Application of Tennessee Gas Pipeline Company for a Certificate of Public Convenience and Necessity

FERC Docket No. CP14-___-000

CONNECTICUT EXPANSION PROJECT

Connecticut, Massachusetts and New York

VOLUME II

ENVIRONMENTAL REPORT

APPENDIX R

INVASIVE SPECIES MANAGEMENT PLAN

JULY 2014

Prepared for:

Houston, TX

Invasive Species Management Plan

Connecticut Expansion Project

New York, Massachusetts, and Connecticut

AECOM
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1.0 INTRODUCTION

Tennessee Gas Pipeline Company, L.L.C. ("Tennessee") is filing an application seeking issuance of a certificate of public convenience and necessity from the Federal Energy Regulatory Commission ("Commission" or "FERC") for the construction and operation of the Connecticut Expansion Project (the "Project") in Albany County, New York, Berkshire and Hampden Counties, Massachusetts and Hartford County, Connecticut. The proposed Project involves the construction of two sections of new 36-inch outside diameter ("OD") pipeline looping totaling 1.35 miles in New York ("New York Loop") and 3.81 miles in Massachusetts ("Massachusetts Loop"), and one section of new 24-inch OD pipeline looping totaling 8.10 miles in Massachusetts and Connecticut ("Connecticut Loop") "), and appurtenant facilities, including main line valves ("MLV"), cathodic protection, and internal inspection device launchers and receivers. To the extent that it is practicable, feasible, and in compliance with existing law, Tennessee proposes to locate the pipeline loops within or adjacent to the right-of-way ("ROW") associated with its existing pipelines designated as the 200 and 300 Lines. Tennessee proposes to begin construction of the Project facilities in winter 2015 and to place the facilities in-service by November 2016. Please refer to Resource Report 1 of this Environmental Report ("ER") for a more complete description of the Project components.

The specific objective of the Invasive Species Management Plan ("ISMP") is to control invasive plant species within the disturbed pipeline right-of-way ("ROW") by means of limited herbicide use, by approved licensed companies who specialize in invasive species control, in concert with other control methods such as mechanical removal, mowing and cutting, if necessary. The rationale for controlling invasive species with herbicides is to ensure that the existing ecosystem is not compromised by the colonization and dominance of these species. Invasive species reduce the effectiveness of the ecosystem by competing with existing native species for light, nutrients and water. They can also change habitat structure, adversely affect native seed production and alter hydrologic regimes in wetlands. By implementing this ISMP, Tennessee will effectively maintain the site in its existing condition and allow for natural successional processes to occur with native vegetation.

2.0 EXISTING CONDITIONS

2.1 Pipeline Facilities

The pipeline alignment is characterized by several ecological communities including several types of upland forests, palustrine emergent ("PEM") wetlands, palustrine scrub shrub ("PSS") wetlands, palustrine forest ("PFO") wetlands, cultural grasslands, agricultural land, and developed land. The following subsections provide a brief description of each community.

2.1.1 Appalachian Oak-Hickory Forest

These occur on well-drained sites, usually ridgetops, upper slopes, or south- and west-facing slopes and generally identified north and south of the existing Project ROW. The soils are usually loams or sandy loams. Dominant trees include one or more the following oaks: red oak (*Quercus rubra*), white oak (*Q. alba*), and black oak (*Q. velutina*). Mixed with the oaks, usually at lower densities, are one or more of the following hickories: pignut (*Carya glabra*), shagbark (*C. ovata*), and sweet pignut (*C. ovalis*). Common associates are white ash (*Fraxinus americana*), red maple (*Acer rubrum*), and Eastern hop hornbeam (*Ostrya virginiana*). There is typically a subcanopy of stratum of small trees and tall shrubs including flowering dogwood (*Cornus florida*), witch hazel (*Hamamelis virginiana*), shadbush (*Amelanchier arborea*), and choke cherry (*Prunus virginiana*). Common low shrubs include maple-leaf viburnum (*Viburnum acerifolium*), blueberries (*Vaccinium angustifolium, V. pallidum*), red raspberry (Rubus idaeus), gray dogwood (*Cornus foemina* ssp. *racemosa*), and beaked hazelnut (*Corylus cornuta*). The shrublayer and groundlayer flora may be diverse.

Charateristic groundlayer herbs are wild sarsaparilla (*Aralia mudicaulis*), false Solomon's seal (*Smilacina racemosa*), Pennsylvania sedge (*Carex pensylvanica*), tick-trefoil (*Desmodium glutinosum, D. paniculatum*), black cohosh (*Cimicifuga racemosa*), rattlesnake root (*Prenanthes alba*), white goldenrod (*Solidago bicolor*), and hepatica (*Hepatica americana*).

2.1.2 Successional Northern Hardwoods

Successional northern hardwoods is described as a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed.

Characteristic trees and shrubs include any of the following: quaking aspen (*Populus tremuloides*), bigtooth aspen (*P. grandidentata*), balsam poplar (*P.balsamifera*), paper birch (*Betula papyrifera*), or gray birch (*B. populifolia*), pin cherry (*Prunus pensylvanica*), black cherry (*P. serotina*), red maple, white pine (*Pinus strobus*), with lesser amounts of white ash, green ash (*F. pensylvanica*), and American elm (*Ulmus americana*). Northern indicators include aspens, birches, and pin cherry. This is a broadly defined community and several seral and regional variants are known.

This cover type category covers all non-forested vegetated areas that are not in agricultural production or landscaped. It includes grasslands, successional old fields and shrublands, and maintained utility ROWs. Open lands are typically previously disturbed lands that have been cleared for farming, utility construction, or other developments and then abandoned.

2.1.3 Northern Hardwoods – Hemlock – White Pine Forest

This community type is common within upland areas along the proposed pipeline route in Massachusetts and Connecticut and is characterized as a closed canopy forest dominated by a mix of evergreen and deciduous trees, with sparse shrub and herbaceous layers. Common tree species of this plant community include sugar maple (*Acer saccharum*), Northern red maple, Eastern white pine, black cherry, sweet birch (*Betula lenta*), red oak and hemlock (*Tsuga canadensis*). The shrub layer is usually open, but included scattered clumps of witch-hazel, red elderberry (*Sambucus pubens*), tartarian honeysuckle (*Lonicera tartarica*), multiflora rose (*Rosa multiflora*) and Rhododendron (*Rhododendron canadense*) along the Project alignment. A sparse herbaceous layer included hayscented fern (*Dennstaedtia punctilobula*), false Solomon's seal, starflower (*Trientalis borealis*), partridberry (*Mitchella repens*), poison ivy (*Toxicodendron radicans*), Canada mayflower (*Maianthemum canadense*) and wild sarsaparilla (*Aralia nudicaulis*).

2.1.4 Mixed Oak Forest

The mixed oak forest, found in the Project area, includes a variable mix of oak species that dominates the canopy: black oak, scarlet oak (*Q. coccinea*), red oak, chestnut oak (*Q. prinus*), and white oak. The canopy is somewhat open. An understory of saplings of canopy species, as well as gray birch, aspen, big-toothed aspen, sweet birch, red maple, and chestnut (*Castanea dentata*) is dense in patches. Blueberries, huckleberry (*Gaylussacia baccata*), sweet fern (*Comptonia peregrina*), scrub oak (*Quercus ilicifolia*), and mountain laurel (*Kalmia latifolia*) are also dense in patches. A scattered herbaceous layer includes Pennsylvania sedge, wild sasparilla, poverty grass, pinweed (*Lechea intermedia*), and pale corydalis (*Corydalis sempervirens*).

2.1.5 Successional White Pine Forest

Successional white pine forests are abandoned agricultural land, usually pasture. Sometimes selective logging maintains the pine as a dominant. White pine dominates the forest, with scattered white oak, red oak, and red maple in the canopy. The shrub layer is variable in density, from sparse to thick: Elderberry (*Sambucus canadensis*), black cherry, maple-leaved viburnum, and often non-native species such as buckthorn (*Rhamnus frangula*), honeysuckle (*Lonicera morrowii*), or/and multiflora rose. A variety of

blackberry vines (often forming thickets), and poison ivy often covers the ground near openings or in formerly open disturbed areas. Low bush blueberries form patches, mixed with black huckleberry exist on sites with less disturbed soils. The herbaceous layer is variable; large patches of Canada mayflower and starflower with clubmosses (*Lycopodium obscurum* and related species) are particularly common on formerly plowed soil. Bracken fern (*Pteridium aquilinum*) is often common. Partridgeberry, fringed polygala (*Polygala uniflora*), and pink lady slipper (*Cypripedium acaule*) grow in many longer established sites.

2.1.6 Palustrine Emergent Wetlands

Emergent wetlands are non-tidal wetlands characterized by erect, rooted, herbaceous hydrophytes. Emergent wetlands are generally dominated by perennial plants and maintain the same appearance through the years. Plant species commonly found in PEM wetlands along the Project alignment included soft rush (*Juncus effusus*), broad-leaved cattail (*Typha latifolia*), purple loosestrife (*Lythrum salicaria*), woolgrass (*Scirpus cyperinus*), lurid sedge (*Carex lurida*), sensitive fern (*Onoclea sensibilis*), spotted touch-me-not (*Impatiens capensis*), skunk cabbage (*Symplocarpus foetidus*), reed canary grass (*Phalaris arundinacea*) and blue flag (*Iris versicolor*).

2.1.7 Palustrine Scrub Shrub Wetlands

Scrub-shrub wetland types may represent a successional stage leading to a forested wetland and include shrubs, young trees, and trees or shrubs that are small and/or stunted due to environmental conditions. Shrub swamps are widespread, highly variable communities with shrub-dominated wetlands that occur on mineral or mucky mineral soils that are either seasonally or temporarily flooded. They are typically found in flat areas in which the water table is at or above the soil surface for most of the year. Shrub swamps are generally found on the transition zone of emergent and forested wetland areas that have been previously disturbed by vegetation control practices or past land use patterns. Common wetland shrubs observed in the Project area include meadowsweet (*Spirea latifolia*), willow (*Salix* spp), silky dogwood (*Cornus amomum*), maleberry (*Lyonia ligustrina*), cinnamon fern (*Osmunda cinnamomea*), soft rush (*Juncus effusus*), sensitive fern (*Onoclea sensibilis*), and false hellebore (*Veratrum viride*)

2.1.8 Palustrine Forested Wetland

Dominant species within these wetlands included red maple, American elm *(Ulmus americana)*, Eastern white pine and American hornbeam *(Carpinus caroliniana)* in the canopy and subcanopy layers, with silky dogwood *(Cornus amomum)* and northern arrowwood (*Viburnum dentatum*) in the understory. Dominant plants in the herbaceous layer included sensitive fern, cinnamon fern (*Osmunda cinnamomea*), Canada mayflower, spotted touch-me-not and poison ivy.

2.1.9 Cultural Grasslands

Cultural grassland is a human created and maintained open community dominated by grasses, normally maintained by mowing, and primarily of conservation interest for the grassland bird community. A grassland community generally occurs on sand or other droughty, low nutrient soils. Surroundings in many areas include Pitch pine/Scrub oak communities. Many small airports with surrounding grasslands were built on sand plains. Pastures and hayfields occur in all areas, and surroundings reflect the regional variations. Airports, cemeteries, pastures, and hayfields provide different habitats, and support different species of plants and animals. Grasslands at many smaller airports are dominated by graminoids, usually little blue stem grass (*Schizachyrium scoparium*), Pennsylvania sedge (*Carex pensylvanica*), and poverty grass (*Danthonia spicata*), and many non-native species. Some cultural grasslands do have some mix of herbaceous species, such as goldenrods (*Solidago* and *Euthamia* spp.) and milk weeds including butterfly weed (*Asclepias* spp. and *A. tuberosa*).

2.1.10 Agricultural Land

The agricultural cover type includes land used for grazing or raising crops. Approximately 2.23-miles of the Project alignment crosses through agricultural land. The remaining agricultural terrain crossed by the Project functions as grazing land for cattle.

2.1.11 Developed Land

Developed lands comprise approximately 0.16-miles of the Project area and include residential areas, industrial and commercial lands. These lands are typically devoid of undisturbed vegetation, and are more commonly defined by mowed lawns, other landscaped areas, and impervious surfaces.

2.2 Invasive Species

Non-native invasive plant species are present within the existing Tennessee ROW and, to a lesser extent, within the adjacent uplands and wetlands to be used for temporary workspace. Invasive species colonization is more prevalent within the ROW due to the early-successional habitat created through ROW management practices, the extent of edge habitat and disturbance by unauthorized all-terrain vehicle use. Although certain species may be abundant in localized areas within the ROW, they do not dominate the ROW to an overall extent that precludes native species. The invasive plant species that have been documented as being present within the ROW and potentially posing a threat to native plant communities are identified below.

2.2.1 Invasive Species Present

2.2.1.1 Purple Loosestrife

Purple loosestrife is a species that spreads rapidly in all forms of emergent and saturated wetland systems. It is tolerant of a variety of different growing conditions, and each plant is capable of producing up to 2.5 million seeds annually. Loosestrife forms large dense stands within wetlands that limit plant diversity, reduce wildlife habitat quality and can adversely affect water quality.

2.2.1.2 Common Reed

Common reed (*Phragmites austalis*) has been observed in several wetlands along the existing ROW in all three loops. The propagation of common reed usually occurs at a relatively high rate through underground rhizomes or wind-dispersed seeds. The establishment of common reed in the existing wetlands and proposed restoration areas would result in a lower diversity of aquatic vegetation as common reed out-competes other species.

2.2.1.3 Reed Canary Grass

Reed canary grass is a tall, perennial grass that commonly forms extensive single-species stands along the margins of lakes, streams, and wet open areas. This species can form huge colonies and overwhelm wetland systems, limiting plant diversity and reducing habitat quality. The species flourishes in disturbed areas, and can be found in the majority of the PEM wetland communities within successional and agricultural areas of the existing ROW in all three loops.

2.2.1.4 Multiflora Rose

Multiflora rose is an extremely aggressive, fast propagating shrub that out-competes native vegetation by forming dense thickets. This species is present within uplands along the majority of the loop segments. It has not created significant thickets across the ROW, but conditions are favorable for expansion of the population should no management be conducted.

3.0 INVASIVE SPECIES MANAGEMENT

3.1 General Management Activities

Herbicides will be applied according to manufacturers' printed recommendations and in accordance with Federal and state regulations governing herbicide application. Table 3.3-1 provides a matrix of invasive species identified within the ROW to date as well as the recommended herbicide per the Connecticut Invasive Plant Working Group *Invasive Plant Management Guide* (2001). The following herbicides are being considered for use:

1) **Glyphosate (Roundup / Rodeo)** – applied to foliage for control of invasive herbaceous (including grasses) and woody plants; also used as a treatment on cut stumps to prevent re-sprouting. Because glyphosate is non-selective, selective application methods and seasonal timing will be used to prevent impacts on non-target species.

2) **Triclopyr (Garlon)** – applied to foliage for control of invasive, broadleaf herbaceous and woody plants; also used as a treatment on cut stumps to prevent re-sprouting, or as a basal bark application to kill woody plants.

3.2 Application Considerations

Per the *Invasive Plant Management Guide* (2001), use of a systemic herbicide is often necessary to achieve adequate control of invasive plants. Systemic herbicides absorb into the plant foliage and/or stems, then translocate (move) and accumulate to toxic levels in the growing points or roots. Following foliar applications in late summer or fall (prior to leaf color change), systemic herbicides will accumulate in storage tissues below ground. In this way, the herbicide is more likely to prevent re-growth the following year.

Herbicides may be applied by the following methods to control invasive plants:

1) Post-emergence (Foliar) Applications
    a. Spray properly diluted herbicide (in water) onto plant foliage.
    b. Wipe herbicide (more concentrated form) onto leaves with wiper applicator.
2) Cut Stump Treatments
    a. Paint concentrated form of herbicide on freshly cut stumps of woody plants.
3) Application equipment
    a. hand-held sprayers, backpack sprayers, paint brush or sprayer for stump and bark treatments

Addition of a non-ionic surfactant [@ 0.5 fluid ounce (1 tablespoon) per gallon of spray] will improve coverage of spray droplets on treated leaves and enhance absorption of the herbicide into the plant. Surfactants (sold under many trade names) can be purchased at fertilizer and pesticide dealerships. Some herbicide formulations already contain a surfactant.

In accordance with FERC's Upland Erosion Control, Revegetation, and Maintenance Plan (Section V.D.) no herbicide application will occur in or within 100 feet of any watercourses without prior authorization by all applicable land management or state agencies.

3.3 Species-Specific Management

3.3.1 Purple Loosestrife

To the extent practicable, loosestrife shall be removed by hand and disposed of off-site. Should significant populations of loosestrife become established, alternative control methods such as limited herbicide application (Rodeo – within wetland areas) shall be considered.

3.3.2 Common Reed

Early control of common reed will be conducted via hand removal or cutting. Stems will be cut below the lowest leaf, leaving a 6-inch or shorter stump, and cut or pulled material we be disposed of off site. Herbicide application treatment (Rodeo – within wetland areas) will be reserved for dense stands where hand removal or cutting is not effective.

3.3.3 Reed Canary Grass

Small populations of reed canary grass will be controlled by hand removal. Isolated plants or small patches can successfully be removed by digging out and removing the entire root mass. Applications of Rodeo will be applied if populations continue to thrive to prevent the development of large infestations.

3.3.4 Multiflora Rose

A combination of mechanical removal and herbicide applications are the preferred management method for this species. All plants will be removed and disposed of off site. Additional control measure will include herbicide applications with a foliar glyphosate treatment. Subsequent management will likely be conducted through regular mowing to prevent seedling establishment.

TABLE 3.3-1

CONNECTICUT EXPANSION PROJECT INVASIVE SPECIES MANAGEMENT HERBICIDE APPLICATION CHART

Invasive Species	Herbicide	Application Rate	Application Method	Frequency / Time of Year
Purple Loosestrife (*Lythrum salicaria*)	Glyphosate (Rodeo only)	Foliar – 1-2% solution Cut Stump – 20%	Foliar and/or Cut Stump	Foliar – Late August Cut Stump – Early Fall
Common Reed (*Phragmites australis)*	Glyphosate (Rodeo only)	25% solution	Cut Stump	September
Reed Canary Grass (*Phalaris arundinacea*)	Glyphosate (Rodeo only)	2%	Foliar	Mid-June to late July
Multiflora Rose (*Rosa multiflora*)	Glyphosate / Triclopyr	1-2% solution	Foliar and/or Cut Stump	Throughout growing season

3.4 Timing Considerations

Construction of the Project facilities is currently scheduled to commence in winter 2015, with an in-service date of November 1, 2016. Through construction activities including vegetation clearing and grading, the majority of the invasive species present within the ROW and temporary workspace shall be removed. Upon completion of construction, the ROW will be reseeded and stabilized in accordance with the FERC's Upland Erosion Control, Revegetation, and Maintenance Plan and Wetland and Waterbody Construction and Mitigation Procedures. Tennessee anticipates conducting limited mechanical treatment of invasive species in fall 2016 and will focus on herbicide applications to prevent colonization of the ROW by invasive species.

3.5 Yearly Monitoring and Herbicide Reapplication

Monitoring will be conducted on a yearly basis up to five years post-construction as stipulated by regulatory agencies. During the first five years following construction, invasive species monitoring will occur at least annually and possibly more frequently during the growing season, as recommended by the qualified contractor hired by Tennessee to conduct invasive species control activities. These surveys will be performed during the first five years to determine growth by re-sprouting plants or re-colonization. Treatment and retreatment will be conducted accordingly, with timing to be determined by Tennessee and its qualified contractor. After the fifth year of monitoring, annual surveys may continue if invasive continue to present a significant threat to re-establishment of native vegetation, as determined by appropriate regulatory agencies. Herbicide applications will be managed on an as-needed basis, and eradication efforts will be incorporated into the current ROW mechanical mowing maintenance plan. Please refer to Table 3.5-1 for a detailed schedule for management activities.

TABLE 3.5-1
CONNECTICUT EXPANSION PROJECT
INVASIVE SPECIES MANAGEMENT PLAN SCHEDULE

Month	Application/Removal Method	Comments
2016		
May	Foliar Herbicide	As necessary to control invasives
September	Foliar Herbicide /Manual	As necessary to control invasives
	Corridor monitoring	Conducted on a yearly basis
	ROW mowing	Conducted on a five year basis
2017		
May	Foliar Herbicide	As necessary to control invasives
September	Foliar Herbicide /Manual	As necessary to control invasives
	Corridor monitoring	Conducted on a yearly basis
2018		
May	Foliar Herbicide	As necessary to control invasives
September	Foliar Herbicide /Manual	As necessary to control invasives
	Corridor monitoring	Conducted on a yearly basis
2019		
May	Foliar Herbicide	As necessary to control invasives
September	Foliar Herbicide /Manual	As necessary to control invasives
	Corridor monitoring	Conducted on a yearly basis
2020		
	Corridor monitoring	Conducted on a yearly basis
2021		
	Corridor monitoring	Conducted on a yearly basis

	ROW mowing	Conducted on a five year basis
2026		
	Corridor monitoring	Conducted on a yearly basis
	ROW mowing	Conducted on a five year basis

4.0 SUMMARY/CONCLUSIONS

Tennessee anticipates conducting the invasive species management within the Projects ROW in a manner that is consistent with the objective of controlling invasive species such that they do not pose a threat to the native ecosystems. Based on the results of the field surveys conducted to support the Project, invasive species are present within both wetland and upland portions of the ROW. The proposed management activities within this plan will reduce the existing populations of invasive species while promoting the establishment of native plant populations.

APPENDIX A

INVASIVE SPECIES FACT SHEETS

Department of Environmental Protection
Environmental and Geographic Information Center
79 Elm St., Hartford, CT 06106 (860) 424-3540

Invasive Plant Information Sheet

Purple Loosestrife Lythrum salicaria Loosestrife Family (Lythraceae)

Ecological Impact: Purple loosestrife is a rapidly spreading herb that forms dense stands in wetlands, especially those that have been disturbed by draining, drawdown, bulldozing, siltation, shoreline manipulation, cattle trampling, or dredging. Exposed soil provides ideal conditions for seed germination. A few pioneering plants produce a large seed bank in the soil. Mature individuals can produce up to two to three million seeds per year. Seeds are mainly wind-dispersed, but can be transported on the feet of waterfowl or by other wetland animals. When growing conditions are optimal, seeds germinate in high densities and suppress the growth of native seedlings. The plants also reproduce vegetatively from underground stems. Purple loosestrife displaces native vegetation and can overrun wetlands thousands of acres in size. The buildup of debris around the roots nearly eliminates shallow water habitat, and enables the plants to colonize deeper waters where it forms dense stands that shade out other emergents. Explosive growth of purple loosestrife leads to a loss of plant diversity, which, in turn, leads to a loss of wildlife diversity. The plants produce abundant nectar for insect pollinators, but are otherwise of little value for wildlife.

Control Methods: The most effective control method for Purple loosestrife is to prevent establishment by annually monitoring for and removing isolated plants. To control established stands, managers should first consider the size of the population. Small populations up to three acres in size can be eradicated by hand pulling and/or herbicide treatment. Large populations covering more than three acres are difficult or impossible to eradicate. The most effective control method for large infestations is biological. However, large stands can be contained by hand pulling new plants along the periphery or treating stray plants with herbicide.

Mechanical Control: Small populations and isolated plants can be hand pulled or removed with a shovel before seed set (before August). After flowering, this method should be avoided so as not to scatter seeds. Be sure to remove the entire plant including all roots, since new plants can sprout from root fragments. Caution need be taken when removing plants, since soil disturbance encourages seedling establishment. Pulled plants should be bagged at the site so that fragments are not dropped when leaving the area. Removed plants should be burned. Follow-up treatments are recommended for at least three years to remove new plants that sprout from seeds persisting

in the soil. After working in infested areas, rinse all equipment and footwear and change clothing before moving to uninfested sites.

Chemical Control: Herbicides can be applied as a foliar spray or as cut stump treatments.
1) Foliar Spray: This method is effective throughout the growing season, but is best done after peak bloom, usually in late August. At this time plants are easily seen and less likely to be overlooked. Spray a 1-2% solution of glyphosate (RodeoTM) and water to no more than 25-50% of the plantÕs foliage. This will help prevent overspraying and protect adjacent native vegetation. Glyphosate is a non-selective herbicide that will kill all vegetation. Follow-up treatments may be needed for at least three years.
2) Cut Stump Treatment: This method is most effective on larger plants in small populations. It is best done in late summer or early fall, when plants are translocating nutrients to the roots. Cut stems about 6 inches from the ground and treat cut surfaces with a 20% solution of glyphosate (RodeoTM) and water. RoundupTM should not be used as it is not approved for use in wetlands. Keep in mind that a DEP permit is required for herbicide use near water. Apply the herbicide with a sponge or paint brush or drip onto the cut surface. To ensure uptake before the plant seals off the cut, apply herbicide immediately after cutting, within 5-15 minutes. Cut stems should be bagged and removed from the site. Follow-up treatments may be needed for at least three years.

Biological Control: This method provides the most effective long-term control of large populations. Biocontrol will not eradicate Purple loosestrife, but can significantly reduce population size and keep it in check. Four insect species from Europe have been approved by the U.S. Department of Agriculture as biological control agents. These include a root-mining weevil (Hylobius transversovittatus), two leaf-eating beetles (Galerucella calmariensis and Galerucella pusilla), and one flower-feeding weevil (Nanophyes marmoratus). Most of the insects depend exclusively on Purple loosestrife and will not threaten native plants. However, some beetle cross-over to native loosestrife has been observed.

October 1999

Department of Environmental Protection
Environmental and Geographic Information Center
79 Elm St., Hartford, CT 06106 (860) 424-3540

Invasive Plant Information Sheet


Common Reed Phragmites australis Grass Family (Poaceae/Gramineae)

Ecological Impact: Common reed is a rapidly growing wetland grass that thrives along freshwater and brackish marshes, riverbanks, and lakeshores. It is particularly prevalent in disturbed or polluted soils along roadsides and in ditches and dredged areas. In undisturbed sites, it can be non-invasive. Common reed quickly establishes and displaces native vegetation. Dense stands provide cover and nesting sites for marsh wrens, swamp sparrows, and red-winged blackbirds, but deter short-grass nesters like willet and seaside sparrow, a species of special concern in Connecticut. Standing dead stems that persist through the winter create a fire hazard.

Control Methods: The most effective control method for Common reed is to prevent establishment by minimizing land disturbance and water pollution. Land management practices that guard against erosion, sedimentation, fluctuating water levels, and nutrient loading in wetlands offer the best long-term protection. Once established, Common reed is very difficult to eradicate. In coastal marshes, reintroducing tidal flow can limit growth, as the species is sensitive to salt levels. Otherwise, control of established stands is possible using a combination of cutting or burning and herbicide treatment.

Mechanical Control: Small, newly-established populations can be hand cut to remove above-ground stems. Digging up plants is labor intensive and not recommended since digging tends to spread rhizome fragments which generate new shoots. Cutting greatly reduces rhizome reserves. Large stands can be mowed or controlled with prescribed burns. A follow-up treatment is needed the second year to control resprouts. Afterwards, cutting or burning should be repeated every three to five years. Burns are best conducted in the winter when standing dead stems provide abundant fuel.

Chemical Control: This method is most effective if done in early fall when plants are translocating nutrients to the rhizomes. Cut stems about two inches above ground level and immediately pour a 25% solution of glyphosate (RodeoTM) and water into the hollow stems. RoundupTM should not be

used as it is not approved for use in wetlands. Keep in mind that a DEP permit is required for herbicide use near water. Glyphosate is a non-selective herbicide that will kill all vegetation. By pouring RodeoTM directly into cut stems, the herbicide is contained and damage to native plants is prevented. Stem cuttings with attached plumes (seed heads) should be bagged and removed from the site. This will help prevent the spread of seeds. Cuttings can be burned or composted, as composting temperatures will kill the seeds. A follow-up treatment is generally needed at the end of the second growing season to control resprouts.

Biological Control: Currently, there are no known biological control methods. Two insect pests, a lepidopterous stem borer (Rhizedra lutosa) and a chloropid (Lipara similis), have shown significant impacts in some research sites. Continued research is needed to determine whether an effective biocontrol program is possible.

October 1999

USDA NRCS
United States Department of Agriculture
Natural Resources Conservation Service

Plant Fact Sheet

REED CANARYGRASS

Phalaris arundinacea L.

Plant Symbol = PHAR3

Contributed by: USDA NRCS Plant Materials Program

Robert H. Mohlenbrock
USDA NRCS 1991
Southern Wetland Flora
@ USDA NRCS PLANTS

Uses

Erosion control: The extensive, rhizomatous root system and dense growth of reed canarygrass provide excellent erosion control, especially along stream banks, shorelines and waterways. Reed canarygrass invades wet areas so its use along ditches, canals and drains can create maintenance problems; it can also be troublesome in wetland habitats.

Filter fields: Reed canarygrass is a heavy user of fertilizer and actively grows throughout a long season. Because of this and its excellent adaptation to wet sites, it is well suited for use in seeding filter fields which collect wastewater from food processing industries, livestock operations, and sewage treatment plants. Cutting and removal of biomass is required for good nutrient uptake performance, but a 6 to 8 inch cut height is recommended for rapid regrowth under these conditions. Any forage produced can be used for livestock feed.

Forage: Reed canarygrass is primarily adapted for permanent hay or pasture on sites too wet for good performance of other forage plants. The forage should be grazed or mowed prior to heading as both quality and palatability decline rapidly after heading. A common mistake is to use reed canarygrass on wet sites where timely harvest is not possible.

Wildlife: This grass provides excellent nesting and escape cover and the shattered seeds are readily eaten by many species of birds.

Status

Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g. threatened or endangered species, state noxious status, and wetland indicator values).

Weediness

This plant may become weedy or invasive in some regions or habitats and may displace desirable vegetation if not properly managed. Please consult with your local NRCS Field Office, Cooperative Extension Service office, or state natural resource or agriculture department regarding its status and use. Weed information is also available from the PLANTS Web site at plants.usda.gov.

Description

Phalaris arundinacea L., reed canarygrass, is a vigorous, productive, long-lived, perennial, sod-forming grass. It is a widespread species native to North America, Europe, and Asia. The numerous broad, moderately harsh, erect leaves are dominantly basal. The coarse, erect stems may reach a height of 6 to 8 feet. Seed is borne in an open panicle which ripens from the top down and shatters readily as it matures. The seed has a short storage life, up to 5 years, and should be checked for germination within 6 months of its use. Reed canarygrass has excellent frost tolerance and is well suited to wet soils that are poorly drained or subject to flooding. It also has good drought tolerance. Growth begins in early spring and continues through the growing season. Regrowth following mowing or grazing is rapid on fertile sites. Forage quality is good prior to heading but then declines rapidly.

Adaptation and Distribution
Reed canarygrass is adapted to soils too wet for bromegrass, fescue, and orchardgrass. It is very cold tolerant and will withstand temperatures well below -30 °F. It is moderately drought tolerant but requires 18 inches annual precipitation or irrigation for good performance. It is adapted to a wide range of soil conditions but its major use is on poorly drained soils or those subject to inundation. Once established, it will withstand continuous inundation for 60 to 70 days. It does well on soils that range from moderately acidic to weakly saline-alkaline. It will tolerate saltier soils with frequent irrigation or natural flooding.

Reed canarygrass is distributed throughout the west, north, and northeastern United States. For a current distribution map, please consult the Plant Profile page for this species on the PLANTS Website.

Establishment
A firm, moist, clean seedbed is needed for good emergence. Old fields or meadows should be cropped to annual crops for 1 to 2 years to eliminate perennial weeds, grasses and sedges before seeding reed canarygrass. The seed germinates readily but is somewhat slow to establish. Seed in pure stands at a rate of 5 to 7 pounds per acre. Seeding should be done in late fall or early spring. Plant shallow, no deeper than 1/2 inch. If necessary, irrigate to maintain surface moisture until plants are well established.

Management
New seedings should not be grazed until fully established. It is best to harvest for hay one to two times before grazing. To maintain plant vigor and promote rapid regrowth, leave a stubble of 6 inches after mowing or grazing. Start spring grazing after plants reach a height of 10 to 12 inches. Harvest hay when the first seedheads appear. Reed canarygrass will persist under close, frequent use but yield will be greatly reduced. Its persistence under heavy use does make it well suited for calving, lambing, holding areas or other special-use pastures.

To maintain good yields an annual application of nitrogen will be required on most sites.

Pests and Potential Problems
The leaf disease *Helminthosporium giganteum* sometimes attacks reed canarygrass and work in Pennsylvania led to the discovery of the disease tawny blotch (*Stagonospora foliicola*) on this plant.

Cultivars, Improved, and Selected Materials (and area of origin)
Improved cultivars and places of development are 'Castor', 'Grove', 'Rival' (Canada) and 'Ioreed', 'Palaton', 'R.P. 200', 'Vantage', 'Venture' (Iowa). 'Palaton', 'Rival', and 'Venture' are low alkaloid-containing cultivars and are greatly preferred for all uses in the Northeast. Common types of reed canarygrass are available from most commercial sources.

Control
Please contact your local agricultural extension specialist or county weed specialist to learn what works best in your area and how to use it safely. Always read label and safety instructions for each control method. Trade names and control measures appear in this document only to provide specific information. USDA, NRCS does not guarantee or warranty the products and control methods named, and other products may be equally effective.

Prepared By & Species Coordinator:
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For more information about this and other plants, please contact your local NRCS field office or Conservation District, and visit the PLANTS Web site<http://plants.usda.gov> or the Plant Materials Program Web site <http://Plant-Materials.nrcs.usda.gov>

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Invasive Plant Information Sheet


Multiflora Rose Rosa multiflora Rose Family (Rosaceae)
Ecological

Ecological Impact: Multiflora rose is an extremely prolific shrub that forms dense, impenetrable thickets which crowd and shade out native species. Individual plants can produce up to 500,000 seeds per year, many of which germinate near the parent. Seeds remain viable in the soil for up to 20 years. Fruits are sought after by birds and mammals, which subsequently disperse the seeds. The shrubs are highly competitive for soil nutrients and can lower crop yields in adjacent fields.

Control Methods: The most effective control method for Multiflora rose is to prevent establishment by annually monitoring for and removing small plants. Repeated cutting and/or mowing over several consecutive years will reduce plant vigor and help prevent spread. However, herbicide use in combination with cutting may be more effective for larger plants.

Mechanical Control: Small, scattered plants can be removed with a shovel, weed wrench, or grubbing hoe. Be sure to remove the entire plant, including all roots, since new plants can sprout from root fragments. Root sprouts resemble seedlings, but are attached to a lateral root and are nearly impossible to pull up. Large patches of plants can be mowed or cut three to six times a growing season for two to four years. Mowing will prevent seedling establishment and is particularly effective where grass cover is dense. Large plants can be top cut with hedge cutters, then mowed annually. Hand cutting large clumps is difficult and time consuming. As an alternative, heavy equipment like a bulldozer can be used to knock down clumps, but further control is necessary due to resprouting and seed germination on disturbed soil. In high quality natural areas, hand cutting is preferred to mowing or bulldozing to minimize habitat disturbance.

Chemical Control: Herbicides can be applied broad scale as a foliar spray, or to select individuals as cut stump treatments. Foliar sprays are highly effective, but should be used only where contact with nearby native vegetation can be prevented.

1) Foliar Sprays: This method can be used throughout the growing season, but results will not be

fully seen until the following spring. Spray a 1-2% v/v solution of glyphosate (e.g., RoundupTM or RodeoTM) or a 0.5% v/v solution of glyphosate plus a surfactant. If plants are in or near wetlands, only RodeoTM should be used. Glyphosate is a non-selective herbicide that will kill all vegetation. Managers should be cautious not to spray so heavily that herbicide drips off the leaves. Other foliar sprays found to be effective include water-soluble triclopyr (Garlon 3ATM) and dicamba (BanvelTM), both specific for broadleaf plants, and fosamine (KreniteTM), a bud inhibitor for woody species. Dicamba is most effective if used when plants are flowering. Fosamine is effective throughout the growing season.

2) Cut Stump Treatment: This method can be used throughout the growing season or during dormancy. Fall application is recommended since, at this time, plants are translocating nutrients to the roots. To ensure uptake of the herbicide before the plant seals off the cut, apply immediately after cutting, within 5-15 minutes. Use a solution of water-soluble triclopyr (Garlon 3ATM) and apply with a hand-held sprayer.

Biological Control: Currently, there are no known biological control methods. A native pathogen which causes rose-rosette disease, and a seed-infesting wasp (European rose chalicid) are being investigated as potential control agents.

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