

Facilities Study Report

For

Physical Interconnection of

PJM Generation Interconnection Request

Project ID AE1-114

Maryland-Lancaster 138 kV

Revision 1: December 2024

Revision 2: September 2025

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 Commonwealth Edison.

Revision History

Revision 1: Initial issuance of report.

Revision 2: Administrative update to clarify microwave scope and oneline diagram. Added description of microwave scope to section B.3. Updated attachment 1 to show transformer high-side circuit breaker.

A. Transmission Owner Facilities Study Summary

1. PROJECT DESCRIPTION

The Project Developer has proposed a Wind Generating Facility located in, Ogle County, Illinois with a designated PJM Project ID of AE1-114. The installed facilities will have a total Maximum Facility Output (MFO) of 150MW with 34 MW of this output being recognized by PJM as Capacity.

2. POINT OF INTERCONNECTION (POI)

The Generating Facility will interconnect with the Commonwealth Edison transmission system via a newly constructed 138kV kV breaker-and-a-half substation, TSS 923 White Eagle Road, tapping the TSS 119 Lancaster - TSS 124 Maryland 138kV line, L.11902, approximately 6.6 miles from TSS 119 Lancaster and 5.3 miles from TSS 124 Maryland.

The construction of the new interconnection substation will result in the splitting of the existing TSS 119 Lancaster – TSS 124 Maryland 138kV, L.11902 into two lines on the transmission system. The new L.92304 will connect TSS 923 White Eagle Road to TSS 124 Maryland and L.11902 will connect TSS 923 White Eagle Road to TSS 119 Lancaster.

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

3. POINT OF CHANGE IN OWNERSHIP

The Point of Change in Ownership will be located at the first dead-end structure inside TSS 923 White Eagle Road fence line.

4. SCOPE OF PROJECT DEVELOPER INTERCONNECTION 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:

- The Project Developer is responsible for construction of the additional 150MW Wind generation. The Project Developer is also responsible for one (1) 138kV circuit breaker, one (1) generator step-up transformer (GSU), one (1) 138kV motor operated disconnect switches, and a 138kV generation lead line with associated structures terminating at TSS 923 White Eagle Road.

- At AE1-114 Maryland-Lancaster 138 kV, in general, Project Developer relaying, etc. to follow section 6.1 (Design F) of latest version of ComEd Interconnection Guidelines (For Generators at Transmission Level) Rev. 2 Effective 12/16/2021, with the following project specific notes (where applicable):
 - New 138kV gas circuit breakers to auto trip and isolate for critical gas level
 - New 138kV Tie Line terminal relay types to be the same as ComEd terminal relays. This includes relay firmware versions
 - ComEd Protection and Control Engineering must review all Project Developer relay protection design drawings and relay settings.
 - Project Developer equipment impedance and/or test data must be provided to ComEd Protection and Control Engineering to model in a short circuit program.
 - Project Developer to include over/under frequency and voltage protection at solar farm collector bus. Suggested settings will be provided by ComEd. Under-frequency settings are to comply with MAIN Guide 1B.
 - Dual bus protection for 34.5kV bus.
 - Dual TRFM protection and site protection must be compliant with NERC & PJM requirements.
 - Metering is required to be installed per ComEd & PJM standards.
 - SCADA interface to ComEd will be required.
 - Witness testing by ComEd or a Distribution Automation will be required and must be pre-scheduled at least 90 days in advance.
 - Project Developer to provide transformer test reports for 138kV - 34.5kV step up transformers, for ComEd short circuit modeling. Test reports must include %Z impedance and load loss.
 - For any new equipment connected to the BES (Bulk Electric System rated at 100kV or above) the associated primary/System 1 and secondary/System 2 protective schemes to have a minimum redundant:
 - Connected CTs (where available)
 - PT secondary (where available)
 - DC control circuits
 - Auxiliary trip relays
 - Circuit breaker trip coils (where available)
 - Communication circuitry
 - Project Developer will be responsible to purchase real estate or obtain the necessary right-of-way easement to install the 138kV transmission line to TSS 923 White Eagle Road substation.
 - New Gas Circuit breaker control for loss of SF6 gas condition should be as follows (see Engineering practice EP-5206E and relay specifications):

- For an open SF6 circuit breaker, when SF6 gas drops to the critical level, the close circuit of breaker shall be opened, and motor operated disconnects on both sides of CB shall be opened.
- For a closed SF6 gas circuit breaker, when SF6 gas drops to the critical level, the circuit breaker shall be opened, and motor operated disconnects on both sides of CB shall be opened and the close of the circuit breaker shall be opened.
- All changes to topology, including generation, must be modeled during the Phase 1 study for PRC-027 compliance. A protection system coordination study is required for new BES buses or when there is a 15% (or greater) change in the fault current for an existing BES bus. Settings changes may be required per the outcome of this coordination study.
- Relay and protective equipment, telecommunications equipment, and Supervisory Control and Data Acquisition (SCADA) to comply with ComEd's Application Technical Requirements and Standards. 138kV L92301 will require two Single Mode Fiber paths from TSS 923 White Eagle to the developer substation control building (Shannon Windfarm).
- System 1 Relays will use the "System 1" Fiber cable for a Current Differential Relay Scheme, which will also provide Direct Transfer Trip (DTT). This Fiber cable will be owned and maintained by the Project Developer and should have minimum of 48 Fibers. The demarcation for the Fibers in this cable will be in a Fiber Distribution Panel (FDP) inside of the TSS 923 Substation. ComEd will own and maintain the FDP. System 2 Relays will use the "System 2" Fiber cable for a Current Differential Relay Scheme, which will also provide Direct Transfer Trip (DTT). This Fiber cable will be owned and maintained by the Project Developer and should have a minimum of 48 Fibers. The demarcation for the Fibers in this cable will be in a Fiber Distribution Panel (FDP) inside of the TSS 923 Substation. ComEd will own and maintain the FDP. The Project Developer will own and maintain both Fiber cables from ComEd's TSS 923 FDP all of the way to their Shannon Wind Farm. Spare Fibers may be used for telephony, SCADA, Metering, Fire Protection, or other data purposes.
- The Project Developer will be responsible to request and bear the cost of any outages required on existing transmission or distribution lines that may be required for the transport of any large equipment, i.e. turbines, rotors, turbine structures, etc.

Option to Build

- If the Project Developer selects the Option to Build, the Project Developer shall construct TSS 923 White Eagle Road.
- The Project Developer shall construct TSS 923 White Eagle Road and transfer ownership to ComEd prior to commercial operation of AE1-114. The Project Developer shall transfer ownership of the real estate in fee to ComEd.
- Substation requirements are described below in section B.
- Project Developer to provide limiting Transmission Facility ratings for their portion of 138 kV L92301, in accordance with NERC FAC-008, FERC Order 881, and PJM Operational requirements for normal and emergency ratings from -55F to 130F in 5F increments.

B. Transmission Owner Facilities Study Results

The following is a description of the planned Transmission Owner facilities for the physical interconnection of the proposed AE1-114 project to Commonwealth Edison transmission system. These facilities shall be designed according to Commonwealth Edison Applicable Technical Requirements and Standards. Once built, Commonwealth Edison will own, operate, and maintain these Facilities.

1. TRANSMISSION OWNER INTERCONNECTION FACILITIES:

The TO Interconnection Facilities will include, but not be limited to, the following:

- A 138kV dead-end structure and foundation within the fence of the Interconnection Substation, to terminate the Project Developer's generator lead line.
- Line conductor from the dead-end structure to the bus position in the switchyard of the interconnection substation.
- One (1) Motor Operated Disconnect (MOD) switch. Disconnect switch shall have a minimum nameplate capability of 3126/3366/4023/4806 A (747/805/962/1149 MVA) SN/SLTE/SSTE/SLD continuous.
- Three (3) metering CTs, three metering PTs, or a combination unit, meters, and associated equipment to meter L.92301.
- Install equipment necessary to provide bi-directional revenue metering (kWH, kVARH) and real time data (kW, kVAR, and circuit breaker status and 138kV voltage) for 138kV L.92301, on the ComEd side of the POI per ComEd applicable standards.
- Three (3) surge arrestors
- Foundations and structures

2. STAND ALONE NETWORK UPGRADES

The Stand Alone Network Upgrades will include, but not be limited to, the following:

TSS 923 White Eagle Road

A new breaker-and-a-half substation, TSS 923 White Eagle Road, will be constructed along the L.11902 138kV transmission line to interconnect the AE1-114 project with the ComEd transmission system.

The greenfield new substation will include:

- Three (3) new gas SF6 138kV circuit breakers BT 1-2, BT 2-3, and BT 1-3, with accommodation for future breakers BT 4-5, BT 5-6, and BT 1-6 rated for 3000A

- Two (2) new 138kV motor-operated disconnect switches, rated for 3000A, to be installed at each new breaker
- Three (3) line disconnect switches, rated for 2000A, to be installed at each line
- Nine (9) new 138kV 1200:1 CCVTs to be installed at Busses 1, 2, and 3
- Two (2) new 2000A wave traps
- Two (2) new CCVTs with Carrier Accessories and Line Tuners
- Three (3) metering CT/PTs
- Nine (9) Surge Arrestors

One (1) new 12kV-208/120V AC auxiliary transformer to be installed. This will be fed via a nearby 12kV distribution line to be determined during detailed design; new 12kV UG cable will be run to allow access to TSS 923 White Eagle Road. The distribution line connection will require construction of new 12kV overhead lines and poles from an existing distribution line to TSS 923 White Eagle Road. Connection details and length will be determined during detailed engineering and may exceed the assumptions in this study. If a lower cost option is found during engineering, the cost estimate would be reduced. It is assumed that no new ROW for the new distribution line will be required, but this will be determined during detailed engineering. One (1) propane 120/208V back-up generator to be installed as the emergency station service AC source.

New control building to be installed to accommodate new relaying and relaying for future breaker-and-a-half bus expansion. Control enclosure shall meet latest ComEd standards. If NERC Low Impact, install BSC/IT UCOMM router and firewall. If Medium Impact, use serial communication. The new control building will contain:

- One (1) 125VDC battery system
- DC distribution panels
- Relay panels
- Marshalling cabinets
- Auxiliary AC power panels
- Building HVAC system
- Fire/security system
- SCADA
- Metering equipment.
- Additionally, auxiliary data communications will be installed to communicate with PD remote end for SCADA and metering purposes.
- Install SEL-3350 RTAC with redundant RST-2228 Switch Architecture (Master, Master Aux A/B, and Aux A/B switches).
- Install SEL-3620 Port Servers as needed for IED relays that must be connected serially over the available 3350 RTAC ports. Preference is to connect relays IP to the switch architecture.
- Install SEL-3555 HMI.
- Install SEL-2488 GPS Clock.

- Install SEL-3555 PDC cabinet per GDD
- Install SEL-2440 devices for any hardwire I/O
- For each Project Developer RTU, install a pair of fiber serial connections to the RTAC for data exchange.
- Connect metering group-provided revenue meter to station IP architecture.
- Confirm latest device model numbers and GDD with the assigned SCADA engineer.

Relay Installs at TSS 923 White Eagle Road.

- Install a 50BF/35/79 SEL-451 for all new CBs. Refer to GDD1930 and 1931
- Install a 79-2/SEL-351A for a second reclosing mode on all new CBs.
- For 138kV lines L11902 and L92304 install a 11-1/DCB SEL-421-5 and 11-2/STEP SEL-311C-1 line protection per GDD1936. Utilize full CT ratio for both systems of line relaying.
- For 138kV lines L11902 and L92304 Install UPLC II relays for DCB and RFL GARD relays for DTT.
- At TSS923, for 138kV line L92301 install standard ComEd 138kV Project Developer interface relaying consisting of a System 1 87L-1/SEL-411L-1 and a System 2 87L-2/SEL-311L-1 current differential scheme.
- In addition, install load rejection logic such that the transfer trip is initiated on both primary and secondary relaying to Project Developer site if 138kV L92301 breaker at TSS923 is opened (Refer to GDD 4003 for load rejection design).

Yard cable trench to be installed from control building to breakers and line terminal structures. Cable Trough to have a drainage system installed below the trough per ComEd standards. A lift station may be needed.

New substation to require installation of new fence and (2) sliding vehicular gates that are positioned no less than one half of the yard diagonal apart, as well as site development and grading. Preliminary security classification for the proposed substation indicates that fencing will be 7' with 1' barbed wire; fencing must adhere to all ComEd specifications and requirements. Security requirements including fencing may change. New station grounding, lightning protection, and lighting to be evaluated by studies, designed, and installed.

The developer ground grid shall not be tied to the TSS 923 White Eagle Road ground grid. New property will need to be purchased.

The access road to the main public road should be a minimum of 28 feet and have an asphalt or concrete approach. The radius transition to the main road to be in accordance with the requirements of the government having jurisdiction of the public road.

- Minimum width of road is 20'-0"
- Minimum turning radius (horizontal curve) of road to be 40'-0" to the center of the road.
- Maximum slope of road is to be 4.5%

Stormwater detention and any other required stormwater management features to be constructed outside of the substation fence. These must satisfy all local, county, state, and federal requirements for stormwater management.

Security system will need to be installed to meet ComEd standards.

If any utilities are routed under the substation these will need to be re-routed outside of the substation.

L11902 and L 92304 will remain on Carrier at TSS 923 White Eagle Road.

Backhaul Communication

- At TSS 923 White Eagle Road Microwave Communication will be used for backhaul communication. PM to engage UCOMM engineering for all matters related to backhaul communication.

3. NETWORK UPGRADES

The Network Upgrades will include, but not be limited to, the following:

Transmission Line Tie-in for new interconnection substation:

Cut existing L11902 138kV transmission line between existing structures #282 and #283 to loop into new TSS 923 substation.

- ComEd will be performing the design, procurement, and construction of the new structures to cut over to the new TSS 923 White Eagle Rd. Substation.
- Remove existing structure #282 and install two new horizontal 138kV deadend structures #282 and #282D on drilled shaft foundations. Both new structures will be approximately 80' in height, and similar to the EM10459.3 framing modified as follows:
 - Two shield wire attachments ahead and back.
 - Longer shield wire arms to account for 0-degree shielding angle.
 - Design ruling span of at least 850'.
 - Current phasing configuration of existing transmission line L11902 is C-A-B west to east. If the proposed substation configuration cannot accommodate this horizontal phasing, proposed structures #282 and #282D could then be modified to vertical deadend structures of approximately 110' in height.
- Approximately 0.14 circuit miles of newly installed conductor and shield wire are required.
 - New conductor and shield wire between proposed deadend structure #282, proposed deadend structure #282D, and proposed 138kV deadend structures at TSS 923 will be 1113.0 kcmil 45/7 ACSR "Bluejay" and 7#6 Alumoweld, respectively.
 - Existing conductor and shield wire on L11902 is the 1113.0 kcmil 45/7 ACSR "Bluejay" and the 3#6 Alumoweld, respectively, and will be transferred to the new cut-in structures #282 and #282D.

- Existing tangent structure #281 and existing deadend structure #283 will remain.

Upgrades to neighboring facilities:

TSS 124 Maryland

- New wave trap tuning pack, UPLC-II(DCB), RFL GARD(DTT)
- Modify existing relay settings based on new line topology
- Update station prints and equipment numbering from L11902 to L92304

TSS 119 Lancaster

- Modify existing relay settings based on new line topology

TSS 180 Lena

- Modify existing relay settings based on new line topology

TDC 370 Eleroy

- Modify existing relay settings based on new line topology

ESSB-427 Titan Tire

- Modify existing relay settings based on new line topology

Microwave Installation:

Install microwave communication at TSS 923 White Eagle Road and TSS 124 Maryland substations.

4. OTHER SCOPE OF WORK

N/A

5. MILESTONE SCHEDULE FOR COMPLETION OF TO WORK

Facilities outlined in this report are estimated to take 60 months to construct, from the time the Generation Interconnection Agreement is fully executed. This schedule is 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.

Description	Start month	Finish month
Detailed Design	1	21

Permitting	21	50
Construction	50	60

6. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- This study is based on the Phase 1 Report for PJM Generation Interconnection New Service Request Project AE1-114 Maryland-Lancaster 138 kV. The steady-state voltage study for stability analysis will be performed by PJM during the Facility Phase. The PJM study could identify upgrades to the ComEd system that would become part of this project's scope of work. It is assumed that all associated network upgrades, as listed in the above System Impact study, are complete prior to this New Service Request Project being placed in service.
- This cost estimates assume that work will be performed during normal weekdays and with no overtime. Transmission line outages for construction have not been identified, but generally are available from September to May. These outages are controlled by PJM.
- Costs are based on 2024 rates and do not reflect a potential increase in Labor or Material costs after 2024.
- ComEd cost estimate is valid for six (6) months after Facilities Study release by PJM.
- The Project Developer will be responsible to request and bear the cost for relocation of existing transmission or distribution lines (including structures and other facilities) that may be required for transmission line crossings, the transport of any large equipment, such as turbines, rotors, turbine structures, cranes, etc. Formal submittal of this request to ComEd's TSO for ultimate review by PJM can be made 7 months prior to back feed request date.
- Foundation design assumes typical soil conditions at locations and will be subject to change after soil boring tests.
- All upgrades to facilities included in this document will be required to meet latest ComEd standards.
- Upgrades are subject to change based on detailed design development.
- ComEd will complete pre-design and post construction survey for the transmission and substation upgrades, as required. This includes, but is not limited to, the LIDAR survey and video imaging for transmission lines. Costs associated with this are at the expense of the Project Developer. Pre-design survey must be completed prior to detailed engineering.
- This study assumes that any additional right-of-way and/or easement work required will be at the expense of the Project Developer.
- This Facilities Study is time dependent. If the project is not into construction within one year of the issuance, the study will be void and the project re-studied, requiring the completion of a new Facilities Study.

- It is assumed that all associated network upgrades, as listed in the Phase 1 study, are complete prior to this queue being placed in service.

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 AE1-114 GIA, and in PJM Manuals M01 and M14D. The details of applicable revenue metering requirements are given in the 'ComEd Interconnection Guidelines' posted on PJM website.

REVENUE METERING FOR PJM AND COMED

- The revenue meter measures the wholesale energy output (Hourly compensated net MWH and Hourly compensated net MVARH) of the Generating Facility.
- The metering equipment, including revenue meter and CT/PT shall be installed, at Project Developer's expense, at the interconnection substation on ComEd side of the Point of Change in Ownership.
- ComEd shall own, operate, maintain, inspect, and test all the metering equipment as set forth in 'Testing of Metering Equipment' section of the PJM Tariff, at the Project Developer's expense.

REAL-TIME METERING FOR PJM

- The Project Developer shall install, own, operate, maintain, inspect, and test real-time metering equipment to measure and transmit directly to PJM the real time MW, MVAR, voltage and status of electrical equipment such as circuit breakers and Motor Operated Disconnect switches, in conformance with the requirements listed in PJM Manuals M-01 and M-14D, at the Project Developer's expense.

RETAIL METERING FOR COMED

- The AMI Meter measures the energy consumption by the Project Developer at transmission level and hence shall be designed to measure low MW flow.
- The metering equipment including AMI Meter and CT/PT shall be installed at the interconnection substation on ComEd side of the POI, at the Project Developer's expense.
- ComEd shall own, operate, maintain, inspect, and test all the metering equipment as set forth in the 'ComEd Interconnection Guidelines'.

8. LAND REQUIREMENTS FOR INTERCONNECTION SUBSTATION

- For a 138kV substation bisecting one transmission line, the site shall be at least 500' x 400' excluding the stormwater detention facility. The site should be expandable to 500' x 800' without any restriction.

- The site should be accessible from at least two sides to bring in future transmission lines. This means that there should be no river, another transmission line, hills, forest, or wetland on at least two sides of the site.
- There should be no legal agreements or other impediment to interconnect additional generator lead lines to this site from other generators in the future.
- The site should not encroach into ComEd transmission or distribution corridors.
- If the Project Developer owns the land surrounding the substation site, the Project Developer must provide open easement to ComEd to bring in future transmission lines into the substation.
- The Project Developer is responsible to build an access road meeting ComEd requirements to the substation site from the nearest public road.
- The Project Developer is responsible to acquire land to install tie-lines integrating the substation with the ComEd transmission system.
- The Project Developer is responsible to acquire land for the stormwater detention facility meeting all applicable ComEd Environmental requirements and all applicable municipal, county, and state requirements for stormwater management.

Upon completion of the construction and installation of the interconnection substation, the tie-line, access road, stormwater detention facility and related improvements and facilities, and the satisfactory completion of testing of the interconnection substation acceptable to ComEd, the Project Developer shall transfer all the Property Rights and Permits to ComEd, at no cost or expense to ComEd, pursuant to documentation that is acceptable to ComEd, including (without limitation) the Property Transfer Documents in fee simple.

All real property conveyed in fee to ComEd must be remediated to and all real property to which real property rights are transferred to ComEd (as determined in ComEd's discretion) must be remediated to IEPA's Tiered Approach to Corrective Action Objectives (TACO) Tier 1 residential remediation standards.

9. ENVIRONMENTAL AND PERMITTING

- ComEd will be responsible to obtain all environmental approvals and permitting required. This includes any endangered species studies and monitoring, as required. Costs associated with this permitting are at the expense of the Project Developer.
- The Project Developer will be responsible for site restoration required for substation and transmission upgrades. This includes, but is not limited to road restoration/improvements, wetland restoration, and farm field restoration/crop damage. Costs associated with this are at the expense of the Project Developer.
- The Project Developer will be responsible for the cost to purchase real estate or obtain the necessary right-of-way easement for all upgrades associated with this project. These associated upgrades are not included in the costs listed in this study.
- The Project Developer will be responsible for remediation costs for locations found to have environmental contaminations and remediation. This may require contaminated soil disposal as well as lead paint removal for existing structure work.
- It is assumed that all necessary permits will be obtained in a timely manner to allow engineering and construction to proceed according to the Milestone Schedule.

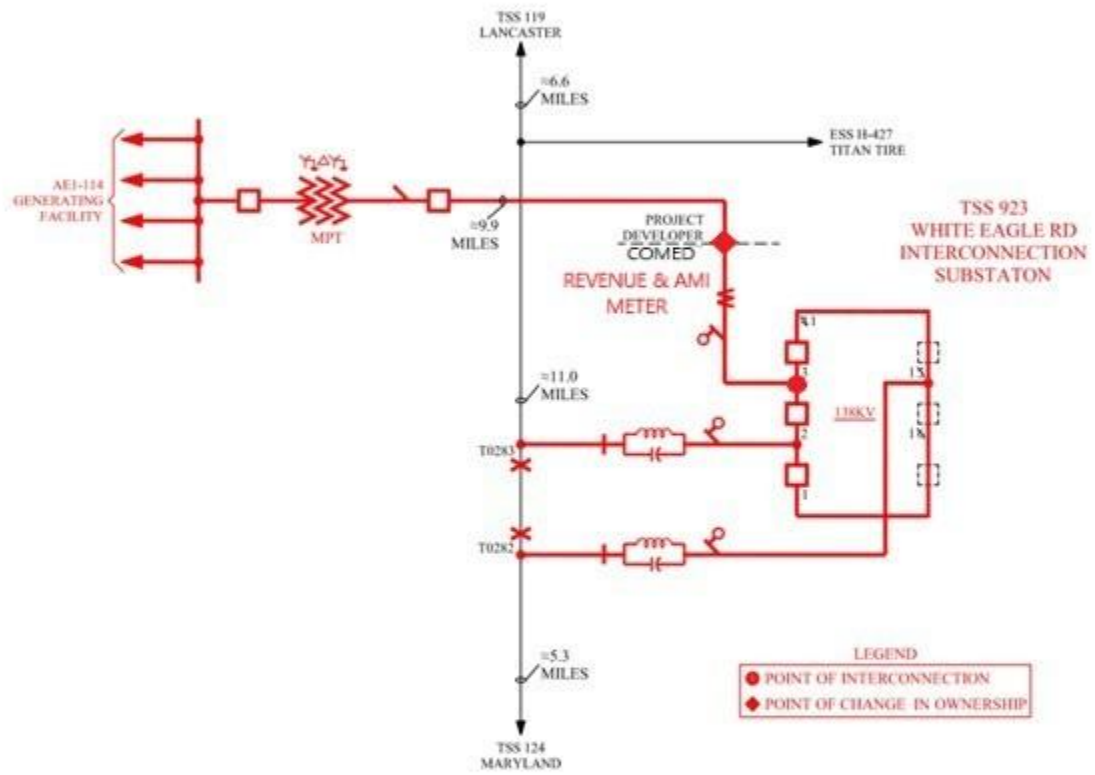
- It is assumed that conveyance of property and rights will be obtained to support the PJM Transmission Outage Schedule.
- It is assumed that the required Environmental Study will yield no impediments to the development of the site.
- ComEd will complete geotechnical soil borings, resistivity study, and analysis for substation and transmission upgrades. Costs associated with this are at the expense of the Project Developer.

C. APPENDICES

- 1) Attachment #1: High Level Project Diagram Depicting Interconnection Facilities for Physical Interconnection and Points of Ownership/Demarcation
- 2) Attachment #2: General Arrangement for the Substation Equipment
- 3) Attachment #3: One Line Diagram
- 4) Attachment #4: Transmission Line Tie-In Plan
- 5) Attachment #5: Geographical Map Showing the Property Location

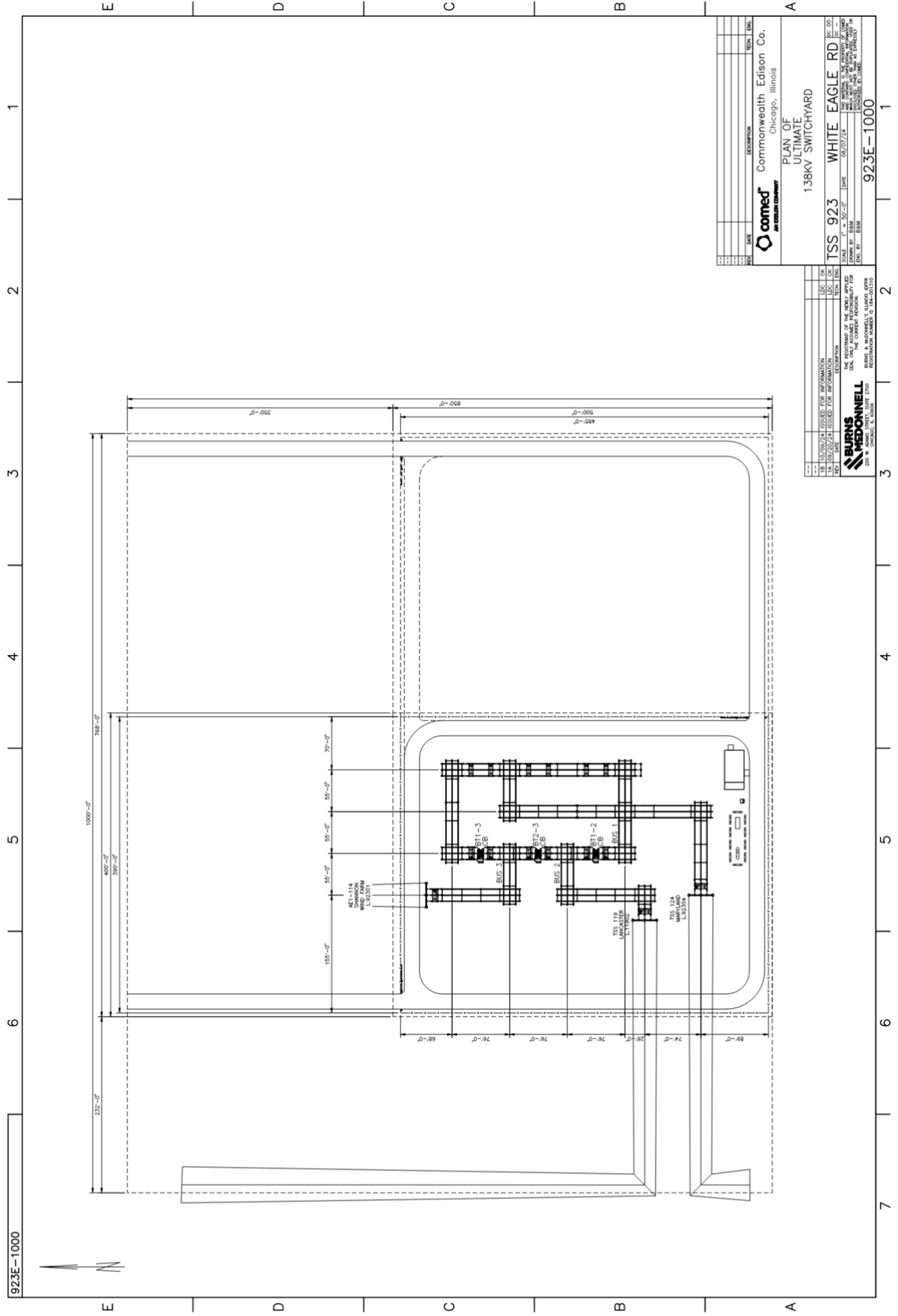
Attachment #1:

**High Level Planning Diagram Depicting Interconnection Facilities and Points of
Ownership/Demarcation**



Attachment #2:

**General Arrangement for the Substation Equipment
(Attached PDF)**



Attachment #3:

**One Line Diagram
(Attached PDF)**

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Attachment #5:
Geographical Map Showing the Property Location
(Attached P)

