



Doc. Name: FEMA Project Scope of Work
Project Name: Renewable Network Upgrades
DR-4339-PR Public Assistance
Received:
Jan 30, 2023
3:38 PM

FEMA Project Scope of Work

Project Name:
Network Upgrades to support the
Integration of Tranche 1 Utility Scale Renewable projects
Date: 10 January 2023

Approvals

The signatures below formally approve the FEMA Project Scope of Work Template.

Director, Renewable Systems Projects	Signature	Date
		27/01/2023
VP – Distribution Engineering, Planning and Investment Strategy	Signature	Date
		



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Overview

Project Name:	Network Upgrades to support the Integration of 12 of the 21 Tranche 1 Utility Scale Renewable projects Studied as of May 31st.
Region:	Island Wide
Damage Number:	223189 & 206253
Damaged Inventory/Asset Category:	Island Wide Substations and Transmission line
FEMA Project Number: <i>(Formerly Project Worksheet)</i>	<Provided by FEMA>

Introduction

The purpose of this document is to present a Project Scope of Work (SOW) along with a 406 Hazard Mitigation proposal with Cost Estimate to be submitted to COR3 and FEMA for projects under DR-4339-PR Public Assistance. COR3 and FEMA will review the completed document to evaluate and If FEMA recommends eligibility, then create a specific project worksheet and post construction-cost estimates to replace the eligible facilities, including Section 406 hazard mitigation for the specific projects.

LUMA Energy provides the Operations and Maintenance of Puerto Rico's electric transmission and distribution system (T&D System) for the entire island of Puerto Rico. The Puerto Rico Electric Power Authority (PREPA) is the agency that owns the facilities, sites, and systems identified in this Scope of Work that are eligible as critical services facilities.

LUMA performed Interconnection Studies, delivered to PREPA and the Puerto Rico Energy Bureau (PREB) on May 31st, for the Tranche 1 RFP where it was determined that 12 of the 21 projects studied, demonstrated the need for replacement of network components in order to reliably deliver their full output to the grid. The Network Upgrades consist of 4 specific projects; three 38kV line upgrades and the replacement of a 115/38kV transformer with a new 67/90/112MVA transformer. Details of the proposed scope of work are detailed herein.



Facilities

Facilities List

Name	Line	GPS Location
38kV Line 700:	700	
38kV Line 4800	4800	
38kV Line 9900	9900	
Santa Isabel TC		

Note: GPS coordinates are required for each facility.

Project Scope

Scope of Work Description

Network Upgrade: Line L700 38KV

The scope of work for the subtransmission line Network Upgrade projects includes identification of lines or line segments where the existing conductor's MVA capacity does not meet the requirement for the additional renewable generation envisioned. Specifically, load flow studies have identified 76 MVA that will be interconnected to 38kV Line 700.

Line 700 is a 38kV subtransmission line has an approximate total distance of 11.3 miles and runs from Costa Sur Power Plant to Guayanilla and from Guayanilla substation to Yauco Hydro Plant 2 with various intermediate segments in between. The existing line consists of wood, concrete, lattice towers, and galvanized steel structures and has a combination of ACSR and copper conductors, with a limiting ampacity of 20 MVA (1/0 CU).

The system impact study for the generation to be interconnected to the line identified existing line segments of Guayanilla to Costa Sur and Guayanilla to Switch 700-13B (approximately 7.27 miles between both segments) as impacted facilities in need of upgrade to rated 76 MVA. The line segment rating needs to be increased to 76 MVA via the installation of new 1192.5 kcmil ACSR per LUMA standards. This effort requires the replacement of an estimated total of 6 structures within a 0.22-mile segment of Guayanilla to Switch 700-13B and a total of 54 structures within a 1.7-mile segment of Guayanilla to Costa Sur. A total of 62 new steel poles will be installed to replace the existing 60 structures, where two existing lattice towers were assumed to be replaced with a new two-pole structure each.



The estimated scope of work to be performed includes the installation of new conductor, new galvanized steel poles (70 and 85 feet in overall length), installation of concrete drilled shaft foundations (for 85 foot poles), drilling to a maximum of 12 feet for direct embedded foundations (for 70 foot poles), installation of crushed stone backfill for direct embedded foundations, transfer of existing distribution facilities to new steel poles, clearing of vegetation for construction access, matting for construction setup, and installation of temporary access roads. Additionally, existing structures, conductors, and hardware will be removed and transported off site for disposal.

Executing this SOW as a mitigation proposal will ensure the terminal and/or point of interconnection is designed to accept the expected capacity provided by the renewable generation to provide primary and redundant sources of generation as part of an overall Grid focused strategy to establish, maintain and restore electrical service before, during and after a storm or other natural disaster or event, The PR Grid Interconnection points will be designed and constructed in alignment with the present LUMA Strategy for grid stability, resilience and operational flexibilities.

Network Upgrade: Line L4800 38KV

The scope of work for the subtransmission line Network Upgrade projects includes to identify lines or line segments where the existing conductor's MVA capacity does not meet the required 48 MVA identified after load flow studies from the Tranche 1 System Impact Study Analysis on 38kV Line 4800.

Line 4800 is a 38kV subtransmission line that forms part of the Puerto Rico electric grid, which is managed and operated by LUMA Energy. The existing line consists of wood, concrete, galvanized steel structures and has copper and ACSR conductors, with a limiting ampacity of 20 MVA (1/0 CU). The line segment rating needs to be increased to 48 MVA via the installation of a new 556 kcmil ACSR per LUMA standards. This effort requires the replacement of an estimated total of 11 structures within a 1.04-mile segment of Toro Negro Substation to the Toa Vaca 3-way Switch and a total of 80 structures within a 7.94-mile segment of Toa Vaca to the Santa Isabel Substation. A total of 91 new steel poles will be installed to replace the existing structures.

Line 4800 has been identified as requiring an upgrade to a 48 MVA rating, as part of the System Impact Study result from Tranche 1 analysis. The existing line extends between the Toro Negro Substation to the Toa Vaca 3-way Switch pole and from Toa Vaca to the Santa Isabel Substation, approximately 11.6 miles long. The system impact study identified existing line segments of Toro Negro Substation to the Toa Vaca 3-way Switch (1.04 miles long) and from Toa Vaca to the Santa Isabel Substation (7.94 miles long) as impacted facilities in need of upgrade to rated 48 MVA.

The estimated construction scope of work to be performed includes the installation of new conductor, galvanized steel poles (70 and 85 feet in overall length), installation of concrete drilled shaft foundations (for 85-foot poles), drilling to a maximum of 12 feet for direct embedded foundations (for 70-foot poles), installation of crushed stone backfill for direct embedded foundations, transfer of existing distribution facilities to new steel poles, clearing of vegetation for construction access, matting for construction setup, and installation of temporary access roads. Additionally, existing structures, conductors, and hardware will be removed and transported off-site for disposal.

Executing this SOW as a mitigation proposal will ensure the terminal and/or point of Interconnection Is of design and capacity to accept the forecasted renewable generation to provide primary and redundant sources of generation as part of an overall Grid focused strategy to establish, maintain and restore electrical service before, during, and after a storm or other natural disaster or event. The PR Grid



Interconnection points will be designed and constructed in alignment with all the present LUMA Strategy for grid stability, resilience and operational flexibilities.

Network Upgrade: Line L9900 38KV

The scope of work for the subtransmission line Network Upgrade projects includes to identify lines or line segments where the existing conductor's MVA capacity does not meet the required 48 MVA identified after load flow studies from the Tranche 1 System Impact Study Analysis on 38kV Line 9900.

Line 9900 is a 38kV subtransmission line that forms part of the Puerto Rico electric grid. The existing line consists of wood, concrete, galvanized steel structures and has a combination of ACSR and copper conductors, with a limiting ampacity of 20 MVA (1/0 CU). The line segment rating needs to be increased to 48 MVA via the installation of new 556 kcmil ACSR per LUMA standards. This effort requires the replacement of an estimated total of 31 structures within a 1.30-mile segment from Tap Switch no. 9905A to Hogar Juvenil substation and a total of 48 structures within a 3.75-mile segment from Hogar Juvenil substation to Rio Blanco substation. A total of 79 new steel poles would be installed to replace the existing structures.

Line 9900 has been identified as requiring an upgrade to 48 MVA rating, as part of the System Impact Study results from the Tranche 1 analysis. The line spans between Tap Switch no. 9905A to Hogar Juvenil substation (2.6 miles long) and from Hogar Juvenil substation to Rio Blanco substation (5.2 miles long). The system impact study identified existing line segments of Toro Negro Substation to the Toa Vaca 3-way Switch (1.04 miles long) and from Toa Vaca to the Santa Isabel Substation (7.94 miles long) as impacted facilities in need of upgrade to rated 48 MVA. The system impact study identified existing line segments of Tap Switch no. 9905A to Hogar Juvenil substation (1.30 miles) and from Hogar Juvenil substation to Rio Blanco substation (3.75 miles long) as impacted facilities in need of upgrade to rated 48 MVA.

The estimated construction scope of work to be performed includes the installation of new conductor, galvanized steel poles (70 and 85 feet in overall length), installation of concrete drilled shaft foundations (for 85-foot poles), drilling to a maximum of 12 feet for direct embedded foundations (for 70-foot poles), installation of crushed stone backfills for direct embedded foundations, transfer of existing distribution facilities to new steel poles, clearing of vegetation for construction access, matting for construction setup, and installation of temporary access roads. Additionally, existing structures, conductors, and hardware will be removed and transported off site for disposal.

Executing this SOW, as a mitigation proposal will ensure the terminal and/or point of Interconnection is of design and capacity to accept the forecasted capacity provided by the renewable generation to provide primary and redundant sources of generation as part of an overall Grid focused strategy to establish, maintain and restore electrical service before, during and after a storm or other natural disaster or event, The PR Grid Interconnection points will designed and constructed in alignment with the current LUMA Strategy for grid stability, resilience, and operational flexibilities.

Network Upgrade: Santa Isabel TC

Tranche 1 Renewable RFP System Impact Study identified the need to replace the existing Santa Isabel TC 115/38kV 56MVA transformer. A new 67/90/112MVA transformer will need to be purchased and installed per LUMA standards. The transformer installation will include an extension of the pad foundations, the construction of a new oil containment pit and the construction of a new fire wall. The



transformer low side 38kV, 2000A circuit breaker will need to be replaced with a new 3000A circuit breaker. The circuit breaker bus side switch will also need to be replaced. The existing 38kV main bus will need to be upgraded to a 3" copper bus. The transformer low side conductors will also need to be upgraded. A new transformer differential protection panel is included in the estimate to meet present LUMA standards, along with associated cables for protection & control, alarms, SCADA, and telecommunication connections. The scope also includes the and transportation of removed equipment to a local LUMA site.

Substation Yard:

- Install one (1) new 67/90/112MVA 115/38kV delta-wye transformer. The transformer will include a Load Tap Changer (LTC), two (2) sets of bushing CTs, and surge arresters.
- Install one (1) new 46kV 3000A 40KAIC circuit breaker on the existing concrete pad.
- Install one (1) new 46kV 3000A manual operated ganged disconnect switch in the existing 38kV structure.
- Upgrade transformer low side conductors to 1192 ACSR with three (3) conductors per phase from the new transformer to the existing 38kV structure.
- Upgrade existing 38kV main bus to 3" copper bus.
- Install grounding connections for the new 115/38kV transformer, 38kV circuit breaker, and 38kV disconnect switch. The new equipment will be connected to the existing ground grid.
- Install new cables for protection, metering, and alarms from the new transformer to the existing control enclosure. Existing conduits will be reused where feasible.
- Install new cables for control, protection, metering, and alarms from the new circuit breaker to the existing control enclosure. Existing conduits will be reused where feasible.
- Extend the existing transformer pad to accommodate the new transformer.
- Install a new oil containment pit with an oil stop valve.
- Install 48 feet wide by 22 feet high (approximate dimensions) firewall.
- Removal and transportation of existing 56MVA transformer, 1200A 46kV circuit breaker, and 1200A 46kV disconnect switch. Equipment will be transported to a local LUMA warehouse facility.
- Clearance sequencing is required and shall be coordinated with LUMA.
- Protection and Control (to be installed in existing Control Enclosure):
 - Install one (1) new 115/38kV transformer protection relay panel.
 - Existing panel 6R – two (2) SEL-487E
 - Install one (1) new 38kV circuit breaker protection relay panel.
 - Existing Panel 7R – one (1) SEL-451

System reliability and planning studies will also be performed to identify improvements at this facility, including transmission lines sectionalizing, transformer protection, reactive power compensation, and reconfiguring the switchyard's electrical bus.

Executing this SOW as a mitigation proposal will ensure the terminal and/or point of Interconnection Is of design and capacity to accept the forecasted capacity provided by the renewable generation to provide primary and redundant sources of generation as part of an overall Grid focused strategy to establish, maintain and restore electrical service before, during and after a storm or other natural disaster or event. The PR Grid Interconnection points will be designed and constructed in alignment with the current LUMA Strategy for grid stability, resilience, and operational flexibilities.



The final SOW (plans and specifications) will be completed by Q2 2023 and construction work will be completed by 2024.

Type of Project

1. **Restoration to Codes/Standards:** Restores the facility(s) to pre-disaster function and approved codes/standards
2. **Improved Project:** Restores the pre-disaster function of the facility(s) and incorporates improvements including any:
 - a. Other improvements, not required by codes and standards
 - b. Changes in facility size, capacity, dimension, or footprint
3. **Alternate Project:** Does not restore the pre-disaster function of the damaged facility(s)

Choose One (Restoration, Improved, or Alternate)

If improved, provide the changes in facility size, capacity, dimension, or footprint. If alternate, provide the rationale for the recommendation.

Improved Project

This work is to comply with FEMA (Public Assistance Alternative Procedures (Section 428) Guide for Permanent Work FEMA-4339-DR-PR February 2020)

Note: If preliminary A&E work has not been completed, the type of work designation is considered initial and is based on currently available information. The type of work designation may be revised based on the results of the completed preliminary A&E work.

Preliminary Engineering

Is architectural and engineering funding required to help define the intended scope of work?

Yes

Codes and Standards

Which of the following codes, specifications, and standards apply to the restoration, replacement, relocation, or alternate scope of work?

The following will be referenced when applying specific codes, specifications, and standards to the project design:

1. Consensus-based codes, per FEMA (Public Assistance Alternative Procedures (Section 428) Guide for Permanent Work FEMA-4339-DR-PR February 2020).
2. Industry standards per FEMA Recovery Policy FP-104-009-5, Version 2, Implementing Section 20601 of the 2018 Bipartisan Budget Act through the Public Assistance Program.
3. FEMA Recovery Interim Policy FP-104-009-11 Version 2.1, Consensus-Based Codes, Specifications, and Standards for Public Assistance.



4. LUMA's latest Design Criteria Document (DCD) which aggregates the design considerations of the vast majority of the consensus-based codes, specifications, and standards listed in FEMA Recovery Interim Policy 104-009-11 Version 2.1 (December 20, 2019).

Codes, Specifications, and Standards

Yes If yes, describe how incorporated below.

Applicable codes and standards will be identified and incorporated into the plans and specifications.

Industry Standards

Yes If yes, describe how incorporated below.

Applicable industry standards will be identified and incorporated into the plans and specifications.
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Cost Estimate

Cost estimates to complete the work have been generated at a class 5 level, which is between -50% and +100% of the final project cost. The estimate includes materials, construction labor and equipment, engineering, permitting, management, and contingencies.

Estimated Budget for Architectural & Engineering Design:	\$7.1M
Estimated Budget for Construction & Procurement:	\$71.2M
Estimated Overall Budget for the Project:	\$78.3M



406 Hazard Mitigation Proposal

406 Mitigation Opportunity Scope of Work

The current SOW detailed above at the four sites Identified as requiring Network Upgrades Is being proposed for funding as a Hazard Mitigation approach. The approach consists of Grid upgrades and Improvements to existing Transmission and Substation Infrastructure for the purpose of incorporating additional clean power generation onto the PR Grid at key points of Interconnection that would directly impact Grid function and critical service reliability for areas Immediately surrounding the points of Interconnection and also the PR Grid at large.

Loss of electrical service due to declared and undeclared events poses a risk to community lifelines, first responder viability, and power grid equipment and assets. Damages sustained from loss of electrical service, as experienced from Hurricane Maria exacerbated the level of damages at key points In the system through drained control batteries, loss of command and control of system equipment, and protection schemes and cascading fault damages causing further damages and threats to property, the general public health and safety.

Incorporating these Network Upgrades as hazard mitigation measures to prevent future and similar damages from loss of electrical service such as described above will greatly enhance the reliability and resilience of the PR Grid. The mitigation measures can also directly affect the asset category infrastructure as well through the hardening of the asset against future and similar damages beyond the proposed SOW to maintain electrical service with upgraded and hardened components including structures, conductors, insulators and hardware. This hardened approach to the relative asset would be aligned with the mitigation strategy currently employed Island-wide on similar projects and would also be applicable and promote a hardened system for standard generation and load flows.

The proposal will be documented and supported with a Benefit-Cost Analysis (BCA).

406 Mitigation Opportunity Cost Estimate

Estimated Budget for Architectural & Engineering to Design:	\$7.1M
Estimated Budget for Construction and Procurement:	\$71.2M
Estimated Overall Budget for the Project:	\$78.3M

Note: If available, detailed engineering cost estimates will be included as an attachment.

Environmental & Historic Preservation (EHP) Requirements

EHP considerations will be identified and evaluated during the base design phase and submitted to FEMA for review. Requirements will be incorporated into the final design and construction documents to be approved by FEMA before construction activities.

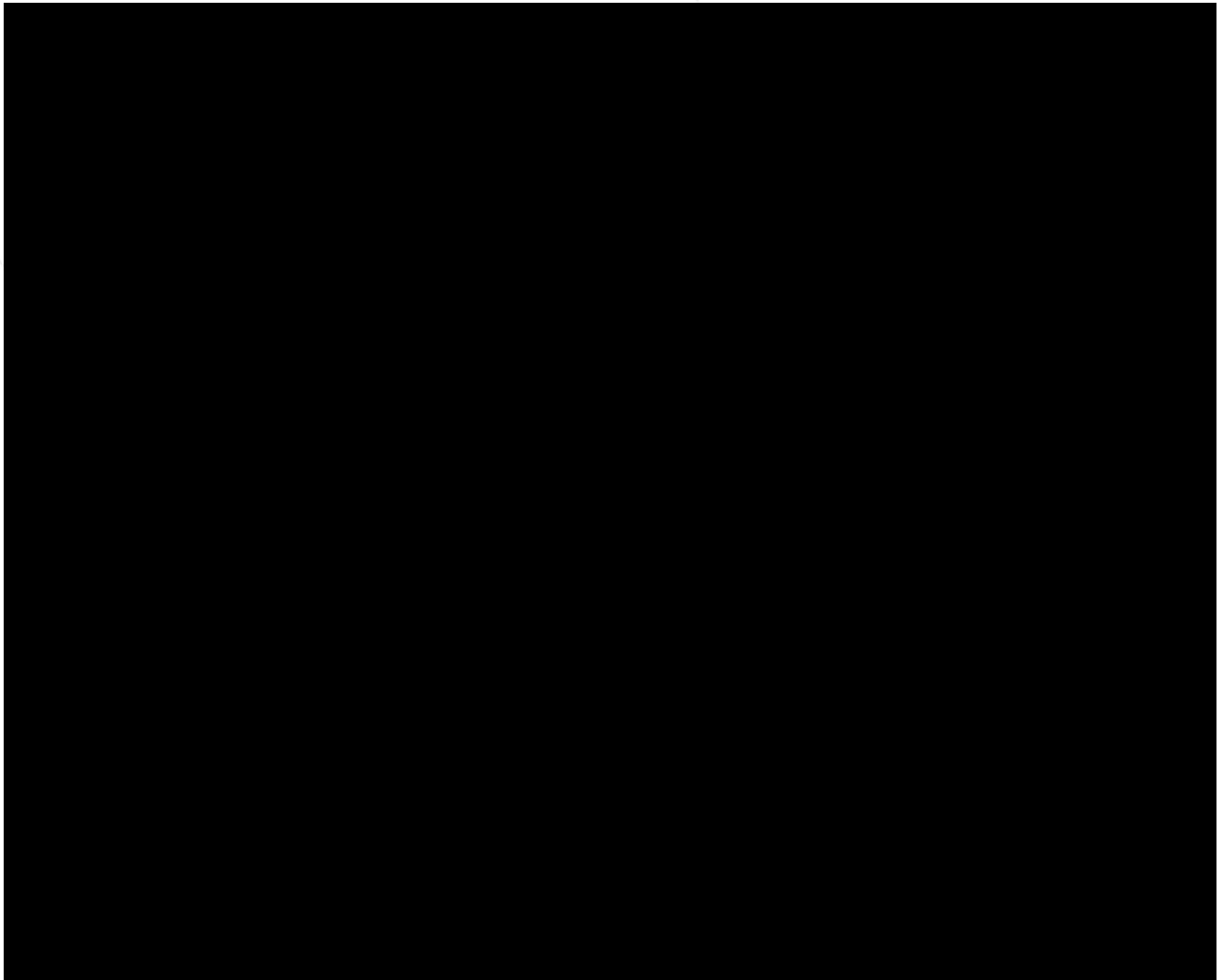


Attachments

Document Name	Description
<N/A>	Project Cost Estimates
<N/A>	Engineering Studies and Designs
Referenced Below	Location Maps and Site Picture

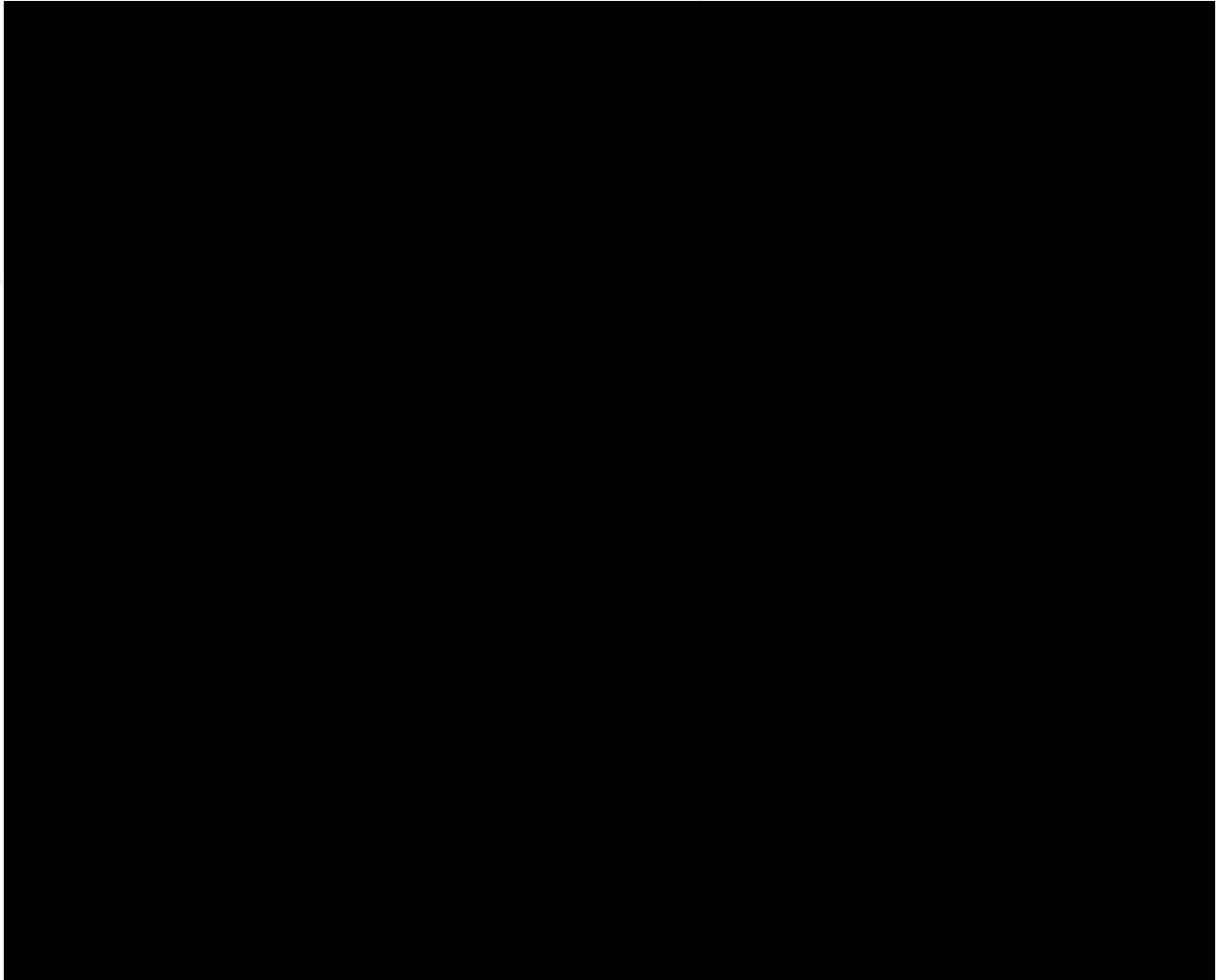


Aerial View 38KV LINE 700



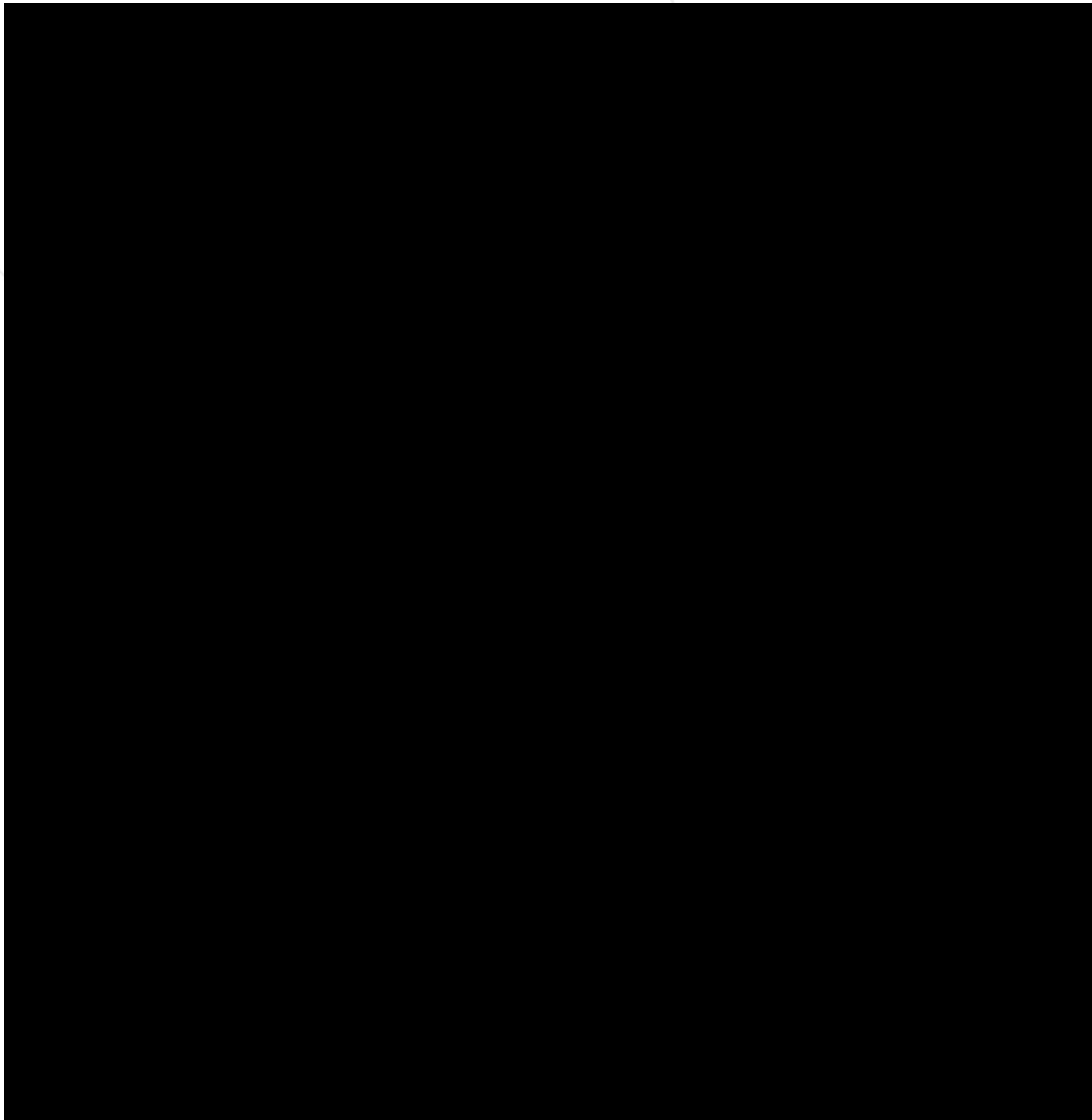


Aerial View 38KV LINE 4800





Aerial View 38KV LINE 9900





Aerial View 38KV LINE 9900

