



United States Operations

Transmission: Vegetation Management Procedures (VMP)

Authorized by:

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Date: 12/31/16

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1.0 Change Control

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2.0 Introduction

2.1 Purpose

The purpose of this Right-of-Way (ROW) Vegetation Management Procedure (VMP) is to document the approved procedures and practices for all phases of vegetation management.

2.2 Scope

The requirements of the VMP apply to transmission, sub-transmission and select distribution ROW for National Grid.

3.0 Definitions

Annual Work Plan – Identifies the vegetation maintenance field work that will be carried out in a specified year.

Article VII Right-of-way – a ROW approved for construction and maintenance under the Article VII regulations of the N.Y.S. Public Service Commission. These lines generally have additional environmental protections and restrictions associated with access, vegetative screening, integrated management, etc.

ATVM- At Time of Vegetation Management

Basal Application – Herbicide application method in which the lower portion of the target species stems and root collar is completely covered by the herbicide solution.

Capable Species – Tree, shrub and vine species that have the ability to grow into the National Grid Clearance Distance (NGMVCD) from conductors.

Compatible Species- woody shrub and herbaceous species that do not have the ability to grow into the National Grid Clearance Distances (NGMVCD).

Clearance Distances – 1) the At Time of Vegetation Management (ATVM) Clearance Distance from vegetation, in a radius around the conductor, to be achieved at the time of vegetation management and 2) National Grid Minimum Vegetation Clearance Distance (NGMVCD) from vegetation, in a radius around the conductor, between conductors and vegetation to be maintained under all rated electrical operating conditions. 3) Minimum Vegetation Clearance Distance (MVCD) from vegetation, in a radius around the conductor derived from the Gallet Equations as defined by FAC 003-4 applying to those lines associated with that standard.

Danger Tree – A tree on or off the ROW that if were cut or failed could contact electric lines.

Foliar Application –a herbicide/water mixture is directed onto the leaves of a select plant.

Hand Cutting – Vegetation management method in which woody vegetation is felled through the use of hand tools, including chainsaws and brush saws.

Hazard Tree – Danger trees which due to species and/or structural defect are likely to fail and fall into the electric facility.

Herbicide – Chemical used to control, suppress or kill plants or severely interrupt their normal growth processes.

Imminent threat – An imminent threat is vegetation condition that poses an increased risk to the reliable operation of a particular transmission circuit and therefore requires 1) mitigation of vegetation condition typically within 24 hours, and 2) notifying the system operator.

Integrated Vegetation Management (IVM) – IVM is an adaptation of Integrated Pest Management (IPM) where the pest is tall growing, capable vegetation. IPM/IVM is a system of controlling pests in which pests are identified, action thresholds considered, all possible control options evaluated and selective, physical, biological and chemical controls are considered. When chemical controls become necessary to control and prevent the growth of capable, tall growing woody species, the Company is committed to employing selective, targeted applications. These treatments shall use approved herbicide products and mixtures that target specific plants or plant communities in a manner calculated to control and eliminate the tall-growing, capable woody species, while preserving as much of the small, compatible woody shrub and herbaceous vegetation as is practical.

IROL - Interconnection Reliability Operating Limit

ISO – Independent System Operator

MA DAR – Massachusetts Department of Agricultural Resources

Major Storm - For transmission vegetation management activities subject to NERC Reliability Standard FAC-003-4, National Grid as the Transmission Owner defines and publishes 'major storms' as allowed by FERC (Federal Energy Regulatory Commission) The term 'major storm' remains an undefined term by the NERC Glossary of Terms and by Reliability Standard FAC-003-4, and is not intended to supersede any regulatory body's definition of 'major storm'.

MVCD – Minimum Vegetation Clearance Distance

NERC – North American Electric Reliability Council

NERC Regulated Circuits – Circuits regulated by FAC 003-3 are all circuits operated at above 200 kV and voltages below 200kV that are designated as IROL by the ISO.

NGMVCD – National Grid Minimum Vegetation Clearance Distance

NH PES – New Hampshire Pesticide Bureau

NPCC – Northeast Power Coordinating Council

NY DPS – New York Department of Public Service

NY Part 84 – The New York Long-Range Transmission ROW Management Program required by the NY Public Service Commission

Non-Selective Treatment – the broadcast application of approved herbicide products and mixtures to remove all woody vegetation

Pasture – Fenced area used for grazing livestock.

Pruning – the cutting and removal of tree branches to provide specified clearance distance between vegetation and the conductors. See A.N.S.I. A300 for additional detail.

RI DEM – Rhode Island Department of Environmental Management

Right-of-Way (ROW) - The corridor of land under a transmission line(s) needed to operate the line(s). The width of the corridor is established by engineering or construction guidance as documented in either construction documents, pre-2007 vegetation maintenance records, or by the blowout standard in effect when the line was built. The ROW width in no case exceeds the applicable Transmission Owner's or applicable Generator Owner's legal rights but may be less based on the aforementioned criteria (FAC 003-3).

Selective Mowing – Mowing small areas of high-density target species, or dense woody vegetation encroaching upon roadways or trails to structures or adjacent to structures.

Selective Treatments – Removal of individual capable woody plant species through the use of a controlled vegetation management method.

Sensitive Area – Areas on ROWs where legal, visual, or environmental impacts/concerns require compromises to the general IVM policy.

Slash – All branches, tops, small diameter main stems and debris resulting from any cutting operation.

Stump Application – Herbicide application method in which the herbicide is applied only to the freshly cut surface of the stump of the target tree.

System Operator – Transmission Control Center's personnel assigned for decision making during the need to operate transmission lines.

"T" Sheet – Strip map of a ROW showing line features (Sometimes referred to as "Q" Sheets)

Transmission – includes all electric lines 115kV and higher in New York and 69kV and higher in New England, used to transport electricity between various generation, switching, and distribution substations.

Tree Removal – the cutting and felling of trees, including wood and brush disposal. Removal may include, where specified, the use of approved herbicides to enable the chemical removal of the target plant(s) from the ROW.

Utility Forest – the forested areas within or adjacent to ROW that are tall enough or may grow tall enough to impact the reliability of the transmission facility.

Vegetation Inspection – The systematic examination of vegetation conditions on a ROW and those vegetation conditions under the Transmission Owner's or applicable Generator Owner's control that are likely to pose a hazard to the line(s) prior to the next planned maintenance or inspection. This may be combined with a general line inspection (FAC 003-3).

VIPER – (Vegetation Inspection Planning Evaluation and Reporting) National Grid's vegetation management system; a combination of databases, GIS and mobile applications.

VMSpec –Vegetation Management Specification

VMP –Vegetation Management Procedure

VMS –Vegetation Management Strategy

VAAFM – Vermont Agency of Agriculture, Food and Market

Visual Buffer – areas of vegetation preserved on the ROW, on both sides of selected improved road crossings, yards, for the purpose of minimizing the visual impacts and linear view of the ROW for motorists.

Water – standing or running water, existing at the time of maintenance operations, which has impact outside the ROW.

Wire Zone/Border Zone – the wire zone is defined as that portion of the ROW floor that is situated either directly beneath the conductor area or for a distance extending approximately ten (10) feet to either side of the conductor. The border zone is that portion of the right-of-way floor situated to the outside of the wire zone extending to the ROW edge. It is sometimes referred to as a transition zone between the wire zone and the adjacent forest edge. The wire zone mid-span is the portion of the span where the conductor is at or near its lowest ground clearance distance, generally 60-70% of the span length.

YOP – Yearly Operational Plan, Massachusetts

4.0 Procedures

4.1 Notifications

P1

Notifications to Nearby Residents

Vegetation Operations, in consultation with vegetation management contractors, shall establish and maintain procedures for notifying nearby residents of all vegetation management activities. Locally produced documents or documents included in Appendix 6 may be used as needed.

P2

Notification to Agencies

Annual permits and construction permits, both civil and environmental that require notification of work commencement, completion or other conditions will be conducted timely and accurately by Vegetation Operations or their contractor; unless otherwise directed

P3

Notification to FERC Compliance

Sustained outages and encroachments into the MVCD observed in real time absent a sustained outage shall be reported to Vegetation Strategy without unnecessary delay. Include the details of the incident or condition. Vegetation Strategy will review and provide notification to the company FERC Compliance management.

P4

Inquiries and Complaints from Landowners and/or Public

Vegetation Operations staff and/or contractors shall respond quickly to any questions or complaints relating to ROW vegetation management from the public and/or government agencies. Inquiries and/or complaints from external parties will be documented and reported to the National Grid Vegetation Operations Supervisor.

P5

Imminent Threat of Interruption:

National Grid personnel or contractor personnel shall report any observed vegetation-related imminent threats that may cause interruptions to the appropriate Company Regional Control Center as outlined in Appendix 12. The Regional Control Center shall take appropriate action per National Grid Control Center operating procedures.

A. **Description**

An imminent threat is vegetation condition that poses an increased risk to the reliable operation of a particular transmission circuit and therefore requires:

1. mitigating the vegetation condition typically within 24 hours, and
2. notifying the system operator.

The characteristics of an imminent threat condition usually are:

1. vegetation that is approaching or threatens to approach the MVCD, or
2. one or more hazard trees that appear very likely to contact a transmission line.

B. **Steps for Reporting** (See also Appendix 12)

1. Declaration of Imminent Threat

All vegetation management personnel are required to report an imminent threat to the operation of transmission and sub transmission circuits. NERC regulated circuits must be reported without delay to the regional control center and the Vegetation Operations Staff.

2. Communication

All initial communications between vegetation management personnel and the regional control centers are to be spoken (email, voice or text messaging are not acceptable for initial reporting). Enough information about the imminent vegetation risk must be provided for the system operator to decide what action needs to be taken to remove the vegetation without jeopardizing the reliability of the transmission system. Up to date contact lists must be on hand by all vegetation management staff and contractors.

3. Mitigation Measures

While the system operator monitors system and reviews options, the vegetation management personnel continues to investigate the threat, notifies National Grid Vegetation Operations staff and reviews options for removal of vegetation. No action to remove vegetation will be performed until directed by the system operator.

4. Documentation

All communication must be documented and retained by the Vegetation Operations staff. Appendix 12 provides an outline for documentation. Vegetation Operations staff will provide the details to the Vegetation Strategist for determination of required updates to the workplan.

4.2 Data and Records Management

P6 Data Management

A. Maintain Data in GIS

The Company utilizes a Smallworld-based GIS as an asset register for all transmission facilities. Facilities include transmission lines and structures, real property information, and Forestry-defined ROW segments and sites. Forestry segments are the basic unit for tracking and scheduling vegetation management work across the system and range in size from approximately 1 to 40 miles in length and 10 to 1,000 acres in area. Vegetation sites are the individual areas within forestry segments where vegetation management work is described in detail. Sites may be as small as a fraction of an acre or 100+ acres in area. Site details are outlined in Appendix 8 and include Land Use Categories, a description of vegetation, a prescription identifying work to be carried out, and may include landowner information such as name, address and many other attributes.

B. VIPER – (Vegetation Inspection Planning Evaluation and Reporting)

Data obtained from Vegetation Operations field reviews and work conducted for vegetation maintenance may be managed across the GIS and mobile applications; both at a corporate level and local level. VIPER databases, applications and interfaces work together or separately to manage data.

P7 Document Development/Control and Retention

Vegetation Management records/systems are to be maintained such that they are: Legible, identifiable and traceable to the activity, can be readily retrieved and stored in a protective manner, and retained over time as specified below.

A. Transmission records and retention times

Document/System	Retention Time (as applicable)
Correspondence with Landowners	Permanently
Correspondence with Municipalities and Regulators	Permanently
Massachusetts Right-of-Way Yearly Operational Plan	Permanently
Vegetation Specifications (Danger Tree, Floor, Substation, Mowing, Aerial Pruning)	Permanently
Massachusetts Five Year Right-of-Way Vegetation Management Plan	Permanently
Transmission Right-of-Way Management Program (New York Part 84 Plan)	Permanently
Transmission Vegetation Strategy(VMS)	Permanently
Segment and Site Data	Maintain current version on an ongoing basis
Invoices/Contractor Daily Progress Report	6 years
Landowner Agreements	Permanently
ROW Inventory Reports	Maintain versions on an ongoing basis
Spill Forms	1 year
Ground Patrol and Aerial Patrol Inspection Data	5 years

B. Vegetation Management Procedure (VMP)

Vegetation Operations shall provide local supervision, coordination and enforcement of this VMP and the companion Vegetation Management Specification (VMSpec) for contractors.

The document control process for this VMP is as follows: It shall be updated by Vegetation Strategy through collaboration Vegetation Management as needed and signed by the manager of Vegetation Strategy.

C. Vegetation Management Specifications (VMSpec):

Development and approval of the VMSpecs is a collaborative effort between the Managers (or assigns) of both Operations and Strategy. They will be updated as needed. At minimum, the following specifications will be maintained:

- Gas ROW for Upstate NY
- Mowing
- SubT Line Clearance (NE Only)
- ROW Floor
- ROW Sideline
- Substation Vegetation Management
- Aerial Pruning

VMSpecs will contain, at minimum, the Appendices listed in the following table:

Vegetation Management Specification (VMSpecs)							
Appendices for inclusion in VMSpec	Gas ROW (UNY)	Mowing	SubT Line Clearance (NE Only)	ROW Floor	ROW Sideline	Substation VM	Aerial Pruning
NERC FAC-003-4				X	X		
Veg Ops Staff and Control Center Contact Sheet	X	X	X	X	X	X	X
National Grid - Environmental Policy	X	X	X	X	X	X	X
Invasive Species BMPs (NY Only)	X	X		X	X	X	X
Threatened and Endangered Species (NY Only)	X	X		X	X	X	X
Notification Materials	X	X	X	X	X	X	X
NE VM Contractor Final Inspection Form	X		X	X	X	X	X
Inventory Categories				X			
Border Zone/Wire Zone Vegetation Lists			X	X	X		
(Conductor) Clearances Distances			X	X	X	X	X
Imminent Threat Procedure and Decision Tree		X	X	X	X	X	X

P8 Tree caused Interruption Record Management and Reporting

A. Reporting of Interruptions

Any interruption caused by trees or vegetation shall be investigated by the Vegetation Operations Supervisor or their contractors. Those interruptions affecting voltages of 69kV and higher shall be investigated and followed up with a notification and report to Vegetation Strategy and entered into VIPER.

Certain vegetation-caused sustained interruptions shall be reported to the Northeast Power Coordinating Council (NPCC). The Vegetation Operations Manager, working with the Regulatory Compliance Department, shall report these interruptions to the appropriate Independent System Operator.

4.3 Contracting

P9 Procure Services (Select Contractors)

A. Bidding

Copies of appropriate maps and drawings shall be furnished to all prospective bidders, together with a detailed site-by-site Field Inventory for IVM. The drawings and/or inventories may be marked to show additional pruning and tree removal requirements and areas where completed wood and brush removal will be required. These drawings and inventories will subsequently be incorporated into and become part of the contract.

B. Purchase Order

Before beginning a treatment operation, the contractor will be sent a Purchase Order, with Terms and Conditions attached, from the National Grid Procurement Department.

P10 Contractor Responsibilities

Vegetation management operations must be conducted according to the ROW VMSpec and according to the written directives of the Vegetation Operations staff. Failure to do so is grounds for removal of the crew from the treatment site by Vegetation Operations staff and possible termination of the contractor's contract. Specification for each operation will contain detailed contractor responsibilities.

4.4 Conduct Operations

P11 Deliver Annual Work Plan

A. Objective

The vegetation management Annual Work Plan lists the tasks and objectives for the fiscal year that meet the goals of the Vegetation Strategy. The work plan should:

- Describe the methods that will be used
- Be flexible enough to adjust to changing conditions
- Document adjustments to the plan
- Considers time necessary to obtain permissions and permit

- Track the work according to the specifics of the plan

B. Delivery

The work plan must be completed within the Fiscal year that it was developed for unless unforeseen circumstances interfere or delay the execution of the plan. Vegetation Operations shall work with Vegetation Strategy to adjust the work plan. Work may be “walked in” or “walked out” with the approval of the Vegetation Strategy specialist as long as there is no risk to the electrical system or MVCD encroachment. Risk must be mitigated and such alteration of the plan must meet the goals of the company and is in accordance with regulatory standards FAC-003-4 (R7).

[Requirement R7 requires the Company to complete its entire annual vegetation work plan for transmission lines covered by FAC-003 every year, although the Requirement acknowledges that revisions to the work plan may be needed in response to changing conditions or inspection results. Such revisions are permitted so long as encroachments into the MVCD are prevented.]

Execution of the workplan shall consist of:

- Procurement of resources (bids, contracts and purchase orders)
- Schedule of work in accordance with company priorities, seasonal constraints, available resources, and permit conditions.
- Flexibility within the schedule to adapt to changing conditions
- Documentation of start-up meetings, progress and completion of work
- Quality control procedures for ensuring that the vegetation management work was completed according to work specifications.

P12 Major Storms

For Transmission Vegetation Management activities subject to NERC Reliability Standard FAC-003-4, National Grid as the Transmission Owner defines and publishes 'major storms' as allowed by FERC (Federal Energy Regulatory Commission) The term 'major storm' remains an undefined term by the NERC Glossary of Terms and by Reliability Standard FAC-003-4, and is not intended to supersede any regulatory body's definition of 'major storm'.

4.5 Practices

P13 Right-of-Way Floor Program

A treatment operation generally includes most of the vegetation management methods described in this procedure. Herbicide treatments, employing herbicides and treatment methods consistent with the sensitivity of the site, shall be the preferred method of vegetation management. Four (4) methods of herbicide treatments are utilized: basal application, cut stump application, cut stubble, low-volume and high-volume foliar applications.

Treatment is generally carried out in two (2) phases: Preparatory Treatment and Foliar Treatment. These two (2) phases may be carried out separately or simultaneously depending on vegetative conditions or permit requirements for each ROW segment.

National Grid Vegetation Operations Supervisors identify ROW segments to be treated each year in the Annual Work Plan. Field inventories of each ROW segment to be treated are completed by National Grid Vegetation Operations Supervisors and are provided to the Contractor. Inventory codes and descriptions used by the National Grid Vegetation Operations Supervisors are presented in Appendix 8.

An IVM treatment operation is carried out within a treatment/calendar year. Preparatory treatment is generally completed prior to June 1 so that any vegetation approaching the NGMVCD is treated prior to new annual growth. Foliar treatment shall be completed prior to October 1 of each year. Certain sites requiring hand cutting, mowing and/or cut stump treatment may be carried out after October 1.

The contractor shall perform an end-to-end inspection of the ROW segment and preparatory treat all vegetation approaching the NGMVCD prior to June 1 of a treatment year to assure reliability of the line.

A. Selective Vegetation Management

The Contractor shall treat all capable vegetation listed in Appendix 9, Exhibit A (tall growing trees) within the wire zone and border zone of the ROW.

The contractor shall treat all capable vegetation listed in Appendix 9, Exhibit B (small trees) within the mid-span of the wire zone of the ROW, except where the mature height would not approach the ATVM clearance distance.

Vegetation listed in Appendix 9, Exhibit B will be retained in the border zone of wider ROWs.

A height limit of 12 feet is applicable for low-volume backpack foliar treatments. A height limit of 16 feet is applicable for high volume or low volume hydraulic foliar treatments (New York only). capable hardwood vegetation greater than the heights specified above shall be hand cut and stump treated. capable hardwood vegetation less than the heights specified above shall be foliar or basal treated.

In sites, due to terrain, conductor height, or other ROW variables, where a normally capable tree will never reach the ATVM clearance distances, such tree may be retained on the ROW during routine maintenance as long as there is no undesirable affect or risk to access, construction, reliability or public safety. These areas must be approved by the National Grid Vegetation Operations Supervisor and noted on the inventories. Such locations will be determined through a combination of field measurements, profile mapping or other technology and will also be routinely reviewed and verified during each inventory cycle.

Capable conifers over two (2) feet tall (knee-height) shall be hand cut. Only Pitch Pine shall be stump treated. Conifer species less than two (2) feet tall shall be foliar treated (except in Massachusetts).

B Non-Selective Vegetation Management

All vines growing on guys, poles and towers shall be treated.

All woody-stemmed species growing within ten (10) feet of guys, poles and towers shall be cleared and treated using the treatment technique being applied

to the surrounding site. Wherever practicable, grape vines shall be treated with low-volume basal or low-volume foliar method.

All trees and shrubs growing within the established or designated access road(s) along the ROW shall be treated to provide an access route 15 feet in width. Where there is no established access road, a route shall be designated and/or approved by the National Grid Vegetation Operations Supervisor, and the Contractor shall clear the same. Where multiple improved access roads exist within the ROW, the Contractor shall maintain all roads.

Treatments will also extend around the perimeter of any substations (within five (5) feet of fence line) and along short side taps associated with the ROW segment.

C. Vegetation Management in Visual Buffers

Where capable vegetation, listed in Appendix 9 Exhibits A and B, cannot be removed, generally trees that are visual buffers, in yards and road crossings, said vegetation shall be pruned to the ATVM clearance distances shown in Appendix 11. The specific maintenance technique is specified in the Field Inventory.

D. Vegetation Management in Protective Buffers

The size/dimensions of protective buffers are generally specified in state level plans/permits. Capable vegetation in protective buffers is hand cut or mowed as specified in the Field Inventory.

P14 Sideline Program

A. Off Right-of-Way Trees

National Grid ROWs are generally cleared to their full width consistent with legal real estate rights and/or permits for initial construction of the electric lines. The forested landscape, or Utility Forest, beyond the maintained ROW, contains trees tall enough and close enough to electric conductors to be capable of growing or falling into the lines. These trees are classified as danger trees and hazard trees. To the extent such vegetation is within its control, National Grid prunes or removes danger trees and hazard trees to reduce the risk of off ROW tree-caused interruptions.

Danger trees beyond the cleared width are generally on land belonging to others. In New England, there are generally no rights to remove trees beyond the fee-owned or easement ROW. In New York, there generally are rights to remove danger trees beyond the fee-owned or easement ROW. Information about individual property rights to remove hazard trees are found in the Company Real Estate department.

B. Risk to Transmission Lines

Danger trees falling into the lines present the greatest risk of tree-caused interruptions on transmission circuits. The risk is primarily related to two (2) non-biotic variables: 1) distance from conductor to the adjacent tree line (clear width), and 2) conductor distance above the ground; and three (3) biotic factors: 1) height of trees, 2) tree species, and 3) tree health and condition. National Grid seeks to mitigate risk of interruptions from danger trees through site specific management of these variables.

A method that can be used for quantifying risk is the Optimal Width Calculator (OWC) software licensed to National Grid by Ecological Solutions, Inc. The OWC calculates a Risk Factor based on the variables discussed above. Data has been collected across National Grid's NY 115kV, 230kV and 345kV transmission system to calculate average Risk Factor by voltage class.

C. Prioritization by Voltage Class

1. High voltage transmission lines, 230kV, 345kV and 115kV IROL (Interconnection Reliability Operating Limit), are allowed the least amount of risk, therefore they are ranked above lower voltages. These circuits are also subject to the NERC Vegetation Management Standard FAC-003-4. These lines are generally constructed with greater ground clearances and clear widths, resulting in much lower risk of interruptions from danger trees.
2. Sub-transmission lines, 23kV to 69kV in NY and 23-kV to 34.5kV in NE, serve customer load. Tree-caused interruptions on these circuits contribute to about 4% of customer non-storm SAIFI. Given the contribution to SAIFI, National Grid has prioritized this group of circuits below high voltage (345kV, 230kV and 115kV IROLs) but above 115kV transmission lines.
3. 115kV transmission lines primarily serve customer load. While customer load is very important to National Grid, tree-caused interruptions on these lines contribute very little to customer non-storm SAIFI – significantly less than 1%. Risk Factors for 115kV lines clearly reflect the lower conductor height and smaller clear width on these lines (compared to high voltage transmission lines).

D. Prioritization within Voltage Classes

National Grid has a method to prioritize all 115 kV, 230 kV and 345 kV circuits. Prioritization takes into account impacts to generators, customers, redundancy of supply, regulatory classifications, etc. During the development of the work plan, and scheduling, priority will be reviewed and serve as one factor in planning, as well as reliability history, maintenance history and system configuration to prioritize lines within these transmission voltage classes. Prioritization of work on the Sub-Transmission voltages, 23 kV to 69 kV, is a collaborative effort between the Vegetation Strategy and Operations groups. Transmission Forestry generates a list of lines to be worked on each year. The Distribution Vegetation Strategist also reviews, adjusts and approves the list. Factors such as the numbers of customers served, reliability history, maintenance history, and system configuration (radial or redundant feed) are considered during this process. Transmission Vegetation Operations, being the service provider for distribution, then schedules the work for the approved lines.

E. Specification

The level of off-ROW Danger Tree work will be specified for each ROW segment and for each ROW edge dependent on voltage class, line priority and vegetation management rights. Work is defined as Level 1, Level 2, etc. These are presented as a hierarchy. Work specified as Level 1 requires work per definition of Level 1. Work specified as Level 2 requires work per Level 2 and Level 1. Level 3 includes Level 2 and Level 1, etc.

- Level 1: Prune or remove danger trees to achieve ATVM Clearance distances. Remove danger trees within the cleared ROW (encroachment). Dead or damaged branches and leaders on off ROW danger trees that are capable of falling onto the conductors shall be pruned.
- Level 2: Prune or remove high risk hazard trees.
- Level 3: Prune or remove all hazard trees.
- Level 4: Prune or remove danger trees emergent above the general canopy height. Pruning is the preferred method.
- Level 5: Prune or remove danger trees to specified Risk Factor. Data for Risk Factor calculation shall be measured and documented at least once per five (5) spans.
- Level 6: Remove all trees to a new cleared width (widening) and Level 1, 2, 3, 4, or 5 danger tree work.

F. Practices and Procedures – New Construction

Initial clearing of new ROWs and clearing of additional width along existing ROW generally requires significant land clearing activities. Land clearing generally involves the removal of all trees on the ROW. Most of the vegetation management techniques discussed in section 4.6 are employed. In addition, cutting, skidding and chipping of whole trees is generally necessary. In most instances specific job requirements for equipment and degree of clearing are specified in state or federal permits for the construction job.

4.6 Techniques

P15 Herbicides

A. Basal Application

This method includes the application of an approved herbicide product to the base of the target stem. It is utilized within sites of higher environmental, aesthetic or public sensitivity where cut and stump treatment would not be as effective in controlling target species.

B. Stump Application (Cut Surface)

This method includes the application of an approved herbicide product to the cut surface and/or stump of a recently cut stem. It is utilized within sites of higher environmental, aesthetic or public sensitivity.

C. Foliar Application

This method includes the application of an approved herbicide product applied as a spray to the leaves and stems of the target. It is selected for its effectiveness in areas where aesthetics and public sensitivity do not restrict its use.

1). High Volume and Low Volume Hydraulic Application (NY only)

This method includes foliar applications using hydraulic spray tanks, mounted on all-terrain units such as pickup trucks, skidders, tracked units, four-wheel all-terrain vehicles (ATVs), etc. The applicator is within ten (10) feet of the target

plant in order to maximize the accuracy of the application and minimize off-target damage.

2). Low Volume Backpack Applications

This method includes light and very light applications of more concentrated herbicide mixtures, using hand-operated backpacks, to selectively deliver the herbicide mixture to the target plants.

This method is especially preferred for its highly selective control in areas that are suitable for foliar treatments but not accessible to or appropriate for treatment with hydraulic units.

P16 Mechanical

A. Hand Cutting

Hand cutting is generally the method of choice where herbicides cannot be applied or where capable vegetation exceeds certain specified heights.

Cut stems parallel to slope as close to the ground as practical. Do not leave stumps that exceed three (3) inches in height.

B Mowing

Use extreme care in order to provide for the safety of workers and the general public. Crews need to mark all obstructions including poles and guy wires with flagging and hand cut all woody growth from around the area within 15 feet. Provide a mechanism, such as a buffer to shield operations that are carried out close to residences or high public use areas. Cut stumps as close to the ground as practical, making sure that stumps do not exceed three (3) inches in height unless otherwise directed by Vegetation Operations staff.

C. Selective Mowing

Selective mowing shall mean mowing small areas of high-density target species such as extensive Sumac, Buckthorn or Multi-flora Rose, particularly in wire zone mid-spans, or dense woody vegetation encroaching upon roadways or trails to structures.

D. Pruning

Pruning may be required in order to achieve ATVM clearances between the line conductors and vegetation. Sites requiring pruning could include:

- At designated road crossings, or designated portions of lines along high use public roads.
- Along the edge of the cleared ROW where, in order to obtain required conductor clearances, side pruning or removal of danger trees is required. On designated portions of lines passing through natural preserves, or public or private parks.
- On designated portions of lines passing over ridges or other exposed views of the ROW in areas of high aesthetic value.
- In general, along all or part of the route of the line when removal of vegetation is to be minimized consistent with reliable line operation.

Pruning shall be carried on in accordance with the A.N.S.I. A-300 standard.

E. Aerial Pruning

Aerial Pruning is a technique of pruning using a saw suspended from a helicopter. There are two (2) methods of removal. The primary method is with a bar of multiple circular saws in a vertical configuration that when flown on the edge of the ROW it sheers limbs that encroach into the limits of the ROW. In some cases, selective pruning of limbs can be made. The second method includes the use of a “tree topper”. This attachment is designed to remove portions of the top of the tree. The height of the tree is reduced to the point that it can be felled safely, by a ground crew, at an arc below the conductors. Aerial pruning is primarily intended for maintenance of the ROW edge in ROWs with difficult terrain; such that mechanized equipment cannot be used and trees would need to be climbed, as well as areas that have been deemed to be “too sensitive” for traversing with tracked or rubber tired equipment.

P17 Contracted Service Work Methods

A. Type A - Sideline/Danger Tree Work

Prune to the existing treed edge unless otherwise called out on the project details or maps. Prune or remove danger trees to achieve at least the ATVM Clearance Distances (Section 5.3.1). Pruning shall be ground-to-sky, including pruning back the upper canopy of edge trees leaving no overhang over the ROW.

Type A sideline work scope includes the removal of small trees up to nine (9) inches diameter breast height that have sprouted from stumps or encroached within the cleared ROW edge.

Dead or damaged branches and leaders on off ROW danger trees that are capable of falling onto the conductor shall be pruned. Prune or remove high risk hazard trees. Hazard trees found beyond the ROW and/or ATVM clearance distances that are judged to be an imminent threat to the conductors shall be brought to the attention of a National Grid Vegetation Operations Supervisor for approval prior to removing. Compatible species shall be retained along the edge of the ROW.

In addition, if the contracted tree crew sees a tree within the wire zone that is approaching or within the NGMVCD, they either must cut the tree or contact a National Grid Vegetation Operations Supervisor immediately.

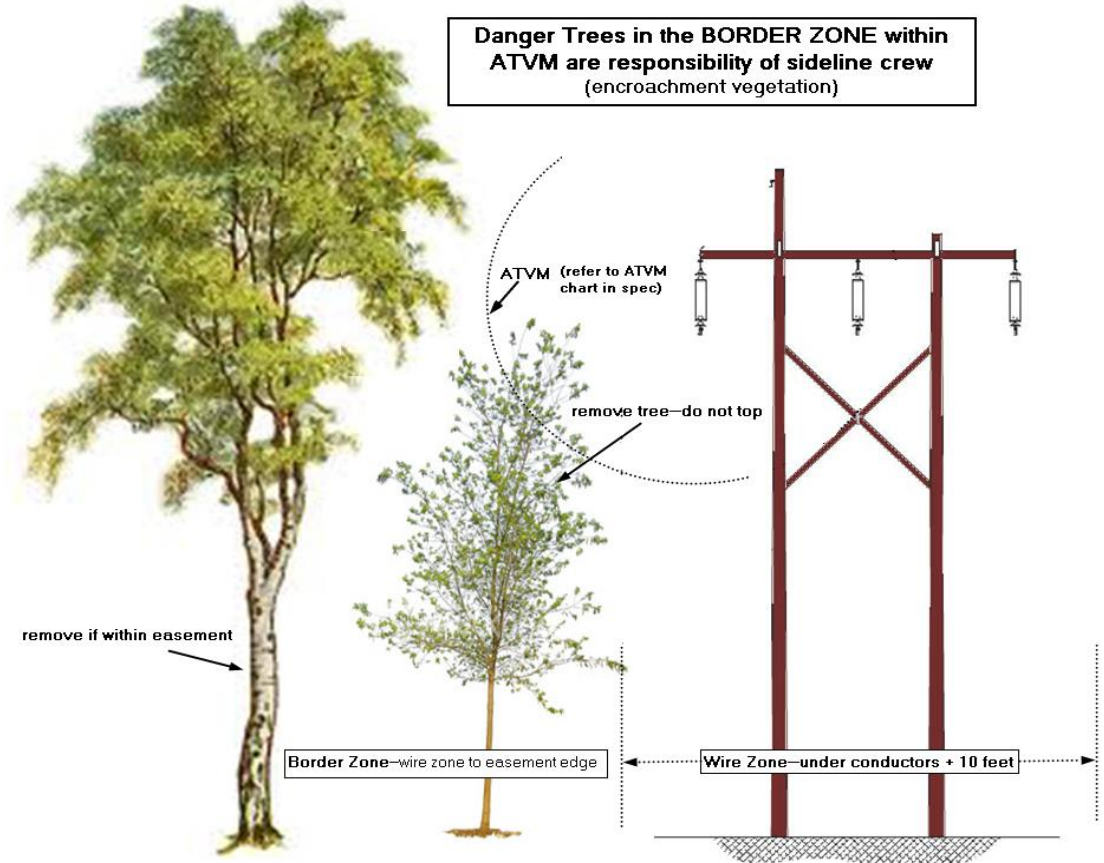
B. Type B – Sideline/Danger Tree Work

Prune or remove danger trees to achieve the ATVM Clearance Distances (Section 5.3.1) unless otherwise called out on the project details or maps. The contractor shall practice A.N.S.I. A-300 pruning in choosing the pruning points within the tree which will often mean clearances greater than ATVM will actually be obtained. Trees shall be directionally pruned to encourage growth away from the transmission line. Where there is already sufficient clearance the contractor shall not prune trees to achieve a "boxed" look or wall of tree canopies along the ROW. Exceptions to this are those narrower ROWs where pruning to this specification will result in a “boxed” look.

Dead or damaged branches and leaders on off ROW danger trees that are capable of falling onto the conductors shall be pruned. Prune or remove high risk hazard trees. Hazard trees found beyond the ROW and/or ATVM clearance distances that are judged to be an imminent threat to the conductors shall be brought to the attention of the National Grid Vegetation Operations Supervisor for approval prior to removing. Compatible species shall be retained along the edge of the ROW.

Any tree in the border zone that is within ATVM shall be removed, not pruned. (see diagram below).

In addition, if the contracted tree crew sees a tree within the wire zone that is approaching or within the NGMVCD, they either must cut the tree or contact a National Grid Vegetation Operations Supervisor immediately.



C. Management of Wood and Brush (Slash)

Wood and brush slash may be generated during vegetation management activities. In general, where tree removal or pruning, or mechanized clearing is required, the brush that has been cut (diced) may be left where it falls after being cut so as to lie close to the ground. Length of diced stems or branches should not exceed ten (10) feet; height of diced slash should not exceed two (2) feet.

Near public roads or private roads, residential or commercial areas, parks, streams, on access roads, or in any sensitive areas indicated in the Field Inventory, the brush shall be disposed of by either chipping or removal to a suitable location within the ROW and neatly piled, windrowed or dispersed. The site-specific slash disposal method is identified in the Field Inventory.

When chipping is required, the chips may be disposed of by dispersing on site in less sensitive areas. Chips shall be removed in areas of more intense landscape management such as lawns.

Where trees and limbs larger than four (4) inches in diameter at the small end are removed and the designated slash disposal is a windrow, the wood shall be neatly piled on the site, taking care not to block any access roads used by either the property owner or the Company. When the authorized slash disposal method is chipping, it may be necessary to remove the larger wood from the site to another approved area of the ROW and piled neatly, or moved to an approved off ROW disposal site.

No burning of wood or brush will be permitted unless specifically authorized by the Vegetation Operations staff.

All species of wild cherry (*Prunus serotina*, *P. virginiana*, *P. pennsylvanica*) that are cut or treated during the growing season can become toxic to livestock during the wilting stage of the leaves. In addition, several species of Maple (*Acer*) have been identified as toxic to horses in the wilting stage as well. Therefore, Maple and Cherry stems, which are cut or treated in active pastures, shall be immediately removed from the pasture following clearing, or arrangements made with the farmer to utilize alternate pastures until the wilting stage and hazard has passed.

Contractors shall comply with all applicable laws and guidelines pertinent to invasive species and their management, as set forth by Government and National Grid.

D. Mitigation of Impacts

If, during their operations, the Contractor causes any damage to occur to the land such as deep ruts or scarified areas, which in the opinion of the National Grid Vegetation Operations Supervisor could cause future erosion or interfere with access for line maintenance, the Contractor shall re-grade the site to original contours, and seed and mulch as required. Areas that do become rutted or where erosion occurs during vegetation management operations will be restored per National Grid companies' policies.

The Contractor shall take reasonable precautions not to remove or damage existing low-growing vegetation, either natural or planted, which are to be preserved on the ROW. Where road crossing buffer vegetation, either natural or

planted, has been damaged beyond reasonable repair because of the Contractor's negligence, this vegetation will be replaced at the Contractor's expense.

The Contractor shall take care not to rut or scarify the ROW for the duration of their operation. All environmental damage resulting from the Contractor's operation shall be permanently repaired at the Contractor's sole expense.

Mobile equipment shall not intrude into road crossing buffers, stream buffer zones or pruning areas, except on designated access routes. When a tree that has been cut must be removed from such an area, it must first be limbed and the brush hand carried to the chipping location or pile site. The trunk wood may be removed by means of a winch line taking adequate care to avoid damaging residual vegetation.

In certain areas, where feasible and advantageous, the National Grid Vegetation Operations Supervisor may authorize the use of aerial lifts and other specialized equipment, in road crossing buffers for the purpose of pruning trees, and disposal. In no case, however, will any vegetation be cleared or any new road be authorized, other than the approved access road through the screen to facilitate the use of this equipment.

The Contractor shall take adequate precautions to protect the watercourses and wetlands from pollution and shall avoid disturbing streambeds and banks and the low-growing vegetation protecting them. Felling vegetation in or across streams and watercourses should be avoided. Vegetation that is felled into watercourses shall be removed as soon as possible. Vegetation removed from a watercourse must be placed on high ground. Brush chipping shall be performed in such a manner that the chipped material shall not enter any watercourse or wetland area, nor accumulate in excess of four (4) inches in depth at any location.

E. Key Specification Requirements

A summary of key specification requirements for vegetation practices and procedures is presented in Procedure P6.

4.7 Work Precautions

P18 Safety

As a contractual term, National Grid requires all contractors to comply with all appropriate state and federal safety laws and regulations. This includes applicable sections of the Occupational Safety and Health Act (OSHA) and all worker safety-related statements and instructions on the herbicide label.

It shall be understood and agreed to by the Contractor that herbicide application, hand cutting, pruning and clearing near existing transmission and distribution lines shall be undertaken while lines are presumed to be energized and operating at voltages up to and including 345kV AC and 450kV DC. The Contractor shall provide competent, trained personnel to complete the work.

In order to insure the safety of their employees, the general public and continuity of service in the energized lines, the Contractor shall exercise extraordinary precautions in removing trees and tree limbs that are in such close proximity to the conductors as to constitute a hazard. Such trees shall be pruned, removed with the aid of ropes,

equipment, or taken down one section at a time until the height of the tree is reduced to the point that it can be felled safely, by a ground crew, at an arc below the conductors.

National Grid's safety requirements are in service procurement documentation and contracts with selected contractors.

In addition, all vegetation management work shall be carried out in compliance with A.N.S.I. Z133.1, American National Standards Institute, Standard for Arboricultural Operations – Safety Requirements.

P19

Sensitive Areas

Sensitive Areas are defined as areas on a ROW where legal, visual or environmental impacts/concerns require compromises to the general vegetation maintenance activities. Sensitive Areas include: public surface, public well and private well drinking water supplies; lakes, ponds, rivers, streams, and any other surface waters; wetlands; endangered species sites; agricultural areas including croplands, orchards, tree plantations and animal pastures; buffers at road crossings; buffers at residential and/or commercial yards; and easement restrictions and/or landowner agreements.

These sensitive areas have varying legal definitions in each of the states in which National Grid companies have transmission and distribution facilities. Permits for IVM activities in these states vary as well. For purposes of this document, sensitive areas and vegetation management within them are discussed in a general way.

In some sensitive areas use of herbicides may not be allowed including in wetlands; endangered species sites; agricultural areas including croplands, orchards, tree plantations and animal pastures. Hand cutting and limited herbicide applications are generally used in these areas.

The IVM treatment crew will deploy a cutting crew or point person in advance of the main herbicide application operation to locate and flag the boundaries of these Sensitive Areas and/or the appropriate buffer zones.

When utilizing chainsaws in a sensitive area, chainsaw bar lubricants must be biodegradable products.

P20

Visual and Protective Buffers

Visually and environmentally sensitive sites must be buffered and treated according to these procedures and VMSpecs.

Visual buffers, consist of trees and/or shrubs, screen the general public from potentially objectionable views of structures and substations. They may be maintained at road crossings, recreational areas, residential or commercial Yards. Specific dimensions for visual buffers may be set by State regulations and/or permit conditions and/or Company policy.

Use shrub buffers on most road crossings or on vantage points where a visual screen is determined to be desirable. Utilize tree/shrub buffers only when legally required or where sites are extremely sensitive visually and shrub growth is inadequate for screening.

Protective buffers may also be established to protect a sensitive area from herbicide deposition. In most instances no herbicides can be applied within these protective

buffers. In some instances herbicides may be applied under certain conditions. Hand cutting or mowing is the primary vegetation management method used in these buffers.

P21 Weather

Herbicide application will be restricted during certain adverse weather conditions such as rain, wind or deep snow.

Herbicide applications will not be made during periods of moderate or heavy rainfall.

Foliar applications are effective in light mist situations; however, any measurable rainfall that creates leaf runoff will wash the herbicide off the target. If foliar applications are interrupted by unexpected rainfall, the treatment will not resume until the rain ends and active leaf runoff has ceased.

Basal applications are ineffective during measurable rainfall. Basal applications that are interrupted by rainfall will not be resumed until the lower stem of the target species is predominately dry.

Excessive wind can create drift during foliar applications. Significant herbicide drift can cause damage to desirable vegetation on or off the ROW. Basal or cut-stump treatments are much less affected by wind because they are applied in such close proximity to the ground.

To prevent any significant off-target drift of herbicides, the applicator will comply with the following restrictions:

- a) During periods of wind, which are strong enough to bend the tops of the main stems of tree species on the ROW, the contractor crew supervisor will periodically observe the application of the foliar treatment to insure that there is no significant movement of the herbicide solution. If the supervisor can see the solution moving off target, applications will immediately stop until the wind has subsided enough to permit further applications.
- b) All herbicide solutions to be used for a foliar application will contain low-drift agents. Low-drift agents will be added to the foliar herbicide solution as per the low-drift agent label. In moderate wind conditions, as per label recommendations, more low-drift agent may be added at the discretion of the contractor supervisor to control significant drift.
- c) Foliar treatments will not be applied to target vegetation that exceeds approximately 12 feet in height for backpack applications and 16 feet in height for hydraulic applications.

P22 Wetlands

IVM methods using herbicides on ROWs in wetlands have come to be accepted in several states. Tall growing trees generally only occur in wooded swamps, areas that are dry for long enough periods each year to support tree growth. Emergent wetlands including: wet meadows, cattail swamps, shrub swamps and bogs, generally do not support tree growth and; therefore, do not require management of vegetation. Occasional high ground or hummocks within emergent wetlands may support tree growth and are hand cut. In addition, herbicide use within wetlands is always limited by the presence of surface water including: lakes, ponds, rivers, streams, seasonal ponds

and streams, and flood storage following heavy rainfall. These buffer zones clearly prevent use of herbicides within or in close proximity to surface water.

Herbicide use in wetlands, therefore, is generally limited to wooded swamps where no standing water is present. State regulations and permits specify restrictions on herbicide use.

4.8 Inspections

P23 Ground Patrols

Vegetation Operations staff and/or contractor personnel carry out a ground-based patrol one time per year (once during each dormant season; regardless of the calendar year) on 230kV and 345kV ROWs. The procedure for ground patrols is included in Appendix 10. (NY DPS requires ground patrol of all circuits operating above 200kV in NY according to CASE 04-E-0822)

In addition to the annual ground patrol above, Vegetation Operations staff and/or contractor personnel carry out a ground patrol one time per ROW Floor Program maintenance cycle, four (4) to eight (8) years.

Information collected during ground patrols and corrective actions are entered into VIPER.

Any of the ground patrols may be replaced by spatial technology when approved by the Manager, Vegetation Strategy and conducted with Company approved technology.

P24 Aerial Helicopter Patrols

Vegetation Operations staff will carry out at least one aerial patrol per calendar year (not to exceed 18 month between patrols) on all circuits operating above 200kV voltages and sub-200kV designated as Interconnection Reliability Operating Limits (IROL) ROWs (per FAC 003-3). Vegetation Operations staff carry out aerial patrols on all other sub-200kV transmission ROW, not regulated under FAC-003-4 in New York (115 kV) and New England (69kV and 115kV) will be aerial patrolled one (1) time every two (2) years (generally one-half of the circuits are patrolled annually).

Aerial patrols on some lines may be substituted with a ground patrol when ground patrols are deemed necessary and are conducted within the 18 month requirement of FAC 003-3

Information collected during aerial patrols and corrective actions are entered into the VIPER.

Any of the aerial patrols may be replaced by spatial technology when approved by the Manager, Vegetation Strategy and conducted with Company approved technology.

P25 Line Department Aerial Patrols

Line Department personnel carry out periodic ground patrols and annual aerial patrols of all 115kV and higher circuits in NY and 69 kV and higher circuits in NE. These patrols may return concerns of vegetation that might result in off-cycle maintenance requirements.

P26 Observed Conditions

Vegetation Operations personnel observe all aspects of vegetation conditions: vegetation growth, clearance, danger trees, and efficacy of work by contractors. Line Department personnel primarily only report vegetation conditions where clearance is approaching the NGMVCD distance and observed hazard trees.

P27 Follow-up to Patrols

Vegetative conditions found in non-compliance with ATVM or NGMVCD, and any hazard tree conditions that present a threat to the transmission system, shall be mitigated within one week of observation. Any conditions found to be an imminent threat will be reported per Section Appendix 12 and mitigated as soon as possible.

P28 Contractor Performance

National Grid Vegetation Operations Supervisors audit contractor performance including conformance with this VMP, use of herbicides, herbicide application rates, treatment effectiveness and compliance with environmental and safety requirements.

P29 Quality Assurance and Control (QA/QC)

A successful quality assurance and control program (QA/QC) is a critical part of any vegetation management program, although not required for compliance with FAC-003-4. The continual improvement of a program can only be obtained by having the appropriate control and auditing measures in place. QA/QC consists of planned reviews of the quality and completeness of the scheduled work plan.

Level of Audit

1. Vegetation Operations shall review transmission rights-of-way for each completed Work Plan using methods such as visual assessment or spatial assessments. Reviews shall be completed within eighteen months from the end of the fiscal year and results will be entered into VIPER.
2. Division foresters shall have the discretion to select the appropriate auditing techniques technique(s) to perform QA/QC reviews. Results shall be entered into VIPER.

5.0 Clearance Distances - (See Appendix 11)

P30 Managing Constraints to Vegetation Maintenance or Achieving Clearance Distances

This procedure covers those situations in which forestry personnel are constrained from performing vegetation maintenance or achieving the minimum clearance distances, as described in this procedure, Appendix 11. Such situations may include, property disputes, vicious animals, landowner accusations of trespass, refusals, or state or local restrictions. Remedies should include utilizing resources within the company to overcome the restriction or seeking legal action to remove the restriction.

For a FAC 003-4 applicable ROW, prior to determining whether a particular ROW is constrained, Vegetation Operations must verify determine the extent to which any vegetation is within the Company's control by verifying through the Company Real Estate department the extent of property and rights that are afforded the site.

Vegetation Operations must also verify through Vegetation Strategy the ROW limits assigned to the site according to FAC 003-4 (R5) guidance. A record of the constraint must be recorded and maintained in VIPER.

1. Clearance Distance Constraints

A. At Time of Vegetation Management Clearance Distances (ATVM):

When ATVM cannot be reached during routine maintenance, at minimum, the site or section of the corridor shall be placed on an off-cycle review status in the VIPER and remain in that status until the constraint is resolved. The timing and frequency of review shall be approved by Vegetation Operations Staff.

B. National Grid Minimum Vegetation Clearance Distances (NGMVCD):

When NGMVCD is at risk of being encroached because of constraints to maintenance, immediate actions shall be taken to relieve the constraint. During the time that work is delayed, the segment or site shall be placed on an off-cycle review status in the VIPER. Actions taken must be recorded and maintained using the records maintenance and retention steps listed in Table1 and retained by Vegetation Operations Staff.

C. Minimum Vegetation Clearance Distances (MVCD):

When MVCD is at risk of being encroached because of constraints to maintenance, immediate actions shall be taken to relieve the constraint. All actions need to be taken without delay, followed through with, and recorded and maintained using the records maintenance and retention steps listed in Table 1 and retained by Vegetation Operations Staff.

2. Constraints to performing scheduled work on FERC Regulated circuits:

When scheduled work is interrupted as a result of a complaint or dispute on FERC lines, actions must be taken in accordance with FAC 003-3, which contains the following requirement:

***R5.** When a applicable Transmission Owner and applicable Generator Owner is constrained from performing vegetation work on an applicable line operating within its Rating and all Rated Electrical Operating Conditions, and the constraint may lead to a vegetation encroachment into the MVCD prior to the implementation of the next annual work plan, then the applicable Transmission Owner or applicable Generator Owner shall take corrective action to ensure continued vegetation management to prevent encroachments [Violation Risk Factor: Medium] [Time Horizon: Operations Planning].*

***M5.** Each applicable Transmission Owner and applicable Generator Owner has evidence of the corrective action taken for each constraint where an applicable transmission line was put at potential risk. Examples of acceptable forms of evidence may include initially-planned work orders, documentation of constraints from landowners, court orders, inspection records of increased monitoring, documentation of the de-rating of lines,*

*revised work orders, invoices, or evidence that the line was de-energized.
(R5)*

All actions need to be taken without delay, followed through with, and recorded and maintained using the records maintenance and retention steps listed below and retained by Vegetation Operations Staff and copies supplied to Vegetation Strategy.

Table 1

<p><u>Actions, record maintenance and retention:</u></p> <ol style="list-style-type: none">1. Site location, description, and nature of restriction (e.g. landowner interference)2. List of restrictions, such as details of complaint, dispute, or legal action. (include documentation)3. Verify that VIPER is updated to show the restriction and any off-cycle review that is required.4. Record all corrective actions taken. (e.g. pruned, rather than removed the tree, or patrolled area for imminent threats)5. Record all corrective actions needed when the restriction is lifted or resolved.6. Adjust the work plan for future maintenance.7. Record Keeping should conform with Section 4.2 of this document.8. Follow-up is required until measures are complete.

~~~~~**End of Document**~~~~~



Appendix 1  
NERC FAC-003-4



## Standard Development Timeline

This section is maintained by the drafting team during the development of the standard and will be removed when the standard becomes effective.

### Description of Current Draft

| Completed Actions                                                             | Date             |
|-------------------------------------------------------------------------------|------------------|
| Standards Committee approved Standard Authorization Request (SAR) for posting | August 19, 2015  |
| SAR posted for comment                                                        | August 24, 2015  |
| 45-day formal comment period with ballot                                      | October 30, 2015 |

| Anticipated Actions         | Date          |
|-----------------------------|---------------|
| 10-day final ballot         | January 2016  |
| NERC Board (Board) adoption | February 2016 |

When this standard receives Board adoption, the rationale boxes will be moved to the Supplemental Material Section of the standard.

## A. Introduction

1. **Title:** Transmission Vegetation Management
2. **Number:** FAC-003-4
3. **Purpose:** To maintain a reliable electric transmission system by using a defense-in-depth strategy to manage vegetation located on transmission rights of way (ROW) and minimize encroachments from vegetation located adjacent to the ROW, thus preventing the risk of those vegetation-related outages that could lead to Cascading.
4. **Applicability:**
  - 4.1. **Functional Entities:**
    - 4.1.1. Applicable Transmission Owners
      - 4.1.1.1. Transmission Owners that own Transmission Facilities defined in 4.2.
    - 4.1.2. Applicable Generator Owners
      - 4.1.2.1. Generator Owners that own generation Facilities defined in 4.3.
  - 4.2. **Transmission Facilities:** Defined below (referred to as “applicable lines”), including but not limited to those that cross lands owned by federal<sup>1</sup>, state, provincial, public, private, or tribal entities:
    - 4.2.1. Each overhead transmission line operated at 200kV or higher.
    - 4.2.2. Each overhead transmission line operated below 200kV identified as an element of an IROL under NERC Standard FAC-014 by the Planning Coordinator.
    - 4.2.3. Each overhead transmission line operated below 200 kV identified as an element of a Major WECC Transfer Path in the Bulk Electric System by WECC.
    - 4.2.4. Each overhead transmission line identified above (4.2.1 through 4.2.3) located outside the fenced area of the switchyard, station or substation and any portion of the span of the transmission line that is crossing the substation fence.

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<sup>1</sup> EPAct 2005 section 1211c: “Access approvals by Federal agencies.”

**4.3. Generation Facilities:** Defined below (referred to as “applicable lines”), including but not limited to those that cross lands owned by federal<sup>2</sup>, state, provincial, public, private, or tribal entities:

**4.3.1** Overhead transmission lines that (1) extend greater than one mile or 1.609 kilometers beyond the fenced area of the generating station switchyard to the point of interconnection with a Transmission Owner’s Facility or (2) do not have a clear line of sight<sup>3</sup> from the generating station switchyard fence to the point of interconnection with a Transmission Owner’s Facility and are:

**4.3.1.1** Operated at 200kV or higher; or

**4.3.1.2** Operated below 200kV identified as an element of an IROL under NERC Standard FAC-014 by the Planning Coordinator; or

**4.3.1.3** Operated below 200 kV identified as an element of a Major WECC Transfer Path in the Bulk Electric System by WECC.

**5. Effective Date:** See Implementation Plan

**6. Background:** This standard uses three types of requirements to provide layers of protection to prevent vegetation related outages that could lead to Cascading:

- a) Performance-based defines a particular reliability objective or outcome to be achieved. In its simplest form, a results-based requirement has four components: *who, under what conditions (if any), shall perform what action, to achieve what particular bulk power system performance result or outcome?*
- b) Risk-based preventive requirements to reduce the risks of failure to acceptable tolerance levels. A risk-based reliability requirement should be framed as: *who, under what conditions (if any), shall perform what action, to achieve what particular result or outcome that reduces a stated risk to the reliability of the bulk power system?*
- c) Competency-based defines a minimum set of capabilities an entity needs to have to demonstrate it is able to perform its designated reliability functions. A competency-based reliability requirement should be framed as: *who, under what conditions (if any), shall have what capability, to achieve what particular result or outcome to perform an action to achieve a result or outcome or to reduce a risk to the reliability of the bulk power system?*

The defense-in-depth strategy for reliability standards development recognizes that each requirement in a NERC reliability standard has a role in preventing system failures, and that these roles are complementary and reinforcing. Reliability standards

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<sup>2</sup> *Id.*

<sup>3</sup> “Clear line of sight” means the distance that can be seen by the average person without special instrumentation (e.g., binoculars, telescope, spyglasses, etc.) on a clear day.

should not be viewed as a body of unrelated requirements, but rather should be viewed as part of a portfolio of requirements designed to achieve an overall defense-in-depth strategy and comport with the quality objectives of a reliability standard.

This standard uses a defense-in-depth approach to improve the reliability of the electric Transmission system by:

- Requiring that vegetation be managed to prevent vegetation encroachment inside the flash-over clearance (R1 and R2);
- Requiring documentation of the maintenance strategies, procedures, processes and specifications used to manage vegetation to prevent potential flash-over conditions including consideration of 1) conductor dynamics and 2) the interrelationships between vegetation growth rates, control methods and the inspection frequency (R3);
- Requiring timely notification to the appropriate control center of vegetation conditions that could cause a flash-over at any moment (R4);
- Requiring corrective actions to ensure that flash-over distances will not be violated due to work constraints such as legal injunctions (R5);
- Requiring inspections of vegetation conditions to be performed annually (R6); and
- Requiring that the annual work needed to prevent flash-over is completed (R7).

For this standard, the requirements have been developed as follows:

- Performance-based: Requirements 1 and 2
- Competency-based: Requirement 3
- Risk-based: Requirements 4, 5, 6 and 7

R3 serves as the first line of defense by ensuring that entities understand the problem they are trying to manage and have fully developed strategies and plans to manage the problem. R1, R2, and R7 serve as the second line of defense by requiring that entities carry out their plans and manage vegetation. R6, which requires inspections, may be either a part of the first line of defense (as input into the strategies and plans) or as a third line of defense (as a check of the first and second lines of defense). R4 serves as the final line of defense, as it addresses cases in which all the other lines of defense have failed.

Major outages and operational problems have resulted from interference between overgrown vegetation and transmission lines located on many types of lands and ownership situations. Adherence to the standard requirements for applicable lines on any kind of land or easement, whether they are Federal Lands, state or provincial lands, public or private lands, franchises, easements or lands owned in fee, will reduce and manage this risk. For the purpose of the standard the term “public lands”

includes municipal lands, village lands, city lands, and a host of other governmental entities.

This standard addresses vegetation management along applicable overhead lines and does not apply to underground lines, submarine lines or to line sections inside an electric station boundary.

This standard focuses on transmission lines to prevent those vegetation related outages that could lead to Cascading. It is not intended to prevent customer outages due to tree contact with lower voltage distribution system lines. For example, localized customer service might be disrupted if vegetation were to make contact with a 69kV transmission line supplying power to a 12kV distribution station. However, this standard is not written to address such isolated situations which have little impact on the overall electric transmission system.

Since vegetation growth is constant and always present, unmanaged vegetation poses an increased outage risk, especially when numerous transmission lines are operating at or near their Rating. This can present a significant risk of consecutive line failures when lines are experiencing large sags thereby leading to Cascading. Once the first line fails the shift of the current to the other lines and/or the increasing system loads will lead to the second and subsequent line failures as contact to the vegetation under those lines occurs. Conversely, most other outage causes (such as trees falling into lines, lightning, animals, motor vehicles, etc.) are not an interrelated function of the shift of currents or the increasing system loading. These events are not any more likely to occur during heavy system loads than any other time. There is no cause-effect relationship which creates the probability of simultaneous occurrence of other such events. Therefore these types of events are highly unlikely to cause large-scale grid failures. Thus, this standard places the highest priority on the management of vegetation to prevent vegetation grow-ins.

## **B. Requirements and Measures**

- R1.** Each applicable Transmission Owner and applicable Generator Owner shall manage vegetation to prevent encroachments into the Minimum Vegetation Clearance Distance (MVCD) of its applicable line(s) which are either an element of an IROL, or an element of a Major WECC Transfer Path; operating within their Rating and all Rated Electrical Operating Conditions of the types shown below<sup>4</sup> [*Violation Risk Factor: High*] [*Time Horizon: Real-time*]:

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<sup>4</sup> This requirement does not apply to circumstances that are beyond the control of an applicable Transmission Owner or applicable Generator Owner subject to this reliability standard, including natural disasters such as earthquakes, fires, tornados, hurricanes, landslides, wind shear, fresh gale, major storms as defined either by the applicable Transmission Owner or applicable Generator Owner or an applicable regulatory body, ice storms, and floods; human or animal activity such as logging, animal severing tree, vehicle contact with tree, or installation, removal, or digging of vegetation. Nothing in this footnote

- 1.1.** An encroachment into the MVCD as shown in FAC-003-Table 2, observed in Real-time, absent a Sustained Outage,<sup>5</sup>
  - 1.2.** An encroachment due to a fall-in from inside the ROW that caused a vegetation-related Sustained Outage,<sup>6</sup>
  - 1.3.** An encroachment due to the blowing together of applicable lines and vegetation located inside the ROW that caused a vegetation-related Sustained Outage<sup>7</sup>,
  - 1.4.** An encroachment due to vegetation growth into the MVCD that caused a vegetation-related Sustained Outage.<sup>8</sup>
- M1.** Each applicable Transmission Owner and applicable Generator Owner has evidence that it managed vegetation to prevent encroachment into the MVCD as described in R1. Examples of acceptable forms of evidence may include dated attestations, dated reports containing no Sustained Outages associated with encroachment types 2 through 4 above, or records confirming no Real-time observations of any MVCD encroachments. (R1)
- R2.** Each applicable Transmission Owner and applicable Generator Owner shall manage vegetation to prevent encroachments into the MVCD of its applicable line(s) which are not either an element of an IROL, or an element of a Major WECC Transfer Path; operating within its Rating and all Rated Electrical Operating Conditions of the types shown below<sup>9</sup> [*Violation Risk Factor: High*] [*Time Horizon: Real-time*]:
  - 2.1** An encroachment into the MVCD, observed in Real-time, absent a Sustained Outage,<sup>10</sup>
  - 2.2** An encroachment due to a fall-in from inside the ROW that caused a vegetation-related Sustained Outage,<sup>11</sup>
  - 2.3** An encroachment due to the blowing together of applicable lines and vegetation located inside the ROW that caused a vegetation-related Sustained Outage,<sup>12</sup>

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should be construed to limit the Transmission Owner's or applicable Generator Owner's right to exercise its full legal rights on the ROW.

<sup>5</sup> If a later confirmation of a Fault by the applicable Transmission Owner or applicable Generator Owner shows that a vegetation encroachment within the MVCD has occurred from vegetation within the ROW, this shall be considered the equivalent of a Real-time observation.

<sup>6</sup> Multiple Sustained Outages on an individual line, if caused by the same vegetation, will be reported as one outage regardless of the actual number of outages within a 24-hour period.

<sup>7</sup> *Id.*

<sup>8</sup> *Id.*

<sup>9</sup> See footnote 4.

<sup>10</sup> See footnote 5.

<sup>11</sup> See footnote 6.

<sup>12</sup> *Id.*



- 2.4** An encroachment due to vegetation growth into the line MVCD that caused a vegetation-related Sustained Outage.<sup>13</sup>
- M2.** Each applicable Transmission Owner and applicable Generator Owner has evidence that it managed vegetation to prevent encroachment into the MVCD as described in R2. Examples of acceptable forms of evidence may include dated attestations, dated reports containing no Sustained Outages associated with encroachment types 2 through 4 above, or records confirming no Real-time observations of any MVCD encroachments. (R2)
- R3.** Each applicable Transmission Owner and applicable Generator Owner shall have documented maintenance strategies or procedures or processes or specifications it uses to prevent the encroachment of vegetation into the MVCD of its applicable lines that accounts for the following: *[Violation Risk Factor: Lower] [Time Horizon: Long Term Planning]*:
- 3.1** Movement of applicable line conductors under their Rating and all Rated Electrical Operating Conditions;
- 3.2** Inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency.
- M3.** The maintenance strategies or procedures or processes or specifications provided demonstrate that the applicable Transmission Owner and applicable Generator Owner can prevent encroachment into the MVCD considering the factors identified in the requirement. (R3)
- R4.** Each applicable Transmission Owner and applicable Generator Owner, without any intentional time delay, shall notify the control center holding switching authority for the associated applicable line when the applicable Transmission Owner and applicable Generator Owner has confirmed the existence of a vegetation condition that is likely to cause a Fault at any moment *[Violation Risk Factor: Medium] [Time Horizon: Real-time]*.
- M4.** Each applicable Transmission Owner and applicable Generator Owner that has a confirmed vegetation condition likely to cause a Fault at any moment will have evidence that it notified the control center holding switching authority for the associated transmission line without any intentional time delay. Examples of evidence may include control center logs, voice recordings, switching orders, clearance orders and subsequent work orders. (R4)
- R5.** When an applicable Transmission Owner and an applicable Generator Owner are constrained from performing vegetation work on an applicable line operating within its Rating and all Rated Electrical Operating Conditions, and the constraint may lead to

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<sup>13</sup> *Id.*

a vegetation encroachment into the MVCD prior to the implementation of the next annual work plan, then the applicable Transmission Owner or applicable Generator Owner shall take corrective action to ensure continued vegetation management to prevent encroachments [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Planning*].

- M5.** Each applicable Transmission Owner and applicable Generator Owner has evidence of the corrective action taken for each constraint where an applicable transmission line was put at potential risk. Examples of acceptable forms of evidence may include initially-planned work orders, documentation of constraints from landowners, court orders, inspection records of increased monitoring, documentation of the de-rating of lines, revised work orders, invoices, or evidence that the line was de-energized. (R5)
- R6.** Each applicable Transmission Owner and applicable Generator Owner shall perform a Vegetation Inspection of 100% of its applicable transmission lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.) at least once per calendar year and with no more than 18 calendar months between inspections on the same ROW<sup>14</sup> [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Planning*].
- M6.** Each applicable Transmission Owner and applicable Generator Owner has evidence that it conducted Vegetation Inspections of the transmission line ROW for all applicable lines at least once per calendar year but with no more than 18 calendar months between inspections on the same ROW. Examples of acceptable forms of evidence may include completed and dated work orders, dated invoices, or dated inspection records. (R6)
- R7.** Each applicable Transmission Owner and applicable Generator Owner shall complete 100% of its annual vegetation work plan of applicable lines to ensure no vegetation encroachments occur within the MVCD. Modifications to the work plan in response to changing conditions or to findings from vegetation inspections may be made (provided they do not allow encroachment of vegetation into the MVCD) and must be documented. The percent completed calculation is based on the number of units actually completed divided by the number of units in the final amended plan (measured in units of choice - circuit, pole line, line miles or kilometers, etc.). Examples of reasons for modification to annual plan may include [*Violation Risk Factor: Medium*] [*Time Horizon: Operations Planning*]:

### **7.1 Change in expected growth rate/environmental factors**

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<sup>14</sup> When the applicable Transmission Owner or applicable Generator Owner is prevented from performing a Vegetation Inspection within the timeframe in R6 due to a natural disaster, the TO or GO is granted a time extension that is equivalent to the duration of the time the TO or GO was prevented from performing the Vegetation Inspection.

- 7.2 Circumstances that are beyond the control of an applicable Transmission Owner or applicable Generator Owner<sup>15</sup>
- 7.3 Rescheduling work between growing seasons
- 7.4 Crew or contractor availability/Mutual assistance agreements
- 7.5 Identified unanticipated high priority work
- 7.6 Weather conditions/Accessibility
- 7.7 Permitting delays
- 7.8 Land ownership changes/Change in land use by the landowner
- 7.9 Emerging technologies
- 7.10 Each applicable Transmission Owner and applicable Generator Owner has evidence that it completed its annual vegetation work plan for its applicable lines. Examples of acceptable forms of evidence may include a copy of the completed annual work plan (as finally modified), dated work orders, dated invoices, or dated inspection records. (R7)

## C. Compliance

### 1. Compliance Monitoring Process

#### 1.1. Compliance Enforcement Authority:

“Compliance Enforcement Authority” means NERC or the Regional Entity, or any entity as otherwise designated by an Applicable Governmental Authority, in their respective roles of monitoring and/or enforcing compliance with mandatory and enforceable Reliability Standards in their respective jurisdictions.

#### 1.2. Evidence Retention:

The following evidence retention period(s) identify the period of time an entity is required to retain specific evidence to demonstrate compliance. For instances where the evidence retention period specified below is shorter than the time since the last audit, the Compliance Enforcement Authority may ask an entity to provide other evidence to show that it was compliant for the full-time period since the last audit.

The applicable entity shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.

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<sup>15</sup> Circumstances that are beyond the control of an applicable Transmission Owner or applicable Generator Owner include but are not limited to natural disasters such as earthquakes, fires, tornados, hurricanes, landslides, ice storms, floods, or major storms as defined either by the TO or GO or an applicable regulatory body.

- The applicable Transmission Owner and applicable Generator Owner retains data or evidence to show compliance with Requirements R1, R2, R3, R5, R6 and R7, for three calendar years.
- The applicable Transmission Owner and applicable Generator Owner retains data or evidence to show compliance with Requirement R4, Measure M4 for most recent 12 months of operator logs or most recent 3 months of voice recordings or transcripts of voice recordings, unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation.
- If an applicable Transmission Owner or applicable Generator Owner is found non-compliant, it shall keep information related to the non-compliance until found compliant or for the time period specified above, whichever is longer.

### **1.3. Compliance Monitoring and Enforcement Program**

As defined in the NERC Rules of Procedure, “Compliance Monitoring and Enforcement Program” refers to the identification of the processes that will be used to evaluate data or information for the purpose of assessing performance or outcomes with the associated Reliability Standard.

### **1.4. Additional Compliance Information**

**Periodic Data Submittal:** The applicable Transmission Owner and applicable Generator Owner will submit a quarterly report to its Regional Entity, or the Regional Entity’s designee, identifying all Sustained Outages of applicable lines operated within their Rating and all Rated Electrical Operating Conditions as determined by the applicable Transmission Owner or applicable Generator Owner to have been caused by vegetation, except as excluded in footnote 2, and including as a minimum the following:

- The name of the circuit(s), the date, time and duration of the outage; the voltage of the circuit; a description of the cause of the outage; the category associated with the Sustained Outage; other pertinent comments; and any countermeasures taken by the applicable Transmission Owner or applicable Generator Owner.

A Sustained Outage is to be categorized as one of the following:

- Category 1A — Grow-ins: Sustained Outages caused by vegetation growing into applicable lines, that are identified as an IROL or Major WECC Transfer Path, by vegetation inside and/or outside of the ROW;
- Category 1B — Grow-ins: Sustained Outages caused by vegetation growing into applicable lines, but are not identified as an IROL or Major WECC Transfer Path, by vegetation inside and/or outside of the ROW;

- Category 2A — Fall-ins: Sustained Outages caused by vegetation falling into applicable lines that are identified as an element of an IROL or Major WECC Transfer Path, from within the ROW;
- Category 2B — Fall-ins: Sustained Outages caused by vegetation falling into applicable lines, but are not identified as an element of an IROL or Major WECC Transfer Path, from within the ROW;
- Category 3 — Fall-ins: Sustained Outages caused by vegetation falling into applicable lines from outside the ROW;
- Category 4A — Blowing together: Sustained Outages caused by vegetation and applicable lines that are identified as an element of an IROL or Major WECC Transfer Path, blowing together from within the ROW;
- Category 4B — Blowing together: Sustained Outages caused by vegetation and applicable lines, but are not identified as an element of an IROL or Major WECC Transfer Path, blowing together from within the ROW.

The Regional Entity will report the outage information provided by applicable Transmission Owners and applicable Generator Owners, as per the above, quarterly to NERC, as well as any actions taken by the Regional Entity as a result of any of the reported Sustained Outages.

## Violation Severity Levels (Table 1)

| R # | Table 1: Violation Severity Levels (VSL) |              |                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----|------------------------------------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|     | Lower VSL                                | Moderate VSL | High VSL                                                                                                                                                                                                                                                                                  | Severe VSL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| R1. |                                          |              | The responsible entity failed to manage vegetation to prevent encroachment into the MVCD of a line identified as an element of an IROL or Major WECC transfer path and encroachment into the MVCD as identified in FAC-003-4-Table 2 was observed in real time absent a Sustained Outage. | <p>The responsible entity failed to manage vegetation to prevent encroachment into the MVCD of a line identified as an element of an IROL or Major WECC transfer path and a vegetation-related Sustained Outage was caused by one of the following:</p> <ul style="list-style-type: none"> <li>• <i>A fall-in from inside the active transmission line ROW</i></li> <li>• <i>Blowing together of applicable lines and vegetation located inside the active transmission line ROW</i></li> <li>• <i>A grow-in</i></li> </ul> |
| R2. |                                          |              | The responsible entity failed to manage vegetation to prevent encroachment into the MVCD of a line not                                                                                                                                                                                    | The responsible entity failed to manage vegetation to prevent encroachment into the MVCD of a line not                                                                                                                                                                                                                                                                                                                                                                                                                      |

|            |  |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            |  |                                                                                                                                                                                                                                                                                                                                 | identified as an element of an IROL or Major WECC transfer path and encroachment into the MVCD as identified in FAC-003-4-Table 2 was observed in real time absent a Sustained Outage.                                                                                                                                          | identified as an element of an IROL or Major WECC transfer path and a vegetation-related Sustained Outage was caused by one of the following: <ul style="list-style-type: none"> <li>• <i>A fall-in from inside the active transmission line ROW</i></li> <li>• <i>Blowing together of applicable lines and vegetation located inside the active transmission line ROW</i></li> <li>• <i>A grow-in</i></li> </ul> |
| <b>R3.</b> |  | The responsible entity has maintenance strategies or documented procedures or processes or specifications but has not accounted for the inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency, for the responsible entity's applicable lines.<br>(Requirement R3, Part 3.2) | The responsible entity has maintenance strategies or documented procedures or processes or specifications but has not accounted for the movement of transmission line conductors under their Rating and all Rated Electrical Operating Conditions, for the responsible entity's applicable lines.<br>(Requirement R3, Part 3.1) | The responsible entity does not have any maintenance strategies or documented procedures or processes or specifications used to prevent the encroachment of vegetation into the MVCD, for the responsible entity's applicable lines.                                                                                                                                                                              |

|            |                                                                                                                                                                |                                                                                                                                                                                           |                                                                                                                                                                                                              |                                                                                                                                                                           |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>R4.</b> |                                                                                                                                                                |                                                                                                                                                                                           | The responsible entity experienced a confirmed vegetation threat and notified the control center holding switching authority for that applicable line, but there was intentional delay in that notification. | The responsible entity experienced a confirmed vegetation threat and did not notify the control center holding switching authority for that applicable line.              |
| <b>R5.</b> |                                                                                                                                                                |                                                                                                                                                                                           |                                                                                                                                                                                                              | The responsible entity did not take corrective action when it was constrained from performing planned vegetation work where an applicable line was put at potential risk. |
| <b>R6.</b> | The responsible entity failed to inspect 5% or less of its applicable lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.) | The responsible entity failed to inspect more than 5% up to and including 10% of its applicable lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.). | The responsible entity failed to inspect more than 10% up to and including 15% of its applicable lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.).                   | The responsible entity failed to inspect more than 15% of its applicable lines (measured in units of choice - circuit, pole line, line miles or kilometers, etc.).        |
| <b>R7.</b> | The responsible entity failed to complete 5% or less of its annual vegetation work plan for its applicable lines (as finally modified).                        | The responsible entity failed to complete more than 5% and up to and including 10% of its annual vegetation work                                                                          | The responsible entity failed to complete more than 10% and up to and including 15% of its annual vegetation work                                                                                            | The responsible entity failed to complete more than 15% of its annual vegetation work plan for its applicable lines (as finally modified).                                |



|  |  |                                                         |                                                         |  |
|--|--|---------------------------------------------------------|---------------------------------------------------------|--|
|  |  | plan for its applicable lines<br>(as finally modified). | plan for its applicable lines<br>(as finally modified). |  |
|--|--|---------------------------------------------------------|---------------------------------------------------------|--|

## D. Regional Variances

None.

## E. Associated Documents

- [FAC-003-4 Implementation Plan](#)

## Version History

| Version | Date             | Action                                                                                                                                                                                                        | Change Tracking |
|---------|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
| 1       | January 20, 2006 | 1. Added "Standard Development Roadmap."<br>2. Changed "60" to "Sixty" in section A, 5.2.<br>3. Added "Proposed Effective Date: April 7, 2006" to footer.<br>4. Added "Draft 3: November 17, 2005" to footer. | New             |
| 1       | April 4, 2007    | Regulatory Approval - Effective Date                                                                                                                                                                          | New             |
| 2       | November 3, 2011 | Adopted by the NERC Board of Trustees                                                                                                                                                                         | New             |
| 2       | March 21, 2013   | FERC Order issued approving FAC-003-2 (Order No. 777)<br><br>FERC Order No. 777 was issued on March 21, 2013 directing NERC to "conduct or contract testing to                                                | Revisions       |

**FAC-003-4 Transmission Vegetation Management**

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|   |                                          |                                                                                                                                                                                                                                                                                                                     |           |
|---|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|   |                                          | obtain empirical data and submit a report to the Commission providing the results of the testing.” <sup>16</sup>                                                                                                                                                                                                    |           |
| 2 | May 9, 2013                              | Board of Trustees adopted the modification of the VRF for Requirement R2 of FAC-003-2 by raising the VRF from “Medium” to “High.”                                                                                                                                                                                   | Revisions |
| 3 | May 9, 2013                              | FAC-003-3 adopted by Board of Trustees                                                                                                                                                                                                                                                                              | Revisions |
| 3 | September 19, 2013                       | A FERC order was issued on September 19, 2013, approving FAC-003-3. This standard became enforceable on July 1, 2014 for Transmission Owners. For Generator Owners, R3 became enforceable on January 1, 2015 and all other requirements (R1, R2, R4, R5, R6, and R7) became enforceable on January 1, 2016.         | Revisions |
| 3 | November 22, 2013                        | Updated the VRF for R2 from “Medium” to “High” per a Final Rule issued by FERC                                                                                                                                                                                                                                      | Revisions |
| 3 | July 30, 2014                            | Transferred the effective dates section from FAC-003-2 (for Transmission Owners) into FAC-003-3, per the FAC-003-3 implementation plan                                                                                                                                                                              | Revisions |
| 4 | Projected final posting January 22, 2016 | Adjusted MVCD values in Table 2 for alternating current systems, consistent with findings reported in report filed on August 12, 2015 in Docket No. RM12-4-002 consistent with FERC’s directive in Order No. 777, and based on empirical testing results for flashover distances between conductors and vegetation. | Revisions |

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<sup>16</sup> *Revisions to Reliability Standard for Transmission Vegetation Management, Order No. 777, 142 FERC ¶ 61,208 (2013)*



**FAC-003 — TABLE 2 — Minimum Vegetation Clearance Distances (MVCD)<sup>17</sup>**  
**For Alternating Current Voltages (feet)**

| ( AC )<br>Nominal<br>System<br>Voltage<br>(kV) <sup>+</sup> | ( AC )<br>Maximum<br>System<br>Voltage<br>(kV) <sup>18</sup> | MVCD<br>(feet)<br>Over sea<br>level up<br>to 500 ft | MVCD<br>feet<br>Over 500<br>ft up to<br>1000 ft | MVCD<br>feet<br>Over<br>1000 ft<br>up to<br>2000 ft | MVCD<br>feet<br>Over<br>2000 ft<br>up to<br>3000 ft | MVCD<br>feet<br>Over<br>3000 ft<br>up to<br>4000 ft | MVCD<br>feet<br>Over<br>4000 ft<br>up to<br>5000 ft | MVCD<br>feet<br>Over<br>5000 ft<br>up to<br>6000 ft | MVCD<br>feet<br>Over<br>6000 ft<br>up to<br>7000 ft | MVCD<br>feet<br>Over<br>7000 ft<br>up to<br>8000 ft | MVCD<br>feet<br>Over<br>8000 ft<br>up to<br>9000 ft | MVCD<br>feet<br>Over<br>9000 ft<br>up to<br>10000 ft | MVCD<br>feet<br>Over<br>10000 ft<br>up to<br>11000 ft | MVCD<br>feet<br>Over<br>11000 ft<br>up to<br>12000 ft | MVCD<br>feet<br>Over<br>12000 ft<br>up to<br>13000 ft | MVCD<br>feet<br>Over<br>13000 ft<br>up to<br>14000 ft | MVCD<br>feet<br>Over<br>14000 ft<br>up to<br>15000 ft |
|-------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------|-------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|-----------------------------------------------------|------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|
| 765                                                         | 800                                                          | 11.6ft                                              | 11.7ft                                          | 11.9ft                                              | 12.1ft                                              | 12.2ft                                              | 12.4ft                                              | 12.6ft                                              | 12.8ft                                              | 13.0ft                                              | 13.1ft                                              | 13.3ft                                               | 13.5ft                                                | 13.7ft                                                | 13.9ft                                                | 14.1ft                                                | 14.3ft                                                |
| 500                                                         | 550                                                          | 7.0ft                                               | 7.1ft                                           | 7.2ft                                               | 7.4ft                                               | 7.5ft                                               | 7.6ft                                               | 7.8ft                                               | 7.9ft                                               | 8.1ft                                               | 8.2ft                                               | 8.3ft                                                | 8.5ft                                                 | 8.6ft                                                 | 8.8ft                                                 | 8.9ft                                                 | 9.1ft                                                 |
| 345                                                         | 362 <sup>19</sup>                                            | 4.3ft                                               | 4.3ft                                           | 4.4ft                                               | 4.5ft                                               | 4.6ft                                               | 4.7ft                                               | 4.8ft                                               | 4.9ft                                               | 5.0ft                                               | 5.1ft                                               | 5.2ft                                                | 5.3ft                                                 | 5.4ft                                                 | 5.5ft                                                 | 5.6ft                                                 | 5.7ft                                                 |
| 287                                                         | 302                                                          | 5.2ft                                               | 5.3ft                                           | 5.4ft                                               | 5.5ft                                               | 5.6ft                                               | 5.7ft                                               | 5.8ft                                               | 5.9ft                                               | 6.1ft                                               | 6.2ft                                               | 6.3ft                                                | 6.4ft                                                 | 6.5ft                                                 | 6.6ft                                                 | 6.8ft                                                 | 6.9ft                                                 |
| 230                                                         | 242                                                          | 4.0ft                                               | 4.1ft                                           | 4.2ft                                               | 4.3ft                                               | 4.3ft                                               | 4.4ft                                               | 4.5ft                                               | 4.6ft                                               | 4.7ft                                               | 4.8ft                                               | 4.9ft                                                | 5.0ft                                                 | 5.1ft                                                 | 5.2ft                                                 | 5.3ft                                                 | 5.4ft                                                 |
| 161*                                                        | 169                                                          | 2.7ft                                               | 2.7ft                                           | 2.8ft                                               | 2.9ft                                               | 2.9ft                                               | 3.0ft                                               | 3.0ft                                               | 3.1ft                                               | 3.2ft                                               | 3.3ft                                               | 3.3ft                                                | 3.4ft                                                 | 3.5ft                                                 | 3.6ft                                                 | 3.7ft                                                 | 3.8ft                                                 |
| 138*                                                        | 145                                                          | 2.3ft                                               | 2.3ft                                           | 2.4ft                                               | 2.4ft                                               | 2.5ft                                               | 2.5ft                                               | 2.6ft                                               | 2.7ft                                               | 2.7ft                                               | 2.8ft                                               | 2.8ft                                                | 2.9ft                                                 | 3.0ft                                                 | 3.0ft                                                 | 3.1ft                                                 | 3.2ft                                                 |
| 115*                                                        | 121                                                          | 1.9ft                                               | 1.9ft                                           | 1.9ft                                               | 2.0ft                                               | 2.0ft                                               | 2.1ft                                               | 2.1ft                                               | 2.2ft                                               | 2.2ft                                               | 2.3ft                                               | 2.3ft                                                | 2.4ft                                                 | 2.5ft                                                 | 2.5ft                                                 | 2.6ft                                                 | 2.7ft                                                 |
| 88*                                                         | 100                                                          | 1.5ft                                               | 1.5ft                                           | 1.6ft                                               | 1.6ft                                               | 1.7ft                                               | 1.7ft                                               | 1.8ft                                               | 1.8ft                                               | 1.8ft                                               | 1.9ft                                               | 1.9ft                                                | 2.0ft                                                 | 2.0ft                                                 | 2.1ft                                                 | 2.2ft                                                 | 2.2ft                                                 |
| 69*                                                         | 72                                                           | 1.1ft                                               | 1.1ft                                           | 1.1ft                                               | 1.2ft                                               | 1.2ft                                               | 1.2ft                                               | 1.2ft                                               | 1.3ft                                               | 1.3ft                                               | 1.3ft                                               | 1.4ft                                                | 1.4ft                                                 | 1.4ft                                                 | 1.5ft                                                 | 1.6ft                                                 | 1.6ft                                                 |

\* Such lines are applicable to this standard only if PC has determined such per FAC-014  
(refer to the Applicability Section above)

<sup>+</sup> Table 2 – Table of MVCD values at a 1.0 gap factor (in U.S. customary units), which is located in the EPRI report filed with FERC on August 12, 2015. (The 14000-15000 foot values were subsequently provided by EPRI in an updated Table 2 on December 1, 2015, filed with the FAC-003-4 Petition at FERC)

<sup>17</sup> The distances in this Table are the minimums required to prevent Flash-over; however prudent vegetation maintenance practices dictate that substantially greater distances will be achieved at time of vegetation maintenance.

<sup>18</sup> Where applicable lines are operated at nominal voltages other than those listed, the applicable Transmission Owner or applicable Generator Owner should use the maximum system voltage to determine the appropriate clearance for that line.

<sup>19</sup> The change in transient overvoltage factors in the calculations are the driver in the decrease in MVCDs for voltages of 345 kV and above. Refer to pp.29-31 in the Supplemental Materials for additional information.

**TABLE 2 (CONT) — Minimum Vegetation Clearance Distances (MVCD)<sup>20</sup>**  
For Alternating Current Voltages (meters)

| ( AC )<br>Nominal<br>System<br>Voltage<br>(KV) <sup>+</sup> | ( AC )<br>Maximum<br>System<br>Voltage<br>(kV) <sup>21</sup> | MVCD<br>meters<br><br>Over sea<br>level up<br>to 153 m | MVCD<br>meters<br><br>Over<br>153m up<br>to 305m | MVCD<br>meters<br><br>Over<br>305m up<br>to 610m | MVCD<br>meters<br><br>Over<br>610m up<br>to 915m | MVCD<br>meters<br><br>Over<br>915m up<br>to 1220m | MVCD<br>meters<br><br>Over<br>1220m<br>up to<br>1524m | MVCD<br>meters<br><br>Over<br>1524m<br>up to<br>1829m | MVCD<br>meters<br><br>Over<br>1829m<br>up to<br>2134m | MVCD<br>meters<br><br>Over<br>2134m<br>up to<br>2439m | MVCD<br>meters<br><br>Over<br>2439m<br>up to<br>2744m | MVCD<br>meters<br><br>Over<br>2744m<br>up to<br>3048m | MVCD<br>meters<br><br>Over<br>3048m<br>up to<br>3353m | MVCD<br>meters<br><br>Over<br>3353m<br>up to<br>3657m | MVCD<br>meters<br><br>Over<br>3657m<br>up to<br>3962m | MVCD<br>meters<br><br>Over<br>3962 m<br>up to<br>4268 m | MVCD<br>meters<br><br>Over<br>4268m<br>up to<br>4572m |
|-------------------------------------------------------------|--------------------------------------------------------------|--------------------------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|---------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------|
| 765                                                         | 800                                                          | 3.6m                                                   | 3.6m                                             | 3.6m                                             | 3.7m                                             | 3.7m                                              | 3.8m                                                  | 3.8m                                                  | 3.9m                                                  | 4.0m                                                  | 4.0m                                                  | 4.1m                                                  | 4.1m                                                  | 4.2m                                                  | 4.2m                                                  | 4.3m                                                    | 4.4m                                                  |
| 500                                                         | 550                                                          | 2.1m                                                   | 2.2m                                             | 2.2m                                             | 2.3m                                             | 2.3m                                              | 2.3m                                                  | 2.4m                                                  | 2.4m                                                  | 2.5m                                                  | 2.5m                                                  | 2.5m                                                  | 2.6m                                                  | 2.6m                                                  | 2.7m                                                  | 2.7m                                                    | 2.7m                                                  |
| 345                                                         | 362 <sup>22</sup>                                            | 1.3m                                                   | 1.3m                                             | 1.3m                                             | 1.4m                                             | 1.4m                                              | 1.4m                                                  | 1.5m                                                  | 1.5m                                                  | 1.5m                                                  | 1.6m                                                  | 1.6m                                                  | 1.6m                                                  | 1.6m                                                  | 1.7m                                                  | 1.7m                                                    | 1.8m                                                  |
| 287                                                         | 302                                                          | 1.6m                                                   | 1.6m                                             | 1.7m                                             | 1.7m                                             | 1.7m                                              | 1.7m                                                  | 1.8m                                                  | 1.8m                                                  | 1.9m                                                  | 1.9m                                                  | 1.9m                                                  | 2.0m                                                  | 2.0m                                                  | 2.0m                                                  | 2.1m                                                    | 2.1m                                                  |
| 230                                                         | 242                                                          | 1.2m                                                   | 1.3m                                             | 1.3m                                             | 1.3m                                             | 1.3m                                              | 1.3m                                                  | 1.4m                                                  | 1.4m                                                  | 1.4m                                                  | 1.5m                                                  | 1.5m                                                  | 1.5m                                                  | 1.6m                                                  | 1.6m                                                  | 1.6m                                                    | 1.6m                                                  |
| 161*                                                        | 169                                                          | 0.8m                                                   | 0.8m                                             | 0.9m                                             | 0.9m                                             | 0.9m                                              | 0.9m                                                  | 0.9m                                                  | 1.0m                                                  | 1.0m                                                  | 1.0m                                                  | 1.0m                                                  | 1.0m                                                  | 1.1m                                                  | 1.1m                                                  | 1.1m                                                    | 1.1m                                                  |
| 138*                                                        | 145                                                          | 0.7m                                                   | 0.7m                                             | 0.7m                                             | 0.7m                                             | 0.7m                                              | 0.7m                                                  | 0.8m                                                  | 0.8m                                                  | 0.8m                                                  | 0.9m                                                  | 0.9m                                                  | 0.9m                                                  | 0.9m                                                  | 0.9m                                                  | 1.0m                                                    | 1.0m                                                  |
| 115*                                                        | 121                                                          | 0.6m                                                   | 0.6m                                             | 0.6m                                             | 0.6m                                             | 0.6m                                              | 0.6m                                                  | 0.6m                                                  | 0.7m                                                  | .07m                                                  | 0.7m                                                  | 0.7m                                                  | 0.7m                                                  | 0.8m                                                  | 0.8m                                                  | 0.8m                                                    | 0.8m                                                  |
| 88*                                                         | 100                                                          | 0.4m                                                   | 0.4m                                             | 0.5m                                             | 0.5m                                             | 0.5m                                              | 0.5m                                                  | 0.6m                                                  | 0.6m                                                  | 0.6m                                                  | 0.6m                                                  | 0.6m                                                  | 0.6m                                                  | 0.6m                                                  | 0.6m                                                  | 0.7m                                                    | 0.7m                                                  |
| 69*                                                         | 72                                                           | 0.3m                                                   | 0.3m                                             | 0.3m                                             | 0.4m                                             | 0.4m                                              | 0.4m                                                  | 0.4m                                                  | 0.4m                                                  | 0.4m                                                  | 0.4m                                                  | 0.4m                                                  | 0.4m                                                  | 0.4m                                                  | 0.5m                                                  | 0.5m                                                    | 0.5m                                                  |

\* Such lines are applicable to this standard only if PC has determined such per FAC-014 (refer to the Applicability Section above)

+ Table 2 – Table of MVCD values at a 1.0 gap factor (in U.S. customary units), which is located in the EPRI report filed with FERC on August 12, 2015. (The 14000-15000 foot values were subsequently provided by EPRI in an updated Table 2 on December 1, 2015, filed with the FAC-003-4 Petition at FERC)

<sup>20</sup> The distances in this Table are the minimums required to prevent Flash-over; however prudent vegetation maintenance practices dictate that substantially greater distances will be achieved at time of vegetation maintenance.

<sup>21</sup> Where applicable lines are operated at nominal voltages other than those listed, the applicable Transmission Owner or applicable Generator Owner should use the maximum system voltage to determine the appropriate clearance for that line.

<sup>22</sup> The change in transient overvoltage factors in the calculations are the driver in the decrease in MVCDs for voltages of 345 kV and above. Refer to pp.29-31 in the supplemental materials for additional information.

**TABLE 2 (CONT) — Minimum Vegetation Clearance Distances (MVCD)<sup>23</sup>**  
**For Direct Current Voltages feet (meters)**

| ( DC )<br>Nominal<br>Pole to<br>Ground<br>Voltage<br>(kV) | MVCD<br>meters<br><br>Over sea<br>level up to<br>500 ft<br><br>(Over sea<br>level up to<br>152.4 m) | MVCD<br>meters<br><br>Over 500<br>ft up to<br>1000 ft<br><br>(Over<br>152.4 m<br>up to<br>304.8 m) | MVCD<br>meters<br><br>Over 1000<br>ft up to<br>2000 ft<br><br>(Over<br>304.8 m<br>up to<br>609.6m) | MVCD<br>meters<br><br>Over 2000<br>ft up to<br>3000 ft<br><br>(Over<br>609.6m up<br>to 914.4m) | MVCD<br>meters<br><br>Over 3000<br>ft up to<br>4000 ft<br><br>(Over<br>914.4m up<br>to 1219.2m) | MVCD<br>meters<br><br>Over 4000<br>ft up to<br>5000 ft<br><br>(Over<br>1219.2m<br>up to<br>1524m) | MVCD<br>meters<br><br>Over 5000<br>ft up to<br>6000 ft<br><br>(Over<br>1524 m up<br>to 1828.8<br>m) | MVCD<br>meters<br><br>Over 6000<br>ft up to<br>7000 ft<br><br>(Over<br>1828.8m<br>up to<br>2133.6m) | MVCD<br>meters<br><br>Over 7000<br>ft up to<br>8000 ft<br><br>(Over<br>2133.6m<br>up to<br>2438.4m) | MVCD<br>meters<br><br>Over 8000<br>ft up to<br>9000 ft<br><br>(Over<br>2438.4m<br>up to<br>2743.2m) | MVCD<br>meters<br><br>Over 9000<br>ft up to<br>10000 ft<br><br>(Over<br>2743.2m<br>up to<br>3048m) | MVCD<br>meters<br><br>Over 10000<br>ft up to<br>11000 ft<br><br>(Over<br>3048m up<br>to<br>3352.8m) |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| ±750                                                      | 14.12ft<br>(4.30m)                                                                                  | 14.31ft<br>(4.36m)                                                                                 | 14.70ft<br>(4.48m)                                                                                 | 15.07ft<br>(4.59m)                                                                             | 15.45ft<br>(4.71m)                                                                              | 15.82ft<br>(4.82m)                                                                                | 16.2ft<br>(4.94m)                                                                                   | 16.55ft<br>(5.04m)                                                                                  | 16.91ft<br>(5.15m)                                                                                  | 17.27ft<br>(5.26m)                                                                                  | 17.62ft<br>(5.37m)                                                                                 | 17.97ft<br>(5.48m)                                                                                  |
| ±600                                                      | 10.23ft<br>(3.12m)                                                                                  | 10.39ft<br>(3.17m)                                                                                 | 10.74ft<br>(3.26m)                                                                                 | 11.04ft<br>(3.36m)                                                                             | 11.35ft<br>(3.46m)                                                                              | 11.66ft<br>(3.55m)                                                                                | 11.98ft<br>(3.65m)                                                                                  | 12.3ft<br>(3.75m)                                                                                   | 12.62ft<br>(3.85m)                                                                                  | 12.92ft<br>(3.94m)                                                                                  | 13.24ft<br>(4.04m)                                                                                 | 13.54ft<br>(4.13m)                                                                                  |
| ±500                                                      | 8.03ft<br>(2.45m)                                                                                   | 8.16ft<br>(2.49m)                                                                                  | 8.44ft<br>(2.57m)                                                                                  | 8.71ft<br>(2.65m)                                                                              | 8.99ft<br>(2.74m)                                                                               | 9.25ft<br>(2.82m)                                                                                 | 9.55ft<br>(2.91m)                                                                                   | 9.82ft<br>(2.99m)                                                                                   | 10.1ft<br>(3.08m)                                                                                   | 10.38ft<br>(3.16m)                                                                                  | 10.65ft<br>(3.25m)                                                                                 | 10.92ft<br>(3.33m)                                                                                  |
| ±400                                                      | 6.07ft<br>(1.85m)                                                                                   | 6.18ft<br>(1.88m)                                                                                  | 6.41ft<br>(1.95m)                                                                                  | 6.63ft<br>(2.02m)                                                                              | 6.86ft<br>(2.09m)                                                                               | 7.09ft<br>(2.16m)                                                                                 | 7.33ft<br>(2.23m)                                                                                   | 7.56ft<br>(2.30m)                                                                                   | 7.80ft<br>(2.38m)                                                                                   | 8.03ft<br>(2.45m)                                                                                   | 8.27ft<br>(2.52m)                                                                                  | 8.51ft<br>(2.59m)                                                                                   |
| ±250                                                      | 3.50ft<br>(1.07m)                                                                                   | 3.57ft<br>(1.09m)                                                                                  | 3.72ft<br>(1.13m)                                                                                  | 3.87ft<br>(1.18m)                                                                              | 4.02ft<br>(1.23m)                                                                               | 4.18ft<br>(1.27m)                                                                                 | 4.34ft<br>(1.32m)                                                                                   | 4.5ft<br>(1.37m)                                                                                    | 4.66ft<br>(1.42m)                                                                                   | 4.83ft<br>(1.47m)                                                                                   | 5.00ft<br>(1.52m)                                                                                  | 5.17ft<br>(1.58m)                                                                                   |

<sup>23</sup> The distances in this Table are the minimums required to prevent Flash-over; however prudent vegetation maintenance practices dictate that substantially greater distances will be achieved at time of vegetation maintenance.

## Guideline and Technical Basis

### Effective dates:

The Compliance section is standard language used in most NERC standards to cover the general effective date and covers the vast majority of situations. A special case covers effective dates for (1) lines initially becoming subject to the Standard, (2) lines changing in applicability within the standard.

The special case is needed because the Planning Coordinators may designate lines below 200 kV to become elements of an IROL or Major WECC Transfer Path in a future Planning Year (PY). For example, studies by the Planning Coordinator in 2015 may identify a line to have that designation beginning in PY 2025, ten years after the planning study is performed. It is not intended for the Standard to be immediately applicable to, or in effect for, that line until that future PY begins. The effective date provision for such lines ensures that the line will become subject to the standard on January 1 of the PY specified with an allowance of at least 12 months for the applicable Transmission Owner or applicable Generator Owner to make the necessary preparations to achieve compliance on that line. A line operating below 200kV designated as an element of an IROL or Major WECC Transfer Path may be removed from that designation due to system improvements, changes in generation, changes in loads or changes in studies and analysis of the network.

| <u>Date that<br/>Planning Study is<br/>completed</u> | <u>PY the line<br/>will become<br/>an IROL<br/>element</u> | <u>Date 1</u> | <u>Date 2</u> | <u>Effective Date<br/>The later of Date 1<br/>or Date 2</u> |
|------------------------------------------------------|------------------------------------------------------------|---------------|---------------|-------------------------------------------------------------|
| 05/15/2011                                           | 2012                                                       | 05/15/2012    | 01/01/2012    | 05/15/2012                                                  |
| 05/15/2011                                           | 2013                                                       | 05/15/2012    | 01/01/2013    | 01/01/2013                                                  |
| 05/15/2011                                           | 2014                                                       | 05/15/2012    | 01/01/2014    | 01/01/2014                                                  |
| 05/15/2011                                           | 2021                                                       | 05/15/2012    | 01/01/2021    | 01/01/2021                                                  |

### Defined Terms:

#### Explanation for revising the definition of ROW:

The current NERC glossary definition of Right of Way has been modified to include Generator Owners and to address the matter set forth in Paragraph 734 of FERC Order 693. The Order pointed out that Transmission Owners may in some cases own more property or rights than are needed to reliably operate transmission lines. This definition represents a slight but significant departure from the strict legal definition of “right of way” in that this definition is based on engineering and construction considerations that establish the width of a corridor from a technical basis. The pre-2007 maintenance records are included in the current definition to allow the use of such vegetation widths if there were no engineering or construction standards that

referenced the width of right of way to be maintained for vegetation on a particular line but the evidence exists in maintenance records for a width that was in fact maintained prior to this standard becoming mandatory. Such widths may be the only information available for lines that had limited or no vegetation easement rights and were typically maintained primarily to ensure public safety. This standard does not require additional easement rights to be purchased to satisfy a minimum right of way width that did not exist prior to this standard becoming mandatory.

### **Explanation for revising the definition of Vegetation Inspection:**

The current glossary definition of this NERC term was modified to include Generator Owners and to allow both maintenance inspections and vegetation inspections to be performed concurrently. This allows potential efficiencies, especially for those lines with minimal vegetation and/or slow vegetation growth rates.

### **Explanation of the derivation of the MVCD:**

The MVCD is a calculated minimum distance that is derived from the Gallet equation. This is a method of calculating a flash over distance that has been used in the design of high voltage transmission lines. Keeping vegetation away from high voltage conductors by this distance will prevent voltage flash-over to the vegetation. See the explanatory text below for Requirement R3 and associated Figure 1. Table 2 of the Standard provides MVCD values for various voltages and altitudes. The table is based on empirical testing data from EPRI as requested by FERC in Order No. 777.

### **Project 2010-07.1 Adjusted MVCDs per EPRI Testing:**

In Order No. 777, FERC directed NERC to undertake testing to gather empirical data validating the appropriate gap factor used in the Gallet equation to calculate MVCDs, specifically the gap factor for the flash-over distances between conductors and vegetation. See, Order No. 777, at P 60. NERC engaged industry through a collaborative research project and contracted EPRI to complete the scope of work. In January 2014, NERC formed an advisory group to assist with developing the scope of work for the project. This team provided subject matter expertise for developing the test plan, monitoring testing, and vetting the analysis and conclusions to be submitted in a final report. The advisory team was comprised of NERC staff, arborists, and industry members with wide-ranging expertise in transmission engineering, insulation coordination, and vegetation management. The testing project commenced in April 2014 and continued through October 2014 with the final set of testing completed in May 2015. Based on these testing results conducted by EPRI, and consistent with the report filed in FERC Docket No. RM12-4-000, the gap factor used in the Gallet equation required adjustment from 1.3 to 1.0. This resulted in increased MVCD values for all alternating current system voltages identified. The adjusted MVCD values, reflecting the 1.0 gap factor, are included in Table 2 of version 4 of FAC-003.

The air gap testing completed by EPRI per FERC Order No. 777 established that trees with large spreading canopies growing directly below energized high voltage conductors create the



greatest likelihood of an air gap flash over incident and was a key driver in changing the gap factor to a more conservative value of 1.0 in version 4 of this standard.

### **Requirements R1 and R2:**

R1 and R2 are performance-based requirements. The reliability objective or outcome to be achieved is the management of vegetation such that there are no vegetation encroachments within a minimum distance of transmission lines. Content-wise, R1 and R2 are the same requirements; however, they apply to different Facilities. Both R1 and R2 require each applicable Transmission Owner or applicable Generator Owner to manage vegetation to prevent encroachment within the MVCD of transmission lines. R1 is applicable to lines that are identified as an element of an IROL or Major WECC Transfer Path. R2 is applicable to all other lines that are not elements of IROLs, and not elements of Major WECC Transfer Paths.

The separation of applicability (between R1 and R2) recognizes that inadequate vegetation management for an applicable line that is an element of an IROL or a Major WECC Transfer Path is a greater risk to the interconnected electric transmission system than applicable lines that are not elements of IROLs or Major WECC Transfer Paths. Applicable lines that are not elements of IROLs or Major WECC Transfer Paths do require effective vegetation management, but these lines are comparatively less operationally significant.

Requirements R1 and R2 state that if inadequate vegetation management allows vegetation to encroach within the MVCD distance as shown in Table 2, it is a violation of the standard. Table 2 distances are the minimum clearances that will prevent spark-over based on the Gallet equations. These requirements assume that transmission lines and their conductors are operating within their Rating. If a line conductor is intentionally or inadvertently operated beyond its Rating and Rated Electrical Operating Condition (potentially in violation of other standards), the occurrence of a clearance encroachment may occur solely due to that condition. For example, emergency actions taken by an applicable Transmission Owner or applicable Generator Owner or Reliability Coordinator to protect an Interconnection may cause excessive sagging and an outage. Another example would be ice loading beyond the line's Rating and Rated Electrical Operating Condition. Such vegetation-related encroachments and outages are not violations of this standard.

Evidence of failures to adequately manage vegetation include real-time observation of a vegetation encroachment into the MVCD (absent a Sustained Outage), or a vegetation-related encroachment resulting in a Sustained Outage due to a fall-in from inside the ROW, or a vegetation-related encroachment resulting in a Sustained Outage due to the blowing together of the lines and vegetation located inside the ROW, or a vegetation-related encroachment resulting in a Sustained Outage due to a grow-in. Faults which do not cause a Sustained outage and which are confirmed to have been caused by vegetation encroachment within the MVCD are considered the equivalent of a Real-time observation for violation severity levels.

With this approach, the VSLs for R1 and R2 are structured such that they directly correlate to the severity of a failure of an applicable Transmission Owner or applicable Generator Owner to manage vegetation and to the corresponding performance level of the Transmission Owner's

vegetation program's ability to meet the objective of "preventing the risk of those vegetation related outages that could lead to Cascading." Thus violation severity increases with an applicable Transmission Owner's or applicable Generator Owner's inability to meet this goal and its potential of leading to a Cascading event. The additional benefits of such a combination are that it simplifies the standard and clearly defines performance for compliance. A performance-based requirement of this nature will promote high quality, cost effective vegetation management programs that will deliver the overall end result of improved reliability to the system.

Multiple Sustained Outages on an individual line can be caused by the same vegetation. For example initial investigations and corrective actions may not identify and remove the actual outage cause then another outage occurs after the line is re-energized and previous high conductor temperatures return. Such events are considered to be a single vegetation-related Sustained Outage under the standard where the Sustained Outages occur within a 24 hour period.

If the applicable Transmission Owner or applicable Generator Owner has applicable lines operated at nominal voltage levels not listed in Table 2, then the applicable TO or applicable GO should use the next largest clearance distance based on the next highest nominal voltage in the table to determine an acceptable distance.

### **Requirement R3:**

R3 is a competency based requirement concerned with the maintenance strategies, procedures, processes, or specifications, an applicable Transmission Owner or applicable Generator Owner uses for vegetation management.

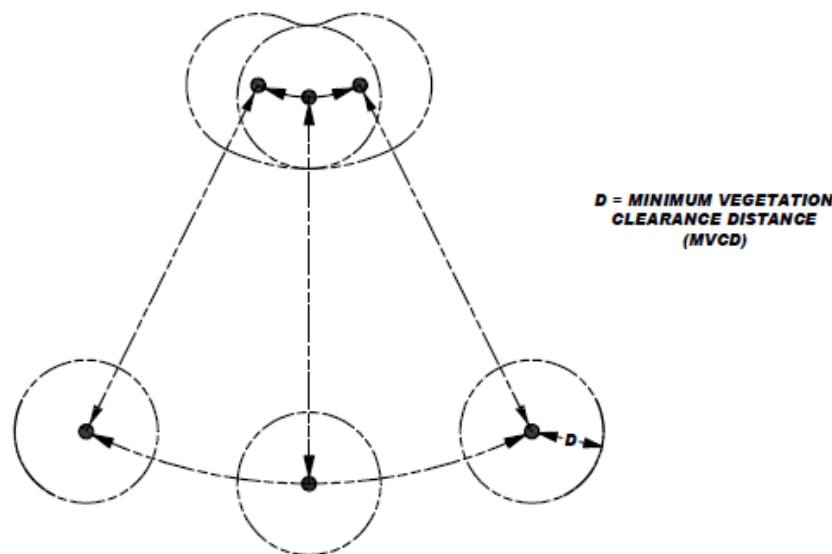
An adequate transmission vegetation management program formally establishes the approach the applicable Transmission Owner or applicable Generator Owner uses to plan and perform vegetation work to prevent transmission Sustained Outages and minimize risk to the transmission system. The approach provides the basis for evaluating the intent, allocation of appropriate resources, and the competency of the applicable Transmission Owner or applicable Generator Owner in managing vegetation. There are many acceptable approaches to manage vegetation and avoid Sustained Outages. However, the applicable Transmission Owner or applicable Generator Owner must be able to show the documentation of its approach and how it conducts work to maintain clearances.

An example of one approach commonly used by industry is ANSI Standard A300, part 7. However, regardless of the approach a utility uses to manage vegetation, any approach an applicable Transmission Owner or applicable Generator Owner chooses to use will generally contain the following elements:

1. *the maintenance strategy used (such as minimum vegetation-to-conductor distance or maximum vegetation height) to ensure that MVCD clearances are never violated*

2. *the work methods that the applicable Transmission Owner or applicable Generator Owner uses to control vegetation*
3. *a stated Vegetation Inspection frequency*
4. *an annual work plan*

The conductor's position in space at any point in time is continuously changing in reaction to a number of different loading variables. Changes in vertical and horizontal conductor positioning are the result of thermal and physical loads applied to the line. Thermal loading is a function of line current and the combination of numerous variables influencing ambient heat dissipation including wind velocity/direction, ambient air temperature and precipitation. Physical loading applied to the conductor affects sag and sway by combining physical factors such as ice and wind loading. The movement of the transmission line conductor and the MVCD is illustrated in Figure 1 below.



**Figure 1**

A cross-section view of a single conductor at a given point along the span is shown with six possible conductor positions due to movement resulting from thermal and mechanical loading.

#### **Requirement R4:**

R4 is a risk-based requirement. It focuses on preventative actions to be taken by the applicable Transmission Owner or applicable Generator Owner for the mitigation of Fault risk when a vegetation threat is confirmed. R4 involves the notification of potentially threatening vegetation conditions, without any intentional delay, to the control center holding switching authority for that specific transmission line. Examples of acceptable unintentional delays may

include communication system problems (for example, cellular service or two-way radio disabled), crews located in remote field locations with no communication access, delays due to severe weather, etc.

Confirmation is key that a threat actually exists due to vegetation. This confirmation could be in the form of an applicable Transmission Owner or applicable Generator Owner employee who personally identifies such a threat in the field. Confirmation could also be made by sending out an employee to evaluate a situation reported by a landowner.

Vegetation-related conditions that warrant a response include vegetation that is near or encroaching into the MVCD (a grow-in issue) or vegetation that could fall into the transmission conductor (a fall-in issue). A knowledgeable verification of the risk would include an assessment of the possible sag or movement of the conductor while operating between no-load conditions and its rating.

The applicable Transmission Owner or applicable Generator Owner has the responsibility to ensure the proper communication between field personnel and the control center to allow the control center to take the appropriate action until or as the vegetation threat is relieved. Appropriate actions may include a temporary reduction in the line loading, switching the line out of service, or other preparatory actions in recognition of the increased risk of outage on that circuit. The notification of the threat should be communicated in terms of minutes or hours as opposed to a longer time frame for corrective action plans (see R5).

All potential grow-in or fall-in vegetation-related conditions will not necessarily cause a Fault at any moment. For example, some applicable Transmission Owners or applicable Generator Owners may have a danger tree identification program that identifies trees for removal with the potential to fall near the line. These trees would not require notification to the control center unless they pose an immediate fall-in threat.

### **Requirement R5:**

R5 is a risk-based requirement. It focuses upon preventative actions to be taken by the applicable Transmission Owner or applicable Generator Owner for the mitigation of Sustained Outage risk when temporarily constrained from performing vegetation maintenance. The intent of this requirement is to deal with situations that prevent the applicable Transmission Owner or applicable Generator Owner from performing planned vegetation management work and, as a result, have the potential to put the transmission line at risk. Constraints to performing vegetation maintenance work as planned could result from legal injunctions filed by property owners, the discovery of easement stipulations which limit the applicable Transmission Owner's or applicable Generator Owner's rights, or other circumstances.

This requirement is not intended to address situations where the transmission line is not at potential risk and the work event can be rescheduled or re-planned using an alternate work methodology. For example, a land owner may prevent the planned use of herbicides to control incompatible vegetation outside of the MVCD, but agree to the use of mechanical clearing. In

this case the applicable Transmission Owner or applicable Generator Owner is not under any immediate time constraint for achieving the management objective, can easily reschedule work using an alternate approach, and therefore does not need to take interim corrective action.

However, in situations where transmission line reliability is potentially at risk due to a constraint, the applicable Transmission Owner or applicable Generator Owner is required to take an interim corrective action to mitigate the potential risk to the transmission line. A wide range of actions can be taken to address various situations. General considerations include:

- Identifying locations where the applicable Transmission Owner or applicable Generator Owner is constrained from performing planned vegetation maintenance work which potentially leaves the transmission line at risk.
- Developing the specific action to mitigate any potential risk associated with not performing the vegetation maintenance work as planned.
- Documenting and tracking the specific action taken for the location.
- In developing the specific action to mitigate the potential risk to the transmission line the applicable Transmission Owner or applicable Generator Owner could consider location specific measures such as modifying the inspection and/or maintenance intervals. Where a legal constraint would not allow any vegetation work, the interim corrective action could include limiting the loading on the transmission line.
- The applicable Transmission Owner or applicable Generator Owner should document and track the specific corrective action taken at each location. This location may be indicated as one span, one tree or a combination of spans on one property where the constraint is considered to be temporary.

### **Requirement R6:**

R6 is a risk-based requirement. This requirement sets a minimum time period for completing Vegetation Inspections. The provision that Vegetation Inspections can be performed in conjunction with general line inspections facilitates a Transmission Owner's ability to meet this requirement. However, the applicable Transmission Owner or applicable Generator Owner may determine that more frequent vegetation specific inspections are needed to maintain reliability levels, based on factors such as anticipated growth rates of the local vegetation, length of the local growing season, limited ROW width, and local rainfall. Therefore it is expected that some transmission lines may be designated with a higher frequency of inspections.

The VSLs for Requirement R6 have levels ranked by the failure to inspect a percentage of the applicable lines to be inspected. To calculate the appropriate VSL the applicable Transmission Owner or applicable Generator Owner may choose units such as: circuit, pole line, line miles or kilometers, etc.

For example, when an applicable Transmission Owner or applicable Generator Owner operates 2,000 miles of applicable transmission lines this applicable Transmission Owner or applicable

Generator Owner will be responsible for inspecting all the 2,000 miles of lines at least once during the calendar year. If one of the included lines was 100 miles long, and if it was not inspected during the year, then the amount failed to inspect would be  $100/2000 = 0.05$  or 5%. The “Low VSL” for R6 would apply in this example.

### **Requirement R7:**

R7 is a risk-based requirement. The applicable Transmission Owner or applicable Generator Owner is required to complete its annual work plan for vegetation management to accomplish the purpose of this standard. Modifications to the work plan in response to changing conditions or to findings from vegetation inspections may be made and documented provided they do not put the transmission system at risk. The annual work plan requirement is not intended to necessarily require a “span-by-span”, or even a “line-by-line” detailed description of all work to be performed. It is only intended to require that the applicable Transmission Owner or applicable Generator Owner provide evidence of annual planning and execution of a vegetation management maintenance approach which successfully prevents encroachment of vegetation into the MVCD.

When an applicable Transmission Owner or applicable Generator Owner identifies 1,000 miles of applicable transmission lines to be completed in the applicable Transmission Owner’s or applicable Generator Owner’s annual plan, the applicable Transmission Owner or applicable Generator Owner will be responsible completing those identified miles. If an applicable Transmission Owner or applicable Generator Owner makes a modification to the annual plan that does not put the transmission system at risk of an encroachment the annual plan may be modified. If 100 miles of the annual plan is deferred until next year the calculation to determine what percentage was completed for the current year would be:  $1000 - 100$  (deferred miles) = 900 modified annual plan, or  $900 / 900 = 100\%$  completed annual miles. If an applicable Transmission Owner or applicable Generator Owner only completed 875 of the total 1000 miles with no acceptable documentation for modification of the annual plan the calculation for failure to complete the annual plan would be:  $1000 - 875 = 125$  miles failed to complete then,  $125 \text{ miles (not completed)} / 1000 \text{ total annual plan miles} = 12.5\%$  failed to complete.

The ability to modify the work plan allows the applicable Transmission Owner or applicable Generator Owner to change priorities or treatment methodologies during the year as conditions or situations dictate. For example recent line inspections may identify unanticipated high priority work, weather conditions (drought) could make herbicide application ineffective during the plan year, or a major storm could require redirecting local resources away from planned maintenance. This situation may also include complying with mutual assistance agreements by moving resources off the applicable Transmission Owner’s or applicable Generator Owner’s system to work on another system. Any of these examples could result in acceptable deferrals or additions to the annual work plan provided that they do not put the transmission system at risk of a vegetation encroachment.

In general, the vegetation management maintenance approach should use the full extent of the applicable Transmission Owner’s or applicable Generator Owner’s easement, fee simple and

other legal rights allowed. A comprehensive approach that exercises the full extent of legal rights on the ROW is superior to incremental management because in the long term it reduces the overall potential for encroachments, and it ensures that future planned work and future planned inspection cycles are sufficient.

When developing the annual work plan the applicable Transmission Owner or applicable Generator Owner should allow time for procedural requirements to obtain permits to work on federal, state, provincial, public, tribal lands. In some cases the lead time for obtaining permits may necessitate preparing work plans more than a year prior to work start dates. Applicable Transmission Owners or applicable Generator Owners may also need to consider those special landowner requirements as documented in easement instruments.

This requirement sets the expectation that the work identified in the annual work plan will be completed as planned. Therefore, deferrals or relevant changes to the annual plan shall be documented. Depending on the planning and documentation format used by the applicable Transmission Owner or applicable Generator Owner, evidence of successful annual work plan execution could consist of signed-off work orders, signed contracts, printouts from work management systems, spreadsheets of planned versus completed work, timesheets, work inspection reports, or paid invoices. Other evidence may include photographs, and walk-through reports.

### **Notes:**

The SDT determined that the use of IEEE 516-2003 in version 1 of FAC-003 was a misapplication. The SDT consulted specialists who advised that the Gallet equation would be a technically justified method. The explanation of why the Gallet approach is more appropriate is explained in the paragraphs below.

The drafting team sought a method of establishing minimum clearance distances that uses realistic weather conditions and realistic maximum transient over-voltages factors for in-service transmission lines.

The SDT considered several factors when looking at changes to the minimum vegetation to conductor distances in FAC-003-1:

- avoid the problem associated with referring to tables in another standard (IEEE-516-2003)
- transmission lines operate in non-laboratory environments (wet conditions)
- transient over-voltage factors are lower for in-service transmission lines than for inadvertently re-energized transmission lines with trapped charges.

FAC-003-1 used the minimum air insulation distance (MAID) without tools formula provided in IEEE 516-2003 to determine the minimum distance between a transmission line conductor and vegetation. The equations and methods provided in IEEE 516 were developed by an IEEE Task Force in 1968 from test data provided by thirteen independent laboratories. The distances provided in IEEE 516 Tables 5 and 7 are based on the withstand voltage of a dry rod-rod air gap,

or in other words, dry laboratory conditions. Consequently, the validity of using these distances in an outside environment application has been questioned.

FAC-003-1 allowed Transmission Owners to use either Table 5 or Table 7 to establish the minimum clearance distances. Table 7 could be used if the Transmission Owner knew the maximum transient over-voltage factor for its system. Otherwise, Table 5 would have to be used. Table 5 represented minimum air insulation distances under the worst possible case for transient over-voltage factors. These worst case transient over-voltage factors were as follows: 3.5 for voltages up to 362 kV phase to phase; 3.0 for 500 - 550 kV phase to phase; and 2.5 for 765 to 800 kV phase to phase. These worst case over-voltage factors were also a cause for concern in this particular application of the distances.

In general, the worst case transient over-voltages occur on a transmission line that is inadvertently re-energized immediately after the line is de-energized and a trapped charge is still present. The intent of FAC-003 is to keep a transmission line that is in service from becoming de-energized (i.e. tripped out) due to spark-over from the line conductor to nearby vegetation. Thus, the worst case transient overvoltage assumptions are not appropriate for this application. Rather, the appropriate over voltage values are those that occur only while the line is energized.

Typical values of transient over-voltages of in-service lines are not readily available in the literature because they are negligible compared with the maximums. A conservative value for the maximum transient over-voltage that can occur anywhere along the length of an in-service ac line was approximately 2.0 per unit. This value was a conservative estimate of the transient over-voltage that is created at the point of application (e.g. a substation) by switching a capacitor bank without pre-insertion devices (e.g. closing resistors). At voltage levels where capacitor banks are not very common (e.g. Maximum System Voltage of 362 kV), the maximum transient over-voltage of an in-service ac line are created by fault initiation on adjacent ac lines and shunt reactor bank switching. These transient voltages are usually 1.5 per unit or less.

Even though these transient over-voltages will not be experienced at locations remote from the bus at which they are created, in order to be conservative, it is assumed that all nearby ac lines are subjected to this same level of over-voltage. Thus, a maximum transient over-voltage factor of 2.0 per unit for transmission lines operated at 302 kV and below was considered to be a realistic maximum in this application. Likewise, for ac transmission lines operated at Maximum System Voltages of 362 kV and above a transient over-voltage factor of 1.4 per unit was considered a realistic maximum.

The Gallet equations are an accepted method for insulation coordination in tower design. These equations are used for computing the required strike distances for proper transmission line insulation coordination. They were developed for both wet and dry applications and can be used with any value of transient over-voltage factor. The Gallet equation also can take into account various air gap geometries. This approach was used to design the first 500 kV and 765 kV lines in North America.



If one compares the MAID using the IEEE 516-2003 Table 7 (table D.5 for English values) with the critical spark-over distances computed using the Gallet wet equations, for each of the nominal voltage classes and identical transient over-voltage factors, the Gallet equations yield a more conservative (larger) minimum distance value.

Distances calculated from either the IEEE 516 (dry) formulas or the Gallet “wet” formulas are not vastly different when the same transient overvoltage factors are used; the “wet” equations will consistently produce slightly larger distances than the IEEE 516 equations when the same transient overvoltage is used. While the IEEE 516 equations were only developed for dry conditions the Gallet equations have provisions to calculate spark-over distances for both wet and dry conditions.

Since no empirical data for spark over distances to live vegetation existed at the time version 3 was developed, the SDT chose a proven method that has been used in other EHV applications. The Gallet equations relevance to wet conditions and the selection of a Transient Overvoltage Factor that is consistent with the absence of trapped charges on an in-service transmission line make this methodology a better choice.

The following table is an example of the comparison of distances derived from IEEE 516 and the Gallet equations.

**Comparison of spark-over distances computed using Gallet wet equations vs.  
IEEE 516-2003 MAID distances**

| ( AC )<br>Nom System<br>Voltage (kV) | ( AC )<br>Max System<br>Voltage (kV) | Transient<br>Over-voltage<br>Factor (T) | Clearance (ft.)<br>Gallet (wet)<br>@ Alt. 3000 feet | Table 7<br>(Table D.5 for feet)<br>IEEE 516-2003<br>MAID (ft)<br>@ Alt. 3000 feet |
|--------------------------------------|--------------------------------------|-----------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------------------------|
|                                      |                                      |                                         |                                                     |                                                                                   |
| 765                                  | 800                                  | 2.0                                     | 14.36                                               | 13.95                                                                             |
| 500                                  | 550                                  | 2.4                                     | 11.0                                                | 10.07                                                                             |
| 345                                  | 362                                  | 3.0                                     | 8.55                                                | 7.47                                                                              |
| 230                                  | 242                                  | 3.0                                     | 5.28                                                | 4.2                                                                               |
| 115                                  | 121                                  | 3.0                                     | 2.46                                                | 2.1                                                                               |

### **Rationale:**

During development of this standard, text boxes were embedded within the standard to explain the rationale for various parts of the standard. Upon BOT approval, the text from the rationale text boxes was moved to this section.

### **Rationale for Applicability (section 4.2.4):**

The areas excluded in 4.2.4 were excluded based on comments from industry for reasons summarized as follows:

- 1) There is a very low risk from vegetation in this area. Based on an informal survey, no TOs reported such an event.
- 2) Substations, switchyards, and stations have many inspection and maintenance activities that are necessary for reliability. Those existing process manage the threat. As such, the formal steps in this standard are not well suited for this environment.
- 3) Specifically addressing the areas where the standard does and does not apply makes the standard clearer.

### **Rationale for Applicability (section 4.3):**

Within the text of NERC Reliability Standard FAC-003-3, “transmission line(s)” and “applicable line(s)” can also refer to the generation Facilities as referenced in 4.3 and its subsections.

### **Rationale for R1 and R2:**

Lines with the highest significance to reliability are covered in R1; all other lines are covered in R2.

Rationale for the types of failure to manage vegetation which are listed in order of increasing degrees of severity in non-compliant performance as it relates to a failure of an applicable Transmission Owner's or applicable Generator Owner's vegetation maintenance program:

1. This management failure is found by routine inspection or Fault event investigation, and is normally symptomatic of unusual conditions in an otherwise sound program.
2. This management failure occurs when the height and location of a side tree within the ROW is not adequately addressed by the program.
3. This management failure occurs when side growth is not adequately addressed and may be indicative of an unsound program.
4. This management failure is usually indicative of a program that is not addressing the most fundamental dynamic of vegetation management, (i.e. a grow-in under the line). If this type of failure is pervasive on multiple lines, it provides a mechanism for a Cascade.

### **Rationale for R3:**

The documentation provides a basis for evaluating the competency of the applicable Transmission Owner's or applicable Generator Owner's vegetation program. There may be many acceptable approaches to maintain clearances. Any approach must demonstrate that the

applicable Transmission Owner or applicable Generator Owner avoids vegetation-to-wire conflicts under all Ratings and all Rated Electrical Operating Conditions.

**Rationale for R4:**

This is to ensure expeditious communication between the applicable Transmission Owner or applicable Generator Owner and the control center when a critical situation is confirmed.

**Rationale for R5:**

Legal actions and other events may occur which result in constraints that prevent the applicable Transmission Owner or applicable Generator Owner from performing planned vegetation maintenance work.

In cases where the transmission line is put at potential risk due to constraints, the intent is for the applicable Transmission Owner and applicable Generator Owner to put interim measures in place, rather than do nothing.

The corrective action process is not intended to address situations where a planned work methodology cannot be performed but an alternate work methodology can be used.

**Rationale for R6:**

Inspections are used by applicable Transmission Owners and applicable Generator Owners to assess the condition of the entire ROW. The information from the assessment can be used to determine risk, determine future work and evaluate recently-completed work. This requirement sets a minimum Vegetation Inspection frequency of once per calendar year but with no more than 18 months between inspections on the same ROW. Based upon average growth rates across North America and on common utility practice, this minimum frequency is reasonable. Transmission Owners should consider local and environmental factors that could warrant more frequent inspections.

**Rationale for R7:**

This requirement sets the expectation that the work identified in the annual work plan will be completed as planned. It allows modifications to the planned work for changing conditions, taking into consideration anticipated growth of vegetation and all other environmental factors, provided that those modifications do not put the transmission system at risk of a vegetation encroachment.



## Appendix 2

### Contact Information



## Vegetation Operations Staff, Control Center and Security Contact Information

| <b>SYSTEMWIDE</b>                     |                  |                                           |
|---------------------------------------|------------------|-------------------------------------------|
| <b>Contact</b>                        | <b>Location</b>  | <b>Telephone Number</b>                   |
| <b>Transmission Call-in</b>           | System           | (508) 421-7452                            |
| <b>Injury Hotline</b>                 | System           | (866) 322-5594                            |
| <b>NEW ENGLAND</b>                    |                  |                                           |
| <b>Contact</b>                        | <b>Location</b>  | <b>Telephone Number</b>                   |
| <b>NE Transmission Control Center</b> | Northboro, MA    | (800) 423-6029 <i>Or</i><br>(800-382-7260 |
| <b>Security</b>                       | Northboro, MA    | (508) 421-7970                            |
| Anne Marie Moran (Manager)            | Worcester, MA    | (508) 860-6925                            |
| Jason Magoon                          | Worcester, MA    | (508) 860-6212                            |
| Jonathan Duval                        | Somerset, RI     | (508) 730-4007                            |
| Eric Gemborys                         | Worcester, MA    | (508) 614-0404                            |
| <b>NEW YORK</b>                       |                  |                                           |
| <b>Contact</b>                        | <b>Location</b>  | <b>Telephone Number</b>                   |
| <b>NY Transmission Control Center</b> | N. Syracuse, NY  | (315) 460-2110                            |
| <b>Security:</b>                      | West             | (716) 831-7740                            |
| Tim Bodkin (Manager)                  | Clifton Park, NY | (518) 406-7014                            |
| Jeremiah (JT) Carroll (Capitol)       | Albany, NY       | (518) 433-3320                            |
| Kenneth Kirkman (Central)             | Syracuse, NY     | (315) 428-5273                            |
| Ryan Blothenburg (Western)            | Fredonia, NY     | (716) 673-7216                            |
|                                       |                  |                                           |





Appendix 3  
National Grid Environmental Policy



# Environment Policy

Our strategy is to be a recognised leader in the development and operation of safe, reliable and sustainable energy systems to meet the needs of our customers and communities and to generate value for our investors.

One of the ways we will achieve this is to protect and enhance the environment, always seeking new and innovative ways to lighten the environmental impact of our past, present and future activities.

*J. Pettigrew*

**John Pettigrew**  
Chief Executive

## We commit to:

- Ensuring environmental sustainability is considered in our decision making and creating a sustainable thinking culture.
- Using resources more efficiently through good design, using sustainable materials, responsibly refurbishing existing assets, recovery and recycling.
- Ensuring our operations that have an impact on natural habitats are conducted in a manner to protect biodiversity and seeking ways to enhance the natural value of the area for the benefit of local communities and/or environment.
- Reducing greenhouse gas emissions: 45% by 2020 and 80% by 2050.
- Looking at ways to reduce the impact of climate change by implementing mitigation and adaptation measures.
- Openly reporting on our environmental and sustainability performance with employees, members of the public and other stakeholders.
- Actively working to prevent pollution which may result from our activities.
- Continually improving our environmental management system to protect the environment, reduce the risk of environmental incidents.
- Satisfying our compliance obligations.
- Actively managing the risks associated with sites where we have responsibility for dealing with contamination associated with past operations.
  - Ensuring our employees have the training, skills, knowledge and resources necessary to meet our environmental commitments.
- Working with governments and regulators to help them develop and deliver more effective environmental policies and targets.
- Helping consumers reduce their dependency on fossil fuels by providing them with access to more sustainable energy and through innovative energy efficiency programmes.
- Ensuring those working on our behalf demonstrate the same commitment to the environment as we do.



For more details  
on this policy, visit  
the SSR Infonet  
homepage or  
[nationalgrid.com](https://nationalgrid.com)





Appendix 4  
Invasive Species Best Management Practices (New York Only)



# New York Utility Company Best Management Practices for Preventing the Transportation of Invasive Species

Environmental Energy Alliance of New York  
Revisions January 2015

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## Appendices

- Appendix 1 - Best Management Practices (BMP's) for Invasive Species Transportation Prevention
- Appendix 2 - 6 NYCRR Part 575 Prohibited and Regulated Invasive Species, September 10, 2014



## 1.0 Introduction

Invasive species are non-native plant, animal, or microbial species that cause, or are likely to cause, economic or ecological harm or harm to human health (Presidential Executive Order 13112). Invasive species means, “A species that is nonnative to the ecosystem under consideration; and whose introduction causes or is likely to cause economic or environmental harm or harm to human health. Harm must significantly outweigh benefit” [New York Environmental Conservation Law §9-1703(10)(a)] Invasive species have been introduced by human action into a region outside their natural geographic range. Introductions occur along a variety of pathways or vectors, either intentionally such as intentional transport of a species for trade, or by accidental means, as in the case of stowaway species found in the ballast-water of ocean-going vessels.

Most scientists regard invasive species as second only to habitat loss as a threat to biodiversity. The presence of invasive species in a given region is one of the leading causes of endangerment to species native to that region. On a nationwide basis, about half of plant and animal species listed as federally Endangered or Threatened are at risk because of invasive species.

Annual economic losses due to invasive species in the U.S. have been estimated at over \$138 billion (Pimentel et al. 2000). These losses include damage to crops and pasture, forest losses, damage from insect and other invertebrate pests, human diseases, and associated control costs.

In an effort, where feasible, to limit the introduction and spread of *invasive species*, this Best Management Practice (“BMP”) will be employed when performing activities that occur in *jurisdictional areas* as authorized by the DEC. The BMP identifies procedures that will be incorporated into routine work practices to prevent the introduction and spread of *invasive species*.

## 2.0 Definitions

The following definitions are applicable to this BMP.

***Environmental Energy Alliance of New York (EEANY)*** – is an association of electric and gas Transmission and Distribution (T&D) companies and electric generating companies that provide energy services in the State of New York. This BMP was prepared by the Land Use Subcommittee of the T&D Committee, which currently represents the following members: Central Hudson Gas & Electric Corporation, Consolidated Edison Company of New York, Long Island Power Authority, National Grid USA Service Company, Inc., New York Power Authority, New York State Electric & Gas Corporation, Orange and Rockland Utilities, and Rochester Gas & Electric Corporation.

***Invasive species*** – species that are non-native to the ecosystem under consideration and whose introduction causes or is likely to cause economic or environmental harm or harm to human health (Management Plan National Invasive Species Council, 2001). For purposes of this document, *invasive species* are those contained on the list contained within 6 NYCRR Part 575 Prohibited and Regulated Invasive Species (Appendix – 2).

***Invasive species plant material*** – seeds, roots, or pieces of plant material that could germinate into live plants.

***Jurisdictional Area*** – lands under the statutory jurisdiction of the NYSDEC such as certain freshwater wetlands and adjacent areas, tidal wetlands, certain water bodies, and any protected and species habitat areas specified by natural resource supervisors.

***NYSDEC General Permit*** – a NYSDEC permit authorizing certain utility line activities under Articles 15, 24, and 25 of NYS Environmental Conservation Law. These activities include: inspection, maintenance, repair, restoration, reconstruction of pre-existing structures, vegetation cutting and trimming, and emergency actions affecting tidal wetlands, protected waters, regulated freshwater wetlands, adjacent areas, and protected habitat areas.

***Regulated Activity*** – an activity taking place within a *jurisdictional area* that requires authorization from the NYSDEC.

***Utility Rights-of-Way*** - is an easement-acquired or fee-owned corridor in which gas or electric transmission facilities are located.

## 3.0 Purpose

This BMP provides guidance for inspecting and cleaning vehicles and equipment to help prevent the spread of invasive species. The procedures identified within this manual outline cost-effective and realistic practices that *Environmental Energy Alliance of New York (EEANY)* utility members will implement when conducting a *regulated activity* within a *jurisdictional area*.

## 4.0 Applicability

This management practice applies to all *EEANY* utility members performing *NYSDEC regulated activities* within *jurisdictional areas* with populations of *invasive species*.

## 5.0 Procedures

There are two procedural options for *EEANY* companies to follow; one is to conduct the BMPs as detailed in the following sections of this plan or to conduct vegetation surveys for invasive species as outlined in Section 5.6. Field crews will be provided a flowchart to assist with determining when to implement these best management practices (Appendix 1).

The following detailed practices will apply where feasible when invasive species are present and when the work is covered by a GP or individual wetland permit.

### 5.1 Equipment

- a. Equipment must arrive clean without visible soil clumps, plant or animal material.
- b. Equipment includes, but is not limited to, vehicles, trailers, machinery, matting, boats, barges, and other watercraft, tools, and other materials.
- c. Transporting equipment will be cleaned before accepting a new load.
- d. Consider tracking pads as a means to remove soil from equipment. If tracking pads are used they must be cleaned after each use in a specific area.
- e. Equipment will be cleaned using one of the methods listed below (use the most effective method that is practical):
  - Brush, broom, shovel or other similar hand tools (used without water)
  - High pressure air (when feasible)
- f. Equipment must be cleaned within one of the below areas:
  - the infested work area
  - an area immediately adjacent to the work area that is itself currently infested with *invasive species*
- g. Do not clean equipment in or near waterways as it may promote the spread of *invasive species* downstream.
- h. Where possible, staging areas will be established in locations that are free of *invasive species*. Otherwise, all equipment will be cleaned using the techniques described in 5.3 before leaving the area.
- i. When wetland matting is required, it will arrive on site visibly clean, be installed prior to any activities, and will be appropriately cleaned before leaving the area.

## 5.2 Inspection and Cleaning

- a. Inspections and cleaning should be conducted especially when moving from an infested area to an uninfested area.
- b. Prior to exiting work area clothing, footwear, and gear should be cleaned of visible signs of plant material.
- c. Carry appropriate cleaning equipment (e.g. wire brush, small screwdriver, boot brush) to help remove soils, seeds, and plant material.
- d. Preferred locations for cleaning are those where:
  - Work activities are taking place;
  - *Invasive species* are already established; or
  - An area immediately adjacent to the work site that is itself currently infested with *invasive species*.
- e. No cleaning of clothing, footwear, gear in or adjacent to waterways – it may promote the spread of *invasive species* downstream.
- f. Cleaning will include brushing or self “pat down” of clothing, footwear, and other personal gear within the infested work area.

## 5.3 Disposal of Impacted Material

- a. Preferred locations for equipment cleaning are those areas where work activities are taking place or immediately adjacent areas currently impacted with *invasive species*.
- b. Do not clean equipment, vehicles or trailers in or near waterways.
- c. Do not dispose of soil, seeds, or plant material in storm drains.
- d. Any plant materials that are incidentally removed after completion of steps a-c from site will be properly disposed of in a manner that prevents viable plant parts and propagules from being spread

## 5.4 Other Prevention Measures

- a. Reasonable steps to avoid transportation of *invasive species*, including small, isolated, populations, will be taken.
- b. As an alternative to cleaning, ancillary equipment such as spare tires and winches when feasible will be covered when entering *jurisdictional areas* containing populations of *invasive species*.
- c. Vehicular access into areas containing populations of *invasive species* will be reduced or minimized to the maximum extent practical. When practical vehicles will be parked outside of the impacted area and crews will enter on foot.

## 5.5 Site Restoration

- a. Minimize soil disturbances by reducing work areas and reducing activities that may result in soil disturbances.
- b. Re-vegetate bare soils as soon as feasible to minimize the possible establishment of *invasive species*. When seeding, non-invasive or local native species must be used (seed mixes will vary from region to region). Seed will be broadcasted over all bare soil areas and covered with a mulch layer such as straw. Choose appropriate seed mixes based on site conditions.

- c. On steep sloping areas (i.e. slopes exceeding 20 percent), soil erosion control matting (i.e. jute mesh or straw blankets) must be installed over the seeded area. The matting should be secured with biodegradable tacks.
- d. Stabilize disturbed soils using appropriate erosion and sediment control procedures as soon as possible. Use invasive free materials such as straw or wood chips; avoid using hay.

## 5.6 Vegetation Survey (Optional)

If the above BMPS are not followed, then vegetation surveys of site(s) to detect populations of invasive species should be made in advance prior to any activities. If the optional vegetation survey is performed and no invasive species are found, then the procedures outlined above in section 5.1 through 5.5 will not be followed. Survey inspections can be integrated with other activities such as ROW inspections and should be kept as simple as possible to meet invasive species management objectives. If significant populations of invasive species are detected on surveys, then Sections 5.1 to 5.5 apply.

- a. Prior to implementing activities scout for, locate and document significant invasive species infestations.
- b. Consider the need for actions based on: 1) the degree of invasiveness; 2) severity of the current infestation; 3) amount of additional habitat or host at risk for invasion; and 4) feasibility of managing the spread.
- c. Plan activities to limit the potential for introduction and spread of invasive species, prior to construction.
- d. Provide appropriate resources in identification of known invasive species for corridor workers.

## 6.0 Training

A flowchart (Appendix 1) to assist field crews on when to implement the above procedures will be distributed to all field crews.

All transmission vegetation management planners, foresters, and ROW maintenance personnel will be trained in the procedures outlined in Section 5.0 above. Additionally, training sessions focused on the identification of *invasive species* identified in Appendix 2 will be conducted by the individual utility companies. This may take the form of hard copy materials, tail gate briefings and/or presentations during regular staff meetings.

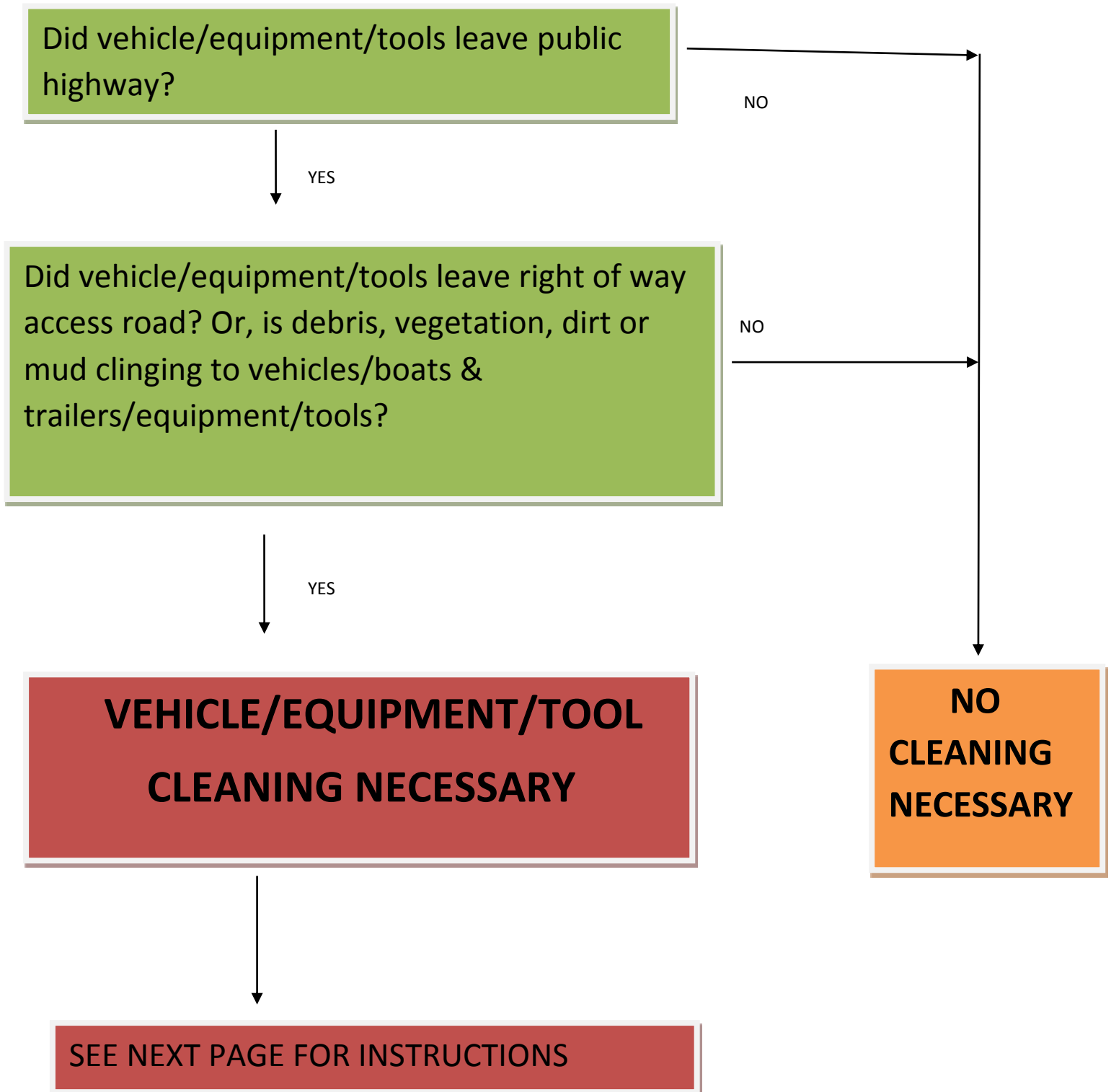
## 7.0 Emergency Work

During emergencies, *EEANY* utility members will strictly comply with the Emergency Action condition protocol outlined in the *NYSDEC General Permit*. Appropriate site-specific *invasive species* controls and restoration efforts will be determined on an individual basis in conjunction with the regional NYSDEC office.

## 8.0 References

- Electric Power Research Institute, 2008. "Invasive Species and Utility Rights of Way: A Review of the Science". EPRI Publication number 1014032, Palo Alto, CA
- Pimentel, D., Lach, L., Zuniga, R. & Morrison, D. 2000. Environmental and economic costs of nonindigenous species in the United States. *Bioscience*, 50(1): 53-65.
- Presidential Executive Order 13112. Volume 64, Federal Register 1999. Invasive Species.
- Wisconsin Council on Forestry. 2010. *Invasive Species Best Management Practice for Transportation and Utility Rights-of-Way*.

## BEST MANAGEMENT PRACTICES (BMP'S) for INVASIVE SPECIES TRANSPORT PREVENTION



## PRIOR TO LEAVING THE RIGHT-OF-WAY

- Prior to loading vehicle/equipment/tools remove as much debris, vegetation, dirt and mud clinging to the equipment as feasible using a brush, broom, shovel or other similar hand tool.
- High pressure air can be used on site for cleaning debris, vegetation, dirt and mud off vehicles/equipment/tools.
- Pick-ups and other small road vehicles shall remove on the right-of-way, as much debris, vegetation, dirt and mud clinging to vehicle as feasible prior to entering the highway.
- Small equipment/tools/boots shall be cleaned on site before removal or storage.
- Arrangements can be made for onsite cleaning or washing of vehicles/equipment/tools if deemed necessary.

## PRIOR TO LEAVING A BOAT LAUNCH:

CLEAN, DRAIN, DRY -- Prior to leaving a boat launch, **Clean** any visible mud, plants, fish or animals before transporting equipment; **Drain** all water holding compartments including live wells, bait wells and bilge areas; **Dry** the boat, trailer and all equipment before use in another water body



## APPENDIX - 2

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### 6 NYCRR Part 575

#### Prohibited and Regulated Invasive Species September 10, 2014

##### ALGAE AND CYANOBACTERIA

###### Prohibited:

*Caulerpa taxifolia*, Killer Green Algae  
*Didymosphenia geminata*,  
*Didymo Prynmesium parvum*, Golden Algae

###### Regulated:

*Cylindrospermopsis raciborskii*, Cylindro  
*Grateloupia turuturu*, Red Algae

##### PLANTS

###### Prohibited:

*Acer pseudoplatanus*, Sycamore Maple  
*Achyranthes japonica*, Japanese Chaff Flower  
*Alliaria petiolata*, Garlic Mustard  
*Ampelopsis brevipedunculata*, Porcelain Berry  
*Anthriscus sylvestris*, Wild Chervil  
*Aralia elata*, Japanese Angelica Tree  
*Artemisia vulgaris*, Mugwort  
*Arthraxon hispidus*, Small Carpet Grass  
*Berberis thunbergii*, Japanese Barberry  
*Brachypodium sylvaticum*, Slender False Brome  
*Cabomba caroliniana*, Fanwort  
*Cardamine impatiens*, Narrowleaf Bittercress  
*Celastrus orbiculatus*, Oriental Bittersweet  
*Centaurea stoebe* (*C. biebersteinii*, *C. diffusa*, *C. maculosa* misapplied, *C. xpsammogena*), Spotted Knapweed  
*Cirsium arvense* (*C. setosum*, *C. incanum*, *Serratula arvensis*), Canada Thistle  
*Cynanchum louiseae* (*C. nigrum*, *Vincetoxicum nigrum*), Black Swallow-wort  
*Cynanchum rossicum* (*C. medium*, *Vincetoxicum medium*, *V. rossicum*), Pale Swallow-wort  
*Dioscorea polystachya* (*D. batatas*), Chinese Yam  
*Dipsacus laciniatus*, Cut-leaf Teasel  
*Egeria densa*, Brazilian Waterweed  
*Elaeagnus umbellata*, Autumn Olive  
*Euphorbia cyparissias*, Cypress Spurge  
*Euphorbia esula*, Leafy Spurge  
*Ficaria verna* (*Ranunculus ficaria*), Lesser Celandine  
*Frangula alnus* (*Rhamnus frangula*), Smooth Buckthorn  
*Glyceria maxima*, Reed Manna Grass

*Heracleum mantegazzianum*, Giant Hogweed  
*Humulus japonicus*, Japanese Hops  
*Hydrilla verticillata*, Hydrilla/ Water Thyme  
*Hydrocharis morsus-ranae*, European Frogbit  
*Imperata cylindrica* (*I. arundinacea*, *Lagurus cylindricus*), Cogon Grass  
*Iris pseudacorus*, Yellow Iris  
*Lepidium latifolium*, Broad-leaved Pepper-grass  
*Lespedeza cuneata*, Chinese Lespedeza  
*Ligustrum obtusifolium*, Border Privet  
*Lonicera japonica*, Japanese Honeysuckle  
*Lonicera maackii*, Amur Honeysuckle  
*Lonicera morrowii*, Morrow's Honeysuckle  
*Lonicera tatarica*, Tartarian Honeysuckle  
*Lonicera x bella*, Fly Honeysuckle  
*Ludwigia hexapetala* (*L. grandiflora*), Uruguayan Primrose Willow  
*Ludwigia peploides*, Floating Primrose Willow  
*Lysimachia vulgaris*, Garden Loosestrife  
*Lythrum salicaria*, Purple Loosestrife  
*Microstegium vimineum*, Japanese Stilt Grass  
*Murdannia keisak*, Marsh Dewflower  
*Myriophyllum aquaticum*, Parrot-feather  
*Myriophyllum heterophyllum*, Broadleaf Water-milfoil  
*Myriophyllum heterophyllum x M. laxum*, Broadleaf Water-milfoil Hybrid  
*Myriophyllum spicatum*, Eurasian Water-milfoil  
*Nymphoides peltata*, Yellow Floating Heart  
*Oplismenus hirtellus*, Wavyleaf Basketgrass  
*Persicaria perfoliata* (*Polygonum perfoliatum*), Mile-a-minute Weed  
*Phellodendron amurense*, Amur Cork Tree  
*Phragmites australis*, Common Reed Grass  
*Phyllostachys aurea*, Golden Bamboo  
*Phyllostachys aureosulcata*, Yellow Groove Bamboo  
*Potamogeton crispus*, Curly Pondweed  
*Pueraria montana*, Kudzu  
*Reynoutria japonica* (*Fallopia japonica*, *Polygonum cuspidatum*), Japanese Knotweed  
*Reynoutria sachalinensis* (*Fallopia sachalinensis*, *Polygonum sachalinensis*), Giant Knotweed  
*Reynoutria x bohemica* (*Fallopia x bohemica*, *Polygonum x bohemica*), Bohemian Knotweed  
*Rhamnus cathartica*, Common Buckthorn  
*Rosa multiflora*, Multiflora Rose  
*Rubus phoenicolasius*, Wineberry  
*Salix atrocinerea*, Gray Florist's Willow  
*Silphium perfoliatum*, Cup-plant  
*Trapa natans*, Water Chestnut  
*Vitex rotundifolia*, Beach Vitex

**Regulated:**

Acer platanoides, Norway Maple  
 Clematis terniflora, Japanese Virgin's Bower  
 Euonymus alatus, Burning Bush  
 Euonymus fortunei, Winter Creeper  
 Miscanthus sinensis, Chinese Silver Grass  
 Robinia pseudoacacia, Black Locust

**FISH****Prohibited:**

Channa argus, Northern Snakehead  
 Channa marulius, Bullseye Snakehead  
 Channa micropeltes, Giant Snakehead  
 Clarias batrachus, Walking Catfish  
 Gambusia affinis, Western Mosquitofish  
 Gambusia holbrooki, Eastern Mosquitofish  
 Hypophthalmichthys harmandi, Largescale Silver Carp  
 Hypophthalmichthys molitrix, Silver Carp  
 Hypophthalmichthys nobilis, Bighead Carp  
 Misgurnus anguillicaudatus, Oriental Weatherfish  
 Mylopharyngodon piceus, Black Carp  
 Neogobius melanostomus, Round Goby  
 Petromyzon marinus, Sea Lamprey  
 Proterorhinus semilunaris (P. marmoratus), Tubenose Goby  
 Tinca tinca, Tench

**Regulated:**

Carassius auratus, Goldfish  
 Cyprinella lutrensis, Red Shiner  
 Cyprinus carpio, Common Carp/ Koi  
 Gymnocephalus cernuus, Ruffe  
 Monopterus albus, Asian Swamp Eel  
 Oreochromis aureus, Blue Tilapia  
 Oreochromis niloticus, Nile Tilapia  
 Pterois miles, Common Lionfish  
 Pterois volitans, Red Lionfish  
 Sander lucioperca (Stizostedion lucioperca), Zander  
 Scardinius erythrophthalmus, Rudd

**AQUATIC INVERTEBRATES****Prohibited:**

Bellamy chinensis (Cipangopaludina chinensis), Chinese Mystery Snail  
 Bellamy japonica, Japanese Mystery Snail  
 Bithynia tentaculata, Faucet Snail  
 Bythotrephes longimanus (B. cederstroemi), Spiny Water Flea  
 Cercopagis pengoi, Fishhook Water Flea  
 Corbicula fluminea, Asian Clam  
 Crassostrea ariakensis, Suminoe Oyster  
 Didemnum spp., Carpet Tunicate

Dreissena polymorpha, Zebra Mussel  
 Dreissena rostriformis bugensis, Quagga Mussel  
 Eriocheir sinensis, Chinese Mitten Crab  
 Hemigrapsus sanguineus, Asian Shore Crab  
 Hemimysis anomala, Bloody Red Shrimp  
 Orconectes rusticus, Rusty Crayfish  
 Potamopyrgus antipodarum, New Zealand Mud Snail  
 Rapana venosa, Veined Rapa Whelk  
 Styela plicata, Asian Sea Squirt

**Regulated:**

Carcinus maenas, European Green Crab  
 Daphnia lumholzi, Water Flea  
 Hemigrapsus takanoi (H. penicillatus), Brush-clawed Shore Crab/ Grapsid Crab

**TERRESTRIAL INVERTEBRATES****Prohibited:**

Achatina achatina, Giant Ghana Snail  
 Achatina fulica (Lissachatina fulica), Giant African Land Snail  
 Adelges tsugae, Hemlock Woolly Adelgid  
 Agrilus planipennis, Emerald Ash Borer  
 Amyntas spp., Asian Earthworms  
 Anoplophora glabripennis, Asian Longhorn Beetle  
 Apis mellifera scutellata x A. mellifera ligustica/ A. mellifera iberiensis, Africanized Honey Bee  
 Archachatina marginata, Giant West African Snail  
 Cryptococcus fagisuga, Beech Scale  
 Lymantria dispar, Asian and European Gypsy Moth  
 Monochamus alternatus, Japanese Pine Sawyer  
 Pityophthorus juglandis, Walnut Twig Beetle  
 Sirex noctilio, Sirex Woodwasp

**TERRESTRIAL AND AQUATIC VERTEBRATES****Prohibited:**

Cygnus olor, Mute Swan  
 Lepus europaeus, European Hare  
 Myocastor coypus, Nutria  
 Nyctereutes procyonoides, Asian Raccoon Dog  
 Sus scrofa (excluding Sus scrofa domestica), Eurasian Boar

**Regulated:**

Alopochen aegyptiacus, Egyptian Goose  
 Cairina moschata, Muscovy Duck  
 Myiopsitta monachus, Monk Parakeet  
 Oryctolagus cuniculus, European Rabbit  
 Trachemys scripta elegans, Red-eared Slider  
 Xenopus laevis, African Clawed Frog

**FUNGI****Prohibited:**

Amylostereum areolatum, Sirex Wasp Fungus  
Geomyces destructans, White-nose Syndrome  
Geosmithia morbida, Thousand Canker Disease  
Phytophthora ramorum, Sudden Oak Death

For the official regulations and species lists please  
see: <http://www.dec.ny.gov/regulations/265.html>



Appendix 5  
Threatened and Endangered Species (New York Only)





**WHO:** Planners, Engineers, Field Supervisors, Field Crews, Foresters, or anyone that plans or performs operation and maintenance activities including National Grid personnel and consultants

**WHAT:** Incidental take of covered species in association with electric and gas operation and maintenance activities, including vegetation and ROW management, and new construction activities

**WHERE:** Covered lands (ROW's with covered species) as identified on the back of this sheet

**WHY:** Required by federal and state endangered species regulations, as identified in National Grid's Incidental Take Permit



frosted elfin (FE)



wild blue lupine (WBL)



Karner blue butterfly (KBB)

## What you must do when working in a ROW where Covered Species are present... Avoidance and Minimization Measures (AMM)

### AMM's for Vegetation Management

1. Mowing, tree-trimming, and herbicide application activities will occur on a rotational basis (every 3 to 5 years) from Sept. 1 through Mar. 31. NO VEG MAINTENANCE between Apr. 1 and Aug. 31.
2. Blades of mowers and brush hogs shall be set at least 8 inches above ground level.
3. Mowing shall be conducted no more than once a year.
4. Tree girdling and hand-pulling of individuals which do not uproot wild blue lupine plants may be completed any time of year.
5. Herbicide applications
  - a. Shall be applied only by personnel who are pesticide-certified and trained in identifying wild blue lupine.
  - b. Shall be applied when conditions do not permit drift.
  - c. Shall not be applied using an open container.
  - d. Filling and emptying herbicide containers shall occur at a distance of greater than 250 ft. from KBB/FE habitat.
  - e. All herbicide applicators shall carry a spill kit.
  - f. All herbicide application equipment shall be inspected prior to use each treatment day.

### AMM's for All Other Covered Activities

1. Vehicle use shall be minimized (i.e. conduct patrols by foot).
2. Walking/driving through WBL and nectar plants shall be avoided, unless absolutely necessary.
3. Pipe and construction debris cannot be left on the ground.
4. Ground disturbance during O&M activities will be revegetated with indigenous species (contact NG environmental).
5. Piling, stacking, chipping or dragging of vegetation will be avoided.
6. Prior to painting or using other chemicals on poles or other structures, tarps or equivalent shall be placed over any nearby WBL.
7. Fuel and oil spill kits shall be immediately available.
8. During any pipeline hydrostatic testing events, no water shall be discharged into the Covered Lands.
9. Snow plowing shall be minimized along ROW access roads. Blades shall be lifted when off pavement. Off-ROW access road areas shall have blades elevated so at least 6 in. of snow cover remains.
10. Salt applications shall be minimized. When possible, sand free of weed seeds will be used in place of salt.



## Regulated wild blue lupine

Flowers  
as seen  
in late  
June

## Other adult KBB food sources

Strawberry  
(*Fragaria virginiana*)

Horsemint  
(*Monarda punctata*)

Hawkweed  
(*Hieracium* sp.)

Common milkweed  
(*Asclepias syriaca*)

Cinquefoil  
(*Potentilla* sp.)

Butterfly weed  
(*Asclepias tuberosa*)

Only known larval food source:  
wild blue lupine

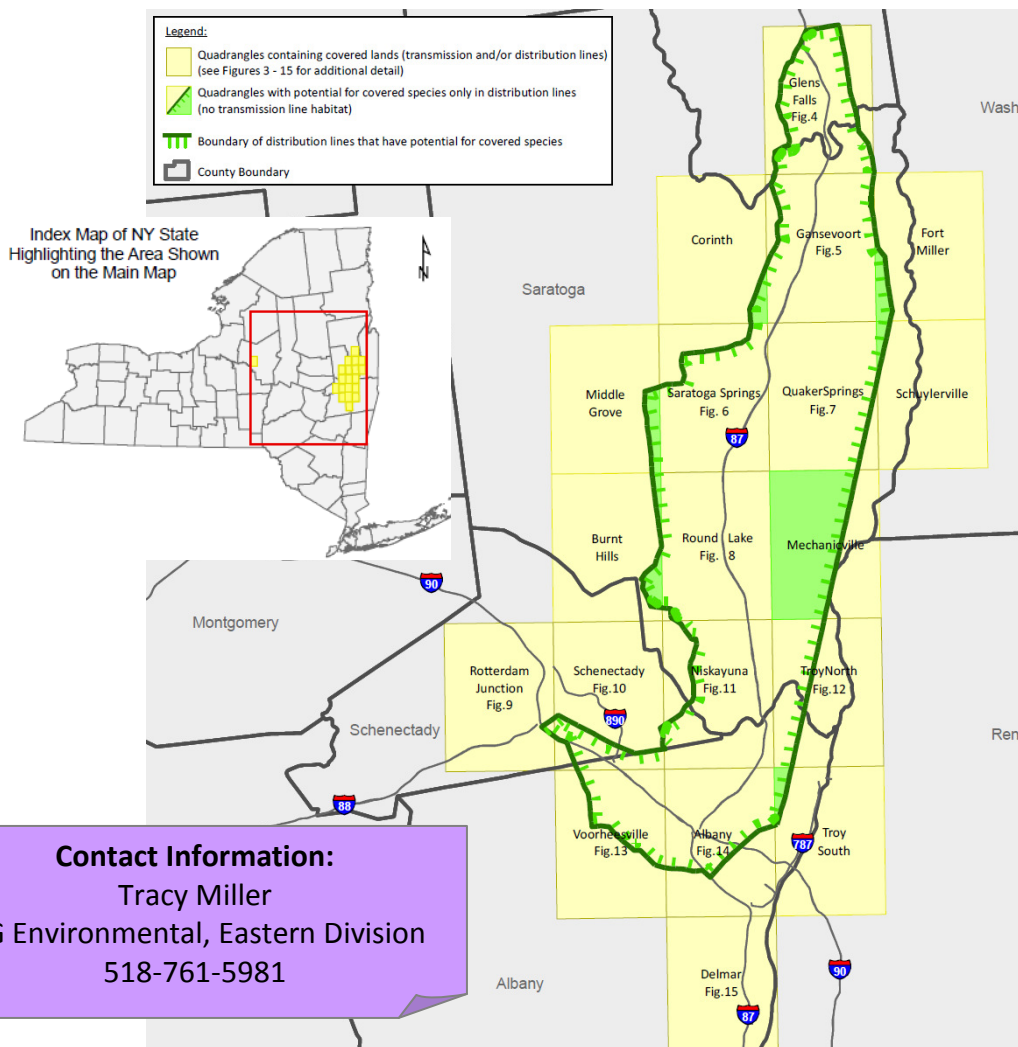
Seed  
pods as  
seen in  
late July

Wild blue lupine seed pods

## COVERED T, SubT, and Gas RIGHTS-OF-WAY

McKownville-Patroun 6  
McKownville-Krumkill 8  
Spier-Glens Falls 8  
Spier-Mohican 7  
Ballston-Mechanicville 6  
Reynolds Rd-Feura Bush 17 Mohican-Butler 18  
Spier (Brook Rd)-Ballston 11  
Spier-Queensbury 5 – Ogden Brook Tap  
Saratoga-Ballston 10 – General Foods Tap  
Spier-Ballston 11 – South St Tap  
Spier-Rotterdam 1 – Weibel Ave Tap  
Rotterdam-Bear Swamp E205  
Queensbury-Henry St 14 – Town of  
Queensbury water pipeline Easement

Grooms Rd-Johnson Rd 13 – Firehouse Rd Tap  
Woodlawn-State Campus 12 – Pinebush Tap  
Rotterdam-Woodlawn 35 – Pinebush Tap  
Spier-Queensbury 17  
Spier-Butler 4  
Warrensburg-Queensbury 9  
Rotterdam-Curry Rd 11  
Rotterdam-Woodlawn 35  
Woodlawn-State Campus 12  
Karner-Patroun 5  
Pipeline E31-5  
Pipeline E12-9  
Pipeline E31-3  
Pipeline E18-19





Appendix 6  
Notification Materials





**Transmission Vegetation Management**  
**Record of Owner/Occupant Notification**

| Work type                |          |
|--------------------------|----------|
| <input type="checkbox"/> | Floor    |
| <input type="checkbox"/> | Sideline |

| Line Information                                      |       |                                                                   |                                               |
|-------------------------------------------------------|-------|-------------------------------------------------------------------|-----------------------------------------------|
| Line Name                                             |       | Road Crossing                                                     |                                               |
| ROWNUM                                                |       | Structure/Veg. Site                                               |                                               |
| Employee                                              |       | Company                                                           |                                               |
| Owner/Occupant                                        |       |                                                                   |                                               |
| Name                                                  |       |                                                                   |                                               |
| Street Address                                        |       |                                                                   | Phone                                         |
| Town                                                  | State | Zipcode                                                           | Tax Map #                                     |
| Type of Notification                                  |       |                                                                   |                                               |
| <input type="checkbox"/> Personal, face to face       |       | <input type="checkbox"/> Door Hanger                              | <input type="checkbox"/> Left IVM Information |
| <input type="checkbox"/> Mailed Letter, Standard Mail |       | <input type="checkbox"/> Mailed Registered Letter, Return Receipt |                                               |
| Contact Notes and /or Follow Up Contacts              |       |                                                                   |                                               |
| Date                                                  |       | Time                                                              |                                               |
| Notes:                                                |       |                                                                   |                                               |

| Road Crossing                                         |       | Structure/ Veg. Site                                              |                                               |
|-------------------------------------------------------|-------|-------------------------------------------------------------------|-----------------------------------------------|
| Owner/Occupant                                        |       |                                                                   |                                               |
| Name                                                  |       |                                                                   |                                               |
| Street Address                                        |       |                                                                   | Phone                                         |
| Town                                                  | State | Zipcode                                                           | Tax Map #                                     |
| Type of Notification                                  |       |                                                                   |                                               |
| <input type="checkbox"/> Personal, face to face       |       | <input type="checkbox"/> Door Hanger                              | <input type="checkbox"/> Left IVM Information |
| <input type="checkbox"/> Mailed Letter, Standard Mail |       | <input type="checkbox"/> Mailed Registered Letter, Return Receipt |                                               |
| Contact Notes and /or Follow Up Contacts              |       |                                                                   |                                               |
| Date                                                  |       | Time                                                              |                                               |
| Notes:                                                |       |                                                                   |                                               |

Notification Form Jan 7.doc



# Notification of Vegetation Work



On behalf of National Grid's Vegetation Management department, \_\_\_\_\_ will soon conduct scheduled maintenance on the electric transmission right-of-way on or adjacent to your property.

The type of work to be done is indicated below:

☐ **Integrated Vegetation Management**

(floor work—see back for details)

☐ **Sideline Maintenance** (see back for details)

Description of work:

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If you have questions regarding this work, or a private water supply well on or within 100 feet of the right-of-way, please contact:

Name

---

Company

Phone

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☐ **If this box is checked, a call back is needed**

Date:

ROW #:

## Program Descriptions

### Integrated Vegetation Management (IVM)

IVM focuses on the removal of tall-growing trees and shrubs to encourage the establishment of a low-growing shrub population on the right-of-way.

Methods used include:

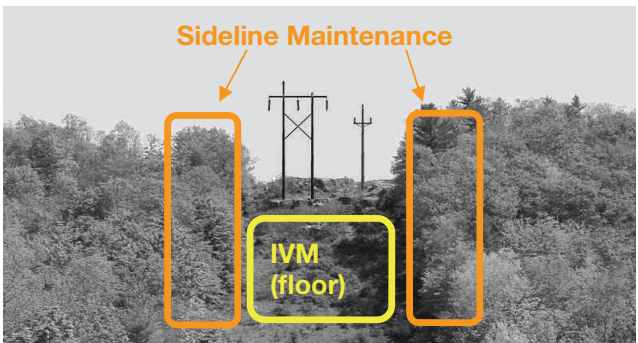
- Hand cutting with chain saws
- Mowing
- Selective herbicide application (applied to foliage or cut stump surface)

Herbicide use is regulated by federal and state statutes and regulations, which protect sensitive areas, such as:

- Surface Water Supplies
- Wetlands
- Public & Private Wells

### Sideline Maintenance

This work consists of removing or pruning danger trees along the sides or edges of transmission line corridors.



Methods used include:

- Skidder bucket or street bucket
- Climbers (for areas inaccessible by equipment)

For more information about our programs and work scheduled for the current year, click on “Operations Documentation” in the following link:

[www.nationalgridus.com/transmission/index.asp](http://www.nationalgridus.com/transmission/index.asp)

Appendix 7  
New England Transmission Forestry Contractor Final Inspection Form





IVM OR SIDELINE Package # ROW# 

## New England Transmission Forestry Contractor Final Inspection Form

Company Name  Area Manager Name General Foreman Name 

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(Check the item below that applies):

☐ I have fully inspected the ROW listed above and consent that the entire right-of-way meets National Grid's Specifications.

☐ I have fully inspected the ROW listed above and consent that the entire right-of-way meets National Grid's Specification requirements, except for the following locations:

**Str# to Str #****Reason for not meeting specification requirements:**

I am verifying that I have field reviewed the above ROW and understand that there could be a financial implication to my company if the above information is incorrect and will affect future work with National Grid.

Signatures Required:

General Foreman Signature

Date

Area Manager Signature

Date

**FOR NATIONAL GRID OFFICE USE ONLY.****Date Received by National Grid Forester:**



## Appendix 8 Inventories



## **The Transmission Right-of-Way Inventory**

### **1. Inventory Method**

The National Grid Foresters shall ensure a detailed site-by-site inventory is completed for each electric line right-of-way scheduled for regular maintenance either prior to or at the time of actual treatment. Currently, the Forester completes the inventories in advance of actual treatment, but in the future, treatment crews may be able to accurately report equivalent field inventory data at the time of treatment, using advanced information technology and handheld geo-referenced systems. Since gas rights-of-way are generally maintained by mowing, inventories for these rights-of-way are not necessary.

### **2. Purpose of the Site-by-Site Inventory**

A site is an area within the right-of-way that consists of a common land use pattern or characteristic, or that requires a unique and different treatment method from adjacent areas. Each site may be as large or small as a land use or treatment method requires. The smallest reportable site shall be a tenth of an acre.

The purpose of the inventory is to thoroughly assess site-by-site field conditions, accurately document desirable and undesirable vegetation conditions, insure the assignment of the appropriate prescriptive treatment methods, and record herbicide use requirements. The inventory also identifies special landowner concerns or sensitive site conditions.

### **3. Inventory Records**

The inventory data is presently collected using handheld data entry systems to record site-specific data. Data collected through the inventory process is then transferred to the master program and summarized for a variety of reports that are used within the maintenance program.

The items documented in the site-by-site inventory include:

- a) Location: The inventory shall describe the site in relation to the adjacent structures, assigning a unique management site number to each site. A management area shall be an area of similar vegetation components that warrant a common management technique.
- b) Land use: The inventory shall identify the right-of-way and/or adjacent land use categories for each site, together with the site sensitivities that influence the management technique that is selected. In the event of multiple uses or sensitivities, the category having the greatest influence on the maintenance method chosen should be assigned. The special note area can be used to further describe and define sensitivities.

The land use codes have remained unchanged from the beginning of the program, which has allowed for consistent review and performance assessment over the last 23 years. The land use code for a particular site is a combination of numbers assigned to represent the land use activity, height, and density class of undesirables requiring treatment and the density of the retained shrub community.

The land use categories are:

Land use (in the thousands position)

- 1000 – Streams
- 2000 - Wetlands
- 3000 - Road Crossings
- 4000 – Commercial/Industrial
- 5000 - Residential
- 6000 – Active Cropland
- 7000 - Active Pasture
- 8000 - Brush Lands
- 9000 – Woodlands

Height - Undesirable, taller growing species (in the hundreds position)

- 000 - no height
- 100 - small (less than 6 ft.)
- 200 - medium (6 to 12 ft.)
- 300 - tall (over 12 ft.)

Density - Undesirables (in the tens position)

- 00 - no density
- 10 - very light (generally less than 100 stems/acre)
- 20 - light (up to 30% canopy cover, and 100 to 1,500 stems/acre)
- 30 - medium (30 - 65% cover, and 1,500 to 5,000 stems/acre)
- 40 - heavy (greater than 65% cover, and over 5,000 stems/acre)

Density - Compatible shrubs (in the ones position)

- 0 - none
- 1 - light (less than 30% woody shrub canopy)
- 2 - medium (30 - 65% canopy cover)
- 3 - heavy (greater than 65% canopy closure)

- c) Plant community: The inventory shall include identifying and reporting the height and density of undesirable taller growing species, together with the density of the predominate desirable woody shrub species. The species lists in Appendix 9 shall be used as a guide to identify woody tree and shrub species and their compatibility within each site. Within the Limits of any easement, property owner concerns, or environmental constraints, the long-term objective should remain the eventual removal of any species capable of invading the wire security zone, while retaining and fostering smaller compatible species already present within the site.

The following Land Use Categories are employed in Forestry GIS.

| <b>Land Use In Forestry GIS</b> |                                                                     |
|---------------------------------|---------------------------------------------------------------------|
| Access Road                     | Off Right-of-way access road                                        |
| Brush Land                      | Land covered by brush                                               |
| Campsite                        | Managed camping area                                                |
| Christmas Trees                 | Managed conifer trees for agriculture                               |
| Commercial/Industrial           | Land used for Commercial/Industrial                                 |
| Cropland                        | Cropland in active cultivation                                      |
| Field                           | Open mowed fields; hay or crop                                      |
| Golf Course                     | Managed golf course                                                 |
| Hedgerow                        | Border between managed fields                                       |
| Nursery                         | Managed trees for agriculture                                       |
| Orchard                         | Managed fruit trees                                                 |
| Organic Farm                    | Certified organic farm                                              |
| Owner No Herbicide              | No herbicide; per landowner agreement                               |
| Parking Lot                     | Paved or gravel lot with no vegetation                              |
| Pasture                         | Animal pasture                                                      |
| Pond/Lake                       | Water body; not wetland or river                                    |
| Private Well                    | Private water supply; encased or open spring                        |
| Protected Watershed             | Watershed areas with restrictions                                   |
| Public Surface Water            | Public water sources: reservoirs and tributaries                    |
| Public Well                     | Managed well for public water supplies                              |
| Railroad                        | Active railway                                                      |
| Residential                     | Residence with maintained lawn and/or trees                         |
| River Crossing                  | River crossings with maintained buffers                             |
| Road Crossing                   | Roads with or without maintained buffers                            |
| Road Crossings                  | Multiple roads within one site                                      |
| Roadside                        | Road parallels transmission line                                    |
| School                          | Public/private school where herbicide restrictions exist            |
| Special                         | Any area that requires special treatment/no listed land use applies |
| State Park/Forest               | Managed/regulated park or forest                                    |
| Streams                         | Stream crossing; may be seasonal                                    |
| Substation Perimeter            | Area around substation that requires vegetation management          |
| Wetlands                        | Regulated wetlands                                                  |
| Woodlands                       | Area that may remain wooded                                         |





Appendix 9  
Border Zone/Wire Zone Vegetation Lists



## EXHIBIT A:

### Undesirable Tall Growing Species

The following is a list of tall growing tree species that are considered undesirable in most right-of-way situations and should be removed from the right-of-way floor wherever practicable, to the extent permitted by landowner constraints and easement conditions. The primary objective of the Transmission Right-of-Way Management Program is to effectively remove and control the re-growth and reinvasion of these species.

In sites, due to terrain, conductor height, or other right-of-way variable, where a normally undesirable tall growing species will never reach the ATVM clearance distances, such tree may be retained on the right-of-way during routine maintenance as long as there is no undesirable affect or risk to access, construction, reliability or public safety. Such locations will be determined through a combination of field measurements, profile mapping or other technology and will also be routinely reviewed and verified during each inventory cycle.

| <b>Species</b>   | <b>Code</b> | <b>Species</b>      | <b>Code</b> |
|------------------|-------------|---------------------|-------------|
| Ash              | ASH         | Cucumber Tree       | CUC         |
| Mountain         | MAS         | Elm                 | ELM         |
| Balsam Fir       | BAF         | Hemlock             | HEM         |
| Basswood         | BAS         | Hickory             | HIC         |
| Beech            | BEE         | Hophornbeam         | HOP         |
| Birch            | BIR         | Maple               | MAP         |
| Cherry           |             | Oak                 | OAK         |
| Black            | BCH         | Pine                | PIN         |
| Choke            | CCH         | Poplar/Aspen        | POP         |
| Domestic         | DCH         | Red Mulberry        | MUL         |
| Pin (Fire)       | PCH         | Sassafras           | SAS         |
| Black Gum/Tupelo | BGU         | Spruce              | SPR         |
| Black Locust     | BLO         | Tamarack/Larch      | TAM         |
| Black Walnut     | BWA         | Tree-of-Heaven      | THE         |
| Butternut        | BUT         | Tulip/Yellow Poplar | TUL         |
| Catalpa          | CAT         | Willow              | WIL         |
| Cedar            | CED         | Other               | OTH         |
| Chestnut         | CHE         |                     |             |

## EXHIBIT B:

### Small to Medium Trees

The following is a list of small to medium trees that may be compatible along the edges of the right-of-way, except on narrower sub-transmission rights-of-way. They should be removed within the wire zone except where the mature height would not invade the Minimum Clearance Distance, or local conditions do not warrant removal. Any plant on the right-of-way that invades the Minimum Clearance Distance may be removed. These smaller tree species may be preferred for retention in buffer areas and other sensitive sites rather than taller growing tree species.

| <b>Species</b>     | <b>Code</b> | <b>Species</b>        | <b>Code</b> |
|--------------------|-------------|-----------------------|-------------|
| Apple              | APP         | American Hornbeam     |             |
| Autumn Olive       | AUT         | "Ironwood"            | HOR         |
| Buckthorn          | BUC         | Hawthorne             | HAW         |
| Common Buckthorn   |             | Mountain Maple        | MOM         |
| European Buckthorn |             | Pear                  | PER         |
| Dogwood            |             | Russian Olive         | RUS         |
| Alternate Leaf     | ADG         | Shadbush/Serviceberry | SHD         |
| Flowering          | FDG         | Shrub Willow          | WIL         |
| Cedars             | CED         | Speckled Alder        | ALD         |
| Witch Hazel        | WIH         | Staghorn Sumac        | SUM         |
|                    |             |                       |             |

## EXHIBIT C:

### Woody Shrubs

The following is a list of shrub species commonly found on rights-of-way across the service territory. While they are nearly always compatible in the border zone, several may grow tall enough to enter Minimum Clearance Distance.

| Species                      | Code | Species              | Code |
|------------------------------|------|----------------------|------|
| American Barberry            | BAR  | Privet               | PRI  |
| Chokeberry                   |      | Gooseberry           | RIB  |
| Black Chokeberry             | BCB  | Rose                 |      |
| Red Chokeberry               | RCB  | Domestic             | DOR  |
| Blueberry                    |      | Multiflora           | MUR  |
| Low                          | BLU  | Rubus                | RUB  |
| Highbush                     | HBL  | Blackberry           | "    |
| Button Bush                  | BTN  | Raspberry            | "    |
| Dewberry                     | DEW  | Silverberry          |      |
| Dogwood                      | DOG  | American             | SIL  |
| Red Osier                    | "    | Sumac                | SUM  |
| Stiff (similar to Red Osier) | "    | Smooth               | "    |
| Grey                         | "    | Winged               | "    |
| Silky                        | "    | Common Spicebush     | SPB  |
| Roundleaf                    | "    | Spirea               | SPI  |
| Elderberry                   | ELD  | Sweetfern            | "    |
| Hazelnut                     | HAZ  | Steeple Bush         | "    |
| American Hazelnut            | "    | Sweetfern            | SWF  |
| Beaked Hazelnut              | "    | Viburnum             | VIB  |
| Honeysuckle                  | HON  | Arrowwood            | ARR  |
| Huckleberry                  | HUC  | Highbush Cranberry   | HCR  |
| Juniper                      | GRJ  | Mapleleaf            | MVB  |
| Dwarf                        | "    | Nannyberry           | NAN  |
| Ground/Trailing              | "    | Northern Wild Raisin | RAI  |
| Mountain Holly               | MOH  | Hobblebush           | HOB  |
| Mountain Laurel              | MOL  | Winterberry Holly    | WIN  |
| New Jersey Tea               | NJT  | American Yew         | AMY  |
| Northern Prickly Ash         | NPA  |                      |      |
| Shrub Oak                    | SOK  | Climbing Vines       |      |
|                              |      | Bittersweet          | CLB  |
|                              |      | Grape                | GRA  |

Note that some of these species can be classified as either exotic or invasive. In addition, some of these species are noxious plants – particularly Multiflora Rose and Poison Sumac. In most situations management objectives within and adjacent to the right-of-way may warrant the removal or reduction of these species. Future discussions with State and Federal agencies to address invasive and exotic species on a landscape scale may require modifications of the current treatment course of action for some species.



Appendix 10  
Ground Patrol Procedure





## **Ground Based Patrol For:**

### **Vegetation on High Voltage Transmission Lines**

Ground based patrols are utilized as a regulatory requirement for some circuits or when vegetation managers believe conditions on certain rights of way may require an off-cycle review. The ground based patrol is usually conducted in the fall and winter of the year and completed no later than June 15<sup>th</sup> to ensure that vegetation threatening the operation of the circuit is removed or pruned prior to the growing season.

The following guidance is provided to each member of the patrol team to encourage consistency in identifying, reporting and documenting vegetation requiring pruning or removal.

#### **Vegetation to be Identified:**

The ground patrol shall focus on identifying vegetation (including vines) that has grown to **within 15 feet** of conductors and **off-right-of-way hazard trees**. The ground patrol will also check At Time of Vegetation Management (ATVM) clearances on rights-of-way treated the previous calendar year.

#### **Tools:**

Each patrol person shall have the following tools at their disposal:

##### **Necessary**

- NGrid ID Badge
- ROW Map (or digital tablet application)
- Hypsometer Laser Range Finder (or equivalent tools for tree height measurements)

##### **Optional**

- Binoculars
- Digital Camera
- NGrid Street Atlas
- Specifications for ROW Veg. Mgmt.
- ATV (when available)

**Data Collection:** Hand held device and/or spreadsheets.

**Corrective Action:** Entry on data sheet must include the best means to eliminate the condition, location and access points. These corrective actions shall be completed prior to June 20.

**Data Documentation:** All data collected in the field and corrective actions must be entered on the Transmission Forestry Ground Patrol forms and the Ground and Aerial Patrol spreadsheet, located on the Transmission Forestry shared drive (or currently prescribed data management system).

#### **Definitions:**

**Danger Tree:** A tree on or off the right-of-way that if were cut or failed could contact electric lines.

**Hazard Tree:** Danger Trees which due to species and/or structural defect are likely to fail and fall in to the electric facility. Factors to consider for identifying a hazard tree include the following:

| <b>Defect</b>             | <b>Tree Condition</b>               | <b>Site Conditions</b>                           |
|---------------------------|-------------------------------------|--------------------------------------------------|
| Crack                     | Lean                                | Side hill                                        |
| Decay                     | Species that are prone to fail      | Saturated or unstable soils                      |
| Decline                   | Emergence (Tree crown above canopy) | Human Activity (Logging; compaction, excavation) |
| Uprooted                  |                                     | Animal Activity                                  |
| Co-dominant Stem          |                                     | Storm damage                                     |
| Scarring                  |                                     | Topography (Berms, rock outcrops)                |
| Excessive Pruning/Topping |                                     |                                                  |



## Appendix 11 Conductor Clearances

(Extracted from Transmission Vegetation Management Strategy  
dated Dec 31, 2016)



## **Clearance Distances**

National Grid specifies three clearance distances to be achieved during maintenance cycles as a defense in-depth strategy and interruption risk abatement management work. Clearance distances established by National Grid below conform to the following regulatory standards and industry guidelines:

- North American Electrical Reliability Corporation (NERC) Vegetation Management Standard FAC-003-4;
- National Electric Safety Code (NESC) Rule 218; and
- Applicable State vegetation management standards or regulations.

### **1. National Grid At Time of Vegetation Management Clearance Distances (ATVM)**

When performing ROW vegetation management, the following At Time of Vegetation Management (ATVM) Clearance Distances, by voltage, shall be achieved. (See Definitions in Section 3.0).

| <b>At Time of Vegetation Management Clearance Distances (ATVM)</b> |                        |                                      |
|--------------------------------------------------------------------|------------------------|--------------------------------------|
| <b>Voltage<sup>1</sup></b>                                         | <b>Vertical (feet)</b> | <b>Horizontal (feet)<sup>2</sup></b> |
| 23 to 46kV                                                         | 12                     | 12 – 38                              |
| 69kV                                                               | 14                     | 14 – 42                              |
| 115kV                                                              | 18                     | 18 - 50                              |
| 230kV                                                              | 22                     | 22 – 50                              |
| 345kV                                                              | 26                     | 26 – 50                              |
| 450kV DC                                                           | 28                     | 28 - 50                              |

1 Includes some Distribution Voltages below 23kV in New England

2 For span lengths greater than 500 feet, contractors need to achieve a horizontal ATVM clearance distance at the higher end of the range. Each range incorporates span lengths, an increase in voltage increases span length, and therefore increases clearance distance.

ATVM Clearance Distances are greater than the Minimum Clearance Distances. In establishing these clearance distances, National Grid considered site-specific conditions such as operating voltage, IVM techniques, fire risks, tree and conductor movement, species types and growth rates, species failure characteristics, local climate rainfall patterns, line terrain and elevation, location of vegetation within the span, worker approach distance requirements and the expected time frame (the maintenance cycle) before vegetation management will be repeated at the site.

## 2. National Grid Minimum Vegetation Clearance Distances (NGMVCD)

Notwithstanding the ATVM Clearance Distances above, the National Grid Vegetation Clearance Distances specified below shall be maintained to minimize risk of flashover between vegetation and conductors. These clearances, while based on published guidance, are intended to mitigate risk and are not used for FAC-003-4 regulatory compliance purposes. The transient overvoltage factor is known for most of the 12kV through 345kV voltages, however, National Grid has chosen to base the NGMVCD on Tables in Annex D of the IEEE Standard 516-2009, a more conservative approach. For the 450kV DC voltage, Table 10.3 of the EPRI HVDC Reference Book is cited for the NGMVCD.

| <b>National Grid Minimum Vegetation Clearance Distances (NGMVCD)</b> |                                |
|----------------------------------------------------------------------|--------------------------------|
| <b>Voltage</b>                                                       | <b>Radial Clearance (feet)</b> |
| 12 to 46kV                                                           | 1                              |
| 69kV                                                                 | 2                              |
| 115kV                                                                | 4                              |
| 230kV                                                                | 6                              |
| 345kV                                                                | 10                             |
| 450kV DC                                                             | 12                             |

## 3. Minimum Vegetation Clearance Distance (MVCD)

Transmission Standard FAC-003-4 for Vegetation Management requires a minimum clearance for voltages operated at or above 200kV or any line operated below 200kV designated by the Planning coordinator as an Interconnection Reliability Operating Limit (IROL). The table below depicts a clearance distance that is representative of the most conservative minimum for elevations above sea level for the service territory (up to 3000 feet). The comprehensive table is located in the FAC-003-4 Standard and must be used for regulatory reporting purposes. National Grid maintains MVCD at all times, as required by FAC 003-4.

| <b>Minimum Vegetation Clearance Distances (MVCD) for US Operations</b> |                                |
|------------------------------------------------------------------------|--------------------------------|
| <b>Voltage</b>                                                         | <b>Radial Clearance (feet)</b> |
| 115kV IROL                                                             | 2.0                            |
| 230kV                                                                  | 4.3                            |
| 345kV                                                                  | 4.5                            |
| 450kV DC                                                               | 8.71                           |

#### 4. Right-of-Way Width

ROW width used for purposes of compliance with FAC-003-4 is defined as the linear distance from the center line transmission to the ROW edge. The ROW edge is typically provided for by easements or fee owned ROW purchased at the time of initial transmission line construction. ROW widths are determined using different methodologies, including the width of the legal easement, engineering specifications, or construction documentation. Verification of ROW widths for purposes of FAC-003-4 compliance can be completed by checking records stored in the VIPER application or construction diagrams, and in all cases can be verified through the Company Real Estate department

ATVM clearance requirements are based on the “optimum” ROW width developed for various voltage classes. Optimum ROW widths may be used for guidance or planning purposes for either maintenance or construction, but are not used for regulatory compliance purposes. A majority of transmission lines on National Grid’s system have widths that are “optimum.” This is why the ATVM horizontal distances were specified as a range. The optimum ROW widths specified below are those distances shown over 50 years of operational experience to render the combined benefits of good access, public safety, ease of construction and enhanced reliability. .

| Optimum Right-of-Way Width |                                                 |
|----------------------------|-------------------------------------------------|
| Voltage                    | Optimum Width from Centerline of Circuit (feet) |
| 12-46 kV                   | 37.5                                            |
| 69 kV                      | 37.5                                            |
| 115 kV                     | 50                                              |
| 230 kV                     | 60                                              |
| 345 kV                     | 75                                              |

#### 5. Exceptions to Clearance Distances:

##### 2.5.1 ATVM Clearances

Legal restrictions and environmental and social concerns may prevent National Grid from achieving ATVM Clearance Distances at various sites across the transmission system. For NERC regulated circuits, National Grid shall map these sites within the VIPER system. All such sites will be inspected as needed and mitigation procedures taken to assure adherence to NGMVCD and MVCD.

##### 2.5.2 Optimal Widths

###### 2.5.2.1 New Construction

When new transmission lines are constructed, the optimal ROW width is the target width sought during ROW acquisition. Width may vary as a result of construction type, terrain and acquisition feasibility.

#### **2.5.2.2 Excess Fee Owned Right of Way**

Where fee ownership extends beyond optimal width, other factors may determine a width, such as:

- Historic vegetation management records
- Construction Plans
- Engineering Guidance



Appendix 12  
Imminent Threat Procedure



# Handling Imminent Vegetation Threat to Transmission Circuit Operation

Is line voltage above 200 kV or 115 kV that is designated at an IROL? (NERC Regulated Lines)

**No? .... Unsure?** Notify National Grid Division Forester (or designee) and await further instructions.

**Yes?** Immediately notify Division Forestry Supervisor or designee of the threat. They must execute the following procedure:

## Declaration of an Imminent Threat

Is vegetation approaching or threatening to approach the MVCD to the conductor (as a fall-in or grow-in)? Would this threat need to be removed within 24 hours?  
**YOU MUST REPORT IMMEDIATELY!!**

## Communication

Without unnecessary delay, call the Transmission Control Center to report the threat.

| <u>Contact</u>                 | <u>Location</u> | <u>Telephone Number</u>                 |
|--------------------------------|-----------------|-----------------------------------------|
| NE Transmission Control Center | Northboro, MA   | (800) 423-6029 <u>or</u> (800)-382-7260 |
| NY Transmission Control Center | N. Syracuse, NY | (315) 460-2110                          |

Provide the following:

- 1) enough information about the threat so the Transmission Control Center can decide on the appropriate operating action.
- 2) contact information for yourself and your Division Forestry Supervisor.

## Mitigation Measures

Stay clear of danger and wait for instructions from the Transmission Control Center and Division Forestry Supervisor. Assist where directed.

## Documentation

- a) Date and Timeline of all steps taken (observation, reporting, mitigation, etc.)
- b) Line name/# and structure #s
- c) Explanation of threat with surrounding circumstances
- d) How the mitigation decision was developed, including discussions with the system operator
- e) How the imminent threat was mitigated (actions by system operator and Forestry Supervisor)
- f) Photographs, if possible

