# Heritage Wind Project

## Case No. 16-F-0546

# 1001.5 Exhibit 5

# Electric System Effects

## TABLE OF CONTENTS

# EXHIBIT 5 ELECTRIC SYSTEM EFFECTS

(a) System Reliability Impact Study

Mott MacDonald prepared a System Reliability Impact Study (SRIS) for the Facility, on behalf of the New York Independent System Operator (NYISO) on April 23, 2018. The SRIS is Appendix 5-A to this Application, but will be filed separately under confidential cover, as NYISO requires the SRIS to remain confidential due to Critical Energy Infrastructure Information (CEII) Regulations. The Facility is currently participating in the NYISO 2019 Class Year.

(b) Potential Reliability Impacts

The SRIS evaluated several power flow base cases, as provided by the NYISO, including a Q545A sensitivity (Empire State Line Alt Project in service) case, single event contingency (N-1) and multiple event contingency (N-1-1) system conditions. The Study Area includes the West (Zone A), Genesee (Zone B), and Central (Zone C) regions in the NYISO system. The following conclusions are derived from the SRIS:

- Steady State Analysis: Analysis conductor for the summer peak and winter peak base cases shows that the Project does not lead to any thermal or voltage violations under N-0 conditions. The Project does not have any adverse impact on the system even when the Q545A sensitivity case in considered. Single event contingency (N-1) analysis indicated the Project does not have any adverse impact on the branch loadings and bus voltages on the 115 kV network and above. The N-1-1 contingency analysis was performed for the summer peak base case. The results show that, with appropriate operational procedures applied under the N-0 operating conditions, the Project does not have any significant adverse impact on bus voltages. Furthermore, the Project does not result in any branch overload under N-1-1 operating conditions within acceptable system power plant dispatch.
- Stability Analysis: From the stability analysis undertaken for the summer peak load and light load cases, the system was found to maintain stability under all Design Criterial Contingencies and local contingencies, with no adverse impact caused by the Project. The Project was found to be compliant with the Post-Transition Low Voltage Ride Through (LVRT) Standard.
- Transfer Assessments: Transfer limit analysis conducted for the summer peak base and sensitivity cases shows that the Project does not have any adverse impact on the transfer limits of the West Central, Volney East, Ontario-NY, and NY-Ontario interfaces. In the case of Dysinger East Open and Closed interfaces, the negative impacts of the Project on the thermal transfer limits can be mitigated by generation redispatch in Area 1 or curtailment of the Project output as per MIS.
- Short Circuit Analysis: Short circuit analysis shows that for buses impacted by the Project, the fault levels are generally within the lowest breaker ratings. In the case of some 34.5 kV buses, the prospective fault levels

exceed the equipment ratings even when the Project is not considered. Mott MacDonald recommended that NYISO conduct an individual breaker analysis for these substations.

The SRIS concludes that the project generally does not cause any adverse impacts to the NYISO system reliability under each of the studied conditions.

(c) Benefits and Detriments of the Facility on Ancillary Services

The SRIS identified the need for a new five breaker ring bus station ("POI Station") including associated attachment facilities to connect the project to the NYISO transmission system. Additionally, the SRIS indicates the need for relatively minor upgrades related to relaying at remote stations. The SRIS did not indicate the requirement for any other system upgrades.

(d) Reasonable Alternatives to Mitigate Adverse Reliability Impacts

The SRIS indicated that the Facility adversely impacts the reliability of Dysinger East Open and Closed interfaces (thermal transfer limits) as mentioned above in Section (b). The SRIS identifies, however, that this adverse impact can be mitigated by generation redispatch in Area 1 or curtailment of the Project output. These mitigations are allowed under NYISO MIS; therefore, the SRIS concludes that the Facility does not adversely impact system reliability.

(e) Estimated Change in Total Transfer Capacity

The SRIS considered the base cases and the Q545A sensitivity scenarios for the Transfer Assessment of the following interfaces: Dysinger East, West Central, Volney East, NY - Ontario and Ontario – NY (open and closed definitions, as applicable).

For the normal transfer limits, the Project is observed to lower the thermal transfer capability of the Dysinger-East Open and Dysinger-East Closed interfaces. For all other interfaces, the Project has either positive impact or no overall negative impact. For emergency transfer limits, it is observed that the Project has a negative impact on the Dysinger-East (open and closed definitions) interfaces. The Project positively improves or has no net overall negative impact on the thermal limits of all other interfaces. The results of the thermal transfer limit conducted on the Q545A sensitivity are similar to the base cases. The Project has a negative impact on the Dysinger-East and Dysinger-East Closed interfaces with overall positive impact on the remaining interfaces.

In order to address the negative impacts identified above, the Project can be redispatched to mitigate the thermal transfer violations under MIS. Alternatively, the generation in Area 1 can also be redispatched for both the base and sensitivity cases.

The proposed mitigation measure resolves the negative impact of the Project on the thermal transfer limits for the Dysinger East (opened and closed) interfaces for both the base case and the Q545A sensitivity case. Furthermore, the mitigation does not significantly impact the thermal transfer limit of the remaining interfaces.

(f) Criteria, Plans, and Protocols

(1) Applicable Engineering Codes, Standards, Guidelines, and Practices

The Facility will be designed in accordance with applicable standards, codes, and guidelines. For portions owned by the Applicant (e.g., collection system), best industry practices will be used, along with any standards/preferences set by the companies designing the Facility. For the POI substation, National Grid requirements will be followed. Additional detail is as follows:

<u>115 kV Overhead Transmission System</u>

As identified in Exhibit 3, the proposed location for overhead lines in the Facility is limited to a less than 200-foot span of 115 kV line between the Facility collection substation and the POI substation (see Appendix 5-B for typical electrical details). This system will be designed and operated in accordance with the Interconnection Agreement, approved tariffs and applicable rules and protocols of National Grid, NYISO, New York State Reliability Council (NYSRC), Northeast Power Coordinating Council (NPCC), North American Electric Reliability Corporation (NERC) and successor organizations. In addition, the Facility will be designed and operated in accordance with (but not be limited to):

- RUS Bulletin 1724E-200
- NESC – National Electric Safety Code
- ANSI – American National Standards Institute
- ASTM – American Society of Testing of Materials
- OSHA – Occupational Safety and Health Administration
- IEEE – Institute of Electrical and Electronics Engineers
- ASCE – American Society of Civil Engineers
- NEC – National Electric Code

The transmission slack span will utilize self-supported steel dead-ends, with overhead optical fiber.

- The transmission slack span will utilize self-supported steel dead-ends, with overhead optical fiber.
- Conductor – 795 “Drake” or similar
- OPGW Shield Wire – ½” 7 Strand EHS Steel or similar
- Shield Wire – ½” 7 Strand EHS Steel or similar
- The limits for the tension of the conductor and shield wires will be based on NESC standards.
- The insulator selection will take into consideration the design BIL of the line and substation. Consideration of mechanical and electrical properties of the insulators is critical to ensure that insulators can withstand the mechanical loads and electrical stresses on them. For both suspension and dead-ends, the percentage of strength rating is 50% of specified mechanical load as per the NESC mechanical properties requirement.
- The vertical clearance requirements for the transmission span have been calculated based on NESC requirements. The clearances will be checked for the following weather conditions:
  1. 250B Extreme Ice Case.
  2. Maximum Operational Temperature.
- The Facility falls within the isokeraunic level of 35 (RUS Bulletin 1724E-200, page E-4, Figure 1). RUS recommends the use of shield wire in all locations where the isokeraunic level is above 20 with the shield angle of 30° degree for structure height 92 ft. above ground.
- The ground resistance value at each structure will be measured after the ground rod has been installed, but prior to bonding any interconnection wires such as static wire(s). The resistance will be 25 ohms or less. If the measured value cannot meet the requirements, then another method of grounding as described in NESC Rule 94B will be used to meet the requirement of NESC Rule 96A.
- All suspension and deadend structures will be designed to meet or exceed various applicable loadings outlined per the NESC.

Horizontal deflections at the top of angle and deadend vertical members will be limited, by camber if necessary, to 1% of pole height. If the deflection is six inches or greater at the top of the structure, and camber is not required by the above criteria, the final design drawings will furnish a construction rake offset distance. Horizontal and vertical deflections of the horizontal members will be limited to 1% of member length.

Collection substation

The substation design will incorporate, but is not limited to, the following standards and codes when applicable:

- NESC - National Electric Safety Code.
- NFPA 70 - National Fire Protection Association - National Electric Code

- NFPA 850 - National Fire Protection Association – Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations
- ACI - American Concrete Institute
- ANSI - American National Standard Institute
- ASCE - American Society of Civil Engineers
- ASTM - American Society for Testing and Materials
- IBC - International Building Code
- IEEE 80 - IEEE Guide for Safety in AC Substation Grounding
- IEEE C37.2 - IEEE Standard Electrical Power System Device Function Numbers and Contact Designation
- IEEE C37.90 - IEEE Standard for Relays and Relay Systems Associated with Electrical Power Apparatus
- IEEE C37.110 - Guide for the Application of Current Transformers Used for Protective Relaying Purposes
- IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers
- IEEE 485 - IEEE Recommended Practice for Sizing Lead-Acid Batteries for Stationary Applications
- IEEE C57.12.10 - IEEE Standard Requirements for Liquid-Immersed Power Transformers
- IEEE 998 - IEEE Guide for Direct Lightning Stroke Shielding of Substations
- IEEE C37.119 - IEEE Guide for Breaker Failure Protection of Power Circuit Breakers
- IEEE 605 - IEEE Guide for Design of Substation Rigid-Bus Structures
- IEEE 693 - IEEE Recommended Practices for Seismic Design of Substations
- IEEE 980 - IEEE Guide for Containment and Control of Oil Spills in Substations
- IEEE 1313.2 – IEEE Guide for the Application of Insulation Coordination

The substation grading will be completed to provide for positive drainage and ensure that water does not pond at or inside the substation. Grading slopes inside the substation fence will preferably be between 0.5 to 1% but under no conditions will the slope be more than 2%. The graded area will extend a minimum of 5 feet beyond the substation fence to allow for yard stone and the perimeter loop of the ground grid. All clearing, grubbing, excavation, and cut/fill will conform to geotechnical report recommendations and the Stormwater Pollution Prevention Plan (SWPPP) (see Appendix 21-E for the Preliminary SWPPP).

Design of the collection substation will consider various environmental data such as:

- Altitude
- Maximum wind speed
- Normal ambient temperature

- Extreme ambient temperature
- Precipitation
- Humidity
- Seismic hazard (acceleration as percent of gravity)

The foundation design will be based on the maximum load (both static and dynamic) that will be applied to the steel structures and/or the equipment. Either drilled piers or spread footing will be used to support steel structures as per geotechnical report recommendation. Cast-in-place headed anchor rods with leveling nuts will be used/designed to connect substation structures/equipment to their foundations.

Oil containment will be designed/installed for the main transformer as required by federal, State and local regulations. The oil containment will have an oil capacity of no less than 110% of equipment total oil capacity.

The steel structure design will conform to the provisions and requirements of the American Institute of Steel Construction (AISC) and ASCE "Substation Structure Design Guide, Manual of Practice 113." Materials for structural steel and miscellaneous steel will conform to the following requirements of the ASTM:

- Wide Flange (WF) Shapes and Tees cut from WF: ASTM A992, Grade 50 or multi-certification A36/A572, Grade 50
- Tubular – a structure composed of closed sections (tubes) of circular, multi-sided, or elliptical cross section and tapered or untapered: ASTM A595 or A500 Grade B
- Pipe: A53, Grade B
- M shapes, S shapes, HP, Channels, and Angles: ASTM A36
- Structural Plates and Bars: ASTM A36

All structures will be galvanized conforming to the requirements of ASTM A123, ASTM A143, and ASTM A153 as applicable. All structural welding design will conform to the requirements of AWS D1.1. All high strength bolts, nuts, and washers will conform to ASTM A325, A394 or A490, ASTM A563, and ASTM F436, respectively, and will be galvanized in accordance with ASTM A153.

The station will maintain voltage-dependent electrical clearances per ANSI/IEEE requirements.

All necessary associated overhead bus, conductors, supports, insulators, terminations etc. will comply with IEEE 605 and all other relevant standards. All connections from the tubular bus to equipment will be made using flexible conductor.

Buses will be designed to carry the maximum load possible, including full load capability (highest name plate rating) of all the transformers feeding off or supplying the bus.

Design will incorporate schedule 40, 6063-T6 seamless aluminum bus tube and stranded All Aluminum Conductor (AAC) flexible conductor. Bus tube will include internal damping cable to reduce Aeolian vibration in accordance with methods given in IEEE 605. Bus calculations considering bus diameter, span length and short circuit forces will be provided in accordance with the methods given in IEEE 605.

Grounding design study will be performed in accordance with IEEE 80. The study will ensure that the ground grid is designed to maintain safe touch and step voltages within IEEE tolerable limits. The ground grid analysis will have following basis: Fault Current, 50 kg body weight, a fault current split factor, soil resistivity and fault duration of 0.5 seconds.

The lightning protection will be designed by using the rolling sphere method per IEEE 998, which will reduce the probability of a direct lightning strike to the station. A constant radius sphere will be used in conjunction with flashover probability calculations to design an efficient and economical shielding system. The shielding calculations will provide shielding for the substation bus and equipment using statistical methods and will not exclude all strikes from the protected area.

The collection substation will be designed with adequate, secure, reliable and redundant protective and control schemes. The protection zones will be overlapped to maintain redundancy while ensuring that the major equipment will be protected. The applicable utility protection practices will be incorporated into the protection and control settings as necessary in the design.

A protective device coordination study will be performed to develop the necessary calculations to select protective relay characteristics and settings, ratio and characteristic of associated current transformers. The coordination study will include time current curves (TCC), which will be showing the various protective devices settings and the time margin between settings. Relay settings are set to protect equipment and detect abnormal conditions. The settings will be chosen according to the IEEE standards to protect the equipment, detect the minimum fault current flows, and coordinate as possible with adjacent protective relay devices.

34.5 kV Underground Collection System

The underground line design will incorporate, but is not limited to, the following standards and codes when applicable:

- ANSI - American National Standards Institute
- ASTM - American Society for Testing and Materials
- IEEE 48 - Standard Test Procedures and Requirements for Alternating Current Cable Terminations 2.5 kV through 765 kV
- IEEE 80 - Guide for Safety in AC Substation Grounding
- IEEE400 - Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems
- IEEE 400.1 - Guide for Field Testing of Laminated Dielectric, Shielded Power Cable Systems Rated 5 kV and Above with High Direct Current Voltage
- IEEE 400.3 - Guide for Partial Discharge Testing of Shielded Power Cable Systems in a Field Environment
- IEEE C2 - National Electric Safety Code
- IEEE C57.12.10 - American National Standards for Transformers
- NFPA 70 - National Electric Code
- TIA/EIA - Telecommunications Industry Association/Electric Industry Alliance
- NEMA - National Electrical Manufacturer's Association

Wind power projects commonly employ medium voltage (MV), low voltage (LV), and fiber optic (FO) cables to connect dispersed wind turbine generators to the collection substation (see Appendix 5-B for typical details). Determining the configuration and sizing of the cable runs (commonly called feeders) is a complex task, requiring a balance of a variety of considerations, including land use restrictions, cable characteristics, soil conditions, equipment and construction constraints, cost, reliability, maintainability, and efficiency. The design process incorporates these considerations in order to provide the client with the most robust, flexible, and cost-effective design possible.

The standard installation configuration is for the cables to be bundled and directly buried in the native soil, approximately 3 feet below grade (4 feet in agricultural areas). Unique installation configurations may be required where the cables cross public roads, utility easements, etc.

The ampacity of all cable configurations (standard single circuit, or unique configurations such as multiple circuits in parallel, circuits crossing each other, etc.) will be determined based on Neher-McGrath methods. The analysis will include the effects of various parameters, including soil thermal resistivity, shield grounding connections, mutual heating from parallel cables, and special thermal backfill resistivity (if used). The calculations will ensure that all cables can carry the expected loads without overheating and damaging components of the cables.

(2) Generation Facility Type Certification

Type certificates for turbines under consideration for this Application are unavailable at this time. However, the Applicant has provided example type certifications for turbine models similar to those under consideration. These third-party type certificates are included as Appendix 5-C. The Applicant will provide the necessary third-party certification to the Siting Board as a post-Certification compliance filing once a final turbine model is selected.

(3) Procedures and Controls for Inspection, Testing, and Commissioning

The various aspects of the Facility will have a written inspection, testing, and commissioning plan, as summarized below, that is adhered to during all stages of construction as well as a post-construction inspection and testing phase. When completed, all documentation will be provided to the Siting Board and stored at the Facility Site for easy review/access in the future.

<u>34.5 kV Underground Collection System</u>

The collection system will be inspected, tested and commissioned in accordance with various ANSI, IEEE, NFPA, IETA, ASTM, etc. requirements, as necessary. All tests shall be performed with the equipment de-energized, except where specifically required for it to be energized for functional testing.

Underground cables systems have comparatively less components than overhead lines or substations. All material received for construction of the underground lines will be visually inspected for defects and compatibility with the design/specifications. This includes, but is not limited to, cables, transformers, fiber, splices/junction boxes and grounding material.

During installation, materials used for cable trench installation will be tested for conformance with the design, including backfill material (gradation, compaction, thermal resistivity, etc.). The cables themselves will be installed in the proper configuration, at the proper depth and the proper spacing. Care must be taken to ensure that the required/minimum/maximum bending radius or pulling tension (if installed in conduit/duct) of the cable is met to avoid damage.

Hardware/terminations at the ends of the cables will be installed in accordance with manufacturer requirements to ensure adequate mechanical strength and electrical continuity. Cable shields/neutrals will be installed per the design and solidly connected to the grounding system or surge arresters, or taped/insulated, where applicable. Phasing of the conductors will be checked to ensure that the end-to-end connection of each conductor is correct per the design of the station/equipment at each end of the cable.

Very Low Frequency (VLF), at a minimum, or Partial Discharge (PD) testing will be performed on cables, in accordance with IEEE recommendations, in order to identify any deficiencies or damage in the cable system that could result in outages or failure. Testing of transformers will be performed in accordance with applicable ANSI/IEEE specifications.

34.5 kV Overhead Collection System

No 34.5kV overhead collection line is proposed.

Collection Substation

The substation will be inspected, tested and commissioned in accordance with various ANSI, IEEE, NFPA, IETA, ASTM, etc. requirements, as necessary. All tests shall be performed with the equipment de-energized, except where specifically required for it to be energized for functional testing.

All material received for construction of the station will be visually inspected for defects and compatibility with the design/specifications. Various industry standard electrical and mechanical tests are performed on equipment before leaving the manufacturers' facilities. Some tests are performed on a "class" of equipment, such that the passing tests results apply to all specific equipment produced. Other tests are required to be performed on each individual piece of equipment. Additional tests will be performed on specific equipment after installation at the Facility site to ensure that there was no damage during handling including, but not limited to:

- Main transformer
- High/medium voltage circuit breakers
- Disconnect switches
- Instrument transformers (current transformer, voltage transformer, etc.)
- Surge arresters
- Station service transformer
- High/medium voltage cables

- Capacitor bank or reactor banks
- DC battery bank and charger

Other standard tests will be performed on “installations” or “systems” to ensure that the components of a design were constructed/installed at the Facility Site in the correct manner. These include, but are not limited to:

- High/medium voltage bus connections and hardware
- Grounding grid (including electrical resistivity of surface stone)
- Low voltage protection, control and instrumentation wiring
- Protective relaying systems
- System Control and Data Acquisition (SCADA)/communication systems

All circuits will be energized and verified for functional operation. Each control circuit will be functionally tested and documented. This will include operation of all equipment, verification of each interlock and trip function. Each alarm device/point will also be verified and documented. This will include an actual operation of the alarm whenever possible.

Concrete foundations will be inspected in various ways. Visual/dimensional inspections will be performed on reinforcing steel/rebar (for bar size, configuration, tie/welds, etc.), anchor bolts (size, location, elevation, plumbness, etc.), formwork (size, dimensions, location, height/reveal, etc.) prior to pouring the concrete. Excavations, subgrade and compacted backfill will be verified to be in accordance with design requirements. The mix design of the concrete will be reviewed for conformance with the design requirements. During pouring of concrete, samples will be taken to ensure that the proper slump, air content, temperature and any additives are in accordance with design requirements. Numerous test cylinders will be obtained for future strength/compression testing at periodic points after pouring (7 days, 28 days, etc.). The cylinders will be tested to determine if the concrete is curing at the proper rate and will meet design strength prior to being loaded.

Any imported yard subbase, surface stone, etc. will be tested for proper sieve gradation, compaction, etc., as necessary. Adequate quantities/dimensions of imported material will be verified. A final survey of station benchmarks, elevations (overall pad and concrete foundations, etc.) will be performed.

Wind Turbines

Turbine commissioning will occur once the wind turbines and substation are fully installed and the NYISO is ready to accept delivery of power to the New York grid. The commissioning activities will consist of testing and inspection of electrical, mechanical, and communications systems, as well as turbine foundations. Turbine foundation testing and inspection will be in accordance with guidance from the American Wind Energy Association (AWEA)/ASCE in the 2011 document entitled *Recommended Practice for Compliance of Large Land-based Wind Turbine Support Structures*. These procedures are summarized below:

- Equipment required: Support trucks, which will be driven to the construction site.
- Materials brought on site: Gearbox oil, lubricating grease, and temporary portable generators. The only chemicals required for this phase are oils, gasoline, and grease used to operate construction equipment and portable generators, gearbox oil, and lubricants. Fuel-handling will be conducted in compliance with the Facility-specific Spill Prevention, Control, and Countermeasures (SPCC) Plan (see Exhibit 23 for additional information on the Preliminary SPCC).
- Timing: Commissioning will preferentially be completed in late spring or summer to take advantage of typically drier weather. If necessary, this activity can be completed in the spring, fall, or winter depending on weather conditions.
- Material generated: Some packing material waste will be generated. The recyclable material will be separated from the non-recyclable material on site. Both types of waste will be removed by a licensed sub-contractor.

(4) Maintenance and Management Plans, Procedures, and Criteria

The Applicant has prepared a Preliminary O&M Plan (Appendix 5-D). This plan details the operations and maintenance methodology and process, typical responsibilities, the maintenance schedule, training, and notifications. The Preliminary O&M Plan is intended to be the foundation of the final O&M Plan that will be implemented at the Facility once it becomes operational and is based on the Applicant's experience and typical O&M maintenance requirements for wind power projects. Ultimately the Applicant's Facility Operators will be responsible for the O&M Plan's implementation. The objective of the O&M Plan is to optimize the Facility's operational capacity and availability through best in class maintenance guidelines and inspections designed to proactively detect any significant safety or maintenance issues.

<u>34.5 kV Underground Collection System</u>

The underground collection system is also passive such that it does not require active operations. The underground lines generally do not have the ability to notify or alarm operators of a problem, unless it manifests itself as an electrical fault that can be sensed by equipment in the substation. Depending on detailed design, there could be some equipment that could provide remote indication or control which includes, but is not limited to:

- Fault locators – the devices are installed at certain intervals through the collection system to assist in locating faults on underground cables (that cannot be verified visually). There are options for these detectors to have remote signaling capabilities;
- Metal-enclosed switchgear.

Unless any switchgear is ordered with remote control capabilities, operation of the collection system will be performed manually by qualified operators. Main operation of the collection system is performed at the collection substation by opening or closing the circuit breaker that protects each cable circuit. Sectionalizing/disconnection of circuit section can be accomplished at junction boxes or switchgear. These activities will be performed by personnel familiar with and trained in the operation and safety hazards of high-voltage electrical equipment. Personal protective equipment (PPE) appropriate for the activities being performed will always be worn/used. Hazards such as arc flash will be present but will be mitigated to the extent practical during detailed design. In accordance with industry standards, hazard labels will be installed on electrical equipment to provide guidance for additional PPE required for operating and accessing such electrical equipment once the Facility is operational.

Most of the underground collection system will not be able to be inspected visually. There will be “access points” that will allow for a limited amount of visual verification such as riser poles that transition to the collection substation, junction boxes that combine multiple cable sections or splices, and entrances to the wind turbines. While terminations and cable ends can be inspected at these points, they are more valuable as a point to connect electrical testing equipment. As with the initial testing/commissioning phase described above, the underground cables will be subject to partial discharge testing during a maintenance outage each year in order to identify and locate any cable damage or impending failures.

Equipment provided by manufacturers typically includes O&M manuals specific to that product, similar to the substation equipment described below. These maintenance intervals and procedures will be used where applicable and can apply to equipment such as pad-mount transformers or metal-enclosed switchgear.

<u>Collection Substation</u>

The collection substation will include a SCADA system that will send status and alarms to the overall Facility SCADA system. These signals will notify operators of any faults within the substation. The SCADA system will allow for remote operation of electrically operated equipment. Operators will be able to open and close circuit breakers, motor-operated disconnect switches, transformer tap changer, etc. Local/manual operation of substation equipment will be performed be trained personnel familiar with the operation and safety hazards of high-voltage electrical equipment. Appropriate PPE will always be worn and used.

Since many items in the substation are large pieces of equipment supplied by major manufacturers, these items will be inspected and maintained in accordance with the manufacturers' O&M manual, which will be stored at the substation. The requirements will differ depending on which manufacturer is used. These items may include, but are not limited to:

- Main power transformer
- High and medium voltage circuit breakers
- Instrument transformers
- Disconnect switches
- Capacitor banks
- Metal-clad switchgear
- Standby generators
- Station service transformers
- Stationary battery and charger

Many of these items will be designed to send preventative alarm signals to the SCADA system to notify operators of problems before they become more significant.

The substation will be visually inspected at regular intervals, as well as after significant weather events, such as extremely high winds and severe snow and ice. Substation design adequacy will be monitored during the operations period of the Facility to ensure changes in environmental circumstances, utility changes, or equipment changers are evaluated for impact to the Facility.

(g) Heat Balance Diagrams

Since there will be no thermal component to the Facility, this requirement is not applicable to the proposed Facility.

(h) Interconnection Substation Transfer Information

(1) Description of Substation Facilities to be Transferred and Timetable for Transfer

National Grid is the connecting transmission owner for this Facility. The POI substation will be a new National Grid 115 kV 5 breaker ring bus to be constructed along the Lockport-Mortimer line segment. See Appendix 5-B for a General Arrangement Plan View drawing of the POI substation. The exact future arrangement and timetable related to POI substation engineering and construction will not be known until the Facilities Study is complete.

(2) Transmission Owner's Requirements

The POI substation will be designed by or will be under the design review of National Grid (i.e., the transmission owner), and the POI substation will be in accordance with their requirements.

(3) Operational and Maintenance Responsibilities

National Grid, as the transmission owner, will operate and maintain the POI substation according to its own standards. The Applicant will not have any responsibilities related to the Operations and Maintenance of the POI substation.

(i) Facility Maintenance and Management Plans

The Applicant will be responsible for the operation, inspection, and maintenance requirements of all Facility components, except for the POI substation.[1] These activities can generally be classified as scheduled inspection/maintenance, unscheduled maintenance/repairs, or electrical system inspection/maintenance. Each of these are briefly described below.

(1) Turbine Maintenance and Safety Inspections

All maintenance and repair activities will be in accordance with applicable permits and associated conditions. To the extent practicable, repairs will be facilitated through use of existing Facility-related infrastructure (e.g., permanent gravel access roads, crane pads, etc.). If existing infrastructure is not adequate to accommodate certain repairs, any additional infrastructure improvements will be conducted in accordance with the applicable regulations and road use agreements with the local municipalities (e.g., widening of an access road within or adjacent to a wetland will be conducted in accordance with Section 401 and 404 of the Clean Water Act, and Article 24 of the Environmental Conservation Law, as applicable).

<u>Scheduled Inspection and Maintenance</u>

Routine and preventative wind turbine maintenance activities are scheduled typically semi-annually with specific maintenance tasks scheduled for each maintenance visit. Maintenance will be done by removing the turbine from service and having wind technicians climb the tower to carry out maintenance activities. Consumables such as

[1] The Applicant may engineer and construct the POI on behalf of National Grid if an arrangement is agreed to by each party. Regardless, the POI will be turned over to National Grid—the POI owner and operator—following the completion of construction.

various greases used to keep the mechanical components operating and oil filters for gearboxes and hydraulic systems will be used for routine maintenance tasks. Following all maintenance work on the turbine, the area will be cleaned up. All surplus lubricants and grease-soaked rags will be removed and disposed of as required by applicable regulations. All maintenance activities will adhere to the same spill prevention industry best practices undertaken during the construction phase.

Unscheduled Maintenance/Repairs

Modern wind turbines are reliable. The major components are designed to operate for over 20 years. However, wind turbines are large and complex electromechanical devices with rotating equipment and many components. As a result, at times, turbines will require repair, most often for small components such as switches, fans, or sensors. Typically, such repairs will take the turbine out of service for a short period of time until the component is replaced. These repairs can usually be carried out by a single technician visiting the turbine for several hours. Events involving the replacement of a major component such as a gearbox or rotor are not typical. If they do occur, the use of large equipment, sometimes as large as that used to install the turbines, may be required.

(2) Electric Transmission and Collection Line Inspections

(i) Vegetation Clearance Requirements

All vegetation within the collection line and overhead transmission line rights-of-way (the "clearing boundary") will need to be cleared during construction.[2] All vegetation within the clearing boundary, except for low-lying growth, will be completely cleared. In addition, vegetation control will be required immediately adjacent to the overhead transmission line clearing boundary to ensure safe operation and prevent damage to the line: vegetation extending above the danger tree clearance line (outside of the clearing boundary) will be cleared to prevent trees from falling into the line. These issues are generally due to vertical movement (sagging) in the wires caused by thermal and mechanical loads, as well as horizontal movement caused by wind (blowout). These issues can also be caused by uncontrolled growth of vegetation itself.

The Preliminary Design Drawings (Appendix 11-A) illustrate vegetation clearing requirements around the small span of overhead transmission lines at the POI site.

[2] Where collection lines are collocated with access roads, clearing associated with the requirements of the access roads may extend beyond the rights-of-way of the collection line.

(ii) Vegetation Management Plans and Procedures

Initial vegetation management (i.e., clearing) along the underground collection line and the overhead transmission line rights-of-way during construction will utilize manual and/or mechanical methods (e.g., chainsaws, pruners, or heavy machinery). Portions of trees and other vegetation that extend into the clearing boundary are typically trimmed. Vegetation that is completely within the clearing boundary may be trimmed so that it is classified as low-lying growth, or may be removed completely (up-rooting, removal, etc.).

Continued maintenance may be through a variety of manual trimming methods, as well as environmentally friendly herbicide treatments used to inhibit vegetation growth (where permitted). The frequency of inspection and management will depend on the rate of growth at the location along the lines. Low-lying growth and vegetation extending into the clear-cut boundary will be checked regularly each year.

(iii) Inspection and Maintenance Schedules

The electrical system will require periodic preventative maintenance. Routine maintenance will include condition assessment for aboveground infrastructure and protective relay maintenance of the substation, in addition to monitoring of the secondary containment system for traces of oil. Please see Section (f)(4) above for information on the maintenance schedule for the electrical system.

(iv) Notifications and Public Relations for Work in Public Rights-of-Way

If work is to be performed in a public ROW, notification and any permit(s) to conduct such work will be addressed with the appropriate agencies prior to starting the work.

(v) Minimization of Interference with Distribution Systems

The overhead collection lines will comply with safety standards referenced in Section (f)(1) above, which provide for separation distances from existing electric and communication distribution lines. In addition, the lines have been sited primarily on private lands and will cross public rights-of-way generally perpendicularly where existing distribution systems may be present.

(j) Vegetation Management Practices for Collection Substation Yard

The perimeter of the substation, outside of the fence and limit of the gravel yard, will be mowed to prevent the emergence of woody plants or trees. Within the fence, the gravel base will limit the growth of vegetation. Pre-emergent herbicide is preferred to prevent vegetation from becoming established, but post-emergent herbicide and/or manual weed removal will be used in the event vegetation does begin to show.

(k) Criteria and Procedures for Sharing Facilities with Other Utilities

The Applicant will accept proposals for sharing of above ground facilities with other utilities as they are submitted. In consideration of such proposals, the Applicant will conduct a site visit with the party proposing the co-location. The Applicant will evaluate the proposal taking into account potential conflicts of interest, interference and reliability issues with the proposed co-location. If necessary, the Applicant may have a qualified third-party review the proposal to determine any detrimental impact of the proposal on the Applicant's Facility.

(l) Availability and Expected Delivery Dates for Major Components

The Applicant is not aware of any equipment availability restrictions. The Applicant currently plans to place the Facility in service by the end of 2023. Based on this in-service timeframe, major Facility components would be expected to arrive onsite starting Q4 2022.

(m) Blackstart Capabilities

Wind energy facilities, such as the proposed Facility, are not suitable for blackstart. Therefore, blackstart capabilities will not be addressed further in this Application.

(n) Identification and Demonstration of Compliance with Relevant Reliability Criteria

Reliability criteria are identified in the SRIS (Appendix 5-A), which includes input from the NYISO and National Grid.