PJM Facilities Study Report

For

Network Upgrade N7541

Transition Cycle #1

July 2025

Introduction

This Facilities Study has been prepared in accordance with the PJM Open Access Transmission Tariff and PJM Manuals. The Transmission Owner (TO) is Virginia Electric and Power Company (VEPCO or Dominion).

A. Project Description

The System Impact Study for PJM Interconnection Transition Cycle #1 has identified the need for PJM Network Upgrade N7541. The scope of this Network Upgrade includes the following:

- Add a 3rd 230/115 kV transformer at Earleys substation and supporting equipment.

B. Transmission Owner Facilities Study Results

1. Detailed Scope of work for Network Upgrade N7541:

The following is a detailed description of Transmission Owner Upgrades for Network Upgrade N7541. These facilities shall be designed according to the Transmission Owner's Applicable Technical Requirements and Standards. Once built the Transmission Owner will own, operate, and maintain these facilities.

The Preliminary Scoping Document located in the Appendices, Attachment #1 and #2.

2. MILESTONE SCHEDULE FOR COMPLETION OF DOMINION WORK

Facilities outlined in this report are estimated to take 51 months to construct, from the time of full execution of the Generation Interconnection Agreement and completion of a construction kickoff call. This schedule may be impacted by the timeline for procurement and installation of long lead items and the ability to obtain outages to construct and test the proposed facilities.

Description	Start month	Finish month
Engineering	1	10
Permitting/Procurement	3	45
Construction	46	51

3. ASSUMPTIONS IN DEVELOPING SCOPE/COST/SCHEDULE

- The preliminary construction schedule is dependent on outage availability.
- See Attachment 1 – Preliminary Scoping Summary – Substation for additional assumptions
- See Attachment 2 – Preliminary Scoping Summary – Transmission for additional assumptions

4. LAND REQUIREMENTS

Dominion will be responsible for the following expectations in the area of Real Estate:

- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation.
- Any other Land/Permitting requirements required by the Network Upgrade

5. ENVIRONMENTAL AND PERMITING

The Dominion will be responsible for the following expectations in the area of Environmental and Permitting:

- Assessment of environmental impacts related to the Network Upgrade including:
    - Environmental Impact Study requirements
    - Environmental Permitting
- A stormwater easement and/or specific stormwater design BMP's to allow access to and use of the facilities, including a maintenance agreement for said stormwater facilities.
- Conditional Use Permit for Substation
- Any additional land needed for Storm Water Management, Landscaping, and Wetlands/Wetlands Mitigation
- Any other Permitting requirements required by the Network Upgrade

C. APPENDICES

Attachment #1: Preliminary Scoping Summary – Substation Earleys

Attachment #2: Preliminary Scoping Summary – Transmssion

Attachment #1

SCOPE OF WORK

Project Number: N7541 – Earleys Substation

Project Description: Install New 230/115kV Transformer and Associated Equipment

Date: 07/01/2025

Revision Number: 0

Project Summary

Network upgrade N7541 provides for the addition of a new 230/115kV transformer and all supporting equipment at Earleys Substation in Hertford County, North Carolina.

Station Modifications:

- Relocation of existing 115kV Cap Bank
- Removal of existing 230/115kV station fence
- Expansion of 230/115kV station footprint
- Installation of level 3 security fence

Assumptions & Clarifications:

1. *The scope of work depicted on the drawings assumes that there is no overlap with other designs and construction activities, except if mentioned in this Project Summary.*
2. *Relay Settings and P&C design will be revised as part of the SPE Scope of Work.*
3. *4-hole pad connections must be replaced with 6-hole pad connections to maintain 4000A ratings.*
4. *Currently, the scope and estimate assume fence security level 3. If it is determined that fence security level should change to a different fence security level, the Dominion team should be informed to adjust the project estimate at the earliest possible opportunity.*
5. *Due to time constraints, an estimated site work cost was included in the estimate based on similar past projects. If the project moves forward a detailed site work estimate will be needed and a total project estimate updated.*

Purchase and install substation material – Network Upgrade:

1. Approximately 21,000 sq ft site preparation and grading as required for the expansion of Earleys Substation (by Dominion)
2. Approximately 600 ft linear of 5/8” chain-link, 15 ft tall, perimeter fence around the station along with the security cameras and integrators as per existing fence standards
3. Two (2), 230kV, backbone (by Transmission)
4. One (1), 115kV, backbone (by Transmission)
5. One (1), 224MVA, 230/115kV, transformer
6. One (1), 230/115kV, transformer oil containment
7. Three (3), 18kV, 15.3kV MCOV, surge arrester
8. Three (3), 230kV, 4000A, 63kA, circuit breaker
9. Six (6), 230kV, 4000A, double end break switch
10. Six (6), 180kV, 144kV MCOV, surge arrester
11. Three (3), 230kV, relay accuracy CCVT
12. One (1), 115kV, 3000A, 40kAIC, circuit breaker
13. Three (3), 115kV, 2000A, center-break switch
14. Three (3), 90kV, 74kV MCOV, surge arrester
15. One (1), 115kV, 3000A, 40kA, circuit breaker (sync close)
16. Approximately 475 ft of 3.5” schedule 40 aluminum pipe
17. Approximately 250 ft of cable trough
18. Expand ground grid for the substation expansion as required
19. Site Development, access roads, and stormwater management as required
20. Station stone as required
21. Structural steel and foundations as per Dominion Energy Standards
22. Conductor, connectors, conduit, control cable, and grounding material as per engineering standards

Relocate substation material – Network Upgrade:

1. One (1), three phases 39.6MVAR @ 124.7kV, cap bank
2. Five (5), 90kV MOV, 74kV MCOV, surge arrester
3. One (1), 115kV, relay accuracy bus CCVT
4. One (1), 115kV, 2000A, 115-300kHz, wave trap
5. Two (2), 115kV, relay accuracy line CCVT
6. One (1), lightning mast
7. Conductor, connectors, conduit, control cable, foundations, structures, and grounding material as per engineering standards

Remove substation material – Network Upgrade:

1. One (1), 115kV, backbone (by Transmission)
2. One (1), 123kV, 3000A, 40kA, circuit breaker (sync close)
3. One (1), 115kV, 1200A, center-break switch
4. One (1), 115kV, relay accuracy line CCVT
5. Conductor, connectors, conduit, control cable, foundations, structures, and grounding material as per engineering standards

Purchase and install relay material – Network Upgrade:

1. One (1), SPR relay/aux package

2. One (1), 4510 – SEL-2411 transformer annunciator
3. One (1), 1217 – 24” dual SEL-487E transmission Tx diff panel
4. Two (2), 1510 – 24” dual SEL-351 transmission breaker w/ reclosing panel
5. Three (3), 1511 – 24” SEL-351 transmission breaker w/o reclosing panel
6. Five (5), 4510 – SEL-2411 breaker annunciator
7. Five (5), 4526_A – circuit breaker fiber optic make-up box
8. One (1) 4526_C - >=84MVA transformer fiber make-up box
9. One (1) 4506 – 3-phase CCVT potential make-up box

Attachement #2

230kV LINE #2171

Earleys Substation

PROJECT N7541

PRELIMINARY SCOPING SUMMARY

This project serves to make room for a proposed substation expansion to Earleys Substation. This work will remove and install one (1) steel static pole and one (1) self-supporting switch structure on 230kV line 2171 between backbone structure 2171/1 and H-frame structure 2171/2, which is located in Hertford County, NC. This project will also install two (2) new 230kV steel backbone structures for strain bus and one (1) 115kV backbone structure for strain bus. The 230kV strain bus conductor will be 2-2500 ACAR and the 115kV strain bus conductor will be 1-2500 ACAR. This project will also reconductor the span between structures 2171/1 and 2171/2 with new bundled (2) 768.2 ACSS/TW/HS "Maumee" conductor to accommodate the proposed switch connection. See **Figure 1** for the project location. The proposed work requires no additional land and will all be completed within existing right of way. The project will install a total of six (6) new structures.

The proposed structures to be installed are one (1) 230kV self-supporting switch structure, one (1) steel static pole structure, two (2) 230kV steel backbone structures and one (1) 115kV steel backbone structure.

The strain bus conductor and structures referred to in this scope are not transmission structures and as such do not have a circuit number assigned to them. Structure numbers will be referred to as labeled in **Figure 2.**

Design Considerations:

EXISTING FACILITIES TO BE REMOVED:

1. Remove one (1) existing 230kV steel self-supporting switch structure as follows:
    a. Structure 2171/1A.

2. Remove one (1) existing steel static pole structure as follows:
    a. Structure 54/275A.

3. Remove one (1) existing 115kV strain bus lattice backbone structure.

4. Remove approximately 0.02 miles of single (1) 115kV conductor between existing backbone structure 54/275 and the existing 115kV strain bus lattice backbone.

5. Remove approximately 0.05 miles of single (1) 795 ACSR "Drake" conductor between existing backbone structure 2171/1 and existing structure 2171/2. This includes the removal of the following items:
    a. Three (3) jumper loop assemblies on structure 2171/2.
    b. Six (6) risers from the switch structure 2171/1A to the existing span between structures 2171/1 and 2171/2.

c. Three (3) existing floating deadend assemblies in the span between structures 2171/1 and 2171/2.

6. Remove approximately 0.09 miles of one (1) 7#7 Alumoweld shield wire as follows:
    a. Remove 0.05 miles from structure 246/321 to structure 54/275A.
    b. Remove 0.04 miles from structure 54/275 to structure 54/275A.

EXISTING FACILITIES TO BE MODIFIED:

1. Replace three (3) conductor strain crossing assemblies [Reference Drawing 32.338] on the following one (1) structure:
    a. Structures 2171/1.

2. Replace three (3) conductor strain crossing assemblies [Reference Drawing 31.340] on the following one (1) structure:
    a. Structures 54/275.

3. Replace three (3) conductor strain crossing assemblies [Reference Drawing 32.338] and three (3) jumper loop assemblies [Reference Drawing 39.228] on the following one (1) structure:
    a. Structure 2171/2.

4. Replace three (3) shield wire deadend assemblies [Reference Drawing 42.011] on the following one (1) structure:
    a. Structure 54/275.

5. Replace one (1) shield wire deadend assemblies [Reference Drawing 42.011] on the following one (1) structure:
    a. Structure 246/321.

6. Cut and transfer two (2) 7#7 Alumoweld from the ahead side of 54/275 to the backside of proposed SB3.

PERMANENT FACILITIES TO BE INSTALLED:

1. Install one (1) 230kV self-supporting switch structure [Reference Drawing 12.830] on foundations as follows:
    a. Structure 2171/1A.
    b. This includes the installation of one (1) horizontal mounted 4000A switch.

2. Install one (1) steel static pole [Reference Drawing 9.008] on a foundation as follows:
    a. Structure 54/275A.

3. Install two (2) 230kV SC steel backbone structures [Reference Drawing 12.905] on foundations as follows:
    a. Structures SB1 and SB2.

4. Install one (1) 115kV SC steel backbone structure [Reference Drawing 11.955] on foundations as follows:
    a. Structure SB3.

5. Install six (6) bundled (2) 768.2 ACSS/TW/HS “Maumee” risers [Reference Drawing 90.050] from line 2171 down to the proposed switch structure 2171/1A.

6. Install three (3) floating deadend assemblies [Reference Drawing 90.064] above the proposed switch structure 2171/1A.

7. Install approximately 0.05 miles of bundled (2) 768.2 ACSS/TW/HS “Maumee” conductor between existing backbone structure 2171/1 and existing structure 2171/2.

8. Install approximately 0.03 miles of bundled (2) 2500 ACAR conductor between proposed structure SB1 and proposed structure SB2.

9. Install approximately 0.03 miles of single (1) 2500 ACAR conductor between existing backbone structure 54/275 and proposed structure SB2.

10. Install approximately 0.03 miles of two (2) 7#7 Alumoweld shield wire between proposed structure SB1 and proposed structure SB2.

11. Install approximately 0.09 miles of one (1) 7#7 Alumoweld shield wire as follows:
    a. Install 0.04 miles from structure 246/321 to structure 54/275A.
    b. Install 0.05 miles from structure 54/275 to structure 54/275A.

CONCEPTUAL SCOPE NOTES:

1. No PLS-CADD modeling was done for this project.

2. Structures are designed based off the following NESC 2017 code parameters: NESC Heavy, 90 mph wind, ¾” Ice & 30 mph wind regardless of project location.

3. It is assumed for detailed engineering that a LiDAR survey will be required.

4. Any potential height restrictions were not accounted for in this design.

5. This project will be installed in the existing 115’ ROW and all work will be done on Dominion-owned property.

6. A wetland delineation has not been completed as part of this conceptual package.

7. Self-supporting switch structure 2171/1A and static pole 54/275A may be able to be reused. This will have to be studied further in detailed engineering.

8. This scope is based on the working copy of the N7541 General Arrangement drawing for Earleys Substation. As this is a working copy of the general arrangement, the copy provided with this scope should be considered for reference only. Please refer to the substation conceptual package for the most up to date document.

CONCEPTUAL ESTIMATE NOTES:

1. Steel pole foundation costs were based off the projects' location and structure type in the regional soil profile map. The regional soil profile map used for this project is Coastal Plains West.

2. Due to the time allotted to create an estimate, stakeholders were not consulted for their respective costs. Stakeholder costs were derived as follows:
    a. DEES permitting costs were based on a cost per mile based off comparable projects in the TC#1 Phase 3 Cycle. Project N9211, which is reconductoring line 123 from Rocky mount Sub to Battleboro Sub, was used to develop the Forestry and Access cost per mile due to similar project scope and location.
    b. Siting and Permitting costs were derived using the permitting spreadsheet but not verified by the permitting team.
    c. Real estate acquisition costs were assumed to be $0 due to no additional land needed to be acquired.
    d. Right of Way Management (Encroachment) costs were based on a cost per mile based off comparable projects in the TC#1 Phase 3 Cycle. Project N9143, which is rebuilding line 35 from AltaVista Sub to Gladys Tap, was used to develop the Encroachment cost per mile due to similar project location.
    e. Forestry, Rehab and Access costs were based on a cost per mile based off comparable projects in the TC#1 Phase 3 Cycle. Project N9211, which is reconductoring line 123 from Rocky mount Sub to Battleboro Sub, was used to develop the Forestry and Access cost per mile due to similar project scope and location.
    f. Surveying costs were based on the typical cost to acquire approximately two (2) miles of survey. These costs were provided by the surveying team as part of TC#1 Phase 3 process.
    g. Communications (Marketing Manager) costs are assumed to be Tier 1 - $25K based off similar linear lengths and locations to projects N9211.
    h. Telecommunications costs are assumed to be $0 due to no fiber being installed for this project.

Figure 1 – Project Location

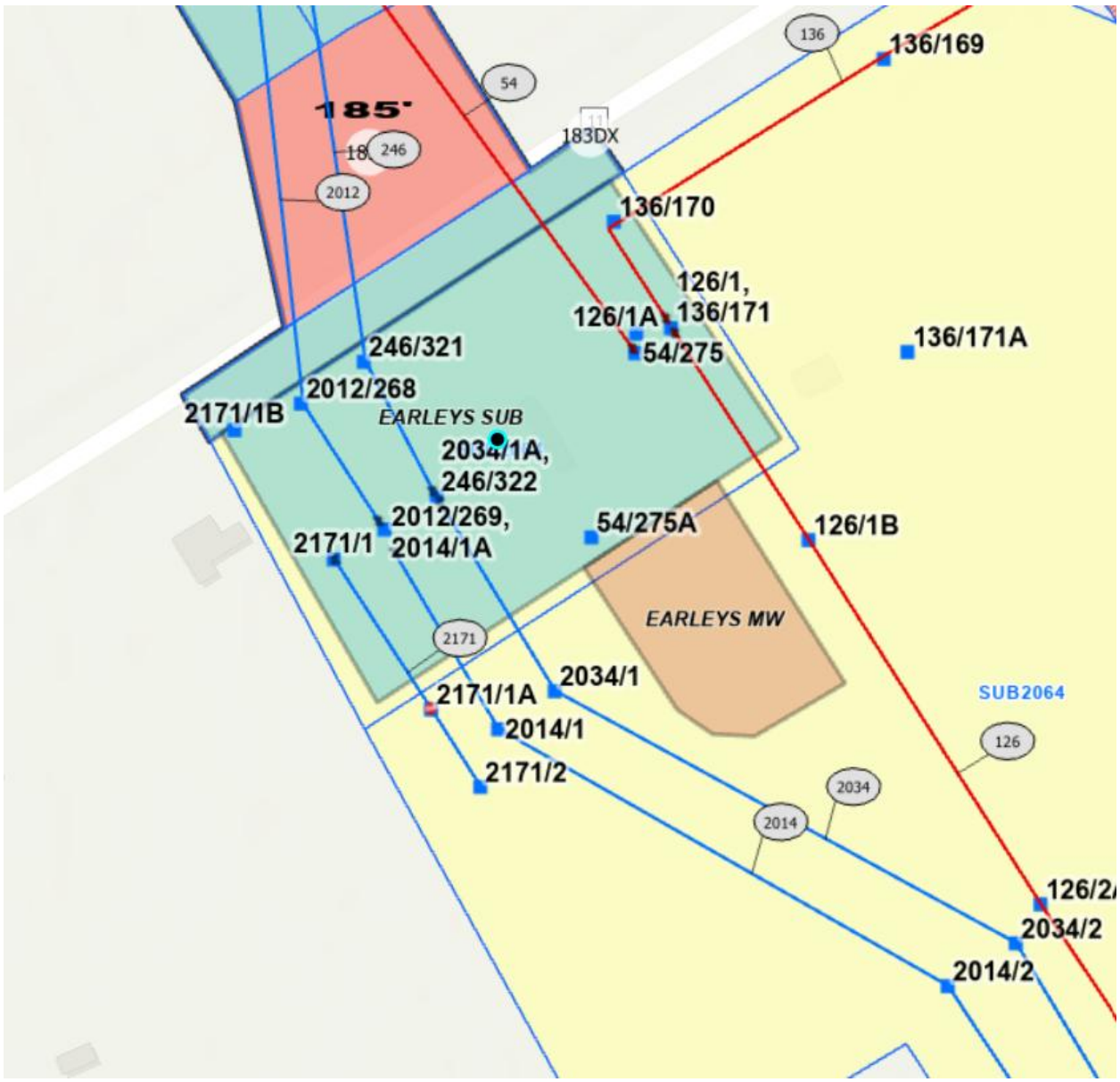

Figure 2 – Structure naming Convention

Required Material Summary

Item	Qty
Static Poles	1
Self-Supporting Switch	1
Backbone Structures	3
12,000-FT 2500 ACAR Conductor Reels	2
12,000-FT 768.2 “Maumee” Conductor Reels	2
7,100-FT Static Wire Reels	1