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COMMONWEALTH OF PUERTO RICO
PUBLIC SERVICE REGULATORY BOARD
PUERTO RICO ENERGY BUREAU

IN RE: REVIEW OF THE PUERTO RICO ELECTRIC POWER AUTHORITY'S COMPREHENSIVE VEGETATION MANAGEMENT PLAN	**CASE NO. NEPR-MI-2019-0005** SUBJECT: Submission of LUMA's Updated Vegetation Management Plan

MOTION SUBMITTING LUMA'S UPDATED VEGETATION MANAGEMENT PLAN

TO THE HONORABLE PUERTO RICO ENERGY BUREAU:

COME NOW LUMA Energy, LLC ("ManagementCo"), and **LUMA Energy ServCo, LLC** ("ServCo"), (jointly referred to as "LUMA"), through the undersigned counsel and respectfully state as follows:

I. Submission of LUMA's Updated Vegetation Management Plan

1. On December 31, 2020, the Puerto Rico Energy Bureau ("Energy Bureau") issued a Resolution and Order that initiated the captioned proceeding to evaluate the Comprehensive Vegetation Management Plan that LUMA shall develop pursuant to Section 4.2(h) of the Puerto Rico Transmission and Distribution System Operation and Maintenance Agreement ("OMA") ("December 31st Order"). The December 31st Order references Section 1.16 of Act No. 17-2019 and Section 4.2(h) of the OMA. *See* December 31st Resolution and Order at p. 1-2.

2. On April 11, 2021, LUMA filed before the Energy Bureau its *Petition Submitting LUMA's Vegetation Management Plan*, whereby LUMA submitted its Vegetation Management Plan, in accordance with the OMA (the "April 11th Motion"). LUMA's Vegetation Management Plan established the basis for transforming the Puerto Rico Electric Power Authority's ("PREPA") current practices into an effective and efficient Vegetation Management Program and provided

guidance for its management and organization. Further, it complied with Act No. 17-2019's public policy objective to create a vegetation management program, to provide safe, efficient, stable, and reliable power services in Puerto Rico in compliance with environmental laws, and to provide a better quality of life for Puerto Ricans.

3. On July 16, 2021, the Energy Bureau issued a Resolution and Order, scheduling a Technical Conference to discuss LUMA's Vegetation Management Plan on August 13, 2021. It also directed LUMA to file any additional information requested during the Technical Conference on or before August 18, 2021.

4. On August 13, 2021, the Technical Conference was held. During the same, the Energy Bureau entered a bench order requiring a sample time and timeline with estimates on budget allocations, the plan's implementation, an example of the cycles of work to be performed, and staffing resources available to perform vegetation management activities.

5. On August 18, 2021, LUMA filed a *Motion in Compliance with Bench Orders Issued during Virtual Technical Conference of August 13, 2021*. Therein, LUMA submitted a plan for implementing the Vegetation Management Plan, an estimate of budget expenditures per activity, additional information on staffing projections, and flow charts outlining the typical cadence of vegetation management work post-reclamation.

6. On October 25, 2023, LUMA received correspondence from the Central Office for Recovery, Reconstruction, and Resiliency of Puerto Rico ("COR3") stating that the Federal Emergency Management Agency ("FEMA") had provided input to LUMA's Vegetation Management Plan. FEMA pointed out the need for PREPA and LUMA to adhere to a vegetation management plan and provide maintenance, following industry standards.

7. LUMA has since incorporated several changes to address FEMA and COR3's petitions, as well as several *motu proprio* revisions that aim to update available data, improve reported accuracy, and reflect current knowledge in executing the Vegetation Management Plan.

8. Accordingly, LUMA respectfully submits its Updated Vegetation Management Plan as *Exhibit 1* to this Motion.

II. Hallmarks of LUMA's Updated Vegetation Management Plan

9. Generally, LUMA's updates to the Vegetation Management Plan revise previously included data, increase clarity in the language, and refine the accuracy and pertinency of what is included in the Vegetation Management Plan. Language has also been updated to reflect progress made since commencement. Likewise, with its revisions, LUMA aims to achieve greater levels of compliance and safety. Notable changes include:

a. Updated mileage information for the transmission and distribution lines and improved language for enhanced accuracy. See Exhibit 1, Section 1.

b. Updated the Stakeholder Management section. Id, Section 2.

c. Defined the measurable key performance indicators to evaluate the Vegetation Management Plan's effectiveness and support continued improvement, such as refining and adjusting monitoring, process, and execution. Id., Section 13.

d. Revised its Applicable Laws, Regulations, and Industry Standards section to include up-to-date and accurate lists of regulatory and government agencies and applicable regulations. Id, Section 3.

e. Added information on the Capital Vegetation Clearing organization, its role, the use of federal funding, and how it differs from Vegetation Maintenance to

reflect the creation of this new organization since its commencement. Id., Section 6.

f. Based on input from FEMA, incorporated an updated inventory of T&D lines, including quantity, type, and dimensions, and informed of the necessary minimum clearing distances. Id., Section 7.

g. Addressed FEMA's need for an Integrated Vegetation Management ("IVM") approach. Id., Section 8. The IVM approach will ensure continuous monitoring and control of the growth of vegetation that could encroach on the components of the T&D system.

h. An appendix on environmental conservation was added to substantially expand the details provided on this subject. Id., Appendix E.

i. An appendix on vegetation debris management was added to expand the details on this subject substantially. Id., Appendix F.

10. In addition, LUMA hereby informs that it is procuring a Work Management system that will be used for Vegetation work to track, plan accurately, and document work performed. Moreover, LUMA has established standard priority response levels across various types of work, including vegetation work. These levels define the expected response times based on the severity of the risk to safety or reliability. LUMA expects to track stakeholder requests and completion times in the Work Management system. The Work Management system is discussed in Section 13 of the Updated Vegetation Management Plan. *Id.*, Section 13.

WHEREFORE, LUMA respectfully requests that the Energy Bureau **receive and accept** the Updated Vegetation Management Plan included as Exhibit 1.

RESPECTFULLY SUBMITTED.

In San Juan, Puerto Rico, this 14th day of June 2024.

We hereby certify that I filed this Petition using the electronic filing system of this Energy Bureau and that we will send an electronic copy of this Motion to PREPA's Counsel, Alexis G. Rivera Medina, arivera@gmlex.net, and Mirelis Valle Cancel, mvalle@gmlex.net.

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Exhibit 1
Updated Vegetation Management Plan

Vegetation Management Plan

June 14, 2024

Executive Summary

As the operator of Puerto Rico's transmission and distribution system (T&D system), LUMA is responsible for rebuilding and modernizing Puerto Rico's electric grid, which includes clearing decades worth of hazardous and overgrown vegetation from coming into contact with the electric system. Such vegetation management efforts are a key component of Prudent Utility Practice. Effective vegetation management is vital to improving safety, reducing interruptions, strengthening overall system reliability, as well as ensuring the effective daily operation of the T&D system for the benefit of our customers, communities, and local environment.

Since assuming operations in June 2021, LUMA has made significant progress, including:

- Clearing hazardous and overgrown vegetation from over 4,500 miles of power lines and 100% of Puerto Rico's approximately 300 electric substation sites;
- Installing over 8,400 automated and protection devices that can remotely detect service interruptions and reduce the size and duration of outages for customers, resulting in the reduction of 100 million minutes of service interruptions experienced by customers during the second quarter of fiscal year 2024; and
- Repairing or replacing over 11,500 poles with infrastructure that can withstand up to 160 mile-per-hour wind gusts.

To address the effects of overgrown vegetation, which is the leading cause of outages across Puerto Rico, LUMA remains focused on building on its past efforts and continuing to take actions that will reduce vegetation-related outages, even as we continue to prioritize environmental stewardship to protect Puerto Rico's unique and diverse environment and natural habitats. As part of these efforts, we work with trained environmental experts, including certified arborists, who carefully review and assess environmental conditions to ensure we're only clearing high-risk vegetation that poses a threat to the reliability of the electric system. We are also partnering with environmental groups to minimize the impact of vegetation work in locations where there are known populations of sensitive, threatened, or endangered plant and animal species.

To help ensure we are operating openly and cooperatively with our many partners on these important vegetation management efforts, LUMA continues to work closely with mayors, municipalities, and other important stakeholders to appraise them of our programmatic efforts, communicate our progress, and share important updates on any potential impacts to our customers in connection with this important reliability work. All these local efforts reflect our belief that programmatic and operational success must and should involve leaders and agencies across Puerto Rico, as well as federal agencies.

To ensure we are prioritizing environment and programmatic success, LUMA complies with all applicable local and federal laws and regulations, including compliance with strict processes established by the Federal Emergency Management Agency (FEMA), the Puerto Rico Department of Natural and Environmental Resources, and the U.S. Fish and Wildlife Services, as well as meeting industry best practices from the American National Standard Institute (ANSI) and the National Electric Safety Code (NESC).

Vegetation Management Plan

Operationally, all of us at LUMA remain focused on ensuring that our vegetation program efforts are effectively communicated with our customers while prioritizing public and worker safety as this important vegetation work is completed. LUMA's vegetation management operations will continue to work under the highest safety standards for our crews, contractors, customers, and communities as we continue to build the more reliable energy system that all our 1.5 million customers can depend on for generations to come.

Contents

Tables & Figures

1.0 Introduction

Effective management of vegetation in and near electric utility infrastructure and in utility easements is critical for the safety of electrical workers and the public. It is also crucial for the reliable and resilient delivery of electric service. Consistent with these statements, and pursuant to the laws, regulations, and relevant industry standards, the Puerto Rico Transmission and Distribution System Operations and Maintenance Agreement dated June 22, 2020 (O&M Agreement or T&D OMA) in Section 4.2(h), Annex I, Section II(A)(10), and Table 2-Handover Checklist in Annex II, calls for a plan to identify and establish the personnel, equipment, functions, processes, and procedures necessary for an effective vegetation management process. As part of LUMA's work prior to submitting the bid in November 2020 and during the Front-End Transition (FET), LUMA developed a Vegetation Management Plan (VMP) which was filed with the Puerto Rico Energy Bureau (PREB) on April 11, 2021. Since that time, LUMA has made considerable progress toward maintaining and clearing vegetation from electric infrastructure to improve safety and reliability in providing electric power services for the people of Puerto Rico. The following are some highlights of the work completed to date.

Clearing Vegetation from All Substations

There are approximately 300 electric substation sites in the Puerto Rico Energy Power Authority's (PREPA) transmission and distribution system (T&D system). Electric substations are the "nodes" in the T&D system and serve a critical role in providing electric service to customers. When equipment at an electric substation is damaged or de-energized, thousands of customers can be impacted at once. When LUMA began operating the T&D system in June 2021, many of the substations were completely overgrown with vegetation. Shrubs and small trees had grown as high as the perimeter fencing. Vines had reached the tops of some energized equipment and served as a potential path for electric current from the equipment to the ground.

One of the first vegetation clearing activities undertaken by LUMA was the removal of hazardous vegetation from all substations. Contract vegetation clearing crews carefully cut down tall vegetation and shrubs and cleared lower-growing vegetation to enable safe access to the critical infrastructure. In some cases, planned outages were scheduled to ensure vegetation growing on and around electric equipment could be removed safely. Lower-growing vegetation was also removed. The resulting debris, estimated at 30 tons, was taken to local composting facilities for disposal. By April 2022, all 300 substation sites had been cleared of vegetation.

To ensure these substations do not return to their pre-commencement state, LUMA has been evaluating conditions in the substations and adjusting maintenance intervals to determine the optimal maintenance cycle. As of May 1, 2024, all 300 substation sites have been maintained at least five times since the initial clearing in 2022.

Clearing Vegetation from Transmission and Distribution Lines

PREPA's distribution system includes over 13,000 miles of primary voltage distribution lines and 2,640 miles of transmission lines. Vegetation-caused outages on the distribution system directly impact customer reliability, whereas vegetation-caused outages on the transmission system impact both the overall stability of the T&D system and customer reliability. When LUMA began operations of the T&D system, the easements and rights-of-way (ROW) at all voltage levels were overgrown and had not been

properly maintained under the prior operator. As a result, vegetation contributes to more than half of the outages in Puerto Rico.

During Fiscal Year 2022 (FY2022), LUMA focused its vegetation clearing work on responding to immediate threats to the T&D system and recovering from vegetation-caused outages. Through this work, about 930 miles of T&D lines were cleared of vegetation. In Fiscal Year 2023 (FY2023), LUMA began performing more planned clearing of the T&D system, with a focus on lines with the greatest impact on customer reliability. LUMA also established a capital vegetation clearing department in FY2023, utilizing federal funds to clear vegetation post-Fiona. As a result of these activities, LUMA cleared over 2,400 miles of T&D lines in FY2023, using a combination of federal funding and the LUMA operations budget. As of May 1, 2024, an additional 1,260 miles of T&D lines have been cleared of vegetation in FY2024.

Overall, over 4,500 miles of T&D lines have been cleared since commencement.

Federal Funding – Vegetation Safety and Reliability Initiative

While progress has been made toward fully remediating the T&D easements of hazardous vegetation, more significant actions were necessary to address the ongoing effects of vegetation on the electric grid. To undertake a more system-wide effort, LUMA's FEMA-funded Vegetation Safety and Reliability Initiative was launched in 2024. It will use the latest vegetation management practices to clear vegetation from rights-of-way from over 16,000 miles of powerlines, poles, substations, and other electric equipment by the end of FY2027.

The Vegetation Safety and Reliability Initiative is the culmination of efforts that started in FY2023 when LUMA began pursuing additional federal funding to implement an island-wide remediation of the hazardous vegetation conditions from over 16,000 miles of T&D easements. In April 2023, LUMA submitted an Initial Scope of Work (ISOW) to the Federal Emergency Management Agency (FEMA) for $1.2B in funding to perform this work. Then, in June 2023, the first Detailed Scope of Work (DSOW) was submitted. A request for proposal (RFP) has also been issued to secure contract vegetation clearing crews to perform the work.

This FEMA-funded vegetation program and the subsequent ongoing maintenance of the rights-of-way will be performed in a manner consistent with the principles outlined in this VMP.

Vegetation Management Plan Background

The Puerto Rico Transmission and Distribution System Operations and Maintenance Agreement dated June 22, 2020 (O&M Agreement or T&D OMA) Section 4.2(h), Annex I, Section II(A)(10), and Table 2-Handover Checklist in Annex II, calls for a plan to identify and establish the personnel, equipment, functions, processes, and procedures necessary for an effective vegetation management process. As part of LUMA's work prior to submitting the bid in November 2020 and during the Front-End Transition (FET), LUMA developed a Vegetation Management Plan (VMP); which was filed with the Puerto Rico Energy Bureau (PREB) on April 11, 2021. Serving as the overarching management tool for planning and executing all vegetation management and clearing activities across the T&D system that serves LUMA's customers, the VMP acknowledges (1) the critical role that electricity plays in Puerto Rico's security, safety, economy, and welfare, (2) PREPA's, and therefore, LUMA's responsibility to provide safe, reliable electric service to its customers, and (3) the major role that tree-conductor conflicts have played in causing faults and interruptions on the system and subsequent outages to these customers.

Two perspectives are presented in this plan:

- Vegetation Management, a strategic approach, is used to describe the elements and functions in LUMA's Vegetation Management and Capital Clearing Implementation Program moving forward; and,
- Vegetation Maintenance and Clearing, providing the tactical context, and describing the control methods and practices required to execute the Vegetation Management strategy.

This Plan provides the roadmap for implementing an effective and efficient Vegetation Management, Clearing and Maintenance Program, with the goal of revamping and enhancing Vegetation Management activities to support the overall sustainability and reliability of electric service in Puerto Rico.

The VMP is based on LUMA's current assessment of the customer priorities and the vegetation management activities that can be taken to meet the needs of our customers. The VMP will be periodically revised based on new information and progress made as LUMA implements vegetation clearing and maintenance activities on the T&D System. The dynamic nature of this plan will be indicative of LUMA's commitment to continuous improvement.

2.0 Stakeholder Engagement

The relationship between LUMA's VMP and key stakeholders is a critical success factor in capturing the benefits inherent in this VMP. Implementation of the various actions and initiatives stated or inferred in the following sections require careful balancing of attention to the seemingly separate, yet sometimes competing, perspectives of these stakeholders. LUMA has and will continue to build relationships with an array of stakeholders as part of the ongoing implementation of this plan. Specific areas addressed in this plan are:

- Federal Agencies
- Government of Puerto Rico Agencies
- Puerto Rico Environmental Non-Governmental Organizations
- Local Municipalities
- Professional Associations or "Green Industry" Trade Groups
- Private Sector Stakeholders
- Academic Institutions
- Customer and Public Relations
- Puerto Rico's Environmental and Cultural Resources
- Commitment to Public Interaction, Demonstration of Stewardship, and VMP Sustainability
- Recognition Programs

2.1 Federal Agencies

As part of our commitment to implementing effective vegetation management and maintenance plans and engaging appropriate parties, LUMA considers and consults with federal agency stakeholders.

2.1.1 USDA Forest Services

The USDA Forest Service has three (3) distinct natural programs with differing objectives and all three (3) are of relevance to LUMA: National Forest System, Research and Development, and State, Private, and Tribal Forestry:[1]

- **The National Forest System** – The El Yunque National Forest (previously named Caribbean National Forest) is in northeastern Puerto Rico and is the only tropical rain forest in the National Forest System. It includes approximately 29,000 acres, and El Yunque Peak, which is 3,540 feet above sea level, is one of the highest peaks in Puerto Rico. The communication tower constructed on El Yunque Peak in 1981 is of paramount importance to all emergency responders. It is, therefore, a high priority for access and power restoration following an outage. The El Yunque National Forest is noted for its biodiversity, including 150 fern species and 240 tree species (88 of which are endemic or rare, and 23 found exclusively in this forest). While it has no large wildlife species, it has hundreds of smaller animals, many of which exist nowhere else on the planet. Thirty-five percent (35%) of the El Yunque National Forest is designated as a wilderness area with an area bounded by the Rio Mameyes, Rio de la Mina, and Rio Icacos rivers as components of the National Wild and Scenic Rivers System. Vegetation maintenance in this area will require proactive engagement with the El Yunque National Forest staff. The designated boundaries average one-quarter mile on either bank, and water quality is protected by the Wild and Scenic Rivers Act of October 2, 1968, as amended, 16 U.S.C Chap. 28. Other factors that impact Vegetation Management, Clearing, and Maintenance activities in this forest include:
    - **Negative Impact**
        - Highway 191 through the forest was closed in 1970 due to a major landslide. After 22 years of continuous efforts to reopen this highway, the National Forest Service concluded that the soils are highly unstable and withdrew any support to reopen it. A transmission line follows this corridor.
    - **Positive Impact**
        - In July 2020, the United States Department of Agriculture (USDA) Forest Service issued a final rule to update the agency's special-use regulations to increase the productivity of national forests and grasslands. The final rule modifies procedures for operating plans and agreements for vegetation management within and along the powerline rights-of-way, 36 CFR Part 251 et seq. The revised rule intends to promote the reliability of the United States' electrical grid and reduce the threat of damage to powerline facilities, natural resources, and nearby communities. It accomplishes this by streamlining the approval for routine and emergency vegetation management to remove or prune hazard trees on national forest lands within the linear boundary of special use authorization for a powerline facility and on abutting national forest lands.

U.S. Department of Agriculture Forest Service, *National Programs and Offices* [website], www.fs.usda.gov/about-agency/national-programs-offices, (accessed 3 January 2024).

- **Research and Development**

There are two (2) areas of particular importance to LUMA's VMP:

- Luquillo Experimental Forest / El Verde Field Station, USDA Forest Service, Rio Grande, Puerto Rico: The El Verde research station was founded in 1940, and the Luquillo Experimental Forest was designated as a United National Educational, Scientific and Cultural Organization (UNESCO) Biosphere Reserve in 1976. With over 2,500 research studies having been performed here, the research scientists and administrators are resistant to any development or disturbance that fragments the forest ecosystem.
- International Institute of Tropical Forestry (IITF), USDA Forest Service, Rio Piedras Puerto Rico: IITF Research and Development (R&D) includes a body of research scientists that conduct research and collaborate with other research scientists around the world in tropical forestry. There is a vast body of information that is of value to LUMA's VMP, including trees, vines, ground cover, soils, hydrology, climate change, wildlife, ecology, forest products and wood utilization.

In both instances, there will be opportunities to collaborate with research scientists on the efficacy of vegetation management techniques employed both within the boundaries of the Experimental Forest and elsewhere on the island.

State and Private Forestry – IITF, USDA Forest Service, Rio Piedras Puerto Rico, S&PF, includes a portfolio of programs that provide technical and financial assistance to the Puerto Rico Department of Natural and Environmental Resources (DNER), universities, and non-profit organizations throughout Puerto Rico. Through targeted technical knowledge, financial assistance, and conservation education, federal resources have been leveraged to protect and support the sustainable management of the islands' forests and ecosystems to produce goods and services important to many communities. A partnership with the urban forestry, forest stewardship and nursery (Reforestation, Nursery and Genetic Resources) programs could result in enhanced environmental urban and rural reforestation, habit development, creation of "green" jobs and income, and conservation education.

2.1.2 USDA Natural Resource Conservation Service

USDA Natural Resource Conservation Service (NRCS) offers financial and technical assistance to agricultural producers in making and maintaining improvements to their land through conservation practices, activities, and other enhancements. They offer two (2) programs that offer partnership opportunities for LUMA's VMP:

- The Environmental Quality Incentives Program (EQIP) provides financial and technical assistance to agricultural producers, addressing natural resource concerns and delivering environmental benefits (e.g., improved water and air quality, conserved ground and surface water, increased soil health and reduced soil erosion, and sedimentation, and improved/created wildlife habitat).[2]
- The Healthy Forests Reserve Program (HFRP) assists landowners in restoring, enhancing, and protecting forestland resources on private and tribal lands through the provision of easements

[2] U.S. Department of Agriculture Natural Resources Conservation Service, *Environmental Quality Incentives Program (EQIP)* [website], www.nrcs.usda.gov/programs-initiatives/eqip-environmental-quality-incentives, (accessed 3 January 2024).

and financial assistance. Through HRFP, landowners promote the recovery of endangered or threatened species, improve plant and animal biodiversity, and enhance carbon sequestration.[3]

LUMA will evaluate opportunities to partner with the NRCS that can support the development of strategies for vegetation maintenance work in areas of agricultural land use. The agency works directly with farmers and can help inform decisions based on an understanding of their needs.

2.1.3 US Fish and Wildlife Service

The mission of the US Fish and Wildlife Service (USFWS) is to support the conservation, protection and enhancement of fish, wildlife, and plants and their habitats for the continuing benefit of the American people. The portfolio of programs and conservation issues they manage are diverse and of relevance to LUMA. This includes but is not limited to agriculture, aquatic habitat connectivity, climate resiliency, energy security, landscape conservation design, state wildlife action plans, urban conservation, and endangered species. The USFWS plays a pivotal role in implementing the Endangered Species Act (ESA) (16 USC 1531 et seq.) in collaboration with states, private landowners, nongovernmental organizations, and other federal agencies, thus conserving endangered and threatened species of fish, wildlife, and plants, an act with which LUMA will comply.

In Puerto Rico, the Caribbean Ecological Services Field Office is in Boquerón, and the Puerto Rican parrot aviary (a sub-office) is located within El Yunque National Forest. Formal research efforts to save the endangered Puerto Rican parrot by the USFWS, USDA Forest Service, and the Commonwealth began in 1968. This field office emphasizes an ecosystem approach through partnerships and there will be opportunities for LUMA to partner with staff in the field office.

Because of the USFWS' role in implementing ESA, LUMA has, and will continue to consult with its staff to evaluate and address concerns regarding the potential impacts of vegetation management on wildlife. The survival of the Puerto Rican parrot is a national priority. There are other threatened and endangered species throughout Puerto Rico.

USFWS manages an unparalleled network of public lands and waters called the National Wildlife Refuge System. There are five (5) National Wildlife Refuges across the island of Puerto Rico which are: Cabo Rojo National Wildlife Refuge, Culebra National Wildlife Refuge, Desecheo National Wildlife Refuge, Laguna Cartagena National Wildlife Refuge, Vieques National Wildlife Refuge. The refuges are established to serve a statutory purpose that targets the conservation of native species dependent on its lands and water. All activities on those acres are reviewed for compatibility with this statutory purpose.

2.1.4 Environmental Protection Agency

The mission of the United States Environmental Protection Agency (EPA) is to protect human health and the environment, as they are the lead agency with statutory authority to implement the major federal environmental laws, including the Clean Water Act of October 1972 as amended, 33 U.S.C. §1251 et seq. (1972) (CWA), and the Federal Insecticide, Fungicide and Rodenticide Act, 7 U.S.C. §136 et seq. (1996) (FIFRA). EPA regulates various provisions of the CWA, including Section 402, 33 U.S. Code § 1342, which regulates storm water discharges associated with industrial activities under the National Pollutant Discharge Elimination System (NPDES) which applies to certain activities that disturb land more than

[3] U.S. Department of Agriculture Natural Resources Conservation Service, *Healthy Forests Reserve Program (HFRP)* [website], www.nrcs.usda.gov/programs-initiatives/hfrp-healthy-frests-reserve-program, (accessed 3 January 2024).

specified thresholds to control discharges into waters of the U.S. The CWA also includes Section 311, 33 U.S.C. § 1321, which requires the prevention of oil discharges to navigable waters or adjoining shorelines. LUMA will meet the requirements under these provisions when applicable. EPA also regulates the FIFRA, covering the manufacture, sale, and use of all pesticides. They also gather health, safety, and exposure data regarding toxic substances.

Any use of EPA-registered herbicides as part of LUMA's vegetation management operations will be in full compliance with FIFRA and all applicable laws and regulations.

2.1.5 US Department of Labor

The United States Department of Labor (DOL) administers federal labor laws to guarantee workers' rights to fair, safe, and healthy working conditions. Relevant to LUMA's VMP is the Occupational Safety and Health Administration (OSHA) that was created to assure safe and healthy working conditions for working men and women by establishing and enforcing standards and providing training, outreach, education, and assistance.

There are OSHA directives relating to vegetation management that are codified in OSHA 1910.269 (Electric Power Generation, T&D) and clarified in ANSI Z133. LUMA will meet both. Similarly, OSHA 1910. 331-335 establishes Minimum Approach Distances (MAD) for incidental work by qualified and nonqualified arborists that LUMA will also meet.

In Puerto Rico, the Puerto Rico Occupational Safety and Health Administration (PROSHA) is the local counterpart to OSHA.

2.2 Government of Puerto Rico Agencies

There are seven (7) agencies within the Government of Puerto Rico with whom LUMA Vegetation Management will continue to establish relationships.

2.2.1 Puerto Rico Department of Agriculture, Agrology and Agricultural Materials Laboratory

The Department of Agriculture is the agency that administers the FIFRA requirements as authorized by the Puerto Rico Pesticide Act, Act No. 49 of June 10, 1953, as amended, 5 L.P.R.A § 1001. This agency is responsible for registering pesticides for use in Puerto Rico, licensing applicators, establishing record-keeping requirements, and enforcement. LUMA's specifications, prescribed right-of-way treatments, and supervision of vegetation management operations will ensure that all such operations are performed in compliance with these regulations.

2.2.2 Department of Natural and Environmental Resources

The Puerto Rico DNER is the executive department of the government of Puerto Rico tasked with protecting, conserving, developing, and managing the natural and environmental resources in the U.S. Government of Puerto Rico. In the DNER organization, there are four (4) areas that are of significance to LUMA's VMP: Forest Service, Wildlife Division, Environmental Quality Board, and the Division of Forest Reserves and Refuges. Three (3) of the four (4) functional areas have a federal counterpart:

- The Puerto Rico Forest Service Bureau is a partner of the USDA Forest Service,
- The Wildlife Division is a Commonwealth partner to the United States Fish and Wildlife Service (USFWS), and,

- The Environmental Quality Board (EQB) is the local partner for the EPA.

To receive federal funds for local program implementation, a Puerto Rico Forest Action Plan (USDA Forest Service) and a Puerto Rico State Wildlife Action Plan (USFWS) are required according to 16 U.S.C. § 2101a.

2.2.3 DNER Forest Service Division

Two (2) programs administered by the DNER in cooperation with the USDA Forest Service are the Urban and Community Forestry (U&CF) and the Forest Stewardship Programs.

- The purpose of the U&CF Program is to provide technical and financial assistance to communities, public and private entities, and municipalities on the management of urban forest resources. Engagement with DNER on this program provides an opportunity as in many cases, the trees posing an unacceptable risk to the T&D system are in developed areas and part of Puerto Rico's urban forests.
- The purpose of the Forest Stewardship program is to provide technical assistance to private forest landowners to encourage and enable active, long-term, multiple-resource forest management.

The link to the Forest Action Plan is http://drna.pr.gov/wp-content/uploads/2016/12/SAP-2016-FINAL-9-15-2016-rev-ETI.compressed.pdf.

2.2.4 DNER Wildlife Division

The Wildlife Division includes the Natural Heritage Program, which has authority for habitat acquisition and a mandate to maintain a conservation data center for wildlife species of concern or critical elements. The conservation data center maintains maps of species distribution and provides technical assistance for using the data bank. Critical elements are not limited to federally or locally listed species. Some species, important to Puerto Rican heritage and culture, although abundant, are considered critical elements for this unit. This program is also in charge of identifying lands for conservation throughout the Island. The link to the Wildlife Action Plan is http://drna.pr.gov/wp-content/uploads/2015/10/PRSWAP-2015.pdf.

The Safe Harbor Program is a USFWS conservation strategy implemented by the DNER Wildlife Division to monitor and manage species of concern on private or non-federal lands. A Safe Harbor Agreement is a voluntary agreement involving private or other non-federal property owners whose actions contribute to the recovery of species listed as endangered or threatened under the ESA.

2.2.5 DNER Environmental Quality Board

As the Commonwealth's counterpart to the EPA, the EQB is concerned with any utility vegetation management (UVM) activities that impact stormwater runoff or otherwise may affect the environment.

2.2.6 DNER Division of Forest Reserves and Refuges

This Division provides management and oversight for Commonwealth nature preserves, parks, and forests. Any UVM within any of the areas or designated corridors between some of these protected areas will require consultation.

Engaging in discussions with the Secretary of the DNER and key staff fosters the development of effective working relationships with the Division heads within this Agency. It is important for LUMA to work

with DNER staff on matters of concern and including each Division head during the initial planning phases of LUMA's VMP to identify opportunities for possible collaboration.

2.2.7 Puerto Rico Industrial Development Company

The Puerto Rico Industrial Development Company (PRIDCO) is a government-owned corporation dedicated to promoting Puerto Rico as an investment destination for companies and industries worldwide. Since its establishment in 1942, PRIDCO has been a catalyst for Puerto Rico's economic development, leading its transformation from a traditional industrial economy to a knowledge-based economy. Their mission is to foster economic development by attracting investment and creating jobs within, among others, manufacturing, life sciences, information technology, aerospace, and export services.

LUMA may investigate opportunities to partner with PRIDCO to develop an incubator that utilizes wood waste from line-clearing operations to create value-added products, jobs, and income opportunities in both urban and rural settings. LUMA is also interested in exploring possibilities to collaborate with PRIDCO in the development of the green industry, a forest products industry, and a local industry to utilize the waste stream of woody debris removed from site clearing, and the creation of an infrastructure to pursue the global market of high-value tropical hardwoods.

2.3 Puerto Rico Environmental Non-Profit Organizations

LUMA is committed to working together with our non-governmental partners, including nonprofit groups and organizations, to further discuss and address issues, concerns, or questions regarding our Vegetation Management operations. Areas of mutual interest and opportunities to collaborate will arise and be factored into the overall Stakeholder Engagement strategy. Among the key groups that LUMA expects to engage are the following:

2.3.1 Para la Naturaleza (Part of The Puerto Rico Conservation Trust)

The Puerto Rico Conservation Trust is a private non-profit organization that currently manages 14 reserves (~13,000 acres) across the island. This entity monitors habitat as it relates to native habitat preservation and restoration and educates the public on the conservation of natural resources.

2.3.2 The Nature Conservancy – Caribbean Division

The Nature Conservancy (TNC) strives to create a sustainable future for Puerto Rico, where communities and nature can thrive together. The TNC works closely with local government and stakeholders using innovative tools and technologies to restore and preserve the vital ecosystems Puerto Ricans rely upon every day. It helps create a more resilient, secure future for nature and people. The TNC partners with the Puerto Rico Conservation Trust, which ultimately holds any easements acquired.

2.3.3 Centro para la Conservación del Paisaje

This entity develops projects to protect, conserve, restore, and positively transform the forest landscape with responsible management strategies for natural resources.

2.3.4 Cafi-Cultura Puertorriqueña

Cafi-Cultura Puertorriqueña, Inc., is a private educational non-profit organization incorporated in 2008 that provides rural communities of Puerto Rico opportunities to improve their quality of life and achieve social and economic justice through sustainable economic development of agriculture, tourism, historic and

natural preservation, and education. They have a volunteer base comprised of a team of professionals in agronomy, horticulture, economic development, conservation, Geographic Information Systems, and biology.

2.3.5 Organización Pro-Ambiente Sustentable

Organización Pro-Ambiente Sustentable Inc. is a non-profit organization founded in San Juan, Puerto Rico. Since 2005, it has managed international programs and certifications aimed at education towards sustainability and environmental protection in search of transforming Puerto Rico into a sustainable island. They provide certification of eco schools and develop specific activities to educate and promote behavioral changes within their communities. Their mission is to integrate initiatives aimed towards creating a sustainable Puerto Rico and increasing awareness among its citizens through environmental action programs that achieve a sustainable island. LUMA will consider opportunities to partner with this organization to advance the Arbor Day Foundation Tree Campus K-12 program at schools across the island.

2.3.6 Ciudadanos del Carso

Ciudadanos del Carso is a private non-profit organization whose mission is the acquisition of land, particularly in the karst region of Puerto Rico, for protection and conservation. This organization monitors habitat as it relates to native habitat preservation and restoration. Ciudadanos del Carso also educates the public on the conservation of natural resources and collaborates with other environmental organizations and government agencies on projects and studies related to the conservation of the karst region. This well-established stakeholder group has an interest in LUMA's activities in the karst region. When appropriate, LUMA intends to engage in discussions on topics of mutual interest to explore opportunities to achieve mutually aspired goals.

2.4 Local Municipalities

There are 78 municipalities in Puerto Rico. For many of these cities, entry into the Arbor Day Foundation Tree City USA program is the first step towards having an urban forestry program. The Municipality of Caguas has been a Tree City USA for the past 10 years, and although neither municipalities of Ponce nor Carolina are certified as a Tree City USA, they both have an agronomist with responsibility for urban trees on staff. Frequently, a limiting factor for municipalities to become a Tree City USA is meeting the standard of $2 per capita on tree maintenance. With the systematic approach to line clearance employed by LUMA, there may be a significant opportunity for LUMA to partner with the municipalities and the Puerto Rico DNER to obtain Tree City USA status.

2.5 Private Sector Stakeholders

The Private Sector offers unique opportunities to effect positive change in Puerto Rico's economy and establish goodwill between LUMA and local businesses.

2.5.1 Commercial Arborists

LUMA continues to engage with certified arborists to foster the profession and support safe work practices in proximity to energized lines, thereby making a positive change within the arboriculture industry in Puerto Rico. One such opportunity is presented by the Tree Care Industry Association (TCIA). It has been advancing tree care since 1938, providing tree care professionals with tools for everyday use to increase profits, lower training costs, retain quality employees, and remain a step ahead of continually

evolving regulatory issues. LUMA will evaluate if there are TCIA member companies operating in Puerto Rico with which to build relationships.

2.5.2 Puerto Rico Hardwoods

This organization is dedicated to bringing the finest hardwoods in the world from Puerto Rico to the market. Following the Hurricanes of 2017, Puerto Rico Hardwoods was a major player along with the USDA Forest Service - IITF in developing a plan for the management of waste wood and vegetative debris. Its goal is to salvage downed wood for economic development, build long-term capacity and expertise for managing and marketing logs and processing materials, and prevent waste from going into landfills.

LUMA is contacting sawmills, such as Puerto Rico Hardwoods, to establish potential partnerships. The remediation phase of this plan is likely to generate a significant volume of logs and other woody debris. We believe there may be opportunities for reuse of the debris and creating other products like woodchips, compost, and biochar.

2.6 Academic Institutions

There are several educational organizations with courses and specializations in topics relevant to LUMA's VMP. LUMA's plan will create demand for qualified personnel and there will be a need to train this new workforce. This creates opportunities for mutually beneficial partnerships between LUMA, the Arbor Day Foundation, and colleges and universities across Puerto Rico.

2.6.1 University of Puerto Rico, Mayagüez Campus

The University includes the College of Agriculture Science and the School of Horticulture, which teaches classes in urban forestry and arboriculture. This campus also hosts the Future Farmers of America, a body of environmental management students. Because of its academic role in providing urban forestry education, UPR Mayaguez should not only be a certified Tree Campus USA but should also lead the way for all other academic institutions of higher learning.

2.6.2 University of Puerto Rico, Rio Piedras Campus

This University includes the Department of Planning. LUMA plans to investigate the feasibility of a partnership with this department to develop plans for the utility corridors to function as more than just a utility corridor. It also represents an opportunity for LUMA to provide an educational opportunity for the next generation of urban professionals.

2.6.3 Universidad Ana G. Méndez, Turabo Campus

This campus is certified by the Arbor Day Foundation as a Tree Campus USA. In partnership with LUMA and the Arbor Day Foundation, the Universidad Ana G. Mendez, Turabo Campus could be held as an example of local environmental stewardship.

2.6.4 Interamericana University of Puerto Rico

This campus is certified by the Arbor Day Foundation as a Tree Campus USA.

2.6.5 Universidad Politécnica of Puerto Rico

This university includes the School of Architecture and Landscape Architecture. A partnership between LUMA's VMP and the Landscape Architecture program's design studios could develop conceptual designs for the utility corridors to function as linear elements for recreation, wildlife, and other functional and aesthetic uses. It is also an important opportunity for LUMA to provide an educational opportunity for the next generation of environmental leaders.

2.7 Customer and Public Relations

As part of LUMA's commitment to a sustainable approach to Integrated Vegetation Management (IVM), (refer to Section 4.0), LUMA will proactively engage with the people of Puerto Rico. This approach addresses four (4) key elements:

2.7.1 Public Transparency

LUMA is committed to informing the communities and customers it serves of the benefits and the importance vegetation management efforts may have on long-term energy system reliability. In doing so, it intends to engage with customers across the island to address questions and concerns.

2.7.2 Landowner Notification

As the operator of the transmission and distribution system on behalf of PREPA, LUMA is responsible for the safe and reliable delivery of energy and is committed to working with customers in its responsibility to maintain vegetation consistent with easements and other existing property owner agreements.

- LUMA makes every attempt to communicate with and notify customers about planned vegetation management activities in and around their property. Notification may be provided by a letter, phone call, door hanger, postcard or other means.
- While permission is not required for the removal of trees in operator owned easements, LUMA may contact customers before accessing their property.
- In emergency cases, LUMA may enter the easement without prior notification to the property owner. To ensure effective communication with customers, LUMA will maintain an inventory of the ownership of lands within the T&D system's ROWs to properly identify the areas where work needs to be performed and address any concerns related to accessing or impacting these lands.

2.7.3 Engagement of Stakeholders

LUMA values the input of community leaders and stakeholders and will consider their concerns regarding planned vegetation management activities. To the extent possible, LUMA will attempt to incorporate these perspectives into its strategic and annual planning process.

2.7.4 Commitment to Public Interaction, Demonstration of Stewardship, and VM Program Sustainability

This commitment is not just to communicate regarding planned maintenance activities, but to make information available that assists landowners and other stakeholders in understanding the purpose of the program, the methods that have been chosen, and how these methods are consistent with our goals for safety, reliability, and stewardship. LUMA develops materials that educate internal and external stakeholders on the benefits of IVM.

2.8 Puerto Rico's Environmental and Cultural Resources

Responsible care, management of Puerto Rico's environmental, and cultural resources are critically important aspects of any VMP. This stewardship represents a shared responsibility between LUMA and all the stakeholders and customers that LUMA serves.

2.8.1 Cultural Resources

Puerto Rico's cultural resources are rich and diverse, providing tangible remains of past human activities. These include buildings; structures; historic or prehistoric objects; rock inscriptions; earthworks, canals, or landscapes, often older than 50 years in age. From the masonry walls that fully encircled the city of San Juan by 1783, including the El Morro and Castillo San Cristóbal fortresses to the Cabo San Juan Lighthouse in Fajardo to the Taino Rock carvings or petroglyphs that can be found throughout the island, Puerto Rico has a wealth of cultural resources. LUMA's VMP seeks to be sensitive to these facts and takes measures to avoid adversely impacting protected cultural resources in accordance with applicable laws and regulations governing the protection and management of these resources.

2.8.2 Aesthetics of Vegetation Management

Puerto Rico is largely composed of mountainous and hilly terrain, with nearly one-fourth of the island covered by steep slopes. With the island's highest mountain range trending east-west and exceeding 3,000 feet above sea level, views of both the Atlantic and the Caribbean Sea are possible from many locations. Care will be taken to apply methods, appropriate for controlling vegetation in visually sensitive areas, including manual, mechanical, biological (for noxious weeds), and EPA-registered herbicide (spot and localized applications):

- The remediation phase of LUMA's VMP may result in visual impacts as overgrown easements are cleared of incompatible vegetation. This is a necessary first step in a process to reestablish conditions that can subsequently be managed using practices that reduce the visual impact of vegetation maintenance operations.
- LUMA will generally use broadcast foliar application registered by EPA and approved by the Agrological Laboratory of Puerto Rico EPA-registered herbicide as a follow-up to heavy mastication and mowing incompatible vegetation.
- LUMA can retain temporary visual buffers at road crossings, highways/visual overlooks, leave sufficient vegetation, where possible, to screen the view of the right-of-way during the remediation phase of the project. These visual buffers will be less significant once reasonably maintainable conditions are restored and the steady-state preventive maintenance phase of the project begins.
- The use of management zones within ROWs includes provisions that create a transition of plant forms, effectively softening the visual impact of a hard, straight-line ROW edge.

2.8.3 Threatened or Endangered Plant or Animal Species

For threatened or endangered (T&E) plant or animal species, LUMA will continue to:

- Control vegetation in locations with known populations of sensitive or T&E species by prescribing appropriate, biological, physical, and approved environmentally safe EPA-registered herbicide control methods that minimize the potential for adverse effects. LUMA intends to also consider practices that achieve our objectives and enhance the quality of critical habitat. These activities will be conducted in consultation with the USFWS, when applicable (see below).

- Consult with the USFWS staff at the Caribbean Field Office or the DNER Wildlife Division to determine whether any T&E species or designated T&E critical habitats are present in the project area.
- If T&E species or designated critical habitats are present in the project area, determine whether they are likely to be affected. If the project is likely to impact an area, but not adversely affect T&E species, obtain concurrence from the USFWS, or the DNER Wildlife Division as appropriate.
- If it is determined that the project is likely to adversely affect T&E species or their designated critical habitats, initiate formal consultation with the USFWS and follow measures developed to mitigate any such impacts.
- Apply mitigation measures (such as timing restrictions, or specific method use) resulting from the above consultations.
- Support training in flora and fauna listed species to enhance the capabilities of its field workers.
- Comply with any other applicable provisions of federal and Puerto Rico laws and regulations governing these protected species.

2.8.4 Steep or Unstable Slopes Topography

The topography of the main island of Puerto Rico is divided into three (3) major regions: the mountainous region, the coastal plains, and the northern karst region. The Cordillera Central Mountain range extends through the entire island trending east-west, dividing it into the northern and southern regions. The mountain region accounts for approximately 60 percent of the land area. The average elevation of the Cordillera Central Mountain range is above 3,400', which results in steep slopes down to the coastal plains.

The ecological diversity of Puerto Rico is reflected in the diversity of its soil. Ten of the 12 soil orders established by Soil Taxonomy, the official system of soil classification of the United States National Cooperative Soil Survey, are present in Puerto Rico.

For steep or unstable slopes, the following mitigation measures may be considered.

- Limit the use of methods that result in significant soil disturbance.
- Limit the use of ground-disturbing mechanical equipment to clear slopes by over 20 percent.
- Perform mechanical clearing when the ground is dry enough to sustain heavy equipment.
- Reseed or replant seedlings on slopes with potential erosion problems and/or take other erosion control measures, as necessary.
- All activities will be designed considering and in compliance with applicable laws and regulations governing the specific geographical area and natural resource present.

2.8.5 Spanned Canyons

Incompatible vegetation within a long transmission line spans from ridge to ridge where conductor clearance is sufficient to ensure no violation of Tolerance Levels (TL) nor exceeding Action Thresholds (AT) (as these terms are defined in Section 8.1 of this plan) will be retained.

2.8.6 Water Resources

Puerto Rico has lakes (none of them natural) and more than 50 rivers. Most of these rivers are born in the Cordillera Central, Puerto Rico's principal mountain range located across the center of the island. The rivers in the northern part of the island are longer with higher flow capacity than those in the south. The south is therefore drier and hotter than the north. These rivers make up 60 watersheds across the island,

where over 95 percent of the runoff returns to the sea. Water resources include wetlands, springs, rivers above ground, caves below ground, lakes, and lagoons.

The following considerations inform the development of site-specific vegetation maintenance prescriptions.

- Using selective methods within riparian zones that minimize disturbance.
- Using selective control methods that preserve non-target compatible vegetation.
- Retaining the physical structure of incompatible vegetation using control methods that eliminate incompatible trees biologically yet allow them to remain standing.
- Recognize before any discharge of dredge or fill of material (displaced soils, and in certain circumstances, vegetation debris) within a water of the U.S. that may be subject to Corps regulations, 33 C.F.R. Parts 320 to 332, or EPA regulations under the CWA, 33 U.S.C. §§ 1251-1387, as well as the DNER regulations, which LUMA will meet, as applicable.
- Notify appropriate government officials of any amount of EPA-registered herbicide, oil, or hazardous substances spilled in or near water.
- Consider climate, geology, and soil types in selecting the EPA-registered herbicide/adjuvant with lowest relative risk of migrating to water resources.
- When using EPA-registered herbicides/adjuvants, apply appropriate buffer zones to preclude the possibility of EPA-registered herbicide movement from the application site to adjoining water bodies.

2.8.7 Invasive Plant Species

Plant species can be identified as either native, endemic, exotic, naturalized, or invasive. Invasive species are those that grow or spread aggressively in their new environment and cause environmental and/or economic harm. LUMA's vegetation activities focused on mitigating the spread of these invasive plant seeds, with treatment prescriptions seeking to minimize ground disturbances. While natural regeneration of native or naturalized species may often be appropriate, introducing a seed stock of plant materials known to support pollinators and other wildlife may be preferred.

There is a body of scientific literature published by the Forest Service's IITF and the academic institutions of Puerto Rico that will provide site-specific information that would inform LUMA's efforts in this area.

2.9 Recognition Programs

LUMA's VMP, designed to achieve industry best performance will involve the support and collaboration of several internal and external stakeholders. A series of recognition programs, two (2) of which are presented herein, provide opportunities to assess and periodically guide refinements through the engagement of these important stakeholders:

- **Tree Line USA**, a program sponsored by the Arbor Day Foundation, recognizes best practices in public and private utility arboriculture, demonstrating how trees and utilities can co-exist for the benefit of the communities they serve. It encourages compliance with five (5) core standards: quality tree care, annual worker training, tree planting and public education, tree-based energy conservation program, and Arbor Day celebration and participation.
- **Right-of-Way Steward Accreditation**, a program offered by the Rights-of-way Stewardship Council, establishes standards for responsible right-of-way vegetation management along corridors. Its requirements, developed by a diverse group of stakeholders, reflect the highest standards for IVM and are available to support self-assessments and third-party audits.

3.0 Applicable Laws, Regulations, and Industry Standards

LUMA complies with all laws and regulations and adheres to industry standards and best practices. The following subsections discuss the principal Federal and Puerto Rico laws and regulations that may apply or have relevance to LUMA's Vegetation Management Program (VMP). This list is not meant to encompass all laws and regulations that may apply to all activities under this VMP, but rather highlight the principal laws and regulations that may apply to these types of activities. LUMA complies with these and all other laws and regulations that are applicable to the activities under this VMP as determined on a case-by-case basis.

The legal requirement to prepare this VMP arises from Section 1.16 of the Puerto Rico Energy Public Policy Act, Act No. 17-2019, as amended ((Act 17-2019), 22 L.P.R.A. § 1141o,, which requires LUMA as the operator of the T&D grid to prepare and present to the PREB a comprehensive VMP in accordance with industry best practices to protect the integrity of the grid, and that such Plan meet the requirements set forth in that section. Section 1.06.(5) of Act 17-2019 also declares an initial objective to establish priorities for the maintenance of the infrastructure of the electric system and create VMP. In addition, Section 6.3 (ww) of the Puerto Rico Energy Transformation and RELIEF Act, Act 57-2014, as amended, 22 L.P.R.A. § 1054b provides that the PREB will oversee the compliance of T&D Operator with a VMP in accordance with best practices in the industry to protect the grid.

3.1 Federal Agencies and Puerto Rico Agencies

Federal Agencies and their Puerto Rico counterparts and the laws and regulations they implement and may impact the Vegetation Management Program in Puerto Rico include:

3.1.1 USDA Forest Service and Puerto Rico Department of Natural and Environmental Resources DNER Forest Service

The following Forest Service laws and regulations apply to LUMA's VMP because distribution lines cross the El Yunque National Forest.

- Federal Lands Policy and Management Act of 1976, 43 U.S.C. §§1701-1785 https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd488457.pdf.
- ROW under Federal Land Policy and Management Act, 43 C.F.R. § 2801.2: https://www.ecfr.gov/current/title-43/subtitle-B/chapter-II/subchapter-B/part-2800
- Wild and Scenic Rivers Act, 16 USC Ch. 28 https://www.nps.gov/parkhistory/online_books/anps/anps_6f.htm
- Special Uses Authorization 36 CFR Part 251, Subpart B: https://www.ecfr.gov/current/title-36/chapter-II/part-251/subpart-B
- LUMA is in the renewal process of PREPA's US Forest Service Special Use Permit in connection with the distribution lines that pass through El Yunque National Forest. This application includes an Operating Plan governing the maintenance activities.
- PREPA has a lease, issued through authorization ID YNF2000, until December 31, 2049, for its microwave communications facility. The lease was issued by the USDA, Forest Service, as authorized by the Federal Land Policy and Management Act, 43 U.S.C. 1761 (a)(5).

The DNER's Forest Service is a partner of the USDA Forest Service. The DNER's Forest Service also oversees the implementation of laws and regulations governing Puerto Rico State Forests, including:

- Puerto Rico Forests Act, Act No. 133 of July 1, 1975, as amended, 12 L.P.R.A § 191, which establishes the public policy of Puerto Rico to protect, expand, and conserve the forest resources of Puerto Rico and creates the Forest Service within the DNER and its implementing regulations.
- DNER Regulation Number 6769, "Regulation of Special permits for the use of Communities and Buildings Associated with Electronic Systems of Communities in State Sorest."

LUMA will continue to meet requirements under these USDA Forest Service and DNER regulations and permits, as applicable to its activities under this VMP, as well as any other laws and regulations governing activities in forest areas that may be applicable to the activities under the VMP.

3.1.2 US Fish and Wildlife Service and Puerto Rico Department of Natural and Environmental Resources Wildlife Division

The purpose of the ESA, 16 USC Ch. 35, is to protect and recover imperiled species and the ecosystems upon which they depend. It is administered primarily by the U.S. Fish and Wildlife Service (see https://www.fws.gov/endangered/esa-library/pdf/ESAall.pdf). The Commonwealth partner for the USFWS is the DNER Wildlife Division. The ESA regulations are codified at 50 C.F.R. Part 402. The DNER has a local counterpart- New Puerto Rico Wildlife Law, Act No. 241 of August 15, 1999, 12 L.P.R.A. § 107. The following related regulations were issued by DNER under the Act:

- Regulations to Govern Vulnerable and Endangered Species in Commonwealth of Puerto Rico.
- Regulation Number 6766. The regulation objective includes the conservation and preservation of vulnerable or endangered species and the conservation of natural habitats.
- Regulation to Govern the Conservation and Management of Wildlife, Exotic Species and Hunting, Regulation Number 6765. The regulation objectives include the protection, conservation, and management of wildlife and the establishment of mechanisms for mitigation after natural habitat modifications.

LUMA will comply with these regulations in implementing this VMP, as applicable.

3.1.3 Environmental Protection Agency, Puerto Rico Department of Agriculture and Puerto Rico Department of Natural and Environmental Resources Environmental Quality Division

EPA is the federal agency that administers the major federal environmental laws, including the CWA and the FIFRA, which regulate the manufacturing, sale, and use of all pesticides and govern the application of EPA-registered herbicides. All EPA-registered herbicide applications performed by LUMA and/or its contractors will comply with FIFRA and LUMA's specifications, prescribed right-of-way treatments, and supervision of vegetation management operations will ensure that all such operations are performed in compliance with FIFRA. The Government of Puerto Rico's partner for the EPA regarding pesticides is the Puerto Rico Department of Agriculture, Agrology and Agricultural Materials Laboratory.

Under the CWA, some of the following provisions could be relevant to some activities under LUMA's VMP:

- Section 401 of the CWA, 33 U.S.C. § 1341, regulates discharges into navigable waters.

- Section 402 of the CWA, 33 U.S.C. § 1342, regulates storm water discharges associated with industrial activities under the NPDES.
- Section 404 of the CWA, 33 U.S.C. § 1344, regulates discharges of dredged or filled material into waters of the U.S. (primarily regulated by the U.S. Army Corps of Engineers).

The DNER's Puerto Rico Water Quality Standards Regulation, Regulation 9399, establishes water quality standards to sustain the designated uses of water bodies in Puerto Rico and establishes means for achieving the quality of the waters of Puerto Rico, among other things. A water quality certificate may be required as part of the permits required under the CWA provisions listed above.

LUMA will continue to meet the requirements under these CWA provisions and the Puerto Rico Water Quality Standards Regulation when applicable to its activities under this VMP.

3.1.4 US Department of Labor, Occupational Safety and Health Administration and Puerto Rico Department of Labor, Puerto Rico Occupational Safety and Health Administration

Occupational Safety and Health Standards (OSHA)1910.269 is directly applicable to utility line clearance tree work, including establishing MAD for qualified utility arborists and trainees. Similarly, OSHA 1910. 331-335 establish MAD for incidental work by qualified and nonqualified arborists. LUMA will comply with these, and other applicable requirements as may be promulgated by OSHA and PROSHA.

3.1.5 North American Electric Reliability Corporation and Federal Energy Regulatory Agency

The North American Electric Reliability Corporation (NERC) is a non-profit organization that works to assure the effective and efficient reduction of risks to the reliability and security of the electrical grid. To that end, NERC has developed Reliability Standards and FAC-003-4, specific to Transmission Vegetation Management. Federal Energy Regulatory Commission (FERC) has adopted this standard for application to the high voltage grid across North America. Though PREPA's transmission system is not connected to that grid (i.e., FAC-003.4 is not a regulatory requirement), LUMA's VMP for PREPA's 230 kV and 115 kV system will generally be aligned with the NERC standard.

3.1.6 The Puerto Rico Office of Permits Management (OGPE, by its acronym in Spanish)

The Planning Board Joint Regulation for the Evaluation and Issuance of Permits Related to Development, Land Use and Business Operations, Regulation Number 9473, contains requirements related to land use and development, including authorization requirements governing the cutting, trimming, uprooting, transplanting or planting of trees as well as certain earth disturbance activities that may be incidental to public works, among other things, which in some cases require permits from OGPE. Exemptions are provided for the following activities: cutting, trimming, and disengaging, which are conducted by PREPA as authorized by law.

3.1.7 Other Puerto Rico Laws and Regulations

There are other laws and regulations specific to Puerto Rico, not specifically listed above, that are related to the protection or management of natural resources, or the environment, which could potentially apply to activities under this VMP depending on the nature of the activities, geographic area and natural resources present at the area of the activities. LUMA will continue to comply with all requirements under these laws and regulations as determined applicable to specific activities undertaken on a case-by-case basis.

3.2 Industry Standards and Best Practices

LUMA's VMP seeks to incorporate the following industry standards and best practices:

- National Electric Safety Code, Rule 218 (2017), adopted by PREPA through Rule 7014.
- ANSI Z133 Safety Requirements for Arboricultural Operations (2017)
- ANSI A300 Tree, Shrub, and other Woody Plant Management- Standard Practices:
  - Part 1 Pruning (2017)
  - Part 7 IVM (2018)
  - Part 9 Tree Risk Assessment (2017)
- ISA Best Management Practices
  - Tree Pruning (2019)
  - Utility Pruning of Trees (2004)
  - Tree Risk Assessment (2017)
  - Utility Tree Risk Assessment (2020)
    - IVM (2021)
  - Closed Chain of Custody for EPA-registered herbicides in the UVM Industry (2011)
- Right-of-Way Stewardship Council
  - ROW Steward Technical Requirements (2016)

3.3 Right to Perform Work

3.3.1 Easements

As the operator of the transmission and distribution system on behalf of PREPA, LUMA follows all previous rules and regulations governing easements and land use in Puerto Rico. PREPA's Regulation for Easements of the Electric Power Authority, Regulation Number 7282, sets forth the process for the acquisition, establishment, constitution, and cancellation of easements for T&D powerlines, electric equipment, structures and other objects, and outlines the minimum requirements applicable as well as PREPA's rights to these easements. This regulation includes requirements governing the type of vegetation that may be planted within these easements and some of the activities and rights granted to PREPA related to vegetation management. Most of the T&D assets owned by PREPA are located within these easements, reflecting established standard easement widths that grant the right of occupancy and the right to perform vegetation maintenance work within the easement.

In some cases, LUMA may identify the need to widen the cleared corridor associated with portions of the transmission system. LUMA will make every attempt to communicate with affected owners and stakeholders and will seek to carry out necessary vegetation management activities with the consent of the fee or property owner. LUMA follows all applicable law under Regulation Number 7282 in working with affected owners and stakeholders.

Where formally recorded easements do not exist, the right to perform vegetation maintenance is acquired by prescriptive rights after the line has been in service for twenty years.

3.3.2 US Forest Service Special Use Permits

Special Use Permits establish the right of occupancy and the right to perform vegetation maintenance work on T&D lines on federal national forests, in this case, the El Yunque National Forest. As mentioned, PREPA has a special use permit for PREPA T&D lines and other PREPA structures within this forest.

LUMA will comply with the requirements of that permit as applicable to T&D structures. A new (revised) Rule was adopted by the Forest Service in 2020 to streamline the approval for routine and emergency vegetation management on NFS lands within the linear boundary of a special use authorization for a powerline facility and on abutting NFS lands to remove or prune hazard trees as defined in the final rule. The intent of the revised Rule is to promote the reliability of the United States' electrical grid and reduce the threat of damage to powerline facilities, natural resources, and nearby communities. LUMA will meet the applicable requirements under this rule and any laws and regulations affecting national forests.

4.0 Vegetation Management Vision, Policy, and Goals

4.1 Vision

LUMA continues to work every day to provide safe and effective management of vegetation while maintaining positive relationships with customers that may be impacted by these activities. We will apply methods based on the site and its needs, utilizing industry best practices and all scientific tree care research information available. In so doing, we seek to minimize impact to sensitive wildlife and plants, cultural resources, and other natural resources as much as possible, in line with federal and local conservation requirements, while ensuring the safe and reliable operation of the electric system.

4.2 Policy

The VMP outlines the steps and actions needed to support the delivery of reliable electric service in a safe and environmentally sound manner. Stewardship and sustainability will be achieved through use of IVM:

4.2.1 Stewardship and Sustainability

LUMA seeks to conduct all vegetation maintenance and management operations in a manner that exemplifies safety and sound environmental stewardship. LUMA's VMP recognizes the inherent risk of working on or in trees and related vegetation that could be electrified due to their proximity to power lines, and that achieving sustainability requires balancing both environmental and social aspects with safety and service reliability objectives:

- The safety of every employee, contractor, and customer is a LUMA core value. LUMA employees continually adopt a proactive approach toward accident prevention and work to establish and sustain a culture of safety first in the workplace.
- LUMA's VMP complies with all applicable environmental laws and regulations. All employees, from the officer level to the front line, are empowered and held accountable for compliance with an obligation to timely raise issues and concerns for resolution.
- All LUMA management, contractors, and employees are accountable for implementing, maintaining, measuring, and finding opportunities for continuous improvement of LUMA's safety and environmental programs.
- The Plan may go beyond regulatory requirements when such action benefits the environment and stakeholders, and we will support and participate in the design, development and establishment of sound public policy and educational initiatives that protect human health and the environment.

- As discussed in Section 2.0, customers, suppliers, and other stakeholders will be engaged in a constructive dialogue on environmental matters to achieve a healthy and safe environment for all.
- See Appendix E for the guidelines for environmental compliance.

4.2.2 Integrated Vegetation Management

LUMA employs the process of IVM to ensure that tall, growing trees and woody shrubs do not interfere with overhead T&D circuits. In doing so, we will balance the use of cultural, biological, physical, and environmentally safe EPA-registered herbicide-based methods for controlling incompatible tall growing woody species while at the same time promoting the establishment and growth of compatible low growing plant communities in the ROW. This vegetation management work may include spatial analysis, project-specific vegetation maintenance prescriptions, annual work plans, and condition assessment inspections to provide a framework for meeting tree-conductor clearance expectations.

4.3 Goals

In achieving this vision and executing this policy, the following goals define the framework under which LUMA's Vegetation Management Program will operate:

4.3.1 Reliable Electric Service

Across Puerto Rico, vegetation is the leading cause of outages, representing more than 50% of service interruptions throughout the island. LUMA's goal is to minimize customer service interruptions caused by trees and other vegetation across the island and improve system reliability and resiliency.

4.3.2 Safe Electric Service

Vegetation growing in conflict with energy delivery infrastructure requires periodic maintenance to ensure the safety of the public and to address any downed powerlines, or impediments to access for inspection, repair, and maintenance of facilities. Our goal is to continue reducing tree-conductor conflict and assure safe electric service for all our customers.

4.3.3 Worker Safety

LUMA is committed to ensuring the health and safety of all employees and community members across Puerto Rico. Each LUMA employee is trained in best practices to set forth in the company's safety and health programs and perform their duties in such a manner as to always ensure safety for themselves, their fellow employees, and the public.

All contract providers of vegetation services are required to establish their own company safety policies and guidelines. Safety policies, practices, and safety-related documentation is reviewed and considered in the contractor qualifications process and monitored as work is completed. Contractors are also required to comply with LUMA's established Health and Safety Terms and Conditions.

4.3.4 Cost-Effective Service

LUMA's goal is to perform work as efficiently and effectively as possible. LUMA employs qualified line clearance arborists and vegetation maintenance workers to perform the necessary work. Crews, equipment, and workload are managed to achieve a high level of productivity, quality, and safety.

4.3.5 Support Development of On-Island Capabilities

LUMA's VMP relies on industry standards and best practices. It emphasizes quality, efficiency, and effectiveness of work. To achieve this, we seek long-term, continuous job opportunities for vegetation management program staff and the vegetation maintenance workforce provided by contract service providers. We emphasize the recruitment and development of qualified individuals, support skills and knowledge-based training, operate a robust QA/QC program, and conduct competitive contracting for vegetation maintenance services.

4.3.6 Form Local Chapter of the International Society of Arboriculture

The International Society of Arboriculture (ISA) provides a worldwide network of tree care professionals, offering personal and professional development opportunities to the arboriculture industry and supporting local and regional arborists with networking and professional development opportunities relevant to specific locales. There are three (3) levels of membership available:

- Professional Membership is open to all individuals actively engaged in the arboriculture field and anyone interested in planting or preserving trees.
- Student Membership is free when they join their local chapter.
- Associate Membership is offered at a reduced membership fee to individuals whose country/province of residence does not use English as the official language.

Of particular interest is the ISA Certification (credentialing) Program, which confirms, through review of education training, industry experience, and successful passing of an exam, that individuals have the necessary knowledge and skills to properly care for trees, as well as portray a high level of dedication to the profession and the community that they serve. Specific certifications include:

- Certified Arborist
- Certified Arborist Utility Specialist
- Certified Arborist Municipal Specialist
- Certified Tree Worker Climber Specialist
- Certified Tree Worker Aerial Lift Specialist
- Certified Master Arborist

The umbrella ISA organization includes the Arborist Research and Education Academy, Society of Commercial Arboriculture, Society of Municipal Arboriculture, and Utility Arborist Association.

5.0 Critical Success Factors

Key factors in achieving the vision and strategic objectives for Vegetation Management include:

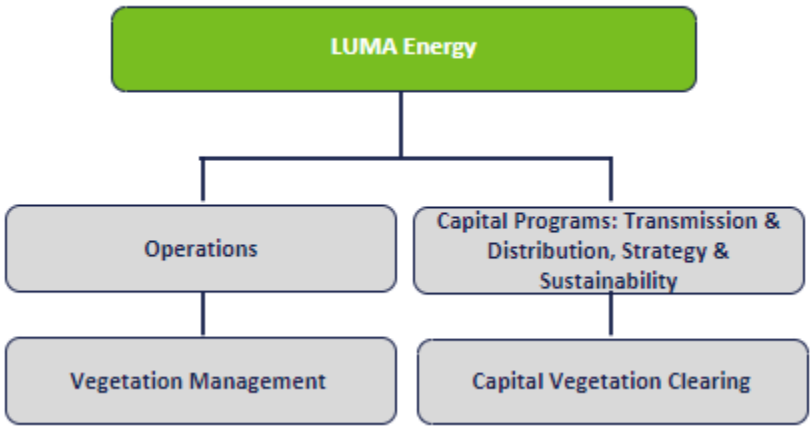
- Forming a specialized vegetation management team, staffed by trained professionals who can rapidly establish procedures and practices aimed at public safety and supporting a safe and efficient work environment.
- Receiving adequate funding to re-establish maintainable tree-conductor clearances on the T&D system (i.e., perform reactive maintenance and reclaim the ROWs).
- As appropriate tree-conductor clearances are re-established, shifting from a reactive and reclamation mode of operation to steady-state IVM, adhering to the processes and practices described in Sections 9.0 and 10.0 of this Plan.

- Fully deploying the principles of IVM (refer to Section 8.0) to provide sustainable management of vegetation over the long term rather than simply controlling vegetation currently in conflict with overhead lines.
- Using technical specifications based on industry standards and best management practices to establish vegetation management, clearing, and maintenance work expectations.
- Using formally established process flows to define standard approaches to efficiently manage and measure the performance of the various types of vegetation maintenance work.
- Implementing a field-enabled IT tool to manage vegetation clearing and maintenance work, including planning, scheduling, executing, and evaluating the effectiveness of vegetation clearing and maintenance activities. The data collected using this tool will support the calculation of resource requirements and budgets, based on quantitative estimates of the vegetation clearing and maintenance workload to be completed.

6.0 Vegetation Management Organization

As discussed in Section 12.0, LUMA's VMP consists of the initial remediation (i.e., capital clearing) of the easements/facilities followed by steady state preventive maintenance. To expedite the completion of the initial remediation phase, LUMA has established a capital project team to provide focused implementation of the remediation work. The Capital Vegetation Clearing team is located within the Capital Programs: Transmission & Distribution, Strategy & Sustainability organization. The Vegetation Management team located in the Operations organization is responsible for some initial remediation of easements as well as steady state preventive maintenance and responding to outages and customer requests. The high-level organizational structure is shown below:

Figure 6.0 Vegetation Management Organization Chart



A detailed organization chart for the Vegetation Management (VM) department within Operations is provided in Appendix D: Vegetation Management Organization Chart. The work of the VM department is funded by the VM O&M budget within Operations. The work of the VM department is expected to continue indefinitely past the remediation stage, as there will always be a need for vegetation maintenance to prevent regression back to the pre-remediated state. In addition to the personnel shown in Appendix D, the VM department utilizes qualified vegetation management contractors to perform most of the field activities associated with vegetation management.

The Capital Vegetation Clearing team within Capital Programs: Transmission & Distribution, Strategy & Sustainability is responsible for capital vegetation clearing which is federally funded. This work is expected to occur over a period of several years utilizing vegetation clearing contractors procured through federal procurement processes. Once an easement has been remediated, the VM department will maintain the easement going forward. The specific staffing details of the Capital Vegetation Clearing team will vary as the project moves through different phases of completion.

7.0 Physical Considerations

In considering the approaches, processes, and practices to invoke LUMA's VMP, there are several physical aspects to consider. This section expands upon three (3) of them:

- T&D System,
- Tree Conductor Clearances, and
- Right Tree / Right Place

7.1 Transmission and Distribution System

The T&D system includes 13,360 miles of overhead primary electric distribution lines and 2,640 miles of transmission lines along with approximately 300 substation sites. LUMA has been assigned responsibility for all Vegetation Management, Clearing and Maintenance activities performed on this system.

7.1.1 Overhead Distribution System Miles

Vegetation maintenance work on the distribution system involves pruning and removal of individual trees. For this discussion, the distribution system can be viewed as consisting of two (2) voltage classes, based on their susceptibility to tree-initiated faults (higher voltages being more susceptible).

Table 7.1.1 Approximate Miles of Overhead Distribution Line by Voltage

Voltage	15 kV Class	5 kV Class			
	7.62/13.20 kV	4.80/8.32 kV	4.16/7.20 kV	2.77/4.80 kV	2.40/4.16 kV
Miles	3,530	3,500	380	<10	5,930

The PREPA distribution system also includes approximately 12,000 miles of low-voltage secondary supply, individual service, and streetlighting lines.

7.1.2 Transmission System Miles

Vegetation maintenance work on the transmission system on circuits energized at 230 kV and 115 kV involves the removal and control of incompatible species and the management of compatible plant communities within the ROW. Circuits energized at 38 kV also include a significant amount of line clearance, tree pruning, and tree removals.

Table 7.1.2 Approximate Miles of Transmission Lines by Voltage

Voltage	230 kV	115 kV	38 kV
Miles	410	700	1,530

7.1.3 Substations

There are approximately 300 substation sites with an estimated area of 200 acres requiring bare ground weed control.

7.1.4 Rights of Ways

PREPA is the owner of the energy delivery system infrastructure. LUMA is responsible for vegetation maintenance on the PREPA ROW. Rights to maintain vegetation in proximity to the T&D system are established by an easement.

7.1.5 Standard Widths: Distribution ROW

The standard width for a primary voltage distribution line ROW does not vary by the intensity of land use, number of phases, or type of construction. These ROW widths on multi-phase distribution lines where conductors are on cross-arms are narrow compared to the UVM industry, resulting in limited tree-conductor clearances for outer phases of cross-arm construction.

Table 7.1.5. PREPA Standard Widths for Distribution ROW, Rural and Residential Sites

Line Type	Voltage Class	Standard ROW Width Edge to Edge (from Centerline)
Single Phase (1Ø)	7.6/13.2 kV	10’ (5’)
Multi-phase (2-3Ø)	7.6/13.2 kV	10’ (5’)
Double circuit 3Ø	7.6/13.2 kV	10’ (5’)
Aerial Spacer Cable	7.6/13.2 kV	10’ (5’)
Single Phase (1Ø)	≤4.8/8.3 kV	10’ (5’)
Multi-phase (2-3Ø)	≤4.8/8.3 kV	10’ (5’)
Low voltage Secondary	120/240 V	10’ (5’)
Services	120/240 V	none

7.1.6 Standard Widths: Transmission Row

The standard width for Transmission line ROW in urbanized/developed areas varies by voltage and type of construction. These ROW widths are significantly narrower than those typically found in the industry, resulting in significant limitations to tree-conductor clearances to outer phases.

Table 7.1.6 (A). Standard Widths for Transmission ROW, Urban / Developed Sites

Line Type	Voltage Class	Standard ROW Width Edge to Edge (from Centerline)
Double Circuit Structure	230 kV	60’ (30’)
Two lines common ROW	230 kV	100’ (50’)
Single Circuit	115 kV	30’ (15’)
Double Circuit Structure	115 kV	40’ (20’)
Two lines common ROW	115 kV	100’ (50’)
Single Circuit	38 kV	25’ (12.5’)
Double Circuit Structure	38 kV	25’ (12.5’)
Two lines common ROW	38 kV	undefined

The standard width for Transmission line ROW in less developed rural areas varies by voltage.

Table 7.1.6 (B) Standard widths for Transmission ROW, Rural Undeveloped Sites

Line Type	Voltage Class	Standard ROW Width Edge to Edge (from Centerline)
Single Circuit	230 kV	100’ (50’)
Double Circuit Structure	230 kV	100’ (50’)
Two lines common ROW	230 kV	100’ (50’)
Single Circuit	115 kV	100’ (50’)
Double Circuit Structure	115 kV	100’ (50’)
Two lines common ROW	115 kV	100’ (50’)
Single Circuit	38 kV	50’ (25’)
Double Circuit Structure	38 kV	50’ (25’)
Two lines common ROW	38 kV	50’ (25’)

7.2 Tree Conductor Clearances

Vegetation maintenance work is intended to reduce risk by addressing the potential for tree-conductor conflicts. Creating and maintaining clearance between energized conductors and trees, sufficient to provide reliability between scheduled preventive maintenance treatments, is a focus of the work. The work is also intended to reduce the likelihood of a tree or branch part interfering with the line. This is a function of the stability of the tree part and its proximity to the line. Pruning and/or removal accomplish this by eliminating tree parts prone to failure and reducing the likelihood of a line strike by increasing separation from conductors.

7.2.1 Distribution Clearances

Table 7.2.1 below provides guidance on tree-conductor clearances within the Removal/Reduction and Edge Zones (pertaining to tree-conductor and overhang clearances) to be established at the time that vegetation maintenance work is performed. Trees and branches within and extending into the Removal/Reduction and Edge Zones are assessed and maintained. The intent is that sufficient clearance be achieved to provide reliability over the course of the interval between scheduled preventive maintenance (see Preventive Vegetation Maintenance Time Frame, within Section 9.2).

The risk trees pose to overhead distribution varies by factors such as nominal voltage, voltage gradient, conductor type (e.g., bare vs coated), and overcurrent protection scheme. These factors vary across the overhead distribution system, and as a result, so does exposure to risk. Required clearances are specified as part of the preventive maintenance prescriptions developed for each project. LUMA expects clearances prescribed and achieved on circuits energized at lower primary voltages may, in some cases, be less than those at higher voltages. Similarly, clearances prescribed and achieved for coated conductor and aerial spacer cable systems may be less than for bare conductors.

The UVM industry recognizes that in most jurisdictions, incidental tree-conductor contact due to ingrowth will occur on a distribution circuit prior to scheduled preventive maintenance. The National Electric Safety Code, adopted by PREPA through Rule 7014, recognizes incidental contact as acceptable and does not create an expectation that utilities will maintain overhead distribution systems free of any tree contact. It focuses on contacts that have the potential to cause damage to conductors. As such LUMA's vegetation management strategy on the distribution system recognizes that incidental tree-conductor contact will occur. The objective is not to achieve clearance sufficient to eliminate any contact with conductors. The objective is to achieve the clearances specified in the table below when vegetation maintenance is performed. Tree-conductor clearance is lost as trees respond to line clearance pruning.

Vegetation Management Plan

Table 7.2.1. Tree-Conductor Clearance Requirements[4]

Line Type	Voltage Class	Expectation of Tree to Conductor Clearances		
		Overhang Clearances[5]	Side Clearances	Under Clearances[6]
Three-phase (3Ø)	7.6/13.2 kV	Ground to sky	12'-15', point of attachment	Remove incompatible species
Multi-phase (2-3Ø)	7.6/13.2 kV	Ground to sky	12'-15', point of attachment	Remove incompatible species
Single phase (1Ø)	7.6/13.2 kV	12' or hinge point plus 2 feet	12'-15', point of attachment	Remove incompatible species
Three-phase (3Ø)	≤4.8/8.3 kV	Ground to sky	12'-15', point of attachment	Remove incompatible species
Multi-phase (2-3Ø)	≤4.8/8.3 kV	Ground to sky	12'-15', point of attachment	Remove incompatible species
Single phase (1Ø)	≤4.8/8.3 kV	12' or hinge point plus 2 feet	12'-15', point of attachment	Remove incompatible species
Secondary lines	120/240 V	5'	5' – closest lateral	5' - closest lateral
Service lines to house	120/240 V	No Hard Contact	No Hard Contact	No Hard Contact
Street light lines	120/240 V	No Hard Contact	No Hard Contact	No Hard Contact

Vegetation maintenance work within the Removal/Reduction and Edge Zones considers the condition and structural integrity of each tree, site conditions that may increase the likelihood of tree failure and expected regrowth response rates.

[4] The clearances provided here represent general distances to be achieved at the time of work. Site specific conditions may warrant adjustments to final clearance distances.

[5] Certain cases of overhang may be allowed to remain as determined on a case-by-case basis.

[6] Vegetation growing within the easement that will never encroach within 10 feet of the primary or 3 feet of the neutral may be allowed to stay in place dependent on facility access.

Vegetation Management Plan

LUMA seeks to eliminate hard contacts between low-voltage service wires and trees. This requires only incidental pruning of the tree and is accomplished during routine scheduled work on the primary lines. Should property owners desire additional clearance, they are directed to the Operations Department, which may opt to temporarily de-energize the line so that a property owner can perform the desired work.

Vines climbing on structures and interfering with equipment also represent a significant risk to reliability and must also be maintained. Vines are cut, and the stump is treated with EPA-registered herbicide.

7.2.2 Transmission Clearances

Guidance on tree-conductor clearances within the Wire and Border Zones[7] will be established at the time that vegetation maintenance work is performed, consistent with the criteria presented in Table 7-7. The intent is that sufficient clearance be achieved to assure reliable service during the interval between scheduled preventive maintenance actions.

Clearance expectations on the transmission system are based on the application of IVM concepts of TL and AT. LUMA is adopting several elements of NERC FAC-003.4 Transmission Vegetation Management. The TL for a transmission circuit compliant with FAC-003.4 can be defined as the point that incompatible trees encroach on the Minimum Vegetation Clearance Distances (MVCD). In this context the AT is the clearance achieved to prevent incompatible tree populations from breaching the MVCD over the interval between preventive maintenance treatments.

Table 7.2.2. Transmission Tree-conductor Clearance Requirements, Wire and Border Zones

Line type	Voltage Class	Wire Zone Clearances	Edge Zone Clearances	Overhang Clearances	ANSI Z133 MAD[8]
All types	230 kV	Remove incompatible species	25’ / edge of easement	Ground to Sky	7’ 0”
All types	115 kV	Remove incompatible species	20’ / edge of easement	Ground to Sky	3’ 11”
All types	38 kV	Remove incompatible species	15’ / edge of easement	Ground to Sky	2’ 11”

The TL and AT model can also be adapted for the management of compatible species. Compatible species, by definition, do not grow to heights that will encroach on the MCVD. Still, they can grow to heights or densities that interfere with line-of-sight requirements for line inspection and densities that impede access for repairs. Compatible plant communities will be assessed on a site-by-site basis and maintained to mitigate potential interference with critical maintenance functions.

[7] Wire Zone refers to the section of a utility transmission right-of-way directly under the wires and extending to a pre-established distance on each side, and Border Zone refers to the section of transmission right-of-way that extends a pre-established distance from the outside transmission wire.

[8] Minimum Approach Distance for Qualified Line Clearance Arborists, per Table 3, ANSI Z-133.

The TL and AT can also be based on the following considerations, but not limited to such as economic optimization of treatments, access, aesthetics, safety of concern to the vegetation manager.

7.2.3 Vegetation at Substations

For safety and security reasons, a fence surrounds each substation. Inside the fence, the land is graded flat and graveled. Outside the substation fence, there is a buffer of rock/gravel. Beyond the buffer, the substation property may range in size from less than an acre to several hundred acres, which may be forest, field, or landscaped shrubs.

A ground mat lies under the gravel within the fenced area of the substation. The ground mat is a metal grid buried under the soil to “ground” the electrical equipment of the substation and to create an equipotential plane. A plant growing up through the ground mat could provide another grounding path for electricity and represent a safety hazard.

Gravel areas within the fenced area of the substation are maintained in a bare-ground condition. A bare ground buffer along and outside the substation fence is also maintained. Tall growing trees outside the fenced area but capable of striking any substation equipment and fencing are reduced or removed.

7.2.4 Access Roads

The LUMA VMP includes work to maintain vegetation that may impede access to T&D lines and equipment. Access roads are retired after use and maintained in a condition that assures access can be achieved by off-road capable all-wheel drive equipment within a reasonable amount of time. Access roads are not maintained in a condition that provides continuously available access to over-the road vehicles.

Access roads are used so line crews, their machinery, and vehicles can safely travel over them to the electric facility for emergency and routine maintenance work. These access roads are generally unimproved dirt or gravel roads. They are kept clear of trees and brushy vegetation. Some are maintained by LUMA, and some by the underlying landowner.

7.3 Right Tree / Right Place

The urban forest is an asset for communities and property owners. However, it often includes species of trees that are not suitable for sites that are near powerlines. If trees grow too close to the electric facilities, they can threaten LUMA’s ability to provide safe and reliable electric service. This reality necessitates the pruning or removal of trees, an expensive proposition with often, sub-optimal results, particularly in the selection of replacement trees. The Arbor Day Foundation has developed a guide to help people select the right tree for the right place.

A healthy community forest begins with careful planning. With a little research and a simple layout, tree “owners” can produce a landscape that will cool their home in summer and tame the winter winds. A well-planned yard will contain trees that grow well in the soil and moisture of the neighborhood. These trees can be properly placed to avoid conflicts with power lines and buildings. The aesthetics will increase property values.

LUMA encourages landowners and communities to plant trees for the many benefits they offer. Regulation Number 7282 “PREPA Regulation for Easements of the Electric Power Authority” requires that only shrubs and plants (no trees) be planted within the easements under power lines. Climbing plants and

vines, as well as bamboo, are prohibited from being planted within an easement. The branches of trees planted outside the easement must not obstruct free passage of the power lines. All shrubs and plants within easements must maintain the minimum vertical distances defined in the following table:

Table 7.3. Shrubs and Plants minimum vertical distances

System Voltage	Vertical Distance[9]
Distribution	12 feet
Sub-Transmission	12 feet
Transmission	16 feet

Any trees, shrubs, or plants planted in violation of Regulation Number 7282 may be uprooted, removed, or cut down at the landowner's cost in accordance with the provisions of Regulation Number 7282. Public education of the requirements of Regulation 7282 is important to minimizing the planting of incompatible species after vegetation clearing or maintenance has occurred in the ROWs. As part of the initial clearing discussed in Section 9.2, LUMA will implement programs to increase public information related to minimum clearing distances from powerlines to reduce the planting of species that should not be planted near powerlines.

8.0 Integrated Vegetation Management

IVM is a structured decision-making process that emphasizes continuous improvement, resulting in refinements over time as monitor processes and practices are adapted to new objectives and conditions.

Vegetation maintenance begins with gaining an understanding of the types of incompatible species native to the ecosystem. From this knowledge, management objectives are set using TL and AT. These objectives are based on internal and external factors including reliability, regulatory compliance, site sensitivity or location, stakeholder considerations, and budgets. Vegetation maintenance treatment methods are then defined, recognizing the economic and environmental effects of the work, after which specific activities are planned, prescribed, and implemented based on site and project specific conditions.

LUMA's VMP applies this approach, ensuring that incompatible tall growing trees and wood plants do not interfere with critically important power facilities. Under an IVM operating model, the goal is to reduce the risk that an incompatible tree or plant species will adversely affect system operations or endanger the safety of customers and crews. To the extent possible, incompatible plants are removed while preserving and enhancing low-growing compatible plant communities. These low-growing species will compete with incompatible plants, providing a form of biological control. In the urban forest, promoting planting of more compact species in place of tall growing landscape trees is a similar strategy based in IVM. LUMA expects that applying IVM will reduce the cost and intensity of the vegetation work required over time while improving system reliability and safety. This approach will also provide safety, environmental, and social benefits.

[9] The minimum vertical distance is measured from the highest part of the vegetation within the easement to the lowest conductor of the power lines.

Vegetation Management Plan

LUMA's Management Program is data-driven and includes vegetation assessments and will also include relevant spatial analysis and mapping techniques. This information will be used to support the development of annual work plans and individual project plans, intended to:

- Selectively remove and discourage the development and growth of incompatible, tall-growing plant species;
- Encourage and promote a stable and diversified compatible plant community consisting of various low-growing species such as shrubs, herbs, grasses, forbs, and ferns;
- Enhance wildlife habitat conditions on the ROW;
- Encourage and promote the concept of the "Right Tree/Right Place" in urban forests and across developed landscape areas, favoring utility-friendly vegetation in proximity to overhead T&D lines.

In implementing this process, LUMA's Vegetation Management Program will continue to:

- Comply with all laws and regulations and incorporate appropriate industry standards and best management practices;
- Comply with rights and land uses established in PREPA's easement for T&D;
- Engage, notify, and educate stakeholders, and consider their interests in the planning process;
- Ensure consistency between the VMP and project-specific vegetation maintenance plans;
- Implement a continuous improvement process that applies experience gained to adjust and refine the Vegetation Management Program and vegetation maintenance practices.

Specific elements to be applied at both the program and project levels include:

- Establishing objectives;
- Evaluating the site;
- Defining TL and AT;
- Evaluating and selecting control methods;
- Implementing control methods; and
- Monitoring treatment and quality assurance activities.

Before presenting the Management Processes and Maintenance Practices that drive LUMA's success in operationalizing this VMP, there are three areas that define the framework for applying and capturing the full benefits of IVM.

8.1 Tolerance Levels and Action Thresholds

Clearance requirements are based on two (2) elements considered in IVM-based vegetation management programs:

- The tolerance level (TL) defines the maximum allowable incompatible-plant pressure (e.g., species, density, height, location, or condition) that can occur without creating unacceptable consequences.
- The AT defines the level of incompatible plant pressure (e.g., species, density, height, location, or condition) where vegetation maintenance treatments should occur to prevent conditions from reaching TL.

If conditions reach the TL, control methods should be implemented. Vegetation maintenance work should be initiated when conditions reach AT. TLs and ATs are based on, but not limited to, the following

considerations: (i) economic optimization of treatments, (ii) access, (iii) aesthetics, (iv) safety of concern to the vegetation manager.

8.2 Compatible and Incompatible Vegetation

The IVM strategy recognizes and emphasizes selectivity in applying vegetation maintenance treatments. The T&D system is populated with millions of plants, but only some have the condition, growth characteristics, or location that make them compatible with safe and reliable energy delivery.

- Compatible species are those that are congruent with the intended use of the site and include shrubs and herbaceous vegetation that will never grow into conflict with overhead conductors.
- Incompatible species are those that are not congruent with the intended use of the site and include tall growing trees and other plant forms (e.g., bamboo and palms) with the potential to conflict with overhead conductors.

An initial list of tree species based on characteristics that affect their compatibility with the T&D system are included in Appendix A. LUMA recognizes the diversity of species in tropical ecosystems and intends to revise and expand such lists to generally characterize species using attributes relevant to our Vegetation Management Program.

The general strategy is to control incompatible species while encouraging the growth of compatible species. Compatible species may, on occasion, need control if their height or density impedes the necessary line of sight for inspection or access to perform maintenance. Project-specific vegetation maintenance prescriptions address both incompatible and compatible species.

8.3 Vegetation Management Zones

Vegetation maintenance work varies by zone within and adjacent to the cleared corridor. There are three (3) zones defined in terms of their location relative to energized conductors, based on ANSI A300 Part 7 (2019) and the companion ISA Best Management Practice (BMP) on IVM.

8.3.1 Distribution Vegetation Maintenance Zones

Trees and branches in proximity to overhead distribution lines exist in three (3) zones (described below in Table 8.3.1). The risks trees pose, and the preventive maintenance requirements intended to mitigate the risk, vary by zone, as does the vegetation management objectives. Trees create a risk to overhead distribution lines by deflecting or falling into contact with conductors. Tree growth that creates incidental contact with distribution lines is generally viewed as low risk.

Table 8.3.1. Vegetation Maintenances Zones Associated with ROW on the Distribution System

Distribution-VM Zone	Definition
Removal/Reduction Zone	• This zone includes trees below and adjacent to the alignment of distribution conductors and includes trees located within the PREPA standard ROW. • In rural and undeveloped areas, this zone is managed for the establishment of a low-growing compatible plant community dominated by herbaceous plants such as grasses, sedges, forbs, and limited low-growing woody shrubs. • In residential and developed areas, the preference is to remove fast-growing trees directly below conductors. Larger and high-value landscape trees are maintained using reduction, directional, and structural pruning.
Edge Zone	• This zone includes trees located beyond the PREPA standard ROW and within the clearance area. • The edge clearance zone extends from the outer edges of the removal/reduction zone to the limit of the specified clearance area. • Structurally sound trees are pruned to maintain clearance and reduce the likelihood of failure and impact to utility targets, and to direct future growth away. • Trees posing moderate to high risk to utility targets are pruned or removed to mitigate risk. • Weakly attached branches are likely to fail, and impact conductors are removed. • Overhanging branches are reduced or removed as necessary to reduce the likelihood of failure and impact on utility targets.
Strike Zone	• This zone includes trees located along and beyond the edge of the maintained corridor. • The width of the strike zone varies by factors such as voltage and land use and may not include all trees tall enough to strike the line should they fail. • Trees in this zone are not routinely pruned or removed unless there is a probable likelihood of failure and impact to conductors under normal weather conditions within the vegetation maintenance time frame.

8.3.2 Transmission Vegetation Maintenance Zones

Incompatible vegetation in proximity to transmission lines also exists in three (3) zones (described below in Table 8.3.2). The risks trees pose, and the maintenance actions to mitigate or abate the risk vary by zone, as does the vegetation management objectives. Trees create a risk to overhead transmission lines by deflecting, falling, and growing into contact with conductors.

Once remediation is completed, LUMA's IVM approach emphasizes the selective use of environmentally safe and EPA-registered herbicides to completely remove all tall-growing incompatible species of vegetation from the ROW environs, while simultaneously preserving, to the extent feasible, all other low-growing desirable vegetation. LUMA will continue to rely on individual plant treatments that consider

species, the height of the woody plants in question, their growing location within the ROW, and the plant's position relative to the overhead conductors. The selective elimination of individual incompatible plants reduces disturbance and unintended damage to compatible plants.

Table 8.3.2 Vegetation Maintenances Zones Associated with ROW on the Transmission System

Transmission VM Zone	Definition
Wire Zone	• The wire zone is that area below and adjacent to the alignment of transmission conductors. It is managed for the established of low-growing compatible plant communities dominated by herbaceous plants such as grasses, sedges, forbs, and limited low-growing woody shrubs. • Vegetation in the wire zone will also be maintained to preserve access and to provide for line-of-site visual inspections. • The wire zone typically has the least ground clearance from conductors. • When wire height is adequate, selected woody vegetation may be incorporated into the wire zone as facilities cross deep valleys, canyons, mountainsides, or other similar terrain. • In some few cases, tall-growing incompatible species may be retained as buffers, visual screening, or for other specific purposes, provided adequate clearances are achieved and maintained.
Border Zone	• The border zone extends from the outer edges of the wire zone to the edge of the cleared corridor. It is managed for a diverse community of compatible herbaceous and woody plants, including shrubs and species of small trees. • Branches extending into the border zone from trees along the edge of the maintained corridor require pruning to achieve and maintain adequate side clearance from energized conductors. • In some cases, transmission ROW may be too narrow to recognize and manage for a discrete border zone, reducing the opportunity to retain woody shrubs and small growing trees.
Strike Zone	• This zone includes trees located along and beyond the edge of the maintained corridor. • The width of the strike zone varies by factors such as voltage and land use and may not include all trees tall enough to strike the line should they fail. • Trees in this zone are not routinely pruned or removed unless there is a probable likelihood of failure and impact to conductors under normal weather conditions within the vegetation maintenance time frame.

9.0 Vegetation Management Processes

9.1 Introduction

This section briefly describes the vegetation management processes, starting with vegetation clearing and then addressing key elements of Vegetation Maintenance.

Table 9-1. General Classification of Vegetation Maintenance and Clearing Work

Vegetation Activity	General Characteristics
Clearing	Work to clear vegetation to remediate the overgrown condition of the easements and facilities and establish acceptable tree-conductor clearances. After a facility is cleared of vegetation, that facility transitions into the ongoing maintenance phase.
Preventive Maintenance	Work that can be specifically planned for and prioritized, scheduled, and managed on a project basis. It represents the largest portion of the Vegetation Management O&M budget.
Corrective Maintenance	Work that is difficult to plan for, but once identified, can be efficiently scheduled. This work is generated by customer requests, LUMA Operations and/or VM program staff. With an effective Preventive Maintenance process in place, a goal to limit this work to <10 percent of maintenance expenditures is reasonable.
Reactive Maintenance	Work that cannot be planned or scheduled but requires immediate attention. This work is typically related to service interruptions and outages.

Process flow diagrams for each maintenance process, consistent with those in use by leading Vegetation Management organizations, are included as an Appendix to the VMP.

9.2 New Vegetation Safety and Reliability Initiative

The T&D system was damaged by strong winds and heavy rainfall during Hurricane Maria. A one-time FEMA-funded island-wide vegetation clearing is crucial to enhancing the reliability and resiliency of the grid, including mitigating the number and duration of future customer outages. The initial clearing of the easements is also necessary to achieve the necessary remediated state. The scope of this work, scheduled to begin in FY2024 and continue after the FEMA obligation of projects, includes the following:

- Environmental and Historical Preservation reviews
- Condition assessments
- Preparation of work scopes
- Removal and disposal (when necessary) of vegetative materials through tree felling, manual vegetation clearing, mechanical vegetation clearing, chipping, mulching, hauling, recycling, and EPA-registered herbicide applications.
- Documentation of work performed.

The detailed scopes of work (DSOWs) for vegetation clearing were submitted to FEMA and will be approved prior to the start of clearing work. These DSOWs include specific details regarding the clearing

of incompatible species from within the ROWs and the clearance distances to be achieved from energized conductors during the initial clearing.

After clearing work is complete for a given facility, that facility transitions into a regular maintenance program to ensure facilities do not return to their pre-remediated state. The specific processes for completing clearing work and conveying facilities to the ongoing vegetation maintenance program will be defined as part of the capital vegetation clearing project.

9.3 Preventive Maintenance

Preventive vegetative maintenance, to be implemented after initial clearing described in Section 12.0, represents the cornerstone of LUMA's Vegetation Maintenance Program. Vegetation managers work within the natural biological system to create sustainable conditions that can efficiently reduce risks posed by trees to the T&D system, but not sufficient to reduce the need for a proactive and systematic inspection and maintenance process. After completion of the remediation of vegetation from rights-of-way. LUMA will:

- Evaluate the benefits of deploying a condition-based approach to identify the need for and scheduling of preventive maintenance versus applying a rigid fixed interval maintenance cycle;
- Perform maintenance activities on a systematic and scheduled basis. In so doing, optimize, over time, the trade-off between the frequency of inspections and subsequent maintenance / total cost, (i.e., shorter intervals can reduce immediate cost but increase total owned cost, and longer intervals can increase the costs of treatments but lower the total owned cost), and overall risk of tree-caused service interruptions / customer outages;
- Manage these activities as discrete projects, whether they are based on individual distribution feeders, transmission circuits, line segments between substations, or identified as individual initiatives.
- Maintain records of annual maintenance plans and actual work performed.

Factors considered in assessing condition and determining the need for and scheduling of preventive maintenance projects are described in Table 9.3.

Table 9.3. Factors Considered in Determining the Need for Preventive Maintenance

Factor	Description
History	Time since previous maintenance.
Projection	Anticipated preventive maintenance time frame.
Performance	Frequency of tree-initiated faults, interruptions, and outages, and related KPI's (LUMA contract compensatory, e.g., SAIFI and SAIDI).
Infrastructure	Voltage, phases, construction framing, conductor type.
Conditions	Field assessment of conditions by VM staff and Service Providers.
Internal input	Input from LUMA Operations, and other LUMA functional departments.
External input	Customer and stakeholder concerns.
Construction	Plans for Utility Transformation and major FEMA capital projects.
Criticality	Critical loads and customers, system stability, resilience, and redundancy.

Project Process

Projects, pre-planned considering risks, loads, vegetation conditions, cultural and environmental impacts, and action threshold, are executed by field technicians familiar with tree species, tree growth, and the risks trees pose to overhead T&D lines. Field technicians work with stakeholders and develop specific preventive maintenance prescriptions for each project. Once planned, a project, with a job package and technical specifications to define specific work requirements is assigned to a vegetation maintenance service provider to complete. Once completed, the service provider completes the required project documentation to be retained by LUMA for future use.
LUMA is evaluating opportunities to adopt additional measures to improve the effectiveness of its Vegetation Preventive Maintenance process through:

- **Enhanced Tree Risk Assessment** (refer to Figure C-2 in Appendix C for the Process Map): The industry is increasingly making use of focused inspections on the most critical elements of distribution circuits based on overcurrent protection zones and/or critical loads (e.g., hospitals). These initiatives typically require additional condition assessment inspections between the completed and next planned preventive maintenance but reap the benefits of fewer critical service interruptions and customer outages.
- **Coordinated Aerial and Ground-Based Inspections**: While not a regulatory mandate, LUMA's approach to managing tree-related risk on the transmission system may include an annual inspection by a combination of aerial and ground-based methods.

Refer to Figure C-1 in Appendix C for an illustrative example of an Industry Best Practice Preventive Maintenance Process Map.

9.4 Corrective Maintenance

While the need to perform work to correct or respond to a condition is difficult to plan for in advance, it can be anticipated. LUMA recognizes this reality, and after the completion of the remediation of the rights-of-way, intends to manage this work to achieve an industry "rule of thumb" of limiting corrective maintenance to less than 10 percent of the vegetation maintenance expenditures.

Corrective maintenance requests can originate from external customers or other stakeholders, or from within LUMA. Regardless of the source, these requests will be screened and assessed for validity either through the call center or qualified vegetation management / service provider personnel.

Once identified and assessed as valid, the request for work will be prioritized per the criteria presented in Table 9.4. Requests should be documented and tracked as part of maintenance record-keeping procedures. The timeframes to adequately respond to requests from customers, or other internal or external stakeholders to perform corrective vegetation clearance are included in Table 9.4.

Table 9.4. Priority of Response for Corrective Maintenance

Priority	Characteristics
1	Conditions pose an immediate public safety hazard or reliability issue. If an imminent safety hazard. The representative who identified the issue should remain on site until a crew arrives or the hazard is abated.
2	Conditions pose a high potential risk. Once verified, work will be completed within 7 days of the initial identification.
3	Conditions pose a moderate risk. Once verified, work will be completed within 30 days of identification.
4	Conditions pose a low risk. Once verified, work can be deferred and completed during regularly scheduled preventive maintenance.

Refer to Figure C-3 in Appendix C for an illustrative example of an Industry Best Practice Corrective Maintenance Process Map.

9.5 Reactive Maintenance

Reactive maintenance is performed in response to an immediate need, appropriately categorized as Priority 1 per Table 9.4. The work is neither planned nor scheduled, as the requirement can occur on a specific localized basis or in response to a major weather event, often supporting LUMA's Line Operations crews.

Vegetation maintenance work in response to storm events includes clearing access and supporting line crews in their efforts to restore service quickly and safely to customers. This work may bypass the normal protocol of notifying customers/property owners in advance and is limited to doing only what is necessary to clear the power lines and correct any obvious hazardous conditions. Debris, including downed trees and branches, are left on site.

Refer to Figure C-4 in Appendix C for an illustrative example of an Industry Best Practice Reactive Maintenance Process Map. Reactive maintenance will be documented and tracked as part of maintenance record-keeping procedures.

9.6 Post-Incident Investigations

Consistent with industry best practices, after completion of the remediation or clearing of the rights-of-way, LUMA's Vegetation Management Program staff investigates a portion of significant tree-caused incidents with two (2) objectives in mind:

- Record observations and findings from the event into a tree failure database and use findings to develop risk and tree failure profiles, and otherwise inform the development and refinement of technical specifications and maintenance prescriptions.
- Gain real-time insight into how trees are creating problems on the overhead T&D system.

In determining which events to investigate, criteria such as the size and/or duration (e.g., ≥500 customers, ≥1 hour) of an outage and /or the interruptions to critical circuits and outages affecting critical loads, will

be established. The specific criteria will be determined as operational experience is gained, and the specific thresholds will change as overall reliability improves.

Refer to Figure C-5 in Appendix C for an illustrative example of an Industry Best Practice Post Incident Investigations Process Map.

9.7 Customer Refusals

LUMA's right to perform vegetation maintenance work in existing easements is established in Regulation 7282. While this legal provision exists, LUMA anticipates that in some cases these rights will be questioned and has developed an escalation process for when this occurs.

The vegetation maintenance process includes notifying stakeholders of planned work prior to field technicians performing work. Vegetation maintenance work also includes a customer notification in advance of starting work. While we expect that most customers will be supportive of this critical reliability work, there is the possibility that a property owner or a customer could initially refuse to allow the necessary work. Vegetation maintenance crews are also sometimes challenged when accessing easements while work is in progress. In these circumstances, we will do all we can ensure this critical work continues even as we work to address any customers questions or concerns.

If customer refusal is final, LUMA uses the process described in Section VII of Regulation 7282 and Section 5 of Act No. 143-1979, 27 L.P.R.A. § 2155, to obtain access to perform the work.

9.8 Customer Complaints

As part of the vital and necessary act of vegetation maintenance and clearing, LUMA recognizes that to ensure the reliability of the grid and ensure outages, some customers could experience a negative aesthetic impact to property landscaping because of this work. To address customer complaints as a result of completed work, LUMA has developed a customer escalation process by which to handle these issues a respectful and appropriate matter remediation.

Refer to Figure C-6 in Appendix C for an illustrative example of an Industry Best Practice Customer Complaint Process Map.

9.9 Customer Damage Claims

LUMA anticipates that unintended damage to private property may occur and is committed to achieving an equitable resolution of damage claims. Following the damage claims process as established by customer experience, for physical damage caused by vegetation maintenance work on a site, the provider of vegetation maintenance services plays a major role in resolving damage claims. LUMA's responsibility is to ensure that any claims of damage are resolved.

Refer to Figure C-7 in Appendix C for an illustrative example of an Industry Best Practice Customer Damage Claims Process Map.

10.0 Vegetation Maintenance and Clearing Practices

LUMA's Vegetation maintenance and clearing practices support a long-term strategy to establish and maintain industry standard conditions for Puerto Rico's T&DD system. The goals of this plan include the analysis of the response of individual trees and plant communities to vegetation maintenance or clearing intervention and anticipating and managing changes in a way that reduces conflicts and costs. By deploying natural processes, the intensity and amount of clearing required will, in time, be reduced resulting in more sustainable conditions that can be efficiently maintained.

The specific requirements for each control method are defined in LUMA's technical specification, including:

- **Biological Control Methods**, reflected in both physical and approved environmentally safe EPA-registered herbicide controls, reduce the amount of human intervention in future years.
- **Physical Control Methods**, address the pruning or removal of tall growing trees and vines in the proximity of distribution facilities and along transmission corridors deemed incompatible with the safe and reliable operation of the power system.
- **EPA-registered Herbicide Control Methods**, surgically applying registered, environmentally safe and EPA-registered herbicides, eliminating incompatible stems from a site and encouraging the establishment and expansion of compatible plant cover, thus suppressing the growth of incompatible species.

After this, practices regarding the disposal of debris are presented.

10.1 Biological Control Methods

Biological control is at the core of LUMA's VMP. Biological controls include managing the level of competition exerted by compatible plant communities, inhibiting reinvasion, and suppressing the growth of incompatible trees.

Though its direct application may appear limited, it has direct application in the urban forest. Aligned with the Right Tree / Right Place Program presented in Section 7.3, this method involves introducing, promoting, and establishing openings for compatible species and cultivars of trees, previously occupied by incompatible tall growing trees. The use of proper pruning practices is also a variant of biological control. Trees respond to pruning in predictable ways. The placement of pruning can reduce re-growth response, direct it away from conductors and reduce the likelihood of decay associated with the pruning wound, reducing the risk of structural failure and line strike.

LUMA intends to also evaluate opportunities to apply biological controls by direct seeding of compatible herbaceous cover within the wire zone on highly disturbed sites.

10.2 Physical Control Methods

Physical control methods prescribed vary based on several factors related to the condition and make-up of ROW vegetation. They also vary based on the type and voltage of the affected facility. Vegetation maintenance and clearing work on:

- Overhead distribution lines consist predominantly of pruning or removing trees that can grow into or fall on the facilities,
- Higher voltage 230 kV and 115 kV transmission lines are less reliant on tree pruning and focus more on the removal of incompatible trees within the cleared easement, 38 kV transmission includes both pruning and removal of tree species within the ROW, and
- Trees outside the cleared corridors are assessed and maintained by physical methods (removal, reduction) as deemed appropriate for the specific situation.

Table 10.2 (below) describes each Physical Control Vegetation Management Practice and its primary use.

Table 10.2. IVM Physical Control Methods

Vegetation Management Practice	Primary Use
Tree Pruning: Pruning limbs and branches using property arboricultural techniques. This work is completed by a skilled line clearance arborist working aloft.	Height reduction and side pruning on distribution lines. Limited side pruning on 230 kV and 115 kV transmission lines, more frequent use on 38 kV lines.
Tree Removal: Felling of incompatible trees**.** This work is completed by a skilled line clearance arborist working at ground level and in some cases aloft.	Reduction/removal zone on distribution lines. Wire and border zone on transmission lines. Reclamation and Steady State preventive maintenance phases.
Severing of Vines: Cutting vines to create a gap between the root system and above-ground portion, interfering with T&D infrastructure.	Predominantly on Distribution lines. Reclamation and Steady State preventive maintenance phases.
Manual Cutting: Individual small-diameter incompatible plants are cut by a chainsaw or other means of severing the above ground-portion of the plant.	T&D ROW, Reclamation, and Steady State preventive maintenance phases.
Mechanical Reduction: The mechanized cutting / removal of branches in the crowns of trees.	T&D ROW, Reclamation, and Steady State preventive maintenance phases.
Mechanical Mastication: The mechanized cutting and shredding of the above-ground portion of woody vegetation.	Medium to high density, larger diameter incompatible stems. Transmission ROW, undeveloped sites. Reclamation phase, ROW widening, and clearing new ROW.
Mechanical Mowing: The mechanized cutting and shredding of the above-ground portion of herbaceous and small-diameter woody vegetation.	Medium or lower density, smaller diameter incompatible stems. T&D ROW, undeveloped sites. Reclamation phase, ROW widening, and clearing new ROW

These physical control vegetation maintenance practices are expanded upon below.

10.2.1 Tree Pruning

Line clearance tree pruning, carried out by qualified line clearance arborists working from an aerial platform or while climbing within a crown of trees, represents a major component of LUMA's VMP, particularly on the distribution system in the more developed areas. All pruning work wounds a tree. Done

poorly, it can result in an exaggerated regrowth response by weakly attached “suckers”, adversely alter tree architecture, and increase exposure to decay organisms that can weaken the tree. Each of these adverse consequences increases the likelihood of tree-initiated faults causing system interruptions and customer outages. In short, improper pruning increases the risk it is intended to address. Consequently, LUMA emphasizes the use of proper arboriculture techniques, based on current industry standards and best vegetation management practices, as outlined in its technical specifications for line clearance pruning.

10.2.2 Tree Removal

Tree removal, performed by qualified line clearance crews working at ground level (some aerial work to reduce the tree is often performed), is often preferred to tree pruning. The stumps of trees that have been removed are typically treated with an EPA-registered herbicide to permanently eliminate the tree from the site, thereby reducing future workload. This is a predominant maintenance practice for the transmission system, and an important practice for the distribution system.

10.2.3 Severing of Vines

Vines on guy wires, poles, and equipment represent a significant risk to reliability. They are severed at the base with an airgap created between the root system and a portion of vine climbing on the structure. The stumps of vines that have been removed are typically treated with an EPA-registered herbicide to permanently eliminate them.

Vines are severed and treated by a qualified worker using a machete or chainsaw at ground level. The upper portion of the vine remains attached and is not removed by vegetation maintenance crew personnel.

10.2.4 Manual Cutting

Manual cutting typically involves the removal of small-diameter incompatible species of tree. Freshly cut stumps are treated with an EPA-registered herbicide to permanently eliminate the tree from the site, thereby reducing future workload.

10.2.5 Mechanical Reduction

LUMA may use mechanized equipment to reduce branches and crowns of trees encroaching on conductors. This may include ground-based boom mounted saws and saws suspended from helicopters. These methods have limited use during the reclamation phase of the project and may be more suitable once cleared corridors have been established.

10.2.6 Mechanical Mastication

Mastication work involves heavy clearing of trees using heavy equipment fitted with a variety of cutting heads capable of reducing standing trees to woody debris. This is an important method during reclamation, widening, and / or clearing of new ROW.

10.2.7 Mechanical Mowing

Mechanical mowing work is like mechanical mastication but involves clearing of small-diameter woody stems and herbaceous plant materials. It is typically used to clear standing vegetation and is also used to reduce debris generated by pruning, hand cutting, and tree removal. It is an important method for the

distribution system, used during the steady state preventive maintenance phase once reclamation has been completed.

10.3 EPA-Registered Herbicide Control Methods

As previously stated, the targeted and careful use of EPA-registered and environmentally safe herbicides can eliminate incompatible stems from a site, encouraging the establishment and expansion of compatible plant cover capable of suppressing the re-establishment and growth of incompatible species. In accomplishing this, LUMA uses methods that are commonly used across the industry, and as defined in LUMA's technical specifications. Table 10.3 describes each of these Vegetation Management Practices and their primary use. EPA-registered herbicides are always surgically applied by trained professionals.

Table 10.3. Common IVM EPA-Registered Herbicide Application Methods

Vegetation Management Practice	Primary Use
Low Volume Foliar: The EPA-registered herbicide mixture is applied selectively to individual incompatible plants by an applicator with a backpack sprayer or small spray rig.	Steady State preventive maintenance. Medium or lower incompatible stem density and heights < 10 ft.
Selective Hydraulic Foliar: The EPA-registered herbicide mixture is applied selectively to incompatible plants by an applicator using a spray rig with a tank, pump, hose, and spray gun.	Transitional from reclamation to steady state phase. Medium to high incompatible stem density and heights < 10 ft.
Hand Cut and Treat: The EPA-registered herbicide mixture is applied selectively to the freshly cut stumps of incompatible plants by an applicator with a backpack sprayer or small hand sprayer.	Reclamation and Steady State preventive maintenance phases. Whenever incompatible stems are cut.
Frill: The EPA-registered herbicide mixture is surgically applied to fresh frill cuts on an incompatible stem by an applicator using a small hand sprayer or spray bottle.	Specialized needs, incidental use; sensitive sites, and inaccessible sites.
Broadcast Foliar: Nonselective application made by calibrated spray nozzles, or a gun applied at a fixed rate to an area.	Follow-up treatment to mastication and mowing. Treatment is surgically applied when incompatible stems have re-sprouted. It is also used for controlling weeds in substations.

LUMA surgically applies EPA-registered herbicides that are commonly used in contemporary UVM programs, and which are currently registered for safe use in Puerto Rico and others that are in the process of being registered.

These vegetation maintenance and clearing practices are expanded upon below:

10.3.1 Low Volume Foliar

Low-volume foliar application is the dominant IVM control method used in the UVM industry today. Planned for use once the ROW is reclaimed, it can assist in controlling incompatible vegetation in Low

volume foliar applications are typically made by an applicator with backpack walking the ROW, with the EPA-registered herbicide mixture being surgically applied to the foliage of individual target plants. It is particularly well-suited for lower densities and heights of incompatible stems. The EPA-registered herbicide mixture used in the low volume foliar application method is water-based and includes higher concentrations of active ingredients as compared to those used in hydraulic foliar applications.

10.3.2 Selective Hydraulic Foliar

Hydraulic foliar applications (a.k.a. high-volume foliar) are used to maintain medium and high-density stands of incompatible vegetation. This application method is typically made by an applicator with a spray gun and hose walking the ROW. A spray rig with a tank and pump is often mounted on an ATV, pickup truck, or other prime mover. The EPA-registered herbicide mixture is applied selectively over the leafy foliage of individual target plants or groups of incompatible species.

The greatest volume though lowest concentrations of EPA-registered herbicide mixtures are applied in this IVM control method. The mixture, though water-based, can result in damage to compatible plant communities.

10.3.3 Hand Cut and Treat

Cut surface application are paired with work to physically control the above-ground portion of incompatible species including trees, bamboo, and vines. While physical methods remove the immediate risk, cut vegetation will re-sprout and grow vigorously. Surgical application of an EPA-registered herbicide eliminates the plant by killing the root system. Cut stump applications involve treating the cut face of the stump, the remaining bark to the ground line, and the surface of any exposed roots. This application is made using a backpack or a small hand sprayer.

The EPA-registered herbicide mixtures used in cut stump applications are not water-based. The active ingredient is diluted in a viscous basal oil carrier.

10.3.4 Frill

Frill applications have limited but important use in LUMA's VPM. They are highly selective and do not require specialized equipment. Frill applications are typically made on sensitive sites such as riparian zones. Because the method is easily transportable, it is also effective for vegetation maintenance work where access is difficult such as for mountain top structures.

Frill applications are typically made by an applicator walking the ROW. A frill cut is made by machete or hatchet, and a small quantity of EPA-registered herbicide is surgically applied to the fresh cut.

10.3.5 Broadcast Foliar

Broadcast foliar applications are not selectively applied and are most suitably used following initial clearing and reclamation work, typically following physical control of incompatible vegetation. While the application method is non-selective, the EPA-registered herbicides used are generally selective, targeting broadleaf plants with limited to no effect on grass.

Surgical application is made by calibrated spray nozzles or a gun. EPA-registered herbicide mixtures used in broadcast foliar applications are applied at a fixed rate to an area that does not vary with stocking. Broadcast foliar applications are made to the foliage of re-sprouted growth following physical control by mastication. The application is made after the re-growth has developed enough foliar surface to intercept

and translocate the EPA-registered herbicide through the above- and below-ground portions of the targeted species.

10.3.6 Tree Growth Regulators

In addition to those EPA-registered herbicide control methods summarized in Table 10-2, LUMA expects to make limited use of Tree Growth Regulators (TGR) to reduce the rate of stem elongation following pruning. In reducing pruned trees' regrowth response, TGRs extend the preventive maintenance intervals, an intervention particularly useful in areas where tree-conductor clearance is constrained. Performed by specialized crews, TGR applications:

- Are generally limited to high-value landscape/amenity trees on urban and developed sites,
- Can be made following pruning,
- The dose applied varies by tree size and species.
- Paclobutrazol is expected to be the TGR used in Puerto Rico,
- Are injected into the soil root plate around the base of the tree.

10.3.7 Total Vegetation Control

The intent of EPA-registered herbicide applications in substations is total vegetation control. The objective to create and maintain gravel areas free of vegetation:

- Bare ground weed control is accomplished by nonselective broadcast foliar applications (not selectively applied) using a non-selective EPA-registered herbicide.
- Application is made by calibrated spray nozzles or a gun. EPA-registered herbicide mixtures used in broadcast foliar applications are applied at a fixed rate to an area of gravel. The EPA-registered herbicide mixtures are also non-selective and are intended to control all forms of plants. They have residual soil activity intended to inhibit germination and establishment of weeds within a growing season.

11.0 Risk Management

LUMA's IVM is a combination of both "take-over," risk remediation in the form of rights-of-way vegetation clearing and "business-as-usual" vegetation maintenance plans. Therefore, there is a certain amount of embedded risk attributable to the:

- Magnitude of the Vegetation Management practices and process shortcomings between the state of the T&D system prior to June 2021 and industry norms, and
- Overall system reliability, of which half of all customer service interruptions are estimated to be attributed to vegetation-caused outages.

LUMA's System Remediation Plan included programs to address both aspects that seeks to abate or mitigate immediate vegetation management-related risk in the most critical locations, along with an ongoing program to clear and re-establish ROW to industry standard widths. Along with reclaiming rights-of-way corridors, the remediation element of this plan calls for a field-enabled information technology (IT) tool to manage the program, along with ongoing line clearance, pruning, tree removal, the methodical use of EPA-registered herbicides, etc., and vegetation management training. The field-enabled IT tool is intended to provide a mechanism for efficient recordkeeping of schedules of maintenance and records of work performed.

11.1 Current State

The Gap Assessment completed prior to commencement revealed several deficiencies in PREPA's execution of its Vegetation Management and Maintenance Programs. LUMA has made progress toward addressing these gaps, but their full remediation is necessary before LUMA can implement a Vegetation Management Program that complies with Contract Standards and Prudent Utility Practices. Some of the deficiencies identified in the Gap Assessment include:

- Lack of a centralized organization with the responsibility and authority for maintaining vegetation and managing vegetation-related processes across the T&D system with no regular focused VMP in place. In-house employees and contractors did not operate using the most up-to-date UVM industry standards and best management practices.
- Vegetation maintenance had largely been deferred, with the vegetation maintenance work being performed by in-house personnel conducting predominantly reactive or corrective maintenance (a.k.a., "hot spotting"). Some preventive vegetation maintenance work was performed by service providers under contracts with PREPA's Project Management Office (PMO).
- Prior pruning practices were not effective, resulting in excessive re-growth and wounding of trees that increased the likelihood of tree-conductor conflicts and structural failures resulting in tree strikes (refer to Appendix B for species prone to structural failure).
- The equipment used by in-house personnel was in poor repair, with a scarcity of any specialized vegetation management equipment. There was little use of EPA-registered herbicides and no use of TGR. The lack of appropriate tools and equipment contributed to low productivity of in-house personnel.
- The deferral and lack of vegetation maintenance is a significant contributor to the poor system reliability, especially in extreme weather events such as hurricanes. This has also created a public safety hazard: directly in the form of fallen wires or children climbing trees too close to energized lines, and indirectly in the form of power outages.

11.2 Actions to Remediate Risk

As recognized in the OMA, the condition of the T&D System at the point in time in which LUMA assumed operation and maintenance responsibilities, as well as the deficiencies and shortcomings in PREPA's vegetation management programs means that LUMA's ability to implement a Vegetation Management Program that fully complies with Contract Standards and Prudent Utility Practices is dependent on completion of various remediation activities and efforts, including:

- Creating a centralized vegetation management team staffed by professionals who establish procedures and practices aimed at mitigating and abating risks trees pose to the T&D system, eliminating public endangerment, and promoting a safe and efficient work environment.
- Initiating the process of re-establishing maintainable tree-conductor clearances on the T&D system, including:
    - Reactive maintenance response initiatives that target specific locations that pose the greatest risk to public safety, reliability, and system capacity, and
    - Reclamation of the ROWs, involving heavy clearing of existing vegetation and, in some cases, requiring widening of existing ROWs.
- Transition from a reactive methodology to steady-state ongoing vegetation maintenance practices, as individual circuits are reclaimed (consistent with the principles of IVM).

Additionally, due to changing climate, land use practices, and wildland urban interface (WUI) growth, utilities across the U.S. and globally are increasingly focused on understanding and mitigating the risk of wildfires involving their electric transmission and distribution systems. Vegetation in proximity to utility facilities and associated utility vegetation management practices is frequently a key component of these utility risk assessment and mitigation activities. In the wake of 2023 Hawaii wildfires, LUMA has begun an effort to assess the risk of wildfires associated with its facilities. The ongoing risk assessment may lead to changes in how LUMA implements vegetation management, but the basic principles associated with IVM and industry best practices discussed in this VMP will still apply.

As LUMA progresses in remediating the various deficiencies identified in the Gap Assessment and implements the required remediation initiatives, LUMA's Vegetation Management, Clearing and Maintenance program will gradually improve until reaching the desired state described below.

11.3 Desired State

The desired state of vegetation management in Puerto Rico reflects alignment and compliance with the policies, procedures, and practices outlined in this VMP. In summary, the desired state, as outlined in the Program Brief and defined in the System Remediation Plan, states:

- Vegetation-related functions will be centrally managed by a dedicated VM team composed of UVM industry subject matter experts (SMEs) with the responsibility and authority to complete the work in a timely and effective manner. The program will be guided by this plan based on current industry standards and best management practices. LUMA's VMP is based on the principles of IVM, which is an approach for sustainable management of vegetation over the long term rather than simply controlling vegetation currently in conflict with overhead lines.
- Technical specifications will establish vegetation maintenance work expectations, and process flows will be used to define standard approaches to manage the various types of maintenance work efficiently. To ensure work is completed up to the standard set-in place, performance measurement and quality systems will be used to analyze this work.

Achieving this state will require collaboration and dedicated work across the T&D system as LUMA clears the existing ROWs, transitions to long-term preventive maintenance of individual circuits as they are cleared, and fully operationalizes a program of rapid reactive response to address the most critical locations.

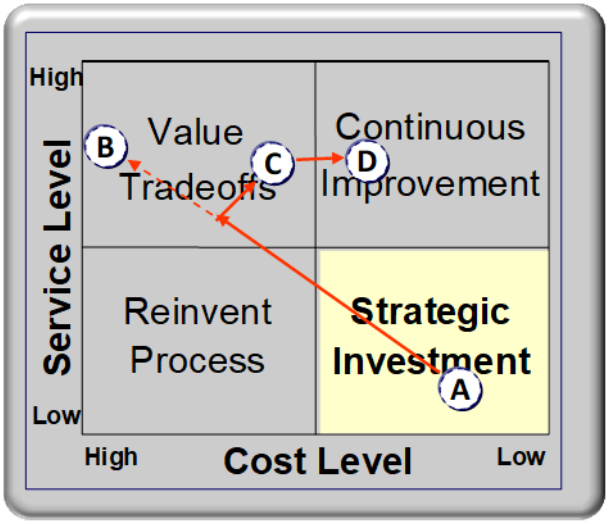
Additionally, LUMA is working to implement a field-enabled IT tool to manage vegetation maintenance work, including planning, scheduling, executing, and evaluating the effectiveness of vegetation maintenance activities. The data collected using this tool will support the calculation of resource requirements and budgets, based on quantitative estimates of the vegetation maintenance workload to be completed. The tool also will support efficient record keeping methods of schedules of maintenance and records of work performed.

Finally, the VM team is staffed with SMEs who will act as mentors, assisting in developing the SME level of knowledge, skills, and capabilities of the requisite vegetation maintenance field force.

12.0 Vegetation Maintenance Improvement Plan

Figure 12.0 illustrates the state of PREPA's Vegetation Management Program prior to commencement, indicating its position in Quadrant IV (often referred to as the "Strategic Investment" quadrant as organizations /programs so categorized often require an infusion of dollars to achieve any substantial and sustainable improvement), the result of severe underinvestment and subsequent poor service level performance.

Figure 12.0. Performance Improvement Process



As we identify improvement opportunities, it is important to note that the journey to Quadrant I (where "Continuous Improvement" becomes the focus) requires three (3) steps:

- Establish performance improvement initiatives (typically in the form of "short-term" and /or one-time investments) to close the service level performance gaps as quickly as possible ("A" towards "B"),
- Offset a portion of any upfront increases in spending and /or investment with the reductions related to initial improvements in organizational or practices efficiencies ("A" towards "B" but diverted to "C"), and
- As Service Level Performance shows improvement, remove any residual non-value-added activities and /or functions that remain ("C" to "D").

- The previous Risk Management section outlines the actions required to achieve the initial level of remediation (the point at which some foundational elements are in place). It defines the desired state and specific actions to achieve a modicum of sustainable performance in our Vegetation Management practices. Assuming an understanding of the need for some well-targeted investments at commencement, we have outlined a three-phased approach to implementation.

The key elements of this plan include the following:

12.1 Rapid Reactive Response

After commencement, LUMA initiated a reactive response intended to identify the “worst of the worst” conditions on the T&D system that presented risk to safety, reliability, and constrains system capacity. Conditions were assessed using “boots on the ground” inspections, collection of outage cause code data, and analysis of worst-performing feeders. This phase of the engagement was conducted over an initial 12-month period, concurrent with the Reclamation Phase or initial clearing phase, of the program.

12.2 Reclamation of Row

Reclamation work is performed to reestablish cleared corridors to PREPA standard widths and maintainable tree-conductor clearances. Deferral of preventive maintenance has resulted in severely overgrown ROWs. Therefore, this phase intends to reclaim the ROW and reestablish conditions that are reasonably maintainable by the systematic application of preventive maintenance practices.

12.3 Preventive Vegetation Maintenance

Preventive vegetation maintenance work, performed once the ROW is reclaimed, is intended to control incompatible vegetation that poses risks to safety, reliability, and system capacity. The previously described IVM-based approach is intended to manage tree and plant community response in a manner that reduces, over time, the intensity of preventive maintenance work.

Events may occur where well-planned preventive vegetation maintenance will not suffice, and either corrective or reactive maintenance will be required. That said, a measure of success in executing this plan is a steady decline in these two (2) categories until the amount of corrective and reactive maintenance is manageable.

12.4 Corrective Vegetation Maintenance

Corrective vegetation maintenance (a.k.a. “hot spotting”) is performed as necessary when a site-specific need for vegetation maintenance is identified by LUMA or in response to a customer request. LUMA manages demand for corrective maintenance as a discreet body of work rather than continually disrupting production on preventive maintenance projects.

12.5 Reactive Vegetation Maintenance

Reactive vegetation maintenance occurs in response to tree-initiated faults, interruptions, and outages. Tree crews can be an important resource to Line Operations in their efforts to respond, restore, and repair tree-related damage to energy delivery infrastructure as safely and efficiently as possible.

In adopting this phased approach to implementation, LUMA is working to achieve the following short-term goals, as outlined in Section 4.0.

12.6 Prioritize Safety

Addressing the backlog of untrimmed trees inherited from the prior operator will mitigate public safety risks due to service interruptions, downed wires, and the public interfering with energized lines.

12.7 Improve Customer Satisfaction

Reducing service interruptions caused by vegetation and potentially shortening interruption duration (i.e., cleared ROWs allow easier access to fault locations) intend to improve the customer experience.

12.8 Achieve Operational Excellence

Applying vegetation management practices, focused on reactive and corrective work (i.e., addressing problems after they arise) are parts of a well-functioning program that will trim vegetation systematically, increasing the efficiency of the workforce and the reliability of the system.

13.0 Performance Management

LUMA's Vegetation Management organization has implemented a performance management system that includes an easily accessible dashboard to facilitate the presentation of Key Performance Indicators / Metrics regarding the efficiency and effectiveness of its Vegetation Management Program. This process currently tracks and reports on the output of vegetation management work, with a goal of implementing a set of clearly defined metrics that are routinely used in best-in-class UVM programs in the future. Other metrics pertinent to the unique challenges LUMA faces in reclaiming the T&D will be identified as needed. We anticipate that, over time, new performance metrics may be developed, and existing metrics may be revised as the program matures. That said, there are five general categories of metrics to consider in developing this performance dashboard.

PRODUCTIVITY

Focused on the cost of performing work, the anticipated use of "cost plus" contracts, renders this metric critical to managing and controlling contractor costs. Hourly billing rates for labor and equipment have been established. The extent to which work units are established for the more typical vegetation management activities (e.g., tree pruning, tree removal, and cost per acres of various IVM activities), and adjusted based on experience, will determine LUMA's ability to control these costs. The objective will be to transition to unit cost and other forms of contracting once a solid baseline is established.

EFFECTIVENESS

These metrics focus on optimizing the work being completed, by computing various cost and production ratios (e.g., prune vs. removal where removals are more costly, remove future workloads, or corrective vs. preventive maintenance expenditures to benchmark against industry norms).

TIME UTILIZATION

These metrics describe how effective a function is in focusing on an assigned task. An example would be a comparison of productive (e.g., pruning trees) to non-productive time (e.g., travel time). Another compares controllable non-productive time (e.g., travel) to time assigned to other tasks unrelated to producing an output (e.g., training).

TIMELINESS

These metrics focus on the ability to meet schedule-related commitments. They are useful at several levels, including the rollout of programs and initiatives, individual projects, and individual transactions such as responding to the need for corrective maintenance (e.g., customer request for "hot spotting").

RESULTS

The primary driver for the increased emphasis on Vegetation Management is PREPA's poor reliability, in particular, the frequency of tree-caused customer outages during and in the absence of major events. Therefore, the performance dashboard should provide transparency regarding the average frequency and duration of customer outages caused by vegetation. This will assist in informing decisions around the focus and periodicity of vegetation maintenance.

A key assumption underlying the rollout of an effective performance management process is the purchase /development of an IT application to house and analyze data and produce user-friendly reports. Vegetation Management software is available in the commercial marketplace, ranging from full-blown enterprise solutions to more simple applications. Initial indications are that LUMA will opt for a solution that can be quickly deployed and compatible with a developing work planning and performance measurement solution.

14.0 Investments and Expenditures

The Vegetation Management Investments and Expenditures section address those systemic deficiencies that preclude LUMA from being able to meet the standards of performance required under the OMA. Presented as part of LUMA's System Remediation Plan, these initiatives and projects define most of the spending contemplated for FY2022 through FY2027, acknowledging that remediation will occur over time, and circumstances may arise that can cause variations from this plan, such as major storms and unexpected power outages.

14.1 Prioritization of Spending Programs

Per the proposed Vegetation Management Improvement Plan summarized in Section 12.0, a three-step prioritization approach was implemented with the goal of rapidly improving system reliability as efficiently and effectively as possible and doing so in a way that leads to sustainable improvement over the long haul.

1. Rapid Reactive Response: Targeting the first twelve months for completion, LUMA initiated a reactive response intended to identify the "worst of the worst" condition on the T&D system that presents risk to safety, reliability, and constraints on system capacity.

2. Reclamation of ROW: Concurrent with the Rapid Reactive Response, reclamation work began to reestablish cleared corridors to PREPA standard widths and maintainable tree-conductor clearances. The intent of this phase is to reclaim the ROW and reestablish conditions that are reasonably maintainable by the systematic application of preventive maintenance practices.

3. Preventive Vegetation Maintenance: With the ROW reclaimed, preventive vegetation maintenance work will be performed to control incompatible vegetation that poses risks to safety, reliability, and system capacity. Preventive Maintenance begins after an asset has been reclaimed.

Once LUMA establishes an effective and efficient preventive Vegetation Maintenance process, it will be poised to respond to requirements to apply corrective and reactive vegetation management as needed.

The initial budget established five projects, focused on initial remediation of risk (refer to Section 12.0):

- Reactive Response
- Reclamation of the T&D System ROW
- Steady-state preventive maintenance
- VM Information Technology
- VM Advanced Technology[10]

The long-term O&M investment and spending plan will presume “business as usual” as the T&D system reaches a remediated state.

14.2 Vegetation Management Workload

The remediation efforts addressed in Section 11.0 and outlined in the five projects submitted as part of the Initial Budgets define most of the workload for the first three (3) years following commencement. However, these initiatives were identified based on an initial assessment conducted by LUMA during the Front-End Transition. After Service Commencement, LUMA deployed a combination of remote sensing spatial analyses, photo interpretation, and “boots on the ground” condition assessments to provide a comprehensive understanding of the vegetation maintenance workload required for PREPA’s T&D system.

An initial assessment used data sets available in the public domain, including National Oceanic and Atmospheric Administration (NOAA) and Coastal Change Analysis Program (CCAP) land classes ($2m^2$ resolution), Google Earth images, and general databases that provided topographic and geographic details. This information was linked to PREPA’s asset management data, including line location, type, and voltage. Once the system was described in general terms, LUMA acquired high resolution ($5cm^2$) near real-time satellite imagery for twenty individual $25km^2$ areas located across the PREPA system. Individual line segments within each area were randomly selected and provided to an experienced vegetation maintenance SME, who then defined the work and crew type and estimated the amount of time each transect would require. This was done for 300 transects. Finally, two (2) experienced SME’s conducted field assessments of 60 individual transects to validate these estimates. The resulting estimate has a statistical accuracy for the workload on the distribution system of ±11 percent at the 90 percent confidence interval.

14.2.1 Tree Exposure on the Distribution System

LUMA used C-CAP[11] data that identified land covers on the T&D system where vegetation maintenance work would be required. The land covers were grouped based on the expected intensity of vegetation maintenance work. For example:

- Forest covers made up of incompatible trees require the most intensive work;
- Shrub cover types may have scattered trees and require significantly less maintenance;
- Open land in agricultural uses, as well as open land in more intensively developed landscapes may include some scattered individual landscape trees; and

[10] Not explicitly discussed elsewhere in the document, this project item is for the assessment and potential adoption of A.I., "big data", high-res remote sensing, etc. Not planned for immediate implementation, this is an area that is seeing rapid development In the UVM Industry, driven by the CA wildfires.

[11] NOAA Coastal Change Analysis Program (2016).

- A fourth group of land covers absent from trees require no vegetation maintenance work.

Table 14.2.1 (A) Caption

Significant VM Work	Some VM Work	Incidental VM Work	No VM Work
Upland Forest	Scrub Shrub	Cultivated Crops	Bare Land
Palustrine Forested Wetland	Palustrine Scrub Shrub Wetland	Pasture Hay	Background
Estuarine Forested Wetland	Estuarine Scrub Shrub Wetland	Grassland	Impervious Surface
		Developed Open Space	Palustrine Emergent Wetland
		Cultivated Crops	Estuarine Emergent Wetland
			Unconsolidated Shore
			Open Water
			Palustrine Aquatic Bed
			Estuarine Aquatic Bed

In describing the forest land of Puerto Rico, the Puerto Rico Forest Action Plan of 2021 states that "succession" is a natural ecological process in which one plant community replaces another over an extended period. "Secondary succession" is the re-establishment of the same or a different plant community in an area where a (natural or man- made) disturbance has occurred. The term "secondary forest" is derived from this concept of succession. Information on stocking, and canopy closure in Puerto Rico shows a predominance of secondary forests with early and mid- successional tree species that are not stocked to their full potential (Brandeis et al., 2007). An estimated 68 percent of Puerto Rico is in young secondary forest, 12 percent is in mature forest, and land reverting to forest accounts for 18 percent of total forest cover.

The National U&CF Advisory Council defines the urban and community forest as broadly including urban parks, street trees, landscaped boulevards, public gardens, river and coastal promenades, greenways, river corridors, wetlands, nature preserves, natural areas, shelter belts of trees and trees at industrial sites. In the Puerto Rico Forest Action Plan of 2021, the urban forests are described as a forested ecosystem characterized by a high concentration of human influences. This plan defines urban classification schemes and states that depending on the classification, between 11 and 50 percent of Puerto Rico could be called urban. LUMA's vegetation maintenance workload assessment stratified the workload on the T&D system by intensity of land use. Developed lands in urban areas form green infrastructure in the same way that roads, water mains, electric lines, and sewers form grey infrastructure. For example, a forest patch can provide habitat for feeding and nesting birds, while a green corridor can ease dispersal if populations become too large or recruitment if they are too small. Connecting open spaces in urban settings creates value. Green infrastructure connects forest and other vegetated land in settings such as wetlands, parks, farms, shorelines, cemeteries, and utility corridors.

The results of this analysis demonstrated differences in the exposure of the overhead distribution system to trees. LUMA used the UVM industry convention to describe the distribution system in terms of miles.

Table 14.2.1 (B) Portion of Distribution System Requiring Vegetation Maintenance as Determined by Initial Assessment

Primary Distribution Voltage Class	Total Miles	Miles with VM Requirements	Percent of Total to be Managed
5 kV	9,729	4,017	70%
15 kV	2,207	504	30%
TOTAL	**11,937**	**4,521**	**61%**

Distribution system VM workload can be further stratified by the intensity of infrastructure (single Ø/multi Ø), land use (urban/residential), accessibility, and slope difficulty.

14.2.2 Tree Exposure on the Transmission System

LUMA used NOAA C-CAP data to assess the workload on the transmission system. The land cover classes presented in Table 14.2.1(A) are also relevant to the transmission system. However, the workload on the transmission system is presented in acres, as is commonly the case in the UVM industry.

Table 14.2.2 (A) Portion of Transmission System Requiring Vegetation Maintenance as Determined by Initial Assessment

Voltage	Total Acres	Acres with VM Requirements	Percent of Total to be Managed
38 kV	8,010	3,255	41%
115 kV	7,169	4,197	59%
230 kV	4,968	3,521	71%
TOTAL	**20,148**	**10,973**	**54%**

The workload on the transmission system can be further stratified by land use (urban/residential), accessibility, and slope difficulty. LUMA also developed a preliminary estimate of the potential need to widen the transmission ROW. The actual determination to widen any transmission corridors will be based on performance requirements, the criticality of a circuit, and site conditions.

Table 14.2.2 (B). Projection of Transmission ROW Widening Requirements as Determined by Initial Assessment

Voltage	Total Miles	Miles of Widening	Acres of Widening
38kV Widening	1,464	628	897
115kV Widening	680	403	373
230kV Widening	423	301	152

14.2.3 Gaps Identified Post-Commencement

Post-commencement, LUMA identified a series of additional challenges that could not be identified during the Gap Assessment conducted in connection with the System Remediation Plan. Specifically, the initial Gap Assessment discussed underestimated the number of clear and open spans in the T&D system. Fieldwork determined that there were fewer clear spans than expected, and that the vegetation was denser than expected. Moreover, the Gap Assessment did not include the large volume of critical and required requests for vegetation control work that were in addition to the remediation work. This led to an initial requirement to do significantly more reactive and corrective actions and less preventative clearing than originally planned.

14.3 Ongoing Vegetation Maintenance

Within the industry, two (2) scheduling models are generally used. The first is a fixed-length cycle schedule where maintenance occurs at regular time intervals (e.g., every 5 years). The determination of the time interval is based on plant species, growth rates, and regrowth rates, as well as the criticality of the facility. A fixed-length cycle schedule has the advantage of being simple to implement, but it may result in work being performed before it is needed in some areas, thereby increasing costs. Fixed-length cycles also effectively mitigate risk because LUMA can easily define the requirements of the maintenance program and demonstrate it was followed.

The second model is a variable-length cycle schedule. A variable-length cycle schedule focuses on performance metrics and incorporates vegetation-specific metrics such as SAIDI, SAIFI, and Customer Average Interruption Duration Index (CAIDI). Factors including criticality of infrastructure, customer count, and system integrity may be included in the scheduling process. A variable length cycle schedule optimizes the use of resources by performing maintenance when the performance metrics indicate it is needed, which may result in more frequent maintenance for some lines and less frequent maintenance for others.

Variable-length cycles are a customer-focused, cost-effective method to address vegetation management. Outages on a distribution system do not have the same impact as outages on high-voltage transmission lines. With variable-length cycle schedules, a distribution line experiencing multiple vegetation outages would gain a higher priority than a distribution line experiencing few vegetation outages. The variable-length cycle schedule optimizes the use of resources by deploying resources to locations where a known problem exists, as opposed to allocating resources to lines that have less of an impact.

LUMA may implement either one or both scheduling models as needed based on experience and analysis of the effectiveness of the VM program. For example, LUMA may find it is most effective to use a fixed-length cycle schedule for higher voltages and a variable-length cycle schedule for lower voltages. To effectively analyze the benefits of both models and optimize the use of vegetation management resources, LUMA is pursuing the use of Artificial Intelligence (AI) analytics tools and advanced imagery data, such as Light Detection and Ranging (LiDAR) and high-resolution satellite imagery, to document conditions in the easements and perform risk modeling. Such tools can analyze areas of greatest risk to create an advanced vegetation maintenance plan based on actual conditions.

Appendix A: Tree Species Incompatible with Powerlines

The following table provides a list of tree species generally incompatible with power lines because of their tendency to exhibit fast and extensive regrowth.

Table A-1 Tree Species Incompatible with Powerlines

Common Name (Spanish)	Common Name (English)	Latin Name (genus, species)
Siris Tree	Lebbeck Tree	Albizia Lebbeck
Albizia	Tall Albizia	Albizia Procera
Achiotillo	N/A	Alchornea Latifolia
Bambu	Bamboo	Bambusa Vulgaris
Almacigo	Gumbo-Limbo	Bursera Simaruba
Canafitula	Golden Shower Tree	Cassia Fistula
Caucho	Rubber Tree	Castilla Elastica
Pino	Australian Pine	Casuarina Equisetifolia
Yagrumo Hembra	Trumpet Tree	Cecropia Schreberiana
Cape Prieto	Spanish Elm	Cordia Alliodora
Guancaste	Earpod	Enterolobium Cyclocarpum
Eucalipto	Rainbow Eucalyptus	Eucalyptus Deglupta
Eucalipto De Alcanfor	Swamp Mahogany	Eucalyptus Robusta
Palo De Goma	India Rubber	Ficus Elastica
Guacima	“Bastard” Cedar	Guazuma Ulmifolia
Emajugua	Sea Hibiscus	Hibiscus Tiliaceus
Molinillo	Sandbox Tree	Hura Crepitans
Guama Americano	Manila Tamarind	Pithecellobium Dulce
Saman	Rain Tree	Samanea Saman
Cheflera	Umbrella Tree	Schefflera Actinophylla
Cassia Amarilla	Siamese Cassia	Senna Siamea
Meaito	African Tulip	Spathodea Campanulata
Citara	Golden Apple	Spondias Dulcis
Pomarroasa	Rose-Apple	Syzygium Jambos
Teca	Teak	Tectona Grandis

Vegetation Management Plan

Common Name (Spanish)	Common Name (English)	Latin Name (genus, species)
Almendra	Indian Almond	Terminalia Catappa
Cenzio	Prickly Ash	Zanthoxylum Martinicense

Appendix B: Species Prone to Structural Failure

The following table provides a list of tree species prone to structural failure.

Table B-1 Species Prone to Structural Failure

Common Name (Spanish)	Common Name (English)	Latin Name (genus, species)
Siris Tree	N/A	Albizia Lebbeck
Albizia	Tall Albizia	Albizia Procera
Almacigo	Gumbo-Limbo	Bursera Simaruba
Yagrumo Hembra	Trumpet Tree	Cecropia Schreberiana
Cape Prieto	Spanish Elm	Cordia Alliodora
Eucalipto	Rainbow Eucalyptus	Eucalyptus Deglupta
Molinillo	Sandbox Tree	Hura Crepitans
Flamboyan Azul	Jacaranda	Jacaranda Mimosifolia
Corcho	Balsa	Ochroma Pyramidale
Palo De Mato	Peronia, Horse-Eye Bean	Ormosia Krugii
Cheflera	Umbrella Tree	Schefflera Actinophylla
Meaito	African Tulip	Spathodea Campanulata
Citara	Golden Apple	Spondias Dulcis
Anacaguita	Panama Tree	Sterculia Apetala
Cenzio	Prickly Ash	Zanthoxylum Martinicense

Appendix C: Vegetation Management Process Maps

The following Figures map out the processes presented in Section 9.0. They are general in nature, illustrative of Industry Best Practices, and will be tailored to ensure alignment with and compliance with applicable Laws and Regulations.

Figure C-1: Preventive Maintenance Process Map (Section 9.2)

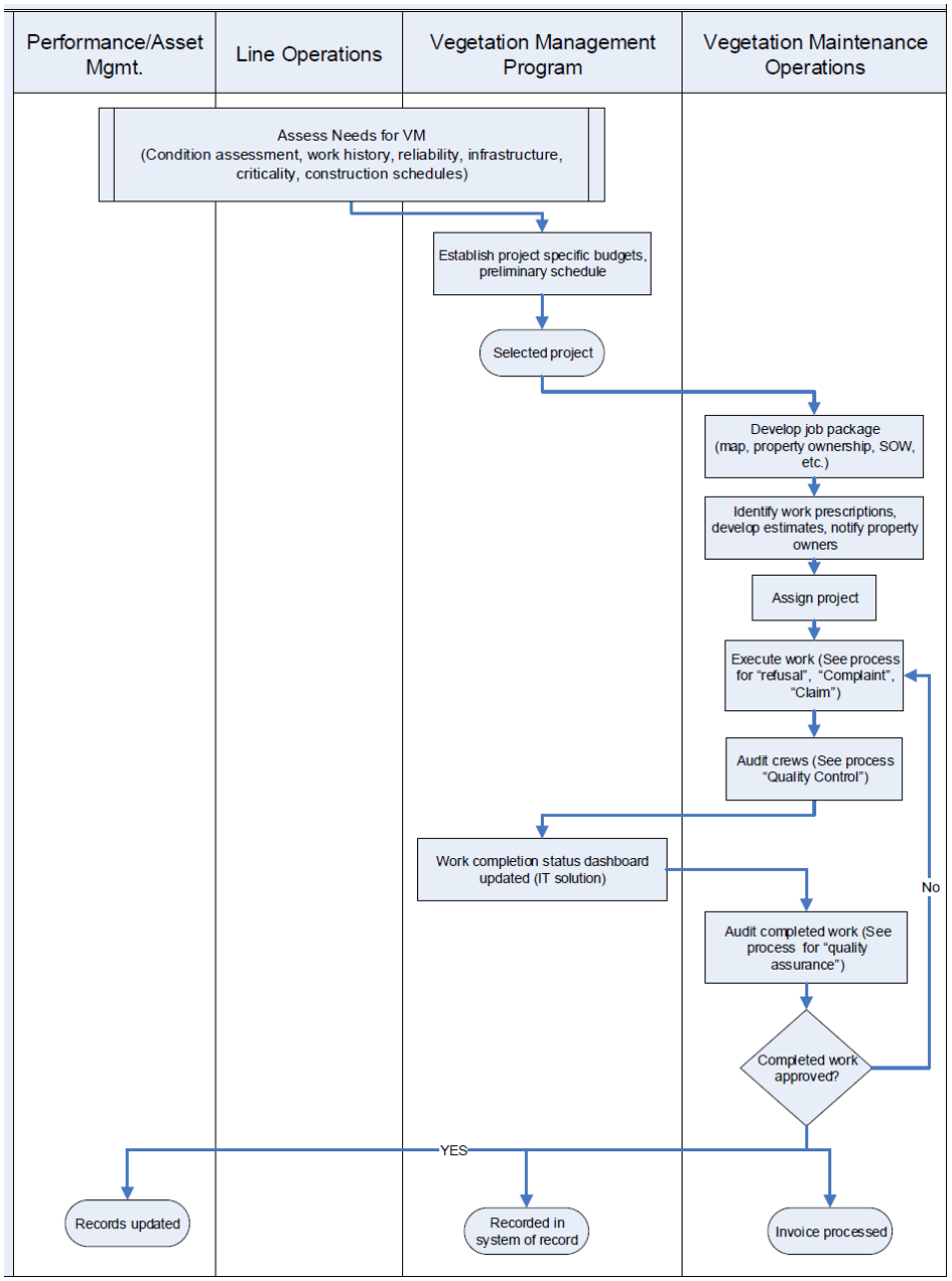
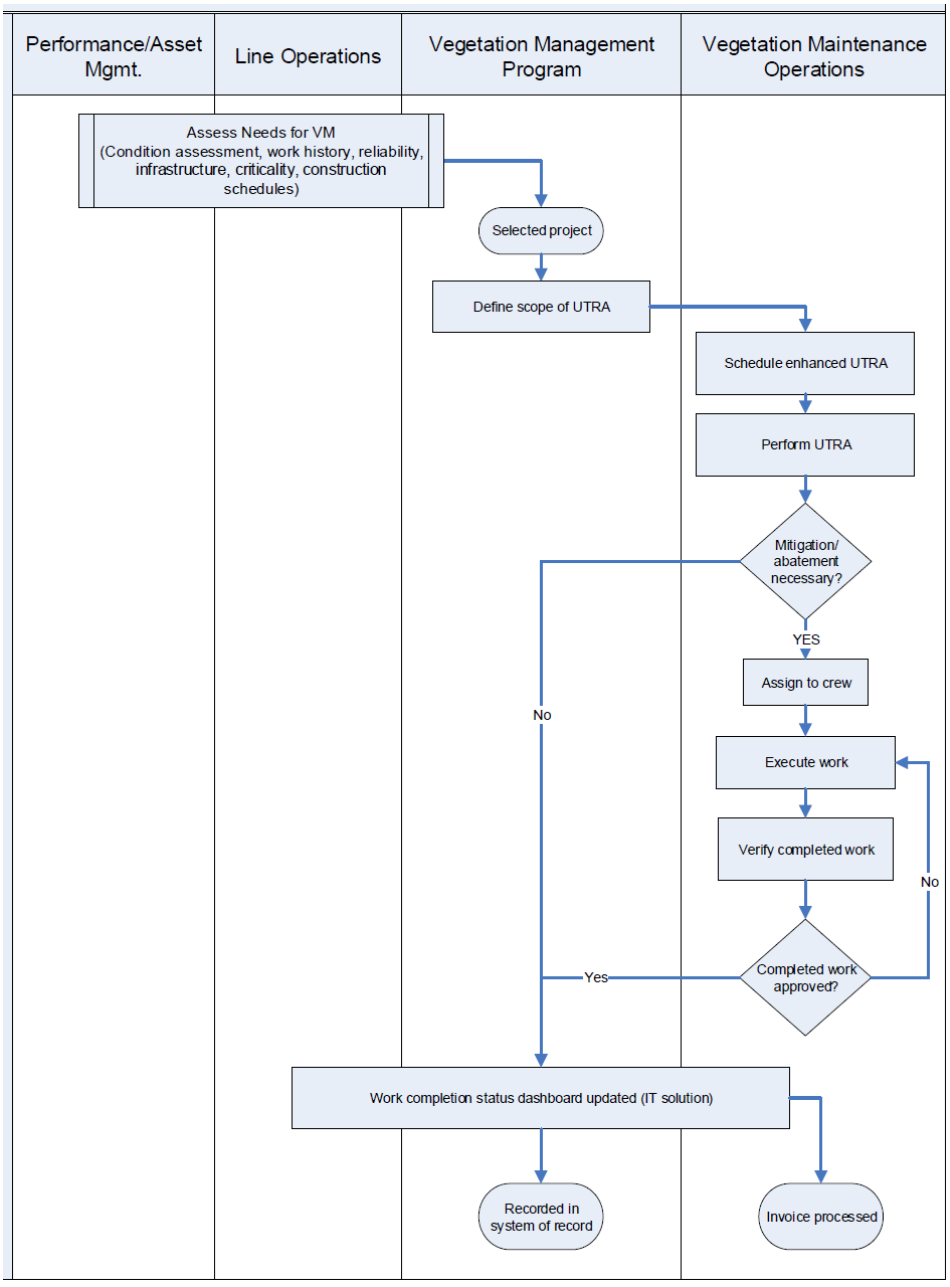


Figure C-2: Enhanced Tree Risk Assessment (Section 9.2)



Note: UTRA is an abbreviation for Utility Tree Risk Assessment.

Figure C-3: Corrective Action Process Map (Section 9.3)

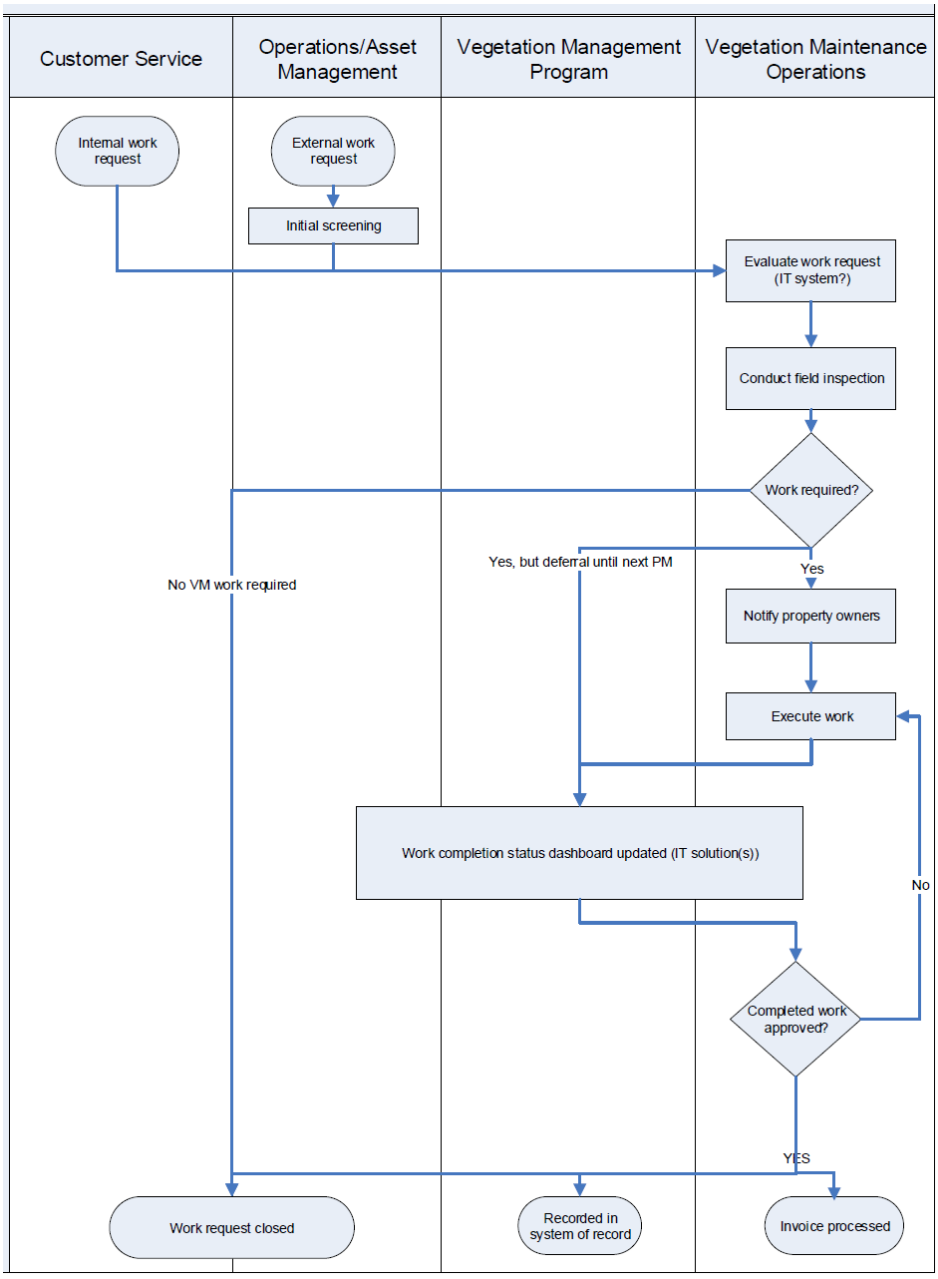


Figure C-4: Reactive Maintenance (Section 9.4)

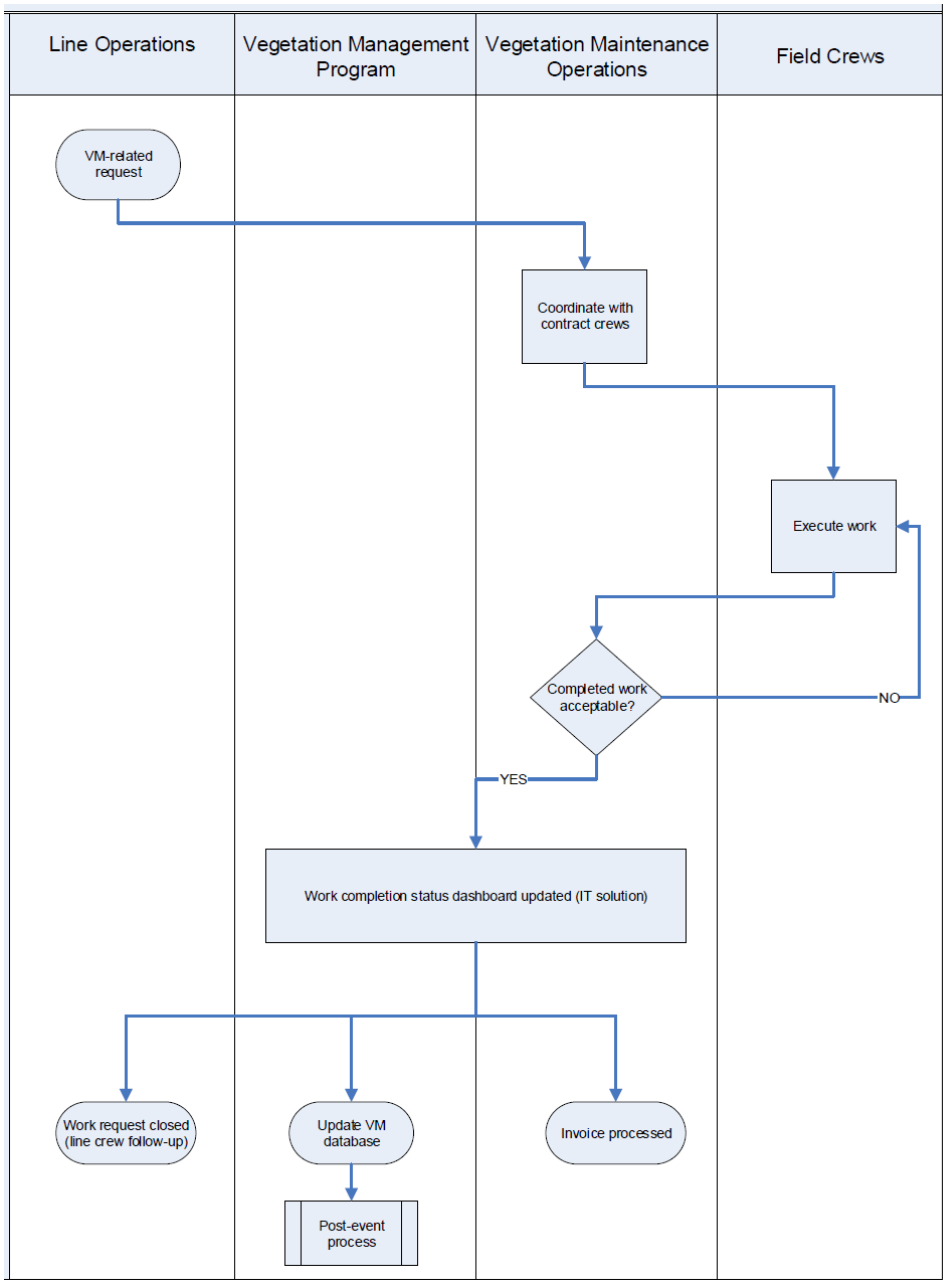


Figure C-5: Post Incident Investigations (Section 9.6)

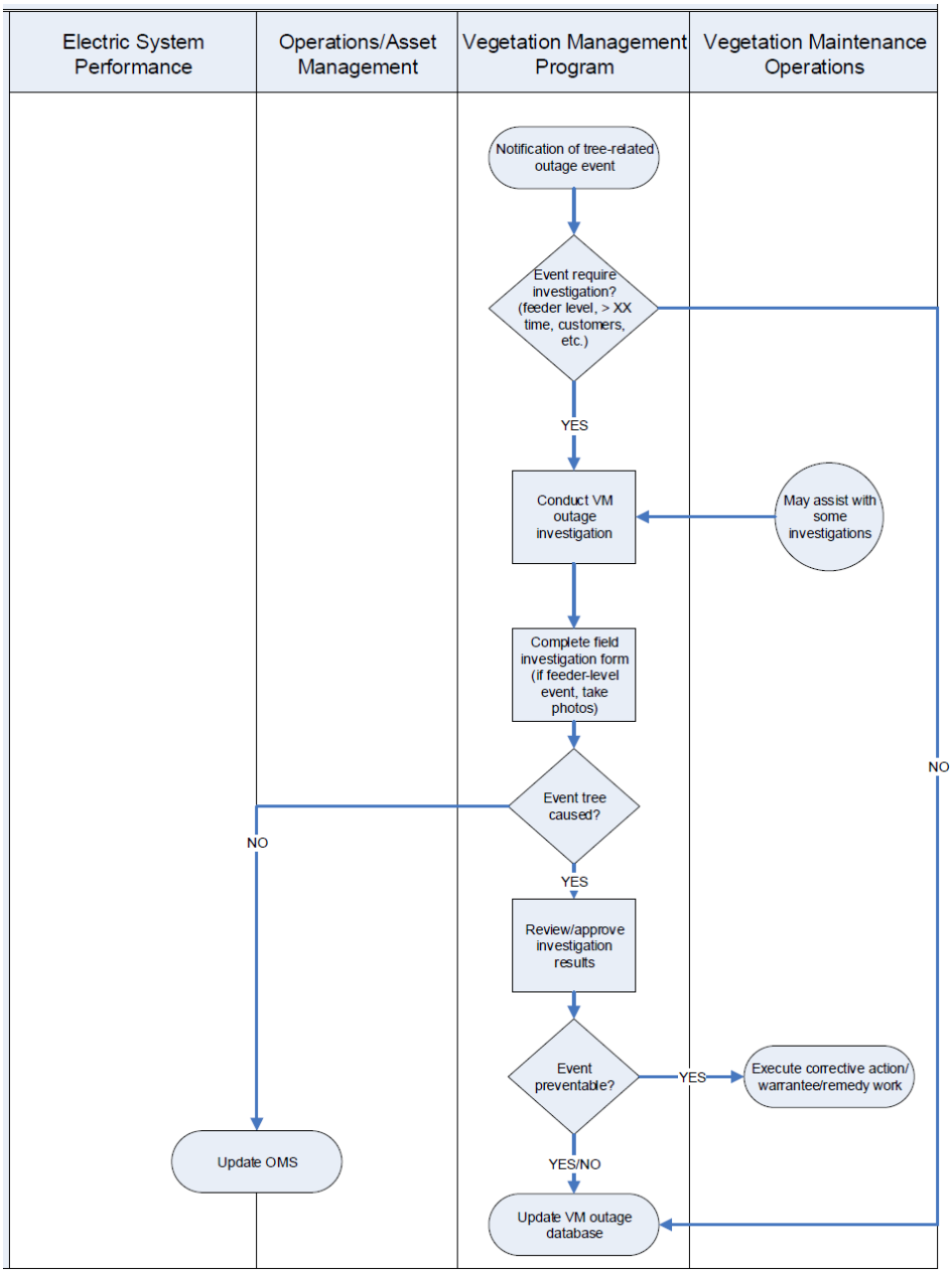


Figure C-6: Customer Complaints (Section 9.8)

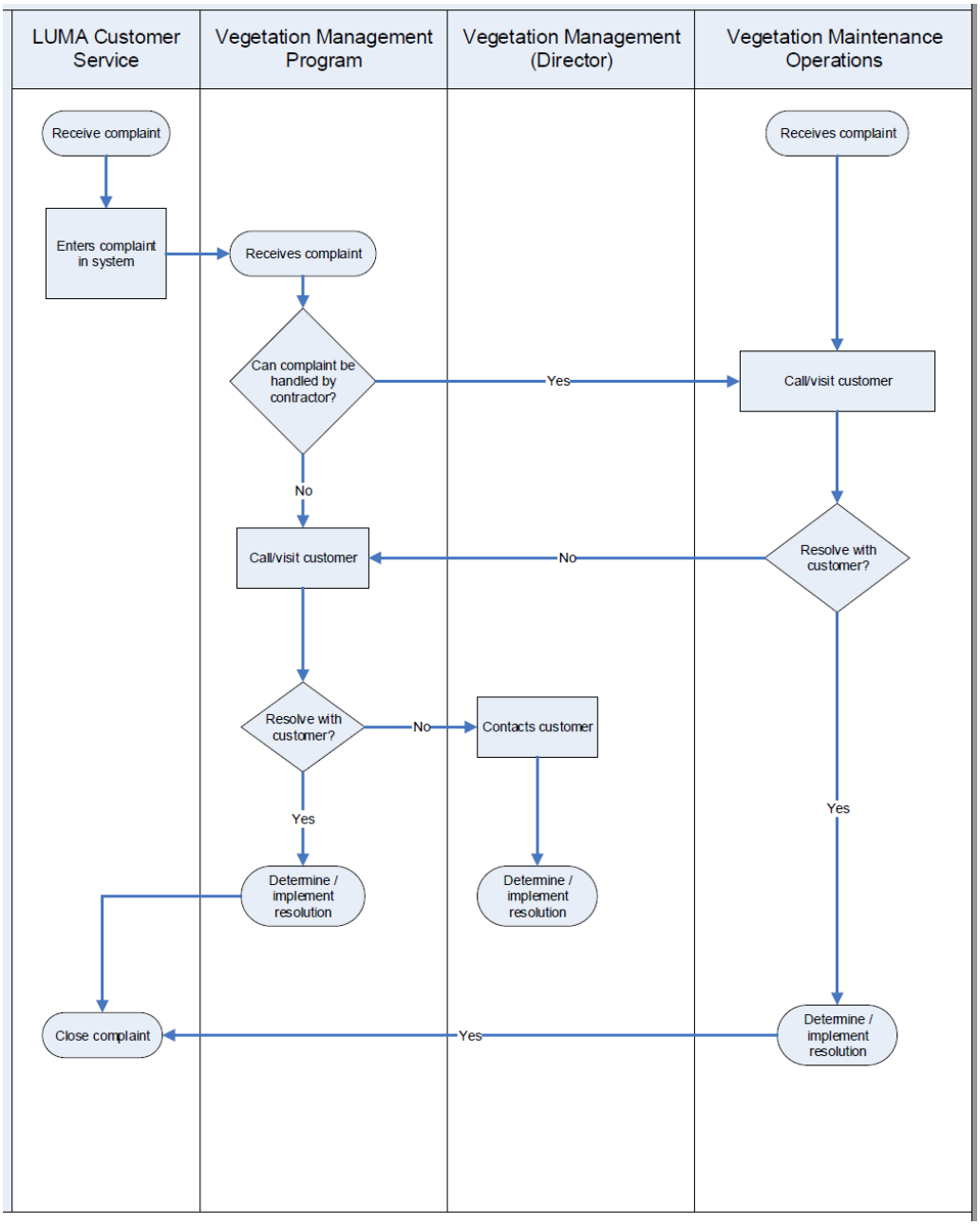
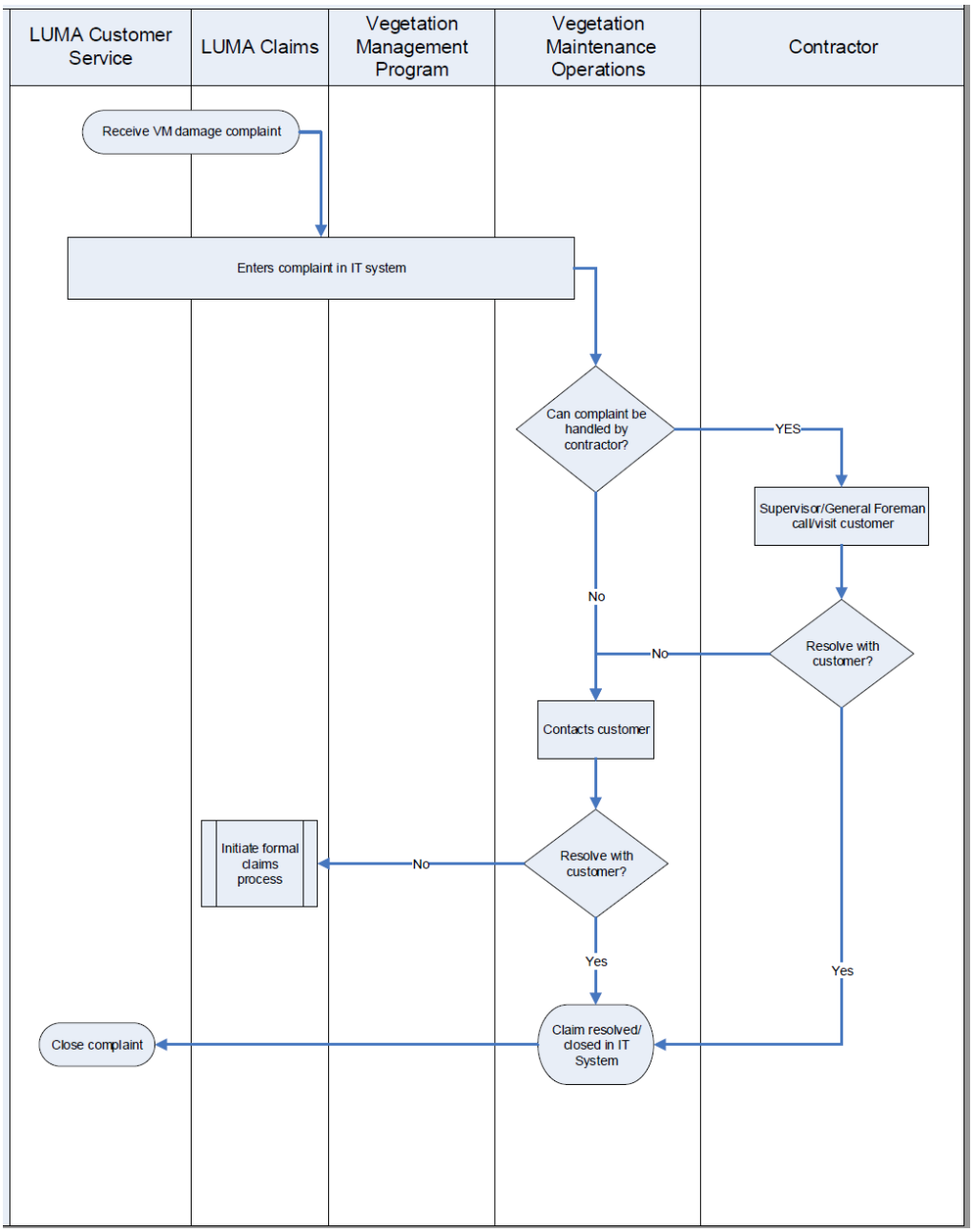
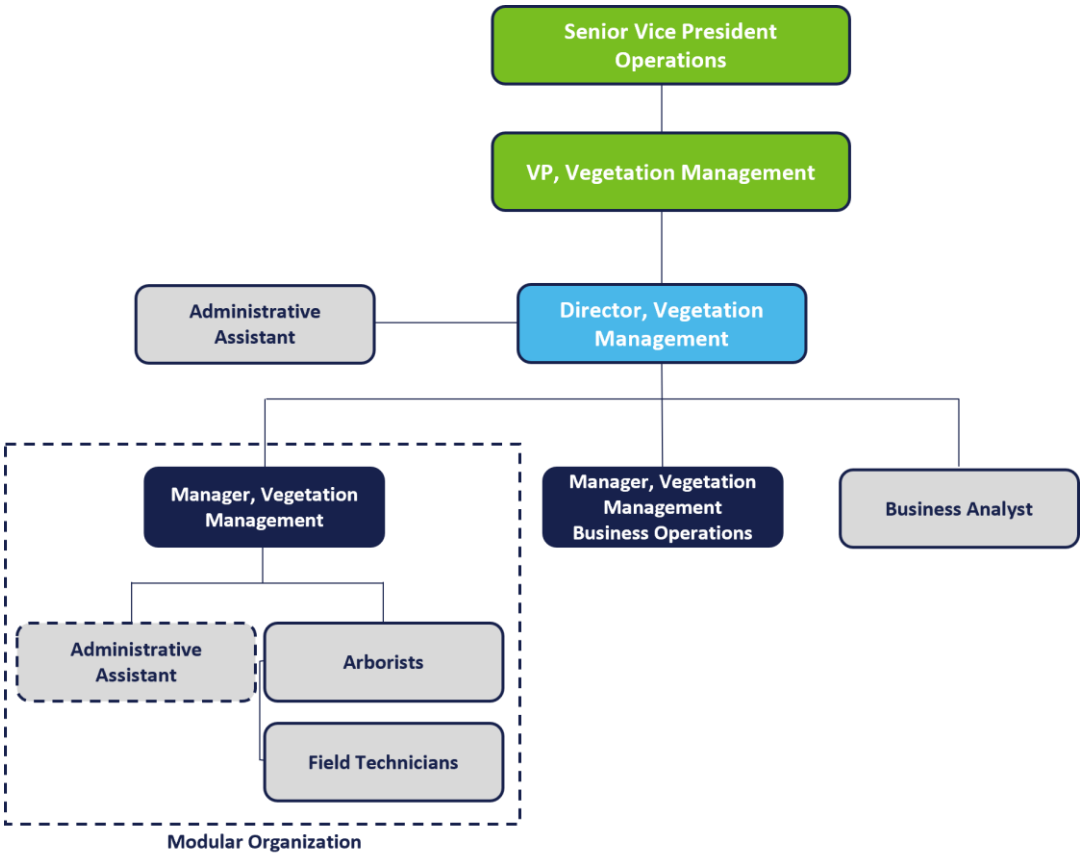


Figure C-7: Customer Damage Claims (Section 9.9)



Appendix D: Vegetation Organization Charts

D-1 Vegetation Management (Operations) Organization.



The following chart (Figure D-1) provides an overview of the structure and functioning of LUMA's VM organization.

1.1 VM Senior Leadership

- **Vice President, VM** – This individual is responsible for achieving LUMA's corporate vegetation goals, communicating these goals to the Director, VM, ensuring the VM Program aligns with these goals, and developing strategic plans for the department. This individual is also responsible for providing Executive Leadership with feedback on how and what resource needs are required to achieve corporate goals.

- **Director, VM** – This individual is responsible for communicating program strengths and weaknesses to the Vice President, VM, developing VM programs to meet corporate objectives, and through the Managers, VM implementing these programs. This individual is also responsible for working with the Finance Lead to ensure vegetation programs are on budget.

- **Manager, VM** – This individual is expected to hold significant operational experience and technical knowledge to implement and execute the program goals identified by the Director. The Manager, VM may specialize in a specific vegetation related function but must continue to

develop cross functional skill sets. This individual must prioritize employee development and mentorship.

- **Manager, VM Business Operations –** This individual manages the business operations of the VM department, which includes overseeing departmental contracts, invoicing, and reporting, and implementing tools and procedures to ensure the efficient operation of the department. This individual also supports department-wide training and safety initiatives.

- **Finance Lead (Matrixed)** – This individual is part of the Operational Finance organization but works closely with the Vice President, VM, and the Director, VM, to ensure proper accounting procedures are implemented and followed. The Finance Lead closely monitors the VM budget, providing feedback to the Vice President, VM, and the Director, VM.

- **Modular Organization –** This part of the organization can be duplicated as needed to meet the workload of the VM organization. Currently, there are three Managers, in Vegetation Management, who have responsibility for Transmission, Distribution East, and Distribution West. The number of managers may increase or decrease as needed. The Administrative Assistant position in the modular organization may or may not be included as the organization expands.

1.2 VM Program Team

- **Business Analyst –** Reporting to the Manager, VM Business Operations. This individual supports all department-wide activities, including invoicing, reporting, and implementing department tools and programs.

- **Administrative Assistant –** These individuals perform a variety of functions as needed to support the needs of the department.

- **Arborist –** This individual is responsible for the execution of the programs, as outlined by the Manager, VM. The Arborist provides technical expertise about utility arboricultural practices, IVM, and tree risk assessments; interfaces with the public/stakeholders; and provides oversight of the vegetation management contractors to ensure contract standards are met. The Arborists mentor and supervisor the Field Technicians.

- **Field Technician –** This individual is responsible for interacting with property owners, performing condition assessments, and developing vegetation maintenance work prescriptions. Reporting to the Arborist, the Field Technician may perform similar duties as required.

Appendix E: Environmental Conservation Guidance

1.0 Introduction

LUMA complies with all with federal and local environmental laws, rules, and regulations as it continues to build a better and more resilient power system for the Island. During work planning, managers must contact the Environmental Department to evaluate all system operations, maintenance, and project activities. These activities are assessed using the IPAC application and any other available database or information to identify possible environmental concerns in the proposed work areas. Once system managers have a comprehensive understanding of the potential environmental concerns and are prepared to proceed to the execution phase, they ensure all LUMA employees and/or contractors have received training related to environmental compliance. Anyone working on the electric system follows environmental recommendations and conservation measures and applies best management practices discussed here and detailed in the LUMA Environmental policies established in the HSE Manual. These outlined measures represent a guide only and do not in any way supersede or amend any existing laws, rules, or regulations.

2.0 Threatened and Endangered Species

The following recommendations and conservation measures must be followed to avoid and minimize possible adverse effects to listed species that could be encountered within and contiguous to PREPA/LUMA ROW's, distribution/transmission lines and poles/towers:

- The use of a qualified biological monitor to implement conservation measures in sites where endangered and threatened species were identified or in areas identified as critical habitats.
- Submit to the Environmental Department a schedule before starting works.
- Recommend limiting operations activities only to previously impacted areas along access roads to lines.
- Avoid impacting additional habitat to the maximum extent possible.
- Avoid pushing or dumping debris or fill material into forested areas along the access roads, particularly while using heavy machinery.
- For more details, see LUMA policy 0335 Wildlife, and Historical Resources Protection.

2.1 Conservation Measures for Reptiles

Protected Species: Puerto Rican Boa (Chilabothrus Inornatus) and Virgin Island Boa (Chilabothrus Monensis).

- Inform all personnel about the potential presence in areas where the proposed work will be conducted.
- Avoid harming the species.
- Display an educational poster of the boa.
- Personnel able to correctly identify must survey the area to verify the presence of any boa within the work area.
- The species should be searched prior to habitat disturbance.

- Project boundaries, buffer zones, and areas to be excluded or protected shall be clearly marked in the project plans and the field, prior to any construction activity, including the removal of vegetation and earth movement.
- Vegetation should first be cleared by hand.
- Prior to the use of heavy machinery, vegetation should be cut about one meter above ground.
- Debris piles should be placed far away from forested areas.
- Record the time, date, and location of any dead or live boa sightings, including photos and coordinates, and send them to the Environmental Department for further report submission to the USFWS.
- No one may capture the boa. If boas need to be moved out of harm's way, designated personnel shall immediately contact the LUMA Environmental Department to properly notify the DNER Rangers for safe capture and relocation of the animal at (787)724-5700, (787)230-5550 and (787)771-1124.
- For more information, please access the USFWS Puerto Rican boa Conservation Measures at: https://ipac.ecosphere.fws.gov/guideline/design/population/156/office/41430.pdf

2.2 Conservation Measures for Amphibians

Protected Species: Coquí Guajón (Eleuctherodactylus cooki); Coqui Dorado (Eleuctherodactylus jasper); Coqui Llanero (Eleuctherodactylus juanariveroi) and Puerto Rican Crested Toad (Peltophryne lemur).

- Inform all project personnel about the potential presence of the above-mentioned species in areas where the proposed work will be conducted.
- A pre-construction meeting shall be conducted to inform all project personnel about the requirement of avoiding harm to the species.
- An educational poster or sign with photos or illustrations of the species should be displayed at the project site.
- Project boundaries, buffer zones, and areas to be excluded or protected shall be clearly marked in the project plans and the field, prior to any construction activity, including the removal of vegetation and earth movement.
- Personnel able to correctly identify should survey the areas to verify the presence of any Coquí within the work area.
- Only a biologist can manage the species and relocate. Designated personnel shall immediately contact the LUMA Environmental Department to properly notify the Puerto Rico DNER Rangers for safe capture and relocation of the animal at (787)724-5700, (787)230-5550 and (787)771-1124.
- Document any sighting, dead or alive, of the species. Record the time, date, and location for any sightings, including photos and coordinates, and send them to the Environmental Department for further report submission to the USFWS.
- Erosion and Sedimentation Control Best Management Practices (BMP's) shall be included in the project scope of work when working within or adjacent to the Coquí habitat (e.g., rivers, streams, drainages, ravines, big boulder areas) to avoid or minimize erosion and sedimentation. (For more details, LUMA policy 0340 Stormwater and Erosion Control)
- All projects associated with streams, rivers, bridges, culverts, etc., shall follow the Post-Disaster Guidance for Repair, Replacement, and Clean-up Projects in Streams and Waterways of Puerto Rico from Hurricane María. (For more details, LUMA policy 0325 Working Near Waterbodies)

2.3 Conservation Measures for Birds

Protected Species: Yellow Shouldered Blackbird (Agelaius xanthomus); Puerto Rican Plain Pigeon (Patagioneas inornata); Puerto Rican Sharp-Shinned Hawk (Accipiter striatus); Puerto Rican Nigthjar (Antrostomus noctitherus); Puerto Rican Parrot (Amazona vittata); Puerto Rican Broad Winged Hawk (Buteo platypterus); Roseate Tern (Sterna dougalii); Elfinwood Warbler (Setophaga angelae).

- If there are species in breeding or nesting season, nest surveys shall be conducted. Managers must coordinate the surveys with the Environmental Department.
- All survey reports must be sent to the Environmental Department prior to any activities.
- Nest searches must be conducted by qualified personnel with the appropriate DNER permits prior to the start of work.
- If nesting activity is detected during or after surveying, a buffer zone of 200 meters will be maintained. This avoidance strategy must be kept until fledglings successfully leave the nest permanently.
- Do not interfere with the nest and chicks.
- Document any sighting, dead or alive, of the species. Record the time, date, and location for any sightings, including photos and coordinates, and send them to the Environmental Department for further report submission to the USFWS.

2.4 Conservation Measures for Sea Turtles

Protected Species: Hawksbill Turtle (Eretmochelys imbricata); Leatherback Sea Turtle (Dermochelys coriacea); Loggerhead Turtle (Caretta caretta); Green Sea Turtle (Chelonia midas)

- A qualified sea turtle monitor will inspect each work area of the beach for possible sea turtle nests during the morning.
- All activity on the project should be limited to daylight hours and should not be started before 08:00 am.
- Utilizing sea turtle-friendly lights for coastal areas is required for works to comply with the Program for the Control and Prevention of Light Pollution Act, Act No. 218 of August 9, 2008, as amended (Act-2018-2008) and the Regulation for the Control and Prevention of Light Pollution, Regulation Number 8786, where lights will be repaired or newly installed.
- If required, debris removal from beach construction activities will be initiated only after the sea turtle monitor has completed that morning's censuses and the nests are clearly marked.
- Any possible obstructions, such as debris buildup, equipment, etc., should be removed from the beach at the end of each day.
- Document any sighting, dead or alive, of the species. Record the time, date, and location for any sightings, including photos and coordinates, and send to LUMAs Environmental Department for further report submittal to the USFWS and the DNER.

2.5 Conservation Measures for Plants

- Limit operations activities to a previously impacted area along the access road to transmission lines and towers.
- Avoid pushing or dumping debris or fill material into forested areas along the access road, particularly while using heavy machinery.

- Applicants are required to survey for listed plants prior to any work in areas within the range of the species and where suitable habitat is present as per available geospatial databases and species information (e.g., IPaC or U.S. Fish and Wildlife Service Geospatial Data).
- If listed species are found within the project site, the crew manager must contact the LUMA Environmental Department, which will contact USFWS. Managers, with assistance from the Environmental and Vegetation Management Departments, must develop measures for USFWS evaluation and approval to avoid or minimize impacts to those species. If no listed plants are found during surveys, no further action is needed.
- If issues concerning the presence of listed plant species arise while work is being performed, project personnel shall stop work and contact the Environmental Department. The USFWS should be contacted for further technical assistance.
- For more details, LUMA policy 0320 Vegetation Management.

3.0 Conservation Measures for Forests and Natural Refuges

- Avoid impacting additional forested habitat to the maximum extent possible.
- Coordinate with the manager of both federal and commonwealth forests and national refuges while working on lines within or adjacent to the boundaries of this forest.

4.0 Conservation Measures for Historical Sites

- If, in the course of the works, previously unidentified structures, sites, buildings, objects, districts, or archaeological deposits, that may be eligible for listing in the National Register, or human remains are uncovered, or if it appears that has affected or will affect a previously identified historic property in an unanticipated manner immediately stop construction activities in the vicinity of the discovery secure the area and take all reasonable measures to avoid or minimize harm to the property.
- Document any sighting. Record time, date, and location. Include photo and coordinates and send to the Environmental Department for further report submittal to the State Historic Preservation Office (SHPO) and the Institute of Puerto Rican Culture (ICP in Spanish).
- For more details, LUMA policy 0335 Wildlife, and Historical Resources Protection.

5.0 Best Management Practices

5.1 Environmental Recommendations

The benefit of erosion prevention is to avoid the problem before it starts. Mitigation of potential environmental impacts during ground disturbance activities, vegetation clearing, and vegetation control activities are described in LUMA Policy 0340 Stormwater and Erosion Control and LUMA Policy 0320 – Vegetation Management. Below are some of the measures to be considered. Please, see these and other policies mentioned below for more details.

Ground Disturbance and Erosion Control:

- Where soil is disturbed, erosion control measures must be installed. Each site has its own characteristics such as nearby water bodies, roads, communities, and other factors that must be considered to implement the most appropriate measures.
- Utilize existing roads, as much as possible, since scraping and grubbing the soil to create access roads will require mitigation measures.
- Clearing should be limited to land necessary for operation or access to the facility.
- Driving and crushing are recommended to maintain grass and shrub ground cover where practicable. The use of heavy machinery that disturb soil (ex. Bulldozers, machines with chains, bladed equipment) will require mitigation measures.
- Fire shall not be used as a clearing tool.
- The centerline access track shall be as straight as practical.
- If an existing long or steep slope is disturbed or a new one is created by grading, mitigation measures will be required.
- Soil that is removed will be reused, compacted and/or protected to prevent erosion from rainfall. If stockpiled, mitigation measures should be applied.
- Every effort shall be made to prevent erosion and preserve existing grass cover, and no windrows of soil or debris will be left on the lower side of the access road or across drainage lines.
- Erosion and sedimentation controls may include rough grading, excavation, backfill, installation of erosion control matting, installation of silt fences and, or hay bales, seeding of soil slopes, water blockage or diversion, installation of stone and riprap, and other related and permanent soil stabilization techniques.
- Periodic inspections shall be performed on the access tracks to verify their integrity and to avoid any environmental non-compliance due to erosion or sedimentation.
- For more details, see the PR Erosion and Sediment Control Handbook for developing areas. https://www.epa.gov/sites/default/files/2018-09/documents/puerto_rico_erosion_and_sediment_control_handbook_for_developing_areas.pdf

5.2 Vegetation Debris

- All brushes, limbs, logs, etc. shall be chipped and or removed daily.
- Debris shall not be left on job sites overnight without express permission from the property owner or LUMA's authorized representative.
- Debris may be left on an unimproved easement provided it is chipped or manually mulched to facilitate onsite recycling/decomposition, provided it will not impede water flow.
- Gather and keep at least 10m away from drains and waterways. Ensure piles are no more than 20m long and 3m high.
- Disposal must be at an authorized facility. Information on the disposition performed should be available.
- For more details, LUMA Policy 0315 – Waste Management and LUMA Policy 0316 – Waste Classification and Disposal

5.3 Working near Waterbodies or Flood Zone

- Avoid water crossings (including wetlands).
- If unavoidable, permits are required. Contact LUMA Permits for assistance.
- All reasonable erosion prevention measures while working around watercourses shall be implemented.

- Pushing or falling trees and debris into a watercourse is prohibited, and all vegetation felled must be immediately removed from flood zones.
- Machine clearing shall not take place adjacent (within 30 feet) to the banks of any watercourse.
- The contractor will clear only the minimum amount of vegetation required below the banks of any watercourse.
- Position all work areas (laydowns, staging, parking, etc.) at least 50 feet from water bodies.
- For more details, LUMA policy 0325 – Working Near Waterbodies.

5.4 Spill Response

- Use or operation of machinery, vehicles, heavy equipment, or any other equipment with leaks of oil or fuel is prohibited. If any equipment spills oil, fuel, or other substances, the crews will be responsible for cleaning, restore, and dispose of contaminated material.
- All situations involving fuel, oil, or any other spills should be addressed to the Environmental Department.
- For more details, LUMA policy 0310 Spill Response

5.5 EPA-Registered Herbicides

- All personnel providing EPA-registered herbicide or growth inhibitor work will have a Puerto Rico applicator's license.
- All EPA-registered herbicides shall be handled and surgically applied in accordance with the product label, and in such a manner as to prevent damage to vegetation outside of the ROW. EPA-registered herbicide logs will be kept current and shall include date, type of EPA-registered herbicide used, location of application, and scope of job. EPA-registered herbicide logs shall be available for inspection upon request. All local Laws, rules, and ordinances relating to EPA-registered Herbicide Application will be observed.
- Accidental releases of EPA-registered herbicide shall be immediately cleaned up in a manner consistent with label requirements and federal and state regulations.
- Areas adjacent to rivers/streams, other bodies of water, crops, or nursery stock shall not be sprayed unless prior permission has been received by a qualified LUMA Representative.

6.0 Inspections

All the work performed in the field requires the implementation of specific conservation measures to mitigate any possible impact on the environmental resources. These measures should be maintained throughout, and some may be until after the execution of the works.

- Any erosion control and/or mitigation measure shall be inspected and maintained regularly until the risk is reduced. Mitigation measures may change throughout an operational or construction period and should be re-evaluated when site conditions change.
- Any conservation measures, biological or archaeological monitoring shall be carried out following the plans or conditions set in specific areas.

Upon completion of work, a site inspection shall be performed to ensure that:

- all vegetation clearing has been satisfactorily performed,
- all erosion control mitigation measures have been taken,

implementation of recovery actions to address the impact on the species was coordinated, and due survey inspections were performed.

7.0 Environmental Permits, Endorsement or Notifications

LUMA has a Permits Department which handles everything related to permits required for operations or project execution. It is recommended that you check with said area to confirm.

- Compliance with the Government of Puerto Rico "Environmental Public Policy Act", of September 22, 2004, as amended, Act 416-2004
  - Administrative Order OGPe 2021-07,
  - Categorical Exclusion; or
  - Environmental Assessment
- Cutting, pruning, and transplanting Permit
- When the work affects water bodies or wetlands:
  - US Corps of Engineers Nationwide Permit
  - US Corps of Engineers/DNER Joint Permit
- Erosion Control Permit triggers:
  - Projects with an area equal to or greater than 900 square meters
  - Projects that remove 40 cubic meters or more of the earth's crust.
  - If the volume of material is less than 40 cubic meters, it can gain access to a body of water.
- Whether or not legal requirements entail a permit, vegetation controls, and mitigation measures shall be taken to comply with state and federal regulations.
- NPDES (Construction General Permit-SWPPP)
  - Activities with more than one acre of land disturbance.
- Forest Service Authorization to access El Yunque Forest.
- Coordination with National Wildlife Refuge System (Vieques, Culebra, Cabo Rojo (2), Desecheo).
- Coordination with DNER for work in any state forest.

USFWS & DNER Technical Assistance might be required when the work affects critical habitat areas.https://www.epa.gov/sites/default/files/2018-09/documents/puerto_rico_erosion_and_sediment_control_handbook_for_developing_areas.pdf

Appendix F: Vegetation Debris Management

1.0 Introduction

Vegetation maintenance and clearing activities will result in the production of vegetative debris that must be managed consistent with all applicable laws, rules, and regulations. The primary objective of LUMA's debris management approach is to effectively manage the accumulation of vegetative debris from maintenance and clearing activities in a proactive and sustainable manner.

2.0 Debris Management Approach

2.1 Leaving Debris Onsite

LUMA's preferred approach to debris management is to prioritize the chipping of vegetative debris and then spreading the material onsite to act as a natural barrier and to limit the amount of material that must be transported offsite. Spreading vegetative debris on the ground is an economical and natural method of controlling regrowth in the easements. Larger debris, such as logs and branches, can also be left on site intact to be used by wildlife as a habitat.

The benefits of leaving vegetation debris onsite include the following:

- Reduction of vegetation encroachment in easements.
- Formation of a natural barrier to regrowth.
- Reduction in frequent clearing activities and use of approved environmentally safe EPA-registered herbicide control methods.
- Reduction of carbon footprint associated with the transportation and disposal of debris.
- Improved efficiency and cost-effectiveness of vegetation maintenance and clearing activities.

In all cases, debris will be handled in compliance with LUMA policies and in compliance with all applicable laws and regulations. For example, debris will not be left near waterbodies or in flood zones.

2.2 Repurposing

In addition to leaving debris onsite, LUMA is exploring opportunities to partner with local companies and artisans to reuse or repurpose debris. This effort includes evaluating the feasibility of transporting large logs to lumber yards to process them into usable lumber. LUMA will also evaluate partnering with local artisans who work with wood and organic materials to make use of debris in the creation of their crafts. Such opportunities will depend on the type of debris created and the needs of the recipient of the debris.

2.3 Offsite Disposal

In situations where neither onsite disposal nor repurposing is possible, vegetative debris will be collected and transported to offsite composting facilities, depending on the volume of the debris and the capacity of the facilities.

LUMA does not currently plan to dispose of vegetative debris in landfills. Landfill disposal may be necessary if none of the above alternatives are available, for example, in an emergency where debris cannot be left on site and repurposing or composting facilities are closed, damaged, or otherwise unavailable.

3.0 Debris Management Methods

Specific debris management methods are described below. In all cases, debris will be handled in compliance with LUMA policies and compliance with all applicable laws and regulations.

3.1 Chip and Blow

Debris generated during pruning and tree removal work will be reduced by mechanical chipping and blown onsite.

- Drum and disk chippers reduce vegetation material into chips four inches or less in diameter. The chips are blown and spread evenly across the site.
- Trunks and branches too large to be handled by the chipper are limbed, and the limbs are then chipped.

Larger trunks are placed in rows along the edge of the easement or scattered, as the situation requires. Depending on the size and type of the material, larger trunks may be taken offsite to local artisans or lumber mills for reuse.

3.2 Pile

Debris generated during pruning and tree removal work is collected in piles and/or rows along the edge of the easement.

3.3 Lop and Scatter

Debris generated during pruning and tree removal work is cut into small pieces and left to lay on the ground. The material is cut (lopped) by an ax or chainsaw.

3.4 Mulching

Mechanized mastication and mowing machinery are used to reduce vegetation on-site to mulch, which is then spread onsite.

3.5 Chip and Haul

This method is like that used in Chip and Blow, but the chips are blown into a truck and hauled offsite for composting or disposal. Depending on the size and type of the material, debris may be taken offsite to local artisans or lumber mills for reuse.

Table F- 3.5 Types of Disposal Methods

Type of Disposal	Disposal Approach	Applicability
Chip and Blow	Leave onsite or repurpose	Accessible undeveloped sites and natural landscapes.
Pile	Leave onsite	Inaccessible undeveloped sites and natural landscapes.
Lop and Scatter	Leave onsite	Undeveloped sites and natural landscapes.
Mulching	Leave onsite	Undeveloped sites and natural landscapes.
Chip and Haul	Haul offsite to compost or repurpose	Developed urban and residential sites, maintained landscapes

4.0 Revision History

Table F- 4.0 Revision History

Appendix F – Vegetation Debris Management	
Creation Date	August 28, 2023
Submitted to FEMA	August 31, 2023
Current Revision	August 28, 2023