Facilities Study Report
For
Physical Interconnection of
PJM Generation Interconnection
Request Project ID AH1-387

"Meadow Brook – Greenland Gap
500 kV"

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff, as well as the Application and Studies Agreement between the Project Developer and PJM Interconnection, LLC (PJM or Transmission Provider (TP)). The Transmission Owner (TO) is The Potomac Edison Company (PE), a FirstEnergy company.

This Facilities Study was performed to satisfy the Phase 2 Faciliti Study resequirement of the PJM Tariff. The Facilities Study is intended to provide scope, cost and schedule estimates for the project as currently defined and approved for Phase 2 study. In the event project changes are made during DP2 that impact this report, updates will be provided as part of the Phase 3 report. Following execution of the project's final agreement, this report will not be updated to account for other changes made as part of the agreement's modification clause and instead the scope change process will be followed.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer has proposed a wind Generating Facility located in Hampshire County, West Virginia. The installed facilities for AH1-387 will have a total Maximum Facility Output (MFO) of 150 MW with 22.05 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the PE transmission system via a newly constructed 500 kV three (3) breaker ring bus substation, tapping the Greenland Gap - Meadow Brook 500 kV line, Transmission Line Number 540, approximately 13.55 miles from Meadow Brook substation.

The construction of the new interconnection substation will result in the splitting of the existing Greenland Gap - Meadow Brook 500 kV line, into two lines on the transmission system. New line designations are to be determined.

The proposed generation interconnection is shown on the single line diagram in Attachment #1.

3. POINT OF CHANGE IN OWNERSHIP (PCO)

The Point of Change in Ownership (PCO) will be located at the first dead-end structure, owned by the Project Developer, outside the new three (3) breaker ring bus interconnection substation fence line.

4. SCOPE OF PROJECT DEVELOPER FACILITIES

Project Developer will design, build, own, operate and maintain the Project Developer Interconnection Facilities on Project Developer's side of the Point of Change in Ownership (PCO). This includes, but is not limited to:

- Circuit breakers and associated equipment located between the high side of the GSU and the Point of Change in Ownership.
- Generator lead line from the Generating Facility to the Point of Change in Ownership.

- Relay and protective equipment, and Supervisory Control and Data Acquisition (SCADA) and telecommunications equipment to comply with the TO's Applicable Technical Requirements and Standards.
- The easements and associated rights of way for the TO owned substation along with the 500 kV line taps to the substation will be acquired by the Project Developer and transferred to the TO at no cost. Site preparation for the TO owned substation, including clearing, grading and an access road, as necessary, is assumed to be by the Project Developer. The access road design must be approved by FirstEnergy to ensure it provides adequate access to the substation to support construction and maintenance activities. Route selection, line design, and right-of-way acquisition for the Project Developer's facilities are not included in this report and are the responsibility of the Project Developer.

B. Transmission Owner Facilities Study Results

The following is a description of Transmission Owner facilities for physical interconnection of the proposed AH1-387 project to PE transmission system. These facilities shall be designed according to FirstEnergy Applicable Technical Requirements and Standards. Once built, PE will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES (TOIF)

1.1 New interconnection substation Line TerminalO

Install line terminal equipment within the AH1-387 interconnection substation. Install one span from AH1-387 interconnection substation to the Project Developer-owned dead-end structure outside of FE substation fence.

- Structures Installed
    - 0.1 miles of conductor triple bundled 795 kcmil 26/7 ACSR shielded by (1) 7#8 Alumoweld and (1) OPGW
    - Substation line exit facilities, including dead end structures and disconnect switches, described in the AH1-387 interconnection substation scope.
- Siting and Permitting
    - Letter of Notification (LON) will be required.
- Scope of work Assumptions
    - Location of PCO assumed
    - Location of generator substation assumed
    - A ground survey will be required for design and as-built.
    - Cost of mobilization/demobilization shared with line Loop scope of work.
    - Assume minimal social and ecological impacts.
    - Assume no local opposition to the project.
- Ancillary Scope of Work

- Project Management
  - Provide project management, coordination, administration, scheduling, material management and project development if required.

1.2 Energize and integrate generator Interconnection Facilities to the transmission system.

- Relay and Controls Scope of Work
  - Integrate Interconnection Facilities protection and controls to the transmission system.
- Ancillary Scope of Work
  - Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development as required
- Testing and Commissioning
  - Test and commission all new relay settings.

2. STAND ALONE NETWORK UPGRADES

2.1 New interconnection substation

A new three (3) breaker ring bus substation will be constructed along the Meadow Brook - Greenland Gap 500 kV transmission line to interconnect AH1-387 with the PE transmission system.

The new substation will be located approximately 13.55 miles from Meadow Brook Substation. The Project Developer will be responsible for acquiring all easements, properties, and permits that may be required to construct both the new interconnection switching station and the associated facilities. The Project Developer will also be responsible for the rough grade of the property and an access road to the proposed three-breaker ring bus site.

- Below Grade:
  - Install (1) lot of ground grid
  - Install (1) lot of cable trench, conduit, and control cables to equipment
  - Install (1) lot of foundations for all equipment, control house, fences posts, and structures
- Above Grade:
  - Install (1) 15x39 PCE including (2) 125VDC battery systems
  - Install (3) 500kv CBs with bushing CTs and (6) CB disconnects (with ground switches)
  - Install (3) MOAB line switches
  - Install (3) set of 3-phase CCVTs
  - Install (9) single 500kv surge arresters
  - Install (3) 500kv deadend/takeoff structures
  - Install (1) SSVTs

- Install all equipment stands and 500kv low and high bus, insulators, shield wiring including one mast, and equipment connections Install (1) high security fence with (2) sliding gates

- Relaying & Control:
  - For the Project Developer 500kV line:
    - (2) SEL-411L relays for primary and backup line protection over fiber For the Greenland Gap 500kV line:
    - (1) wideband wave trap to be used with the primary protection
    - (1) wideband line tuner to be used with the primary protection
    - (1) wideband wave trap to be used with the backup protection
    - (1) wideband line tuner to be used with the backup protection
    - (1) SEL-421 relay for primary line protection over power line carrier
    - (1) SEL-411L relay for backup line protection over power line carrier
    - (1) UPLC transceiver for primary DCUB
    - (1) UPLC transceiver for backup DCUB
    - (1) UPLC transceiver for DTT
    - Three (3) PCM-5350 carrier monitors
  - (1 lot) hybrids for dual DCUB and DTT schemes utilizing phase-to-phase coupling For the Meadow Brook 500kV line:
    - (1) wideband wave trap to be used with the primary protection
    - (1) wideband line tuner to be used with the primary protection
    - (1) wideband wave trap to be used with the backup protection
    - (1) wideband line tuner to be used with the backup protection
    - (1) SEL-421 relay for primary line protection over power line carrier
    - (1) SEL-411L relay for backup line protection over power line carrier
    - (1) UPLC transceiver for primary DCUB
    - (1) UPLC transceiver for backup DCUB
    - (1) UPLC transceiver for DTT
    - Three (3) PCM-5350 carrier monitors
  - (1 lot) hybrids for dual DCUB and DTT schemes utilizing phase-to-phase coupling For each of the (3) 500V breaker positions:
    - (1) SEL-451 relay with dedicated lockout For general relaying support:
    - (1) lot of SEL-3350 or similar data concentrator RTACs for relay remote access
    - (1) lot of Arbiter 1094b or similar GPS Clocks for timing
    - (1) lot of Qualitrol TWS systems for traveling wave monitoring, for networked lines > 100kV

        - (1) lot of SEL-3555 or similar data concentrator RTACs for use as PMU data concentration
        - (1) DFR for fault recording

- Additional Equipment to be Removed:
    - None
- General Notes/Assumptions:
    - Power quality SATEC meters to be installed for each transmission line
    - Backup station service feed will be from local distribution
    - Security system will follow guidance for 500kv stations from the FE OTB Guide
    - Developer will provide final executed lease agreement noting the appropriate parcel ID.
- Project Developer/ 3rd Party Impacted Sites:
    - Developer will follow FE transmission protection requirements for collector substation
    - Developer is solely responsible for protecting its own equipment in such a manner that electrical faults or other disturbances on the FE transmission system do not damage its equipment.
- Ancillary Scope of Works
    - Project Management
        - Provide project management, coordination, administration, scheduling, material management and project development as required
    - Environmental
        - Environmental Scope:
            - Environmental will be needed for new substation
        - Environmental Assumptions:
            - Road Bonds are required
            - Environmental Filming (Documentation of Existing roads are required
            - Environmental Access and Road Crossing Permit Fees is required
            - Environmental Development of Permit Binder is required
            - Environmental Cultural Resource Consultation is required
            - Environmental Construction walk down is required
            - RTE consultation letters are required
            - Wetland delineations and WDR are required
            - Stormwater permits and local approvals are assumed
            - Internal environmental engineering and external project management costs are included
            - A phase 1-A site assessment is included

- Forestry
  - Forestry by developer.
- Information Technology Assumptions:
  - Estimate is built using the transport decision assigned under SCoReS #205499.
  - Estimated design, installation, and testing/commissioning for MPLS equipment for SCADA transport at AH1-387 Substation. Assumed SCADA work is included in this cost.
  - Estimate SCADA work at AH1-387 Substation to support HMI, security cameras, breakers, relays, relay panels, RTU, meter, traveling wave monitor, MOAB, GOABs, battery charger, data concentrator, DFR, PCM, battery monitor, and disconnect switches installation is included elsewhere.
  - Estimated cost associated with Crossbow engineering and materials at AH1-387 Substation is included elsewhere.
- RE/ROW
  - RE/ROW Scope:
    - RE Support is needed to review drawings and coordination of developer real estate to FE.
  - RE/ROW Assumptions:
    - 5.22 acres needed for this new substation.
    - The developer is providing the land for the new substation and for the line loop from our existing lines to the new substation.
    - Only internal consultive support is needed with 1 access road and 1 laydown yard.
  - Real estate funding has been included for:
    - Internal support including document review, project planning meetings, subcontractor oversight and assistance with transfer of assets if required.
    - External support for general project support, and minimal construction support and damage settlements/releases.
    - Direct damage payments not included in estimate
    - Kept GIS / R&R for installation of structures.
- Distribution Upgrades
  - Existing Conditions
    - Existing: PE-SVEC Circuit 333000038 AAAC Size 2 7.2kV/12.47kV Tap near M1114331-PE34
    - Existing: Class 5 Wood Poles installed 1986 40' height 1 Dead End Included
  - Distribution Scope:
    - (1) Tap Structure

- (2) Tangent Structures
- 0.13 Mile Tap line
- Approximately 200' Span Lengths

▪ Distribution Assumptions:

- New Poles are wood direct embed No guying needed
- Conductor for new line to match existing
- .13 Miles of forestry needed No siting required
- Environmental Permitting needed

o Testing & Commissioning

▪ T&C Scope:

- Testing and commissioning of all new substation equipment

▪ T&C Assumptions:

- SCADA, IT, Security, and Meter testing and commissioing will be provided by other groups.

- Standard Design References:
  - FirstEnergy's *Requirements for Transmission Connected Facilities*:
  - www.pjm.com/planning/design-engineering/to-tech-standards.aspx.
  - PJM Protection Standard (PJM Manual 7):
  - https://pjm.com/-/media/documents/manuals/m07.ashx
- PE Protection Specification:
  - Refer to *Attachment 4* of this document.
- Material List and Equipment Ratings:
  - Refer to Attachment 3.

2.2 ADSS Fiber Installation

- IT Scope:
  - Install/Test approximately 0.84 miles of new eastern 96F/SM ADSS cable from the AH1-387 substation control house to STR 191 on the Greenland Gap-Meadow Brook 500kV line. (P1-PE-N-00020749) Underground ADSS will be utilized for approximately for this entire run to the existing splice point.
  - Install/Test approximately 3.0 miles of new western 96F/SM ADSS cable from the AH1-387 substation control house to STR 181 on the Greenland Gap-Meadow Brook 500kV line. (P1-PE-N-00020749) Underground ADSS will be utilized for approximately 0.05 miles from the substation control building to the riser pole M114329-PE34.
  - Aerial ADSS Fiber will be utilized for approximately 0.57 miles from riser pole M114329-PE34 to the distribution structure M114319-PE34. Underground ADSS will be utilized for

approximately 0.12 miles from the structure M114319-PE34 to the riser pole M114317-PE34.

- Aerial ADSS Fiber will be utilized for approximately 0.64 miles from riser pole M114317-PE34 to the distribution structure 1094113-PE34. Underground ADSS will be utilized for approximately 0.24 miles from structure 1094113-PE34 to the structure M137911-PE34.
- Aerial ADSS Fiber will be utilized for approximately 1.10 miles from riser pole M137911-PE34 to the distribution structure 1058850-PE34.
- Underground ADSS will be utilized for approximately 0.27 miles from structure 1058850-PE34 to tie to the existing splice point on the Greenland Gap - Meadow Brook fiber line.

- IT Assumptions:
  - It is assumed that redundant MPLS paths are required at the new substation due to the 500kV voltage level.
  - The new substation build will include conduit builds for necessary Project Developer connections.
  - Two fiber cables are required to the PCO, but they will not need to be independently routed.

2.3 MPLS Equipment

- Estimated design, installation, and testing/commissioning for MPLS equipment for SCADA transport at AH1-387 Substation.
- Estimated cost associated with Crossbow engineering and materials at AH1-387 Substation.

2.4 In – Sub Fibers Run

- Estimated (2) in-sub fibers to connect to the PCO demarcation point.

2.5 New interconnection substation – FE Option to Build Scope

FirstEnergy work at new interconnection substation

- Below Grade
  - None
- Above Grade
  - Install (1) security system and camera system.
  - Install (1) indoor security AC cabinet.
- Relay and Control Scope of Work
  - Install (1) network fiber termination rack.
  - Programming of SCADA RTU.
- Scope of Work Assumptions

- Assumed Project Developer will install camera foundations and conduits to FirstEnergy standards.
- Assumed 2 weeks of testing and commissioning for testing to Transmission Control Centers.
- Assumed Project Developer will install fiber from generator station to OTB station and bring fiber into control house.
- FirstEnergy will be responsible for network fiber.

- Ancillary Scope of Work
  - Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development as required.
  - Testing and Commissioning
    - Testing of new site to Transmission Control Center; perform functional testing as required

3. NETWORK UPGRADES

3.1 Meadow Brook –Greenland Gap 500 kV Line

Loop Meadow Brook –Greenland Gap 500 kV Line into the proposed AH1-387 interconnection substation, approximately 13.5 miles from the Meadow Brook 500 KV Substation

- Existing Conditions:
  - Per TAMI the existing line is constructed on single circuit, lattice tower structures. Existing conductor is double bundled 2032 kcmil 72/7 ACSR shielded by (2) 7#6 Alumoweld.
- Install:
  - (2) single circuit steel monopole dead-end structures on concrete foundations
  - 0.2 miles of double bundled 2032 kcmil 72/7 ACSR conductor shielded by (1) OPGW and (1) 7#6 Alumoweld
- Transfer:
  - existing conductors to new dead-end structures
- Removal:
  - Approximately 0.01 miles of double bundled 2032 kcmil 72/7 ACSR conductor and (2) 7#6 Alumoweld shield wire
  - Siting/Licensing Assumptions:
  - Letter of Notification (LON) will be required.
  - Assume minimal social and ecological impacts.
  - Assume no local opposition to the project.
- General Notes/Assumptions:

- Outage can be obtained to perform line construction.
- A ground survey will be required for design and as-built.
- It is assumed the existing conductor and shield wire are in adequate condition and can be transferred. An engineering analysis during project development will be required.
- It is assumed the adjacent structures are in adequate condition and can handle the new loading. An engineering analysis during project development will be required.
- The loop cut-in and substation location were not provided in detail. A general area was provided. Specific substation location and layout will be required during project development and execution. Scope of project may change.

- Ancillary Scope of Works
  - Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development if required.
  - Access Roads
    - Access roads will be required, terrain is flat, approximately 0.3 miles.
  - Forestry
  - Scope:
    - Approximately 1.0 acre of forestry clearing is required.
  - Environmental
    - Environmental will be needed for new substation.
    - Environmental Assumptions:
      - Road Bonds are required
      - Environmental Filming (Documentation of Existing roads are required
      - Environmental Access and Road Crossing Permit Fees is required
      - Environmental Development of Permit Binder is required
      - Access and Aerial crossing permits are included
      - Environmental Cultural Resource Consultation is required
      - Environmental Construction walk down is required
      - RTE consultation letters are required
      - Wetland delineations and WDR are required
      - Stormwater permits and local approvals are assumed
      - Internal environmental engineering and external project management costs are included
      - A phase 1-A site assessment is included
  - RE/ROW

- Rights & restrictions review on existing line
- New ROW will be required
- Assumptions:
    - Project Developer is providing the land for the line loop from our existing lines to the new substation.
    - Only internal consultive support is needed with 1 access road and 1 laydown yard.
- Real estate estimates included:
    - Internal support including document review, project planning meetings, subcontractor oversight and assistance with transfer of assets if required.
    - External support for general project support, and minimal construction support and damage settlements/releases.
    - Direct damage payments not included in estimate
    - Kept GIS / R&R for installation of structures.

3.2 Meadow Brook Substation

Install new backup wave traps and line tuners at Meadow Brook Substation. Include additional UPLC and PCM-350 relay panel and wiring to convert to a PR DCUB and BU DCUB.

- Below Grade
    - Install cable conduit, and control cables for new equipment.
    - Install foundations for new equipment.
- Above Grade
    - Install (1) new UPLC and PCM with (1) lot of hybrids in new relay switchboard panel in existing Meadow Brook control house.
- Relay & Control
    - Install (1) new UPLC and PCM with (1) lot of hybrids in new relay switchboard panel in existing Meadow Brook control house.
    - Coordination Study to modify DCB scheme to convert to PR DCUB scheme.
- Additional Equipment to be Removed
    - None
- Assumptions
    - There is enough space inside the station for the added equipment
    - 2000A Wave trap is sufficient but to be determined during engineering phase
- Ancillary Scope of Works
    - Project Management
        - Provide project management, coordination, administration, scheduling,

material management and project development if required.

- Environmental
  - Assumptions:
  - Road Bonds are required
  - Environmental Filming (Documentation of Existing roads are required
  - Environmental Access and Road Crossing Permit Fees is required Environmental Development of Permit Binder is required
  - Environmental Cultural Resource Consultation is required
  - Environmental Construction walk down is required
  - RTE consultation letters are required
  - Wetland delineations and WDR are required
  - Stormwater permits and local approvals are assumed
  - Internal environmental engineering and external project management costs are included
- Information Technology
  - Assumptions:
    - Existing SCADA transport at Meadow Brook Substation is sufficient for additional SCADA telemetry.
- Testing and Commissioning
  - Testing and Commissioning to support new relays and revision of relay settings.

3.3 Greenland Gap

Install new backup wave traps and line tuners at Greenland Gap Substation.
Include additional UPLC and PCM-350 relay panel and wiring to convert to a PR DCUB and BU DCUB.

- Below Grade
  - (1) Lot of Excavation, Foundations, Conduit, and Wiring for new wave trap and line tuner.
- Above Grade
  - Install (1) new 500kv 2000A Single Phase Wave Trap and Line Tuner. Includes Steel Stands.
- Relay & Control
  - Install (1) new UPLC and PCM with (1) lot of hybrids in new relay switchboard panel in existing Greenland Gap control House.
  - Coordination Study to modify DCB scheme to convert to PR DCUB scheme.
- Additional Equipment to be Removed
  - Wavetrap and line tuner
  - Carrier equipment, line relays, and associated accessoriess

- Assumptions
    - There is enough space in the existing Control house for the new panel.
    - There is enough space inside the station for the added equipment
- Ancillary Scope of Works
    - Project Management
        - Provide project management, coordination, administration, scheduling, material management and project development if required.
    - Environmental
        - Road Bonds are required
        - Environmental Filming (Documentation of Existing roads) are required
        - Environmental Access and Road Crossing Permit Fees is required
        - Environmental Development of Permit Binder is required
        - Environmental Cultural Resource Consultation is required
        - Environmental Construction walk down is required
        - RTE consultation letters are required Wetland delineations and WDR are required
        - Stormwater permits and local approvals are assumed
    - Information Technology
        - Assumptions:
            - Existing SCADA transport at Greenland Gap Substation is sufficient for additional SCADA telemetry.
            - Assumed developer is responsible for building fiber communications from generator site to AH1-387 interconnection substation
    - Testing and Commissioning
        - Testing and commissioning of new wave traps and line tuners and auxillary equipment, if needed.

4. Other Scope of Work

4.1 Revenue metering.

Provide revenue metering panel within new AH1-387 Control House. Integrate revenue metering to interconnection substation. Provide new 3-phase 500kV Free-standing CT/VT Combo Units.

- Below Grade Scope of Work:
    - (1) Lot of excavation, conduit, backfill, grounding, and wiring between Free Standing CT/VT Combo units to revenue metering.
    - (1) Lot of foundations for Free-standing CT/VT 500 kV Combo Unit.
- Above Grade Scope of Work:

- (1) set of 3-phase Free Standing CT/VT Combo Unit 500 kV.

- Relay & Control Scope of Work
  - (1) New Revenue Metering Panel with test switches. The material for the Revenue Meter to be included in revenue metering Ancillary Scope of Work.

- Scope of Work Assumptions:
  - It is assumed current and voltage signals will be pulled from new 3-phase free standing CT/VT Combo Units. Costs for these combo units are included in the AH1-387 interconnection substation scope.
  - Assumes enough room in AH1-387 Control house to support a new revenue metering panel.
  - Assumes enough room in AH1-387 substation to add in free standing CT/VT Combo Units.
  - Assumes the same crew that is constructing the OTB FE Work scope will be adding the revenue metering panel and freestanding CT/VT combo units.
  - Temp const facilities and construction general conditions (Scope Capture) are included in AH1-387 interconnection substation scope.

- Ancillary Scope of Work
  - Project Management
    - Provide project management, coordination, administration, scheduling, material management and project development if required.
  - Revenue Metering
    - Provide high end revenue meter and engineering support for revenue metering at new interconnection substation AH1-387.
  - Testing and Commissioning
    - Testing and commissioning services as required.

4.2 Option to Build Oversight

FirstEnergy oversight of developer design and construction of new interconnection substation

- Below Grade
  - Must meet FirstEnergy standards - Option to Build.

- Above Grade
  - Must meet FirstEnergy standards - Option to Build.

- Relay and Controls Scope of Work
  - Must meet FirstEnergy standards - Option to Build.

- Scope of Work Assumptions
  - Engineering oversight for review/comment of OTB site design for meeting FirstEnergy Standards.
  - Geotechnical/site/civil oversight for review/comment of OTB site grading design for

meeting FirstEnergy standards.

- Construction Oversight assumed for 6 months (note: potential for additional oversight for Geotech/site/civil site construction for challenging projects).
- Developer responsible for apparatus testing of devices and supplying results to FirstEnergy
- FirstEnergy commissioning oversight is assumed for duration of construction
- Developer responsible for providing final 3D As-builts per FE direction, oversight, and approval

- Ancillary Scope of Work
  - Project Management
    - Coordinate with developer and provide project management, coordination, administration, scheduling, material management and project development for FirstEnergy scope of work.
    - Provide construction oversight for project construction duration.
  - Forestry
    - Completed by Developer.
  - Real Estate and Right-of-Way
    - Support as required for transfer of property to FirstEnergy upon construction completion
    - Internal support including document review, project planning meetings, assistance with transfer of assets as required.
  - Environmental
    - Environmental review of proposed site.
  - Testing and Commissioning
    - Commissioning review of developer supplied information and witness of critical testing

5. MILESTONE SCHEDULE FOR COMPLETION OF PE WORK

Facilities outlined in this report are estimated to take 41 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule may be impacted by the timeline for procurement and installation of long lead items, the ability to obtain outages to construct and test the proposed facilities.

Activity	Start Month	End Month
Preliminary Engineering	1	2
Siting, Permits & Real Estate	5	30
Detailed Engineering	3	30
Equipment Delivery	32	32
Construction	33	39
Testing & Commissioning	37	41

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

6.1 Scope Assumptions:

- Project Developer will coordinate design and alignment of proposed 500 kV generator lead line with the Transmission Owner for review of any clearance, right-of-way or right-of-way encroachment issues with TO owned facilities.
- Project Developer will coordinate design and construction of proposed 500 kV lead line. For these areas, the Project Developer shall provide TO with proposed drawings prior to construction and as-built drawings, confirmed by as-built survey data post-construction.
- Transmission Owner's preference would be to limit interference and avoid transmission line crossings with new 500 kV terminal positions. As a minimum, Project Developer facilities should not encroach within 100 feet of TO centerline at blowout conditions. If Project Developer's line design does not comply with this requirement TO would need to review this area as a special exception.
- Additional costs will be incurred by the Project Developer, if final alignment of the 500 kV generator lead line causes encroachments, changes, or modifications to any existing or relocated TO facilities.
- Project Developer is responsible for making all arrangements for electric distribution service (if required) for its generation station. No costs or schedule are included herein.
- All new generator only and new generator plus load facilities must be isolated from the PE Transmission System by a Power Transformer with a winding configuration meeting the requirements in FirstEnergy's "Requirements for Transmission Connected Facilities" document.

6.2 Cost Estimate Assumptions:

- The cost estimates provided in this report were developed as of February 13, 2026, based upon current market conditions. Hence, they are subject to significant changes in the event that project implementation is delayed. Notwithstanding the cost estimates from this report being used in the Generator Interconnection Agreement for the related project, PE reserves the right to re-evaluate and provide a more accurate cost estimate during the implementation phase of the project. In accordance with section 217 of the Open Access Transmission Tariff, the Project Developer will be responsible for 100 percent of the actual costs of the facilities required to accommodate its Interconnection Request.

- PE reserves the right to charge the Project Developer operation and maintenance expenses to maintain the Project Developer attachment facilities, including metering facilities, owned by PE. These costs will be specified in the Generator Interconnection Agreement.

6.3 Schedule Assumptions:

- This schedule assumes that all issues covered by the "Environmental, Real Estate and Permitting Issues" section of this document are resolved. Construction cannot begin until after all applicable permits and/or easements have been obtained.
- PE's ability to support this schedule also depends on the feasibility of taking the required outages to support construction. Outages that are determined to negatively impact system reliability or cause congestion may be delayed or denied, at any time, even if they are submitted on time based on the Outage Submittal Rules in section 4.2.1 of PJM Manual 03. This includes, but is not limited to, outages requested between the months of June and September, as well as January and March, which typically get denied due to summer and winter peak conditions. Therefore, the construction schedule will be adjusted as needed to accommodate any outage restrictions that have been identified by PE or the Transmission Provider.

7. REVENUE METERING REQUIREMENTS

All revenue metering needed for this interconnection project must meet the metering requirements stated in Appendix 2, section 8 of the AH1-387 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the "Requirements for Transmission Connected Facilities" posted on PJM website.

The revenue metering will be installed on the Transmission Owner side of the Point of Change in Ownership, and will be installed, owned, and maintained by Transmission Owner.

The revenue metering system (particularly the revenue metering current transformers) shall be designed to accurately meter the light loads that will occur when the facility is not generating power and only back-feeding station service from the Transmission Owner. This may require the use of high accuracy extended range current transformers.

Transmission Owner will obtain real-time, site-specific, generation data from PJM, via the required communication link from Project Developer to PJM. Transmission Owner will work with PJM and Project Developer to ensure the generation data provided to PJM meets Transmission Owner's requirements.

These requirements are in addition to any metering required by PJM.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

Land requirements for the interconnection substation needed for this interconnection project must meet the requirements in the following documents posted on PJM website.

- Requirements for Transmission Connected Facilities
- Geotechnical Design Requirements

The appropriate land requirements for a new interconnection substation are dependent on several electrical and physical factors/attributes. FirstEnergy will ultimately have to evaluate every property individually to assess the feasibility of construction, as well as any additional requirements that may be needed to support geotechnical and environmental concerns.

As a preliminary guide for site selection, FirstEnergy has provided a list of specifications for the substation size, Siting and Geotechnical standards, and Environmental requirements. It is important to note that these specifications are general, and as such, no construction activities should be performed on a selected site without prior approval from FirstEnergy.

8.1 Site Dimensions and Layout:

The typical new interconnection substation is a three-breaker-ring bus tapping an existing transmission line. The standard layout and dimensions of the substation are based on the voltage level of the interconnection system.

Below is a table summary of the typical substation dimensions for AH1-387. The standard requirement for a parking area has been included. However, Environmental, Geotechnical, and other factors may significantly increase the area required. For example, sites that require stormwater detention facilities will require area in addition to the typical dimensions provided in the table.

Substation Voltage	**Dimension Size (ft)**	**Dimension Acres**	**Dimension size w/ 100ft buffer (ft)**	**Acre size w/ 100ft buffer**	**Parking (15 cars) 230ftx60ft**	**Total Acres (Buffer + Parking)**
500kV	575x465	6.86	675x565	9.35	0.5	9.85

8.2 Real Estate Transfer

The preferred method for conveying a property to the TO is by "fee simple" transfer. If there are subdivisions or other conditions that hinder the ability for the Project Developer to convey the property by "fee simple" transfer, the TO may allow the use of an exclusive easement. These conditions should be discussed with the TO, and the accepted method of transfer should be confirmed early in the Interconnection process.

The Project Developer is required to obtain the following documents in the sequence listed below:

- Acquire the Interconnection Facilities property in fee from the property owner.
- Acquire an easement from the property owner for the Interconnection Facilities to the TO's T-Line (using the TO's template), if the size of property acquired doesn't sufficiently bi-sect the TO's existing right of way. If the property acquired by the Project Developer sufficiently overlaps the TO's existing right of way, this Interconnection Facilities easement is not needed.
- Provide access agreements to the TO from the property owners and Project Developer (this may be required if an exclusive easement is being used instead of conveying property to the TO in "fee simple".
- Provide an assignment of appropriate easement rights to the TO upon project completion. (Note: assignment must include all of TO's language in order to safely, operate and maintain facilities. It's critical that TO's easement templates are used when Project Developer is acquiring easements intended to be assigned to the TO.
- Provide deed conveyance of "fee simple" property for the Interconnection Facilities to the TO upon project completion and prior to transfer of title to personal property.

Document Exhibits:

Project Developer shall provide a survey and legal description detailing the location of the substation (preferably located adjacent to an existing transmission line right of way), ingress-egress to the substation from a dedicated public roadway, and easement for distribution and communication facilities and/or transmission facilities if necessary. This drawing shall be prepared by a licensed and registered surveyor and include at a minimum (ingress-egress, distribution and communication facilities locations may not need to be shown on the survey if property being conveyed is by "fee simple"):

- Legal description and survey of fee property being conveyed, including all lot split requirements
    - When property is conveyed to the TO by fee simple, the Project Developer is required to submit a completed Phase I Environmental Site Assessment (ESA) to the TO in accordance with all the requirements outlined in ASTM E 1527-05 prior to the start of construction of a substation property that will be transferred to the TO. Furthermore, if the Phase I ESA completed for the property documents the presence of any recognized environmental conditions (RECs), the Project Developer shall bear the cost and responsibility to complete a Phase II ESA in accordance with ASTM Standard E 1903-97 (Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process), however, final approval and property conveyance shall be at the sole discretion of the TO.
- Legal description for new transmission right of way (if "fee simple" conveyance is not used)
- Legal description for new distribution right of way (if "fee simple" conveyance is not used)
- Legal description for any other energy-related facilities that may be required (if "fee simple" conveyance is not used)
- Legal description for ingress-egress to a dedicated public roadway (if fee simple conveyance is not used)
- Survey drawing that shows:
    - New right of way along with the location of existing easements
    - Other existing facilities on the property
    - Names of adjoining property owners
    - Basic drawing features: title block, north arrow, legend, graphic scale

8.3 Geotechnical and Siting Requirements:

Project Developer shall refer to Geotechnical Design Requirements provided on PJM's website. In addition, below are a list of standard siting guidelines to account for when selecting a property for the interconnection substation:

- Slopes steeper than 2:1 and/or taller than 10' shall have slope stability performed.
- Factor of Safety (FS) shall be 1.5 for permanent condition.
- Minimum road width shall be 16'. AutoTurn Analysis shall be performed to accommodate the design vehicle needed inside the substation curve widening to be provided as necessary.
- Longitudinal slope for main access road to substation shall be 0.5%-10%. This is a mandatory design specification.
- Slope across the substation pad shall be 0.5%-2%.
- Every 20' vertical slope shall require a bench.

Site Grading and Preparation Responsibility:

It is the responsibility of the Project Developer to properly vet a proposed substation location. The proposed location should be reviewed by a Civil Engineer to determine the site's suitability for construction and

operation as a substation (refer to Attachment 5 to FE's preliminary Geotechnical summary report). This should include a review of available information regarding the specific site location that should be considered when estimating constructability, risk, cost, and schedule. The substation is considered the substation and all associated FirstEnergy Facilities needed to operate and maintain the site such as, access roads, stormwater management facilities, walls/structures, and utilities. This review should include, but is not limited to:

- Geologic Hazards
    - Karst
    - Geologic formation/group
        - Hard bedrock (shallow bedrock difficult to excavate)
        - Weak bedrock
    - Landslide susceptibility and topography
    - Surficial soils survey
    - Coal resource mapping
- Environmental Hazards
    - Flood mapping
    - Wetland Mapping
    - Any pollution information that could affect construction.
    - Corrosivity
- Past development
    - Mining activity
    - Previously reclaimed site

9. APPLICABLE TECHNICAL REQUIREMENTS AND STANDARDS

The Requirements for Transmission Connected Facilities, Revision 7, dated January 27, 2026, shall apply.

The GeoTechnical Design Requirements, dated July 20, 2022, shall apply.

The FirstEnergy Approved Vendor List, dated February 6, 2026, shall apply.

The TPP-REF-003 Transmission Planning Criteria, Revision 10, dated December 19, 2023, shall apply.

10. ENVIRONMENTAL AND PERMITTING

The following are possible environmental, real estate and permitting issues:

- Environmental permitting, Real Estate acquisition, and notifications to the state's Public Utilities Commission (PUC) vary, some up to twelve (12) months after preliminary engineering is completed to secure the required approvals.
- Prior to agreement by Project Developer to purchase the property, a Phase 1 Environmental Assessment should be conducted for the entire site to avoid assumption of environmental liabilities by Project Developer or Transmission Owner.
- The Transmission Owner interconnection substation may involve environmental surveys, permits, approvals and plans with federal, state, and/or local agencies.
- Assumed Project Developer is to provide all access rights, easements, ROW and permits necessary to complete the Project to the satisfaction of Transmission Owner. Environmental permitting shall encompass all federal, state, and local requirements, consultations, and agency coordination. Confirmation of meeting all permitting requirements shall be provided to Transmission Owner, prior to start of construction. Following construction and energization, confirmation of permit closeout shall be provided to the satisfaction of Transmission Owner, prior to transfer of ownership.

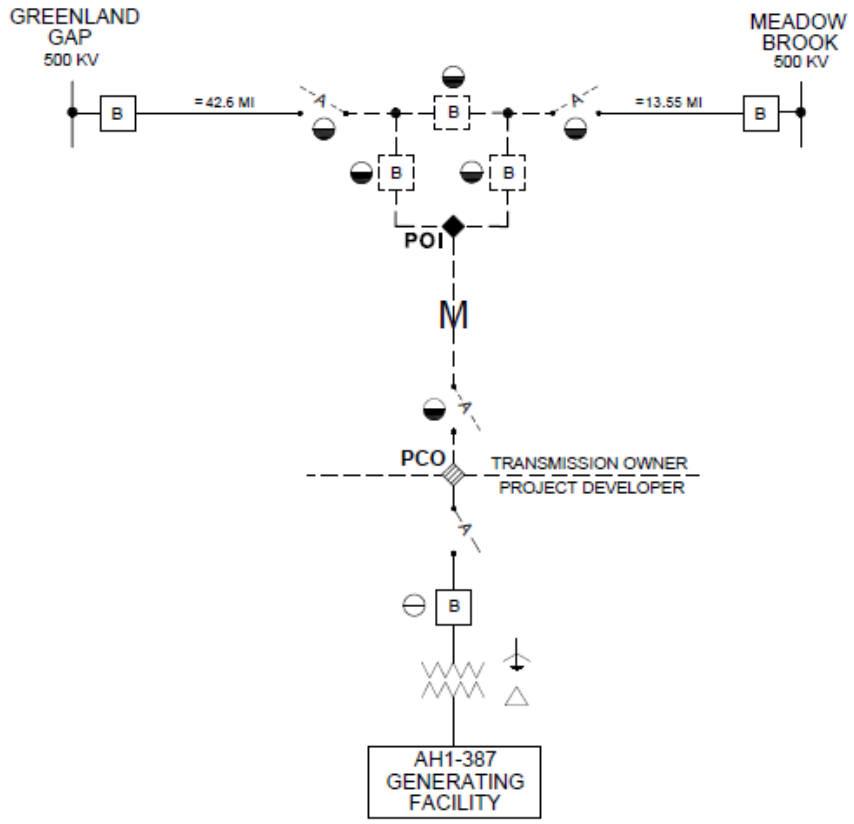
If any of these elements are not included in the final agreement between Transmission Owner and Project Developer, twelve (12)-to-eighteen (18) months should be added to the Project Schedule to secure necessary permits, and additional costs would apply.

- Project Developer will provide copies of all the relative environmental permits and other necessary approvals to Transmission Owner before Transmission Owner accepts the Interconnection Facilities.
- Project Developer is required to install an access road from the new interconnection substation to the nearest public road (must be approved by Transmission Owner) and obtain access rights for Transmission Owner. Project Developer is responsible to maintain access road and ensure unimpeded access for Transmission Owner at all times.
- Project Developer is responsible for all property acquisition (including easements/rights-of-way (ROW)) for transmission, distribution and communication facilities needed for the generator interconnection.
- If Project Developer owns the project property, in fee title, Transmission Owner will require a fee property transfer for the interconnection substation site which may require subdivision approval, together with permanent access rights to and from the substation, as well as a perpetual easement for any transmission lines to the substation. Project Developer is responsible for all costs, including but not limited to subdivision, associated with the property transfer.
- If Project Developer leases the project property, the Project Developer will be required to obtain fee property from the underlying fee property owner, on behalf of Transmission Owner, for the interconnection substation site, together with permanent access rights to and from the substation, as well as a perpetual easement for any transmission lines to the substation.
- All property rights must be surveyed and metes and bounds descriptions prepared for incorporation into Transmission Owner's document forms, for transfer of title.
- The Transmission Owner interconnection substation and transmission line loop will involve PUC notification/approval.
- All work occurs within an existing transmission line right-of-way or on Project Developer's property with access to all existing structures possible via that property and the right-of- way following established access routes that do not cross wetlands or streams.
- Project Developer will develop, and secure regulatory approval for, all necessary Erosion and Sediment Control (E&SC) plans and National Pollutant Discharge Elimination System (NPDES) permits.
- Project Developer will obtain all necessary permits.
- Project Developer will conduct all necessary wetlands and waterways studies and permits.
- Project Developer will conduct all necessary historical and archaeological studies.
- If the Project Developer plans to cross the transmission line right of way with facilities or access roads, please refer to the Transmission Rights-of-Way Restrictions information located at:

  https://www.firstenergycorp.com/help/safety/real-estate-power-lines/transmission-right-of-way.html#ROWform

C. APPENDICES

ATTACHMENT #1: SINGLE LINE DIAGRAM FOR THE PHYSICAL INTERCONNECTION



◆ = **POI** (POINT OF INTERCONNECTION)

◈ = **PCO** (POINT OF CHANGE IN OWNERSHIP) LOCATED AT THE DEAD-END STRUCTURE WHERE PROJECT DEVELOPER'S LINE TERMINATES

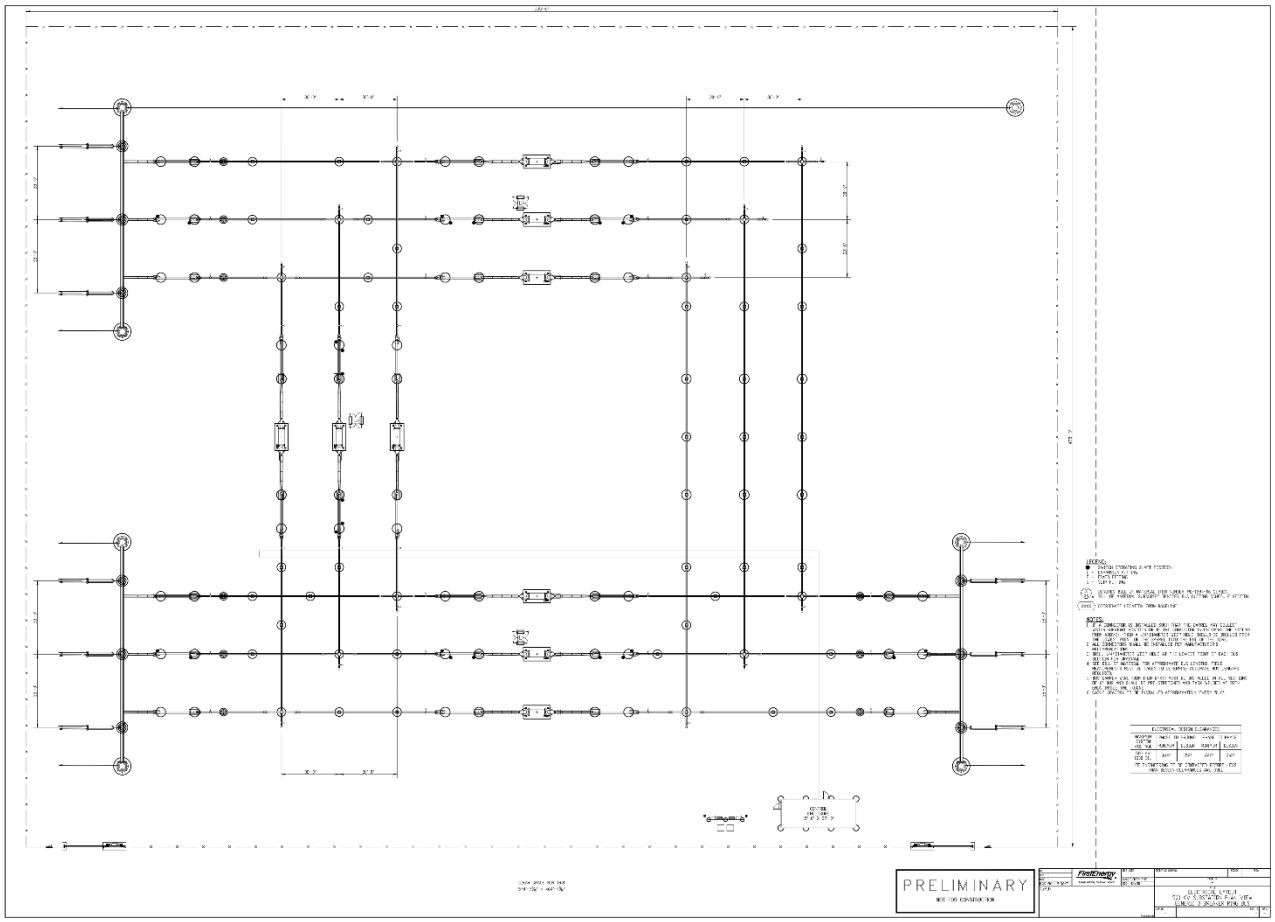
M = REVENUE METERING FOR THE PROJECT DEVELOPER IS OWNED, OPERATED, AND MAINTAINED BY TRANSMISSION OWNER

◒ = SCADA CONTROL

⊖ = BREAKER POSITION INDICATOR

FirstEnergy Energy Delivery Technical Services	TITLE AH1-387 INTERCONNECTION TO THE GREENLAND GAP - MEADOW BROOK 500 KV LINE			
BY: K E F	DATE: 4-21-2026	AGREEMENT	DOC. ID POI-APS-PE-AH1-387	REV. 2
APP: -	ISSUE: PRELIMINARY			

ATTACHMENT #2: SUBSTATION GENERAL ARRANGEMENT



ATTACHMENT #3: MATERIAL LIST AND EQUIPMENT RATINGS

Item name (unit)	Quantity
Wire - Shield - OHGW (lf)	2,342.40
Wire - Shield - OPGW (lf)	1,742.40
Wire - Fiber - ADSS (ft)	59,118.99
Wire - Fiber - Underground (ft)	7,107.23
Conduit - Rigid (lf)	1,773.00
Conductor - AAC (ft)	1,270.00
Conductor - ACSR (ft)	12,196.80
Cable - Control/Communication (lf)	30,940.00
Switch - Motor Operator - Substation (ea)	9.00
Disconnect Switch - Substation - 500 kV (ea)	9.00
AC/DC Panelboard (ea)	2.00
Battery - 125V (ea)	1.00
Security - Camera (ea)	38.00
Security - Physical Access Control (Badge Reader) (ea)	2.00
Capacitor Coupled Voltage Transformer (CCVT) - 500 kV (ea)	9.00
Current Transformer - Slip Over (CT) - 500 kV (ea)	3.00
Potential Transformer (PT) - 500 kV (ea)	3.00
Station Service Voltage Transformer (SSVT) - 230 kV (ea)	2.00
Anchor Bolt - Substation (ea)	580.00
Insulator - Substation - 500 kV (ea)	55.00
Surge Arrester - 500 kV (ea)	9.00
Circuit Breaker - 550 kV 63 kA (ea)	3.00
Battery Monitor (ea)	1.00
Package Control Enclosure - Prefabricated (ea)	1.00
Relay - Individual (ea)	17.00
Relay Panel (ea)	11.00
Hard Bus - 2.5 inch (ft)	240.00
Hard Bus - 6 inch (ft)	3,160.00
Steel Support Structure (ea)	91.00
Engineered Steel Poles (ea)	7.00
Insulator - Line - Porcelain/Glass (ea)	1,989.00
Battery Charger (ea)	1.00
Digital Fault Recorder (DFR) (ea)	1.00
Remote Terminal Unit (RTU) (ea)	4.00
Cable Trench (lf)	415.00

ATTACHMENT #4: PROTECTION SCOPE

Project Developer Protection Requirements

At the Tap Substation:

The generation delivery points must comply with the technical requirements detailed in the FirstEnergy "Requirements for Transmission Connected Facilities" document.

The Generator Step-Up (GSU) transformer(s) connecting to the FE system shall have a grounded-wye winding configuration on the high side and a delta configuration on the low side. This establishes an effective ground on the transmission system and mitigates overvoltage conditions during ground faults. A delta connected winding on the low side provides isolation of zero-sequence currents such that the FE system will not be exposed to ground faults on the generator system.

Single fully rated circuit breaker is required at the point of interconnection (POI).

Two (2) SEL-411L's for primary and backup current differential protection are required for the transmission line connecting the FE interconnection substation to the POI. Project Developer shall install and maintain direct fiber that is routed to the FE interconnection substation for primary and backup relay protection communications. Relay part number and firmware shall be sent to FE for approval to confirm communications compatibility. The 87L channel shall also be used for breaker failure DTT communications.

Redundant protection schemes are required to protect the Project Developer owned equipment at POI voltage. Each zone of protection covering the POI voltage portion of the Project Developer's system, the GSU Transformer(s), and the POI voltage interconnection breaker, shall be protected by two independent relay schemes meeting the following redundancy requirements. Primary and backup relaying shall use independent CTs, and independent PTs or independent windings from the same PTs. Primary and backup relaying shall not have any common wiring, isolating switches, or auxiliary tripping relays. Redundancy of a protection system can be achieved by ensuring that there is no single point of failure between two locally independent primary and backup protection schemes for a given element. Relays from the same manufacturer are acceptable for both the primary and backup schemes.

A protection scheme containing generator Intertie functions is required and must be able to provide tripping for the following functions: overfrequency, underfrequency, phase and zero-sequence overvoltage, phase undervoltage, directional overcurrent, and directional power. The current source and voltage source are to be at the Transmission POI voltage. The current source for the intertie relaying is preferred to be from CTs on the POI voltage interconnection breaker. The voltage source for the intertie relaying is preferred to be located between the high side of the GSU Transformer and the POI voltage interconnection breaker. If the PTs are located on the line-side of the breaker, PT primary-side fusing is required for isolation of a failed PT to prevent interruption of the FirstEnergy line.

C800 CTs must be used on the POI voltage portion of the Project Developer's system, and the CTs should not saturate for the maximum expected through-fault current at the tap ratio in use.

The relaying system and interrupting device control circuits shall have a reliable source of power independent from the AC system or immune to AC system disturbance or loss (for example - DC battery and charger) to assure proper operation of the protection scheme.

If there are multiple existing utility feeds, they shall not be paralleled. Either a mechanical or electrical interlock shall be in place to prevent paralleling of service points.

The Project Developer's protection system shall be designed and constructed in accordance with all mandatory Protection and Control (PRC) standards established by the North American Electric Reliability

Corporation (NERC). The Project Developer shall coordinate with FirstEnergy and Regional Reliability Coordinator to determine all applicable PRC requirements and ensure the facility's design and operation achieve full compliance.

The Project Developer is solely responsible for protecting its own equipment in such a manner that electrical faults or other disturbances on the FE transmission system do not damage its equipment.

FE Protection Requirements

To coordinate with proposed Project Developer substation, the relay settings at the following stations will need adjusted (note that in some cases due to limitations of the existing relays, relays may need to be replaced):

The interconnection of the new load to the Bulk Electric System (BES) transmission network will initiate a review of existing protection schemes and may introduce new requirements to ensure compliance with the Protection and Control (PRC) standards established by the North American Electric Reliability Corporation (NERC). Additional protection system upgrades at the interconnecting station, and potentially at other affected Stations, will be determined by FirstEnergy and the Regional Reliability Coordinator during subsequent stages of the project, prior to design.

Greenland Gap:

AH1-387 Ring Bus 500kV line – Modify the DCB scheme to convert to a PR DCUB scheme. Install one (1) UPLC and one (1) PCM-5350 for a BU DCUB scheme for a dual DCUB scheme.

Install one (1) wideband wave trap to be used with the backup protection.

Install one (1) wideband line tuner to be used with the backup protection.

Install (1 lot) hybrids for dual DCUB & DTT schemes utilizing phase-to-phase coupling

Meadow Brook:

AH1-387 Ring Bus 500kV line – Modify the DCB scheme to convert to a PR DCUB scheme. Install one (1) UPLC and one (1) PCM-5350 for a BU DCUB scheme for a dual DCUB scheme.

Install one (1) wideband wave trap to be used with the backup protection.

Install one (1) wideband line tuner to be used with the backup protection.

Install (1 lot) hybrids for dual DCUB & DTT schemes utilizing phase-to-phase coupling

New AH1-387 Ring Bus Substation:

Project Developer 500kV line – Install a standard line protection relay panel with Primary and Backup SEL-411L. The primary and backup line protection schemes will provide current differential protection over dedicated fiber.

Greenland Gap 500kV line – Install a standard line protection relay panel with Primary SEL-421, Backup SEL-421, (3) UPLCs, (3) PCM-5350s, (1 lot) hybrids, and (1 lot) of auxiliary relays. The primary relay will provide primary line protection via a DCUB over PLC scheme. The backup relay will provide backup line protection via a DCUB over PLC scheme. (1) UPLC, (1) PCM-5350, and (1 lot) auxiliary relays will implement a DTT over PLC scheme.

Meadow Brook 500kV line – Install a standard line protection relay panel with Primary SEL-421, Backup SEL-421, (3) UPLCs, (3) PCM-5350s, (1 lot) hybrids, and (1 lot) of auxiliary relays. The primary relay will provide primary line protection via a DCUB over PLC scheme. The backup relay will provide backup line protection via a DCUB over PLC scheme. (1) UPLC, (1) PCM-5350, and (1 lot) auxiliary relays will implement a DTT over PLC scheme.

Install three (3) appropriately rated circuit breakers for 500kV application, two (2) CTs per bushing

Install three (3) SEL-451 relays for 500kV breaker failure to trip protection.

Install one (1) set of three (3) 500kV CVTs for each line position of the ring bus (3 sets total).

Install one (1) SEL-3350 RTAC for relay remote access, one (1) SEL-3555 RTAC for PMU data concentration, one (1) Arbiter 1094B or similar GPS Clock, one (1) Qualitrol TWS system for traveling wave monitoring, and (1) DFR for fault recording.

Short Circuit Data

The short circuit levels at the location of the new AH1-387 Ring Bus 500 kV bus are the following:

Short Circuit values at 500 kV

Three phase faults = 20.0 kA

Single line to ground fault = 15.9 kA

Transmission System Impedances at 500 kV, 100 MVA base

Positive sequence Z1 = (0.00026 + j 0.00577) (per unit)

Zero sequence Z0 = (0.00230 + j0.01004) (per unit)

The fault current and system impedance values are for the proposed tap location on the existing 500 kV line, for the normal system configuration connecting to Greenland Gap and Meadow Brook substations. The fault currents provided are bolted, symmetrical values for present, normal transmission system conditions. Future increases in fault currents are possible and it is the Project Developer's responsibility to upgrade their equipment and/or protective equipment coordination when necessary.

ATTACHMENT #5: PRELIMINARY GEOTECHNICAL SUMMARY

Observation & Concern Table:

Category	Source	Risk	Comment
Surficial Soil Survey	USDA Soil Survey	Low	Moderately drained
Geologic Formation/Group	WV/USGS Geologic Survey	Low	This site is part of the Helderberg Group, Tonoloway Limestone, and/or the Wills Creek Formation. Shallow bedrock anticipated.
Karst	USGS	Moderate	Located within mapped carbonate rock formation
Landslide Susceptibility	GIS/Google Earth/FEMA Risk Map	Low	Located in low-risk area
Coal Mining and Oil and Gas Wells	WV Geologic Survey, TAMI 2	Low	No coal mining activity in this area. No oil or gas wells in this area.
Environmental Hazard	US Wetland Maps/FEMA	Low	Low risk of flooding
Prior Development	TAMI/GIS MAP/Historic Aerials	Low	Undeveloped except for existing T-Line

Site Background / Geologic Hazards

FE conducted this review to determine potential geologic hazards and risks at the proposed generator developer location (AH1-387). The reviewed location is in Capon Springs, Hampshire County, West Virginia. This includes a proposed substation located along the Meadow Brook – Greenland Gap 500kV transmission line. The substation would be located between existing tower structures 194 and 195 approximately one mile west of the West Virginia and Virginia border. The existing transmission line operated by Mon Power was installed in 1977. The proposed substation would consist of (3) breaker 500kV ring bus with SCADA control. This location was reviewed for surficial soils survey, geologic formation/group, karst, landslide susceptibility, coal mining and oil and gas well resource mapping, environmental hazards, and prior development. The review was performed to identify any geologic risks that could affect the project's budget, constructability, and/or schedule.

Surficial Soil Survey

The United States Department of Agriculture Web Soil Survey indicates that the site is currently mapped as the Laidig very stony loam (LbD). The Laidig formation generally consists of fine-grained soils with numerous cobbles and boulders at the surface, underlain by channery loam, very channery sandy clay loam, or channery sandy loam (CL, ML, SM, and SC), including varying percentages of gravel. The Laidig is further underlain by bedrock at relatively shallow depths at the site. The formation is mapped as Hydrologic Soil Group (HSG) B classification, indicating the soils are well drained and generally have

a moderate infiltration rate. The depth to the water table is listed as 24 to 44 inches while the depth to the restrictive fragipan layer is listed to be 20 to 60 inches.

Geologic Formation/Group

The site is located in the Valley and Ridge Physiographic Province which is described as containing folded and faulted mountain ridges and low-lying valleys from the Precambrian to early Mississippian age. The Geologic Map of West Virginia maps the site to be underlain by the Helderberg Group, Tonoloway Limestone, and/or the Wills Creek Formations. These groups are of a sequence of Late Silurian and Early Devonian period geologic rock formations found across the Appalachian Basin. Based on available aerial imagery (Geodigital) possible rock outcrops appear to be present within the proposed development area.

Karst

The site is underlain by the Helderberg Group, Tonoloway Limestone, and/or the Wills Creek Formation as described previously. The Helderberg Group primarily consists of various types of massive bedded limestone, but also includes dolomite, shale, chert, and occasional sandstone. The Tonoloway Limestone formation consists primarily of laminated fine-grained, dark-gray argillaceous limestone (calcisiltite and micrite) and interbedded shale. The Wills Creek Formation is a varied mix of rocks, primarily greenish-gray nonfissile shale and yellowish-gray thin-bedded friable sandstone, but also includes siltstone, limestone, and dolomite.

The site is underlain by carbonate bedrock and can therefore have a potential for karst features to be located within the site limits. In addition, The West Virginia Tax Districts Containing Karst Terrain exhibit indicates that there are known caverns located within Hampshire County. Transmission Asset Mapping Interface 2 was also reviewed and is mapped to be withing a karst feature area. A determination of karst risk should be discussed in the sites geotechnical report to better understand the risk. Based on available mapping there is moderate risk of karst.

Landslide Susceptibility

Based on the LiDar-Mapped Landslide Density map of West Virginia, the site, which is located in the Northern Appalachian Ridges and Valleys, generally exhibit 0.5 landslides per square mile which is considered low. The FEMA national risk index also rates the area as a very low risk to landslides. However, the West Virigina landslide tool, which maps landslides that have occurred in the past, shows some landslides have occurred within the area with the nearest recorded landslide approximately 1.2 miles away at the north end of Spring Mountain. TAMI was utilized to generate elevation profiles for the potential site area and are provided in Appendix D. The ground surface drops in a relatively uniform gradient from Tower 195 to Tower 194 from approximately El. +1,780 feet +1,640 feet in a span of 1,370 feet (1V:10H). The profile along the horizontal distance of the ROW drops approximately 10 feet over a 260-foot span. Given the gentler sloping conditions, the likely occurrence of a landslide remains low.

Resource mapping

There is no significant coal resources or mining activity in this region based on West Virginia mining maps. TAMI 2 also does not indicate any mining activity in the site vicinity.

The West Virigina Geological and Economic Survey indicates several gas wells within Hampshire County, but none within the vicinity of the prospective site.

Environmental Hazards

Based on FEMA and U.S. Fish and Wildlife Service maps there are no wetlands or features that would cause an increased risk of flooding. An environmental study should still be performed to confirm this prior to construction.

Past Development

The past development assessment of the site was based on aerial photography. Based on aerial photography dating back to 1955 this site has only been developed for the transmission line and access roads.

Recommendations & Geotechnical Opinion

List of Observations/ Meadow Brook – Greenland Gap 500kV

1. This site is part of the Helderberg Group, Tonoloway Limestone, and/or the Wills Creek Formation
2. Moderate potential for Karst
3. Low risk for landslide
4. Low environmental impact risk
5. No mining activity present or recorded in the area.

The geotechnical conditions of this site seem to conclude that it is relatively low risk location to develop a substation. However, there is potential for karst related construction concerns and the potential for relatively shallow bedrock or cemented fragipan zones. The developer should plan a subsurface investigation and associated geotechnical report commenting on each risk before the site is designed and developed. All findings need to be confirmed with field data. There are no anticipated budget, constructability, or schedule issues. All findings should be confirmed by the developer prior to construction.