = 450 feet

Source: 1) Parcel Data, Town of Coventry GIS 2) RIDOT, Roads, 2010
3) FWS, NWI Wetlands, 2010 4) USGS, 6in Aerial Imagery, 2011
5) RIGIS, Town Boundaries, 1989

ess group
environmental consulting & engineering services

Legend

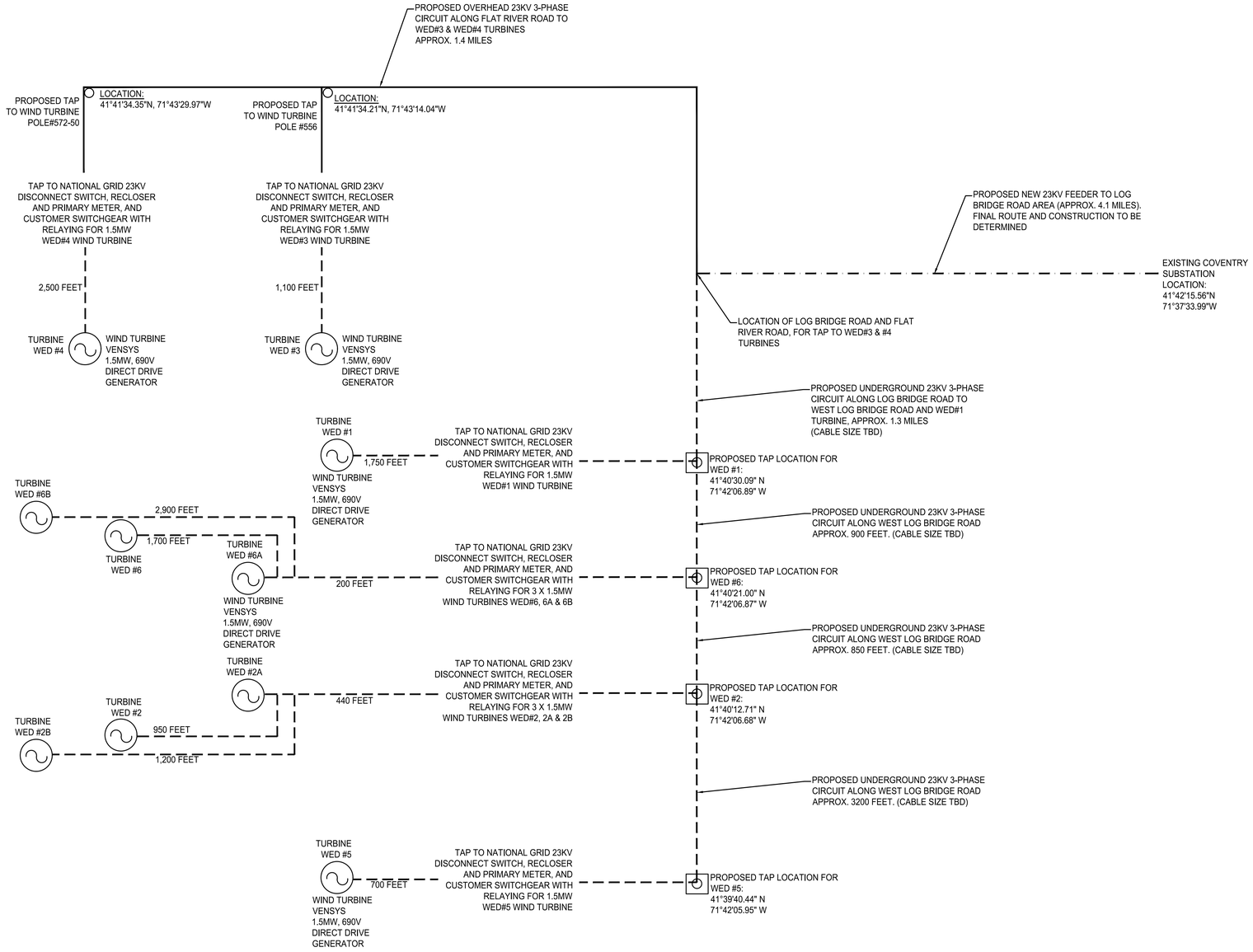
- Turbine Location Point
- Access Road Centerline
- Access Road
- Parcel Boundary

Coventry Turbine Location Map

PRIMARY
SECONDARY
OVERHEAD
UNDERGROUND

ONE LINE POWER DIAGRAM

- LOAD-BREAK SWITCH FUSE, SIZE AS INDICATED
- TRANSFORMER, SIZE AS INDICATED (DELTA-WYE GND TYPICAL)
- CIRCUIT BREAKER
- DRAW-OUT CIRCUIT BREAKER
- K1 KIRK-KEY INTERLOCK
- CURRENT TRANSFORMER
- POTENTIAL TRANSFORMER
- SOLID STATE TRIP UNIT
- GROUND
- Ⓐ AMMETER
- As AMMETER SWITCH
- Ⓥ VOLTMETER
- Vs VOLTMETER SWITCH
- T2 DRY TYPE TRANSFORMER. "2" INDICATES SIZE, REFER TO DRY TYPE TRANSFORMER SCHEDULE
- L.A. LIGHTNING ARRESTER
- CABLE TERMINATION / LOAD-BREAK ELBOW
- FUSED CUT-OUT
- GROUP-OPERATED AIR-BREAK (GOAB) SWITCH
- Ⓜ REVENUE METER (BY UTILITY)
- 200A 200A LOAD BREAK ELBOWS



DAVID J. COLOMBO
No. 8527
REGISTERED PROFESSIONAL ENGINEER
ELECTRICAL
01-29-2015

No.	DATE	DESCRIPTION
0	01/19/2015	ISSUED FOR REVIEW

REVISIONS

PROJ. MANAGER:
CHIEF DESIGNER:
REVIEWED BY: DATE

SEAL

SCALE:
HORZ.:NONE
VERT.:
DATUM:
HORZ.:
VERT.:
0
GRAPHIC SCALE

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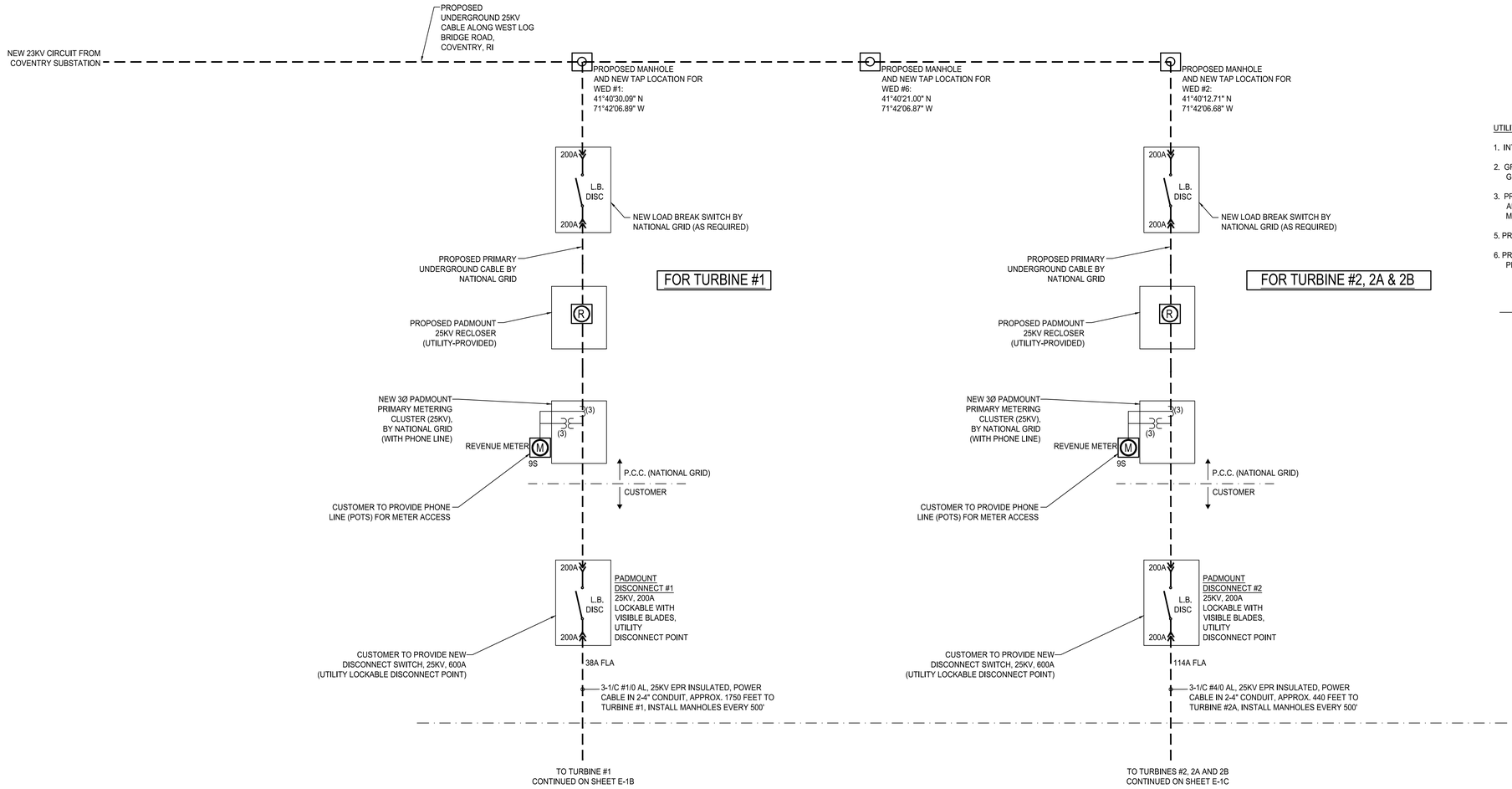
WIND ENERGY DEVELOPMENT, LLC
COVENTRY WIND TURBINES
PROPOSED OVERALL 23KV ONE-LINE DIAGRAM
COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: JAN 2015
E-0
SIZE: D | REV: 0



UTILITY INTERCONNECTION NOTES:

1. INTERFACE TRANSFORMER TO BE WYE PRIMARY AND SECONDARY.
2. GROUNDING TRANSFORMER TO HAVE INSULATED H0 BUSHING WITH EXTERNAL GROUND STRAP, TO ALLOW PLACEMENT OF NEUTRAL CT ON TRANSFORMER PRIMARY.
3. PROVIDE POTS PHONE LINE TO THE NGRID PRIMARY METERING. PROVIDE 3 FEET ADDITIONAL PHONE LINE AND LIQUID-TIGHT CONDUIT WITH END NUT TO BOTTOM OF METER SOCKET.
5. PROTECTIVE RELAYS TO HAVE BATTERY BACKUP OR UPS FOR BACKUP.
6. PROTECTIVE RELAY ALARM CIRCUIT TO BE WIRED TO TRIP SWITCH FOR REDUNDANCY PER NATIONAL GRID REQUIREMENTS.

DEVICE NO.	DESCRIPTION
27T	TIME UNDER VOLTAGE RELAY
27I	INSTANTANEOUS UNDER VOLTAGE RELAY
32F	FORWARD OVER POWER RELAY
32R	REVERSE POWER RELAY
46	NEGATIVE PHASE SEQUENCE OVERCURRENT RELAY
47	REVERSE PHASE VOLTAGE RELAY
50/51	INSTANTANEOUS / TIME OVERCURRENT RELAY
51N	GROUND OVERCURRENT RELAY
59I	INSTANTANEOUS OVERVOLTAGE RELAY
59T	TIME OVERVOLTAGE RELAY
60	VOLTAGE BALANCE RELAY
81/O	OVER FREQUENCY RELAY
81/U	UNDER FREQUENCY RELAY

PRIMARY
SECONDARY
OVERHEAD
UNDERGROUND

ONE LINE POWER DIAGRAM

- LOAD-BREAK SWITCH FUSE, SIZE AS INDICATED
- TRANSFORMER, SIZE AS INDICATED (DELTA-WYE GND TYPICAL)
- CIRCUIT BREAKER
- DRAW-OUT CIRCUIT BREAKER
- KI — KIRK-KEY INTERLOCK
- CURRENT TRANSFORMER
- POTENTIAL TRANSFORMER
- SOLID STATE TRIP UNIT
- GROUND
- A — AMMETER
- As — AMMETER SWITCH
- V — VOLTMETER
- Vs — VOLTMETER SWITCH
- T2 — DRY TYPE TRANSFORMER. "2" INDICATES SIZE, REFER TO DRY TYPE TRANSFORMER SCHEDULE
- L.A. — LIGHTNING ARRESTER
- CABLE TERMINATION / LOAD-BREAK ELBOW
- FUSED CUT-OUT
- GROUP-OPERATED AIR-BREAK (GOAB) SWITCH
- M — REVENUE METER (BY UTILITY)
- 200A — 200A LOAD BREAK ELBOWS

DAVID J. COLOMBO
No. 8527
REGISTERED PROFESSIONAL ENGINEER
ELECTRICAL
01-29-2015

TURBINE #1 IS CONNECTED TO A SINGLE NET METER
TURBINES #2, #2A & #2B CONNECTED TO A SINGLE NET METER

No.	DATE	DESCRIPTION
6	1/29/2015	REVISED FOR 23KV INTERCONNECTION
5	10/29/2014	REVISED FOR PERRY HILL INTERCONNECTION POINT
4	9/17/2014	REVISED FOR GROUNDING TRANSFORMER
3	7/14/2014	REVISED FOR VENSYS TURBINE
2	7/7/2014	REVISED TURBINE CONFIGURATION
1	01/03/2013	REVISED FOR NGRID APPLICATION
0	01/20/2012	ISSUED FOR REVIEW

REVISIONS

No.	DATE	DESCRIPTION

REVISIONS

PROJ. MANAGER:
CHIEF DESIGNER:
REVIEWED BY: DATE

SEAL

SCALE:
HORZ.:NONE
VERT.:
DATUM:
HORZ.:
VERT.:
0
GRAPHIC SCALE

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WIND ENERGY DEVELOPMENT, LLC

COVENTRY - PIGGY LANE WIND TURBINES

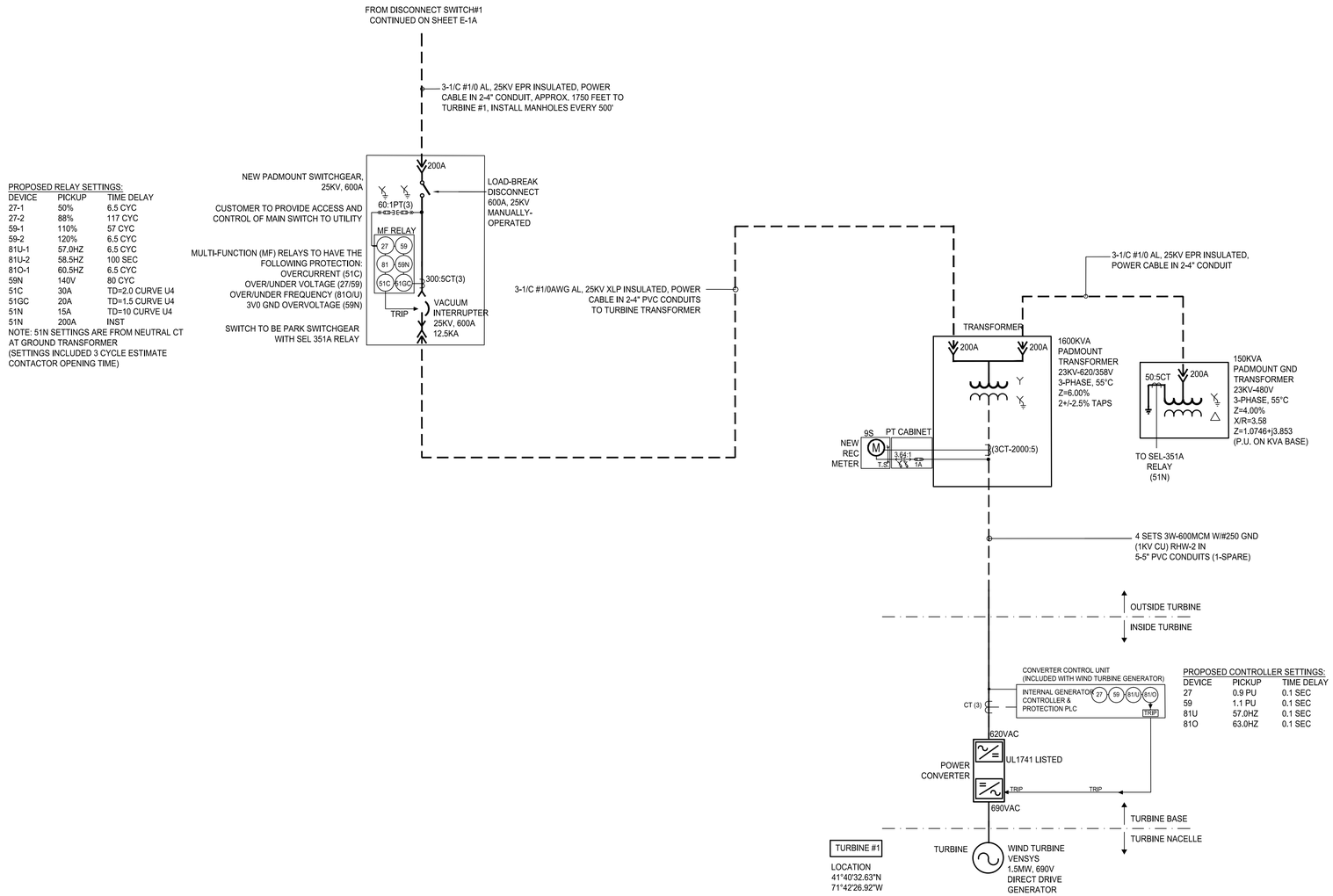
PROPOSED ONE-LINE DIAGRAM

OFF OF PERRY HILL ROAD, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: JAN 2012

E-1A

SIZE: D REV: 6



CONTRACTOR SHALL PROVIDE ALL EQUIPMENT SHOWN ON ONE-LINE DIAGRAM, UNLESS NOTED TO BE PROVIDED BY UTILITY.

PRIMARY
SECONDARY
OVERHEAD
UNDERGROUND

DEVICE NO.	DESCRIPTION
27T	TIME UNDER VOLTAGE RELAY
27I	INSTANTANEOUS UNDER VOLTAGE RELAY
32F	FORWARD OVER POWER RELAY
32R	REVERSE POWER RELAY
46	NEGATIVE PHASE SEQUENCE OVERCURRENT RELAY
47	REVERSE PHASE VOLTAGE RELAY
50/51	INSTANTANEOUS / TIME OVERCURRENT RELAY
51N	GROUND OVERCURRENT RELAY
59I	INSTANTANEOUS OVERVOLTAGE RELAY
59T	TIME OVERVOLTAGE RELAY
60	VOLTAGE BALANCE RELAY
81/O	OVER FREQUENCY RELAY
81/U	UNDER FREQUENCY RELAY
59N	ZERO-SEQ. GROUND OVER-VOLTAGE RELAY (3V0)

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- TRANSFORMER, SIZE AS INDICATED (DELTA-WYE GND TYPICAL)
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- DRAW-OUT CIRCUIT BREAKER
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- POTENTIAL TRANSFORMER
- SOLID STATE TRIP UNIT
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- AS AMMETER SWITCH
- V VOLTMETER
- VS VOLTMETER SWITCH
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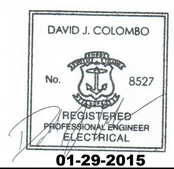
- FUSED CUT-OUT
- GROUP-OPERATED AIR-BREAK (GOAB) SWITCH
- M REVENUE METER (BY UTILITY)
- 200A 200A LOAD BREAK ELBOWS



01-29-2015

No.	DATE	DESCRIPTION
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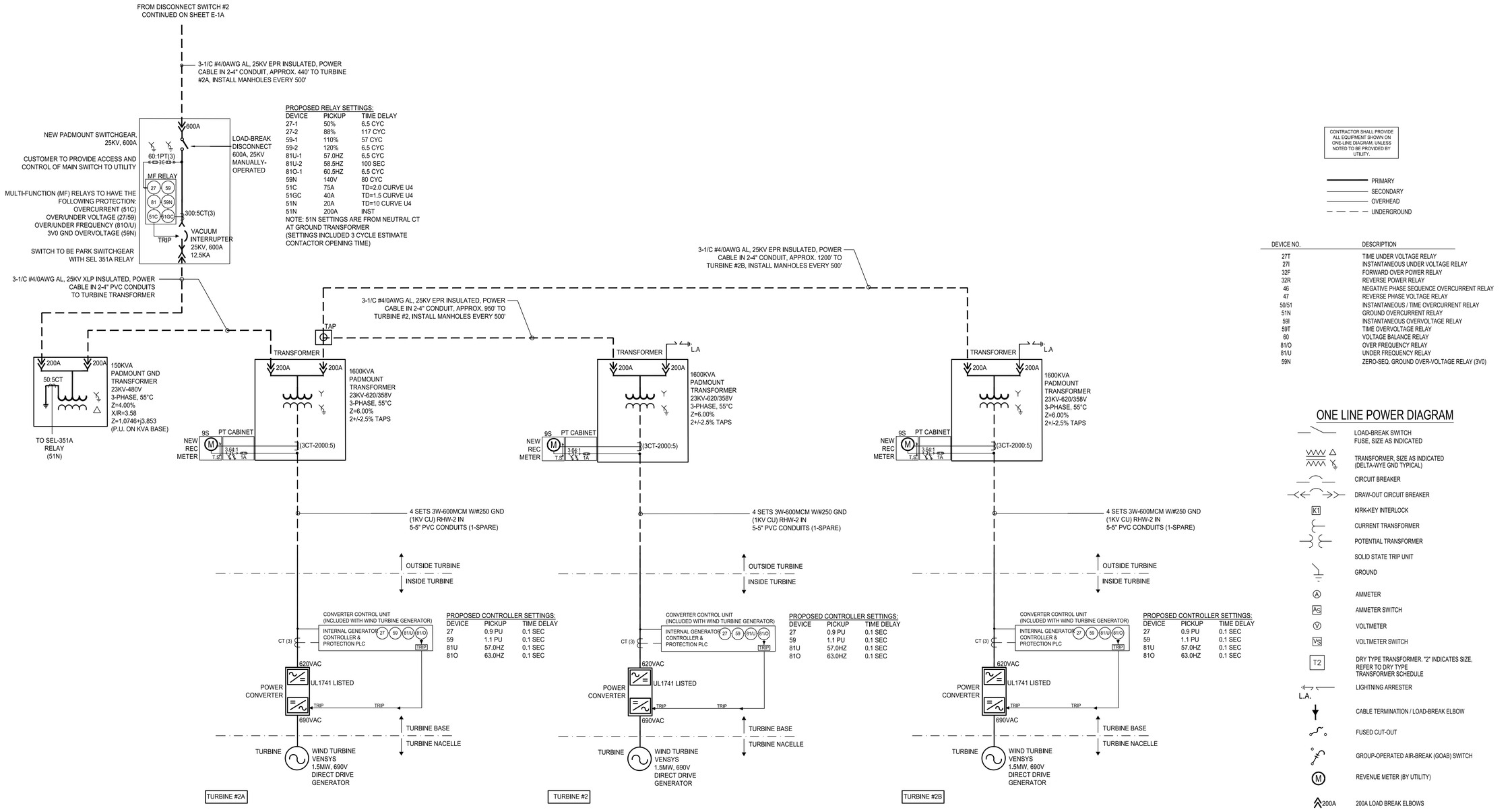
WIND ENERGY DEVELOPMENT, LLC
COVENTRY - PIGGY LANE WIND TURBINES
PROPOSED ONE-LINE DIAGRAM
OFF OF PERRY HILL ROAD, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: JAN 2012
E-1B
SIZE: D | REV: 6



DAVID J. COLOMBO
No. 8527
REGISTERED PROFESSIONAL ENGINEER ELECTRICAL

01-29-2015

No.	DATE	DESCRIPTION
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REVISIONS

No.	DATE	DESCRIPTION

REVISIONS

PROJ. MANAGER:
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SEAL

SCALE:
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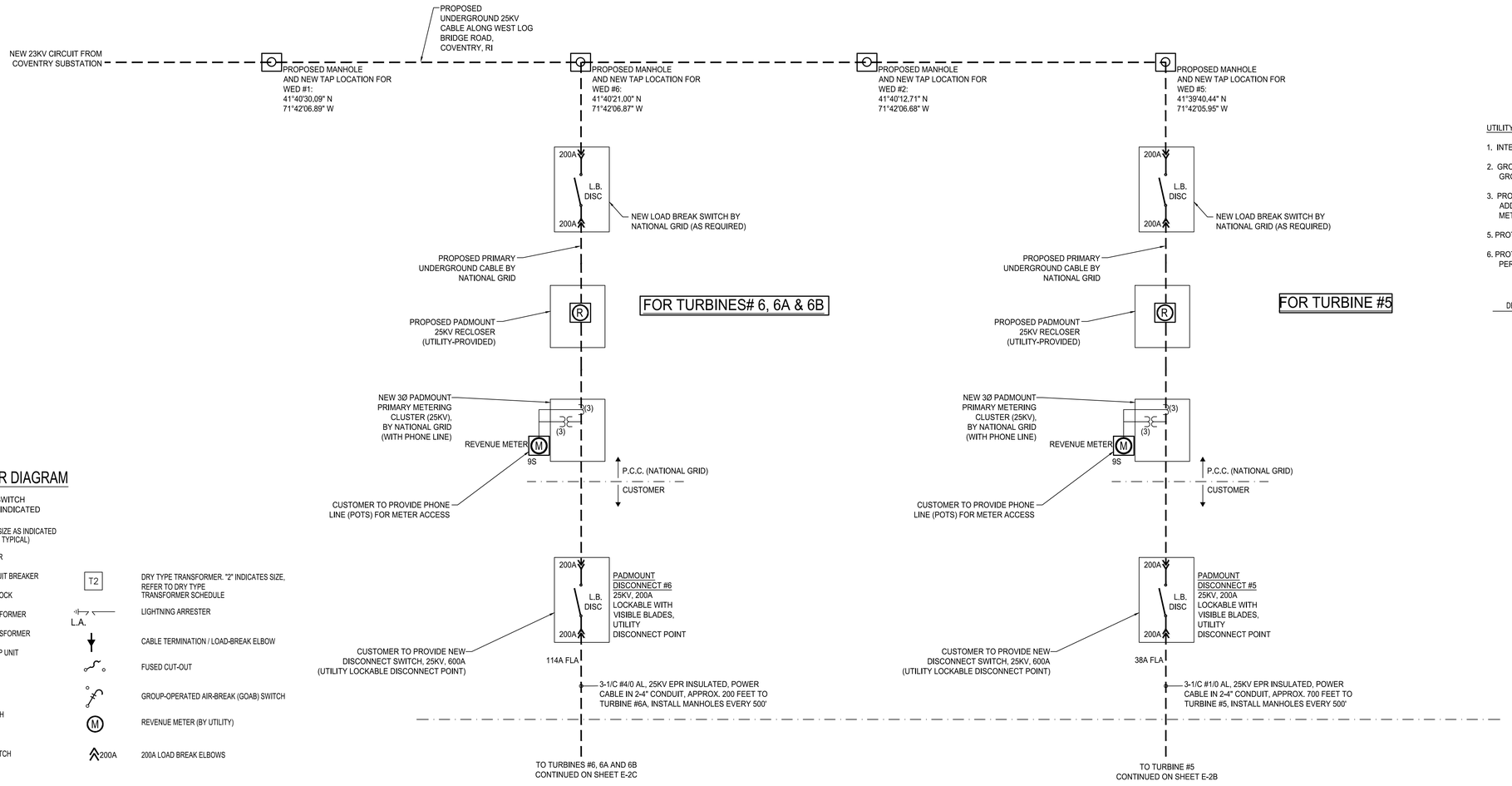
COVENTRY - PIGGY LANE WIND TURBINES
PROPOSED ONE-LINE DIAGRAM
OFF OF PERRY HILL ROAD, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: JAN 2012
E-1C
SIZE: D | REV: 6



ONE LINE POWER DIAGRAM

- LOAD-BREAK SWITCH, FUSE, SIZE AS INDICATED
- TRANSFORMER, SIZE AS INDICATED (DELTA-WYE GND TYPICAL)
- CIRCUIT BREAKER
- DRAW-OUT CIRCUIT BREAKER
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- GROUND
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- CABLE TERMINATION / LOAD-BREAK ELBOW
- FUSED CUT-OUT
- GROUP-OPERATED AIR-BREAK (GOAB) SWITCH
- M — REVENUE METER (BY UTILITY)
- 200A — 200A LOAD BREAK ELBOWS

UTILITY INTERCONNECTION NOTES:

1. INTERFACE TRANSFORMER TO BE WYE PRIMARY AND SECONDARY.
2. GROUNDING TRANSFORMER TO HAVE INSULATED H0 BUSHING WITH EXTERNAL GROUND STRAP, TO ALLOW PLACEMENT OF NEUTRAL CT ON TRANSFORMER PRIMARY.
3. PROVIDE POTS PHONE LINE TO THE NGRID PRIMARY METERING. PROVIDE 3 FEET ADDITIONAL PHONE LINE AND LIQUID-TIGHT CONDUIT WITH END NUT TO BOTTOM OF METER SOCKET.
5. PROTECTIVE RELAYS TO HAVE BATTERY BACKUP OR UPS FOR BACKUP.
6. PROTECTIVE RELAY ALARM CIRCUIT TO BE WIRED TO TRIP SWITCH FOR REDUNDANCY PER NATIONAL GRID REQUIREMENTS.

DEVICE NO.	DESCRIPTION
27T	TIME UNDER VOLTAGE RELAY
27I	INSTANTANEOUS UNDER VOLTAGE RELAY
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59T	TIME OVERVOLTAGE RELAY
60	VOLTAGE BALANCE RELAY
81/O	OVER FREQUENCY RELAY
81/U	UNDER FREQUENCY RELAY

- PRIMARY
- SECONDARY
- OVERHEAD
- UNDERGROUND

DAVID J. COLOMBO
No. 8527
REGISTERED PROFESSIONAL ENGINEER
ELECTRICAL
01-29-2015

TURBINE #5 IS CONNECTED TO A SINGLE NET METER
TURBINES #6, #6A & #6B ARE CONNECTED TO A SINGLE NET METER

No.	DATE	DESCRIPTION
4	1/29/2015	REVISED FOR 23KV INTERCONNECTION
3	9/17/2014	REVISED FOR GROUNDING TRANSFORMER
2	7/14/2014	REVISED FOR VENSYS TURBINE
1	7/7/2014	REVISED TURBINE CONFIGURATION
0	4/28/2014	ISSUED FOR REVIEW

REVISIONS

PROJ. MANAGER:
CHIEF DESIGNER:
REVIEWED BY: DATE

SEAL

SCALE: HORZ.:NONE VERT.:
DATUM: HORZ.: VERT.:
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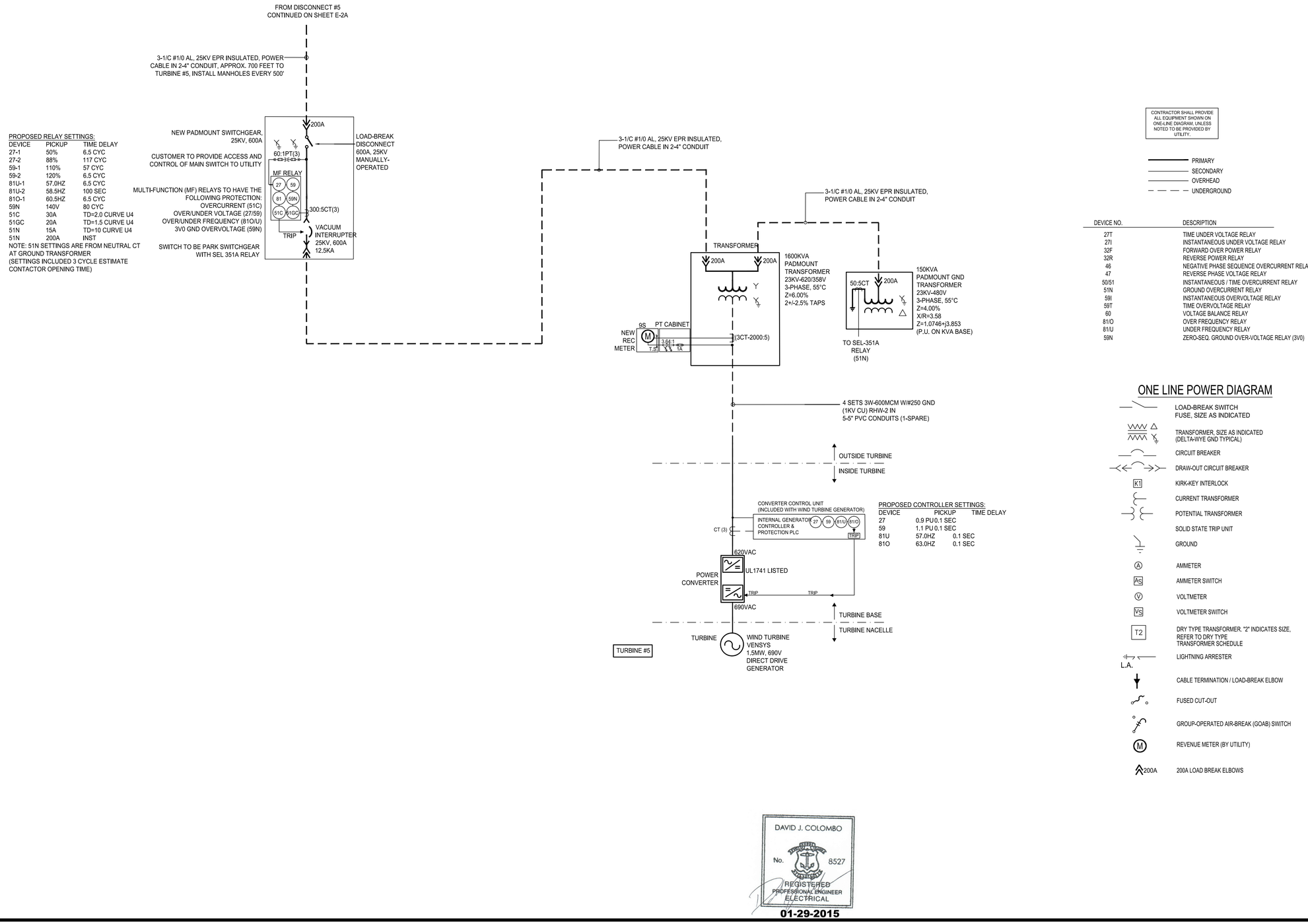
WIND ENERGY DEVELOPMENT, LLC
COVENTRY VICTORY HWY WIND TURBINES
PROPOSED ONE-LINE DIAGRAM
VICTORY HIGHWAY, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: APRIL 2014
E-2A
SIZE: D | REV: 4



DAVID J. COLOMBO
No. 8527
REGISTERED PROFESSIONAL ENGINEER
ELECTRICAL

01-29-2015

No.	DATE	DESCRIPTION
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REVISIONS

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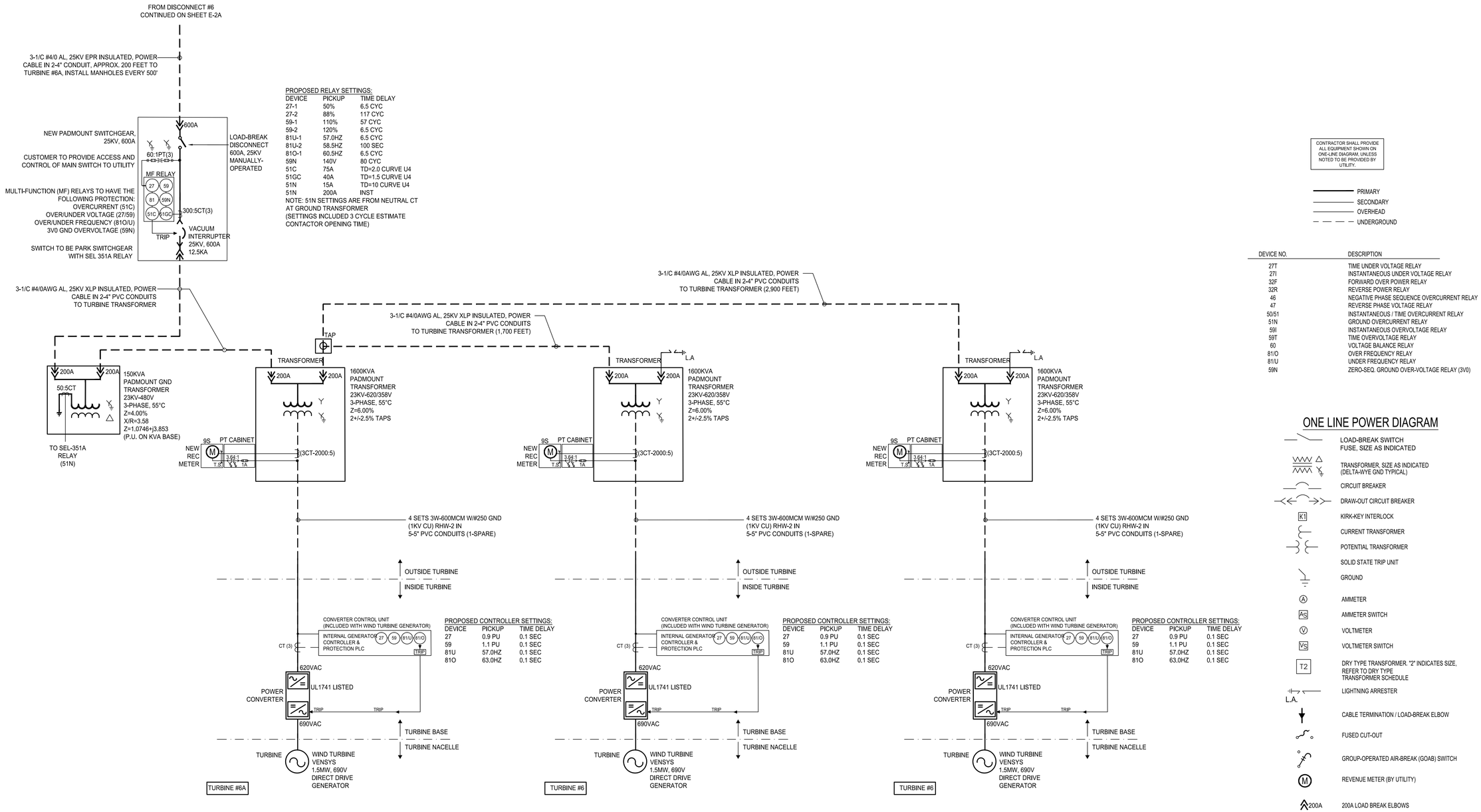
PROPOSED ONE-LINE DIAGRAM
VICTORY HIGHWAY, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: APRIL 2014
E-2B
SIZE: D REV: 4



DAVID J. COLOMBO
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ELECTRICAL
01-29-2015

No.	DATE	DESCRIPTION
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REVISIONS

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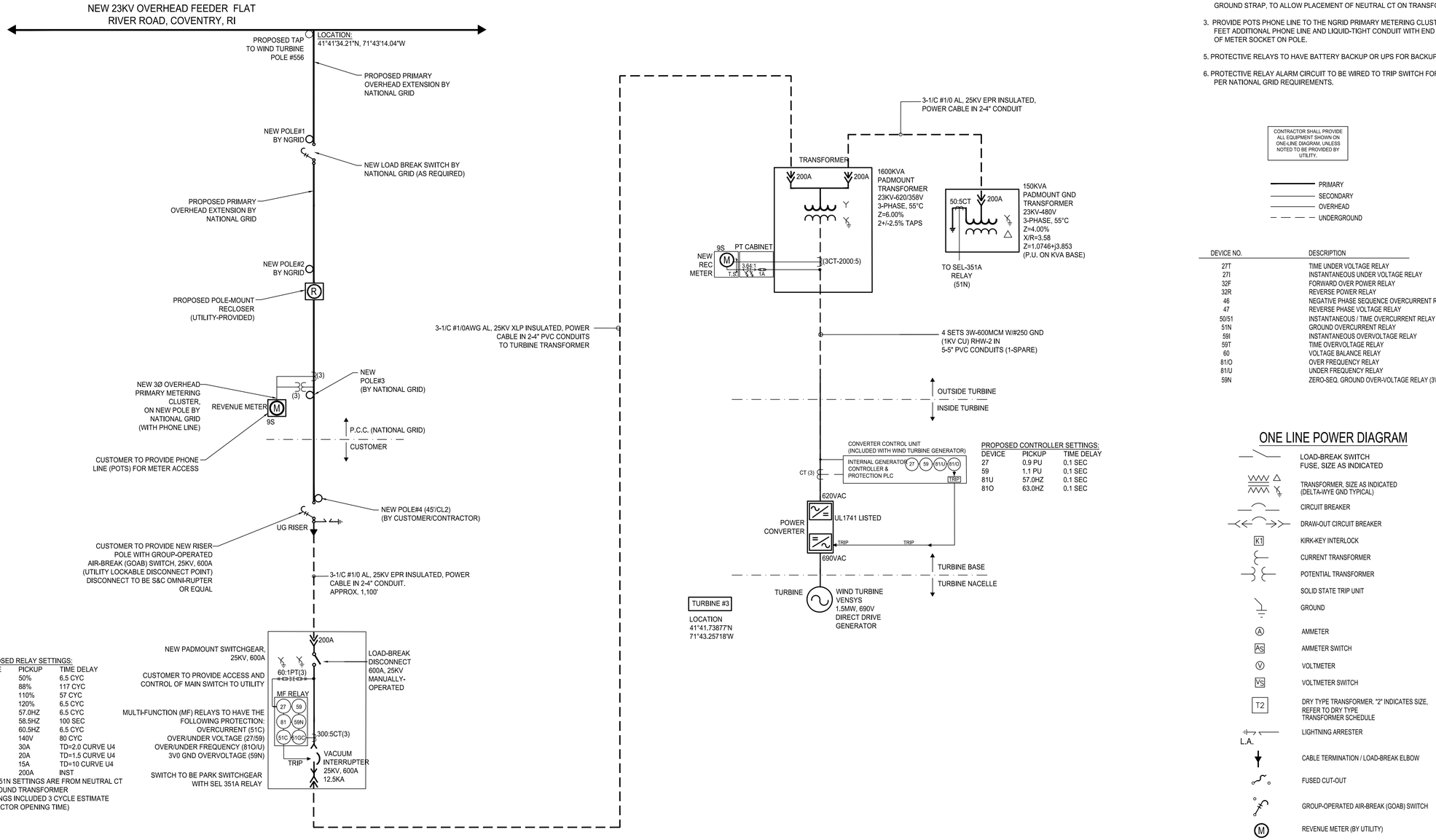
COVENTRY VICTORY HWY WIND TURBINES
PROPOSED ONE-LINE DIAGRAM
VICTORY HIGHWAY, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: APRIL 2014
E-2C
SIZE: D REV: 4



UTILITY INTERCONNECTION NOTES:

1. INTERFACE TRANSFORMER TO BE WYE PRIMARY AND SECONDARY.
2. GROUNDING TRANSFORMER TO HAVE INSULATED H0 BUSHING WITH EXTERNAL GROUND STRAP, TO ALLOW PLACEMENT OF NEUTRAL CT ON TRANSFORMER PRIMARY.
3. PROVIDE POTS PHONE LINE TO THE NGRID PRIMARY METERING CLUSTERS. PROVIDE 3 FEET ADDITIONAL PHONE LINE AND LIQUID-TIGHT CONDUIT WITH END NUT TO BOTTOM OF METER SOCKET ON POLE.
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CONTRACTOR SHALL PROVIDE ALL EQUIPMENT SHOWN ON ONE-LINE DIAGRAM, UNLESS NOTED TO BE PROVIDED BY UTILITY.

PRIMARY
SECONDARY
OVERHEAD
UNDERGROUND

DEVICE NO.	DESCRIPTION
27T	TIME UNDER VOLTAGE RELAY
27I	INSTANTANEOUS UNDER VOLTAGE RELAY
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ONE LINE POWER DIAGRAM

- LOAD-BREAK SWITCH FUSE, SIZE AS INDICATED
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- VS VOLTMETER SWITCH
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DAVID J. COLOMBO
No. 8527
REGISTERED PROFESSIONAL ENGINEER
ELECTRICAL
01-29-2015

No.	DATE	DESCRIPTION
4	1/29/2015	REVISED FOR 23KV INTERCONNECTION
3	9/17/2014	REVISED FOR GROUNDING TRANSFORMER
2	7/14/2014	REVISED FOR VENSYS TURBINE
1	7/7/2014	UPDATED INT APP
0	8/22/2013	ISSUED FOR REVIEW

REVISIONS

PROJ. MANAGER:
CHIEF DESIGNER:
REVIEWED BY: DATE

SEAL

SCALE:
HORZ.:NONE
VERT.:
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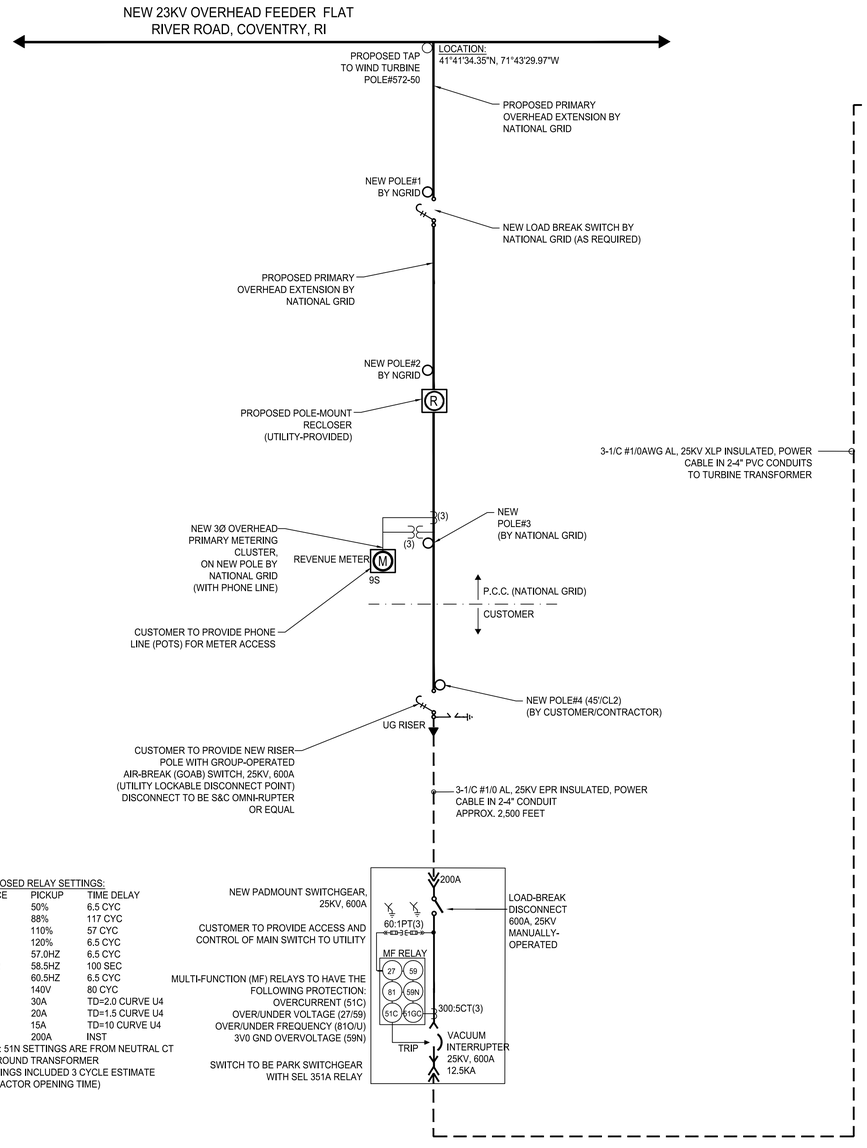
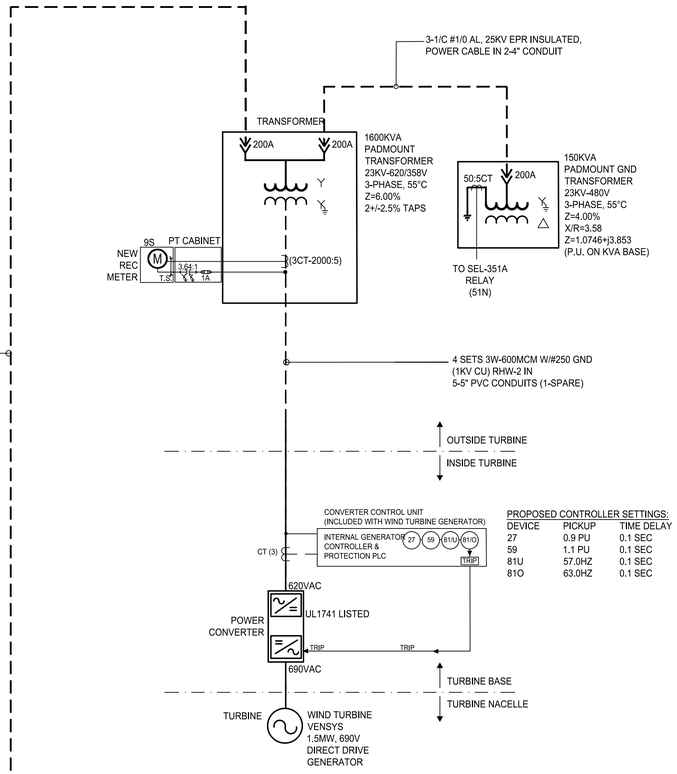
WIND ENERGY DEVELOPMENT, LLC
COVENTRY WIND#3 1.5MW WIND TURBINE
PROPOSED ONE-LINE DIAGRAM
FLAT RIVER ROAD, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: AUGUST 2013
E-1.3
SIZE: D REV: 4





PROPOSED CONTROLLER SETTINGS:

DEVICE	PICKUP	TIME DELAY
27	0.9 PU	0.1 SEC
59	1.1 PU	0.1 SEC
81U	57.0HZ	0.1 SEC
81O	63.0HZ	0.1 SEC

TURBINE #4

LOCATION
41°41'10.84"N
71°43'42.48"W

UTILITY INTERCONNECTION NOTES:

1. INTERFACE TRANSFORMER TO BE WYE PRIMARY AND SECONDARY.
2. GROUNDING TRANSFORMER TO HAVE INSULATED H0 BUSHING WITH EXTERNAL GROUND STRAP, TO ALLOW PLACEMENT OF NEUTRAL CT ON TRANSFORMER PRIMARY.
3. PROVIDE POTS PHONE LINE TO THE NGRID PRIMARY METERING CLUSTERS. PROVIDE 3 FEET ADDITIONAL PHONE LINE AND LIQUID-TIGHT CONDUIT WITH END NUT TO BOTTOM OF METER SOCKET ON POLE.
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OVERHEAD
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ONE LINE POWER DIAGRAM

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- TRANSFORMER, SIZE AS INDICATED (DELTA-WYE GND TYPICAL)
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DAVID J. COLOMBO
No. 8527
REGISTERED PROFESSIONAL ENGINEER
ELECTRICAL
01-29-2015

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1	7/7/2014	UPDATED INT APP
0	9/17/2013	ISSUED FOR REVIEW

REVISIONS

No.	DATE	DESCRIPTION

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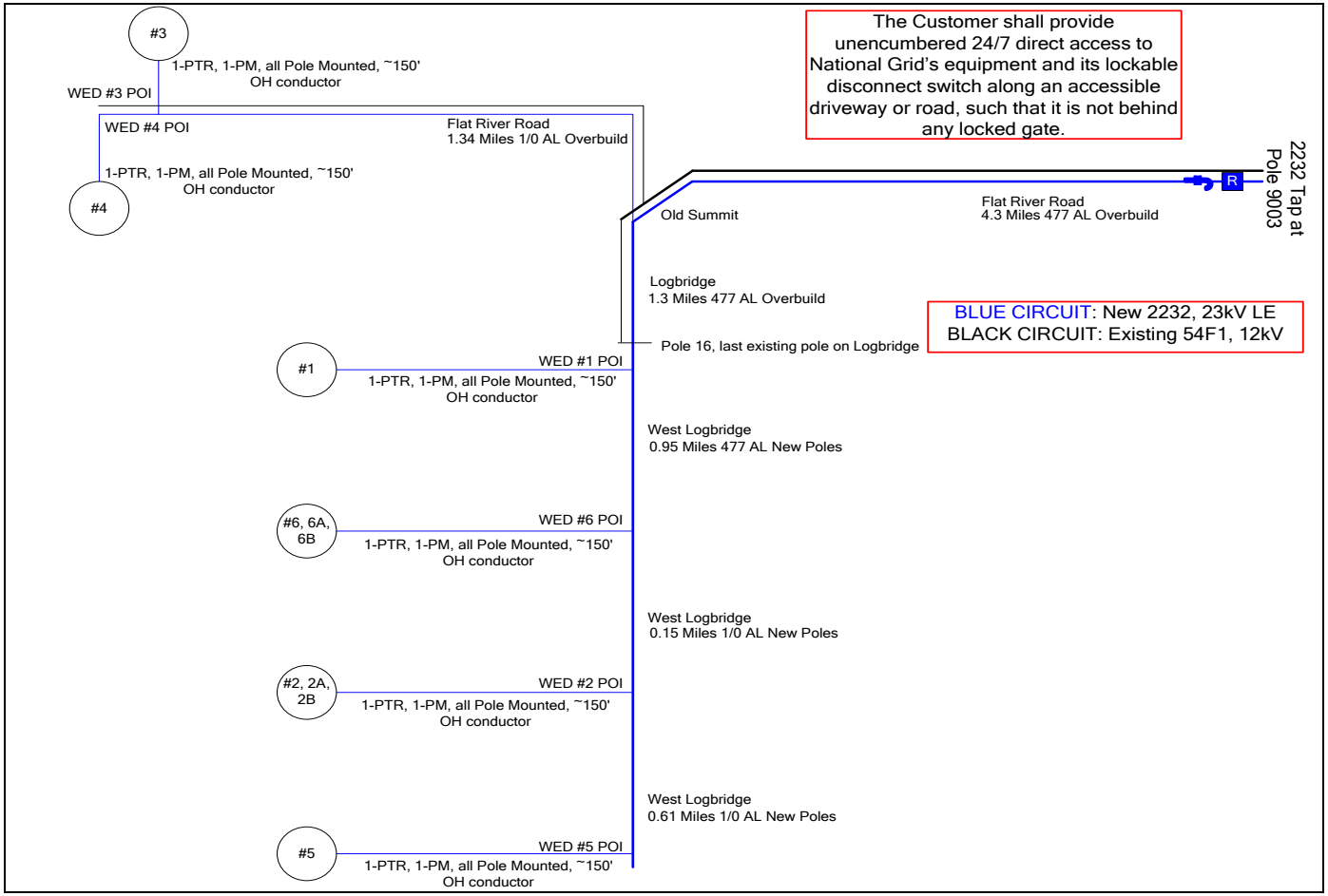
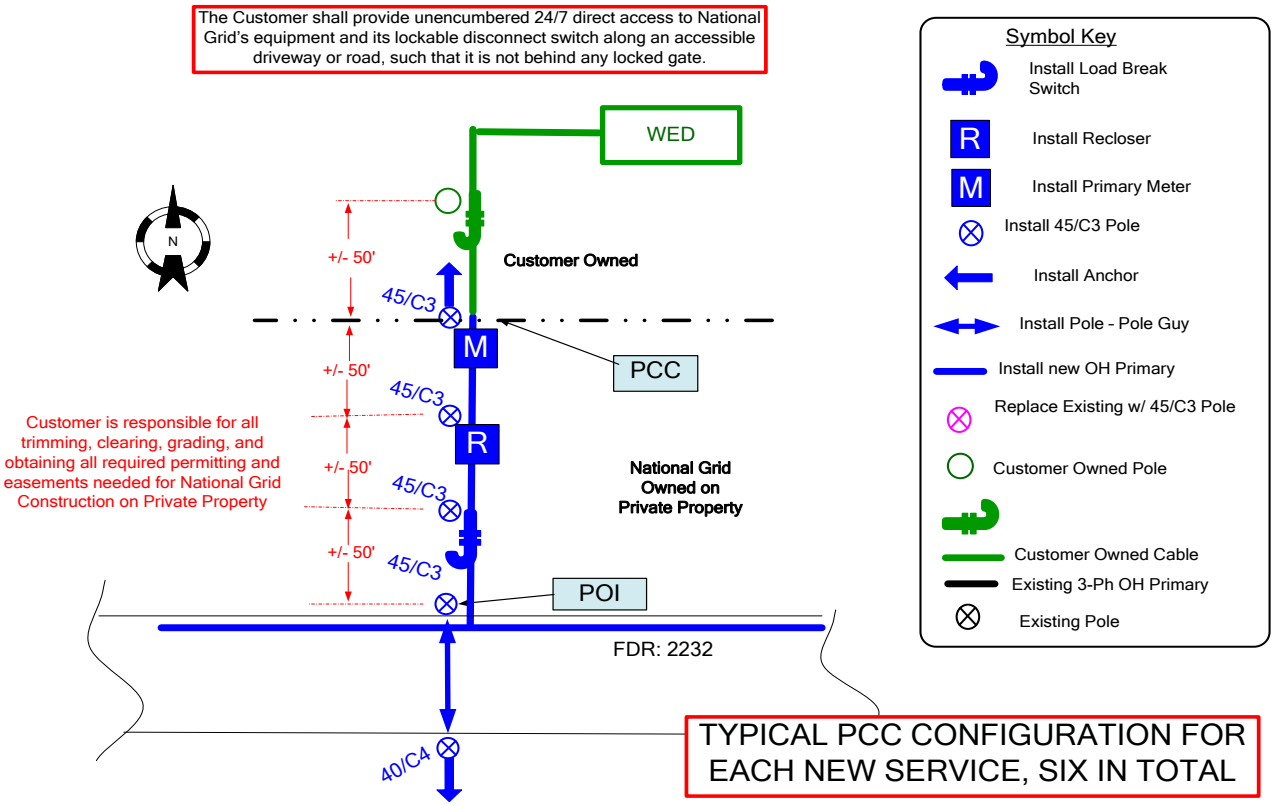
WIND ENERGY DEVELOPMENT, LLC
COVENTRY WIND#4 1.5MW WIND TURBINE
PROPOSED ONE-LINE DIAGRAM
FLAT RIVER ROAD, COVENTRY RHODE ISLAND

PROJ. No.: 144D
DATE: SEPT 2013
E-1.4
SIZE: D REV: 4

Appendix B EPS Modifications


#3
1-PTR, 1-PM, all Pole Mounted, ~150' OH conductor
WED #3 POI
WED #4 POI
Flat River Road
1.34 Miles 1/0 AL Overbuild
1-PTR, 1-PM, all Pole Mounted, ~150' OH conductor
#4
The Customer shall provide unencumbered 24/7 direct access to National Grid's equipment and its lockable disconnect switch along an accessible driveway or road, such that it is not behind any locked gate.
2232 Tap at Pole 9003
R
Old Summit
Flat River Road
4.3 Miles 477 AL Overbuild
Logbridge
1.3 Miles 477 AL Overbuild
BLUE CIRCUIT: New 2232, 23kV LE
BLACK CIRCUIT: Existing 54F1, 12kV
Pole 16, last existing pole on Logbridge
#1
WED #1 POI
1-PTR, 1-PM, all Pole Mounted, ~150' OH conductor
West Logbridge
0.95 Miles 477 AL New Poles
#6, 6A, 6B
WED #6 POI
1-PTR, 1-PM, all Pole Mounted, ~150' OH conductor
West Logbridge
0.15 Miles 1/0 AL New Poles
#2, 2A, 2B
WED #2 POI
1-PTR, 1-PM, all Pole Mounted, ~150' OH conductor
West Logbridge
0.61 Miles 1/0 AL New Poles
#5
WED #5 POI
1-PTR, 1-PM, all Pole Mounted, ~150' OH conductor


The Customer shall provide unencumbered 24/7 direct access to National Grid's equipment and its lockable disconnect switch along an accessible driveway or road, such that it is not behind any locked gate.
WED
N
+/- 50'
Customer Owned
45/C3
M
PCC
+/- 50'
45/C3
R
Customer is responsible for all trimming, clearing, grading, and obtaining all required permitting and easements needed for National Grid Construction on Private Property
+/- 50'
45/C3
National Grid Owned on Private Property
+/- 50'
45/C3
POI
FDR: 2232
40/C4
Symbol Key
Install Load Break Switch
Install Recloser
Install Primary Meter
Install 45/C3 Pole
Install Anchor
Install Pole - Pole Guy
Install new OH Primary
Replace Existing w/ 45/C3 Pole
Customer Owned Pole
Customer Owned Cable
Existing 3-Ph OH Primary
Existing Pole
TYPICAL PCC CONFIGURATION FOR EACH NEW SERVICE, SIX IN TOTAL