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Topical Report

Pipeline Corridors through Wetlands — Impacts on Plant Communities: Cassadaga Creek Tributary Crossing, Gerry Township, Chautauqua County, New York

Prepared by:
Center for Environmental Restoration Systems
Energy Systems Division
Argonne National Laboratory

Gas Research Institute

Environment and Safety Research Group
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PIPELINE CORRIDORS THROUGH WETLANDS — IMPACTS ON PLANT COMMUNITIES: CASSADAGA CREEK TRIBUTARY CROSSING, GERRY TOWNSHIP, CHAUTAUQUA COUNTY, NEW YORK

TOPICAL REPORT

(August 1992-November 1993)

Prepared by

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For

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16. Abstract (Limit 200 words)

The goal of the Gas Research Institute Wetland Corridors Program is to document impacts of existing pipelines on the wetlands they traverse. To accomplish this goal, 12 existing wetland crossings were surveyed. These sites varied in elapsed time since pipeline construction, wetland type, pipeline installation techniques, and right-of-way (ROW) management practices. This report presents the results of a survey conducted over the period of August 3-4, 1992, at the Cassadaga wetlands crossing in Gerry Township, Chautauqua County, New York. The pipeline at this site was installed during February and March 1981. After completion of pipeline installation, the ROW was fertilized, mulched, and seeded with annual ryegrass. Two adjacent sites were surveyed in this study: a forested wetland and an emergent wetland. Eleven years after pipeline installation, the ROW at both sites supported diverse vegetative communities. Although devoid of large woody species, the ROW within the forested wetland had a dense vegetative cover. The ROW within the emergent wetland had a slightly less dense and more diverse vegetative community compared with that in the adjacent natural areas (NAs). The ROW within the emergent wetland also had a large number of introduced species that were not present in the adjacent NAs. The ROW, with its emergent marsh plant community, provided habitat diversity within the forested wetland. Because the ROW contained species not found within the adjacent NAs, overall species diversity was increased.

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Research Summary

Title	Pipeline Corridors through Wetlands — Impacts On Plant Communities: Cassadaga Creek Tributary Crossing, Gerry Township, Chautauqua County, New York
Contractor	Argonne National Laboratory
Principal Investigators	L.M. Shem, G.D. Van Dyke, and R.E. Zimmerman
Report Period	August 1992-November 1993
Objective	Document the historical impacts of pipeline rights-of-way (ROWs) on wetlands.
Technical Perspective	The impact of pipeline construction in wetlands is a very sensitive issue and one that is under strict regulatory control. Neither the natural gas industry nor the regulatory community has a documented basis to define the type, value, or environmental consequences of past pipeline activities in wetlands. This report is one of a series documenting these impacts. This report is the result of field studies in a forested wetland and an adjacent emergent wetland along a pipeline installed 11 years prior to sampling. Pipeline installation was by conventional open trenching with a backhoe operating from timber pads.
Results	Observable impacts of the ROW on hydrology and vegetation were limited to the ROW itself. The ROW within the forested wetland had more standing water and fewer plant species than did the adjacent natural areas (NAs). ROW maintenance excluded larger woody plants. The wetland fidelity of ROW plant species was similar to that of the NAs. While many of the species found in the ROW also occurred in the NAs, the ROW contributed 18 new species to the wetland, and provided habitat diversity by causing a break in the natural vegetative community through which it passed. The ROW within the emergent wetland contained a vegetative community that was visually similar to that in the adjacent NAs, with a slightly higher percentage of facultative upland (FACU) and upland (UPL) species. The ROW contributed 23 species to the species richness of the site. The ROW contained a greater number of introduced species than were found in the NAs, most likely resulting from a history that included seeding for and grazing of the site by domestic cattle.

Technical Approach

A relatively homogeneous study site was selected within a forested wetland community and an emergent sedge meadow within the wetland. Sites were of adequate size to allow sampling of plots along five equally spaced transects crossing the ROW at right angles. Plots were located along each transect on either side of the center of the ROW and within the NAs on either side of the ROW. The condition of the ROW surface, amount of the soil surface covered by standing water, and soil core profiles were recorded for each transect. Vegetative cover was recorded for each species in each plot by vegetative stratum (herb, shrub, sapling, tree). Plant data were analyzed to determine similarities and differences between the two sides of the ROW and the two NAs.

Project Implications

This study shows that, within 11 years after installation of the pipeline, the ROW through the forested wetland developed a dense and diverse stand of vegetation consisting mostly of native herbaceous plant species. Exclusion of larger woody plants by periodic maintenance perpetuates a successional stage consisting predominantly of herbaceous wetland plants. Alterations of ROW surface elevations and soils appear to contribute to the dominant status of an introduced FACW species on the ROW, a species not found in the adjacent NAs. Slight alterations of the ROW surface, including surface soils, within the emergent wetland resulted in a wetter and a drier side to the ROW, with greater numbers of species than were present in the adjacent NAs. More introduced species were present on the ROW than in the NAs. Agronomic species were also more common on the ROW, although there was no record of their having been planted. Grazing by cattle may have contributed to the presence of agronomic species.

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Pipeline Corridors through Wetlands — Impacts on Plant Communities: Cassadaga Creek Tributary Crossing, Gerry Township, Chautauqua County, New York

by

L.M. Shem, G.D. Van Dyke, and R.E. Zimmerman

1 Introduction

1.1 Background

Pipelines for the distribution of natural gas traverse all types of terrain, including wetlands. Prior to the wetlands regulatory climate of the late 1980s and the early 1990s, the construction of right-of-way (ROW) corridors through wetlands was often welcomed by landowners and local communities; ROW corridors opened up wetlands, thereby providing public access. With the promulgation of more stringent regulations related to development activities (including no-net-loss wetland policies), an assessment of the historical impacts of pipeline ROWs through wetlands is needed to evaluate construction and reclamation methods, assist in future permit application processes, and evaluate future construction costs.

The Gas Research Institute (GRI) Wetland Corridors Program was designed to evaluate impacts of gas-pipeline construction and subsequent maintenance on wetlands. The data gathered through this GRI program provide a better understanding of the type, degree, and duration of impacts of various pipeline-construction techniques. This information will enable the industry to evaluate current construction practices and provide factual input to regulatory bodies.

Careful evaluation of the impacts of pipeline installation on wetlands is necessary because specific impacts may be beneficial to some plant and/or animal species and detrimental to others. Some impacts may appear to be detrimental when, in fact, they improve conditions for certain sensitive species or provide for greater diversity of species and habitat.

The initial questions addressed by the GRI Wetland Corridors Program are as follows:

1. Do ROW construction and/or management practices lead to differences in ROW plant communities with respect to adjacent wetland communities?

2. Does the ROW alter the diversity of the adjacent wetland community? If so, how far do the impacts extend?

3. Does the ROW enhance species diversity of the wetland?

4. Are there ROW construction and management practices that can enhance the positive contributions of ROWs to wetlands and minimize detrimental impacts?

Answers to these broad questions will provide information related to a number of more specific questions. Data on the type of plant communities that develop on ROWs in various wetlands when specific pipeline construction and management practices are utilized and comparison of the ROW plant communities with the plant communities in areas adjacent to the ROW will provide a basis for comparing environmental impacts of previous and current construction and management practices. Valuable data for such comparisons include numbers of plant species present, species that are dominant, percentage of the species that are native to the area, and fidelity of the plants to wetlands. Other measures of the quality of species present are also valuable, but those data are not available at present.

Concern exists as to whether pipeline corridors provide avenues of access for nonnative and invasive plants. Whether such plants become established along pipeline ROWs and from there invade adjacent areas, and the extent to which such invaders modify the plant communities in adjacent areas, are important to determining potential impacts of pipelines on wetlands.

Potential positive impacts are also important to assess. The degree to which ROWs provide habitat for rare or endangered species and other desirable species that are poorly represented in the adjacent areas is important information. Assessments of impacts of pipeline corridors on wetlands should also include the contribution of corridors to both plant and animal species diversity.

Answers to the above questions will assist the industry and regulatory agencies in evaluating current installation and management practices and making modifications that are beneficial to wetland quality enhancement.

1.2 Goals and Objectives

The goal of the GRI Wetland Corridors Program is to document impacts of existing pipelines on the wetlands they traverse. To accomplish this goal, 12 existing wetland crossings were surveyed. The sites evaluated differed in years since pipeline installation (ranging from 8 months to 31 years), wetland type, installation technology used, and management practices. Each wetland survey had the following specific objectives:

- Document vegetative communities existing in the ROW and in adjacent wetland communities;

- Evaluate similarities and differences between the plant communities in the ROW and in the adjacent wetland communities;

- Document qualitative changes to the topography, soils, and hydrology attributable to ROW construction; and

- Identify impacts caused by ROW construction on rare, threatened, endangered, or sensitive species.

These individual wetland objectives were fulfilled by the collection and analysis of field data and the presentation of those data and their analysis in nine individual site reports. An upcoming summary report further synthesizes and interprets the data from all individual sites.

The following sections constitute a data report of field studies conducted on August 3 and 4, 1992, at two wetland sites along a pipeline ROW in the township of Gerry, Chautauqua County, New York.

2 Description of Study Area

2.1 Site Selection and Location

Personnel from a local gas distribution company assisted a team from Argonne National Laboratory (ANL) in selecting areas at the Chautauqua County site classified as "Jurisdictional Wetlands" under Section 404 of the Clean Water Act (Appendix A). Wetlands were identified along a 7,200-ft-long (2,195-m-long)* section of a 12.75-in.-diameter (32.4-cm-diameter) pipeline installed during February and March 1981. The two sites selected are located in the Cassadaga wetlands, at the pipeline crossing of a tributary of Cassadaga Creek. At each site, the wetland extended at least 200 m along the ROW and at least 50 m beyond each edge of the ROW. The sites are located in Gerry Township, approximately 0.5 mi (0.8 km) east of the village of Red Bird (in Ellery Township). The locations of the sites are shown in Figure 1.

Two adjacent sites were selected so that the effects of pipeline installation on two different vegetative communities could be compared. The natural vegetation at one site, a forested wetland, included an open canopy of broad-leaf deciduous shrubs and trees. The other site, an emergent wetland, was a wet meadow with mixed sedges, grasses, and forbs (Cowardin et al. 1991).

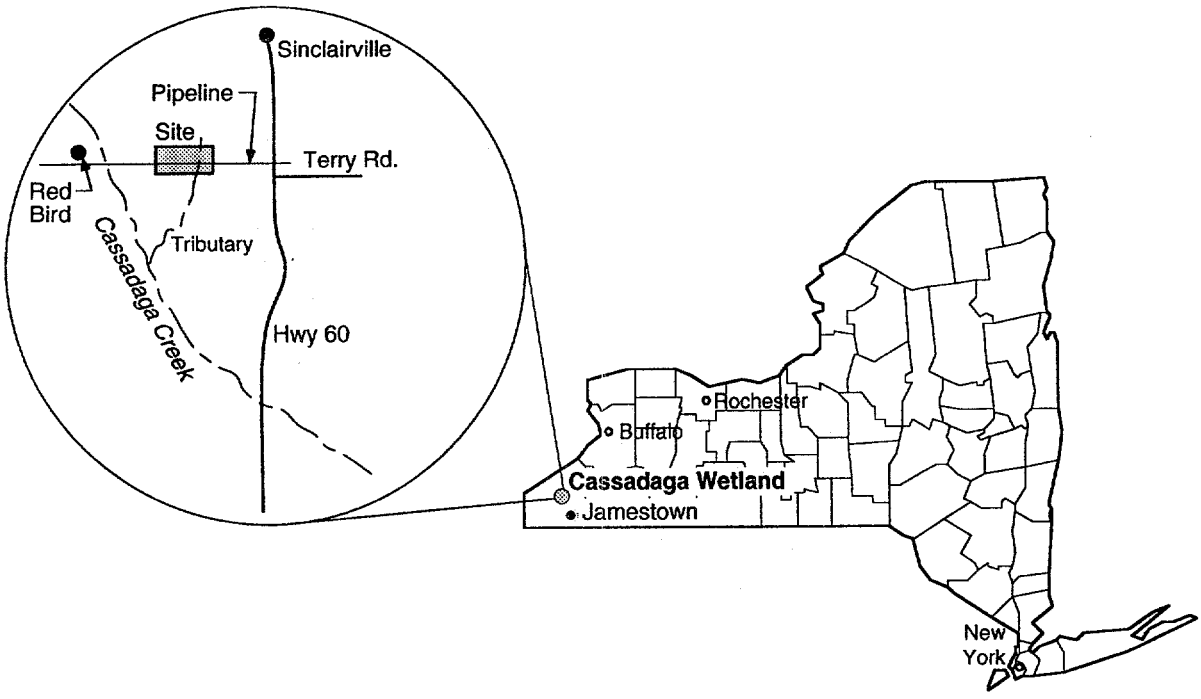

FIGURE 1 Location of Cassadaga Wetland Study Sites in Peabody Township, Chautauqua County, New York

* Measurements are given in metric units except where they were actually measured in English units; in these cases, metric equivalents are given in parentheses.

2.2 Soils

Soils within the wetland are mapped as Henrietta muck and Lamson silt loam in the U.S. Department of Agriculture (USDA) Soil Survey for Chautauqua County (Soil Conservation Service [SCS] 1993). Both of these soils are classified as hydric soils (SCS 1991). The study area, encompassing both sites, is mapped as Henrietta muck, a very deep, nearly level, poorly drained soil formed in deposits of muck 4-16 in. thick over very fine sands. Slopes are 0-1%. The available water capacity is high, and permeability is rapid to very rapid throughout the soil.

Lamson silt loam is described as a very deep, nearly level, poorly drained, medium lime, sandy soil with a silty surface. Lamson silt loam is formed in lake-laid deposits. Slopes are 0-3%. The available water capacity is low, and permeability is moderate to moderately rapid throughout the soil.

2.3 Hydrology

The topography of the study area slopes gently southwestward toward Cassadaga Creek. Water drains from the farms to the east through the wetlands to the creek. The water table in the wetland was at or near the surface. There were some areas of ponded water, and several small tributaries to the creek traversed the ROW from northeast to southwest.

2.4 Climate

In this temperate climate, winters are cold and summers are moderately warm. Average daily temperatures in the winter are approximately 21°F (-5°C), with average lows around 12°F (-11°C). Average daily temperatures in summer are approximately 68°F (20°C), with average highs around 77°F (25°C). Precipitation is well distributed throughout the year. The total annual precipitation is approximately 40 in. (101 cm); 3-4 in. (6-10 cm) falls in a typical month. Snowfall occurs between November and April, with an average of 101 in. (257 cm) in a year (SCS 1993).

2.5 History and Management Practices

Preconstruction. The wetland in which the sites are located has been grazed and logged in the past. It has not been logged for at least 15 years, but occasional grazing still occurs (McChesney 1992).

Pipeline Construction. Construction at the Cassadaga Creek wetland took place in February and March 1981. The pipeline was constructed across the wetlands using traditional construction techniques. Backhoes supported by timber mats were used for excavation. The pipe

was constructed alongside the excavated ditch, lowered into the ditch, and weighted down with concrete. The ROW was cleared to a width of 50 ft (15.2 m), and the ditch was excavated to a depth of 4-5 ft (1.2-1.5 m) and a width of 8-12 ft (2.4-3.6 m). This width was necessary to prevent the sides of the ditch from caving in and allow space to apply the concrete weights to the pipe. An attempt was made to separate the top 6 in. (15 cm) of soil so that it could be placed back on top of the ditch fill. However, because of the amount of water associated with the soil and space limitations, separation of the topsoil proved to be impractical.

ROW Restoration. Restoration of the ROW was undertaken as soon as construction through the wetland was completed. Seed, fertilizer, and mulch were applied to provide a quick cover and prevent erosion. Annual ryegrass seed was applied at a rate of 20-40 lb/acre (23-46 kg/ha); fertilizer (10-10-10 NPK) at a rate of 500 lb/acre (577 kg/ha); and hay or straw mulch at a rate of 2 ton/acre (2.1 t/ha). Observations made by pipeline company personnel soon after construction indicated that indigenous vegetation was becoming reestablished in the disturbed ROW and that reseeding was unnecessary.

To the west of the sampling sites, the ROW passed through a cedar forest. Because of concern that heavy snow might accumulate in the ROW during the winter and prevent free movement of deer within the cedar forest, white spruce tree seedlings were planted in the emergent wetland ROW in strips 6 ft (1.8 m) wide and within 10 ft (3 m) from either edge of the ROW. The objectives of the plantings were to reduce the abruptness of the edge and decrease the effective width of the ROW. Within one year after planting, however, all of the white spruce appeared to have been eaten by deer. A second attempt was made to establish trees at the edges of the ROW using Norway spruce, which are not preferred by deer. However, these trees did not flourish and were eventually cut down. No trees were planted in the forested wetland site.

ROW Maintenance. Management practices consist of routine maintenance performed on the ROW to maintain access to the pipeline. Subsequent maintenance at the Cassadaga Creek tributary crossing consisted of cutting, by hand, the larger-diameter trees during the winter of 1989 and mowing drier portions of the ROW in 1991. Annual foot patrols of the ROW are conducted to inspect the pipeline through the wetland.

3 Approach and Methods

3.1 General Approach

The primary objectives listed in the Introduction (Section 1.2) provided the general guidelines for this study. To allow comparison of results across sites, methodologies for site reconnaissance, vegetation data collection, and data analysis used at this site were similar to those used at the other sites.

One gas-transfer pipeline, installed 11 years prior to this survey, traversed the different wetland communities (a forested wetland and an emergent wetland) within the study area. Each of the two communities was surveyed as a separate site. Sampling techniques were adapted to the vegetative strata present in each community.

3.2 Habitat Description

The pipeline, and hence the ROW, extended in an east-west direction through the study area. Figure 2 provides a general cross section of the forested wetland community, and Figure 3 a general cross section of the emergent wetland community. General site habitat data, including topography, water levels, direction of water flow, soil conditions, and structure of the plant communities, were recorded on the basis of a general reconnaissance of the sites. Soil characteristics, as observed from samples collected using a hand auger, were compared with those listed for Henrietta and Lamson soils, as mapped for the site in the *Soil Survey of Chautauqua County, New York* (SCS 1993).

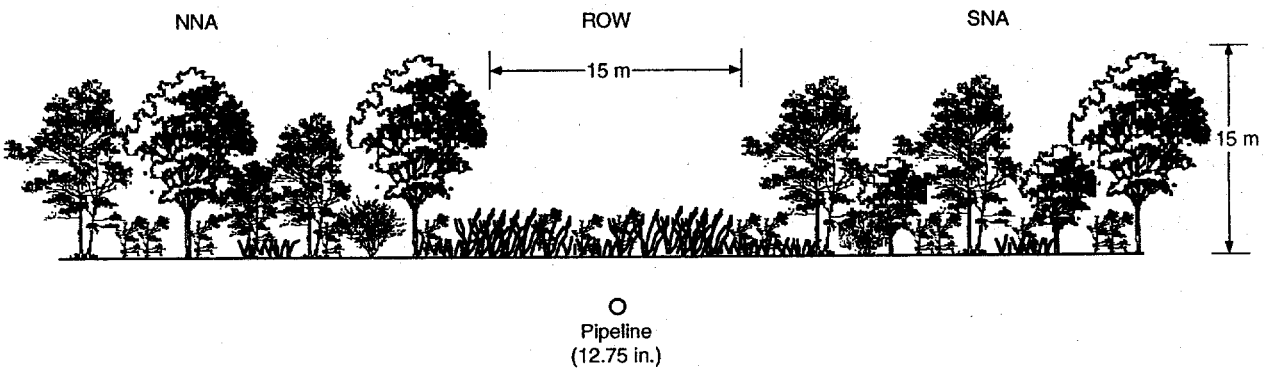

FIGURE 2 Generalized Cross Section Showing the ROW, Pipeline Location, and Vegetation Types — Forested Wetland Site

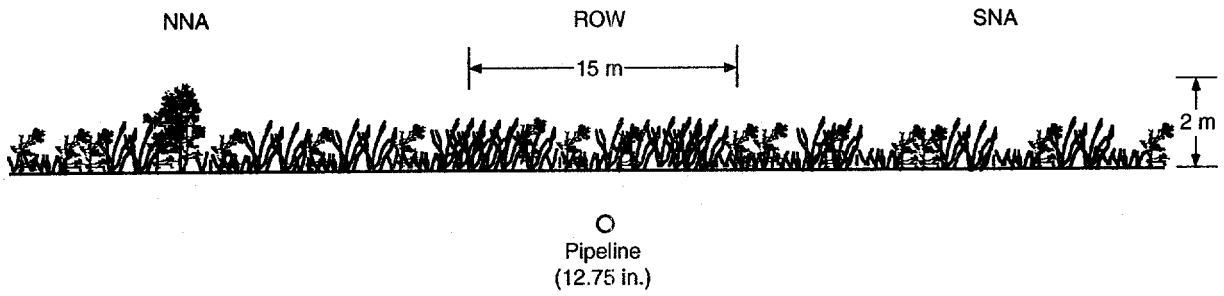

FIGURE 3 Generalized Cross Section Showing the ROW, Pipeline Location, and Vegetation Types — Emergent Wetland Site

3.3 Sampling Design for Vegetational Studies

The design for sampling was similar for each of the two study sites. Four areas were defined on the basis of their relationship to the midline of the ROW. These areas consist of the two sides of the ROW and the natural areas (NAs), defined as wetland areas immediately adjacent to either side of the ROW that are undisturbed by pipeline installation. The areas were divided into the north natural area (NNA), south natural area (SNA), north ROW, and south ROW. This sampling design allows comparisons between the two vegetative communities in the NAs on either side of the ROW, between the vegetative communities developing on the two sides of the ROW, and between the vegetative communities developing on the ROW and those occurring in the NAs. For convenience, the four areas are designated at each site by their direction from the midline of the ROW.

Transects. Within each site, five transect starting points were established at 20-m intervals along the midline of the ROW. Transects were established perpendicular to the midline of the ROW at each transect starting point and extended 30 m in each direction from the center of the ROW into the adjacent natural community. Figure 4 illustrates the general layout of the transects. Because directional orientation for the pipeline is east-west, orientation of the transects was north-south.

Four 1-m × 3-m sampling plots were established along each transect for sampling the herb stratum. The two plots on the ROW began 1 m from either side of the center of the ROW and extended to 4 m along the transect in either direction. The two plots in the NAs began 20 m from the center of the ROW and extended to 23 m from the center of the ROW along the transects. Shrub, vine, sapling, and tree data were collected in the NAs of the broad-leaved forested wetland only by using 10-m × 20-m plots along each transect, beginning 10 m from, and extending to 30 m from, the center of the ROW. Figure 5 illustrates the layout of plots along each transect in relation to the pipeline and the edges of the ROW. Each plot had the transect line as its eastern edge.

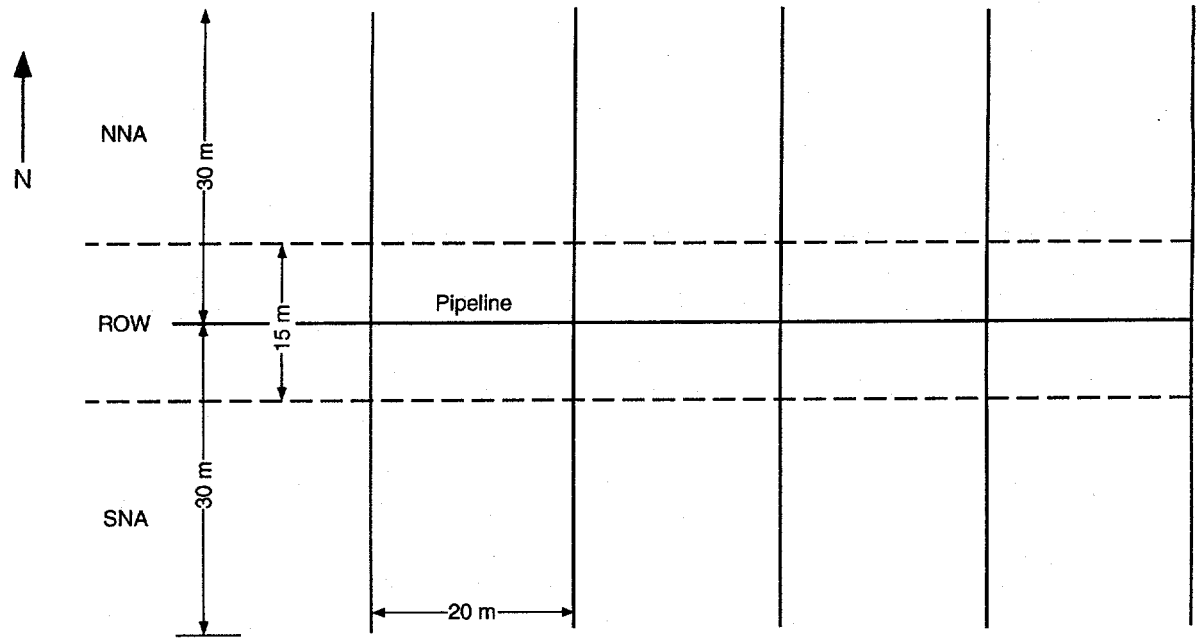

FIGURE 4 Plan View of Study Site Showing Transcect Length and Spacing

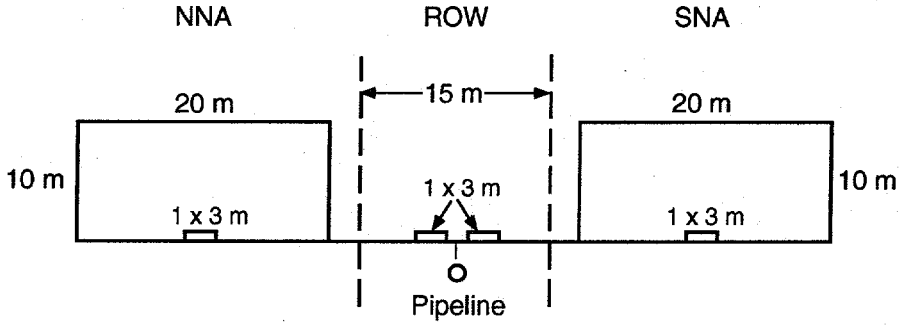

FIGURE 5 Location and Dimensions of Sampling Plots along One Transect

Sampling Procedures. Vegetational data were collected for all plots at each site. Two specimens of each plant species found on or near the plots were collected as voucher specimens. Plant names, wetland indicator categories, life-forms, and origin of each species were derived from Reed (1988).

Vegetational data were collected by recording a visually estimated areal coverage for each species within the sampling plots. Estimates were made separately for the herb, shrub, and sapling strata, as defined in the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (FICDW 1989). The herb stratum is defined as herbaceous plants, including graminoids, forbs, ferns, herbaceous vines, and woody species under 3 ft (0.91 m) in height. The shrub stratum

includes multistemmed, bushy shrubs and small trees and saplings between 3 and 20 ft (0.9 to 6.1 m) high. Saplings are defined as having a diameter at breast height (dbh) of 0.4 to 4.9 in. (10 to 12.4 cm) and a height exceeding 20 ft (6.1 m). Basal area measurements were recorded for each member of the tree stratum. Trees are defined as having a dbh of greater than or equal to 5.0 in. (12.7 cm) and a height exceeding 20 ft (6.1 m). Surface area cover estimates were also recorded for standing water and moss at each site.

3.4 Data Analysis

Analyses of vegetative data collected from sampling plots for all 17 sites studied as part of the GRI Wetland Corridors Program were consistent. Analyses focused on comparing the plant communities on the ROW with those in the NAs and determining hydrophytic characteristics of the plant communities in each area. Particular attention was given to dominant species because they are used in several wetland delineation methods. Although the number of species dominant, species richness, and the variety of plant life-forms present are all aspects of community diversity, no diversity indices were calculated. Diversity indices that use coverage values as measures of species importance were considered, but they were judged inappropriate because of differences in the number of strata in the ROW and NAs and because coverage values are not additive across strata.

Species Richness, Wetland Indicator Categories, and Species Characteristics. The total number of species present (species richness) was determined for each side of the ROW, for the total ROW, for each NA, and for the NAs combined. Wetland indicator categories (Reed 1988) were identified for each species in the study plots. These categories are defined in Appendix B, Section B.1. The number of species in each category was determined for each area by stratum and for all strata combined. Because one plant species could occur in any or all strata, when data from different strata were combined, each species was considered only once, independent of the number of strata in which it occurred. Species characteristics, including life-forms and origins, were also determined from Reed (1988). Symbols for life-forms and species origins are given in Appendix B, Section B.2.

Dominant Species. The definition of and methodology for the determination of dominant species in this study were taken from the 1989 Federal Manual (FICWD 1989). In the manual, dominance refers "strictly to the spatial extent of a species that is directly discernible or measurable in the field," as opposed to number of individuals present. Using this definition, dominant species were identified by plant stratum, rather than by total community. For each area, the dominant species were determined for each stratum by ranking each species in a plant stratum in descending order relative to total areal coverage of all plants in that stratum. The highest ranking species, which make up 50% of the total areal coverage or half of the total relative percent coverage (RPC), are the dominant species for that stratum. Any remaining species with 20% or more RPC are also considered dominant.

Community Similarity Indices. Sørensen's coefficient of community index (CC_S) was used to measure similarity between vegetative communities (Brower, Zar, and von Ende 1990). This index uses the following formula:

$$CC_S = 2c/(a+b) \quad (1)$$

where

a = the number of species in community A,

b = the number of species in community B, and

c = the number of species in common between communities A and B.

A CC_S value of 1.00 indicates 100% similarity in species composition between communities A and B. A value of 0.00 represents no species in common. Community similarity indices that use coverage values as measures of species importance were considered, but they were judged inappropriate because of differences in the strata present in the plant communities on the ROW compared to those in the NAs and because of the nonadditive characteristic of coverage data.

Comparisons were made between the combined ROWs and combined NAs, the two portions of the ROW, each portion of the ROW and its adjacent NA, and the two NAs.

Prevalence Index Values. Prevalence index values (PIVs) were calculated according to methods outlined in the 1989 Federal Manual (FICWD 1989), substituting RPC data from quadrat coverage estimates for relative frequencies from intercept data. This substitution is logical because both relative frequency and RPC are estimates of relative coverage (Bonham 1989). The PIV is an average wetland indicator value ranging from 1.0 to 5.0 and weighted by the RPC. Because areal coverage was determined by stratum, the PIVs were calculated for each area by stratum only. The average RPCs for each species in the five plots in each area were used in calculating the PIV for the area. The equation for calculating a PIV is presented in Appendix B, Section B.3.

Average Wetland Values. Average wetland values (AWVs) (Zimmerman et al. 1991) were calculated for the species in each of the five areas. This index is an average of the wetland indicator values for all plants present. It differs from the PIV in that it is not weighted by RPC; rather, all plants present are represented equally, regardless of their frequency of occurrence. Because areal coverage is not considered, the calculation of an index value is not restricted to one vegetative stratum. An overall site AWV was determined, as well as values for each stratum. See Appendix B, Section B.4, for the equation.

4 Results

The results of field investigations conducted on August 3 and 4, 1992, are presented separately for each site. Observations from the general site reconnaissance are summarized in Sections 4.1.1 and 4.2.1, and vegetative data from plot sampling and analysis of those data are discussed in Sections 4.1.2 and 4.2.2.

4.1 Forested Wetland Study Site

4.1.1 General Ecology

This site supported a relatively young stand of mostly ashes and maples with an open canopy. The majority of the tree species were represented by sapling and shrub species; shrubs were common in the understory. No full-size trees were present. The herb stratum consisted of ferns and horsetails, sedges and grasses, and various forbs; mosses were also common. About one-third of the soil surface was covered by standing water. Samples taken with a hand auger revealed soil profiles consistent with those described for Henrietta muck (SCS 1993).

4.1.2 Plant Community

Plant Species, Life-Forms, and Species Origins. Appendix C presents field data that were collected by sampling the vegetative community that had become established in the ROW and the community that persists in the NAs adjacent to the ROW. Table C.1 lists plant species found on the forested wetland site by scientific name and provides field collection numbers, authorities, wetland indicator categories, life-forms, and origin, as given in Reed (1988). Table C.2, which is a compilation of the field plot data, provides the percent areal coverage for each species occurring within each sample plot. Table C.3 summarizes the distribution of each species by average percent areal coverage, and their frequency (the number of plots in which the species occurred out of five plots) within the specific areas. Species are grouped by distribution within the four strata (herb, shrub, sapling, tree).

A total of 89 taxa of plants were collected from the forested wetland study site. Of these, nine could not be identified beyond the genus level because only immature specimens were available. The 89 taxa included 5 taxa of ferns, 1 of horsetail, 8 of sedges, 3 of bulrushes, 1 of rush, 7 of grasses, 41 of forbs, 13 of shrubs, 2 of woody vines, and 8 of trees. Of the 80 plants identified to species, 70 are native to New York and 10 were introduced. Only one species, spotted touch-me-not (*Impatiens capensis*), has an annual growth form only; all others have perennial growth forms.

Eighty-six of the 89 taxa of plants found within the study site occurred in study plots. Sixty taxa were identified in plots within the NAs, and 56 in plots within the ROW. Three species were present in the NAs, but did not occur within plots and are not included in the data analysis. Of the 10 introduced species, 6 occurred in both the NAs and the ROW, while 2 were limited to the NA, and 2 others were limited to the ROW. All tree species were native to the area. No introduced annual species were found on the site.

Species Richness and Wetland Indicator Categories. Table 1 lists the number of plant species found in the NAs and the ROW, by wetland indicator category within each vegetative stratum. Although the same species may have occurred in more than one stratum, it is counted only once when strata are combined. Definitions of the strata are provided in Section 3.3.

Table 1 lists the total numbers of species found in each of the two habitat types (NAs and ROW, columns 3 and 4) and the number of species common to both habitats (column 5). The numbers of species unique to each habitat are provided in columns 6 and 7. Of the 86 species occurring in plots at this site, only 44% were found in both habitats; 35% were unique to the NAs, and 21% were unique to the ROW. The ROW lacked shrub, sapling, and tree strata.

Figure 6 graphically represents the number of species of each wetland indicator type found in the NAs compared to the ROW. Figure 7 depicts these data in terms of percent of species in each wetland indicator category. The data show that 64% of *all* species found in the ROW and 71% of the *identified* species from the ROW were obligate wetland (OBL) or facultative wetland (FACW) species. Similarly, 62% of *all* species found in plots in the NAs and 68% of the *identified* species were either OBL or FACW species. No upland (UPL) species were identified at this site.

Table 2 summarizes the distribution of plants in plots on the north and south sides of the ROW. The results show that 66% of the 56 species occurring in the ROW were present on both sides; 27% were unique to the north side and 7% were unique to the south side. Of the 56 species, 64% were OBL and FACW species. Five species could be identified to genus only.

Table 3 compares species distribution between the NNA and SNA. The comparison shows that 66% of the species were found in both areas, while 10% were unique to the NNA and 24% were unique to the SNA. Of the 68 species found in the NAs, 62% were either OBL or FACW species. Eight of the shrub stratum species were not present in the herb stratum, while all species present in the sapling and tree strata were represented in the shrub stratum. All but one tree species were also present in the sapling stratum. Only FACW and facultative (FAC) species occurred in the shrub, sapling, and tree strata. Shrubs and saplings were more prevalent and more diverse in the SNA than in the NNA (see Table C.3). Four species of trees occurred in each of the two NAs; three of these occurred in both NAs. The total basal area for trees in the SNA was almost 50% more than the total basal area for trees in the NNA. Most of this difference was attributable to an increased basal area for green ash.

TABLE 1 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the NAs and the ROW (by individual stratum and combined strata) — Forested Wetland

Stratum	Wetland Indicator Category	Number of Species: Occurring in NAs	Occurring in ROW	Common to Both Areas	Unique to NAs	Unique to ROW	Total
Herb	OBL	18	13	9	9	4	22
	FACW	22	23	17	5	6	28
	FAC	9	7	5	4	2	11
	FACU	5	8	3	2	5	10
	UPL	0	0	0	0	0	0
	Unid[a]	6	5	3	3	2	8
	Total	60	56	37	23	19	79
Shrub	OBL	0	0	0	0	0	0
	FACW	5	0	0	5	0	5
	FAC	5	0	0	5	0	5
	FACU	3	0	0	3	0	3
	UPL	0	0	0	0	0	0
	Unid	1	0	0	1	0	1
	Total	14	0	0	14	0	14
Sapling	OBL	0	0	0	0	0	0
	FACW	2	0	0	2	0	2
	FAC	2	0	0	2	0	2
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	Total	4	0	0	4	0	4
Tree	OBL	0	0	0	0	0	0
	FACW	2	0	0	2	0	2
	FAC	3	0	0	3	0	3
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	Total	5	0	0	5	0	5
Combined Strata	OBL	18	13	9	9	4	22
	FACW	24	23	18	6	5	29
	FAC	13	7	5	8	2	15
	FACU	7	8	3	4	5	12
	UPL	0	0	0	0	0	0
	Unid	6	5	3	3	2	8
	Total	68	56	38	30	18	86

[a] Plants not identified to species or not assigned a wetland indicator category according to Reed (1988).

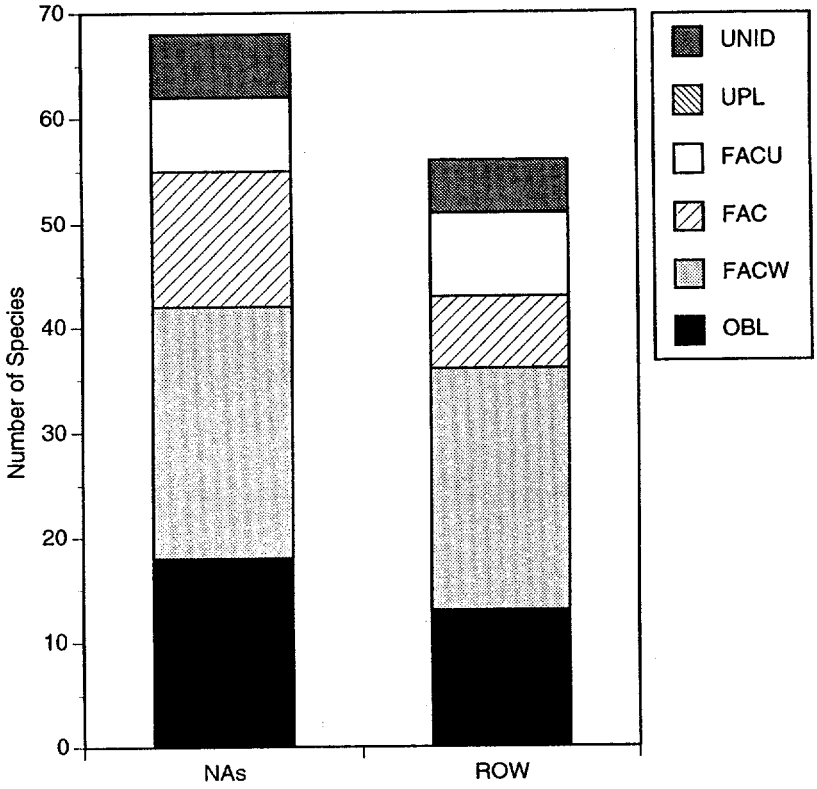

FIGURE 6 Number of Species in Each Wetland Indicator Category by Area — Forested Wetland Site

Dominance. Table 4 lists the dominant species for each habitat (by stratum) and the RPC for each species. Actual areal coverages (by species) in each habitat (averaged for five plots per habitat) are given in Table C.3. Two of the three species dominant in the herb stratum in the NAs were FACW species. The third dominant, a sedge (*Carex* sp.), could not be identified to species because no fruiting bodies were present. Both dominant species on the ROW were FACW species. The herb stratum in both the NAs and in the ROW was dense; the sums of the areal coverages of individual species were 192.2% and 187.3%, respectively. All dominant species were native, except European meadow rush (*Juncus inflexus*).

The leading dominant species in the ROW, the introduced European meadow rush, had an average areal coverage in the ROW of 55.2%, but this species was not found in the adjacent NAs. The second dominant, reed canary grass, had an average areal coverage of 42.4% in the ROW, but only 3.1% in the NAs. The dominant species in the herb stratum in the NAs were likewise poorly represented in the ROW. Sensitive fern had an average areal coverage of 42.2% in the NAs, but only 7.3% in the ROW. The sedge (*Carex* sp.) had an average coverage of 38.5% in the NAs, but did not occur in the ROW. Spotted touch-me-not had an average areal coverage of 25.6% in the NAs, but only 4.4% in the ROW.

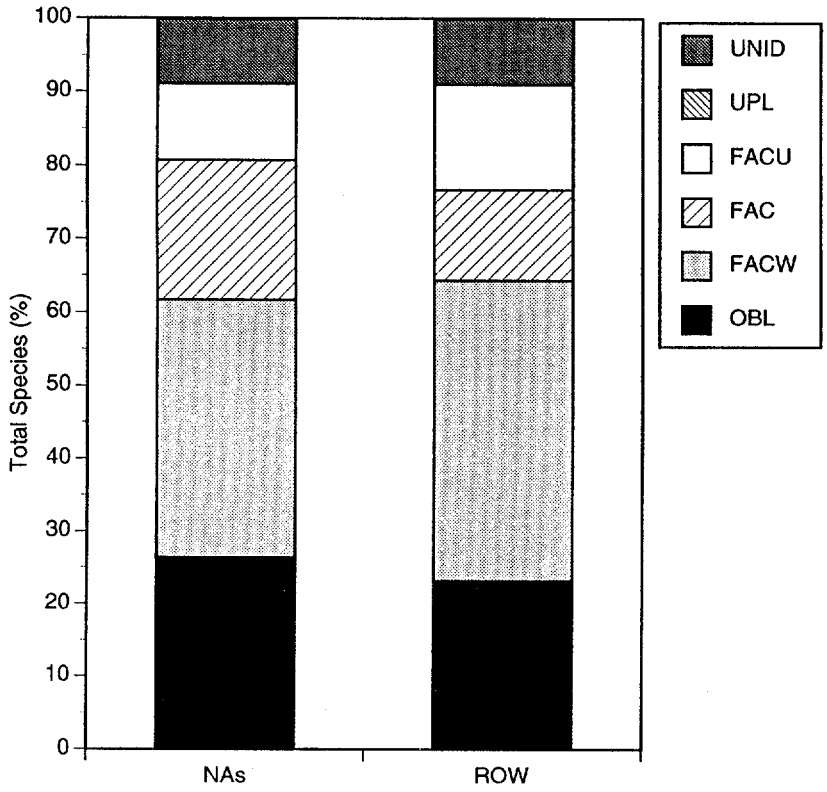

FIGURE 7 Percent of Species in Each Wetland Indicator Category by Area — Forested Wetland Site

Unlike the ROW, which included only an herb stratum, three other strata were present in the adjacent NAs. The sparse shrub stratum (with a sum of coverages of 10.5%) was dominated by a single species, American hornbeam (*Carpinus caroliniana*). The sapling stratum had a total coverage of 10.0% and was dominated by two species — green ash *(Fraxinus pennsylvanica*) and red maple (*Acer rubrum*). The tree stratum, with a relatively low basal area of 7.0 m^2/ha, was dominated by a single species — green ash.

All identified dominant species in all strata of the NAs and the ROW were FACW or FAC species. The unidentified sedge that occurred as one of the dominants in the herb stratum of the NAs was a narrow-leaved, tussock-forming sedge that grew in areas of standing water. Because it occurred only in standing water, this sedge is likely to be at least a FAC wetland species.

Community Similarity Index. Table 5 presents Sørensen's CC_s indices, derived by comparing species composition of the vegetation in the various areas. Comparing the two sides of the ROW yielded a CC_s of 0.80; comparing the NNA and SNA yielded a CC_s of 0.77; and comparing the herb stratum species in the NAs with those in the ROW yielded a CC_s of 0.64. Because shrubs, saplings, and trees occurred only in the NAs, the CC_s for comparison of the combined strata in the NAs with the herb stratum in the ROW was lower (0.61) than the value obtained by comparison of only the herb stratum in the NAs and the ROW.

TABLE 2 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the North and South Sides of the ROW (by stratum and combined strata) — Forested Wetland

		Number of Species					
Stratum	Wetland Indicator Category	Occurring in North Side of ROW	Occurring in South Side of ROW	Common to Both Sides of ROW	Unique to North Side of ROW	Unique to South Side of ROW	Total
Herb[a]	OBL	12	10	9	3	1	13
	FACW	22	20	19	3	1	23
	FAC	5	5	3	2	2	7
	FACU	8	5	5	3	0	8
	UPL	0	0	0	0	0	0
	Unid[b]	5	1	1	4	0	5
	Total	52	41	37	15	4	56

[a] Only the herb stratum was present.

[b] Plants not identified to species or not assigned a wetland indicator category according to Reed (1988).

Prevalence Index Values and Average Wetland Values. Table 6 presents PIVs and AWVs for the ROW plots and the NA plots by stratum for all species and for dominant species only. All values are based on identified species only. The PIVs and AWVs for species in the herb stratum of the NAs were slightly lower than those for the ROW. These values indicate hydric vegetation in both the NAs and the ROW, and are close to the value for FACW species. However, the value for the herb stratum in the NAs does not include the value for the unidentified sedge. If this sedge proved to be an upland species, the AWV for dominants would increase to 3.00 and the PIV to 3.08. Because the sedge was observed in areas of standing water, it is unlikely that it was a UPL species. The PIVs and AWVs for shrubs, saplings, and trees in the NAs ranged from 2.00 for tree dominants to 3.00 for shrub dominants. These values represent a single dominant species in each of the strata. The PIVs were similar to the AWVs for all strata, regardless of whether all species or dominants only were considered. The largest difference between a PIV and an AWV occurred between the values for all species in the tree stratum, where the AWV was 0.26 larger than the PIV. Here, the presence of a single FACW dominant lowered the overall PIV, which is weighted by relative coverage.

TABLE 3 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the NNA and SNA (by individual stratum and combined strata) — Forested Wetland

Stratum	Wetland Indicator Category	Number of Species: Occurring in NNA	Occurring in SNA	Common to Both Areas	Unique to NNA	Unique to SNA	Total
Herb	OBL	12	17	11	1	6	18
	FACW	17	18	13	4	5	22
	FAC	7	9	7	0	2	9
	FACU	3	4	2	1	2	5
	UPL	0	0	0	0	0	0
	Unid[a]	6	4	4	2	0	6
	Total	44	52	37	8	15	60
Shrub	OBL	0	0	0	0	0	0
	FACW	3	5	3	0	2	5
	FAC	4	5	4	0	1	5
	FACU	1	2	0	1	2	3
	UPL	0	0	0	0	0	0
	Unid	0	1	0	0	1	1
	Total	8	13	7	1	6	14
Sapling	OBL	0	0	0	0	0	0
	FACW	1	2	1	0	1	2
	FAC	0	2	0	0	2	2
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	Total	1	4	1	0	3	4
Tree	OBL	0	0	0	0	0	0
	FACW	2	2	2	0	0	2
	FAC	2	2	1	1	1	3
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	Total	4	4	3	1	1	5
Combined Strata	OBL	12	17	11	1	6	18
	FACW	19	21	16	3	5	24
	FAC	11	13	11	0	2	13
	FACU	4	6	3	1	3	7
	UPL	0	0	0	0	0	0
	Unid	5	4	4	2	0	6
	Total	50	61	45	7	16	68

[a] Plants not identified to species.

TABLE 4 Dominant Species by Vegetative Stratum — Forested Wetland

Stratum	Area	Scientific Name	Common Name	Wetland Indicator Category[a]	Relative Percent Coverage	Total Relative Percent Coverage
Herb	NAs	*Onoclea sensibilis*	Sensitive fern	FACW	21.2	21.2
		Carex sp.			19.5	40.7
		Impatiens capensis	Spotted touch-me-not	FACW	13.5	54.2
	ROW	*Juncus inflexus*	European meadow rush	FACW	29.5	29.5
		Phalaris arundinacea	Reed canary grass	FACW	22.5	52.0
Shrub	NAs	*Carpinus caroliniana*	American Hornbeam	FAC	55.0	55.0
	ROW	(No shrubs present)				
Sapling	NAs	*Fraxinus pennsylvanica*	Green ash	FACW	45.0	45.0
		Acer rubrum	Red maple	FAC	40.0	85.0
	ROW	(no saplings present)				
Tree	NAs	*Fraxinus pennsylvanica*	Green ash	FACW	78.6	78.6
	ROW	(no trees present)				

[a] Wetland indicator categories are defined in Appendix B.

4.2 Emergent Wetland Study Site

4.2.1 General Ecology

This site, traditionally described as a wet meadow, is seasonally flooded and supports a diverse community of grasses, sedges, and forbs, as well as occasional scattered small shrubs. Although the general topography was almost level, elevational differences of 5 to 10 cm over several meters were common. The north side of the ROW appeared to have a slightly elevated ridge toward the center of the ROW, possibly over the pipeline, with some small depressions toward its outer edge. The general appearance of the vegetation in the ROW was similar to that in the adjacent NAs, except for the absence of the small shrubs scattered throughout the NAs. Soil cores taken with a hand auger revealed profiles consistent with those described for Henrietta muck soils (SCS 1993).

TABLE 5 Coefficient of Community Values: Comparison of Similarity of Species Found in Study Plots — Forested Wetland

	Comparison		
Stratum	NAs to ROW	North ROW to South ROW	NNA to SNA
Herb	0.64	0.80	0.77
Shrub	0.00	0.00	0.67
Sapling	0.00	0.00	0.40
Tree	0.00	0.00	0.75
Combined strata	0.61	0.80	0.81

4.2.2 Plant Community

Plant Species, Life-Forms, and Species Origins. Field data gathered by sampling the vegetative community that has become established in the ROW and the community that persists in the NAs adjacent to the ROW are presented in Appendix C. Table C.4 lists plant species found on this site by scientific name and field collection numbers, and provides authorities, wetland indicator categories, life-forms, and origins, as given in Reed (1988). Table C.5 presents percent areal coverage data for each species occurring within each sampling plot. Table C.6 summarizes the distribution of each species by average percent areal coverage, and their frequency (the number of plots out of five) within the specific habitat. Species are grouped by distribution within the four strata.

A total of 74 taxa of plants were collected from the emergent wetland study site; 71 of these occurred within the sampling plots. Eight of the 74 taxa could not be identified to species because mature specimens were not available. The 74 taxa consisted of 3 taxa of ferns, 1 of horsetail, 8 of sedges, 3 of bulrushes, 6 of rushes, 8 of grasses, 28 of forbs, 6 of herb-size shrubs, and 3 of tree seedlings. Of the 64 plants occurring in study plots and identified to species, 15 are listed as species introduced to the region (Reed 1988). Three species have annual growth forms only and two have biennial growth forms; all others have perennial growth forms. Three species were annual or biennial introduced forbs.

TABLE 6 Prevalence Index and Average Wetland Values (by individual stratum and combined strata) for All Species and Dominant Species Only in the NAs and ROW — Forested Wetland

Stratum	Habitat	Species	Prevalence Index Value	Average Wetland Value
Herb	NAs	All	1.95	2.02
		Dominant only	2.00	2.00
	ROW	All	2.04	2.20
		Dominant only	2.00	2.00
Shrub	NAs	All	2.79	2.85
		Dominant only	3.00	3.00
Sapling	NAs	All	2.50	2.50
		Dominant only	2.47	2.50
Tree	NAs	All	2.14	2.80
		Dominant only	2.00	2.00
Combined strata	NAs	All	NC[b]	2.15
	ROW[a]	All	NC	2.20

[a] Only the herb stratum was present.

[b] PIVs could not be calculated for combined strata, because areal coverage is used in its calculation.

Within plots in the NAs, 48 species of plants were identified. Sixty-one species were identified within plots in the ROW. Of the 15 introduced species, 14 occurred in the ROW; 4 of these also occurred in the NAs. A single introduced species was found only in the NAs. One introduced species of tree and one introduced species of shrub occurred as seedlings within the plots. Several of the introduced species are commonly used agronomic or horticultural species. These include timothy (*Phleum pratense*), Canada bluegrass (*Poa compressa*), birds-foot trefoil (*Lotus corniculatus*), hop clover (*Trifolium aureum*), alsike clover (*Trifolium hybridum*), peppermint (*Mentha ×piperita*), and common red raspberry (*Rubus idaeus*).

Species Richness and Wetland Indicator Categories. Table 7 lists the number of plant species found in the NAs and in the ROW by wetland indicator category. Only an herb stratum, as defined in the 1989 Federal Manual, was present on the emergent wetland site (see Section 3.3).

TABLE 7 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the NAs and the ROW (by individual stratum and combined strata) — Emergent Wetland

Stratum	Wetland Indicator Category	Number of Species: Occurring in NAs	Occurring in ROW	Common to Both Areas	Unique to NAs	Unique to ROW	Total
Herb[a]	OBL	8	12	7	1	5	13
	FACW	17	19	14	3	5	22
	FAC	7	6	5	2	1	8
	FACU	10	17	9	1	8	18
	UPL	1	3	1	0	2	3
	Unid[b]	5	4	2	3	2	7
	TOTAL	48	61	38	10	23	71

[a] Only the herb stratum present.

[b] Plants not identified to species or not assigned a wetland indicator category according to Reed (1988).

Table 7 lists the total number of species found in each of the two habitat types, NAs and ROW (columns 3 and 4); the number of species common to both habitats (column 5); and the number of species unique to each habitat (columns 6 and 7). Of the 71 species occurring in plots at this site, only 54% were found in both habitats; 14% were unique to the NAs and 32% were unique to the ROW.

Of the 64 identified species, 55% were either OBL or FACW species, 28% were facultative upland (FACU) species, and 5% were UPL species. Figure 8 compares the *number* of species in each wetland indicator category for the ROW and for the NAs. Figure 9 presents these data in terms of *percent* of species in each wetland indicator category. Patterns for the two habitats are similar.

Table 8 summarizes the distribution of plants in plots on the north and south sides of the ROW. The table shows that 52% of the 61 species in the ROW occurred on both sides; 30% were unique to the north side and 18% were unique to the south side. The data also show that 54% of the 57 species identified on the site were OBL and FACW species, while 30% of the identified species were FACU species, and 5% were UPL species. Four species could be identified to genus only.

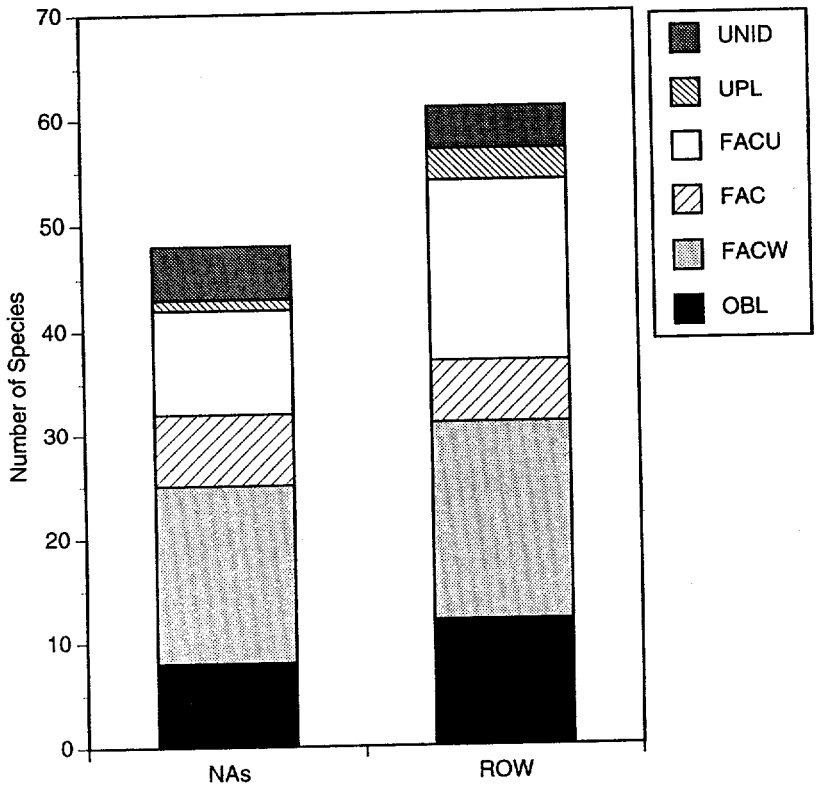

FIGURE 8 Number of Species in Each Wetland Indicator Category by Area — Emergent Wetland Site

Table 9, which compares species distribution between the NNA and SNA, shows that 48% of the species were found in both areas, 10% were unique to the NNA, and 42% were unique to the SNA. Of the 43 species identified in the NAs, 58% were either OBL or FACW species, while 23% were FACU species.

Dominance. Table 10 lists the dominant species for each habitat and the RPC for each species. Actual areal coverages for each species in each habitat, averaged for five plots per habitat, are given in Table C.6. Three of the four dominant species in the herb stratum of the NAs are FACW species, while the fourth is an FAC species. Two of the dominants in the ROW are FACW and two are FACU species. The herb stratum in the NAs was slightly better developed than in the ROW — the sum of areal coverages for all individual species in the NAs was 128.0% (compared with 110.5% for the ROW). All dominants were native species.

Community Similarity Index. Table 11 presents Sørensen's CC_s indices, derived by comparing species composition of the vegetation in the various habitats. A comparison of the two sides of the ROW yielded a CC_s of 0.69; a comparison of the NNA and SNA yielded a CC_s of 0.65; and a comparison of the NAs with the ROW yielded a CC_s of 0.70. The slight difference between the CC_s values may be attributable to the sizes of the samples rather than any actual differences. Comparison of all ROW to all NA plots involved 10 plots in each habitat; comparison

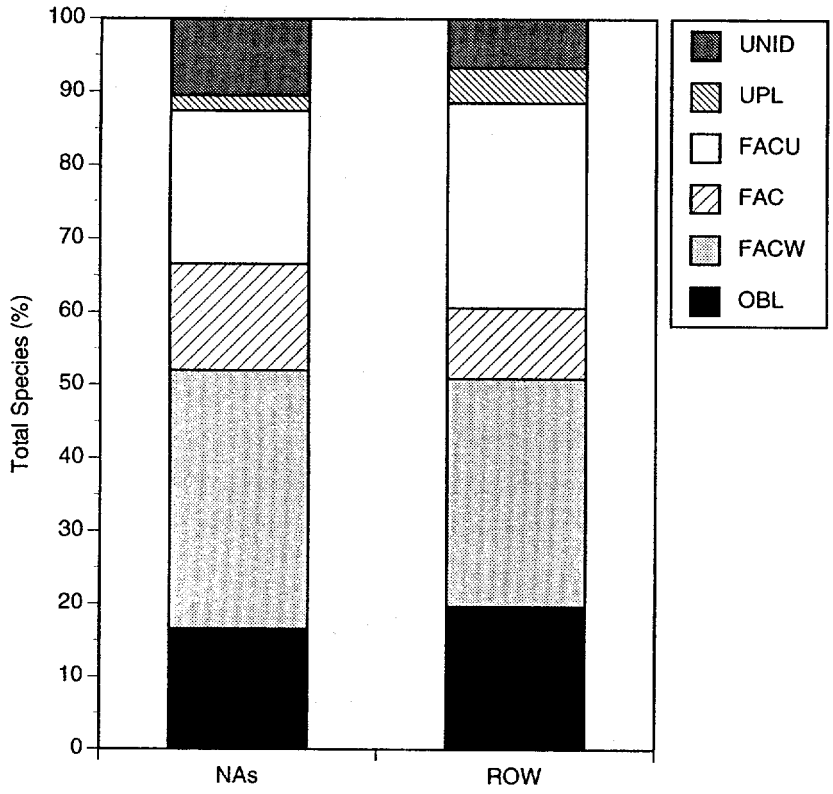

FIGURE 9 Percent of Species in Each Wetland Indicator Category by Area — Emergent Wetland Site

of the two sides of the ROW involved only 5 plots in each habitat. Because the chances of a species occurring within plots increases as the number of plots increases, the chances of a species occurring in plots within both habitats also increases with the number of plots. Thus, the slightly higher CC_s value for comparison of the NAs with the ROW may be partially the result of the larger numbers of plots involved.

Prevalence Index Values and Average Wetland Values. Table 12 presents PIVs and AWVs for the combined ROW plots and the combined NA plots for all species and for dominant species. Again, values are based on identified species only. Both PIVs and AWVs for all species in the herb stratum of the NAs and the ROW were very similar. However, values for dominants only were higher for the ROW. Although the two leading dominants in the ROW were FACW species, both of the next two dominants were FACU species; as a result, the AWV for dominants in the ROW is 3.00. The PIV for dominants in the ROW is lower because of the influence of the coverages of the two leading dominants on this weighted value.

TABLE 8 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the North and South Sides of the ROW — Emergent Wetland

Stratum	Wetland Indicator Category	Number of Species: Occurring in North ROW	Occurring in South ROW	Common to Both Areas	Unique to North ROW	Unique to South ROW	Total
Herb[a]	OBL	9	10	7	2	3	12
	FACW	15	16	12	3	4	19
	FAC	6	4	4	2	0	6
	FACU	14	10	7	7	3	17
	UPL	3	0	0	3	0	3
	Unid[b]	3	3	2	1	1	4
	Total	50	43	32	18	11	61

[a] Only the herb stratum was present.

[b] Plants not identified to species or not assigned a wetland indicator category according to Reed (1988).

TABLE 9 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the NNA and SNA — Emergent Wetland

Stratum	Wetland Indicator Category	Number of Species: Occurring in NNA	Occurring in SNA	Common to Both Areas	Unique to NNA	Unique to SNA	Total
Herb[a]	OBL	5	7	4	1	3	8
	FACW	11	16	10	1	6	17
	FAC	4	7	4	0	3	7
	FACU	7	8	5	2	3	10
	UPL	0	1	0	0	1	1
	Unid[b]	1	4	0	1	4	5
	TOTAL	28	43	23	5	20	48

[a] Only the herb stratum was present.

[b] Plants not identified to species or not assigned a wetland indicator category according to Reed (1988).

TABLE 10 Dominant Species by Vegetative Stratum — Emergent Wetland

Stratum	Area	Scientific Name	Common Name	Wetland Indicator Category[a]	Relative Percent Coverage	Total Relative Percent Coverage
Herb[b]	NAs	*Rubus hispidus*	Bristly blackberry	FACW	17.3	
		Juncus effusus	Soft rush	FACW	14.6	
		Phalaris arundinacea	Reed canary grass	FACW	14.6	
		Solidago rugosa	Wrinkled golden-rod	FAC	12.0	58.5
	ROW	*Phalaris arundinacea*	Reed canary grass	FACW	31.7	
		Rubus hispidus	Bristly blackberry	FACW	7.4	
		Fragaria virginiana	Virginia strawberry	FACU	7.3	
		Potentilla simplex	Old field cinquefoil	FACU	5.9	52.3

[a] Wetland indicator categories are defined in Appendix B.

[b] Only the herb stratum was present.

TABLE 11 Coefficient of Community Values: Comparison of Similarity of Species Found in Study Plots — Emergent Wetland

	Comparison		
Stratum	NAs to ROW	North ROW to South ROW	NNA to SNA
Herb	0.70	0.69	0.65
Shrub	N/A[a]	N/A	N/A
Sapling	N/A	N/A	N/A
Tree	N/A	N/A	N/A
Combined strata	0.70	0.69	0.65

[a] Not applicable because this stratum was not present.

TABLE 12 Prevalence Index and Average Wetland Values for All Species and Dominant Species Only in the Herb Stratum of the NAs and ROW — Emergent Wetland

Area	Species	Prevalence Index Value	Average Wetland Value
NAs	All	2.50	2.51
	Dominant Only	2.21	2.25
ROW	All	2.48	2.65
	Dominant Only	2.51	3.00

5 Discussion

5.1 Forested Wetland Site

Clearing of the ROW and installation of the pipeline by conventional open trenching as well as subsequent restoration and maintenance during the past 11 years has created a vegetative community that consists of a single vegetative stratum — an herb stratum — that differs substantially from the stratified community of the NAs, which encompasses herb, shrub, sapling, and tree strata. Only 38 of the 86 species occurring in plots at this site were identified in both the NAs and the ROW, resulting in a relatively low similarity index ($CC_s = 0.61$) between the ROW and the adjacent NAs. Of the 56 species found in the ROW plots, 68% also occurred in the NA plots, indicating that local seed sources are important and that the habitats are similar. Although the ROW has only one stratum, it has nearly the same species diversity (56 species) as the NAs, in which 60 species were identified.

The percentage of wetland species (64% OBL or FACW) found in the ROW compared favorably with that (67% OBL and FACW species) found in the herb stratum of the NAs. Both the PIVs and AWVs for identified species were only slightly higher for the ROW than for the NAs and well below the 3.00 cutoff for wetlands listed in the 1989 Federal Manual. However, as indicated in Section 4.1.2, if the unidentified sedge is an upland species, the PIV could be over 3.00.

Although the composition of the vegetation in the ROW was quite different than that in the NAs, the ROW contained no more introduced species than the NAs. Introduced species in both areas occurred only in the herb stratum. However, the introduced species did constitute a much larger portion of the total coverage in the ROW, where European meadow rush, the leading dominant, represented 29% of the RPC. All other introduced species in the ROW combined made up less than 1% of the RPC.

Past logging and grazing probably facilitated the introduction of nonnative species into the NAs at this site. All introduced species occurring in the NAs were widely distributed and were present in relatively small amounts. Reed meadowgrass (*Glyceria maxima*), the most abundant introduced species in the NAs, represented almost 7% of the total RPC. All other introduced species contributed less than 1% to the total RPC. It seems unlikely that the presence of the ROW is a significant contributing factor to either the number or abundance of introduced species in the NAs. The most abundant introduced species found in the ROW was not present in the NAs.

The richness of the identified species, a majority of which were native perennials, and the relatively high total coverage (the sum of the individual coverages was 187.3%) indicated that a relatively stable vegetative community had developed in the ROW during the 11 years that had elapsed since pipeline installation. Although annual ryegrass had been seeded in the ROW following pipeline construction, none was present in any sampling plots and none was observed in the ROW or the NAs. It is not possible to determine from the data collected in 1992 (11 years

after pipeline installation) whether seeding the ROW had any beneficial effects (such as deterring weedy species) or adverse effects (such as delaying colonization by naturally occurring species).

Any impacts the ROW may have had on the shrub, sapling, and tree strata in the NAs are overshadowed by the impacts of previous logging and grazing. The forest in the NAs was clearly a second-growth forest; no apparent differences were noted between vegetation adjacent to the ROW and that farther from it.

Several factors probably account for the relatively low similarity between the ROW vegetation and that found in the NAs. The destruction of vegetative communities and the disturbance of the soils supporting them, both associated with pipeline installation, set back succession in the ROW. Exclusion of large woody species, conducted as part of maintenance activities, made the ROW more suitable for sun-adapted, and less suitable for shade-adapted species.

5.2 Emergent Wetland Site

The installation of the pipeline and subsequent maintenance activities had fewer obvious impacts at this site than in the forested wetland to the east. The vegetation in the NAs consisted of an herb stratum with occasional scattered shrubs; the herb stratum in the ROW was similar, but no shrubs were present. The data confirm that the vegetation in the ROW was similar to that in the adjacent NAs — 38 of the 71 species found on the site occurred both in the ROW and the NAs, yielding a CC_s of 0.70. Of the 48 species identified in the NAs, 79% also occurred in the ROW. Sixty-two percent of the ROW species also occurred in, and were likely derived from, the NAs. The species richness of the ROW (with 61 species) was higher than that of the NAs.

All four dominant species within the ROW were native. Two of the dominant species (both FACW) also occurred as dominants in the adjacent NAs. The other two were FACU species; the abundance of these species, mainly in the north side of the ROW, may be influenced by the slightly higher elevation of that side of the ROW (see Section 4.2.1).

Of the 73 species unique to the ROW, 10 were introduced species. Only one introduced species was unique to the NAs. Several of the introduced species unique to the ROW were agronomically important legumes. Although their number was high, the introduced species constituted a small portion of the plant coverage in the ROW — the total RPC for all introduced species in the ROW was only 5.8%. The presence of mineral soils at the surface (as a result of pipeline installation), the modification of ROW elevations, and a history of grazing may all contribute to the invasion and persistence of the introduced species. The species may have also been planted after pipeline installation, although no record of this could be found.

Differences in species distribution between the south and the north sides of the ROW are probably related to slight differences in elevation after final grading. Standing water covered

12.7% of the south side of the ROW and only 0.4% of the north side of the ROW. Similarly, standing water covered 1.8% and 0.4% of the soil on the NNA and SNA, respectively. Thus, the south side of the ROW was somewhat wetter than any of the other areas at this site. The survey results show that 60% of the species on the south side of the ROW were OBL or FACW, compared to 48% on the north side of the ROW, 53% in the SNA, and 57% in the NNA. The calculated CC_S for comparison of the two sides of the ROW was slightly lower than that for comparison of the ROW with the NAs. Again, the CC_S values reflect the differences in the two sides of the ROW and the similarity of the ROW vegetation to that in the adjacent NAs. The PIVs and AWVs for the ROW and for the NAs were very similar, except the AWV of dominants in the ROW. The areas of higher elevation and disturbed soils in the ROW allow for the existence of FACU species, such as the Virginia strawberry and old field cinquefoil. These differences demonstrate the effects that minor changes in surface grade can have on vegetation.

One of the factors that probably contributed to the similarity between the vegetation in the ROW and that in the adjacent NAs is the history of grazing. Grazing tends to select for aggressive species and species that are able to respond to disturbance (Barbour and Billings 1988). Thus, species with the potential to reinvade the ROW after pipeline installation are more likely to be selected.

6 Summary and Conclusions

6.1 Summary

The primary goal of the GRI Wetland Corridors Program is to identify and evaluate the impacts of pipeline construction and ROW maintenance on the wetlands they traverse. To accomplish this goal, pipelines crossing various wetlands throughout the eastern United States were surveyed. The objectives for each study site were to document the vegetative communities on the ROW and on adjacent NAs that had not been disturbed by pipeline construction; to evaluate the similarities and differences between the plant communities on the ROW and the NAs; to document changes to the topography, soils, and hydrology attributable to ROW construction; and to identify the impacts caused by ROW construction on rare, threatened, endangered, or sensitive species.

This study involved a comparison of the vegetative community that had developed on the ROW of an 11-yr-old pipeline through a forested wetland and a nearby emergent wetland in the township of Gerry, Chautauqua County, New York. These two sites provided an opportunity to study the impacts of pipeline construction and maintenance in two different vegetative communities.

The ROW within the forested wetland supported a diverse wetland vegetative community consisting predominantly of native perennial species. The vegetative community was similar to that found in the adjacent NAs in terms of numbers of introduced species, sums of the areal coverages of all species, and species diversity. However, introduced species covered a greater area in the ROW, and the leading dominant was an introduced species. These differences may be caused or influenced by several factors: (1) the ROW included more areas of lower elevation with deeper standing water than did the adjacent forested wetland; (2) exposed mineral soil at the surface (a result of the pipeline construction firm's inability to salvage topsoil for replacement at the top of the trench) may favor the introduced species; and (3) the exclusion of shrubs, saplings, and trees from the ROW favors sun-adapted species. Fertilization and seeding of the ROW within this site had no obvious impacts after 11 years had elapsed.

The ROW within the emergent wetland supported a vegetative community that was more diverse than the community in the adjacent NAs and included more introduced species. The two sides of the ROW also differed; considerably more standing water was observed on the south side than on the north side of the ROW or in the adjacent NAs. The drier north side supported two dominant species that are classified as FACU species. The factors contributing to this difference include the following: (1) the slightly altered ROW topography created areas of slightly lower elevation with more standing water on south side of the ROW; (2) exposed mineral soil may favor the introduced species; and (3) grazing may favor the survival of introduced agronomic pasture species.

6.2 Conclusions

The establishment and maintenance of the pipeline ROW through the forested wetland resulted in a vegetative community that consisted of species similar, in terms of their fidelity to wetlands, to those that constituted the herb stratum of the adjacent NAs. The exclusion of shrubs, saplings, and trees from the ROW resulted in a discontinuity in the natural community and diversity of habitat in the wetland. New edges, providing habitat for edge species, were created on either side of the ROW.

The establishment and maintenance of the pipeline ROW through the emergent wetland had few obvious effects on the wetland. The most noticeable was the exclusion of scattered shrubs from the ROW. Vegetative sampling revealed differences between the two sides of the ROW related to slight elevational differences. Although the ROW did little to provide diversity in general habitat type, it did contribute to species richness and provided habitat for several introduced species, including agronomically important species. No threatened or endangered species were found at this site.

Slight changes in ROW topography and the contractor's inability to replace topsoil during pipeline construction may account for some of the species richness within the ROW in these two communities.

7 References

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Appendix A:

Definition of Jurisdictional Wetlands

Appendix A: Definition of Jurisdictional Wetlands

Wetland identification and delineation necessary to implement Section 404 of the Clean Water Act and the "Swampbuster" (Subtitle B) provision of the Food Security Act of 1985 involves four agencies: the U.S. Army Corps of Engineers (COE), the U.S. Environmental Protection Agency (EPA), the U.S. Fish and Wildlife Service (FWS), and the Soil Conservation Service (SCS). On January 10, 1989, these agencies, which had operated with slightly different definitions of wetland, adopted a uniform definition based on hydrology, vegetation, and soils.

The joint agreement stipulates that to be classified as a Jurisdictional Wetland, an area must have hydrotrophytic vegetation, hydric soils, and a wetland hydrology. All three criteria are mandatory; without any one criterion, the area is not a Jurisdictional Wetland. A schematic diagram of this delineation process is shown in Figure A.1. See the *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* for a more detailed discussion of the various terms and criteria (FICWD 1989).

Problems uncovered during field trials of the 1989 Federal Manual and disagreement among the four agencies on revisions in 1991 resulted in the EPA and the COE reverting to use of the 1987 *COE Wetlands Delineation Manual*, which also defines wetlands on the basis of vegetation, hydric soils, and hydrology, but with slightly different definitions of these parameters. In January 1994, the four agencies entered into a joint Memorandum of Agreement, "Concerning the Delineation of Wetlands for Purposes of Section 404 of the Clean Water Act and Subtitle B of the Food Security Act," which, in broad terms, stipulates that the EPA and the COE will accept SCS procedures for delineating wetlands (SCS 1988) on agricultural lands and that SCS will use the 1987 *COE Wetlands Delineation Manual* (COE 1987) for areas that are not agricultural lands.

The individual reports on the pipeline crossings through wetlands that are part of the GRI Wetland Corridors Program use the definition and criteria of the 1989 Federal Manual that were in effect during 1990 and 1991, the first two years of these studies. The use of the rigorous criteria of the 1989 manual should provide sufficient information for application to other procedures in the evolving field regulatory procedures for delineation and preservation of jurisdictional wetlands.

References

COE: see U.S. Army Corps of Engineers.

Federal Interagency Committee for Wetland Delineation, 1989, *Federal Manual for Identifying and Delineating Jurisdictional Wetlands*, U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture, Cooperative Technical Publication, Washington, D.C.

FICWD: see Federal Interagency Committee for Wetland Delineation.

SCS: see Soil Conservation Service.

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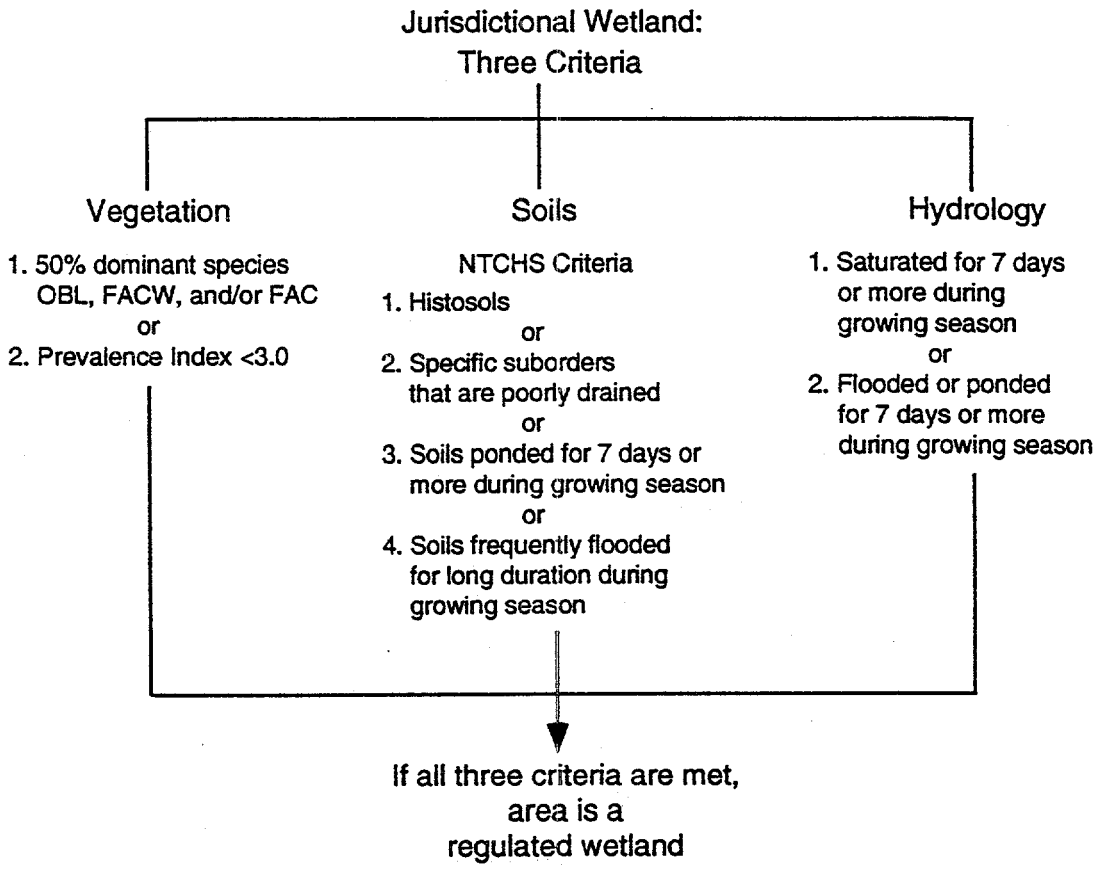

FIGURE A.1 Schematic Diagram of the Wetland Delineation Process (Source: FICWD 1989)

Appendix B:

Data Analysis — Definitions and Equations

Appendix B: Data Analysis — Definitions and Equations

B.1 Wetland Indicator Categories

Wetland indicator categories used in this report to classify the types of plant species were taken from Reed (1988). The five basic categories, commonly called the "wetland indicator status," are based on frequency of occurrence in wetlands. They are defined as follows:

Category	Value	Definition
Obligate wetland (OBL)	1.0	Plants that almost always occur in wetlands under natural conditions (estimated probability >99%)
Facultative wetland (FACW)	2.0	Plants that usually occur in wetlands (estimated probability 67-99%) but occasionally are found in nonwetlands
Facultative (FAC)	3.0	Plants that are equally likely to occur in wetlands or nonwetlands (estimated probability 34-66%)
Facultative upland (FACU)	4.0	Plants that usually occur in nonwetlands (estimated probability 67-99%) but occasionally are found in wetlands (estimated probability 1-33%)
Obligate upland (UPL)	5.0	Plants that almost always occur in nonwetlands under natural conditions (estimated probability >99%)

B.2 Life-Form and Origin

The life-form and origin symbols are used for describing plant characteristics. The following symbols are used:

Symbol	Life-Form or Origin
A	Annual
B	Biennial
E	Emergent
F	Forb
F3	Fern
G	Grass
GL	Grasslike
H2	Horsetail
I	Introduced
N	Native
P	Perennial
S	Shrub
T	Tree
V	Herbaceous vine
WV	Woody vine

Symbols are combined to describe the life-form and origin; for example, ANG means annual native grass and PIEF means perennial introduced emergent forb. For further description refer to the report by Reed (1988).

B.3 Prevalence Index Value

The prevalence index value (PIV) was determined by using the method outlined in the 1989 Federal Manual (FICWD 1989). The PIV, modified for this report to use relative percent areal coverage instead of relative frequencies as described in the 1989 Federal Manual, is defined as

$$PIV = \frac{RPC_o + 2RPC_{fw} + 3RPC_f + 4RPC_{fu} + 5RPC_u}{100} \qquad (B.1)$$

where

RPC_o = Relative percent coverage (RPC) of obligate wetland species,

RPC_{fw} = RPC of facultative wetland species,

RPC_f = RPC of facultative species,

RPC_{fu} = RPC of facultative upland species, and

RPC_u = RPC of upland species.

B.4 Average Wetland Value

The average wetland value (AWV), defined in Zimmerman et al. (1991), differs from the PIV in that it is not coverage data or frequency of occurrence that is used in determining the AWV, but rather the total number of species present. Thus, all species present are represented equally in the AWV. The AWV is defined as

$$AWV = \frac{N_o + 2N_{fw} + 3N_f + 4N_{fu} + 5N_u}{N_o + N_{fw} + N_f + N_{fu} + N_u} \quad \text{(B.2)}$$

where

N_o = number of obligate wetland species,

N_{fw} = number of facultative wetland species,

N_f = number of facultative species,

N_{fu} = number of facultative upland species, and

N_u = number of upland species.

B.5 References

Federal Interagency Committee for Wetland Delineation, 1989, *Federal Manual for Identifying and Delineating Jurisdictional Wetlands,* U.S. Army Corps of Engineers, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and U.S. Department of Agriculture, Cooperative Technical Publication, Washington, D.C.

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Appendix C:

Plant Species List, Areal Coverage Data, and Species Distribution

Appendix C: Plant Species List, Areal Coverage Data, and Species Distribution

TABLE C.1 Plant Species List — Forested Wetland

Field Number	Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
112	*Acer rubrum* L.	Red maple	FAC	NT
30	*Agrostis stolonifera* L.	Spreading bentgrass	FACW	PNG
9	*Amphicarpaea bracteata* (L.) Fernald	American hog-peanut	FAC	APNFV
87	*Aster simplex* Willd.	Panicled aster	FACW	PNF
67	*Aster* spp.			
35	*Aster umbellatus* Mill.	Flat-top white aster	FACW	PNF
92	*Athyrium filix-femina* (L.) Roth	Subarctic lady fern	FAC	PNF3
108	*Betula allegnaniensis* Britton	Yellow birch	FAC	NT
122	*Bidens* spp.			
131	*Boehmeria cylindrica* (L.) Swartz	Small-spike false-nettle	FACW+	PNF
129	*Caltha palustris* L.	Common marsh-marigold	OBL	PNF
32	*Carex annectens* (Bickn.) Bickn.	Yellow-fruit sedge	FACW	PNGL
91	*Carex cristatella* Britton	Crested sedge	FACW	PNGL
26	*Carex lupulina* Muhl. ex Willd.	Hop sedge	OBL	PNEGL
19	*Carex lurida* Wahlenb.	Shallow sedge	OBL	PNEGL
103	*Carex* sp. (wide leaves)			
82	*Carex* sp. (fine leaves)			
34	*Carex tribuloides* Wahlenb.	Blunt broom sedge	FACW+	PNGL
54	*Carex* × *stipata* Muhl. ex Willd.	Stalk-grain sedge	OBL	PNGL
107	*Carpinus caroliniana* Walter	American hornbeam	FAC	NT
99	*Chelone glabra* L.	White turtlehead	OBL	PNF
88	*Cornus stolonifera* Michx.	Red-osier dogwood	FACW+	NS
120	*Corylus cornuta* Marshall	Beaked hazel-nut	FACU-	NS
109	*Crataegus* sp.			
125	*Dryopteris* spp.			
15	*Epilobium hirsutum* L.	Great-hairy willow-herb	FACW	PIF
45	*Equisetum arvense* L.	Field horsetail	FAC	PNH2
66	*Eupatoriadelphus maculatus* (L.) R.M. King and H. Rob	Spotted joe-pye-weed	FACW	PNF
11	*Eupatorium perfoliatum* L.	Common boneset	FACW+	PNF
5	*Euthamia graminifolia* (L.) Nutt.	Flat-top fragrant-golden-rod	FAC	PNF
64	*Fragaria virginiana* Duchesne	Virginia strawberry	FACU	PNF
126	*Fraxinus nigra* Marshall	Black ash	FACW	NT
113	*Fraxinus pennsylvanica* Marshall	Green ash	FACW	NT
116	*Galium asprellum* Michx.	Rough bedstraw	OBL	PNF
21	*Galium trifidum* L.	Small bedstraw	FACW+	PNF

TABLE C.1 (Cont.)

Field Number	Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
24	*Glyceria maxima* (Hartm.) O.R. Holmberg	Reed meadowgrass	OBL	PIG
110	*Hamamelis virginiana* L.	American witch-hazel	FAC-	NST
28	*Holcus lanatus* L.	Common velvet grass	FACU	PNG
104	*Hypericum punctatum* Lam.	Dotted St. John's-wort	FAC-	PNF
119	*Ilex verticillata* (L.) Gray	Common winterberry	FACW+	NST
3	*Impatiens capensis* Meerb.	Spotted touch-me-not	FACW	ANF
50	*Juncus inflexus* L.	European meadow rush	FACW	PIGL
130	*Leersia oryzoides* (L.) Swartz	Rice cutgrass	OBL	PNG
132	*Lobelia cardinalis* L.	Cardinal flower	FACW+	PNF
14	*Lycopus americanus* Muhl. ex W. Barton	American bugleweed	OBL	PNF
42	*Lycopus virginicus* L.	Virginia bugleweed	OBL	PNF
17	*Mentha* × *piperita* L.	Peppermint	FACW+	PIEF
69	*Mimulus ringens* L.	Alleghany monkey-flower	OBL	PNF
105	*Mitella diphylla* L.	Two-leaf bishop's-cap	FACU	PNF
101	*Mysotis scorpoides* L.	True forget-me-not	OBL	PIF
7	*Onoclea sensibilis* L.	Sensitive fern	FACW	PNEF3
93	*Osmunda cinnamomea* L.	Cinnamon fern	FACW	PNEF3
96	*Parthenocissus quinquefolia* (L.) Planch.	Virginia creeper	FACU	NWV
1	*Phalaris arundinacea* L.	Reed canary grass	FACW+	PNG
98	*Poa compressa* L.	Canada bluegrass	FACU	PIG
29	*Poa pratensis* L.	Kentucky bluegrass	FACU	PNG
37	*Polygonum sagittatum* L.	Arrow-leaf tearthumb	OBL	APNF
63	*Potentilla simplex* Michx.	Old field cinquefoil	FACU-	PNF
118	*Prunus virginiana* L.	Choke cherry	FACU	NST
62	*Ranunculus allegheniensis* Britton	Allegheny mountain butter-cup	FAC	PNF
102	*Ribes triste* Pallas	Swamp red currant	OBL	IS
94	*Rosa palustris* Marshall	Swamp rose	OBL	NS
52	*Rubus hispidus* L.	Bristly blackberry	FACW	NS
70	*Rubus idaeus* L.	Common red raspberry	FAC-	IS
13	*Sagittaria latifolia* Willd.	Broad-leaf arrow-head	OBL	PNEF
111	*Salix humilis* Marshall	Tall prairie willow	FACU	NS
89	*Salix rigida* Muhl.	Heart-leaf willow	OBL	NS
90	*Salix sericea* Marshall	Silky willow	OBL	NS
61	*Salix* sp.			
20	*Scirpus atrovirens* Willd.	Green bulrush	OBL	PNEGL
86	*Scirpus* sp.			
18	*Scirpus validus* Vahl	Soft-stem bulrush	OBL	PNEGL
127	*Scutellaria lateriflora* L.	Blue skullcap	FACW+	PNF
124	*Sium suave* Walter	Hemlock water-parsnip	OBL	PNEF
123	*Solanum dulcamara* L.	Climbing nightshade	FAC-	PIF
60	*Solidago canadensis* L.	Canada golden-rod	FACU	PNF

TABLE C.1 (Cont.)

Field Number	Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
6	*Solidago gigantea* Ait.	Giant golden-rod	FACW	PNF
100	*Solidago patula* Muhl. ex Willd.	Rough-leaf golden-rod	OBL	PNF
36	*Solidago rugosa* Mill.	Wrinkled golden-rod	FAC	PNF
56	*Solidago* sp.			
95	*Symplocarpus foetidus* (L.) Salisb.	Skunk-cabbage	OBL	PNF
41	*Taraxacum officinale* G.H. Weber	Common dandelion	FACU-	PIF
97	*Thalictrum pubescens* Pursh	Tall meadow-rue	FACW+	PNF
8	*Thelypteris thelyptroides* (Michx.) J. Holub	Marsh fern	FACW+	F3
0	*Toxicodendron radicans* (L.) Kuntz	Poison ivy	FAC	NWVS
12	*Typha latifolia* L.	Broad-leaf cattail	OBL	PNEF
114	*Ulmus americana* L.	American elm	FACW-	NT
10	*Verbena hastata* L.	Blue vervain	FACW+	PNF
128	*Viburnum lentago* L.	Nannyberry	FAC	NTS

[a] Wetland indicator categories are assigned to plants in the United States on a regional basis. New York is located in Region 1. A '+' following an indicator category reveals a frequency toward the high end of the category (more frequently found in wetlands), while a '-' indicates a frequency toward the low end of the category (less frequently found in wetlands).

[b] Plant characteristics and life-forms assigned to each species are indicated in this column. See Appendix B for definitions of life-forms/origins.

TABLE C.2 Coverage Estimates by Stratum for Species in the Forested Wetland

Field Number	Species Names	Areal Coverage (%)[a]																			
		SNA					South Side of ROW					North Side of ROW					NNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
	Standing Water	0.5	40	20	25	50	10	40	1	2	50	0	0	20	50	5	20	80	35	30	90
	Mosses	50	20	50	10	10	10	20	20	10	40	60	20	10	2	25	20	5	5	20	0.5
Herb Stratum																					
112	*Acer rubrum*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
30	*Agrostis stolonifera*	-	-	-	0.5	0.5	0.5	2	-	2	-	-	3	20	5	1	2	1	-	1	0.5
9	*Amphicarpaea bracteata*	3	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	1	-	-	-	-
87	*Aster simplex*	-	-	-	-	-	1	-	-	-	-	0.5	0.5	-	-	-	-	-	-	7	-
67	*Aster* spp.	4	2	1	4	-	-	-	-	-	-	0.5	-	-	-	-	-	2	1	-	-
35	*Aster umbellatus*	10	-	2	-	1	-	1	-	-	1	2	-	-	1	-	4	15	7	5	-
92	*Athyrium filix-femina*	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-
122	*Bidens* sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-
131	*Boehmeria cylindrica*	10	2	-	5	1	-	-	-	-	0.5	-	-	0.5	-	-	-	-	0.5	-	2
129	*Caltha palustris*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	*Carex annectens*	-	-	-	-	-	-	-	-	-	-	1	2	1	0.5	-	-	-	-	-	-
91	*Carex cristatella*	7	-	-	-	-	0.5	-	-	-	-	0.5	-	-	-	-	2	-	-	-	-
26	*Carex lupulina*	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
19	*Carex lurida*	-	-	-	-	-	-	-	0.5	-	-	-	-	0.5	-	-	-	-	-	-	-
82	*Carex* sp. (narrow leaves)	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	-	5	-	-	-
103	*Carex* sp. (wide leaves)	30	10	5	75	40	-	-	-	-	-	-	-	-	-	-	80	10	80	40	5
34	*Carex tribuloides*	-	-	-	-	-	-	-	-	-	2	-	-	-	1	-	-	5	-	-	-
54	*Carex* × *stipata*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
99	*Chelone glabra*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
88	*Cornus stolonifera*	-	0.5	-	-	-	-	-	-	1	-	0.5	-	-	-	-	-	-	-	-	-
120	*Corylus cornuta*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-
125	*Dryopteris* sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
15	*Epilobium hirsutum*	-	-	-	-	0.5	1	1	-	1	-	2	-	-	-	-	-	-	-	-	-
45	*Equisetum arvense*	20	50	20	-	0.5	20	20	50	30	40	40	30	25	30	0.5	20	5	-	40	-
66	*Eupatoriadelphus maculatus*	-	-	-	-	0.5	-	0.5	1	2	-	0.5	8	1	2	0.5	2	-	-	-	-
11	*Eupatorium perfoliatum*	-	-	-	-	3	2	1	0.5	1	5	1	-	0.5	2	2	0.5	1	6	5	2
5	*Euthamia graminifolia*	-	-	-	-	-	-	5	1	1	-	0.5	0.5	1	-	-	-	-	-	-	-
64	*Fragaria virginiana*	2	-	-	-	-	-	-	-	1	-	-	-	0.5	1	-	-	-	-	-	-
113	*Fraxinus pennsylvanica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-
116	*Galium asprellum*	-	-	-	-	0.5	-	-	-	-	-	-	-	-	0.5	0.5	5	1	0.5	-	-
21	*Galium trifidum*	5	5	5	20	10	3	10	10	15	10	2	15	10	15	2	2	5	2	10	0.5
24	*Glyceria maxima*	-	10	-	-	20	-	-	-	-	-	-	-	-	-	-	0.5	40	20	2	5

TABLE C.2 (Cont.)

Field Number	Species Names	Areal Coverage (%)[a]																			
		SNA					South Side of ROW					North Side of ROW					NNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
28	*Holcus lanatus*	-	-	-	-	-	-	-	2	2	1	0.5	-	1	2	-	-	-	-	-	-
104	*Hypericum punctatum*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
119	*Ilex verticillata*	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-
3	*Impatiens capensis*	2	40	25	15	40	5	1	1	10	15	1	2	5	2	2	2	50	10	35	40
50	*Juncus inflexus*	-	-	-	-	-	70	50	80	70	40	60	60	80	40	2	-	-	-	-	-
130	*Leersia oryzoides*	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
132	*Lobelia cardinalis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
14	*Lycopus americanus*	0.5	-	-	-	1	-	-	-	-	0.5	0.5	0.5	-	0.5	-	-	-	-	-	-
42	*Lycopus virginicus*	-	-	-	-	0.5	0.5	0.5	1	0.5	5	0.5	-	-	0.5	-	-	-	-	-	-
17	*Mentha × piperita*	-	-	-	-	0.5	0.5	0.5	3	-	2	-	-	-	-	2	-	-	-	-	-
69	*Mimulus ringens*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
105	*Mitella diphylla*	0.5	-	-	0.5	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	2
101	*Mysotis scorpoides*	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	0.5
7	*Onoclea sensibilis*	30	75	90	20	5	-	10	4	20	15	1	3	5	10	5	2	80	70	40	10
93	*Osmunda cinnamomea*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
96	*Parthenocissus quinquefolia*	10	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	5	5	1	3	3
1	*Phalaris arundinacea*	-	-	-	20	10	50	50	10	30	40	50	60	30	2	100	-	-	-	1	-
98	*Poa compressa*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	*Poa pratensis*	-	-	-	-	-	0.5	-	0.5	-	-	1	-	-	-	-	-	-	-	-	-
37	*Polygonum sagittatum*	0.5	-	0.5	1	2	0.5	-	-	0.5	-	0.5	0.5	-	0.5	0.5	0.5	2	1	1	1
63	*Potentilla simplex*	-	-	-	-	-	-	-	0.5	-	-	-	0.5	-	-	-	-	-	-	-	-
62	*Ranunculus allegheniensis*	-	-	-	-	-	-	-	-	-	-	0.5	2	0.5	-	-	-	-	-	-	-
102	*Ribes triste*	0.5	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-
94	*Rosa palustris*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
52	*Rubus hispidus*	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	5	2	0.5	2
70	*Rubus idaeus*	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	1	-
13	*Sagittaria latifolia*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
89	*Salix rigida*	-	-	-	-	-	-	30	-	-	-	0.5	-	-	-	-	-	-	-	-	-
90	*Salix sericea*	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-
61	*Salix* spp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
20	*Scirpus atrovirens*	-	-	3	-	20	-	2	1	30	13	-	2	30	40	5	-	-	1	-	0.5
86	*Scirpus* spp.	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-
18	*Scirpus validus*	-	-	-	-	-	-	0.5	-	0.5	-	-	-	-	-	0.5	-	-	-	-	-
127	*Scutellaria lateriflora*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
124	*Sium suave*	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5
123	*Solanum dulcamara*	-	5	-	3	-	-	-	-	-	0.5	-	-	-	-	-	-	2	4	-	10

TABLE C.2 (Cont.)

Field Number	Species Names	Areal Coverage (%)[a]																			
		SNA					South Side of ROW					North Side of ROW					NNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
60	*Solidago canadensis*	-	-	-	-	-	-	-	-	0.5	-	-	2	-	-	-	-	-	-	-	-
6	*Solidago gigantea*	-	-	-	-	-	-	1	1	2	3	0.5	-	-	1	-	-	-	-	-	-
100	*Solidago patula*	2	1	3	5	5	-	-	-	1	-	-	-	0.5	-	-	-	-	2	2	-
36	*Solidago rugosa*	1	-	-	-	-	-	-	0.5	-	-	-	0.5	0.5	-	-	4	1	-	1	0.5
56	*Solidago* sp.	-	-	-	-	2	-	1	1	-	3	0.5	-	1	0.5	-	-	1	1	-	-
95	*Symplocarpus foetidus*	0.5	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
41	*Taraxacum officinale*	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-
97	*Thalictrum pubescens*	1	-	-	-	-	-	-	-	1	-	-	1	-	-	-	1	-	-	-	-
8	*Thelypteris thelyptroides*	-	0.5	0.5	-	-	-	-	-	-	-	-	-	-	1	-	-	-	0.5	2	-
0	*Toxicodendron radicans*	2	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	5	-	-	-	0.5
12	*Typha latifolia*	-	-	10	-	40	5	2	-	2	20	5	1	5	30	5	-	-	-	40	75
114	*Ulmus americana*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	*Verbena hastata*	-	-	-	-	-	0.5	-	0.5	-	-	0.5	0.5	1	1	0.5	-	-	-	-	-
Shrub Stratum																					
112	*Acer rubrum*	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	2	-	-	-
108	*Betula alleghaniensis*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
107	*Carpinus caroliniana*	30	2	3	10	2	-	-	-	-	-	-	-	-	-	-	4	3	1	2	0.5
88	*Cornus stolonifera*	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
120	*Corylus cornuta*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
109	*Crataegus* sp.	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
126	*Fraxinus nigra*	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
113	*Fraxinus pennsylvanica*	-	-	1	1	1	-	-	-	-	-	-	-	-	-	-	5	4	-	0.5	1
110	*Hamamelis virginiana*	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
119	*Ilex verticillata*	-	5	1	-	0.5	-	-	-	-	-	-	-	-	-	-	1	-	0.5	1	-
118	*Prunus virginiana*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-
111	*Salix humilis*	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
114	*Ulmus americana*	1	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
128	*Viburnum lentago*	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-
Sapling Stratum																					
112	*Acer rubrum*	10	10	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
112	*Betula alleghaniensis*	-	-	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
113	*Fraxinus pennsylvanica*	-	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20	10	-
114	*Ulmus americana*	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C.2 (Cont.)

Field Number	Species Names	Areal Coverage (%)[a]																			
		SNA					South Side of ROW					North Side of ROW					NNA				
		T1[a]	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
Tree Stratum																					
112	*Acer rubrum*	670	-	408	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
108	*Betula allegnaniensis*	227	-	-	133	-	-	-	-	-	-	-	-	-	-	-	-	-	314	-	-
107	*Carpinus caroliniana*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	907	-	-	-
113	*Fraxinus pennsylvanica*	699	254	1064	3301	1390	-	-	-	-	-	-	-	-	-	-	2048	133	1854	254	-
114	*Ulmus americana*	133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	201	-	-

[a] Each value represents the value given to a species in a single plot of Transect 1 (T1) through Transect 5 (T5). Values are percent areal coverages for herb, shrub, and sapling strata. Values are total basal area for all trees of that species in the plot.

TABLE C.3 Average Coverage, Absolute Frequencies, and Distribution of Species in the Forested Wetland (by area)

Field Number	Species Names	Average Percent Coverage/ Absolute Frequency SNA	South ROW	North ROW	NNA
	Standing Water	27.1/5	20.6/5	15.0/2	51.0/5
	Mosses	28.0/5	20.0/5	23.4/5	10.1/5
Herb Stratum					
	Plants found in all four areas				
30	*Agrostis stolonifera*	0.2/2	0.9/3	5.8/4	0.9/4
35	*Aster umbellatus*	2.6/3	0.4/2	0.6/2	6.2/4
131	*Boehmeria cylindrica*	3.6/4	0.1/1	0.1/1	0.5/2
91	*Carex cristatella*	1.4/1	0.1/1	0.1/1	0.4/4
45	*Equisetum arvense*	18.1/4	32.0/5	25.1/5	13.0/3
66	*Eupatoriadelphus maculatus*	0.1/1	0.7/3	2.4/5	0.4/1
11	*Eupatorium perfoliatum*	0.6/1	1.9/5	1.1/4	2.9/5
21	*Galium trifidum*	9.0/5	9.6/5	8.8/5	3.9/5
3	*Impatiens capensis*	24.4/5	6.4/5	2.4/5	27.4/5
7	*Onoclea sensibilis*	44.0/5	9.8/4	4.8/5	40.4/5
1	*Phalaris arundinacea*	6.0/2	36.0/5	48.4/5	0.2/1
37	*Polygonum sagittatum*	0.8/4	0.2/2	0.4/4	1.1/5
20	*Scirpus atrovirens*	4.6/2	9.2/4	15.4/4	0.3/2
100	*Solidago patula*	3.2/5	0.2/1	0.1/1	0.8/2
36	*Solidago rugosa*	0.2/1	0.1/1	0.2/2	1.3/5
56	*Solidago* sp.	0.4/1	1.0/3	0.4/3	0.4/2
97	*Thalictrum pubescens*	0.2/1	0.2/1	0.2/1	0.2/1
12	*Typha latifolia*	10.0/2	5.8/4	9.2/5	23.0/2
	Plants found in both NAs and south side of ROW				
123	*Solanum dulcamara*	1.6/2	0.1/1	0.0/0	3.2/3
0	*Toxicodendron radicans*	0.4/1	0.1/1	0.0/0	1.1/2
	Plants found in both NAs and north side of ROW				
9	*Amphicarpaea bracteata*	0.6/1	0.0/0	0.1/1	0.2/1
67	*Aster* spp.	2.2/4	0.0/0	0.1/1	0.6/2
82	*Carex* sp. (wide leaves)	0.4/1	0.0/0	0.2/1	1.0/4
116	*Galium asprellum*	0.1/1	0.0/0	0.2/2	1.3/3
105	*Mitella diphylla*	0.2/2	0.0/0	0.2/1	0.4/1
101	*Mysotis scorpoides*	0.2/2	0.0/0	0.1/1	0.1/1
96	*Parthenocissus quinquefolia*	2.0/1	0.0/0	0.2/2	3.4/5
8	*Thelypteris thelyptroides*	0.2/2	0.0/0	0.2/1	0.5/2

TABLE C.3 (Cont.)

Field Number	Species Names	Average Percent Coverage/ Absolute Frequency SNA	South ROW	North ROW	NNA
	Plants found in both NAs only				
92	*Athyrium filix-femina*	0.4/1	0.0/0	0.0/0	0.1/1
26	*Carex lupulina*	0.6/1	0.0/0	0.0/0	2.0/4
103	*Carex* sp. (narrow leaves)	32.0/5	0.0/0	0.0/0	43.0/5
24	*Glyceria maxima*	6.0/2	0.0/0	0.0/0	13.5/5
130	*Leersia oryzoides*	2.0/1	0.0/0	0.0/0	0.0/0
52	*Rubus hispidus*	0.1/1	0.0/0	0.0/0	1.9/4
70	*Rubus idaeus*	0.4/1	0.0/0	0.0/0	1.2/2
124	*Sium suave*	0.1/1	0.0/0	0.0/0	0.1/1
95	*Symplocarpus foetidus*	0.5/2	0.0/0	0.0/0	0.1/1
	Plants found in SNA and both sides of ROW				
88	*Cornus stolonifera*	0.1/1	0.2/1	0.1/1	0.0/0
15	*Epilobium hirsutum*	0.1/1	0.6/3	0.4/1	0.0/0
64	*Fragaria virginiana*	0.4/1	0.2/1	0.3/2	0.0/0
14	*Lycopus americanus*	0.3/2	0.1/1	0.3/3	0.0/0
42	*Lycopus virginicus*	0.1/1	1.5/5	0.2/2	0.0/0
17	*Mentha* × *piperita*	0.1/1	1.2/4	0.4/1	0.0/0
	Plant found in SNA and south side of ROW				
102	*Ribes triste*	0.1/1	0.1/1	0.0/0	0.0/0
	Plants found in SNA only				
112	*Acer rubrum*	0.1/1	0.0/0	0.0/0	0.0/0
129	*Caltha palustris*	0.1/1	0.0/0	0.0/0	0.0/0
99	*Chelone glabra*	0.1/1	0.0/0	0.0/0	0.0/0
104	*Hypericum punctatum*	0.1/1	0.0/0	0.0/0	0.0/0
93	*Osmunda cinnamomea*	0.2/1	0.0/0	0.0/0	0.0/0
98	*Poa compressa*	0.1/1	0.0/0	0.0/0	0.0/0
94	*Rosa palustris*	0.1/1	0.0/0	0.0/0	0.0/0
114	*Ulmus americana*	0.1/1	0.0/0	0.0/0	0.0/0
	Plants found in NNA and both sides of ROW				
87	*Aster simplex*	0.0/0	0.2/1	0.2/2	1.4/1
34	*Carex tribuloides*	0.0/0	0.4/1	0.2/10	1.0/4

TABLE C.3 (Cont.)

Field Number	Species Names	Average Percent Coverage/ Absolute Frequency SNA	South ROW	North ROW	NNA
	Plants found in NNA only				
54	*Carex* × *stipata*	0.0/0	0.0/0	0.0/0	0.1/4
120	*Corylus cornuta*	0.0/0	0.0/0	0.0/0	0.4/4
125	*Dryopteris* sp.	0.0/0	0.0/0	0.0/0	0.2/4
113	*Fraxinus pennsylvanica*	0.0/0	0.0/0	0.0/0	0.4/1
61	*Salix* spp.	0.0/0	0.0/0	0.0/0	0.2/1
127	*Scutellaria lateriflora*	0.0/0	0.0/0	0.0/0	0.1/1
	Plants found in both sides of ROW				
19	*Carex lurida*	0.0/0	0.1/1	0.1/1	0.0/0
5	*Euthamia graminifolia*	0.0/0	1.4/3	0.4/3	0.0/0
28	*Holcus lanatus*	0.0/0	1.0/3	0.7/3	0.0/0
50	*Juncus inflexus*	0.0/0	62.0/5	48.4/5	0.0/0
29	*Poa pratensis*	0.0/0	0.2/2	0.2/1	0.0/0
63	*Potentilla simplex*	0.0/0	0.1/1	0.1/1	0.0/0
89	*Salix rigida*	0.0/0	6.0/1	0.1/1	0.0/0
18	*Scirpus validus*	0.0/0	0.2/2	0.1/1	0.0/0
60	*Solidago canadensis*	0.0/0	0.1/1	0.4/1	0.0/0
6	*Solidago gigantea*	0.0/0	1.4/4	0.3/2	0.0/0
10	*Verbena hastata*	0.0/0	0.2/2	0.7/5	0.0/0
	Plants found in north side of ROW only				
122	*Bidens* sp.	0.0/0	0.0/0	0.1/1	0.0/0
32	*Carex annectens*	0.0/0	0.0/0	0.9/5	0.0/0
119	*Ilex verticillata*	0.0/0	0.0/0	0.1/1	0.0/0
62	*Ranunculus allegheniensis*	0.0/0	0.0/0	0.6/3	0.0/0
90	*Salix sericea*	0.0/0	0.0/0	0.1/1	0.0/0
86	*Scirpus* spp.	0.0/0	0.0/0	0.4/1	0.0/0
41	*Taraxacum officinale*	0.0/0	0.0/0	0.1/1	0.0/0
	Plants found on site but not in plots				
69	*Mimulus ringens*	0.0/0	0.0/0	0.0/0	0.0/0
132	*Lobelia cardinalis*	0.0/0	0.0/0	0.0/0	0.0/0
13	*Sagittaria latifolia*	0.0/0	0.0/0	0.0/0	0.0/0

TABLE C.3 (Cont.)

Field Number	Species Names	Average Percent Coverage/ Absolute Frequency			
		SNA	South ROW	North ROW	NNA
Shrub Stratum					
	Plants found in both NAs				
112	*Acer rubrum*	0.4/2	0.0/0	0.0/0	0.5/2
108	*Betula alleghaniensis*	0.1/1	0.0/0	0.0/0	0.2/1
107	*Carpinus caroliniana*	9.4/5	0.0/0	0.0/0	2.1/5
113	*Fraxinus pennsylvanica*	0.6/3	0.0/0	0.0/0	2.1/5
119	*Ilex verticillata*	1.3/3	0.0/0	0.0/0	0.5/3
114	*Ulmus americana*	0.3/2	0.0/0	0.0/0	0.2/1
128	*Viburnum lentago*	0.2/1	0.0/0	0.0/0	0.4/2
	Plants found in SNA only				
88	*Cornus stolonifera*	0.6/1	0.0/0	0.0/0	0.0/0
120	*Corylus cornuta*	0.2/1	0.0/0	0.0/0	0.0/0
109	*Crataegus* sp.	0.2/1	0.0/0	0.0/0	0.0/0
126	*Fraxinus nigra*	0.1/1	0.0/0	0.0/0	0.0/0
110	*Hamamelis virginiana*	0.6/2	0.0/0	0.0/0	0.0/0
111	*Salix humilis*	1.0/1	0.0/0	0.0/0	0.0/0
	Plant found in NNA only				
118	*Prunus virginiana*	0.0/0	0.0/0	0.0/0	0.1/1
Sapling Stratum					
	Plant found in both NAs				
113	*Fraxinus pennsylvanica*	3.0/1	0.0/0	0.0/0	6.0/2
	Plants found in SNA only				
112	*Acer rubrum*	8.0/3	0.0/0	0.0/0	0.0/0
112	*Betula alleghaniensis*	2.0/1	0.0/0	0.0/0	0.0/0
114	*Ulmus americana*	1.0/1	0.0/0	0.0/0	0.0/0
Tree Stratum[a]					
	Plants found in both NAs				
108	*Betula allegnaniensis*	72.0/2	0.0/0	0.0/0	62.8/1
113	*Fraxinus pennsylvanica*	1341.6/5	0.0/0	0.0/0	857.8/4
114	*Ulmus americana*	26.6/1	0.0/0	0.0/0	40.2/1
	Plant found in SNA only				
112	*Acer rubrum*	215.6/2	0.0/0	0.0/0	0.0/0
	Plant found in NNA only				
107	*Carpinus caroliniana*	0.0/0	0.0/0	0.0/0	181.4/1

[a] Basal areas in square centimeters rather than percent cover.

TABLE C.4 Plant Species List — Emergent Wetland

Field Number	Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
38	*Achillea millefolium* L.	Common yarrow	FACU	PNF
59	*Agrostis scabra* Willd.	Rough bentgrass	FAC	PNG
30	*Agrostis stolonifera* L.	Spreading bentgrass	FACW	PNG
23	*Amelanchier* sp.			
67	*Aster* sp.			
35	*Aster umbellatus* Mill.	Flat-top white aster	FACW	PNF
51	*Caltha palustris* L.	Common marsh-marigold	OBL	PNF
32	*Carex annectens* (Bickn.) Bickn.	Yellow-fruit sedge	FACW	PNGL
19	*Carex lurida* Wahlenb.	Shallow sedge	OBL	PNEGL
71	*Carex* sp. (Small and fine)			
82	*Carex* sp. (Wide leaves)			
79	*Carex swanii* (Fernald) Mackenz.	Swan's sedge	FACU	PNGL
34	*Carex tribuloides* Wahlenb.	Blunt broom sedge	FACW+	PNGL
33	*Carex vulpinoidea* Michx.	Fox sedge	OBL	PNEGL
54	*Carex* × *stipata* Muhl. ex Willd.	Stalk-grain sedge	OBL	PNGL
78	*Crataegus* sp.			
46	*Eleocharis* sp.			
45	*Equisetum arvense* L.	Field horsetail	FAC	PNH2
66	*Eupatoriadelphys maculatum* (L.) R.M. King and H. Rob	Spotted joe-pye-weed	FACW	PNF
11	*Eupatorium perfoliatum* L.	Common boneset	FACW+	PNF
5	*Euthamia graminifolia* (l.) Nutt.	Flat-top fragrant-golden-rod	FAC	PNF
64	*Fragaria virginiana* Duchesne	Virginia strawberry	FACU	PNF
21	*Galium trifidum* L.	Small bedstraw	FACW+	PNF
28	*Holcus lanatus* L.	Common velvet grass	FACU	PNG
58	*Hypericum mutilum* L.	Slender St. John's-wort	FACW	PNF
3	*Impatiens capensis* Meerb.	Spotted touch-me-not	FACW	ANF
4	*Juncus effusus* L.	Soft rush	FACW+	PNEGL
50	*Juncus inflexus* L.	European meadow rush	FACW	PIGL
65	*Juncus tenuis* Willd.	Slender rush	FAC-	PNGL
40	*Lamium amplexicaule* L.	Dead nettle	UPL	AIF
75	*Lotus corniculatus* L.	Birds-foot trefoil	FACU-	PIF
14	*Lycopus americanus* Muhl. ex W. Barton	American bugleweed	OBL	PNF
42	*Lycopus virginicus* L.	Virginia bugleweed	OBL	PNF
76	*Lysimachia ciliata* L.	Fringed loosestrife	FACW	PNF
39	*Lysimachia nummularia* L.	Creeping jennie	OBL	PIF
55	*Mentha arvensis* L.	Field mint	FACW	PNF
17	*Mentha piperita* L.	Peppermint	FACW+	PIF
7	*Onoclea sensibilis* L.	Sensitive fern	FACW	PNEF3
47	*Oxalis europaea* Jordan	Upright yellow woodsorrel	UPL	PIF
1	*Phalaris arundinacea* L.	Reed canary grass	FACW+	PNG
27	*Phleum pratense* L.	Timothy	FACU	PIG
73	*Poa compressa* L.	Canada bluegrass	FACU	PIG

TABLE C.4 (Cont.)

Field Number	Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
29	*Poa pratensis* L.	Kentucky bluegrass	FACU	PNG
37	*Polygonum sagittatum* L.	Arrow-leaf tearthumb	OBL	APNF
83	*Populus tremula* L.	Quaking aspen	FACU	IT
68	*Potentilla norvegica* L.	Norwegian cinquefoil	FACU	ABPNF
63	*Potentilla simplex* Michx.	Old field cinquefoil	FACU-	PNF
49	*Prunella vulgaris* L.	Heal-all	FACU+	PIF
74	*Pteridium aquilinum* (L.) Kuhn	Bracken fern	FACU	PNF3
62	*Ranunculus allegheniensis* Britt.	Allegheny mountain butter-cup	FAC	PNF
52	*Rubus hispidus* L.	Bristly blackberry	FACW	NS
70	*Rubus idaeus* L.	Common red raspberry	FAC-	IS
13	*Sagittaria latifolia* Willd.	Broad-leaf arrow-head	OBL	PNEF
85	*Salix sericea* Marsh.	Silky willow	OBL	NS
61	*Salix* sp.			
20	*Scirpus atrovirens* Willd.	Green bulrush	OBL	PNEGL
48	*Scirpus microcarpus* J. & K. Presl	Small-fruit bulrush	OBL	PNGL
72	*Sisyrinchium angustifolium* Mill.	Pointed blue-eye-grass	FACW-	PNF
60	*Solidago canadensis* L.	Canada golden-rod	FACU	PNF
57	*Solidago gigantea* Ait.	Giant golden-rod	FACW	PNF
43	*Solidago patula* Muhl. ex Willd.	Rough-leaf golden-rod	OBL	PNF
36	*Solidago rugosa* Mill.	Wrinkled golden-rod	FAC	PNF
56	*Solidago* sp.			
53	*Stellaria alsine* Grimm	Bog starwort	OBL	AIF
77	*Stellaria graminea* L.	Lesser starwort	FACU-	PNF
41	*Taraxacum officinale* G.H. Weber	Common dandelion	FACU-	PIF
8	*Thelypteris thelyptroides* (Michx.) J. Holub	Marsh fern	FACW+	F3
84	*Trifolium aureum* Pollich	Hop clover	UPL	ABIF
44	*Trifolium hybridum* L.	Alsike clover	FACU-	PIF
31	*Trisetum spicatum* (L.) Richter	Spiked false-oats	FACU	PNG
12	*Typha latifolia* L.	Broad-leaf cattail	OBL	PNEF
81	*Ulmus rubra* Muhl.	Slippery elm	FAC	NT
10	*Verbena hastata* L.	Blue vervain	FACW+	PNF
22	*Viburnum recognitum* Fernald	Northern arrow-wood	FACW-	NS

[a] Wetland indicator categories are assigned to plants in the United States on a regional basis. New York is located in Region 1. A '+' following an indicator category reveals a frequency toward the high end of the category (more frequently found in wetlands), while a '-' indicates a frequency toward the low end of the category (less frequently found in wetlands).

[b] Plant characteristics and life-forms assigned to each species are indicated in this column. See Appendix B for definitions of life-forms/origins.

TABLE C.5 Coverage Estimates by Stratum for Species in the Emergent Wetland

Field Number	Species Names	Areal Coverage (%)[a]																			
		SNA					South Side of ROW					North Side of ROW					NNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
	Standing Water	1	1	-	-	-	60	2	-	1	0.5	2	-	-	-	-	5	3	-	1	-
	Mosses	1	30	15	1	70	30	60	1	10	5	40	50	40	40	50	5	3	30	15	20
38	*Achillea millefolium*	-	2	1	1	20	-	0.5	1	-	-	0.5	0.5	2	5	20	-	-	-	0.5	-
59	*Agrostis scabra*	-	0.5	0.5	-	-	-	-	-	-	-	-	1	1	1	4	-	2	0.5	15	5
30	*Agrostis stolonifera*	3	-	-	-	-	0.5	-	-	0.5	-	1	-	0.5	0.5	-	-	-	-	-	-
23	*Amelanchier* sp.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	*Aster* sp.	-	-	-	-	-	-	0.5	-	-	0.5	-	-	-	-	-	-	-	-	-	-
35	*Aster umbellatus*	-	2	3	0.5	6	-	2	1	0.5	-	5	0.5	1	1	-	-	2	10	4	3
51	*Caltha palustris*	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
82	*Cares* sp.	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
32	*Carex annectens*	5	-	-	-	-	-	5	35	-	1	3	2	2	2	1	0.5	-	0.5	-	5
19	*Carex lurida*	-	-	-	-	-	-	4	1	-	0.5	-	-	-	-	-	-	-	-	-	-
71	*Carex* sp.	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
79	*Carex swanii*	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	*Carex tribuloides*	-	2	-	10	-	-	-	-	0.5	10	0.5	0.5	0.5	2	-	1	2	10	10	-
33	*Carex vulpinoidea*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
54	*Carex* × *stipata*	0.5	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-
78	*Crataegus* sp.	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
46	*Eleocharis* sp.	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-
45	*Equisetum arvense*	-	-	-	-	-	0.5	-	-	-	0.5	0.5	0.5	-	-	0.5	-	-	-	-	-
66	*Eupatoriadelphus maculatum*	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
11	*Eupatorium perfoliatum*	-	0.5	-	-	-	-	0.5	-	-	-	1	-	-	-	-	-	-	-	-	-
5	*Euthamia graminifolia*	0.5	10	1	10	1	-	2	1	-	-	0.5	1	1	2	1	-	1	2	2	1
64	*Fragaria virginiana*	-	5	15	2	50	-	-	1	-	-	-	15	40	10	15	-	-	5	2	1
21	*Galium trifidum*	2	2	-	-	-	0.5	5	2	10	20	15	2	0.5	0.5	-	0.5	0.5	0.5	0.5	1
28	*Holcus lanatus*	-	-	-	-	-	-	0.5	0.5	-	-	0.5	2	0.5	0.5	-	-	-	0.5	-	-

TABLE C.5 (Cont.)

Field Number	Species Names	Areal Coverage (%)[a]																			
		SNA					South Side of ROW					North Side of ROW					NNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
58	*Hypericum mutilum*	0.5	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	1	-	-	-	-
3	*Impatiens capensis*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4	*Juncus effusus*	-	1	-	1	-	-	1	1	1	-	10	-	-	-	-	20	10	50	30	75
50	*Juncus inflexus*	0.5	-	-	-	-	1	20	2	-	-	-	-	-	-	-	-	-	-	-	-
65	*Juncus tenuis*	-	-	0.5	-	1	-	-	2	-	-	-	5	0.5	1	0.5	-	-	0.5	-	1
40	*Lamium amplexicaule*	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-
75	*Lotus corniculatus*	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-
14	*Lycopus americanus*	-	0.5	-	-	-	-	0.5	-	-	-	0.5	0.5	0.5	-	0.5	-	-	-	-	-
42	*Lycopus virginicus*	-	-	-	-	-	-	0.5	-	-	-	0.5	-	-	-	-	-	-	-	-	-
76	*Lysimachia ciliata*	-	-	-	-	-	-	-	3	-	-	-	-	1	-	-	-	-	-	-	-
39	*Lysimachia nummularia*	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-	-	-	-	-	-
55	*Mentha arvensis*	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-
17	*Mentha × piperita*	-	-	-	-	-	-	-	0.5	-	-	0.5	-	-	-	-	-	-	-	-	-
7	*Onoclea sensibilis*	3	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	0.5	-	-	-
47	*Oxalis europaea*	0.5	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-
1	*Phalaris arundinacea*	70	50	-	-	-	60	15	40	50	70	40	40	15	20	-	40	25	1	-	0.5
27	*Phleum pratense*	0.5	-	-	-	-	-	-	-	-	-	10	-	0.5	-	-	-	-	-	-	-
73	*Poa compressa*	-	25	3	10	2	-	-	10	-	1	-	-	-	-	-	-	-	-	5	-
29	*Poa pratensis*	-	-	-	-	-	0.5	10	-	-	-	2	-	-	-	-	-	-	-	-	-
37	*Polygonum sagittatum*	1	-	-	-	-	0.5	-	0.5	-	-	0.5	-	-	-	-	0.5	0.5	-	-	-
83	*Populus tremula*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-
68	*Potentilla norvegica*	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
63	*Potentilla simplex*	-	1	-	1	2	-	-	-	-	-	-	5	10	20	30	-	-	3	-	4
49	*Prunella vulgaris*	-	-	-	-	-	-	-	1	-	-	-	2	0.5	2	1	-	-	-	-	-
74	*Pteridium aquilinum*	-	-	50	-	30	-	-	-	-	-	-	-	7	1	-	-	-	-	-	-
62	*Ranunculus allegheniensis*	-	-	0.5	-	-	-	-	-	-	-	-	0.5	0.5	0.5	0.5	-	-	-	-	-
52	*Rubus hispidus*	-	5	60	25	70	0.5	1	4	-	1	-	-	10	50	15	5	10	25	8	15
70	*Rubus idaeus*	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C.5 (Cont.)

Field Number	Species Names	Areal Coverage (%)[a]																			
		SNA					South Side of ROW					North Side of ROW					NNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
13	*Sagittaria latifolia*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
85	*Salix sericea*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
61	*Salix* sp.	-	-	-	-	-	-	-	1	-	-	-	-	-	0.5	0.5	-	2	2	-	-
20	*Scirpus atrovirens*	1	-	-	-	-	5	-	1	10	10	20	3	-	-	-	20	-	-	-	-
48	*Scirpus microcarpus*	-	-	-	2	-	5	-	2	30	1	3	-	-	-	-	25	20	0.5	1	-
72	*Sisyrinchium angustifolium*	-	0.5	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
60	*Solidago canadensis*	-	-	-	-	-	-	-	-	-	25	-	-	-	-	15	-	3	-	-	-
57	*Solidago gigantea*	0.5	-	-	20	1	-	0.5	1	-	1	-	-	-	-	-	-	-	-	0.5	-
43	*Solidago patula*	0.5	-	-	-	-	-	-	-	-	-	1	2	-	0.5	-	-	-	-	-	-
36	*Solidago rugosa*	0.5	-	20	15	40	0.5	2	0.5	-	-	0.5	5	15	2	1	1	10	35	30	2
56	*Solidago* sp.	3	-	0.5	-	-	-	0.5	0.5	-	-	-	-	-	1	0.5	-	-	-	-	-
53	*Stellaria alsine*	-	-	-	-	-	0.5	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-
77	*Stellaria graminea*	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
41	*Taraxacum officinale*	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-	-	-	-	-	-
8	*Thelypteris thelyptroides*	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-
84	*Trifolium aureum*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-	-	-
44	*Trifolium hybridum*	-	-	-	-	-	-	-	-	-	-	0.5	-	-	0.5	1	-	-	-	-	-
31	*Trisetum spicatum*	-	0.5	1	3	3	-	-	0.5	-	1	0.5	0.5	4	20	3	-	0.5	0.5	-	0.5
12	*Typha latifolia*	0.5	-	-	-	-	3	-	-	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-
81	*Ulmus rubra*	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	*Verbena hastata*	-	-	-	-	-	1	-	-	-	-	0.5	-	-	-	-	0.5	0.5	-	0.5	-
22	*Viburnum recognitum*	0.5	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[a] Each number represents the value given to a species in a single plot of Transect 1 (T1) through Transect 5 (T5).

TABLE C.6 Average Coverage, Absolute Frequencies, and Distribution of Species in the Emergent Wetland

Field Number	Species Names	Average Percent Coverage/ Absolute Frequency SNA	South ROW	North ROW	NNA
	Standing Water	0.4/2	12.7/4	0.4/1	1.8/3
	Mosses	23.4/5	21.2/5	44.0/5	14.6/5
	Plants found in all four areas				
38	*Achillea millefolium*	4.8/4	0.3/2	5.6/5	0.1/1
35	*Aster umbellatus*	2.3/4	0.7/3	1.5/4	3.8/4
32	*Carex annectens*	0.1/1	8.2/3	2.0/5	1.2/3
34	*Carex tribuloides*	2.4/2	2.1/2	0.7/4	4.6/4
5	*Euthamia graminifolia*	4.5/5	0.6/2	1.1/5	1.2/4
64	*Fragaria virginiana*	14.4/4	0.2/1	16.0/4	1.6/3
21	*Galium trifidum*	0.8/2	7.5/5	3.6/4	0.6/5
4	*Juncus effusus*	0.4/2	0.6/3	2.0/1	37.0/5
65	*Juncus tenuis*	0.3/2	0.4/1	1.4/4	0.3/2
1	*Phalaris arundinacea*	24.0/2	47.0/5	23.0/4	13.3/4
37	*Polygonum sagittatum*	0.2/1	0.2/2	0.1/1	0.2/2
52	*Rubus hispidus*	32.0/4	1.3/4	15.0/3	12.6/5
20	*Scirpus atrovirens*	0.2/1	5.2/4	4.6/2	4.0/1
48	*Scirpus microcarpus*	0.4/1	7.6/4	0.6/1	9.3/4
36	*Solidago rugosa*	15.1/4	0.6/3	4.7/5	15.6/5
31	*Trisetum spicatum*	1.5/4	0.3/1	5.6/5	0.3/3
	Plants found in both NAs and south side of ROW				
54	*Carex* × *stipata*	0.1/1	0.1/1	0.0/0	0.1/1
7	*Onoclea sensibilis*	0.6/1	0.2/1	0.0/0	0.1/1
73	*Poa compressa*	8.0/4	2.2/2	0.0/0	1.0/1
57	*Solidago gigantea*	4.3/3	0.5/3	0.0/0	0.1/1
	Plants found in both NAs and north side of ROW				
59	*Agrostis scabra*	0.2/2	0.0/0	1.4/3	4.5/4
58	*Hypericum mutilum*	0.1/1	0.0/0	0.1/1	0.2/1
63	*Potentilla simplex*	0.8/3	0.0/0	13.0/4	1.4/2
	Plants found in SNA and both sides of ROW				
30	*Agrostis stolonifera*	0.6/1	0.2/2	0.4/3	0.0/0
11	*Eupatorium perfoliatum*	0.1/1	0.1/1	0.2/1	0.0/0
14	*Lycopus americanus*	0.1/1	0.1/1	0.4/4	0.0/0
56	*Solidago* sp.	0.7/2	0.2/2	0.3/2	0.0/0
12	*Typha latifolia*	0.1/1	0.8/2	0.1/1	0.0/0

TABLE C.6 (Cont.)

Field Number	Species Names	Average Percent Coverage/ Absolute Frequency SNA	South ROW	North ROW	NNA
	Plant found in SNA and south side of ROW				
50	*Juncus inflexus*	0.1/1	4.6/3	0.0/0	0.0/0
	Plants found in NNA and south side of ROW				
47	*Oxalis europaea*	0.1/1	0.0/0	0.1/1	0.0/0
27	*Phleum pratense*	0.1/1	0.0/0	2.1/2	0.0/0
74	*Pteridium aquilinum*	16.0/2	0.0/0	1.6/2	0.0/0
62	*Ranunculus allegheniensis*	0.1/1	0.0/0	0.4/5	0.0/0
43	*Solidago patula*	0.1/1	0.0/0	0.7/3	0.0/0
	Plants found in SNA only				
82	*Cares* sp. (Wide leaves)	0.2/1	0.0/0	0.0/0	0.0/0
71	*Carex* sp. (Small and fine)	0.2/1	0.0/0	0.0/0	0.0/0
79	*Carex swanii*	0.2/1	0.0/0	0.0/0	0.0/0
78	*Crataegus* sp.	0.6/2	0.0/0	0.0/0	0.0/0
3	*Impatiens capensis*	0.1/1	0.0/0	0.0/0	0.0/0
70	*Rubus idaeus*	0.1/1	0.0/0	0.0/0	0.0/0
72	*Sisyrinchium angustifolium*	0.2/2	0.0/0	0.0/0	0.0/0
81	*Ulmus rubra*	0.1/1	0.0/0	0.0/0	0.0/0
22	*Viburnum recognitum*	0.2/2	0.0/0	0.0/0	0.0/0
	Plants found in NNA and both sides of ROW				
28	*Holcus lanatus*	0.0/0	0.2/2	0.7/4	0.1/1
85	*Salix sericea*	0.0/0	0.0/0	0.0/0	0.2/1
61	*Salix* sp.	0.0/0	0.2/1	0.2/2	0.8/2
60	*Solidago canadensis*	0.0/0	5.0/1	3.0/1	0.6/1
10	*Verbena hastata*	0.0/0	0.2/1	0.1/1	0.3/3
	Plants found in both sides of ROW				
45	*Equisetum arvense*	0.0/0	0.2/2	0.3/3	0.0/0
42	*Lycopus virginicus*	0.0/0	0.1/1	0.1/1	0.0/0
76	*Lysimachia ciliata*	0.0/0	0.6/1	0.2/1	0.0/0
17	*Mentha* × *piperita*	0.0/0	0.1/1	0.1/1	0.0/0
29	*Poa pratensis*	0.0/0	2.1/2	0.4/1	0.0/0
49	*Prunella vulgaris*	0.0/0	0.2/1	1.1/4	0.0/0
53	*Stellaria alsine*	0.0/0	0.1/1	0.1/1	0.0/0

TABLE C.6 (Cont.)

Field Number	Species Names	Average Percent Coverage/ Absolute Frequency SNA	South ROW	North ROW	NNA
	Plants found in north side of ROW only				
67	*Aster* sp.	0.0/0	0.2/2	0.0/0	0.0/0
51	*Caltha palustris*	0.0/0	0.1/1	0.0/0	0.0/0
19	*Carex lurida*	0.0/0	1.1/3	0.0/0	0.0/0
66	*Eupatoriadelphus maculatum*	0.0/0	0.1/1	0.0/0	0.0/0
68	*Potentilla norvegica*	0.0/0	0.1/1	0.0/0	0.0/0
77	*Stellaria graminea*	0.0/0	0.4/1	0.0/0	0.0/0
	Plants found in south side of ROW only				
46	*Eleocharis* sp.	0.0/0	0.0/0	0.1/1	0.0/0
40	*Lamium amplexicaule*	0.0/0	0.0/0	0.1/1	0.0/0
75	*Lotus corniculatus*	0.0/0	0.0/0	0.1/1	0.0/0
39	*Lysimachia nummularia*	0.0/0	0.0/0	0.2/2	0.0/0
55	*Mentha arvensis*	0.0/0	0.0/0	0.1/1	0.0/0
83	*Populus tremula*	0.0/0	0.0/0	0.1/1	0.0/0
41	*Taraxacum officinale*	0.0/0	0.0/0	0.2/2	0.0/0
8	*Thelypteris thelyptroides*	0.0/0	0.0/0	0.1/1	0.0/0
84	*Trifolium aureum*	0.0/0	0.0/0	1.0/1	0.0/0
44	*Trifolium hybridum*	0.0/0	0.0/0	0.4/3	0.0/0
	Plants found in site but not in plots				
33	*Carex vulpinoidea*	0.0/0	0.0/0	0.0/0	0.0/0
13	*Sagittaria latifolia*	0.0/0	0.0/0	0.0/0	0.0/0
23	*Amelanchier* sp.	0.0/0	0.0/0	0.0/0	0.0/0