



## **Integrated Vegetation Management on Pipeline Rights-of-Way** **Addendum to Best Management Practices: Integrated Vegetation Management**

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The intent of this document is to serve as an addendum to the *Best Management Practices: Integrated Vegetation Management for Electric Utility Rights-of-Way* published by the International Society of Arboriculture. The aforementioned publication and this addendum are designed to provide managers and field technicians with what industry experts consider to be the most appropriate Integrated Vegetation Management (IVM) techniques that can be utilized on pipeline right-of-way (ROW) projects. It is recommended that all site-specific safety, environmental, and facilities conditions and constraints be evaluated prior to implementing any best management practices (BMPs) described. This publication is not intended to replace the reader's organization policies and procedures nor does it supersede applicable laws and regulations.

### **Introduction**

Pipelines carrying natural gas, oil, water, and other liquids and gases traverse North America above ground and underground along rights-of-way (ROW). Vegetation growing on pipeline ROW can compromise the integrity of pipeline facilities and cause problems with public safety, energy supply, security, emergency service restoration, ROW and facility access, and lines-of-sight (Miller, 2007). Vegetation that is not maintained can also compromise compliance with applicable regulatory requirements. A properly maintained pipeline ROW is typically kept clear of trees and large shrubs that can interfere with above-ground pipelines and underground pipelines via plant root systems. Vegetation on ROW growing near pipelines can be systematically managed to:

1. Facilitate safe, reliable, and cost-efficient service and transport;
2. Facilitate routine ground access to the ROW for inspection, maintenance, and testing of the pipeline;
3. Facilitate aerial patrol of the ROW to identify maintenance needs and encroachment issues;
4. Facilitate compliance with applicable laws and regulations; and
5. Potentially provide natural resource values (e.g., wildlife habitat, grazing, recreation, etc.).

Vegetation on pipeline ROW is most commonly managed by manual and mechanical methods (i.e., mowing, chainsaw use and other physical means of cutting vegetation). Mechanical cutting can be an effective method to initially clear vegetation on ROW, but potential safety, economic, and environmental issues indicate that more progressive vegetation control methods may be necessary to effectively manage pipeline ROW vegetation over the long-term. The use of IVM can reduce maintenance costs and improve access to and security of pipeline ROW. IVM has proven cost-effective in controlling unwanted vegetation in other ROW corridors with similar objectives, such as electric transmission ROW and along roadsides. The potential exists to manage vegetation on pipeline ROW in a similar manner as electric transmission ROW because both experience similar vegetation management challenges (Nowak et al., 2002).



## **Integrated Vegetation Management**

IVM is a system of managing vegetation by implementing different control options, which are based on anticipated effectiveness, environmental impact, site characteristics, economic considerations, and public and worker health and safety. IVM principles and practices can be utilized to 1.) manage vegetation so that it is compatible with the intended use of the ROW and 2.) control vegetation that can present safety and service reliability challenges. The various phases of IVM have been described as follows (ANSI A300 Part 7, 2011 and Miller, 2007):

1. Define and document objectives;
2. Assess field conditions to evaluate the site for planning purpose;
3. Set ecological and economic thresholds for incompatible vegetation that indicate a need for treatment;
4. Prescribe site-specific treatments based on inventory of the site condition and knowledge of the compatible and incompatible organisms;
5. Utilize a diverse array of treatment modes and methods implement IVM; and
6. Monitor treatment effects on target and non-target organisms.

Vegetation is managed to sustainably produce desired conditions (plant community density, structure and composition) and associated values consistent with management objectives. The choice of control methods is based on the environmental impact and the anticipated effectiveness of the control method, along with site characteristics, safety, current land use and other factors (Miller, 2007).

IVM is a process that balances the use of physical (manual and mechanical cutting), chemical (herbicides), cultural (tillage) and biological (allelopathy, herbivory) treatments for managing plant populations to tolerable levels (McLoughlin, 1997). The method used at one point in time can establish the future trajectory of vegetation development on the site, influencing the frequency, extent, and type of future treatment needs. When selecting vegetation control methods, effectiveness should be a dominant factor, but the choice of method can be equally influenced by site characteristics, applicable regulations, environmental effects, cost, and public sentiment. In IVM, no one treatment is consistently utilized; rather, each management decision is made with full consideration of all treatment options (Nowak et al., 2002).

Chemical treatment methods (e.g., herbicides) can be an effective IVM tool for controlling plant populations when used properly (Figure 1). Herbicides are widely recognized as an effective way of directly controlling incompatible plants. In some cases, the use herbicides in a ROW segment may be the only viable IVM prescription, particularly when desired management objectives cannot be achieved over the same ROW segment through utilization of physical, biological, or cultural control methods.

Numerous scientific studies conclude that the use of stable, low-growing, less intrusive plant communities that compete with and resist invasion of incompatible vegetation can be one of the most effective long-term vegetation management tools on overhead electric transmission ROW (Bramble and Byrnes, 1983; Nesmith et al., 2004). Documented benefits of this vegetation management approach include improved cost effectiveness, service reliability, safety, aesthetics, wildlife habitat enhancement, and decreased fire risk. This success can be translated to vegetation management challenges on pipeline ROW.



**Figure 1.** A distribution gas pipeline ROW managed with IVM principles and techniques (ROW was treated with herbicide two years prior).

Utilizing IVM principles and practices to manage vegetation on pipeline ROW can lead to significant cost savings and enhance plant and wildlife habitat conditions on the pipeline ROW. Similar benefits have been realized by electric utilities with power line corridors. In general, IVM has not been widely used on pipeline ROW. Many vegetation management objectives and challenges are similar, regardless of ROW function, and much can be learned by reviewing vegetation control practices in other disciplines and industries (Nowak et al., 2002). Field research on pipeline ROW is valuable to further understand how IVM can be adapted to pipeline vegetation management programs.

## **Reasons and Benefits for Pipeline ROW Vegetation Management**

The following section details the reasons for managing vegetation and the benefits of utilizing IVM principles and practices on pipeline ROW.

### ***Safety and Reliability***

Urban and rural development as well as the natural growth of plants has resulted in encroachments near to or within pipeline ROW. Vegetation and other obstructions may interfere with safe and effective access, inspection, maintenance and operation of pipeline facilities. Pipeline operators may also control vegetation to mitigate potential fire risk and hazards (e.g., near gas and oil wells and



pipelines). To ensure safety and reliability, pipeline operators require direct and immediate access to facilities and buried pipelines in order to conduct testing on the pipeline to monitor its integrity and to perform general maintenance and repairs. In the event of an emergency, a clear ROW is necessary for pipeline operators and emergency response officials. Obstructions on the right of way can prohibit safe and timely access in case of emergency.

Third-party damages are a leading cause of incidents to natural gas pipelines. Third-party incidents can occur when, for example, digging, blasting, boring, excavating or other construction occurs near the pipeline and the buried pipe is accidentally hit. This can cause damage to the underground pipeline, nearby property and even personal injury. It is recommended that any person contact the local utility locating services prior to digging or excavating near underground utilities and have all underground utilities located and marked. A well- managed pipeline ROW helps identify the presence of underground facilities by clearly delineating the presence of the ROW, and improving visibility of markers.

### ***Pipeline Inspection, Maintenance, and Testing***

A clear ROW can make inspection efforts more safe and effective. The U.S. Department of Transportation requires that many pipeline ROW be routinely patrolled<sup>1</sup>. Inspections may identify signs of a leak or damage and spot activities occurring near the pipeline that may threaten its safety or integrity. Excessive vegetation such as trees, brush, landscaping or other obstructions can block the view of and impede access to the pipeline. In addition, tree roots can damage pipeline coating or the pipe itself. Pipeline coating can be an important safety measure as it helps prevent corrosion of the pipeline.

A ROW clear of obstructions is important because it helps identify the location of pipeline facilities to those who are performing construction, inspection, testing or routine maintenance work and for responding to emergencies near the buried pipeline. Pipeline markers, unobstructed by vegetation, placed along a ROW are a visible indicator that an underground pipeline is in the area. Pipeline markers are important for public safety as well. It is a federal crime to willfully deface, damage, remove or destroy any pipeline sign or ROW marker. While the markers are very helpful to indicate the presence of pipelines in the area, they do not show the exact location, depth, or how many pipelines are in the ROW. These pipeline markers can provide valuable information about the type of underground facilities and important contact information.

### ***Aerial Patrol of Pipeline ROW***

In portions of the United States where higher densities of woody vegetation are present, vegetation clearing and maintenance can be performed to allow for and facilitate effective aerial reconnaissance (Figure 2). Dense, low-growing, green vegetation cover is desired to monitor the pipeline ROW from the air to identify below ground leaks. Herbs, grasses, and forbs have smaller, more localized roots as compared to trees having more extensive and established root systems. Smaller, lower-growing plants can experience root death and exhibit plant necrosis sooner and more noticeably than trees as a result of the soil oxygen depletion that occurs with gas pipeline leaks.

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<sup>1</sup> Code of Federal Regulations, Title 49, §192.705

Aerial reconnaissance of the ROW utilizing photo imagery and lasers to capture field information can help the ROW manager to make maintenance decisions. Ground verification of the aerial imagery and data may be required depending upon field conditions and vegetation density on the pipeline ROW. The ROW owner can make more informed decisions with appropriate analytical and delivery tools that can be utilized as part of the long-term management of the pipeline ROW.



**Figure 2.** Aerial reconnaissance of a natural gas pipeline ROW with vegetation impacts caused by pipeline-associated ambient soil temperature increases.

### ***FERC Compliance***

The Federal Energy Regulatory Commission (FERC) has various compliance requirements for pipeline ROW. FERC requirements concerning revegetation and maintenance of the pipeline ROW can be found in “Upland Erosion Control, Revegetation, and Maintenance Plan” (2003). The FERC policy concerning pipeline ROW vegetation states that:

"Routine vegetation maintenance clearing shall not be done more frequently than every three years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be maintained annually in a herbaceous state. In no case shall routine vegetation maintenance occur between April 15 and August 1 of any year."

The intent is to protect wildlife (e.g., nesting birds) and habitat from mechanical vegetation control methods. “Clearing”, as described above, refers to the physical removal of vegetation from the ROW.



Removed vegetation can be detrimental to wildlife, especially ground-nesting birds utilizing the ROW plant communities. IVM can offer alternative control measures that are compliant with FERC constraints and can still be applied between April 15 and August 1 to manage incompatible vegetation on pipeline ROW.

### ***Natural Resources Impacts and Enhancements***

Natural resources typically impacted or enhanced by ROW management activities include 1.) biological resources (e.g., plants and wildlife), 2.) soil and land use resources, 3.) water resources (e.g., wetlands, streams, groundwater), 4.) air resources, and 5.) cultural resources (e.g., archaeological sites). For purposes of this addendum, biological resource impacts and enhancements are covered in more detail.

Impacts to wildlife resources from pipeline ROW activities can result in habitat loss, habitat and population fragmentation, introduction of invasive plant species, wildlife displacement, and disruption of rare, threatened, and endangered species. However, numerous studies have demonstrated that properly managed ROW can provide valuable habitat for many species of wildlife, including game and non-game species, as well as threatened and endangered species. As part of IVM, establishing goals for what type of wildlife or natural community is desired to benefit from ROW management activities is necessary to determine what vegetation control method may best be utilized.

Vegetation within a ROW is typically maintained free of large shrubs and trees and as such, an early successional plant habitat is created. A positive effect of an early successional habitat in the ROW is the potential for an overall increase in plant species diversity. The ROW creates an open space that when surrounded by trees, provides a habitat for meadow-type plants to thrive (Bramble and Byrnes, 1983). Additionally, the creation of early successional plant habitats in a ROW is detrimental to some species and beneficial to others. For example, bird species that nest in brush or grass plant communities facilitated by the Wire Zone-Border Zone method are particularly prevalent on ROW. On the State Game Lands 33 Research and Demonstration Project in central Pennsylvania, the abundance of birds along a transmission ROW was about seven times higher than in the adjacent forest and nearly four times as many birds were observed in the shrubby border zones than in the wire zones (Yahner et al., 2002). With its combination of trees and shrubs, the border zone is important habitat for bird species.

There are many opportunities for pipeline companies to work with public and private organizations to demonstrate that their ROW can be compatible with wildlife enhancement programs. Pipeline companies also have a vested interest in maintaining stable and compatible vegetation on their ROW in order to prevent erosion and cost-effectively manage ROW operations (Nowak et al., 2002). The pipeline industry can work collaboratively with wildlife, land conservation and environmental groups to effectively manage vegetation, adequately protect the environment, and provide multiple land use values on pipeline ROW (Figure 3).

Examples of environmental benefits and impacts associated with vegetation management and wildlife compatibility with ROW and their vegetative communities may be found in the series of symposia proceedings titled “Environmental Concerns in Rights-of-Way Management”.

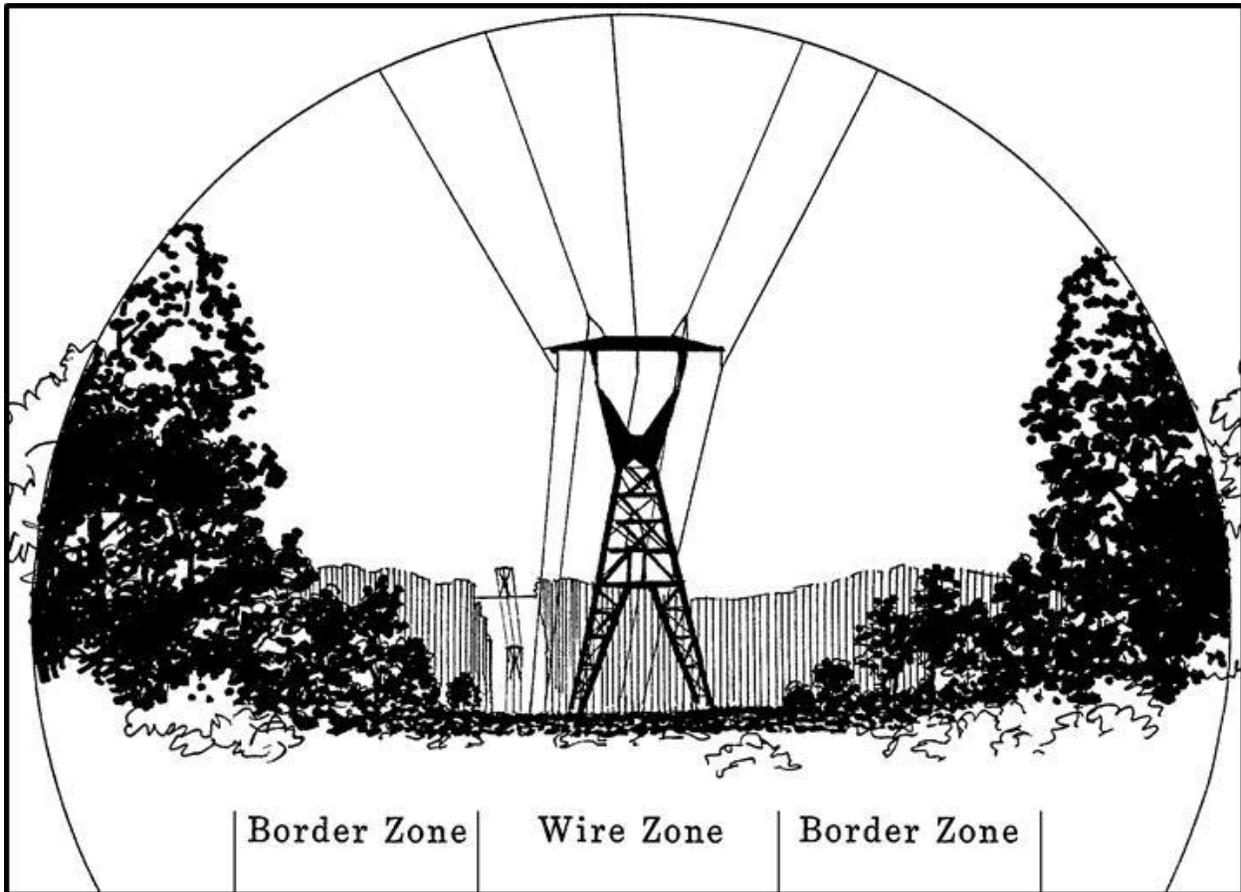


**Figure 3.** Example of multiple land uses on a natural gas pipeline ROW.

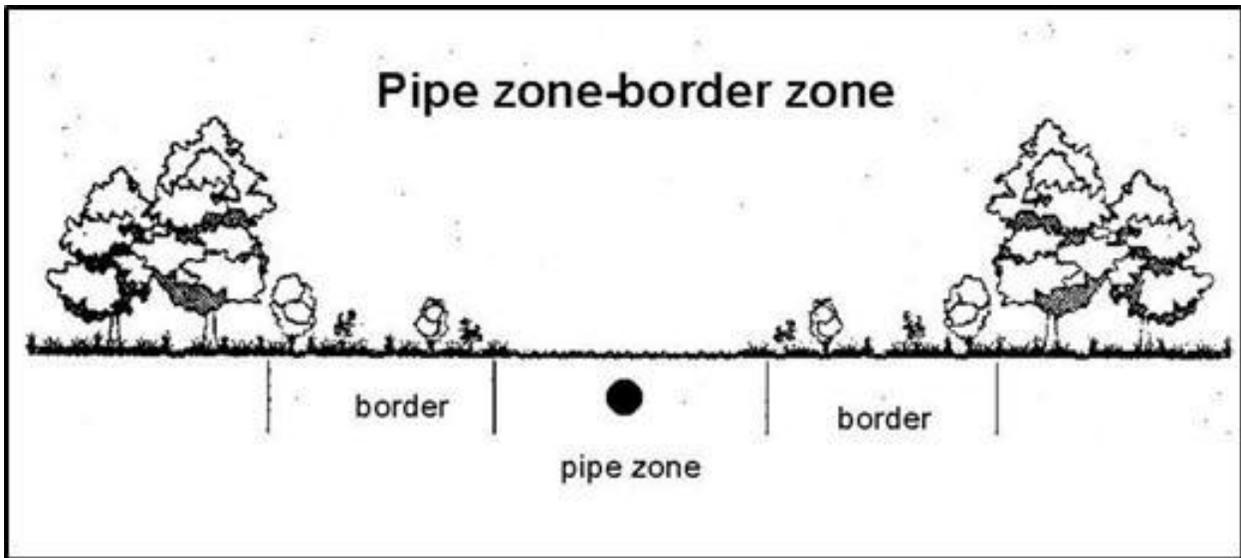
### **Pipe Zone – Border Zone**

Many pipeline ROW are relatively wide which can allow for varied vegetation management techniques and methods. There is the potential for the pipeline zone to be managed one way, while the off-pipeline zones, or border zones, be alternatively managed. Electric transmission ROW and pipeline ROW can both be managed using distinct zones. Electric transmission ROW have been successfully managed using the Wire Zone – Border Zone method (Figure 4). Low-growing vegetation is typically encouraged in the Wire Zone (i.e., under the overhead wires and in the immediate adjacent area). The Border Zone is a transition zone extending toward the edge of the ROW and is managed for taller vegetation. The zone designation used for electric transmission ROW can be applied to pipeline ROW (Figure 5). On pipeline ROW, vegetation can be managed according to where the plant is located on the ROW in relation to the pipeline. Over the pipe zone, forbs and grasses may be encouraged. Taller growing vegetation species with more extensive root systems can be managed on the edges of a pipeline ROW.

A more comprehensive approach utilizing pipeline zone – border zone vegetation management concepts and various vegetation control methods can be realized through utilization of IVM principles and practices (Nowak et al., 2002).



**Figure 4.** Wire Zone-Border Zone concept for integrated vegetation management on electric transmission ROW.



**Figure 5.** Pipe Zone-Border Zone concept for integrated vegetation management on pipeline ROW (Adapted from Yahner et al., 2001).



## Summary

Pipeline and electric utility ROW have many similarities with regard to siting, planning, construction methods, operational procedures, and maintenance practices. Vegetation growing on ROW can interfere with pipeline and electric facility safety and reliability. A commitment to safety and sound economic and environmental management of natural resources indicates that more progressive vegetation control methods may be necessary to effectively manage pipeline ROW vegetation over the long-term.

IVM offers a systematic way of planning and implementing a pipeline vegetation management program. The various phases of IVM have been described as: 1) define and document objectives; 2) assess field conditions to evaluate the site for planning purpose; 3) set ecological and economic thresholds for incompatible vegetation that indicate a need for treatment; 4) prescribe site-specific treatments based on inventory of the site condition and knowledge of the compatible and incompatible organisms; 5) utilize a diverse array of treatment modes and methods implement IVM; and 6) monitor treatment effects on target and non-target organisms.

Managers can select control options that best promote management objectives as well as address safety, environmental, and economic factors. When effectively implemented, IVM is a systematic, preventive strategy that results in site-specific treatments to meet management objectives. A sound program includes documented processes to evaluate results, which should involve both monitoring for quality assurance while work is underway and after it is completed (Miller, 2007).

Utilizing IVM principles and practices to manage vegetation on pipeline ROW can 1) facilitate safe and reliable service and transport; 2) enable routine ground access to the ROW for inspection, maintenance, and testing of the pipeline; 3) facilitate aerial patrol of the ROW enabling inspectors to identify maintenance needs and encroachment concerns; 4) increase regulatory compliance; and 5) potentially provide other natural resource values (e.g., wildlife habitat, multiple land use, recreation, etc.).

Documented benefits of IVM applied on electric transmission ROW include improved safety, cost effectiveness, service reliability, aesthetics, wildlife habitat enhancement, community relations opportunities, and decreased fire risk. There are significant opportunities to expand the application of IVM principles and practices developed for electric transmission ROW to the management of vegetation on pipeline ROW.



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