

**Tri-State Montrose-Nucla-Cahone Transmission Line
Improvement Project**

Draft Plan of Development

Montrose, Ouray, San Miguel, and Dolores Counties, Colorado

Appendix T

Draft Operations, Maintenance and Vegetation Management Plan

Appendix T

Draft Operations, Maintenance and Vegetation Management Plan

Tri-State Generation and Transmission Association (Tri-State) has developed this operations and maintenance plan as part of the Plan of Development (POD) that accompanies its application to the Bureau of Land Management (BLM) for a Right of Way (ROW) grant. If the ROW grant is approved, the final POD and all appendices will be attached to the Decision Record. This plan provides guidance to field personnel, environmental staff, and maintenance crews on measures identified by Tri-State, BLM and US Forest Service (FS) to minimize environmental and land use effects that may occur as part of the operation and maintenance of the transmission line. It will be the responsibility of Tri-State to comply with measures identified in this plan.

Operation and Maintenance of the Transmission Line

Tri-State is required to operate and maintain transmission and substation facilities. The following outlines activities required to maintain and operate a 230-kV transmission line. Tri-State is requesting that ongoing routine and emergency maintenance activities within the approved access and transmission Right of Ways (ROWS) are authorized in the Special Use Permit (FS), Renewed ROW Grant (BLM) and easements obtained for the project. Maintenance activities fall into three categories-minor routine, heavy routine, and emergency. The routine maintenance activities have been further broken into two additional categories-minor and heavy. Vegetation management is also discussed in this appendix. Each of these categories is discussed in greater detail below.

Types of Line Maintenance Activities

Routine Minor Maintenance Activities

Annual Inspections

To ensure the safety and reliability of the transmission line, Tri-State will continue to conduct annual on-the-ground and aerial visual inspections of the new 230-kV transmission line, including the conductors, insulators, supporting structures, hardware, shield wires, ground wires, guy wires, and anchors. Annual aerial or ground inspections will be conducted to identify encroaching vegetation in the transmission ROW. On-the-ground inspections involve the use of 4-wheel drive pickup trucks and All-Terrain Vehicles (ATVs). In general, pickup trucks are utilized on existing roads, and ATVs are utilized for down-line access. Aerial inspections are conducted from a helicopter. Routine annual inspections would occur during dry weather conditions. Routine ground inspections would also be scheduled in accordance with timing restrictions imposed by the BLM and FS and as outlined in the Environmental Protection Measures (EPMs) table, listed in Chapter 5 of the POD. In addition, the line is flown once a year by helicopter.

Pole Testing

Tri-State and most utilities have a pole testing program that occurs every 5-20 years to assess the condition of structures and document damage from weather, wildlife, rot, etc. This work includes hand excavating around the wood pole, completing a detailed inspection of the wood pole at the ground line (to determine extent of wood rot) and re-treating that portion of the wood pole if

necessary. Core samples from the wood pole may also be taken, and poles may be treated with an approved chemical preservative. Access to structures is typically done using authorized access roads using four-wheel drive trucks or 4-wheel drive ATV's. Impacts are limited to the base of the pole and would occur entirely within the permitted ROW. Very limited ground disturbance is involved and the soils are replaced after the testing activities are complete.

Minor Routine Equipment Repairs

Annual inspections may identify weakening transmission line components that need to be replaced. Minor maintenance repairs include insulator replacement, conductor repair, single or minimal pole replacement, cross-arm replacement, guy wire repair/tightening, hardware tightening, anchor replacement within authorized limits of the ROW, inactive nest removal, and installing/maintaining bird protection devices.

If maintenance or replacement of the insulators, conductors, hardware, or shield wires is needed, large bucket and boom trucks will be used to access the transmission line using authorized access. When structures and crossarms need to be replaced or conductor repaired, additional equipment beyond a bucket truck may be required. Figure T-1 shows a typical bucket truck.



Figure T-1: Bucket Truck Shown with Outriggers used for Stabilization

Height requirements for all structures are subject to the clearances outlined in the current version of the National Electric Safety Code (NESC). Any future changes to NESC's clearance requirements for the conductors may result in a need to increase the height of some structures. The FS, BLM, and/or private landowners would be notified if any modifications to structure height—to meet NESC clearance—were required.

The size of future work areas at structure sites could be a maximum of 100 feet by 100 feet within the ROW (depending on slope) and may require some maintenance including grading of existing pad sites constructed for the transmission line construction to support bucket and/or boom trucks if structure replacements are required in the future. Work areas for structure replacement would be entirely within the 150-foot ROW permitted for the transmission line.

It is assumed minor routine repairs as described above would require agency notification, but would not require agency approval or further environmental review if all stipulations and EPMs outlined in the ROW Grant and final Operations and Maintenance Plan in the POD are followed. Agency notification and approval/review would be required if minor routine maintenance would result in impacts outside of the authorized 150-foot existing transmission ROW, outside authorized access road ROWs, or would occur in documented sensitive biological or cultural resource areas. It is understood that any work conducted outside of the authorized transmission and access road ROWs may be subject to additional environmental and cultural resource clearances. All regularly scheduled maintenance activities would be completed in compliance with maintenance related EPMs, listed in Chapter 5 of the POD.

Road Maintenance

Tri-State will periodically remove vegetation from access ROWs and conduct minor grading within the approved access road prism to allow for the safe passage of maintenance equipment. This work would comply with committed EPMs including seasonal restrictions to avoid and minimize impacts to sensitive resources. If Tri-State is required to do road maintenance on authorized access roads, the appropriate agency would be notified but no formal or additional authorization would be required if the improvements would occur entirely in compliance with the POD and ROW Grant stipulations.

Major Corrective Routine Maintenance Activities Requiring Agency Approval Prior to Initiation

Major corrective routine maintenance activities would include multiple structure replacements and or re-location of structures outside of the authorized transmission ROW, re-conductoring of the line, voltage upgrades that would result in increased ROW requirements and any corrective maintenance or road improvement/re-location activity that would require disturbance outside of the authorized access and transmission ROW. This maintenance category would also include installation of new culverts or armored crossings for access.

Major corrective routine maintenance activities may require the uses of multiple pieces of equipment and crews beyond the standard bucket truck, hot-line truck (Bronto) and pick-up trucks used for minor routine maintenance activities.

Major corrective maintenance activities would also comply with environmental protection measures outlined in Table 4 of the POD.

Tri-State would be required to notify and acquire formal authorization to proceed prior to conducting any major/non-emergency routine maintenance activities on federal and state lands as well as in occupied habitat for the Gunnison Sage-Grouse.

Emergency Response, Maintenance Activities and Notification Procedures

Emergency outages may be caused by lightning strikes, high winds, heavy snow and ice, vandalism, or equipment failure. The type of emergency, location, weather, or season will define the equipment and timeframe required to restore service or address a public safety concern. If the line is significantly damaged, the repairs could take from one day to several days, depending on the severity of the damage, location, and weather conditions. The duration of the interruption would depend on the source of the fault and would vary from a couple of seconds to up to a few days.

In an emergency, Tri-State will notify the agencies/landowner as soon as possible once it is determined that access to the transmission line ROW on federal or other public and private land is required. The first priority is to address the outage to ensure public safety. Any details about the type and schedule of activities required to remedy the outage or transmission line damage will be provided to agencies as soon as possible.

The Final POD will identify acceptable access routes for emergency access at all times of the year. Tri-State would use the access routes permitted in the POD for emergency repairs. However, Tri-State must respond to an emergency as quickly and efficiently as possible. In certain situations, access may be required outside of the permitted access ROW; these routes would be temporary in nature and would be restored and decommissioned after the emergency is addressed. Depending on access route conditions, a bulldozer may be needed to pull a bucket truck onto the ROW. Emergency access in the winter may require using a track hoe, unlike normal scheduled maintenance. Tri-State would meet on site with agency staff after the emergency in order to determine the rehabilitation required and the rehabilitation schedule of any new ground disturbance. Examples of required rehabilitation measures used in the past include removing ruts, recontouring, mulching and reseeding disturbed ground.

Protection equipment within the substations would monitor the operating condition of the electrical system and would rapidly de-energize the line or substation equipment if a fault or other problem is detected. The nature of the problem would be relayed to Tri-State's Control Center via the utility's communication system, Optical Ground Wire (OPGW). The system operator would diagnose the problem and restore service using remote operation of switches and circuit breakers if possible. Montrose and Durango maintenance personnel would be dispatched to the site, if necessary. Tri-State has procedures in place to address the potential for accidents and personal injury during the construction and operation phase of the project. This specific information can be found in *Appendix J, Emergency Preparedness Plan*.

Timing restrictions outlined in the EPM table and the EA would not apply in cases of emergencies as Tri-State's first priority is to restore electrical service and ensure public safety.

Vegetation Management for Transmission Rights-of-Way

The primary cause of electrical outages are trees or portions of trees located within or adjacent to the ROW, that grow, blow or fall into on overhead electric power lines. In addition, vegetation management is crucial to access electrical facilities and reducing wildfire impacts to and from power lines. While some of these outages cannot be prevented (due to storms, heavy winds, etc.), a good percentage can, and they are mitigated by managing the vegetation before it becomes a

problem. Arcing can occur if the physical separation between trees and power lines is not properly maintained. Arcing distances vary depending on voltage and ambient conditions, but any branch in close proximity to a conductor can spark a fire. Utilities and regulators generally agree that keeping overhead conductors clear of trees and vegetation is critical to both electric service reliability and fire prevention. Preventing outages and fires related to tree and power line conflicts are in the interest of public safety and are mandated by federal law.

Since the time when the line was constructed, new legislation, administrative actions, and Memorandums of Understanding (MOUs) have driven changes in the way federal land managers and utility companies manage transmission line (ROWs). Most recently, transmission lines are being recognized and treated as an essential part of the nation's "critical infrastructure." Recent legislation and other actions designating energy infrastructure as critical infrastructure or otherwise requiring management and maintenance of such infrastructure include the following:

- **National Fire Plan**

Adopted in August of 2000, the National Fire Plan shifts the focus of fire protection to Wildland Urban Interface (WUI) and emphasized five key items:

1. Firefighting
2. Rehabilitation of burned areas
3. Hazardous fuels reduction
4. Community assistance
5. Accountability for fire management programs

- **Executive Order 13212 (Signed May 2001)**

"Actions to Expedite Energy-Related Projects." Executive Order 13212 designates the power grid as being essential to national security and seeks to improve and expedite cooperation among federal agencies to ensure the supply and availability of energy for the country.

- **Healthy Forests Initiative (Signed August 22, 2002)**

The Healthy Forests Initiative provides for the use of "Stewardship Contracting," which gave agencies authority to trade goods for services, expedites administrative procedures for hazardous fuels reduction and ecosystem restoration of federal lands, and provides for the use of Categorical Exclusions for fuel treatment projects:

Up to 1,000 acres by mechanical methods

Up to 4,500 acres by prescribed fire

- **Healthy Forest Restoration Act of 2003 P.L. 108-148**

The Healthy Forest Restoration Act defines utility ROW corridors as WUI, provides as much as a 1.5-mile buffer zone adjacent to ROW, provides for streamlining the National Environmental Policy Act (NEPA) by encouraging community collaboration prior to document preparation, and focuses on reduction of hazardous fuels and removal of biomass.

- **Energy Policy Act of 2005 P.L. 109-58 (Signed August 8, 2005)**

The Energy Policy Act requires federal agencies to expedite approvals that are necessary for owners or operators of electrical transmission lines to comply with applicable reliability standards, and directs North American Energy Reliability Council (NERC) and Federal Energy Regulatory Commission (FERC) to develop and enforce electrical transmission reliability standards. The standards became effective February 7, 2007, and stipulate that failure to meet standards may result in a \$1 million dollar per day penalty.

- **MOU between Edison Electric Institute and Federal Agencies (FS, BLM, National Park Service (NPS), U. S. Fish and Wildlife Service (USFWS) and U.S. Environmental Protection Agency (EPA)) Confirmed May 25, 2006**

This MOU provides a framework to develop integrated vegetation management (IVM) practices for construction and maintenance of utility corridors and encourages agencies to expedite projects or review of permits to ensure security and reliability of utility transmission lines.

The MNC Project is subject to NERC reliability standards because it falls into the following category:

“Transmission lines (“applicable lines”) operated at 200-kV or higher, and transmission lines operated below 200-kV designated by the Planning Coordinator as being subject to this standard including but not limited to those that cross lands owned by federal, state, provincial, public, private, or tribal entities”.

In response to changing federal legislation and industry standards, Tri-State has developed an Transmission Vegetation Management Program (TVMP) to ensure the vegetation treatment of its transmission ROWs is consistent with the NERC Vegetation Management Standard FAC-003-1 and FAC-003-2. A copy of the TVMP is provided below in Attachment T-1. The objective of the TVMP is to ensure the safe and reliable operation of Tri-State’s transmission system in an environmentally sensitive, cost-effective manner while also protecting the forest from fire. Failure to comply with NERC-mandated vegetation management will result in FERC fines.

NERC is a self-regulatory organization (non-government organization) that has statutory responsibility to regulate bulk power system users, owners, and operators through the adoption and enforcement of FERC standards for fair, ethical, and efficient practices. NERC is responsible for creating and revising Vegetation Management Standards for transmission lines that are operated at 230-kV or higher, and transmission lines below 200-kV designated by the Reliability Coordinator as being subject to this standard, including but not limited to those that cross federal lands owned by federal, state, provincial, public, private, or tribal entities.

The reliability objective of NERC’s Vegetation Management Standard is to “prevent vegetation-related outages which could lead to cascading by effective vegetation maintenance while recognizing that certain outages such as those due to vandalism, human errors, and acts of nature are not preventable.” Cascading events are defined by NERC as the uncontrolled successive loss of system elements triggered by an incident at any location. Cascading results in widespread electric service disruption that cannot be restrained from sequentially spreading beyond an area predetermined by study. Experience has shown that serious outages and operational issues have

resulted from interference between overgrown vegetation and transmission lines (NERC 2008). To maintain electric reliability, it is critical that NERC's vegetation management standards are applied to applicable lines on federal, state, private, and public lands and easements (NERC 2008). It should be noted that NERC is currently revising the FAC-003-1 standard. Tri-State may need to adapt its vegetation management standards in the future to ensure compliance with these federal regulations and guidance. If the Tri State vegetation management standards were changed, the FS would be notified prior to implementation of the new standards.

It is Tri-State's policy to proactively mitigate vegetation hazards and threats to power system safety and reliability to the extent reasonable and practical within three main areas of concern:

- Vegetation and fuels on the ROW
- Vegetation and fuels adjacent to the ROW
- Prevention of wildfire on and off the ROW

Tri-State's long-term TVMP objective includes creating sustainable ROWs. This means the removal and management of trees and other incompatible (tall growing) vegetation that could pose a hazard to the safe construction and/or long-term operation of the power line to meet the NERC guidelines for vegetation management.

The new Montrose-Nucla-Cahone 230-kV Transmission Line will be regulated under NERC standards for reliability which includes vegetation management. Violations of these standards can result in fines up to \$1 million dollars per day in the event of a vegetation induced outage.

Vegetation Management of ROW

Vegetation management is a critical component of transmission maintenance and is a federal requirement for lines operated at 200-kV or above. Tri-State standards for safe operation of overhead a 230-kV transmission lines include a minimum vegetation clearance standard of 15 feet. Periodic treatment will include cutting danger trees, already within the minimum clearance, and those trees and other vegetation likely to approach the clearance standard within 10 years, considering growth and mortality. Table T-1 outlines the minimum clearances between conductors and trees within transmission ROWs. Tri-State's Transmission Vegetation Management Program has been included with this appendix to provide more detail on the program and required clearances. (Attachment T-2)

In various areas within Tri-State's Transmission System, the method in which Tri-State removes trees from the ROW can be governed by contracts, ROW easements, or Special Use Permits (SUPs), especially on government lands. However, the necessary treatment is governed by NERC/FERC standards and Tri-State's assessment of the potential for vegetation induced outages. The transmission line has to operate under FERC/NERC operating standards for vegetation management. These guidelines can be revised over time and the Tri State vegetation management standards must be adaptive to these changes. If the Tri State vegetation management standards were changed, the FS, BLM, and private landowners would be notified prior to implementation of the new standard.

The frequency of tree trimming and removal is determined by line location, species/communities, condition, growth rate, and height. Fuel loading and fire regimes may also

play a role in determining level of vegetation management required to protect both the transmission line and surrounding lands. Various types of trees have different growth rates that also affect the frequency of the tree trimming and cutting cycle. Insect and disease outbreak within the ROW area may also affect vegetation treatment frequency and the number of trees to be removed.

Desired conditions will vary and can be specific for portions of the ROW or unique sections of ROW. In general, it is Tri-State's practice to modify the optimum desired condition to reasonably accommodate other important resource or management issues and work with the FS and BLM to establish mutually acceptable practices while complying with NERC. However, the safe and reliable operation of the power transmission system is the primary objective; all other resource and management issues will be addressed after the emergency has been resolved.

As part of pre-construction activities, Tri-State will create desired conditions on the ROW and remove danger trees adjacent to the transmission ROW (where needed). The goal of pre-construction vegetation management is to establish compatible vegetation communities that will require minimal maintenance for the first 10 years of the transmission line operation. This process entails removing vegetation that could grow, blow, or fall into structures or the conductors in the next ten years. This generally involves removing all tall growing tree species over 5 feet in height and leaving smaller re-generation, shrubs, grasses and forbs. Tri-State's maintenance group will be responsible for maintaining this desired condition (compatible vegetation for transmission line operation) within the ROW. The line will be inspected on an annual basis to identify trees that could affect system reliability and result in a federal violation. Tri-State will provide the FS and/or BLM a summary of the results of the annual inspection to discuss upcoming maintenance needs and address compensation for merchantable timber removed from National Forest lands if required.

Vegetation management activities would be an approved maintenance activity within the transmission ROW and the removal of danger trees off the ROW would be permitted as part of the final ROW Grant/Special Use Permit/easement agreements. Tri-State would notify the affected agency of any planned large scale vegetation management activity (meant to address fuel loading concerns) or large scale removal of regeneration with the transmission ROW and would hold a meeting with the appropriate agency representatives prior to the work occurring. On lands administered by the FS, the district realty agent would be notified if trees of merchantable value are to be removed from or adjacent to the ROW.

If requested, each year in early spring or summer, the FS, BLM, and other public as well as private landowners will be notified of the areas that have been identified for treatment and the approximate number of trees per product class in each area. On lands administered by the FS, tree removal will be consistent with what each district requires for the removal of merchantable timber which is outlined in detail in the body of this POD.

If during an annual inspection, danger trees, that is a tree or group of trees within or adjacent to the ROW is discovered that may present an imminent threat to the transmission line, they will be removed immediately. Danger trees are considered an emergency and would likely be removed without prior approval or notification of the agencies. Planned vegetation management activities or cooperative projects, such as fuel reduction projects, would be coordinated with the agencies

as discussed above. Table T-1 shows the expected frequency of routine vegetative management by action and land cover type. It is expected that minimal vegetation management work would be required for the first 10 years the line is in operation because vegetation will have been treated prior to transmission line construction. See section 4.3.7 in the Plan of Development.

The maintenance crews will then perform vegetation management activities in dry conditions in the summer or early fall unless there is an imminent threat to the line. Vegetation management activities will comply with the conditions of the ROW Grant, SUP, and final POD.

Table T-1. Vegetation Management Frequency for the MNC Transmission Line ROW

Land Cover	Expected Vegetation Management Actions	Typical Frequency
Agricultural or Grassland	None likely to be necessary due to adequate clearance/density.	None - Low
Sagebrush	Occasional thinning if fuel loads are excessive within the ROW.	None - Low
Meadow	Scattered danger trees may have to be trimmed/removed.	Low - Moderate
Oak Scrub	Occasional thinning if fuel loads are excessive within the ROW.	Low - Moderate
Forest	Remove danger trees that are within 15 feet of conductor. Thin vegetation if fuel load is excessive within the ROW.	Low - Moderate

Tree clearing would not occur during migratory bird breeding season per however, if tree clearing would occur during the avian breeding season (early spring through summer), Tri-State will send a qualified biologist into the field ahead of vegetation management activities to ensure compliance with Migratory Bird Treaty Act (MBTA) and Bald and Golden Eagle Protection Act (BGEPA) and provide the results to the agencies.

Tri-State will be responsible for vegetation management within the ROW guided by FERC/NERC standards. In areas adjacent to the ROW, Tri-State will cooperate with landowners and land management agencies to mitigate risks from hazardous fuels accumulation within the ROW, noxious weeds, and wildfire events as specified in the TVMP.

Noxious Weeds

Noxious weed management within the ROW for the life of the transmission line and access routes will be completed by the FS under an existing management agreement covering all Tri State transmission lines on FS administered lands. A similar agreement could be created with the BLM or Tri-State will hire a third party contractor to treat weeds that propagated as the result of transmission line construction and long-term maintenance activities. Further details on noxious weed management will be included in the Final POD, *Appendix P: Reclamation Plan and Appendix S: Noxious Weed Plan*.

References

North American Electric Reliability Corporation. (2008). FAC Reliability Standard for Transmission Vegetation Management FAC-003-2 and FAC-003-3.

Attachments

- T-1 American National Standards Institute, Inc. A300, Part 7 (2006): Tree, Shrub and other Woody Plant Maintenance-Standard Practices (Integrated Vegetation Management- a. Electric Utility Rights-Of-Way)
- T-2 Tri-State Generation & Transmission Association, Inc.: Transmission Vegetation Management Program (Feb 2015).

Attachment T-1. Tree, Shrub, and Other Woody Plant Maintenance



ANSI®
A300 (Part 7)-2006

American National Standard
for Tree Care Operations –

Tree, Shrub, and Other Woody Plant Maintenance –
Standard Practices (*Integrated Vegetation Management*
a. Electric Utility Rights-of-way)

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American National Standard

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Contents

	Page
Foreword	ii
1 ANSI A300 standards scope, purpose, application, and implementation	57
70 Part 7 – Integrated Vegetation Management (IVM) standards	57
71 Normative references	57
72 Definitions	58
73 IVM a. Electric Utility Rights-of-way practices	59
Annex	
A Wire Zone – Border Zone Concept	61
B Integrated Vegetation Management Flow Chart	63
C Applicable ANSI A300 interpretations	65

Foreword (This foreword is not part of American National Standard A300 Part 7-2006)

An industry-consensus standard must have the input of the industry that it is intended to affect. The Accredited Standards Committee A300 was approved June 28, 1991. The committee includes representatives from the residential and commercial tree care industry, the utility, municipal, and federal sectors, the landscape and nursery industries, and other interested organizations. Representatives from varied geographic areas with broad knowledge and technical expertise contributed.

The A300 standards are placed in proper context if one reads the Scope, Purpose, and Application. This document presents performance standards for the care and maintenance of trees, shrubs, and other woody plants. It is intended as a guide in the drafting of maintenance specifications for federal, state, municipal, and private authorities including property owners, property managers, and utilities.

The A300 standards stipulate that specifications for tree work should be written and administered by a professional possessing the technical competence to provide for, or supervise, the management of woody landscape plants. Users of this standard must first interpret its wording, then apply their knowledge of growth habits of certain plant species in a given environment. In this manner, the users ultimately develop their own specifications for plant maintenance.

ANSI A300 Part 7 – *Integrated Vegetation Management a. Electric Utility Rights-of-way*, should be used in conjunction with the rest of the A300 standard when writing specifications for tree care operations.

Suggestions for improvement of this standard should be forwarded to: A300 Secretary, c/o Tree Care Industry Association, 3 Perimeter Road – Unit 1, Manchester, NH 03103, USA or e-mail: tcia@treecareindustry.org

This standard was processed and approved for submittal to ANSI by Accredited Standards Committee on Tree, Shrub, and Other Woody Plant Maintenance Operations – Standard Practices, A300. Committee approval of the standard does not necessarily imply that all committee members voted for its approval. At the time it approved this standard, the A300 committee had the following members:

Tim Johnson, Chair
(Artistic Arborist, Inc.)
Bob Rouse, Secretary
(Tree Care Industry Association, Inc.)

<i>Organizations Represented</i>	<i>Name of Representative</i>
American Nursery and Landscape Association	Warren Quinn
	Craig J. Regelbrugge (Alt.)
American Society of Consulting Arborists	Tom Mugridge
	Donald Zimar (Alt.)
American Society of Landscape Architects	Ron Leighton
Asplundh Tree Expert Company	Geoff Kempter
	Peter Fengler (Alt.)
Bartlett Tree Expert Company	Peter Becker
	Dr. Thomas Smiley (Alt.)
Davey Tree Expert Company	Joseph Tommasi

<i>International Society of Arboriculture</i>	<i>Dick Jones (Alt.)</i> <i>Bruce Hagen</i> <i>Sharon Lilly (Alt.)</i>
<i>National Park Service</i>	<i>Robert DeFeo</i> <i>Dr. James Sherald (Alt.)</i>
<i>Professional Landcare Network</i>	<i>Preston Leyshon</i> <i>Tanya Tolpegin (Alt.)</i>
<i>Professional Grounds Management Society</i>	<i>Tom Shaner</i>
<i>Society of Municipal Arborists</i>	<i>Andrew Hillman</i> <i>Tom Russo (Alt.)</i>
<i>Tree Care Industry Association</i>	<i>Dane Buell</i> <i>James McGuire (Alt.)</i>
<i>U.S. Forest Service</i>	<i>Ed Macie</i> <i>Keith Cline (Alt.)</i>
<i>Utility Arborist Association</i>	<i>Matthew Simons</i> <i>Jeffrey Smith (Alt.)</i>

Additional organizations and individuals:

- American Forests (Observer)*
- Beth Palys (Observer)*
- Peter Gerstenberger (Observer)*
- Mike Galvin (Observer)*
- Myron Laible (Observer)*
- Richard Rathjens (Observer)*
- Richard Roux (NFPA-780 Liaison)*

American National Standard
for Tree Care Operations –

Tree, Shrub, and Other
Woody Plant Maintenance –
Standard Practices
*(Integrated Vegetation Man-
agement a. Electric Utility
Rights-of-way)*

Clause 1 excerpted from ANSI A300 (Part 1) – 2001
Pruning

1 ANSI A300 standards

1.1 Scope

ANSI A300 standards present performance standards for the care and maintenance of trees, shrubs, and other woody plants.

1.2 Purpose

ANSI A300 standards are intended as guides for federal, state, municipal, and private authorities including property owners, property managers, and utilities in the drafting of their maintenance specifications.

1.3 Application

ANSI A300 standards shall apply to any person or entity engaged in the business, trade, or performance of repairing, maintaining, or preserving trees, shrubs, or other woody plants.

70 Part 7 – Integrated Vegetation Management (IVM) standards

70.1 Purpose

The purpose of this document is to provide standards for developing specifications to implement an integrated approach to management of vegetation.

70.2 Reasons for Integrated Vegetation Management (IVM)

The reason for Integrated Vegetation Management is to promote sustainable plant communities that are compatible with the intended use of the site, and discourage incompatible plants that may pose concerns, including safety, security, access, fire hazard, electric service reliability, emergency restoration, visibility, line-of-sight requirements, regulatory compliance, environmental, or other specific concerns.

70.3 Implementation

70.3.1 Specifications for integrated vegetation management should be written and administered by a vegetation manager.

70.3.2 IVM specifications shall be adhered to.

70.4 Safety

70.4.1 IVM shall be implemented by a qualified vegetation manager familiar with the practices and hazards of vegetation management and the equipment used in such operations.

70.4.2 This standard shall not take precedence over applicable industry safe work practices.

70.4.3 Operations shall comply with applicable Federal and State Occupational Safety and Health standards, ANSI Z133.1, FIFRA, Federal EPA, as well as state and local regulations.

71 Normative references

ANSI A300 for *Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices*

ANSI Z133.1 *Arboricultural Operations – Pruning, Repairing, Maintaining, and Removing Trees and Cutting Brush – Safety Requirements*

29 CFR 1910, *General Industry*

29 CFR 1910.268, *Telecommunications*

29 CFR 1910.269, *Electric Power Generation & Distribution*

¹⁾Available from U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC 20210.

ANSI A300 (Part 7)-2006

29 CFR 1910.331-335, *Electrical Safety*

FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act)

72 Definitions

72.1 action threshold: The maximum acceptable levels of plant density and height that initiates implementation of a control method.

72.2 biological control methods: Control of vegetation using plants, animals, insects, or pathogens.

72.3 chemical control methods: Control of vegetation through the use of herbicides, growth regulators, or other pesticides.

72.4 cultural control methods: Control of vegetation through the establishment of compatible stable plant communities or the use of crops, pastures, mulching, or other managed landscapes.

72.5 danger tree: A tree on or off the right-of-way that could contact electric supply lines.

72.6 electric supply lines: Conductors used to transmit electric energy and their necessary supporting and containing structures.

72.7 electric utility right-of-way: A corridor of land over which electric lines are located. The utility may own the land in fee, own an easement, or have certain franchise, prescription, or license rights to construct and maintain lines.

72.8 hazard tree: A structurally unsound tree that could strike a target when it fails. As used in this clause the target of concern is electrical supply lines.

72.9 integrated vegetation management (IVM): A system of managing plant communities in which compatible and incompatible vegetation is identified, action thresholds are considered, control methods are evaluated, and selected control(s) are implemented to achieve a specific objective. Choice of control methods is based on effectiveness, environmental impact, site characteristics, safety, security and economics.

72.10 maintenance cycle: Planned length of time between vegetation maintenance activities.

72.11 manual control method: Control of vegetation using hand-operated tools.

72.12 mechanical control methods: Control of vegetation using equipment-mounted saws, mowers, or other devices.

72.13 non-selective management: Methods used to control vegetation within a prescribed area without regard to retaining compatible vegetation.

72.14 right-of-way reclamation: Reestablishing IVM on a right-of-way that is not currently managed to the full extent of its easement or ownership rights and intended purpose. Conditions on a right-of-way in need of reclaiming include tall, dense amounts of undesirable vegetation, and electric supply lines that are inaccessible. Reclamation usually involves initial non-selective methods of mowing or hand-cutting, or broadcast application of herbicides.

72.15 selective management: Methods used to target specific vegetation within a prescribed area while retaining compatible vegetation.

72.16 shall: As used in this standard denotes a mandatory requirement.

72.17 should: As used in this standard denotes an advisory recommendation.

72.18 specifications: A document stating a detailed, measurable plan or proposal for provision of a product or service.

72.19 standards, ANSI A300: Performance parameters established by industry consensus as a rule for the measure of quantity, weight, extent, value, or quality.

72.20 vegetation, compatible: Vegetation that is desirable and/or suitable to the intended use of the site.

72.21 vegetation, incompatible: Vegetation that is undesirable, presents a safety hazard, or is unsuitable to the intended use of the site.

72.22 vegetation manager: An individual engaged in the profession of vegetation management who, through appropriate experience, education, and

¹⁾Available from U.S. Department of Labor, 200 Constitution Avenue, NW, Washington, DC 20210.

related training, possesses the competence to provide for or supervise an integrated vegetation management program.

73 IVM a. Electric Utility Rights-of-way practices

73.1 IVM objectives

73.1.1 The vegetation manager (VM) shall define the objectives based on the intended purpose and use of the site.

73.1.2 The vegetation manager shall define action thresholds.

73.2 Site evaluations

73.2.1 The management area shall be inspected to evaluate existing conditions to determine if action thresholds have been met and what type of control method is necessary to meet the objectives.

73.2.2 Pre-control evaluations should include right-of-way use, type of electric supply line, general conditions, ownership, intended uses of the site, adjacent land use, existing vegetation, topography, soils, fire risk, sensitive or protected areas, water resources, sensitive or protected species, and regulations.

73.2.3 Vegetation that is compatible or incompatible with the objectives shall be identified.

73.2.4 Post-control evaluations should monitor efficacy and appropriateness of methods used, general site conditions, other impacts of treatments, and recommendations for future actions.

73.2.5 The results of site evaluations should be documented.

73.3 Management control method selection

73.3.1 Vegetation manager shall choose from available management control methods and implement appropriate methods.

73.3.2 Control methods selection should be based on pre-control evaluations, expected growth rates, electric supply line priority, economics, regulations, and specified objectives.

73.3.3 Efficacy of IVM control methods should be considered when scheduling implementation.

73.3.4 Control methods should promote compatible vegetation.

73.4 Communication

73.4.1 Communication with property owners, customers, and regulators regarding IVM activities should be proactive and shall be in compliance with federal, state, and local regulations.

74 IVM implementation

74.1 All laws, rules and regulations regarding public and worker safety shall be followed.

74.2 Specifications developed for IVM shall be adhered to.

74.3 Maintenance cycles should be based on existing vegetation, expected growth rates, and action thresholds.

74.4 Cultural control method

74.4.1 Over time and with successful implementation, cultural control methods should be preferred.

74.4.2 Cultural control methods should be considered for use once incompatible vegetation has been controlled.

74.5 Biological control method

This method should be considered for use once incompatible vegetation has been controlled.

74.6 Initial clearing of rights-of-way

74.6.1 When planning, designing, and constructing new rights-of-way, consideration should be given to future vegetation management needs.

74.6.2 When rights-of-way are being initially established, written easements should be secured defining rights to implement whatever IVM treatments are necessary to meet objectives.

ANSI A300 (Part 7)-2006

74.7 Quality assurance

74.7.1 An IVM program should include a quality assurance program to ensure best practices are followed, objectives of IVM are met, and that all specifications are adhered to.

74.7.2 The results of IVM treatments and of the quality assurance program shall be clearly documented.

75 IVM applications**75.1 Tools and equipment**

75.1.1 IVM equipment used to implement the program shall be in proper working condition.

75.1.2 Equipment shall be used according to manufacturers' instructions.

75.2 Chemical control application**75.2.1 Materials**

75.2.1.1 Materials shall be used in accordance with federal, state, and local regulations.

75.2.1.2 Materials shall be applied according to manufacturers' labels.

75.2.1.3 Consideration should be given to utilizing products that minimize the risk to humans and the environment.

75.2.1.4 Consideration should be given to minimizing the amount of materials utilized over time to minimize the risk to humans and the environment.

75.2.1.5 Materials and methods should be selected to reduce the chance of developing resistance when the threat exists.

75.3 Selective management

75.3.1 The vegetation manager should employ selective management of vegetation whenever there is sufficient compatible vegetation actively growing on the right-of-way.

75.3.2 Where rights-of-way cross surface water resources, selective management should be utilized to create a buffer, retaining as much compatible vegetation as possible.

75.3.3 When incompatible vegetation with the potential for re-sprouting is manually-cleared, herbicide should be applied to the remaining stump.

75.4 Non-selective management

75.4.1 Right-of-way reclamation utilizing non-selective methods should be implemented as an initial step toward developing selective management on the site.

75.5 Mechanical methods

75.5.1 When performing right-of-way reclamation, mechanical clearing methods should be considered.

75.5.2 Where rights-of-way cross surface water resources, selective management should be utilized to create a buffer, retaining as much compatible vegetation as possible.

75.6 Tree pruning and tree removal

75.6.1 Tree pruning shall comply with ANSI A300 Part 1, section 5.9 – *Utility Pruning* standard.

75.6.2 Danger trees should be monitored, pruned, or removed as appropriate.

75.6.3 Trees identified as hazard trees should be pruned or removed as appropriate.

Annex A: Wire Zone – Border Zone Concept

The wire zone – border zone concept is a proven method that ensures the reliability of electric supply lines while promoting stable plant communities and wildlife habitat. Annex A provides supplemental information about this method.

A-1 Annex A Glossary

A-1.1 Border zone: An area on an electric utility right-of-way outside the wire zone, extending to the outer edge of the established right-of-way. Applies to electric utility rights-of-way only.

A-1.2 Wire zone: An area on an electric utility right-of-way directly beneath and between the energized conductors farthest out on the pole/tower. This area is the most likely to contain vegetation that could potentially grow into contact with the energized conductors. This area is also typically used as access to the poles, towers, and conductors for repair, inspection, and maintenance. Applies to electric utility rights-of-way only.

A-2 On electric utility rights-of-way, selective management may be implemented in the border zone whenever there is sufficient compatible vegetation.

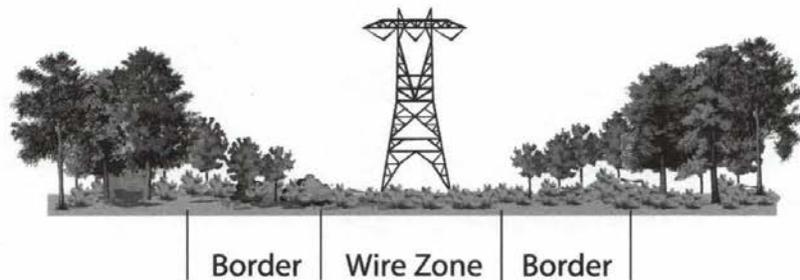
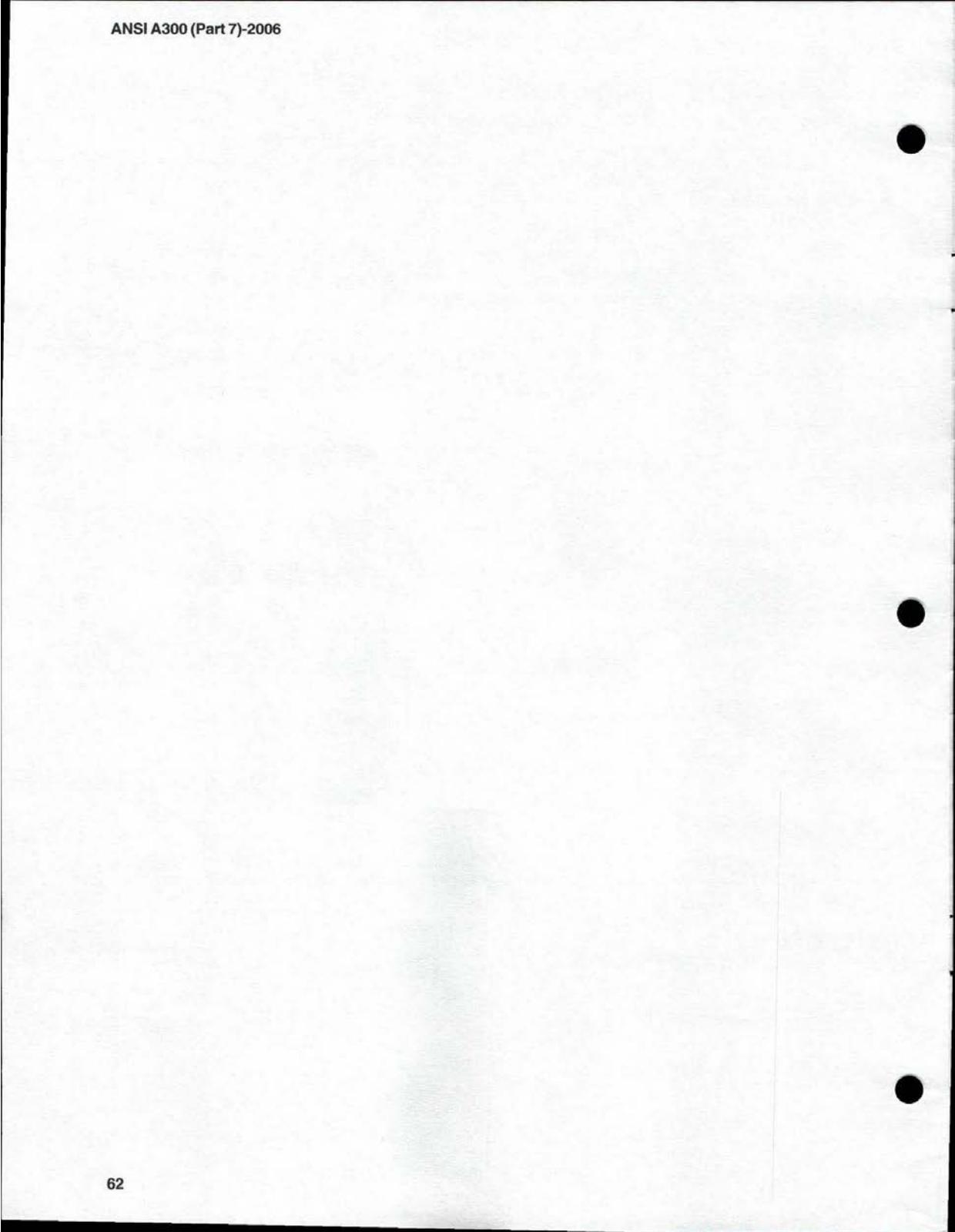


Figure 1: Wire Zone – Border Zone

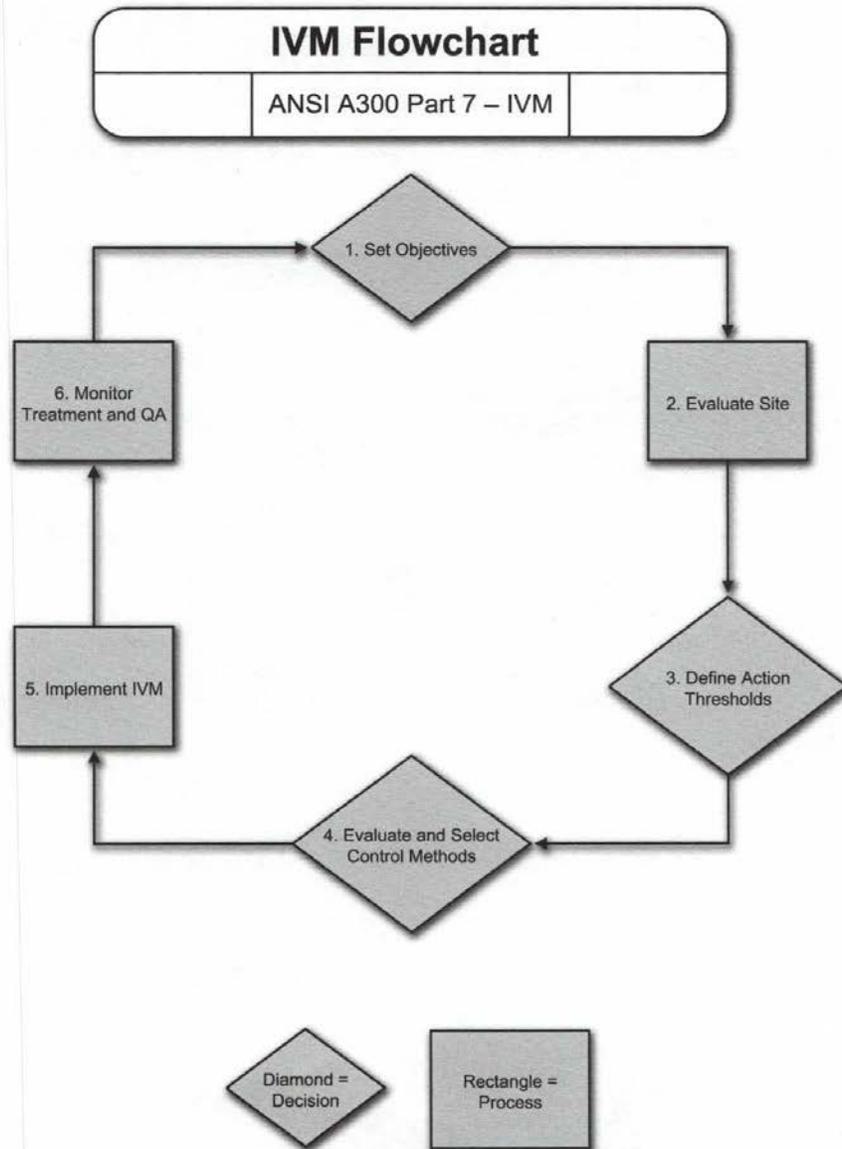
A-3 On electric utility rights-of-way, non-selective management may take place in the wire zone of a right-of-way.

A-4 On rights-of-way that contain minimal or no compatible vegetation, or are very dense or not maintained, right-of-way reclamation by non-selective methods may be implemented in the border and wire zone.



Annex B: Integrated Vegetation Management Flow Chart

The following flow chart illustrates the IVM process as represented in the A300 Part 7 standard. Each element is explained in this standard.



ANSI A300 (Part 7)-2006

Annex C: Applicable ANSI A300 interpretations

The following interpretations apply to the ANSI A300 Part 7 IVM standard.

A-1 Interpretation of "should" and "shall."

"An advisory recommendation" is the common definition of "should" used in the standards development community and the common definition of "should" used in ANSI standards. An advisory notice is not a mandatory requirement. Advisory recommendations may not be followed when defensible reasons for non-compliance exist.

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TVMP GLOSSARY OF TERMS

Action Thresholds:

Areas of consideration using the findings from inspections in order to prioritize vegetation management schedules to ensure MVCDs, as defined by FAC-003-3, are never breached.

Altitude Correction Factor:

A multiplier, applied to specify distances, that adjusts those distances to account for the change in relative air density (RAD) from the RAD used to determine the specified distance. Altitude correction factors apply to both minimum worker approach distances and to minimum vegetation clearance distances.

Annual:

A frequency completed within a 365 day period.

ANSI A300, Part 7:

Tree, Shrub and Other Woody Plant Maintenance — Standard Practices for Integrated Vegetation Management and Electric Utility Rights of Way. American Nation Standards Institute parameters established and recognized as industry best practice specifically describing comprehensive vegetation management methods and pruning maintenance. The Integrated Vegetation Management offers a systematic approach to planning and implementing a vegetation management program.

Border zone:

An area that extends from the edge of the wire zone to the edge of the ROW.

Calendar Year:

A frequency completed the following year between January 1 and December 31. As an example, testing completed anytime in 2009 that has a maintenance frequency of a calendar year is required to be tested again anytime between January 1, 2010 through December 31, 2010.

Danger tree:

A tree adjacent to, and outside of, the ROW that is tall enough to have the potential to fall into the line facilities within 1 year of the last performed maintenance. As identified in NERC Standard FAC-003-3, a danger tree is a tree 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.

Danger tree zone:

An area that is adjacent to, and outside of, the ROW.

Member(s):

Any one, or group, of the 44 cooperative member-owners of Tri-State. Each is a consumer-owned, non-profit rural utility serving residences, farms, ranches, small towns, businesses and industries located in Colorado, Nebraska, Wyoming and New Mexico.

Minimum Vegetation Distance (MVCD):

As defined in the NERC Glossary of Terms and specified in FAC-003-3 Table 2: The calculated minimum distance stated in feet (meters) to prevent flash-over between conductors and vegetation, for various altitudes and operating voltages.

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Mitigation action plan:

A specific method and degree of transmission vegetation management work used to address mitigation areas.

Mitigation area:

A location on the ROW, or in the danger tree zone, where TSGT is restricted from attaining clearances specified for Clearance 1 or Clearance 2.

Mitigation List:

A list of mitigation areas and associated information gathered during inspections, including, but not limited to, the mitigation action plan.

Mitigation measures:

The implementation of a mitigation action plan in order to achieve sufficient clearances for the protection of the transmission facilities for locations identified in the ROW where TSGT is restricted from attaining the MVCD.

Right(s)-of-Way (ROW):

As defined in the NERC Glossary of Terms: 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 standards 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.

SOP #11:

TSGT's Standard Operating Procedure for Reports to The System Operator. Defines the specific information required to be submitted for all transmission circuit interruptions, including specific vegetation related outage information.

TVMP:

Transmission Vegetation Management Program as required by NERC Standard FAC-003-1, and as updated for FAC-003-3 requirements.

TSGT Document Management System:

Documentum

TSGT Training System:

Learning Management System (LMS)

TSGT Transmission Line Database:

GIS system utilizing GPS handheld units. As of July 1, 2014, this system is transferring to Cascade.

TSGT Work Management System:

Asset Suites

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Vegetation:

All plant material, growing or not, living or dead.

Vegetation Inspection:

As per the NERC Glossary of Terms: The systematic examination of vegetation conditions on a Right-of-Way and those vegetation conditions under the applicable 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.

Wire zone:

An area that includes all the ground beneath electrical supply lines extending 20 feet to the outside of the outermost conductor or to the edge of the ROW, whichever is lesser.

Attachment T-2. Transmission Vegetation Management Program.

**TRI-STATE GENERATION & TRANSMISSION
ASSOCIATION, INC.**

TRANSMISSION VEGETATION MANAGEMENT PROGRAM

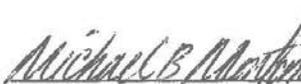
System Integrity and Reliability through a Dedicated Maintenance Team



TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC.

TRANSMISSION VEGETATION MANAGEMENT PROGRAM

Management Review and Approval:

Job Title / Name	Signature	Date
Transmission Maintenance Manager Eastern Region Jaime Leal		1/23/14
Transmission Maintenance Manager Western Region Mac Fellin		1/20/14
Transmission Maintenance Manager Southern Region Mike Montañó		1/21/14

Senior Management Review and Approval:

Job Title / Name	Signature	Date
Senior Manager Transmission Maintenance Robert Rojas		1/31/14

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**TRI-STATE GENERATION AND TRANSMISSION ASSOCIATION, INC.
TRANSMISSION VEGETATION MANAGEMENT PROGRAM**

Introduction

Tri-State Generation and Transmission Association, Inc., (hereinafter referred to as "Tri-State" or "TSGT") headquartered in Westminster, Colorado, is a consumer-owned, nonprofit, cooperative that supplies wholesale electricity to 44 member rural utilities. These distribution systems, in turn, serve residences, farms, ranches, small towns, businesses and industries. Tri-State has organized Transmission Maintenance into three geographic areas. Transmission East includes Northeast Colorado, Wyoming and Nebraska. Transmission West includes West and Southeast Colorado. Transmission South includes New Mexico.

Tri-State shall comply with all applicable NERC and Regional Entity Reliability Standard Requirements mandated by FERC, pursuant to section 215 of the Federal Power Act (FPA), 2005.

Disclaimer

These maintenance standards furnished by Tri-State are for internal use only and for informational purposes and the convenience of the Tri-State Cooperative Membership (hereinafter referred to as "Member"). These policies are subject to change from time to time. Any use of this information by the Member, its officers, directors, employees, servants, agents, and successors will be at the Member's risk and without liability or legal exposure to TSGT, its officers, directors, employees, servants, agents, successors and assigns, and Member shall indemnify and hold harmless TSGT, its officers, directors, employees, servants, agents, successors and assigns from all claims, causes of action, damages, losses and expenses including attorneys' fees arising out of or resulting there from which may arise respecting the use of the attached documents by the Member, its officers, directors, employees, servants, agents, successors and assigns.

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Table of Contents

1.0	Overview	3
1.1	Objective	3
1.2	Applicable Lines	3
2.0	Vegetation Maintenance	4
2.1	Maintenance Overview	4
2.2	Maintenance Strategy	5
2.3	Vegetation Clearances.....	6
2.3.1	Vegetation Management Clearances.....	6
2.3.2	Minimum Vegetation Clearance Distance (MVCD).....	7
2.3.3	Potentially Threatening Vegetation Conditions	7
2.4	Maintenance Intervals	7
2.4.1	Vegetation Inspection	7
2.4.2	Vegetation Management.....	8
2.5	Annual Work Plan.....	9
2.5.1	Action Thresholds.....	9
2.5.2	Work Schedule and Verifications	9
2.6	New Construction Vegetation Clearing.....	9
3.0	Management Constraint Mitigation	10
3.1	Mitigation Areas.....	10
3.2	Corrective Action.....	10
3.2.1	Vegetation Management Constraint.....	10
3.2.2	Potential Risk Constraint	10
4.0	Compliance Reporting	11
5.0	Documentation.....	11
5.1	File Format and Structure.....	11
5.2	Data Retention.....	11
6.0	Transitional Equipment.....	12
6.1	IROL and Major Transfer Paths.....	12
6.2	Discovered Equipment.....	12
6.3	Acquired and Transferred Equipment	12
6.4	Expectations at Time of Acquisition or Transfer	12
6.5	Regulatory Reporting and Mitigation.....	12
7.0	Maintenance By and For Other Entities.....	13
7.1	Contractual Agreements.....	13
7.2	Regulatory Reporting and Mitigation.....	13
8.0	Compliance Map.....	14
8.1	FAC-003-3 Supporting Evidence.....	14
9.0	Revisions	15
9.1	Review Cycles and Responsibilities.....	15
9.2	Revision History.....	15

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1.0 Overview

1.1 Objective

The objective of the TSGT Transmission Vegetation Management Program (TVMP) is 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. This vegetation management strategy incorporates the following principles:

- Ensure the safe and reliable operation of TSGT transmission system
- Achieve cost efficiency
- Minimize adverse environmental impacts
- Comply with all laws and regulations
- Maintain a harmonious relationship with landowners and the public.

TSGT's TVMP is consistent with the most current version of the North American Electric Reliability Corporation (NERC) Vegetation Management Standard FAC-003. It is TSGT's policy to proactively mitigate vegetation hazards and threats to power system safety and reliability to the extent reasonable and practical within the following main areas of concern:

- Vegetation within the legal control of TSGT: on the Right-of-Way (ROW) and adjacent to the ROW
- Prevention of wildfire on the ROW and adjacent to the ROW with cooperation from landowners and/or land management agencies.

1.2 Applicable Lines

While TSGT strives to maintain all of its line facilities to the same standard, the vegetation management for the following line facilities is specifically governed by this TVMP. The *TSGT FAC-003 Applicable Lines*, located on TSGT's internal intranet Transmission Maintenance page in the TVMP Related Information section, reflects the lines governed by this TVMP.

- Lines identified as elements of a Major Transfer Path, regardless of voltage, as designated by the Western Electricity Coordinating Council (WECC) or Midwest Reliability Organization (MRO);
 - WECC major transfer path elements owned by TSGT are included and designated in the listing.
 - TSGT owned lines have not been designated as MRO critical path elements.
- Lines identified as elements of an Interconnection Reliability Operating Limit (IROL), regardless of voltage, as designated by WECC, MRO or TSGT Transmission Planning;
 - TSGT owned lines have not been identified as IROL elements by WECC, MRO or TSGT.
- All other lines rated at 200kV and above.
 - TSGT owned lines within the WECC region are included and designated in the listing.
 - TSGT does not own applicable lines within the MRO region.

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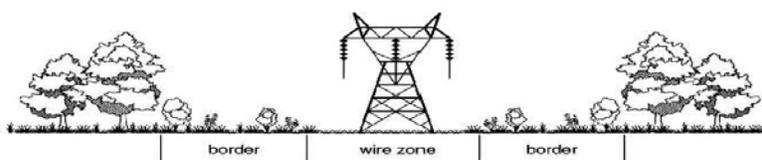
2.0 Vegetation Maintenance

The following practices and procedures are based on TSGT's intimate knowledge and experience of vegetation native to the TSGT service territory. As part of the TSGT training, TSGT line field personnel are provided reference documents ANSI A300 Part 7 (Integrated Vegetation Management a. Electric Utility Rights of-way) as well as the companion publications Part 1 (Best Management Practices - Integrated Vegetation Management and Utility Pruning of Trees).

2.1 Maintenance Overview

It is the philosophy and practice of TSGT's Transmission Maintenance department to manage vegetation on TSGT transmission line ROWs towards a desired condition. The desired condition utilizes the Bramble and Byrnes Wire Zone-Border Zone approach as depicted in [Figure 1](#). In general, the optimum desired condition is one of stable, low growth plant communities, free from noxious or invasive plants, and without an accumulation of large amounts of vegetative debris from vegetation management activities in the wire zone. Low growth plant communities preclude the risks associated with taller vegetation. These communities will typically be comprised of herbaceous plants and low growing shrubs which ideally are native to the local area. Border zone areas will normally be managed for trees that ascend in height with increasing distance from the transmission line. Where trees and other taller vegetation are required on the ROW to meet other environmental objectives, the desired condition shall be to maintain the tree heights to provide the clearances between the vegetation and conductors in accordance with [Table 3](#) and never less than the Minimum Vegetation Clearance Distance (MVCD) in [Table 4](#).

Figure 1: Bramble and Byrnes Wire Zone-Border Zone



Large accumulations of vegetation debris from intensive or repetitive vegetation treatments may require mitigation to reduce risks from wildfire and enhance the fire survivability of the transmission facility. Therefore, a desired condition should also incorporate appropriate fuel management considerations to mitigate wildfire intensity and duration, as well as reduce the potential for fire starts. Consideration is given to removing or mulching large accumulations of biomass on the ROWs rather than leaving material to become a fuel source. Adequate access to each structure and along the ROW is also essential to provide for efficient, cost effective vegetation treatment activities.

In areas adjacent to the ROW, TSGT will cooperate with landowners and land management agencies to collaboratively mitigate risks from hazardous vegetation and wildfire events.

TSGT's transmission system and associated ROWs are made up of many different age classes, land ownership easement and permit requirements, ecological conditions, and other management issues. Consequently, desired conditions will vary and can be specific for each ROW or unique section of ROW. In general, it is TSGT's practice to modify the optimum desired condition to reasonably accommodate other important resource or management issues. However, the safe and reliable operation of the power transmission system will be the primary objective and all other resource and management issues are considered secondary.

Achieving the desired condition on a ROW is a process that may take several iterations over an extended period of time. However, once defined, the desired condition serves as the guide for future vegetation management actions. All subsequent vegetation treatment activities should consistently move toward achieving the desired condition. Once achieved, the desired condition will be proactively maintained by periodic re-treatments.

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2.2 Maintenance Strategy

TSGT's TVMP is a comprehensive and integrated vegetation management program utilizing the full extent of TSGT's easements and other legal rights allowed and a variety of management methods. Vegetation management does not occur on a rigid time cycle basis. Rather, the maintenance schedule is driven by the condition of the vegetation found during inspections and the management tool to be applied to trim or remove the vegetation. The vegetation is managed with sufficient frequency to keep the vegetation beyond expected conductor movement and MVCD clearances, [Table 4](#), at all times. Annual inspections of the ROW allow time for fast growth and danger trees to be caught and added into the annual work plan.

TSGT takes into account the inter-relationships between vegetation growth rates, vegetation control methods, and inspection frequency. The level of anticipated tree growth and average mature height, for trees within the TSGT service territory, is indicated in [Table 1](#). TSGT has adopted 1.5 years, maximum, as the inspection and management intervals. Expected conductor movement, MVCD and interval average growth are considered in the clearances left after maintenance in [Table 3](#) to allow for conductor movement and vegetation growth between intervals without encroachment into the MVCD. An additional buffer is included to allow for changes in growth pattern.

An annual work plan is created and closely followed throughout the year to ensure unexpected changes created by weather, work schedules, or land management disputes can be monitored and responded to without allowing encroachment into the MVCD. During the annual inspection cycle, fast growing trees and danger trees are identified and added to the work plan.

Table 1: Tree growth and average mature height

Tree	Average Growth Rate Feet/Year	Induced Growth Rate Feet/Year	Average Mature Height Feet
Ash	1.00	3.0	65
Aspen	1.25	3.0	45
Birch	1.00	2.0	55
Boxelder	1.50	3.0	40
Catalpa	0.80	2.0	45
Cedar	0.70	1.0	45
Cottonwood (Rio Grande)	2.75	5.0	80
Elm (American)	1.50	3.0	80
Elm (Chinese)	2.00	3.5	60
Juniper (Utah)	0.25	0.5	25
Locust (Honey)	0.90	1.5	50
Maple (Norway)	0.60	1.5	45
Maple (Red)	1.00	1.5	45
Maple (Silver)	1.75	4.0	70
Oak (Pin)	0.70	1.5	50
Oak (Scrub)	0.80	1.5	45
Oak (White)	0.70	1.5	65
Pine (White & Red)	1.00	1.0	70
Pine (Piñon)	0.5	1.0	50
Pine (Ponderosa)	1.25	2.0	230
Poplar (Carolina)	2.75	5.0	80
Poplar (Lombardy)	2.50	4.0	65
Poplar (White)	1.25	3.0	50
Spruce (Norway)	1.00	1.0	60
Willow (Black)	2.00	5.0	50

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2.3 Vegetation Clearances

2.3.1 Vegetation Management Clearances

The clearance distances to be achieved at the time of transmission vegetation management work are based upon local conditions, conductor movement, anticipated growth and the expected time frame in which TSGT plans to return for future vegetation management work. These clearances assume that transmission lines and their conductors are operating within their Rating. TSGT has developed a table of vegetation management clearances (Table 3) that establishes the minimum clearance distances to be achieved at the time of vegetation management for the various line voltages and altitudes that TSGT maintains. When trees growing either directly under or adjacent to the line approach the minimum vegetation clearances requiring maintenance specified in Table 2, they are trimmed back to meet the minimum clearance after removal indicated in Table 3. If possible, trees will be cut completely down and removed from the ROW. The landowner is consulted on whether or not to completely cut down or just trim the encroaching tree. In various areas within TSGT's Transmission System the ability to cut down or trim is governed by contracts, ROW easements, or special use permits, especially on government lands.

Table 2: Vegetation Clearance Requiring Management

Line Voltage (kV)	Minimum Clearance (feet between conductor and tree)							
	3000' factor (1.00)	4000' factor (1.02)	5000' factor (1.05)	6000' factor (1.08)	7000' factor (1.11)	8000' factor (1.14)	9000' factor (1.17)	10000' factor (1.20)
34.5	8.50	8.67	8.93	9.18	9.44	9.69	9.95	10.20
69	10.00	10.20	10.50	10.80	11.10	11.40	11.70	12.00
115	10.67	10.88	11.20	11.52	11.84	12.16	12.48	12.80
138	11.33	11.56	11.90	12.24	12.58	12.92	13.26	13.60
230	13.00	13.26	13.65	14.04	14.43	14.82	15.21	15.60
345	15.33	15.64	16.10	16.56	17.02	17.48	17.94	18.40

Distances incorporate IEEE 516-2003 Table 1 and OSHA 29 CFR 1910.269 Table R-10 altitude correction factors.

Table 3: Clearance After Management

Line Voltage (kV)	Minimum Clearance (feet between conductor and tree)							
	3000' factor (1.00)	4000' factor (1.02)	5000' factor (1.05)	6000' factor (1.08)	7000' factor (1.11)	8000' factor (1.14)	9000' factor (1.17)	10000' factor (1.20)
34.5	13.50	13.77	14.18	14.58	14.99	15.39	15.80	15.80
69	15.00	15.30	15.75	16.20	16.65	17.10	17.55	17.55
115	15.67	15.98	16.45	16.92	17.39	17.86	18.33	18.33
138	16.33	16.66	17.15	17.64	18.13	18.62	19.11	19.11
230	18.00	18.36	18.90	19.44	19.98	20.52	21.06	21.06
345	20.33	20.74	21.35	21.96	22.57	23.18	23.79	23.79

Distances allow for conductor movement, MVCD and no less than average vegetation growth for maintenance intervals.

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2.3.2 Minimum Vegetation Clearance Distance (MVCD)

The MVCD is a calculated minimum distance to prevent flash-over between conductors and vegetation that is derived from the Gallet Equations. 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 and transmission outages. [Table 4](#) shows the MVCD for the voltages and altitudes of TSGT applicable transmission lines. If distances between the vegetation and conductor are approaching the MVCD, TSGT will follow the process identified in [section 2.3.3](#) for addressing potentially threatening vegetation conditions.

Table 4: FAC-003-3 Table 2 Minimum Vegetation Clearance Distances (MVCD)

(AC) Nominal System Voltage (KV)	(AC) Maximum System Voltage (kV)	MVCD (feet) 3001 - 4000	MVCD (feet) 4001 - 5000	MVCD (feet) 5001 - 6000	MVCD (feet) 6001 - 7000	MVCD (feet) 7001 - 8000	MVCD (feet) 8001 - 9000	MVCD (feet) 9001 - 10000
345	362	3.67	3.82	3.97	4.12	4.27	4.43	4.58
230	242	3.49	3.63	3.78	3.92	4.07	4.22	4.37
138	145	2.03	2.12	2.21	2.3	2.4	2.49	2.59
115	121	1.68	1.75	1.83	1.91	1.99	2.07	2.16
69	72	0.99	1.03	1.08	1.13	1.18	1.23	1.28

2.3.3 Potentially Threatening Vegetation Conditions

When potentially threatening vegetation conditions are confirmed, notification to TSGT System Operations shall be made without any intentional delay. This confirmation could be in the form of TSGT field personnel who personally identify such a threat in the field. Confirmation could also be made by TSGT field personnel evaluating a situation reported by a landowner or contractor. 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, and delays due to severe weather.

Vegetation-related conditions that warrant immediate communication to TSGT System Operations 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).

The TSGT process to ensure the proper communication between field personnel and TSGT System Operations is contained within TSGT's SOP #11, Reports to the System Operator, maintained and documented by the TSGT System Operations department. The system operator and the field personnel will agree on 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.

2.4 Maintenance Intervals

2.4.1 Vegetation Inspection

TSGT shall inspect 100% of the applicable transmission line miles defined in [section 1.2](#). TSGT will, at a minimum, patrol each transmission line facility either by air (helicopter) or by ground at least once per calendar year and with no more than 18 calendar months between inspections on the same ROW. Routine ground patrols are conducted by TSGT transmission line maintenance personnel who are responsible for the oversight and maintenance of the transmission facilities in their respective areas. Routine aerial (helicopter) patrols are conducted under contract by firms that specialize in this type of work. In both cases, any encroachments, including vegetation, are documented and forwarded to the appropriate line supervisor or line foreman for assessment and resolution.

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When TSGT is prevented from performing a Vegetation Inspection due to a natural disaster, unexpected weather conditions or system emergencies, TSGT will complete the Vegetation Inspection within the expected calendar year or 18 months, whichever is less, plus the time extension that is equivalent to the duration of the time TSGT was prevented from performing the Vegetation Inspection. Regional line superintendents shall be responsible for approving when an extension to the annual patrol is required. The line superintendents will follow-up with the crew supervisor/foreman to ensure the inspection gets completed within the extension. The schedule changes shall be noted in the annual work plan.

TSGT also considers local conditions that may require additional patrols during the year, such as immediate water supply, local annual rainfall, irrigation, native plant species, and other factors that may alter the normal vegetation growing patterns within each corridor. Constraint mitigation measures, as outlined in [section 3.0](#), and limited ROW width may also alter the frequency of inspections. In addition, aerial or ground inspections may be conducted after an interruption occurrence.

All TSGT transmission line maintenance personnel shall document that they have performed the vegetation inspections identified above. This information shall be retained in the TSGT Transmission Line Database and/or hard copy reports electronically filed in the TSGT Document Management System, as per [section 5.0](#).

2.4.2 Vegetation Management

TSGT completes 100% of its annual vegetation work plan for the applicable lines to ensure no vegetation encroachments occur within the MVCD. TSGT generally executes and completes vegetation management work orders within one year, or sooner depending on the action threshold(s) outlined in [section 2.5.1](#). Potentially threatening vegetation conditions are managed within 24 hours of notification, if it can safely be achieved.

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 shall be documented in the annual work plan. Acceptable reasons for modification to the annual work plan may include, but are not limited to:

- Crew or contractor availability and mutual assistance agreements
- Identified unanticipated high priority work
- Rescheduling work between growing seasons
- Change in expected growth or decay rate and other environmental factors
- Weather conditions and ROW accessibility
- Delays in obtaining the required permits or permission from landowners and management agencies
- Land ownership changes and changes in land use by the landowner
- Construction changes within or adjacent to the ROW that might affect the execution of the work
- Circumstances that are beyond TSGT's control

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2.5 Annual Work Plan

2.5.1 Action Thresholds

Annual transmission vegetation management work plans are developed by TSGT. Utilizing data gathered from line inspections, vegetation management work on specific transmission line ROWs are identified, prioritized and scheduled based on the following action thresholds criteria:

- Confirmation of a potentially threatening vegetation condition ([section 2.3.3](#))
- Criticality of the line, based on Major Transfer Path, IROL or other TSGT criteria, [section 1.2](#)
- Proximity to MVCD ([Table 4](#))
- Level of anticipated growth based on tree growth and average mature height ([Table 1](#))
 - Vegetation type, amount, and height
 - Local growing conditions such as water availability (rainfall or irrigation)
- Proximity to minimum vegetation clearances requiring maintenance ([Table 2](#))

2.5.2 Work Schedule and Verifications

The line supervisor or line foreman that receives the reports generated during the routine ground or aerial Vegetation Inspections described above will assess the information contained in the reports and prepare corrective maintenance work orders, or work order tasks within the TSGT Work Management System. The vegetation management methods used, such as manual clearing, or mechanical clearing, or other actions, will be described in the TSGT Vegetation Management Work Plan. The required corrective vegetation management work that needs to be completed will then be scheduled. These plans and work schedules shall take into account the time required to obtain permissions or permits from landowners, land management agencies, or regulatory authorities. It is TSGT's practice to complete required vegetation management work and close the respective corrective maintenance work orders, or work order tasks within the same calendar year that the encroachment was reported. These work orders will remain in effect until the vegetation encroachment is removed. Foremen and superintendents periodically monitor open work orders to confirm they are closed in a timely manner. The same procedure is followed whether TSGT line crews or contractors complete the vegetation management. This process is illustrated in the *TSGT Vegetation Management Scheduling and Quality Inspections Process* flow chart located on TSGT's internal intranet Transmission Maintenance page in the TVMP Related Information section.

Documentation that TSGT has implemented an annual Vegetation Management Work Plan is retained in the TSGT Work Management System and/or the TSGT Document Management System as per [section 5.0](#). All TSGT transmission line maintenance personnel shall document corrective action taken to remain in compliance with the vegetation management clearance distances identified in [Table 2](#), [Table 3](#), and [Table 4](#). This information shall be retained in TSGT's Work Management System and Transmission Line Database.

2.6 New Construction Vegetation Clearing

TSGT secures transmission line and associated access road ROW by obtaining easements/permits from property owners or land management agencies prior to the construction of new transmission lines. It is TSGT's goal to obtain with these easements/permits the rights necessary to cut down, trim and/or otherwise control all woody stem vegetation necessary for the safe reliable construction, operation and maintenance of the transmission line. Initial ROW clearing work is accomplished by contract vegetation management crews either immediately before or during the construction of any new transmission line. The work accomplished by this initial clearing will establish the desired vegetation profile to be maintained by future vegetation maintenance. New construction vegetation clearing will follow the procedures and guidelines outlined in this TVMP.

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3.0 Management Constraint Mitigation

3.1 Mitigation Areas

TSGT has developed corrective actions to achieve sufficient clearances for the protection of the transmission facilities when TSGT identifies locations on the ROW where TSGT is constrained from attaining the clearances in [section 2.3](#). Constraints to performing vegetation maintenance work as planned include, but are not limited to: legal injunctions filed by property owners; the discovery of easement stipulations which limit TSGT's rights; federal, state or local rules and regulations; easements; land owner challenges; and previous TSGT written agreements, as well as special circumstance areas. Locations where vegetation cannot be managed as planned are identified as mitigation areas. These areas shall be included in the mitigation list and be defined by span location, reason for mitigation and mitigation action plan. Mitigation action plans are created specifically for each mitigation area to address unique conditions of the vegetation and its environment. The mitigation list is included as part of the annual plan. The process to address mitigation areas is illustrated in the *TSGT Landowner Refusal Process* located on TSGT's internal intranet Transmission Maintenance page in the TVMP Related Information section.

3.2 Corrective Action

TSGT defines a corrective action as the implementation of a mitigation action plan in order to achieve sufficient clearances for the protection of the transmission facilities. The specific actions taken as corrective actions will be documented and tracked for the mitigation area. Reports on vegetation management and mitigation are continuously available to management for monitoring purposes.

3.2.1 Vegetation Management Constraint

When TSGT identifies locations where performing planned vegetation maintenance work is constrained, but the transmission line is not at potential risk and the work event can be rescheduled, or re-planned using an alternate work methodology or interval, TSGT line crew will coordinate with TSGT Land Rights and take at least one of the following actions to ensure the reliability of the system:

- Work with landowners to purchase trees that are in TSGT ROW. This purchase is done with the understanding that TSGT will completely remove the trees and the landowner will never plant trees in the ROW.
- Work with landowners to allow pruning to a minimum of one and a half year average re-growth.
- Coordinate with local law enforcement agencies.
- Modify the inspection and/or maintenance intervals until mitigation is resolved.

3.2.2 Potential Risk Constraint

When TSGT identifies locations where performing planned vegetation maintenance work is constrained, which potentially leaves the transmission line at risk, TSGT line crew will follow the vegetation management constraint corrective actions indicated in [section 3.2.1](#) and coordinate with TSGT System Operations, as per [section 2.3.3](#), to take at least one of the following additional actions to ensure the reliability of the system:

- Limit the loading on the transmission line
- Take the line out of service

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4.0 Compliance Reporting

TSGT will submit a quarterly report to WECC identifying all Sustained Outages of applicable lines, operated within their Rating and all Rated Electrical Operating Conditions, as determined by TSGT, to have been caused by vegetation. Reports will include, as a minimum, the following:

- 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 TSGT.

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

- Category 1A - Grow-ins: Sustained Outages caused by vegetation growing into applicable lines, that are identified as an element of 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 element of 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.

5.0 Documentation

5.1 File Format and Structure

All test results not stored within the TSGT Line Database will be saved into the TSGT Document Management System using the appropriate filename structure and location. Maintenance documents may be saved in word, excel, **pdf** or other scanning formats. Ensure inspection and vegetation management dates are correct, all appropriate boxes are checked, all required fields are completed and Comments are included, if needed, within the TSGT Line Database prior to closing the maintenance work order.

5.2 Data Retention

Documentation required by FAC-003 will be retained as follows, or as otherwise dictated by current standards:

- 3 months for voice recordings
- 12 months for system operation logs
- 3 years for all other documentation required by FAC-003-3

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6.0 Transitional Equipment

6.1 IROL and Major Transfer Paths

A line operated below 200kV that is newly designated as either an element of an IROL, or an element of a Major Transfer Path will be inspected and have vegetation concerns address by the later of: 1) twelve (12) months after the date it is initially designated as being an element of an IROL or an element of a Major Transfer Path, or 2) January 1 of the planning year when the line is forecast to become an element of an IROL or an element of a Major WECC Transfer Path.

6.2 Discovered Equipment

When line facilities previously unknown to TSGT, or newly identified as regulated, are identified, they are placed into the maintenance schedule and patrolled within six months of discovery.

6.3 Acquired and Transferred Equipment

All transfers of ownership or maintenance responsibilities are governed by approved TSGT legal contracts or agreements. Transfer of ownership and maintenance responsibilities for TSGT member cooperative facilities are coordinated through the TSGT Low Side Transition Team. All acquired line facilities rated at 200kV or above, or are designated elements of an existing IROL or existing Major Transfer Path regardless of voltage, will be inspected and have vegetation concerns addressed within twelve (12) months of the close date of the acquisition agreement.

6.4 Expectations at Time of Acquisition or Transfer

1. Facility has been in service.
2. Facility has been maintained to a different standard than that of TSGT.
3. Maintenance activities will be up to date and to the transferring entities standards.

6.5 Regulatory Reporting and Mitigation

In the event that maintenance records do not provide the needed information, at a minimum last maintenance date and supporting documentation, or it is found that the transferring entity's maintenance activities are not current, TSGT will incorporate the transmission line facility into the existing TSGT Transmission Maintenance priorities and:

1. Schedule and complete vegetation inspection and, as needed, management not to exceed twelve (12) months.
2. File a mitigation plan with the appropriate regulatory agency within six months of transfer, if it is determined that the facility cannot be inspected and managed within twelve (12) months.
3. TSGT shall not assume liability for regulatory fines for the newly acquired facility unless it does not meet the requirements within this section. TSGT's liability for regulatory maintenance requirements will be from time of ownership forward.

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7.0 Maintenance By and For Other Entities

7.1 Contractual Agreements

All jointly-owned and shared maintenance responsibilities are governed by approved TSGT legal contracts or agreements. Most established agreements hold that the maintenance entity will maintain the contractual equipment to their own maintenance standards. Transmission lines may be separated by line segment based on ownership and maintenance responsibilities within a transmission line facility.

7.2 Regulatory Reporting and Mitigation

When not specified by legal contracts or agreements, due to contract origination dates prior to 2007 regulatory requirements, TSGT Transmission Maintenance will meet regulatory requirements by observing and expecting the following.

1. The maintaining entity will report all maintenance activities for regulated facilities to the appropriate owner.
2. The maintaining entity will supply maintenance information to the owning entity, as required by contract. Maintenance entities for TSGT owned facilities that are not obligated by contract to share the required regulatory information and do not respond to TSGT requests for information are expected to report the information directly to the appropriate regulatory agency.
3. The maintaining entity will file all regulatory mitigation reports, as needed, to the appropriate regulatory agency. The maintaining entity will notify the owning entity immediately upon identifying the need and prior to filing the mitigation report.

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8.0 Compliance Map

8.1 FAC-003-3 Supporting Evidence

R1. Major Transfer Path and IROL elements

- [Section 1.2](#) of the *TVMP* defines the TSGT applicable lines.
- The *TSGT FAC-003 Applicable Lines* reflects the lines, including WECC major transfer paths, governed by this *TVMP*.
- The *TSGT Annual Work Plan* provides inspection and management schedules and completion.
- Quarterly vegetation outage reports provide outage listing, even when no outages occur.

R2. All other applicable lines

- [Section 1.2](#) of the *TVMP* defines the TSGT applicable lines.
- The *TSGT FAC-003 Applicable Lines* reflects the lines governed by this *TVMP*.
- The *TSGT Annual Work Plan* provides inspection and management schedules and completion.
- Quarterly vegetation outage reports provide outage listing, even when no outages occur.

R3. Documented maintenance strategy

3.1 Movement of applicable line conductors under Rating and all Rated Electrical Operating Conditions;
3.2 Inter-relationships between vegetation growth rates, control methods, and inspection frequency

- [Section 2.2](#) of the *TVMP* summarizes the TSGT vegetation maintenance strategy.
- [Section 2](#), all sections, of the *TVMP* details the strategy.

R4. Control center notification

- [Section 2.3.3](#) of the *TVMP* summarizes the TSGT procedure for notification to the control center for potentially threatening vegetation conditions.

R5. Constraint mitigation

- [Section 3.0](#) of the *TVMP* summarizes the TSGT mitigation action where vegetation management is constrained.
- [Section 3.2.1](#) and [3.2.2](#) of the *TVMP* provide corrective actions for potentially threatening vegetation conditions.
- The *TSGT Landowner Refusal Process* provides a flowchart for this process.

R6. 100% Vegetation Inspections

- [Section 2.4.1](#) of the *TVMP* defines the vegetation inspection intervals and expected completion.
- The *TSGT Annual Work Plan* records the inspections scheduled and completed.

R7. 100% vegetation management

- [Section 2.4.2](#) of the *TVMP* defines the vegetation management intervals and expected completion.
- The *TSGT Annual Work Plan* records the vegetation work scheduled and completed.

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9.0 Revisions**9.1 Review Cycles and Responsibilities**

It shall be the responsibility of all Transmission field personnel to adhere to the practices as outlined in this TVMP. It shall be the responsibility of the regional line maintenance superintendents, to review and approve the program to ensure maintenance, system reliability, personnel safety and regulatory needs are met in a timely manner. Approved revisions will be posted to the departmental intranet page immediately following agreement and submittal by the three regional superintendents with their managers' approvals. Regional and senior managers shall review and approve the program every calendar year. Revisions of the TVMP will be maintained for a minimum of five calendar years, or as otherwise required by state or federal regulations.

9.2 Revision History

Rev No.	Section	Revision Description	Effective Date
--		Base document in section V of Line Standards manual	05/31/07
--	VIII	Added Acquired Equipment	07/19/08
--		Added Revision Request Form	09/16/08
2.0	V Intro, I, VIII	Replaced Responsibility and Authority with Document Control section. Moved Revision Request Form to this section Revised Vegetation Management Program Added statements to support regulatory requirements	04/30/09
2.1	V	Reorganized section, added IEEE table 5, to better support regulatory audits.	07/23/09
2.2	C B, D	Changed Document Control Retention Period from 3 years to 5 years to match TVMP section and FAC-003-1 requirements. Changed management review description and authorities to follow Joel Bladow's Delegation of Authority for Maintenance Standards. Removed specific names.	02/04/10
2.3	IV.A IV.B,C,D VI, VIII IX, IX.G.	Added six month extension Added clarifying statements. Rewrote Mitigation and Annual Plan Removed specific software references and added reference to SO #3 Changed Document Control section and moved Revision Request Form to external Related Information	03/11/11
3.0	All	Extracted section V (TVMP) and associated information from the Line Standards manual into this separate document Added clarifying statements in response to Forum Peer Review	06/06/11
3.1	8.0 10, 11	Removed Standing Order #3 reference. Rewrote to unify sections within all TM standards.	02/15/12
4.0	all	Reorganize and strengthen information to align with FAC-003-3.	07/01/14