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PIPELINE CORRIDORS THROUGH WETLANDS — IMPACTS ON PLANT COMMUNITIES: MILL CREEK TRIBUTARY CROSSING, JEFFERSON COUNTY, NEW YORK, 1992 SURVEY

TOPICAL REPORT

(July 1992-July 1994)

Prepared by

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For

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The goal of the Gas Research Institute Wetland Corridors Program is to identify representative 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 the survey in July 1992 at Mill Creek tributary crossing, Jefferson County, New York. Data were collected from three wetland communities along the 1991 pipeline and compared with predisturbance data obtained in a June 1991 survey. Within one year after pipeline installation, 50% of the soil surface of the ROW in the scrub-shrub community was covered by emergent vegetation. Average wetland values for the ROW in 1992 were lower than in 1991, indicating that the removal of woody plants resulted in a community composed of species with greater fidelity to wetlands. In the emergent marsh community, after one year, the average percentage of surface covered by standing water was greater in the ROW than in the adjacent natural areas. The ROW in the forested wetland community also contained standing water, although none was found in the natural forest areas. The entire study site remains a wetland, with the majority of plant species in all sites being either obligate or facultative wetland species. Weighted and unweighted average wetland indices for each community, using all species, indicated wetland vegetation within the newly established ROW.

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Research Summary

Title	Pipeline Corridors through Wetlands — Impacts on Plant Communities: Mill Creek Tributary Crossing, Jefferson County, New York, 1992 Survey
Contractor	Argonne National Laboratory
Principal Investigators	G.D. Van Dyke, L.M. Shem, and R.E. Zimmerman
Report Period	July 1992-July 1994
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 is one of a series of reports documenting these impacts. This data report is the result of field studies in three wetland community types (scrub-shrub, emergent marsh, forested wetland) along a one-year-old pipeline in the state of New York. Plant data from this study are compared to data collected just prior to installation of the pipeline.
Results	Observable impacts of the ROW on hydrology and vegetation varied by community. In the scrub-shrub wetland community, the topography of the ROW was similar to that in the adjacent natural areas (NAs) unaffected by pipeline installation. In the forested wetland and the emergent marsh, a greater percentage of the ROW's surface was covered by standing water compared to the NAs. Within the scrub-shrub community, 50% of the ROW's surface was covered by emergent vegetation; lesser percentages were found in the emergent marsh and the forested wetland. In each community, the number of plant species occurring in the ROW was less than the number in the adjacent NAs. About 30% of the species occurring in the ROW in each community were not found in the NAs. The number of introduced species in the ROW compared to the NAs was much lower in the scrub-shrub community, somewhat lower in the emergent marsh, and slightly greater in the forested wetland. Re-establishment of vegetation on the ROW within the various

communities was progressing rapidly without seeding or soil amendments.

Technical Approach

An attempt was made to select a relatively homogeneous study site within the scrub-shrub community and the emergent marsh. These sites occupied at least 150 meters along the ROW. Five transects were established across the ROW at each site for sampling. No such sites were available in the forested wetland, so a single transect was sampled within this community. Data were collected on soils, hydrology, and plant cover from transect plots within both sides of the ROW and within the NAs on either side of the ROW. Plant data were analyzed to determine similarities and differences between the two sides of the ROW and the two adjacent NAs.

Project Implications

This study shows that within one year after installation of the pipeline in this wetland (in 1991), vegetation had developed on the ROW within each of the three community types that included many species found in the adjacent NAs and collectively fewer introduced species than were present in the NAs. Vegetation was developing rapidly within the newly created ROW without seeding or soil amendments. Vegetation developing within the ROW consisted of wetland species. Further studies are needed to determine the length of time necessary for newly developing ROW plant communities to achieve the same level of diversity and total areal coverage as the plant communities in the adjacent NAs.

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Pipeline Corridors through Wetlands — Impacts on Plant Communities: Mill Creek Tributary Crossing, Jefferson County, New York, 1992 Survey

by

G.D. Van Dyke, L.M. Shem, 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 transverse. 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 on a field survey conducted between July 7 and July 10, 1992, along a pipeline crossing of a wetland adjacent to the south-southwest boundary of the city of Watertown, New York. The wetland occupies the floodplain of a tributary of Mill Creek. The pipeline, installed in the summer of 1991, traverses several community types within the wetland. Data collected from the July 1992 field survey are compared with data collected in June 1991, before installation of the new pipeline.

2 Description of Study Area

2.1 Site Selection and Location

In April 1991, personnel from a local power company assisted a team from Argonne National Laboratory (ANL) in selecting an area classified as "Jurisdictional Wetlands" under Section 404 of the Clean Water Act. (See Appendix A for information on jurisdictional wetlands.) The pipeline crossing in the Mill Creek tributary floodplain was selected because it included several types of wetland habitats. Figure 1 shows the location of the wetland adjacent to the south-southwest boundary of the city of Watertown. The wetland is bordered by Holcomb Street on the west and extends along the city boundary for approximately 600 m* east-southeast toward Washington Street.

This site was particularly interesting because of the opportunity it provided to collect data from an existing ROW, and to establish a pre-disturbance baseline for a planned second pipeline to be installed during the summer of 1991. Because the route of the planned pipeline joined the existing ROW approximately midway across the wetland, several different study areas were available: (1) an emergent marsh along the planned pipeline; (2) the existing pipeline, which would not be affected by installation of the planned pipeline; and (3) one or more sites along the existing pipeline where the planned pipeline would be installed on the same ROW.

The pipeline company personnel expressed interest in conducting baseline and follow-up studies on innovative installation techniques planned for the emergent marsh. These techniques would involve removing the vegetative mat intact and replacing it (with minimal disturbance) following pipeline installation.

The existing pipeline ROW, with its 8-in. (20-cm)-diameter pipeline, was constructed in 1966. Three sites along this ROW and one additional site in the emergent wetland along the ROW of the planned pipeline were sampled in early June 1991. Results of that study are presented in a separate report (Van Dyke et al. 1994).

The new 12-in. (30.5-cm)-diameter pipeline was installed during the summer of 1991. Figure 2 illustrates the locations of the 1966 and 1991 pipelines as they traverse the wetland. The north-south segment of the 1991 pipeline ROW passes through about 200 m of emergent cattail marsh before it enters a scrub-shrub community about 30 m north of the 1966 pipeline ROW. From the junction of the two pipeline ROWs, the 1991 pipeline follows the 1966 pipeline ROW east-southeast until it exits the wetland. The first 150 m of the ROW containing both pipelines passes through a scrub-shrub community that intergrades into a forested wetland community, which in turn intergrades into a lowland forest.

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

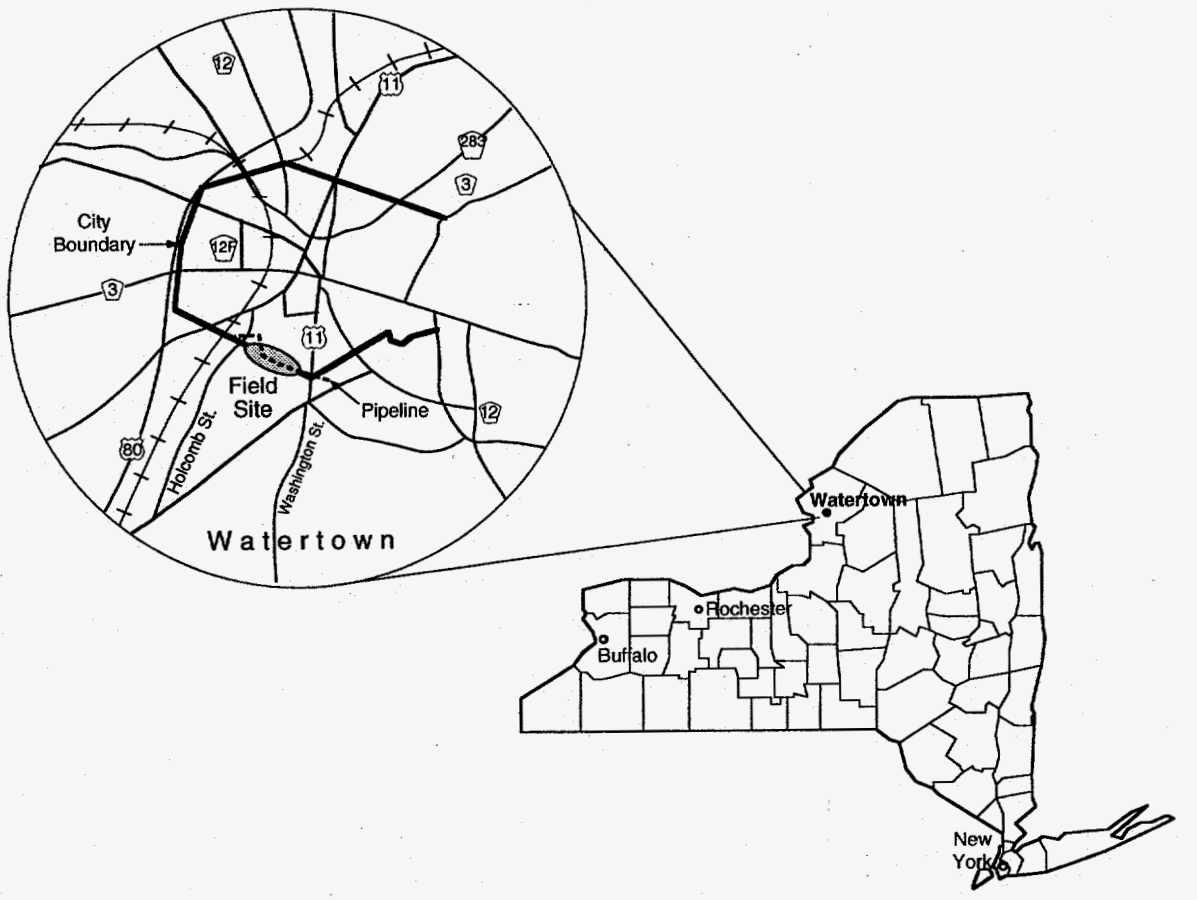

FIGURE 1 Location of the Mill Creek Tributary Study Site in Jefferson County, New York

2.2 Soils

The soils found at the subject wetland consisted mainly of four types: Lamson fine sandy loam, Canadaiqua silt loam, Minoa fine sandy loam, and Palms muck (Soil Conservation Service [SCS] 1989). The soils at the study sites consisted of mostly Lamson soils, which are very deep, poorly to very poorly drained soils that formed in stream- or lake-laid sediments and are dominated by fine to very fine sand. Canadaiqua soils are very deep, poorly to very poorly drained soils that formed in lake deposits on glacial lake plains. Minoa soils are very deep, somewhat poorly drained soils that formed in water-sorted sediments and are dominated by fine to very fine sand. Palms muck soils are very poorly drained soils that formed in deposits of organic materials, 16 to 50 in. thick, over loamy mineral soil deposits in bogs and depressions on lake plains, till plains, and outwash plains. All four of these soil types are found in areas with slopes ranging from 0 to 3 in. (0 to 8 cm). All but Minoa are listed as hydric soils in *Hydric Soils of the United States* (SCS 1991).

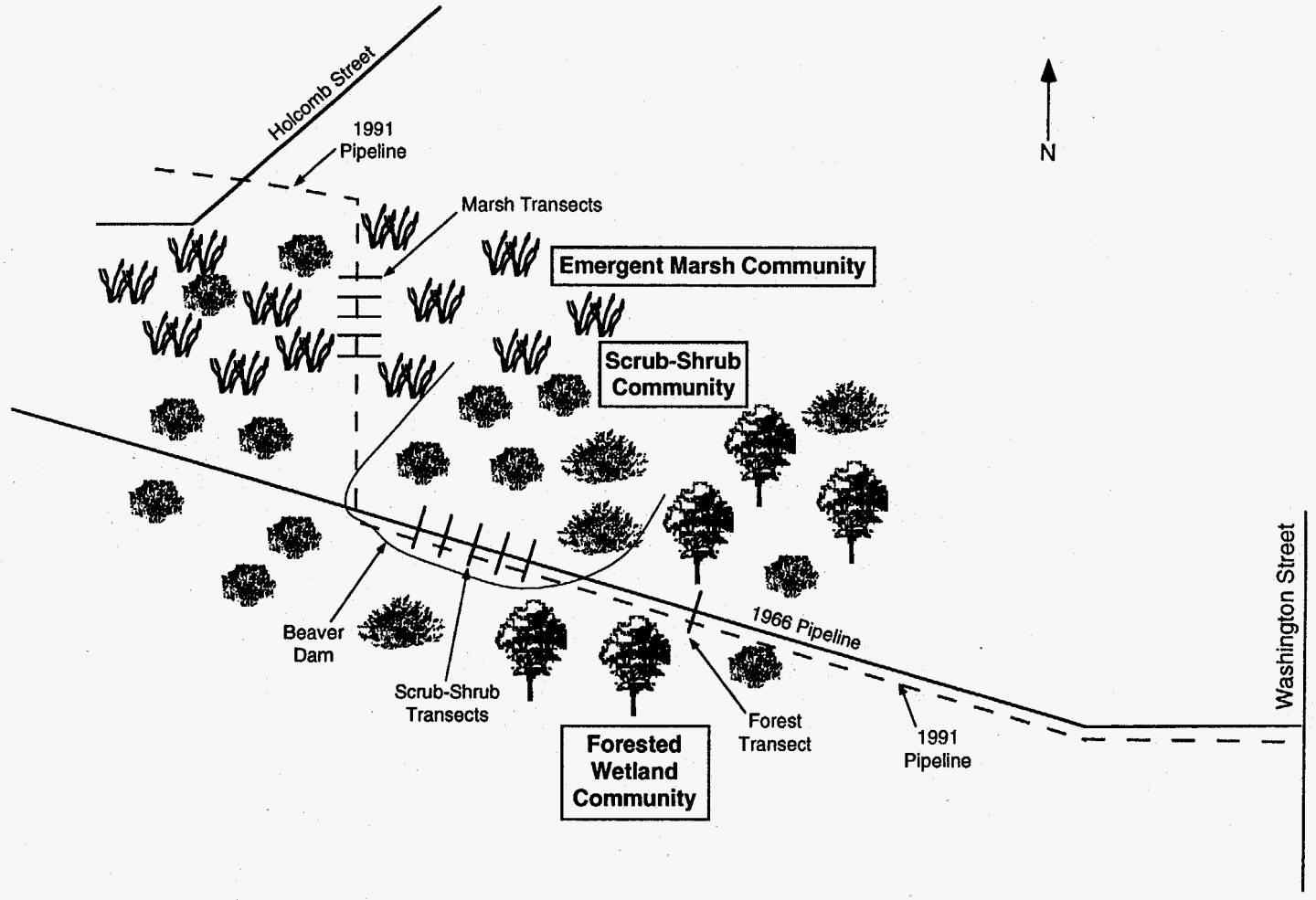

FIGURE 2 Relative Locations of the Three Wetland Communities Studied

2.3 Hydrology

The soil surface of the wide valley floor along the route of the 1966 pipeline shows little relief from its western edge, just east of Holcomb Street, for about 400 m, until it slopes upward very gradually to its forested eastern edge. There are no well-defined drainage channels in the valley floor. Sheet water flow is from north-northeast to south-southwest, crossing the pipeline ROW at a right angle. Sewage effluent is discharged into the wetland at its western edge near the pipeline ROW.

Although attempts have been made to improve drainage, and the wetland has been drained in the past, water levels at the pipeline crossing are presently at or above the soil surface in much of the wetland throughout most of the year. An extensive U-shaped beaver dam maintains standing water over an area measuring approximately 100 m × 100 m just east of the center of the wetland along the ROW. The location of this dam is shown in Figure 2.

2.4 Climate

Jefferson County has a temperate climate of cold winters and moderately warm summers with occasional hot spells (SCS 1989). The average winter temperature is 21°F (-6°C) and the average daily minimum temperature is 12°F (-11°C). The lowest recorded temperature at Watertown is -32°F (-35°C). Summer temperatures average 68°F (20°C) with average daily highs of 77°F (25°C). The highest recorded temperature at Watertown is 97°F (36°C).

Total annual precipitation is 40 in. (101.6 cm), which is distributed fairly evenly throughout the year and is almost always adequate for all crops. Monthly precipitation ranges from 2.65 to 4.01 in. (6.73 to 10.19 cm); the lower range occurs in the late winter and the higher range in the late summer and fall. The average seasonal snowfall is 101 in. (256.5 cm).

In nine out of ten years, the growing season ranges from 122 to 181 days, depending on the daily minimum temperature. In one out of ten years, the growing season ranges from 173 to 234 days.

2.5 History and Management Practices

Area History. The wetland area, designated as "W-2" on the New York State Department of Transportation (NYSDT) map for Jefferson County (NYSDT 1986), is described in the pipeline application permit to the U.S. Army Corps of Engineers as an emergent wet meadow with an outer area consisting of abandoned hayfields that are presently used for septic disposal. A verbal account of the wetland's history was given by Tim Wright (Wright 1991). Wright indicated that the area had been partially drained by plowed furrows along the drainage gradient to allow pasturing during the 1950s and 1960s. Following the construction of nearby Interstate Highway

81 (in approximately 1960), the water levels were elevated and the natural vegetation was allowed to grow back. Water levels in the area have been further elevated by an extensive series of beaver dams. Most of those dams are less than 20 in. (50.8 cm) in height.

Pipeline Construction. The existing 8-in. (20.3-cm)-diameter pipeline was installed in 1966, using the conventional methods of the time. Specific information on the construction methods was not available. However, if typical pipeline industry guidelines were followed, it is likely that the slash from clearing the area was used as corduroy and support pads were used in wetland areas. Information was not available on any maintenance activity that may have occurred on the ROW from 1966 to 1991. During our June 1991 survey, it appeared that little or no maintenance had been performed at this site, except for hand-clearing of a few shrubs to facilitate recent survey work in the ROW.

Construction of the 12-in (30-cm)-diameter 1991 pipeline was started during the last week of June and completed by the end of August. Slash from the scrub-shrub and the forested wetland areas provided support for the backhoe used to excavate the ditch and for the heavy equipment used for pipeline fabrication and installation. Support pads were brought in for use in the emergent wetland. Plans called for keeping sections of the emergent vegetation mat intact during excavation and backfilling.

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.

The initial sampling of the four vegetative communities in this wetland occurred during early June 1991 (Van Dyke et al. 1994). Resampling of three of these communities — the scrub-shrub community, the emergent marsh, and the forested wetland — was completed during July 1992 to evaluate the impacts from the installation of the new pipeline through these communities during late June and July 1991. The general approach in 1992 was the same as in 1991 to allow comparison of data from the two sampling periods.

3.2 Habitat Description

General site data including topography, water levels, water flow direction, soil surface conditions, and ROW characteristics were recorded based on general reconnaissance of the sites. ROW boundaries were identified on the basis of survey flags remaining at the northern edge of the ROW and on width measurements.

Figure 3 depicts a generalized cross-section of the scrub-shrub vegetation along a north-south line perpendicular to the 1966/1991 ROW. The vegetation ranged from mostly shrubs north of the ROW to mostly saplings and small trees south of the ROW. Shallow, standing water was maintained throughout the scrub-shrub area by a low, extensive beaver dam. The scrub-shrub community intergraded eastward into a forested wetland that soon intergraded into a lowland forest. Figure 4 is a generalized cross-section of the emergent marsh vegetation along an east-west line perpendicular to the 1991 ROW. A generalized north-south cross-section of the vegetation at the 1966/1991 forested wetland ROW site is shown in Figure 5.

3.3 Sampling Design for Vegetational Studies

At each of the three study sites, four sampling areas were defined on the basis of their relationship to the ROW: the two sides of the ROW on either side of the ROW midline, and the two adjacent natural areas (NAs), undisturbed by pipeline installation, on either side of the ROW. Defining these four areas allows for comparisons between the two vegetative communities in the

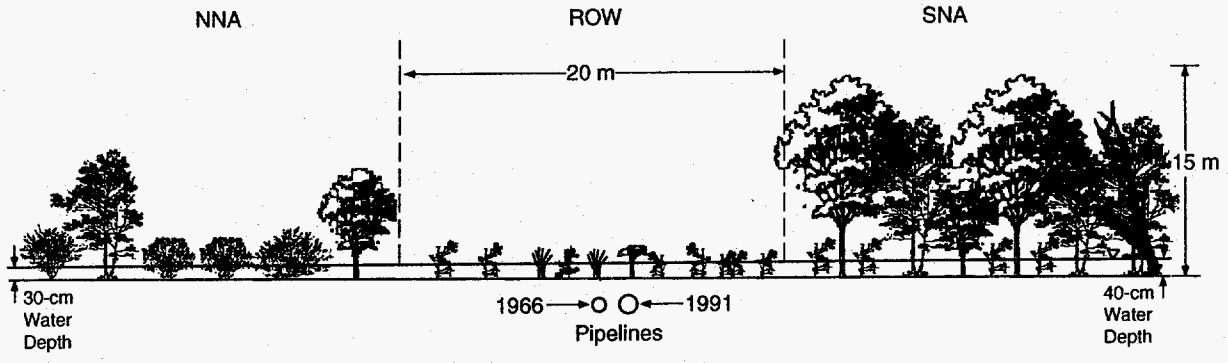

FIGURE 3 Generalized Cross-Section Showing the ROW, 1966 and 1991 Pipeline Locations, and Vegetation Types in the Scrub-Shrub Community

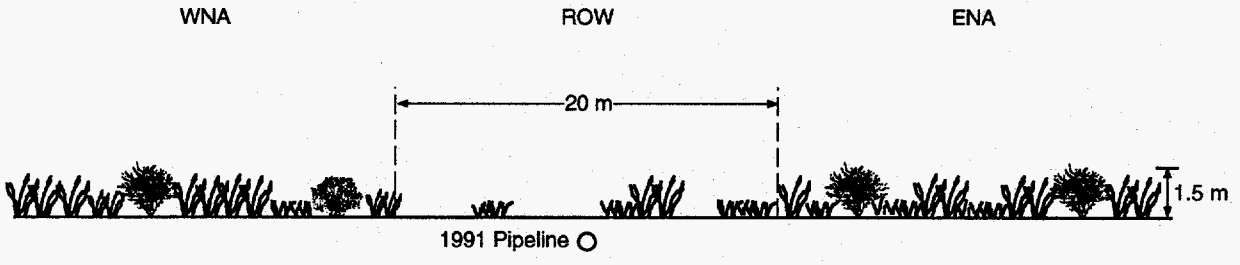

FIGURE 4 Generalized Cross-Section Showing the ROW, 1991 Pipeline Location, and Vegetation Types in the Emergent Marsh Community

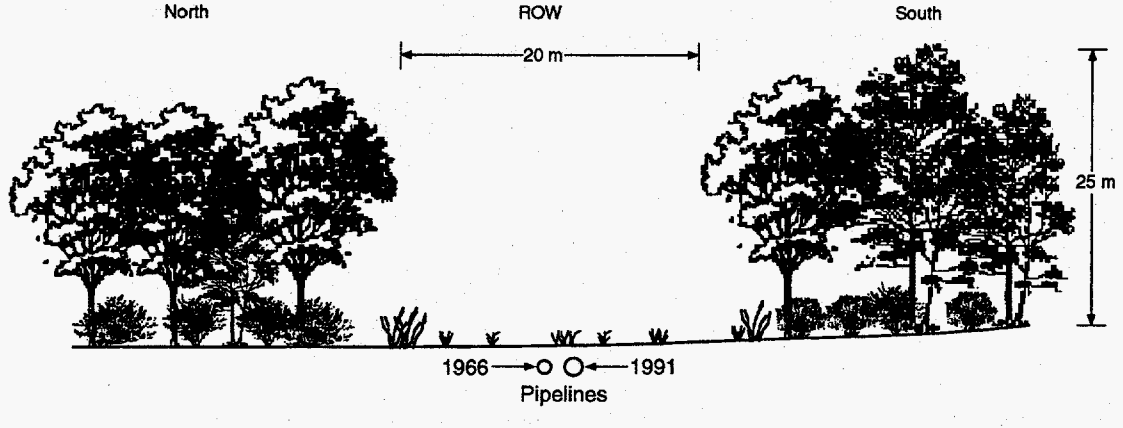

FIGURE 5 Generalized Cross-Section Showing the ROW, 1966 and 1991 Pipeline Locations, and Vegetation Types in the Forested Wetland Community

NAs, the vegetative communities developing on the two sides of the ROW, and the vegetative communities developing on the ROW and those occurring in the NAs. For convenience, these four sampling areas are designated at each site by their direction from the midline of the ROW.

Transects. Sampling sites were established in each of the three communities. Figure 2 shows the locations of the scrub-shrub, emergent marsh, and forested wetland communities.

Scrub-Shrub Site. A primary sampling site was established along the 1966/1991 pipeline ROW within the scrub-shrub community. Five stations were established, at 30-m intervals, along the center of the ROW at this site. The first, the westernmost station, was randomly located within the scrub-shrub community near the western edge. At each station, 60-m-long transects perpendicular to and centered on the existing pipeline were established. Five belt transects, each 20 m wide and 60 m long, were established by using the station transects as a centerline for each belt transect. Each belt transect was divided into four segments: the north and south sides of the ROW, represented by 10-m segments on either side of the ROW midline, and the north natural area (NNA) and south natural area (SNA), represented by the segments between 10 and 30 m from the center of the ROW. Plot sizes were 10 m × 20 m in the ROW and 20 m × 20 m in the NAs. Figure 6 shows the layout of the five transects (T1 through T5) and plots. Figure 2 shows the location of the transects.

Emergent Marsh Site. A second primary site was established in the emergent marsh community along the 1991 pipeline ROW. As at the scrub-shrub site, five stations were established at 30-m intervals; the first (northernmost) station was located randomly along the ROW at a sufficient distance (approximately 80 m) into the marsh to avoid wetland edge effects. At each station, a 60-m transect was established perpendicular to the midline of the ROW. Five belt transects, each 10 m wide, were established by using each of the station transects as a northern boundary. Each belt transect was divided into four segments. Two 10-m × 10-m segments, consisting of the first 10 m on either side of the ROW midline, were used as the sampling plots to collect data on the ROW. The outer two 10-m × 20-m segments, extending from 10 to 30 m on either side of the ROW midline, were used as the sampling plots to provide data on the NAs undisturbed during pipeline installation. Figure 7 shows the layout of these transects and plots. Figure 2 shows the locations of the five transects.

Forested Wetland Site. The third sampling area, a secondary site consisting of a single station, was established in the forested wetland east of the scrub-shrub community, along the 1966/1991 pipeline ROW. A single station was used in this community because an insufficient uniform area was available for multiple stations. The terrain gradually increased in elevation along the ROW from west to east after exiting the scrub-shrub community. A station was randomly located approximately 100 m east of the nearest transect in the scrub-shrub community, in approximately the same area sampled in 1991. The transect and four sampling plots were established using the same procedures and dimensions as those used in the scrub-shrub community. Figure 2 shows the location of the transect.

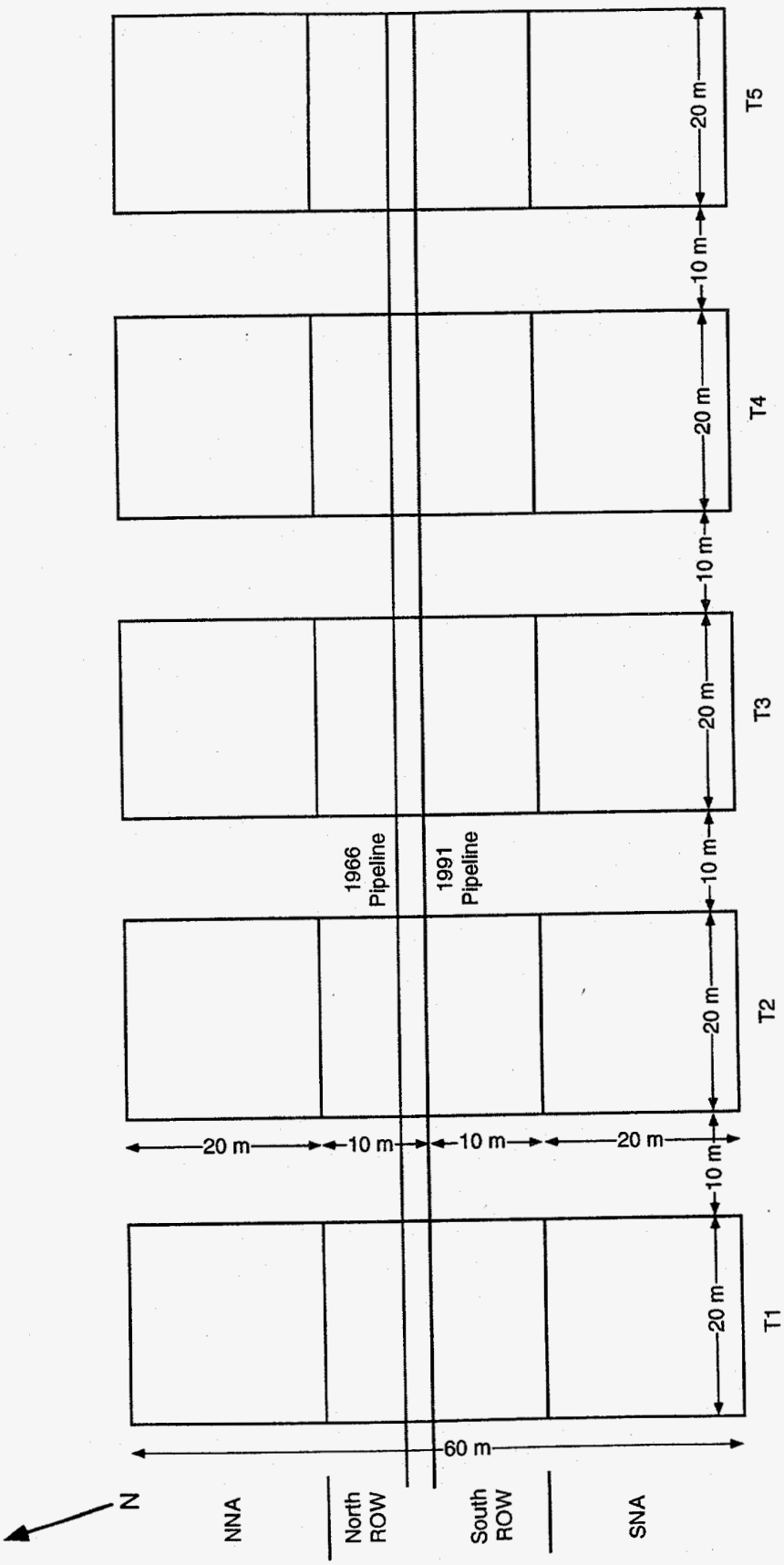

FIGURE 6 Plan View Showing Belt Transects and Study Plot Sizes for the Scrub-Shrub Community

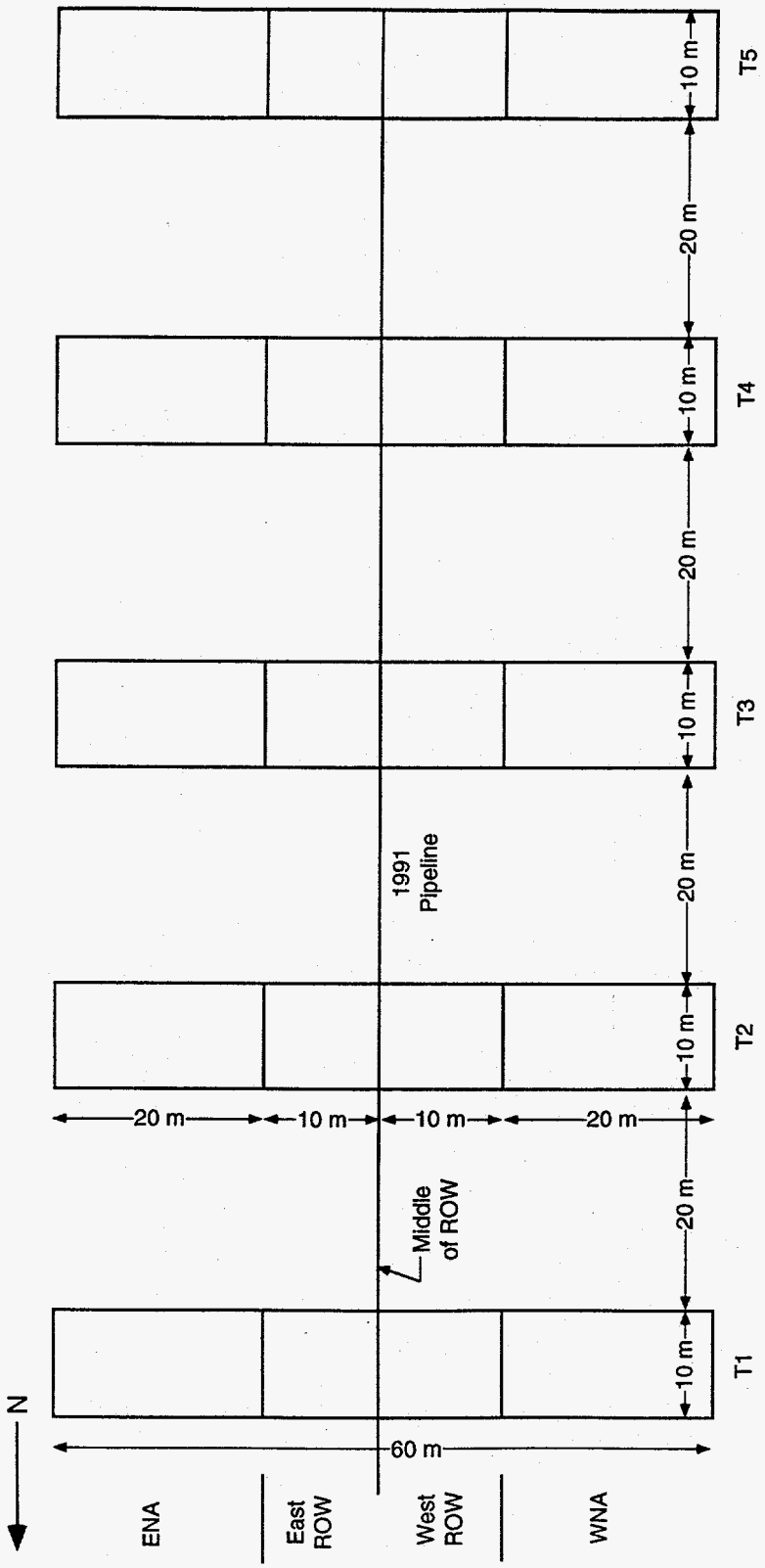

FIGURE 7 Plan View Showing Belt Transects and Study Plot Sizes for the Emergent Marsh Community

Sampling Procedures. Vegetational data were collected in July 1992 on each of the measured plots at each of the three sites. Two specimens of each plant species (found on or near the plots) that had not been collected in 1991 were collected as voucher specimens. Plant names, wetland indicator categories, life-forms, and the origin of each species were derived from the national list of plant species (Reed 1988). Vegetational data were collected using areal coverage estimates within sampling plots. At each site, estimates were made separately for the herb stratum, the shrub stratum, the sapling stratum, and the tree stratum, as defined in the 1989 *Federal Manual for Identifying and Delineating Jurisdictional Wetlands* (FICDW 1989), hereafter referred to as the "Federal Manual." Herbs are defined as herbaceous plants, including graminoids, forbs, ferns, herbaceous vines, and woody species under 3 ft (1 m) in height. Shrubs include multistemmed bushy shrubs, small saplings, and trees between 3 ft and 20 ft (.91 m and 6.1 m) in height. Saplings are defined as having a diameter at breast height (dbh) of 0.4 to 4.9 in. (1 to 12 cm) and a height exceeding 20 ft (6.1 m). 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).

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 for the sites included in the Wetland Corridors Program 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

Three wetland vegetational communities were sampled along the route of the newly installed 1991 pipeline. These included a scrub-shrub community, an emergent marsh, and a forested wetland. The emergent marsh and the scrub-shrub community were relatively uniform for a sufficient distance along the ROW to permit extensive sampling. The route of the new pipeline enters the wetland just east of Holcomb Street and passes south through an emergent cattail marsh until it enters the scrub-shrub community just north of where the new ROW for the 1991 pipeline joins the ROW for the 1966 pipeline.

Two primary sampling sites were established: one in the emergent marsh along the 1991 pipeline ROW and one in the scrub-shrub community along the 1966/1991 pipeline ROW. A secondary site was established (along the 1966/1991 pipeline ROW) in the forested wetland just east of the scrub-shrub community. (Figure 2 shows the location of each of these sampling sites.) All sites were sampled between July 7 and July 10, 1992.

Vascular plants belonging to 127 different taxa were collected from the three study sites. Of these, 119 were identified to species. The eight plants not identified to species were immature at the time of sampling. (Site-specific lists of species are presented in Appendix C, Tables C.1, C.4, and C.7.)

4.1 Scrub-Shrub Community

4.1.1 General Ecology

The scrub-shrub community (Figure 2) occupies a nearly level area, with shallow standing water throughout the site. The standing water was maintained at a depth of 10-25 in. (25-60 cm) in the sampling area by an extensive, U-shaped beaver dam that surrounded the site on the south, east, and west sides. Some standing water was also present on the low side of the dam about 40 m south of the center of the ROW. This dam was present at the time of the 1991 sampling and had been rebuilt where it was breached by pipeline installation during June 1991. In July 1992, slash used to support construction equipment remained on the working (south) side of the ROW one year after construction. In most places, this slash had been pressed into the saturated soil, presumably by heavy construction equipment. However, toward the south edge of the ROW, some of the ends of the slash and associated soil were near or above the water surface. The rest of the ROW surface was relatively level.

Soil profiles throughout this site were consistent with Lamson soils, as described earlier (Section 2.2). Ninety-seven percent of the ground surface was covered by standing water. Estimates of the standing water for each plot are given in Appendix C, Table C.2.

4.1.2 Plant Community

North of the ROW, the vegetation consisted predominantly of shrubs, with scattered saplings and young trees. The vegetation south of the ROW consisted mainly of saplings and young trees. A number of large willows were present near the beaver dam, close to the southern ends of the transects. Some of these were lodged to the north within the transects. These lodged willows contributed to the diversity of the vegetation in the area because their tilted root masses contained soils exposed above the standing water, providing habitats for a number of more mesic species. A number of young maples had lodged in this area following the 1991 construction activities. Very little emergent herbaceous vegetation was present. The floating lesser duckweed *(Lemna minor)* covered most of the water surface while the submerged star duckweed *(Lemna trisulca)* was abundant below the water surface in areas of sufficient direct sunlight.

Plant Species, Life-Forms, and Species Origins. Fifty-five taxa were observed at this site (see Appendix C, Table C.1); 51 of these were identified to species. Their wetland indicator categories, life-forms and origins, and whether they are native to the area, were determined using the *National List of Plant Species that Occur in Wetlands, Region 1* (Reed 1988). Eight of the species are listed as regionally introduced species; seven of these are forbs and one a tree. Six of the seven introduced forbs were limited in distribution to the exposed soil entrapped in the roots of the lodged large willow trees. Coverage values for each species in each plot are given in Appendix C, Table C.2. (See Appendix B, Section B.2, for a description of symbols used for describing life-forms and origins.) The distribution by area, along with average percent coverage and absolute frequency, is given for each species in each stratum in Appendix C, Table C.3.

Species Richness and Wetland Indicator Categories. Table 1 lists the number of plant species found in the combined NAs and combined sides of the ROW at the scrub-shrub site. Species counts are given by wetland indicator categories for each vegetative stratum and for all strata combined. Definitions of the strata are provided in Section 3.3, "Sampling Procedures."

Table 1 gives the total number of species found in the NAs and the ROW (columns 3 and 4), the number of species found in both habitats (column 5), and the number of species that occurred in one habitat but not the other (columns 6 and 7). Of the 55 taxa of vascular plants occurring in the transects at the scrub-shrub site, 87% were present in the combined NAs, while only 45% were present on the ROW. Most of the 55% unique to the NAs were unique to the SNA and occurred on the exposed soil associated with the lodged willows.

Thirty-eight percent of all the species in the herb stratum were obligate wetland (OBL) and 23% were facultative wetland (FACW) species. In other strata, more than 50% of the species were FACW species. Although the herb stratum was sparse, it contained the greatest number of species and the most OBL species. It also had the greatest number of facultative upland (FACU) species (11) and the only upland (UPL) species present on the site. Nine of the FACU and the single UPL species occurred on the exposed soil associated with the lodged willows in the SNA. Two FACU

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) — Scrub-Shrub Community

Stratum	Wetland Indicator Category[a]	Number of Species					
		Occurring in NAs	Occurring in ROW	Common to Both Areas	Unique to NAs	Unique to ROW	Total
Herb	OBL	16	12	8	8	4	20
	FACW	12	6	6	6	0	12
	FAC	3	2	1	2	1	4
	FACU	9	2	0	9	2	11
	UPL	1	0	0	1	0	1
	Unid[b]	4	2	2	2	0	4
	TOTAL	45	24	17	28	7	52
Shrub	OBL	1	1	1	0	0	1
	FACW	6	2	2	4	0	6
	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	9	3	3	6	0	9
Sapling	OBL	0	0	0	0	0	0
	FACW	2	0	0	2	0	2
	FAC	1	0	0	1	0	1
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	TOTAL	3	0	0	3	0	3
Tree	OBL	0	0	0	0	0	0
	FACW	2	0	0	2	0	2
	FAC	1	0	0	1	0	1
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	TOTAL	3	0	0	3	0	3
Combined Strata[c]	OBL	16	13	9	7	4	20
	FACW	14	6	6	8	0	14
	FAC	4	2	1	3	1	5
	FACU	9	2	0	9	2	11
	UPL	1	0	0	1	0	1
	Unid	4	2	2	2	0	4
	TOTAL	48	25	18	30	7	55

[a] OBL = obligate wetland species; FACW = facultative wetland species; FAC = facultative species; FACU = facultative upland species; and UPL = upland species. See Appendix B for more detailed information on wetland indicator categories.

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

[c] When data from different strata are combined, each species is considered only once.

species were present in the ROW only. Four taxa in the herb stratum could not be identified to species and therefore could not be classified. No OBL species were found in either the sapling or the tree stratum.

Table 2 summarizes the distribution of plants in the plots on the south and north sides of the ROW at the scrub-shrub site. Of the 25 species found in the ROW, 52% occurred in both the north and south sides, 40% in the south side only, and 8% in the north side only. The 10 species unique to the south side of the ROW occurred mostly in areas where the soil surface was elevated by embedded slash. Shrub-sized specimens were found only near the northern edge of the ROW, which was the storage side during pipeline construction. These specimens remained because of incomplete clearing of the ROW. No saplings or trees remained in the ROW.

As shown in Table 3, the NAs at the scrub-shrub site contained a total of 48 taxa, with 25% occurring in both the NNA and SNA. Sixty-three percent were unique to the SNA, and 13% were unique to the NNA. In the herb stratum, 69% of the species were unique to the SNA and 11% were unique to the NNA. The shrub stratum contained nine species, 67% of which were unique to the NNA with 33% occurring in both the NNA and SNA. The three species common to both the NNA and SNA were all tree species represented by shrub-size specimens. Two species of saplings, silver maple (*Acer saccharinum*) and green ash (*Fraxinus pennsylvanicum*), occurred in both areas, while crack willow (*Salix fragilis*) was unique to the SNA. In the tree stratum, silver maple and crack willow occurred in both areas, while green ash was unique to the NNA.

Figure 8 shows a graphic presentation of the number of species by wetland indicator category for each area in the scrub-shrub community. Figure 9 shows the percentage of species by wetland indicator category for each area. The percentages of OBL, FACW, and facultative (FAC) species in the NAs totaled 70.8%, while the percentages of OBL, FACW, and FAC species in the ROW totaled 84.0%. The NNA contained 100% OBL, FACW, and FAC species, while only 66.7% of the species in the SNA belong in these categories.

Dominance. The dominant species in each stratum of the scrub-shrub community are listed with the RPC for each in Table 4. The strata in all areas were dominated by OBL or FACW species, except for the tree stratum, which was dominated by one FACW and one FAC species.

The herb stratum in the NAs was dominated by subsurface suspended star duckweed and surface floating lesser duckweed with RPCs of 48.9% and 43.6%, respectively. The cumulative sum of the absolute average coverage for the two duckweeds was 122%; the sum of the coverage for all emergent rooted vascular plants in the herbaceous stratum was 9.95%. Many of the rooted vascular plants occurred on the exposed soil in the roots of the lodged willows; however, some seedlings of the woody species were emerging from standing water. Blue cattail (*Typha × glauca*) was the leading dominant in the ROW; lesser duckweed was the second dominant. RPCs for these two species were 26.8% and 25.5%, respectively. Total absolute coverage for the ROW was 90.9% with a 50.5% coverage of emergent vegetation.

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 individual stratum and combined strata) — Scrub-Shrub Community

Stratum	Wetland Indicator Category	Number of Species: 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	OBL	10	11	9	1	2	12
	FACW	1	6	1	0	5	6
	FAC	0	2	0	0	2	2
	FACU	1	2	1	0	1	2
	UPL	0	0	0	0	0	0
	Unid[a]	1	2	1	0	1	2
	TOTAL	13	23	12	1	11	24
Shrub	OBL	1	0	0	1	0	1
	FACW	2	0	0	2	0	2
	FAC	0	0	0	0	0	0
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	TOTAL	3	0	0	3	0	3
Combined Strata	OBL	11	11	9	2	2	13
	FACW	2	6	2	0	4	6
	FAC	0	2	0	0	2	2
	FACU	1	2	1	0	1	2
	UPL	0	0	0	0	0	0
	Unid	1	2	1	0	1	2
	TOTAL	15	23	13	2	10	25

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

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) — Scrub-Shrub Community

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	8	14	6	2	8	16
	FACW	4	10	2	2	8	12
	FAC	1	2	0	1	2	3
	FACU	0	9	0	0	9	9
	UPL	0	1	0	0	1	1
	Unid[a]	1	4	1	0	3	4
	TOTAL	14	40	9	5	31	45
Shrub	OBL	1	0	0	1	0	1
	FACW	6	3	3	3	0	6
	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	9	3	3	6	0	9
Sapling	OBL	0	0	0	0	0	0
	FACW	2	2	2	0	0	2
	FAC	0	1	0	0	1	1
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	TOTAL	2	3	2	0	1	3
Tree	OBL	0	0	0	0	0	0
	FACW	2	1	1	1	0	2
	FAC	1	1	1	0	0	1
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	TOTAL	3	2	2	1	0	3
Combined Strata[b]	OBL	8	14	6	2	8	16
	FACW	6	11	3	3	8	14
	FAC	3	3	2	1	1	4
	FACU	0	9	0	0	9	9
	UPL	0	1	0	0	1	1
	Unid	1	4	1	0	3	4
	TOTAL	18	42	12	6	30	48

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

[b] When data from different strata are combined, each species is counted only once.

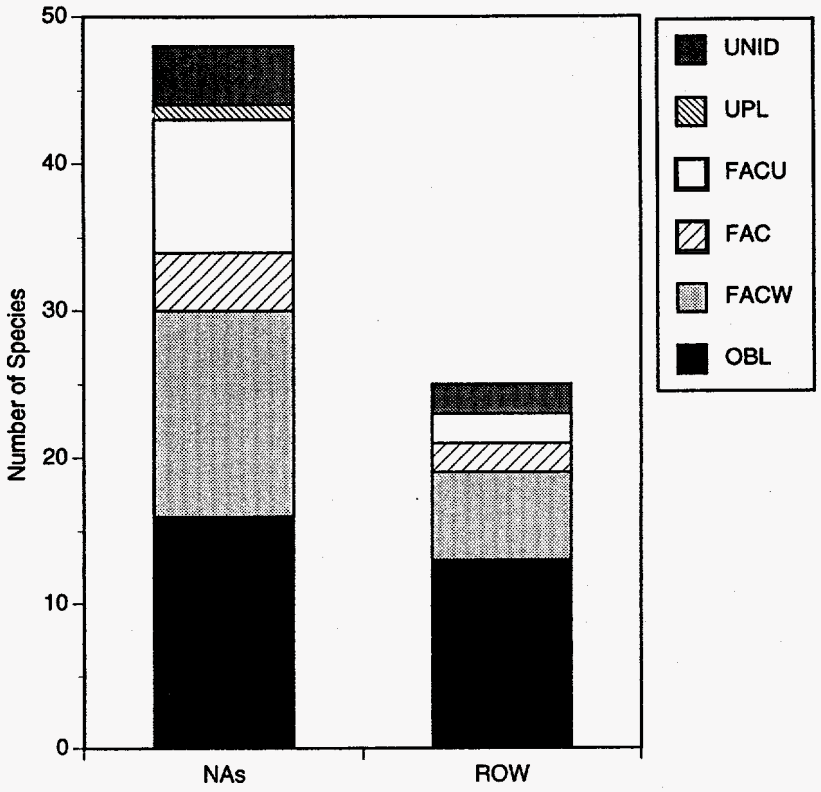

FIGURE 8 Number of Plant Species in Each Wetland Indicator Category by Area in the Scrub-Shrub Community

The dominant species in the shrub stratum in the NAs were meadow willow (*Salix petiolaris*), an OBL species, and pussy willow (*Salix discolor*), a FACW species (see Table 4 for RPCs). The sum of the absolute coverages for individual species in the shrub stratum in the NAs was 22.5%. The sum of absolute coverages of individual species in the shrub stratum in the ROW was 1.1%. Only three species were present in the shrub stratum in the ROW: two tree species and one shrub species. The two tree species were dominant, as listed in Table 4.

A sapling stratum, present only in the NAs, was dominated by silver maple, which accounted for 80.1% of the RPC. Green ash and crack willow were also present.

The tree stratum, also present only in the NAs, was dominated by crack willow and silver maple, which together accounted for 98.9% of the RPC.

Coefficient of Community. Table 5 lists Sørensen's coefficient of community (CC_S) values, derived by comparing species present in the various areas. When the strata are combined and when only herb stratum species are considered, the CC_S obtained by comparing species on the two sides of the ROW was higher than the CC_S obtained by comparing the two NAs. The low similarity for the herb stratum in the two NAs is related to the presence of unique species

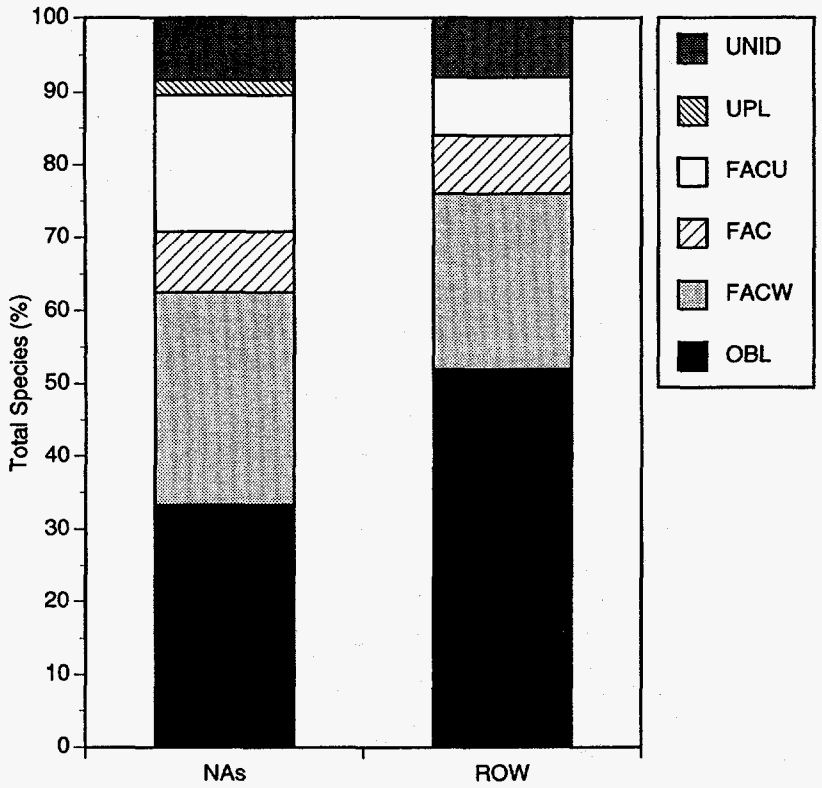

FIGURE 9 Percentage of Species in Each Wetland Indicator Category by Area in the Scrub-Shrub Community

associated with the exposed soil of the lodged willows in the SNA only. The shrub strata in the two NAs had a CC_s of 0.50; the sapling and tree strata both had a CC_s of 0.80. Shrubs were present only on the north side of the ROW.

Prevalence Index Values and Average Wetland Values. Table 6 presents, by stratum, the PIVs and AWVs for the combined ROW and the combined NAs for all species and for dominants only. The PIVs and AWVs for all species and for dominants only in the herb, shrub, and sapling strata were less than 3.00, indicating wetland vegetation. Both the PIV and the AWV for all tree stratum species in the NAs were less than 3.00; the PIV and the AWV for dominant tree stratum species only were 3.00.

The large difference between the AWV for the NAs and the AWV for the ROW, when all species in the herb stratum were considered, was related to the more mesic conditions of the exposed soil in the roots of the lodged willows. The low wetland indicator values for the dominants in the herb stratum in both areas were due to the abundance of the duckweeds and cattails, which are OBL species. The dominants in the shrub stratum in the NAs also had lower wetland indicator values than did all species combined. The values for the shrub stratum on the ROW probably have little meaning because the few shrubs present on the ROW are a result of incomplete destruction of the ROW vegetation during pipeline construction, rather than a result of habitat differences.

TABLE 4 Dominant Species by Vegetative Stratum in Each Habitat — Scrub-Shrub Community

Stratum	Areas	Species Scientific Name	Common Name	Wetland Indicator Category	Relative Percent Coverage	Sum of Relative Percent Coverage
Herb	NAs	*Lemna trisulca*	Star duckweed	OBL	48.9	
		Lemna minor	Lesser duckweed	OBL	43.6	92.5
	ROW	*Typha x glauca*	Blue cattail	OBL	26.8	
		Lemna minor	Lesser duckweed	OBL	25.5	52.3
Shrub	NAs	*Salix petiolaris*	Meadow willow	OBL	44.5	
		Salix discolor	Pussy willow	FACW	14.7	59.2
	ROW	*Acer saccharinum*	Silver maple	FACW	45.5	
		Fraxinus pennsylvanica	Green ash	FACW	36.4	81.9
Sapling	NAs	*Acer saccharinum*	Silver maple	FACW	80.1	80.1
Tree	NAs	*Salix fragilis*	Crack willow	FAC	70.2	
		Acer saccharinum	Silver maple	FACW	28.7	98.9

TABLE 5 Coefficient of Community Values Comparing Areas on the Basis of Species Composition — Scrub-Shrub Community

	Comparison		
Stratum	NAs to ROW	North ROW to South ROW	NNA to SNA
Herb	0.49	0.67	0.33
Shrub	0.50	0.00	0.50
Sapling	0.00	NC[a]	0.80
Tree	0.00	NC	0.80
Combined	0.49	0.68	0.40

[a] NC = not calculated. No species were present in this stratum.

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

Stratum	Areas	Species	Prevalence Index Value	Average Wetland Value
Herb	NAs	All	1.05	2.20
		Dominant only	1.00	1.00
	ROW	All	1.02	1.73
		Dominant only	1.00	1.00
Shrub	NAs	All	1.67	2.11
		Dominant only	1.25	1.50
	ROW	All	1.82	1.67
		Dominant only	2.00	2.00
Sapling	NAs	All	2.05	2.33
		Dominant only	2.00	2.00
Tree	NAs	All	2.71	2.33
		Dominant only	3.00	3.00
Combined Strata	NAs	All	NC[a]	2.20
	ROW	All	NC	1.70

[a] NC = not calculated. Values could not be calculated for combined strata because areal cover (which is not additive) is used in its calculation.

The tree stratum had the highest PIVs and AWVs for all species and for dominants only. The value of 3.00 for dominant tree stratum species indicated neither wetland nor upland vegetation.

4.1.3 Comparison of Data from 1991 and 1992

Sampling was performed in June 1991, just before pipeline construction, and again in July 1992, after the 1991 pipeline had been in place for a year. Water levels in the scrub-shrub community in 1992 were similar to those that occurred just prior to pipeline construction in 1991. (All references to 1991 data in this section refer to Van Dyke et al. 1994.) Visual inspection indicted that the beaver dam responsible for maintaining the water levels had been repaired at the two sites where it had been breached during pipeline construction. In 1992, the ROW surface lacked the depressions that had been present in 1991. Instead, the southern side was elevated by

partially buried slash, with some of the ends of the woody slash exposed above the water near the southern edge of the ROW.

Shrubs, saplings, and trees had been almost entirely removed from the ROW by construction of the 1991 pipeline, except for the few remaining shrubs occurring near the northern edge. Emergent herb stratum vegetation on the ROW covered 50.5% of the surface area in 1992, compared to 5.6% in 1991. Two species of duckweed were abundant in 1992: lesser duckweed, a surface floating species, and star duckweed, a submerged suspended species. These contributed 40.4% of the total herb stratum in 1992, compared with 99% coverage for the floating lesser duckweed in 1991. Star duckweed was not recorded in 1991.

Pussy willow and meadow willow were both dominant in the shrub stratum in both years. Silver maple qualified as a dominant shrub in 1991, but not in 1992. The sapling stratum was dominated by silver maple both years. Silver maple and crack willow dominated the tree stratum both years. Estimates of percent coverage for dominant species varied considerably between years, and the rankings of the dominants also changed.

The numbers of shrub, sapling, and tree species encountered in sampling plots in the NAs were slightly higher in 1991, compared to 1992. However, the number of herb species encountered in NA sampling plots in 1992 (45) was more than double the number encountered in 1991 (20). In both years, total coverage by emergent herbs was low, with an average cover of 9.95% in 1992 and 4.15% in 1991. Most of the herbs in the NAs, other than the duckweeds, occurred on exposed soil associated with the lodged willows.

Table 7 presents a comparison of the numbers of plants present in sampling plots in the ROW and the NAs (scrub-shrub community) in 1991 and 1992. Individual species present only in 1991, present only in 1992, and present in both years are listed in Appendix D, Tables D.1, D.2, and D.3, respectively. Sixteen species were present in the plots during both years; eleven of these were shrub or tree species. Seven species, all shrubs or trees occurring in the NAs, were encountered in 1991 but not in 1992. Fifteen percent of the 39 species that were encountered in 1992 but not in 1991 were found only in the ROW, while 62% were found only in the NAs; 23% occurred in both. Although the ROW had been severely disturbed, 15 of the 18 species present in 1991 were again present in 1992, along with 15 new species, resulting in an 83% increase in the number of species in the ROW.

Table 8 provides a comparison of plant species collected in 1991 to those collected in 1992 using Sørensen's CC_s values. The shrub and sapling strata in the NAs showed the greatest similarity. Comparison of the species composition of the herb stratum in the ROW in 1991 and 1992 and the herb stratum in the NAs in 1991 and 1992 resulted in low CC_s values.

Table 9 compares AWVs and PIVs by stratum for all species and for dominants only for 1991 and 1992. Little variation occurred between the two years.

TABLE 7 Number of Plant Species Present in 1991 Only, 1992 Only, and Both 1991 and 1992 by Wetland Indicator Category — Scrub-Shrub Community

Wetland Indicator Category	Present in 1991 Only				Present in 1992 Only				Present in 1991 and 1992[b]
	ROW	NAs	Both	Total	ROW	NAs	Both	Total	Total
OBL	0	1	0	1	4	7	5	16	0
FACW	0	2	0	2	0	4	2	6	4
FAC	0	0	2	2	0	1	0	1	8
FACU	0	0	0	0	2	9	0	11	4
UPL	0	0	1	1	0	1	0	1	0
Unid[a]	0	1	0	1	0	2	2	4	0
Total	0	4	3	7	6	24	9	39	16

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

[b] Species that were present in both areas in at least one of the two years.

TABLE 8 Coefficient of Community Values Comparing 1991 and 1992 Data on the Basis of Species Composition — Scrub-Shrub Community

	Comparison	
	NAs	ROW
Stratum	1991 to 1992	1991 to 1992
Herb	0.40	0.44
Shrub	0.86	0.40
Sapling	0.75	0.00
Tree	0.57	0.00
Combined	0.43	0.53

TABLE 9 Prevalence Index and Average Wetland Values for All Species and Dominant Species Only in the NAs and the ROW (by individual stratum and combined strata) — Scrub-Shrub Community

			Prevalence Index Value		Average Wetland Value	
Stratum	Areas	Species	1991	1992	1991	1992
Herb	NAs	All	1.04	1.05	2.00	2.20
		Dominant only	1.00	1.00	1.00	1.00
	ROW	All	1.06	1.02	2.08	1.73
		Dominant only	1.00	1.00	1.00	1.00
Shrub	NAs	All	1.96	1.67	2.42	2.11
		Dominant only	1.79	1.25	1.67	1.50
	ROW	All	1.86	1.82	2.42	1.67
		Dominant only	1.57	2.00	1.67	2.00
Sapling	NAs	All	2.00	2.05	2.20	2.33
		Dominant only	2.00	2.00	2.00	2.00
	ROW[a]	All	2.00	none	2.00	none
		Dominant only	2.00	none	2.00	none
Tree	NAs	All	2.38	2.71	2.50	2.33
		Dominant only	2.35	3.00	2.50	3.00
	ROW[a]	All	2.94	none	2.67	none
		Dominant only	3.00	none	3.00	none
Combined	NAs	All	NC[b]	NC	2.20	2.20
Strata	ROW	All	NC	NC	2.27	1.83

[a] No trees or saplings were present on the ROW in 1992.

[b] NC = not calculated. Values could not be calculated for combined strata because areal cover (which is not additive) is used in its calculation.

4.2 Emergent Marsh Community

4.2.1 General Ecology

The emergent marsh is a nearly level area draining toward the south (Figure 2). The soil surface is partially covered by standing water in each transect. The percentage of the surface covered by standing water, averaged across all transects, was 14% for the NAs and 40% for the ROW. Less than 1% of the soil surface was not covered by water or vegetation in the NAs; 6% of the soil in the one-year-old ROW was exposed.

The soils in this area are mapped as Lamson soils on the Jefferson County soil maps. (A description of Lamson soils is given in Section 2.2.) Observations of hand-augured soil cores taken along each transect confirmed the presence of Lamson soils throughout the study site.

4.2.2 Plant Community

The dense vegetation in the NAs consisted predominantly of cattails, horsetails, and a wide variety of forbs and shrubs. The shrubs were most abundant toward the center of the site (transects T2, T3, and T4). Vegetation in the ROW was poorly developed, with only 25% total vegetative areal coverage.

Plant Species, Life-Forms, and Species Origins. A total of 79 plant taxa were observed in the emergent marsh site; 75 of these were represented in the transects. Wetland indicator values, life-forms, and origins (Reed 1988) for the 70 plants identified to species are given in Appendix C, Table C.4. Fifteen species (two grasses, twelve forbs, and one shrub) were introduced, non-native species. Coverage values for each species in each plot are given in Table C.5. Sixty-two of the species occurred in plots in the NAs and 37 in plots within the ROW. Species distributions, average percent coverages (by area), and absolute frequencies are provided in Table C.6. (Appendix B, Section B.2, provides definitions of the symbols used to describe life-forms and origins.)

The herb stratum in the NAs contained 57 taxa, consisting of two ferns, two horsetails, fifteen sedges, seven grasses, two rushes, twenty forbs, five woody species, and four forbs that could not be identified to species. Seven of the eight introduced species were represented in the herb stratum.

The shrub stratum in the NAs contained eight species, including shrub-sized specimens of one tree species. No sapling or tree-size specimens were present.

The herb stratum in the ROW was composed of 37 species, including one fern, two horsetails, four rushes, two sedges, five grasses, twenty-one forbs, and two woody species. No shrubs or larger plants were present in the ROW.

Species Richness and Wetland Indicator Categories. Table 10 gives the number of species by wetland indicator category for the NAs and the ROW at the emergent marsh site. Of the 75 species present, 24 occurred in both areas, 38 were unique to the NAs, and 13 were unique to the ROW. In the NAs, 82% of the species found were OBL (45%), FACW (26%), or FAC (11%) species. Only 5% FACU and 6% UPL species were present. In the ROW, 84% of the species found were OBL (51%), FACW (22%), or FAC (11%) species. Only 8% FACU and 3% UPL species were present. Thus, the vegetation in both communities consisted primarily of wetland species.

Table 11 compares species in the east and west sides of the ROW at the emergent marsh site. The two sides of the ROW were similar in total number of species (33 on the east and 31 on the west ROW). Seventy-three percent of the species in the ROW occurred in plots on both sides of the ROW. The two sides of the ROW were also similar in the distribution of species within the wetland indicator categories.

As shown in Table 12, 63% of the species occurring in the NAs occurred in both NAs. Sixty-seven percent of the species in the herb stratum occurred in both NAs, while 38% of the shrub species occurred in both NAs. Some of the differences between the two NAs may relate to differences in the percentage of the soil surface covered by standing water, which ranged from 5% to 55% for plots in the ENA and from 1% to 15% for plots in the WNA.

Figure 10 is a graphic representation of the number of species by wetland indicator category and by area. Figure 11 compares the percentages of species in each category by area. Although the numbers of species are lower for the ROW, the percentages of species in the various wetland indicator categories for the combined NAs and the combined ROW are very similar.

Dominance. The dominant species for each area, by stratum, at the emergent marsh site are listed in Table 13, along with the RPC for each species, based on 10 plots per habitat. Two OBL species, blue cattail and water horsetail (*Equisetum fluviatile*), were dominant in the herb stratum in the NAs. Dominants in the ROW were blue cattail, broad-leaf water plantain (*Alisma plantago-aquatica*), and water horsetail — all OBL species. The dominant species in the shrub stratum were silky dogwood (*Cornus amomum*) and red-osier dogwood (*Cornus stolonifera*), both FACW species. No shrubs were present in the ROW.

Coefficient of Community. Table 14 shows the CC_S values between areas, by stratum, for the emergent marsh site. The two sides of the ROW were very similar (CC_S of 0.84). The NAs have similar herb strata (CC_S of 0.80), but have a less similar shrub stratum (CC_S of 0.55). The lower CC_S for the shrub stratum may be caused partially by actual areal differences and partially by a sample area that was insufficient to obtain an adequate sample of larger plants. Comparisons between the herb stratum of the ROW and the NAs yielded a CC_S of 0.49.

TABLE 10 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 Marsh Community

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	27	19	12	15	7	34
	FACW	15	8	6	9	2	17
	FAC	5	4	2	3	2	7
	FACU	3	3	1	2	2	5
	UPL	3	1	1	1	0	3
	Unid[a]	4	2	1	3	1	5
	TOTAL	57	37	23	33	14	71
Shrub	OBL	1	0	0	1	0	1
	FACW	4	0	0	4	0	4
	FAC	2	0	0	2	0	2
	FACU	0	0	0	0	0	0
	UPL	1	0	0	1	0	1
	Unid	0	0	0	0	0	0
	TOTAL	8	0	0	8	0	8
Combined Strata[b]	OBL	28	19	13	15	6	34
	FACW	16	8	6	10	2	18
	FAC	7	4	2	5	2	9
	FACU	3	3	1	2	2	5
	UPL	4	1	1	3	0	4
	Unid	4	2	1	3	1	5
	TOTAL	62	37	24	38	13	75

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

[b] When data from different strata are combined, each species is considered only once.

TABLE 11 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the East and West Sides of the ROW (by individual stratum and combined strata) — Emergent Marsh Community

		Number of Species					
Stratum	Wetland Indicator Category	Occurring in East Side of ROW	Occurring in West Side of ROW	Common to Both Sides of ROW	Unique to East side of ROW	Unique to West Side of ROW	Total
Herb and Combined[a]	OBL	17	16	14	3	2	19
	FACW	8	7	7	1	0	8
	FAC	2	4	2	0	2	4
	FACU	3	2	2	1	0	3
	UPL	1	0	0	1	0	1
	Unid[b]	2	2	2	0	0	2
	TOTAL	33	31	27	6	4	37

[a] No shrubs, saplings, or trees occurred in the ROW; therefore, the herb stratum and the combined strata were the same in this case.

[b] Plants not identified to species.

Prevalence Index Values and Average Wetland Values. As shown in Table 15, both PIVs and AWVs for the NAs and the ROW were less than 3.00, indicating wetland vegetation in both areas in the emergent marsh site. Values for the herb stratum were all below 2.00; PIVs for all species were lower than AWVs for all species because the dominants were all OBL species. Both the PIV and the AWV for the shrub stratum for all species were over 2.00; however, the values for dominant shrubs were both less than 2.00. Thus, the shrub stratum was also dominated by species with a high fidelity to wetlands.

4.2.3 Comparison of Data from 1991 and 1992

The percentage of the soil surface covered by standing water in the NAs was 14% in 1992 compared to 33% in 1991. However, for the ROW, the percentage of the surface covered by standing water was 39% in 1992 compared to 23% in 1991.

During pipeline construction, the vegetative mat on most of the ROW surface was destroyed. Some intact pieces of the mat (most less than one square meter) were replaced on the ROW surface during trench filling and final grading. In 1991, the sum of the average coverages for individual species was 192.4% in the as-yet undisturbed ROW; however, in 1992, the sum of the average coverages was reduced to 24.6%. The sum of the average coverages for individual

TABLE 12 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the ENA and WNA (by individual stratum and combined strata) — Emergent Marsh Community

Stratum	Wetland Indicator Category	Number of Species					
		Occurring in ENA	Occurring in WNA	Common to Both Areas	Unique to ENA	Unique to WNA	Total
Herb	OBL	25	20	18	7	2	27
	FACW	13	13	11	2	2	15
	FAC	3	5	3	0	2	5
	FACU	3	2	2	1	0	3
	UPL	3	1	1	2	0	3
	Unid[a]	3	4	3	0	1	4
	TOTAL	50	45	38	12	7	57
Shrub	OBL	1	1	1	0	0	1
	FACW	3	3	2	1	1	4
	FAC	1	1	0	1	1	2
	FACU	0	0	0	0	0	0
	UPL	1	0	0	1	0	1
	Unid	0	0	0	0	0	0
	TOTAL	6	5	3	3	2	8
Combined Strata[b]	OBL	26	21	19	7	2	28
	FACW	14	13	11	3	2	16
	FAC	4	6	3	1	3	7
	FACU	3	2	2	1	0	3
	UPL	4	1	1	3	0	4
	Unid	3	4	3	0	1	4
	TOTAL	54	47	39	15	8	62

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

[b] When data from different strata are combined, each species is considered only once.

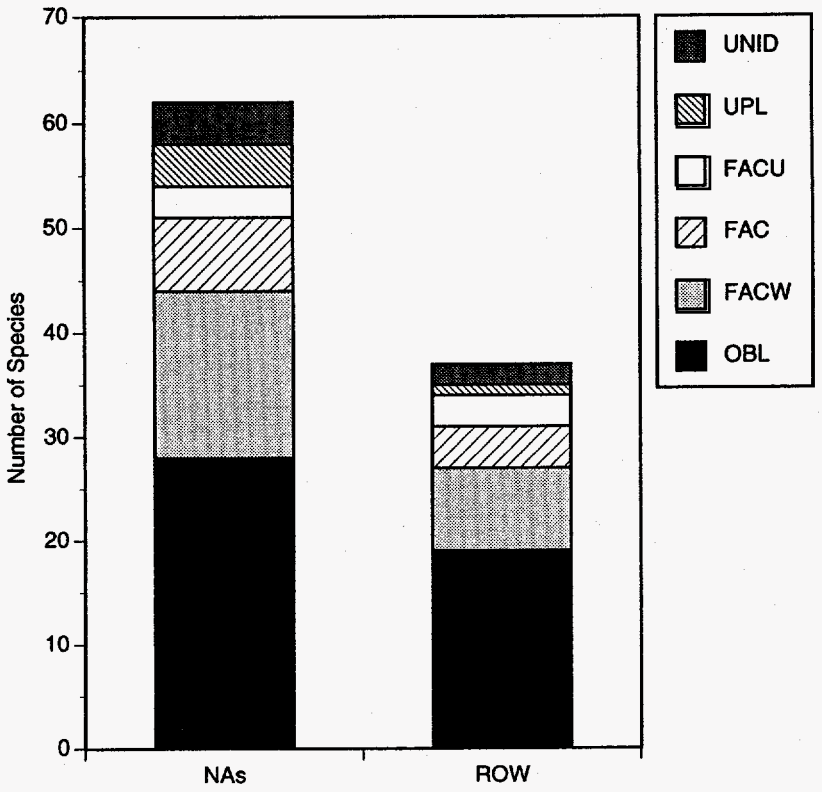

FIGURE 10 Number of Species in Each Wetland Indicator Category by Area in the Emergent Marsh Community

species in the NAs in 1991 was 183.9% compared to 193.7% in 1992. In the shrub stratum, the sum of the average coverages for individual species in the 1991 ROW prior to pipeline installation was 54.2%, compared to 0% in 1992 after pipeline installation. Shrub coverage in the NAs was 49.0% in 1991 and 50.1% in 1992. These figures indicate little change in shrub coverage in the NAs from 1991 to 1992, while in the ROW shrubs were eliminated.

Table 16 compares plant species present in the emergent marsh in 1991 with those present in 1992. The eight species of herbs that were present in plots at this site in 1991 but not in 1992 are listed in Appendix D, Table D.4. All of these were present in a single plot in 1991 and had coverages of less than 0.25% except grove bluegrass (*Poa alsodes*), which had an average coverage of 3.63%. Table D.5 lists the 26 species present in 1992 but not in 1991, and Table D.6 lists the 53 species that occurred in both 1991 and 1992. Of the 26 species newly encountered in 1992, 38% were unique to the ROW, 42% were unique to the NAs, and 19% occurred in both. Only three of the species that were found only in 1992 had average coverages greater than 1%. Rice cutgrass (*Leersia oryzoides*) had an average coverage of 3.15% in the NAs. The number of species in the ROW decreased from 48 in 1991 to 37 in 1992.

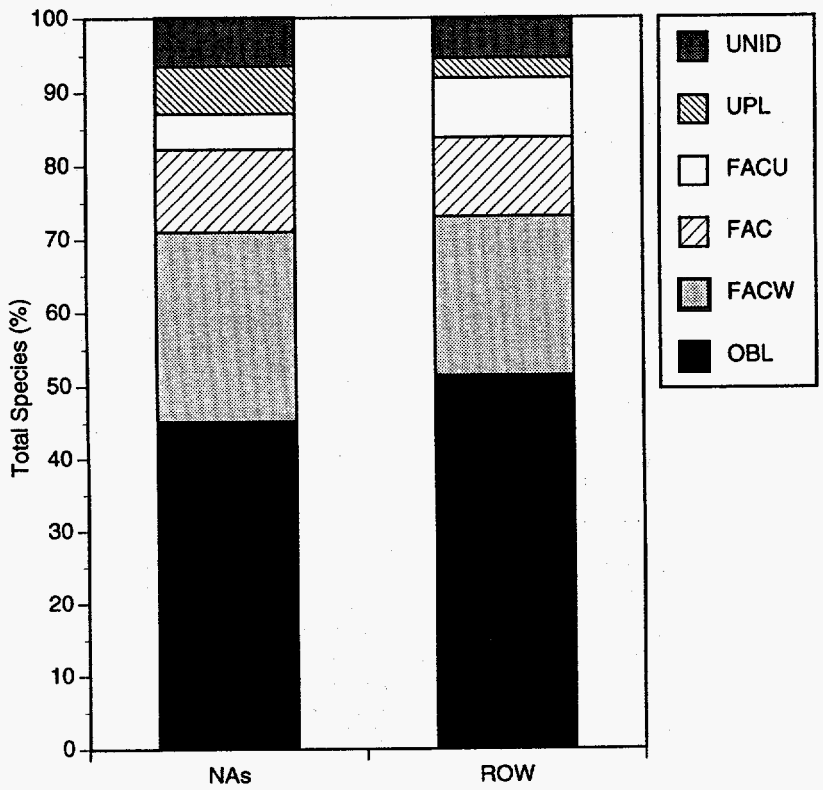

FIGURE 11 Percentage of Species in Each Wetland Indicator Category by Area in the Emergent Marsh Community

TABLE 13 Dominant Species by Vegetative Stratum for Each Habitat — Emergent Marsh Community

Stratum	Area	Species Scientific Name	Common Name	Wetland Indicator Category	Relative Percent Coverage	Sum of Relative Percent Coverage
Herb	NAs	*Typha × glauca*	Blue cattail	OBL	37.6	
		Equisetum fluviatile	Water horsetail	OBL	15.0	52.6
	ROW	*Typha × glauca*	Blue cattail	OBL	21.0	
		Alisma plantago-aquatica	Broad-leaf water plantain	OBL	20.6	
		Equisetum fluviatile	Water horsetail	OBL	17.5	59.1
Shrub[a]	NAs	*Cornus amomum*	Silky dogwood	FACW	36.8	
		Cornus stolonifera	Red-osier dogwood	FACW+	26.0	62.8

[a] The shrub stratum is not represented in the ROW.

TABLE 14 Coefficient of Community Values Comparing Areas on the Basis of Species Composition — Emergent Marsh Community

	Comparison		
Stratum	NAs to ROW	East Side of ROW to West Side of ROW	ENA to WNA
Herb	0.49	0.84	0.80
Shrub	0.00	0.00	0.55
Combined Strata	0.48	0.84	0.77

TABLE 15 Prevalence Index Values and Average Wetland Values for All Species and Dominant Species Only in the NAs and the ROW (by individual stratum and combined strata) — Emergent Marsh Community

Stratum	Areas	Species	Prevalence Index Value	Average Wetland Value
Herb	NAs	All	1.41	1.87
		Dominant only	1.00	1.00
	ROW	All	1.33	1.83
		Dominant only	1.00	1.00
Shrub	NAs	All	2.29	2.57
		Dominant only	1.59	1.50
Combined Strata	NAs	All	NC[a]	1.95
	ROW[b]	All	NC	1.83

[a] NC = not calculated. Values could not be calculated for combined strata because areal coverage (which is not additive) is used in its calculation.

[b] Only one stratum, the herb stratum, was present.

TABLE 16 Number of Plant Species Present in 1991 Only, 1992 Only, and Both 1991 and 1992 by Wetland Indicator Category — Emergent Marsh Community

Wetland Indicator Category	Present in 1991 Only				Present in 1992 Only				Present in 1991 and 1992			
	ROW Only	NAs Only	Both	Total	ROW Only	NAs Only	Both	Total	ROW Only	NAs Only	Both[a]	Total
OBL	0	1	0	1	4	4	2	10	0	4	22	26
FACW	0	0	1	1	2	2	2	6	0	4	9	13
FAC	0	2	2	4	1	2	0	3	0	1	5	6
FACU	0	1	1	2	2	1	0	3	0	0	2	2
UPL	0	0	0	0	0	1	0	1	0	0	3	3
Unid	0	0	0	0	1	1	1	3	1	0	2	3
TOTAL	0	4	4	8	10	11	5	26	1	9	43	53

[a] Occurred in both NAs and ROW, either in one year or in both years together.

Table 17 gives CC_S values comparing the species in the emergent marsh NAs and ROW between 1991 and 1992. The CC_S comparing the herb stratum species present in the ROW in 1991 and 1992 was only slightly less than the comparable value for the NAs. Removal of the shrubs from the ROW is reflected by a CC_S of 0.00, compared to 0.94 for the shrub stratum in the NAs.

Table 18 compares the PIVs and the AWVs in the emergent marsh NAs and ROW, by stratum, for all species and for dominants only. Both the PIV and AWV for all species in the NAs and in the ROW tended to be slightly lower in 1992 than in 1991. Values for dominant species in the herb stratum were much lower in 1992 because the dominants were all OBL species. PIVs and AWVs for the shrub stratum in the NAs were very similar for 1991 and 1992. Because no shrubs or trees were found in the ROW in 1992, no comparisons could be made for these strata in the ROW.

4.3 Forested Wetland Community

4.3.1 General Ecology

The forested wetland community is located east of the scrub-shrub community along the pipeline ROW (Figure 2). As the ROW proceeds east from the scrub-shrub community, it passes through an area of mixed shrubs and trees, then through a forested wetland community that soon intergrades into lowland forest. The beaver dam occurs approximately where the scrub-shrub community changes into mixed shrubs and trees. Thus, the forested wetland community had not been submerged by the beaver dam.

TABLE 17 Coefficient of Community Values Comparing 1991 and 1992 Data on the Basis of Species Composition – Emergent Marsh Community

	Comparison	
	NAs	ROW
Stratum	1991 to 1992	1991 to 1992
Herb	0.70	0.65
Shrub	0.94	0.00
Combined Strata	0.75	0.65

TABLE 18 Prevalence Index and Average Wetland Values for All Species and Dominant Species Only in the NAs and the ROW (by individual stratum and combined strata) — Emergent Marsh Community

			Prevalence Index Value		Average Wetland Value	
Stratum	Area	Species	1991	1992	1991	1992
Herb	NAs	All	1.55	1.41	1.90	1.87
		Dominant only	1.59	1.00	2.00	1.00
	ROW	All	1.60	1.33	1.98	1.83
		Dominant only	1.63	1.00	2.00	1.00
Shrub	NAs	All	2.05	2.29	2.56	2.57
		Dominant only	1.64	1.59	1.67	1.50
	ROW[a]	All	2.27	none	2.50	none
		Dominant only	1.66	none	1.50	none
Tree	NAs[b]		none	none	none	none
	ROW[a]	All	3.00	none	3.00	none
		Dominant only	3.00	none	3.00	none
Combined	NAs	All	NC[c]	NC	2.00	1.97
Strata	ROW	All	NC	NC	1.98	1.83

[a] No shrubs or trees were present on the ROW in 1992.

[b] No trees were present in the NAs in 1991 and 1992.

[c] NC = not calculated. Values could not be calculated for combined strata because areal coverage (which is not additive) is used in its calculation.

Because of the limited extent of forested wetland along the pipeline route, only one transect was sampled. The west edge of the transect was approximately 100 m east of the last scrub-shrub transect. The SNA along the transect sloped upward slightly to the south. No shrubs, saplings, or trees were observed in the ROW. At the time of sampling, the NAs on either side of the ROW contained no standing water; however, about 39% of the ROW surface was covered with standing water. Approximately 75% of the north side of the ROW was covered with standing water, while on the south side only 2% of the surface was submerged. Slash, partially covered with soil, remained on the south portion of the ROW. The soils are mapped as Lamson.

4.3.2 Plant Community

A total of 65 taxa of vascular plants occurred within the forested wetland transect. Of these, 62 were identified to species. Table C.7 lists these taxa with common names, wetland indicator categories, and life-forms and origins (Reed 1988). The 65 taxa consisted of one horsetail, three ferns, seven sedges, two rushes, four grasses, twenty-eight forbs, three vines, ten shrubs, and seven trees. Table C.8 provides the distribution and areal coverage for the NAs and for the two sides of the ROW. Ten introduced species were identified: one grass, five forbs, three shrubs, and one tree. Although all introduced species occurred in the ROW, only two were limited to the ROW. (See Appendix B, Section B.2, for definitions of the symbols used to represent life-forms and origins.)

Species Richness and Wetland Indicator Categories. Table 19 gives the number of species by wetland indicator category and by stratum found in the NAs and in the ROW at the forested wetland site. Of the 65 species identified, 91% occurred in the NAs. Thirty-two percent of the species occurred in the ROW, and 9% were unique to the ROW. All 65 species were represented in the herb stratum. Only four were present in the shrub stratum, two in the sapling stratum, and four in the tree stratum. Sixty-two percent of the species were OBL (31%) or FACW (31%) species; 14% were FAC, 14% FACU, and 5% were UPL species.

None of the 21 herb species identified in the forested wetland ROW occurred in both sides of the ROW (Table 20). Vegetation on the ROW was sparse and the two sides were quite different. Only OBL species occurred on the north side of the ROW; three FACU and one UPL species were present on soil associated with and elevated by the slash logs left from pipeline construction on the south side of the ROW.

As shown in Table 21, only 36% of the 59 species found in the forested wetland NAs occurred in both the NNA and SNA sampling plots. All species were present in the herb stratum with the same distributions as when all strata were considered together. Eighty-one percent of the species occurred in the SNA while 54% occurred in the NNA. Seventy-nine percent of the species in the NAs were OBL (30%), FACW (34%), or FAC (15%) species; 15% were FACU or UPL species.

TABLE 19 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 Community

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	17	11	8	9	3	20
	FACW	20	5	5	15	0	20
	FAC	9	1	1	8	0	9
	FACU	7	3	1	6	2	9
	UPL	2	1	0	2	1	3
	NI[a]	1	0	0	1	0	1
	Unid[b]	3	0	0	3	0	3
	TOTAL	59	21	15	44	6	65
Shrub	OBL	0	0	0	0	0	0
	FACW	3	0	0	3	0	3
	FAC	0	0	0	0	0	0
	FACU	0	0	0	0	0	0
	UPL	1	0	0	1	0	1
	Unid	0	0	0	0	0	0
	TOTAL	4	0	0	4	0	4
Sapling	OBL	0	0	0	0	0	0
	FACW	1	0	0	1	0	1
	FAC	0	0	0	0	0	0
	FACU	0	0	0	0	0	0
	UPL	1	0	0	1	0	1
	Unid	0	0	0	0	0	0
	TOTAL	2	0	0	2	0	2
Tree	OBL	0	0	0	0	0	0
	FACW	3	0	0	3	0	3
	FAC	1	0	0	1	0	1
	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
Combined Strata[c]	OBL	17	11	8	9	3	20
	FACW	20	5	5	15	0	20
	FAC	9	1	1	8	0	9
	FACU	7	3	1	6	2	9
	UPL	2	1	0	2	1	3
	NI[a]	1	0	0	1	0	1
	Unid	3	0	0	3	0	3
	TOTAL	59	21	15	44	6	65

[a] Identified species of plants for which an indicator status has not yet been determined.

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

[c] When data from different strata are combined, each species is considered only once.

TABLE 20 Number of Plant Species by Wetland Indicator Category Found in the Study Plots in the North and South Sides of the ROW (by individual stratum and combined strata) — Forested Wetland Community

Stratum	Wetland Indicator Category	Number of Species: 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 and Combined[a]	OBL	4	7	0	4	7	11
	FACW	0	5	0	0	5	5
	FAC	0	1	0	0	1	1
	FACU	0	3	0	0	3	3
	UPL	0	1	0	0	1	1
	Unid[b]	0	0	0	0	0	0
	TOTAL	4	17	0	4	17	21

[a] No shrubs, saplings, or trees occurred in the ROW; therefore, the herb stratum and the combined strata were the same in this case.

[b] Plants not identified to species.

Figures 12 and 13 compare species in the forested wetland by wetland indictor categories and by area. The lower number of species on the ROW is obvious in Figure 12; however, the percentage of OBL species on the ROW is higher. Eighty-one percent of the species on the ROW were OBL, FACW, and FAC species, while 78% of the species in the NAs were included in these categories.

Dominance. Table 22 lists the dominant species and their associated RPCs, by stratum, for the forested wetland. In the herb stratum of the NAs, five species qualified as dominants. One was the introduced common buckthorn (*Rhamnus cathartica*), a UPL species. The others were native species with wetland indicators ranging from OBL to FAC. Blue cattail, an OBL species, was the only herb dominant in the ROW.

Shrub, sapling, and tree strata occurred only in the NAs. Common buckthorn was dominant in the shrub stratum of the NAs. Silver maple, a FACW species, occurred as the dominant sapling; the only other sapling, common buckthorn, was a co-dominant. Silver maple was the leading dominant in the tree stratum and crack willow, a FAC species, was a co-dominant.

Coefficient of Community. A comparison of the combined NAs with the combined ROWs gave a CC_s value of 0.38 for the forested wetland community (Table 23). Because the two

TABLE 21 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 Community

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	8	13	4	4	9	17
	FACW	10	19	9	1	10	20
	FAC	6	6	3	3	3	9
	FACU	4	6	3	1	3	7
	UPL	2	1	1	1	0	2
	NI[a]	0	1	0	0	1	1
	Unid[b]	2	2	1	1	1	3
	TOTAL	32	48	21	11	27	59
Shrub	OBL	0	0	0	0	0	0
	FACW	3	1	1	2	0	3
	FAC	0	0	0	0	0	0
	FACU	0	0	0	0	0	0
	UPL	1	1	1	0	0	1
	Unid	0	0	0	0	0	0
	TOTAL	4	2	2	2	0	4
Sapling	OBL	0	0	0	0	0	0
	FACW	1	1	1	0	0	1
	FAC	0	0	0	0	0	0
	FACU	0	0	0	0	0	0
	UPL	1	0	0	1	0	1
	Unid	0	0	0	0	0	0
	TOTAL	2	1	1	1	0	2
Tree	OBL	0	0	0	0	0	0
	FACW	2	3	2	0	1	3
	FAC	0	1	0	0	1	1
	FACU	0	0	0	0	0	0
	UPL	0	0	0	0	0	0
	Unid	0	0	0	0	0	0
	TOTAL	2	4	2	0	2	4
Combined Strata[c]	OBL	8	13	4	4	9	17
	FACW	10	19	9	1	10	20
	FAC	6	6	3	3	3	9
	FACU	4	6	3	1	3	7
	UPL	2	1	1	1	0	2
	NI	0	1	0	0	1	1
	Unid	2	2	1	1	1	3
	TOTAL	32	48	21	11	27	59

[a] Identified plant species for which an indicator status has not yet been determined.

[b] Plants not identified to species.

[c] When data from different strata are combined, each species is considered only once.

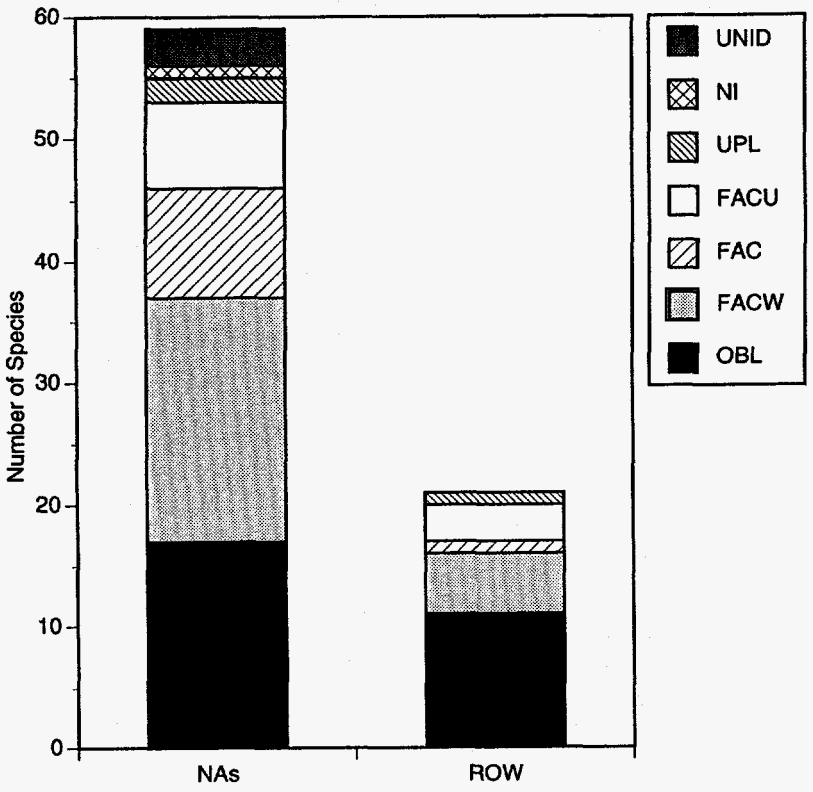

FIGURE 12 Number of Species in Each Wetland Indicator Category by Area in the Forested Wetland Community

sides of the ROW shared no species in common, their CC_s was 0.00. The CC_s comparing the two NAs was low, 0.53 for both the herb stratum and for all strata combined. The CC_s for the NNA and SNA was the same (0.67) for the shrub, sapling, and tree strata.

Prevalence Index Values and Average Wetland Values. Table 24 provides the AWVs and PIVs for the NAs and the ROW in the forested wetland community. Both AWVs and PIVs for all species and dominant species only in the herb stratum are lower for the ROW than for the NAs. No comparisons can be made between the NAs and the ROW for the shrub, sapling, and tree strata because these strata did not occur in the ROW. The shrub stratum was dominated by common buckthorn, a UPL species, causing an AWV and a PIV for dominants of 5.00. PIVs for all species and for dominants only in the herb, sapling, and tree strata were below 3.00, indicating wetland vegetation in these strata.

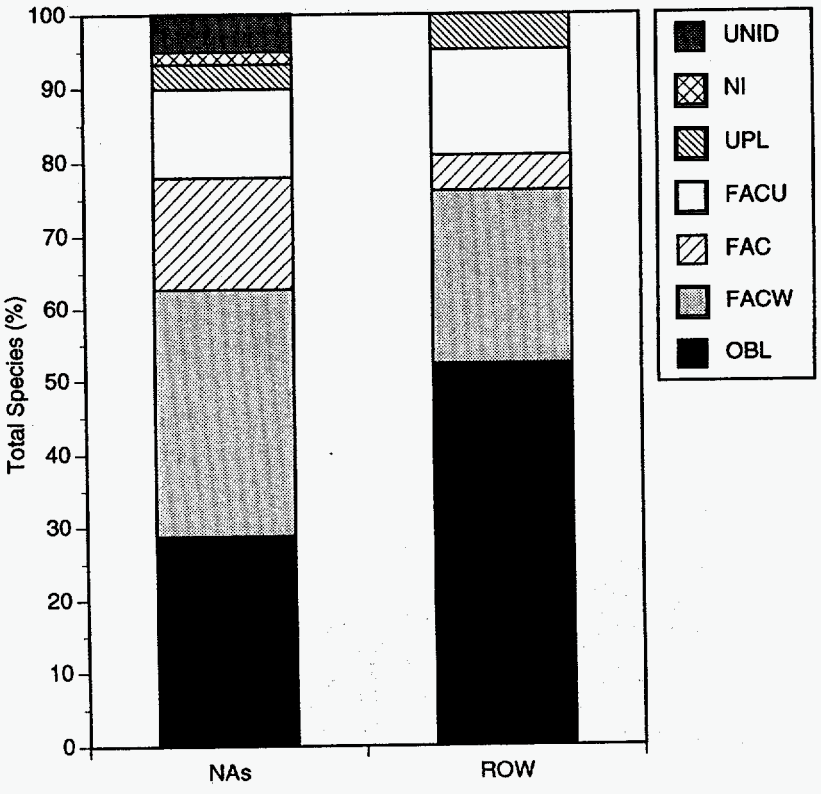

FIGURE 13 Percentage of Species in Each Wetland Indicator Category by Area in the Forested Wetland Community

TABLE 22 Dominant Species by Vegetative Stratum — Forested Wetland Community

Stratum	Area	Species Scientific Name	Common Name	Wetland Indicator Category	Relative Percent Coverage	Sum of Relative Percent Coverage
Herb	NAs	*Onoclea sensibilis*	Sensitive fern	FACW	22.2	
		Rhamnus cathartica	Common buckthorn	UPL	11.3	
		Glyceria striata	Fowl manna grass	OBL	9.6	
		Impatiens capensis	Spotted touch-me-not	FACW	6.1	
		Toxicodendron radians	Poison ivy	FAC	3.9	53.1
	ROW	*Typha × glauca*	Blue cattail	OBL	61.5	61.5
Shrub	NAs	*Rhamnus cathartica*	Common buckthorn	UPL	80.7	80.7
Sapling	NAs	*Acer saccharinum*	Silver maple	FACW	75.0	
		Rhamnus cathartica	Common buckthorn	UPL	25.0	100.0
Tree	NAs	*Acer saccharinum*	Silver maple	FACW	64.0	
		Salix fragilis	Crack willow	FAC	32.0	96.0

TABLE 23 Coefficient of Community Values Comparing Areas on the Basis of Species Composition — Forested Wetland Community

Stratum	Comparison		
	NAs to ROW	North ROW to South ROW	NNA to SNA
Herb	0.38	0.00	0.53
Shrub	0.00	NC[a]	0.67
Sapling	0.00	NC	0.67
Tree	0.00	NC	0.67
Combined Strata	0.38	0.00	0.53

[a] NC = not calculated. Only the herb stratum was present in the ROW.

4.3.3 Comparison of Data from 1991 and 1992

Obvious construction effects in the 1991 ROW included embedded logs in the soil surface on the working (south) side of the ROW (constituting about 7% of the ROW surface), standing water (covering about 40% of the soil surface), and exposed, disturbed soils that remained unvegetated. None of these were present prior to construction of the 1991 pipeline.

Table 25 compares species present in 1991 and 1992 by wetland indicator category for the forested wetland community. The numbers of species in the OBL and FACW categories were much higher in 1992. Of the 78 species encountered in plots in this site over the two years, 17% were identified only in 1991 (Table D.7), 59% were identified only in 1992 (Table D.8), and 24% occurred in the sampling plots during both years (Table D.9). The number of species in the ROW decreased from 26 in 1991 to 21 in 1992. The total number of species in the ROW in 1992, therefore, was 81% of the number in 1991. The total number of species in the NAs increased from 27 in 1991 to 59 in 1992, a 120% increase. Seventy-one percent of the species found in the ROW in 1992 also occurred in the NAs.

The vegetational community that existed on the ROW prior to installation of the 1991 pipeline was substantially altered. The CC_S values listed in Table 26, comparing forested wetland species data from 1991 and 1992, are all low. The CC_S for the herb stratum (the only stratum present on the two sides of the ROW) was only 0.13, with only three species in common between

TABLE 24 Prevalence Index and Average Wetland Values for All Species and Dominant Species Only in the NAs and the ROW (by individual stratum and combined strata) — Forested Wetland Community

Stratum	Areas	Species	Prevalence Index Value	Average Wetland Value
Herb	NAs	All	2.36	2.35
		Dominant only	2.71	2.60
	ROW	All	1.39	1.95
		Dominant only	1.00	1.00
Shrub	NAs	All	4.42	2.75
		Dominant only	5.00	5.00
Sapling	NAs	All	2.75	3.50
		Dominant only	2.75	3.50
Tree	NAs	All	2.32	2.25
		Dominant only	2.33	2.50
Combined Strata	NAs	All	NC[a]	2.35
	ROW	All	NC	1.95

[a] NC = not calculated. Values could not be calculated for combined strata because areal cover (which is not additive) is used in its calculation.

the two sampling events. Spotted touch-me-not (*Impatiens capensis*), which had an average coverage of 26% in the two ROW plots in 1991, had an average coverage of 1.5% in 1992. Blue cattail, which was not present on the site in 1991, had an average coverage of 10% in 1992 and was the leading dominant on the ROW.

Forested wetland PIVs and AWVs for both NA and ROW vegetation (like the values for the scrub-shrub and emergent marsh) were similar for 1991 and 1992. Table 27 lists PIVs and AWVs by stratum for all species and for dominants only for 1991 and 1992. Comparing values for the two years reveals only small changes — except for changes in values resulting from the removal of shrub, sapling, and tree strata from the ROW.

TABLE 25 Number of Plant Species Present in 1991 Only, 1992 Only, and Both 1991 and 1992 by Wetland Indicator Category — Forested Wetland Community

Wetland Indicator Category	Present in 1991 Only				Present in 1992 Only				Present in 1991 and 1992		
	ROW	NAs	Both	Total	ROW	NAs	Both	Total	NAs	Both[a]	Total
OBL	0	0	0	0	3	7	7	17	0	3	3
FACW	0	0	2	2	0	7	3	10	0	9	9
FAC	1	2	2	5	0	5	1	6	1	2	3
FACU	1	1	1	3	2	4	1	7	0	3	3
UPL	0	0	0	0	1	2	0	3	0	1	1
Unid[b]	0	2	1	3	0	2	0	2	0	0	0
NI[c]	0	0	0	0	0	1	0	1	0	0	0
Total	2	5	6	13	6	28	12	46	1	18	19

[a] Occurred in both the NAs and ROW in either 1991 or 1992 or occurred in both NAs and ROW when both years were combined.

[b] Plants not identified to species.

[c] Identified plant species for which an indicator status has not yet been determined.

TABLE 26 Coefficient of Community Values Comparing 1991 and 1992 Data on the Basis of Species Composition — Forested Wetland Community

	Comparison	
	NAs	ROW
Stratum	1991 to 1992	1991 to 1992
Herb	0.37	0.13
Shrub	0.33	0.00
Sapling[a]	0.00	0.00
Tree	0.25	0.00
Combined Strata	0.38	0.13

[a] There were no saplings in common in 1991 and 1992.

TABLE 27 Prevalence Index and Average Wetland Values for All Species and Dominant Species Only in the NAs and the ROW (by individual stratum and combined strata) — Forested Wetland Community

Stratum	Areas	Species	Prevalence Index Value 1991	Prevalence Index Value 1992	Average Wetland Value 1991	Average Wetland Value 1992
Herb	NAs	All	2.76	2.36	2.76	2.35
		Dominant only	2.88	2.71	2.50	2.60
	ROW	All	2.09	1.39	2.48	1.95
		Dominant only	2.00	1.00	2.00	1.00
Shrub	NAs	All	4.64	4.42	3.50	2.75
		Dominant only	5.00	5.00	5.00	5.00
	ROW[a]	All	4.62	none	3.50	none
		Dominant only	5.00	none	5.00	none
Sapling	NAs[b]	All	none	2.75	none	3.50
		Dominant only	none	2.75	none	3.50
	ROW[a]	All	3.00	none	3.00	none
		Dominant only	3.00	none	3.00	none
Tree	NAs	All	2.87	2.32	2.50	2.25
		Dominant only	3.00	2.33	3.00	2.50
	ROW[c]		none	none	none	none
Combined Strata	NAs	All	NC[d]	NC	2.71	2.35
	ROW	All	NC	NC	3.00	2.11

[a] No shrubs or saplings were present on the ROW in 1992.

[b] No samplings were present in the NAs in 1991.

[c] No trees were present on the ROW in 1991 or 1992.

[d] NC = not calculated. Values could not be calculated for combined strata because areal cover (which is not additive) is used in its calculation.

5 Discussion

5.1 Scrub-Shrub Community

Prior to construction of the 1991 pipeline, the site was covered with shallow standing water retained by an extensive beaver dam that surrounded the site on the east, south, and west. Construction activities had breached this dam at the west and east edges of the site. However, when we resampled the site in July 1992, the dam had been restored and water levels were comparable to preconstruction levels. The presence of only hydric vegetation on the ROW and the absence of dead or dying upland plants suggest that the dam had been restored prior to the 1992 growing season. The winter survival of the beaver colony indicates that the dam was restored before winter 1991. An abundance of cattails in the ROW in 1992 and scattered cattails in the NAs, along with the absence of cattails in any sampling plots during the 1991 growing season, implies that water levels were low for a sufficient time during the 1991 growing season to allow for cattail establishment. Cattails need very shallow water or saturated soils for germination and survival of seedlings. It is likely that water drawdown associated with breaching of the beaver dam during pipeline construction contributed to seed germination and seedling establishment.

Although the ROW had been cleared of vegetation during pipeline construction, the total areal coverage and number of species present in the herb stratum of the ROW were greater in 1992 than prior to installation of the pipeline in 1991. The areal coverage of herb stratum vegetation, excluding star duckweed and lesser duckweed, was 50.5% in 1992 compared to 5.6% in 1991 (prior to pipeline installation). The number of species present doubled. The following factors may have contributed to the rapid development of the herb stratum in the ROW: a period of low water levels during installation of the 1991 pipeline; the presence of partially buried slash on the working side of the ROW, which provided habitat variety; the release of nutrients caused by soil disturbance during construction; and increased light caused by the removal of woody vegetation from the ROW. Also, some of the differences between the June 1991 and the July 1992 sampling results may be related to the later sampling date in 1992.

As in 1991, the transects for sampling in 1992 were located on the basis of a random starting point and thus did not encompass the same plots; this may account for some of the differences in species composition and percent coverages between the two years. Star duckweed was much more abundant in both the ROW and NAs during the 1992 survey than in 1991. The reason for the increase is not clear, but may be associated with the following: increased winds in the cleared ROW may have blown the surface stratum of lesser duckweed aside, allowing increased light penetration below the water's surface; a plume of nutrients released by pipeline installation activities and the fluctuation of water levels may have contributed to more abundant vegetation; and sampling in 1992 took place later in the growing season.

CC_S values, comparing the species present by stratum for 1991 and 1992, also reflect changes in the herb stratum in the NAs, which was represented by 20 species in 1991 and 45 species in 1992. Some of the increases in species numbers may be the result of favorable

conditions for seed germination during pipeline installation caused by the release of nutrients from construction activities and lowering of the water levels. The later sampling date during the 1992 growing season probably also allowed for development of more species.

Comparison of shrub stratum species present in the NAs in 1991 and 1992 resulted in a high CC_S (0.86). The few differences in species composition are most likely attributable to random sampling. Comparisons of species present in the sapling and tree strata in 1991 and 1992 resulted in lower CC_S values. Only a few saplings or trees occurred in the NNA and these showed no evidence of disturbance by pipeline installation. Some saplings in the SNA had lodged since the 1991 sampling, but were still alive, as indicated by their foliage.

A high degree of similarity was observed between the 1991 and 1992 PIVs and the 1991 and 1992 AWVs for individual and combined strata. Wetland values for all strata of vegetation in the NAs in 1992 were very similar to corresponding values for 1991 — whether all species or just dominants were considered. The higher PIVs and AWVs for the tree stratum, compared to other strata, were not unique to this study. This same pattern was observed in a number of other ROW studies and may indicate a lower sensitivity of larger plants to hydrologic conditions.

The removal of most woody plants from the ROW and the ensuing increase in emergent vegetation has resulted in an herb stratum on the ROW that includes more species with high fidelity to wetlands. This is reflected in a lower AWV for 1992 than for 1991. Thus, the installation of the pipeline has resulted in both increased species diversity and increased hydric vegetation in the ROW. At the same time, it has created a break in the forest that provides edge habitat for some species, while fragmenting the environment for others. Because the ROW is relatively narrow, it is not likely to impede the dispersal of species, except those that have very limited mobility.

5.2. Emergent Marsh Community

Because the natural topography of the emergent marsh site was relatively level and the site was only partially covered by standing water, large differences in the percentage of the soil surface covered by standing water in the NAs could be brought about by small changes in water level. The planned attempt to save and replace the vegetative mat on the surface of the ROW was apparently unsuccessful. While some sections of the mat, measuring up to approximately 1 square meter total area, were returned to the ROW surface, most of the surface consisted of disturbed soils. The intact sections of vegetative mat and the soft saturated soils resulted in a somewhat uneven ROW surface; 39% was covered with standing water and about 6% consisted of exposed unvegetated soil. The increase in the percentage of the ROW surface covered with water from 1991 to 1992, compared to the ROW surface in 1991 and compared to the NAs in 1992, may be related to compression of the soils by heavy machinery used for pipeline installation, regrading of the ROW, and vehicle tracks that appear to have been made after final grading.

The number of species occurring in plots in the NAs in 1992 (62) was almost the same as in 1991 (59), with 46 species in common. Some of the differences in species composition may be

due to the later sampling date in 1992 and some to the limited sampling using randomly located plots. While some changes in species might theoretically be brought about by pipeline installation, it seems reasonable to assume that disturbance was minimal because no evidence of disturbance off of the ROW was noted and hydric conditions were not modified. In 1991, rice cutgrass (*Leersia oryzoides*) was not recorded in this site. In 1992, it had an average coverage of 3.15% in the NAs. It is likely that its absence in 1991 is explained by the earlier sampling date when the species was not developed enough to be identified; some of the coverage attributed to grove bluegrass in 1991 may have actually been very immature rice cutgrass. Because grove bluegrass is an early flowering grass, the seed culms that were evident during June 1991 may have already withered by July 8, when the 1992 sampling was conducted.

While the vegetation in the NAs remained very similar to that present prior to pipeline construction, the ROW vegetation was considerably changed by pipeline construction. In 1992, the sum of coverages for all species was much reduced from 1991. The number of species occurring in ROW plots was about 25% less than the number present in 1991. Of the 37 species found in ROW plots in 1992, 10 were unique to the newly created ROW — indicating the changed nature of the ROW habitat. The most significant change in the ROW was the lack of competition of shrubs and robust herb species such as cattails, boneset (*Eupatorium perfoliatum*), and Joe-pye-weed (*Eupatoriadelphus maculatus*). Minor changes in topography and soil disturbance resulting from pipeline installation activities also contributed to the change in ROW habitat.

It is anticipated that, within several years, the ROW will develop an herb stratum similar to that found in adjacent NAs. However, some differences in species composition are likely to remain, especially if shrubs are not allowed to re-invade the ROW. A lack of shrubs in the ROW will likely exclude some herb species that are typically found only in plots where shrubs, rather than robust emergent herbs, are dominant.

5.3 Forested Wetland Community

Only a single, randomly located transect was sampled in the forested wetland community because of the small community size. One transect is not an adequate sample size to accurately assess the ROW impacts. Differences in data could be attributable to plot location (a random sample was taken for each survey). For this community, observable impacts were more reliable than the collected data. In early June 1991, many species were too small to identify or had not yet emerged. The two NAs also have slight topographic differences; the SNA is at a slightly higher elevation.

The ROW through the forested wetland community was altered in a number of ways. Shrubs, saplings, and trees were removed and slash was placed on the working side to support construction equipment. This slash remained partially embedded in surface soils. Also, the ROW surface was generally depressed, as evidenced by the fact that 39% of the ROW surface was covered with standing water, while no standing water occurred in the NAs. These changes in the ROW surface resulted in blue cattail, which was not present in 1991, becoming the leading

dominant in 1992. There was no observable evidence of disturbance in the physical habitat of the area. Even though a single transect was sampled, the wetland indicator values (AWVs and PIVs) for the various strata in the NAs were very similar for 1991 and 1992. Wetland indicator values for the herb stratum in the ROW in 1992 were all lower than comparable values for 1991, indicating that more hydric vegetation was present in 1992.

6 Summary and Conclusions

6.1 Summary

As stated in the Introduction (Section 1), 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 are to document the vegetative communities on the ROW and NAs that were not disturbed by pipeline construction; evaluate the similarities and differences between the plant communities on the ROW and the NAs; document qualitative changes to topography, soils, and hydrology attributable to ROW construction; and identify impacts caused by ROW construction on rare, threatened, endangered, or sensitive species.

This study involved the collection and analysis of data within the Mill Creek tributary crossing wetland along the southwest border of Watertown, New York. A gas transmission pipeline was installed approximately 12 months prior to collection of the data presented in this report. Prior to installation of the pipeline in 1991, field studies were conducted at this site to provide data on an existing pipeline installed in 1966 and to provide baseline data for the present study. Three vegetative community types were sampled during this study: a scrub-shrub community, an emergent marsh, and a forested wetland.

The 1991 pipeline was installed within the 1966 pipeline ROW in the scrub-shrub community and forested wetland, but it crossed the emergent marsh within a newly created ROW. In two communities (the scrub-shrub community and the emergent marsh), five transects (comprising a total of 10 sampling plots within the ROW and 10 within the NAs) were established for the 1991 and 1992 surveys. Vegetational data from the randomly located transects for the two years were very similar for the NAs in the emergent marsh. Data for the shrub stratum in the scrub-shrub community for the two years were quite similar, while data for the sapling and tree strata were less similar. The size and number of plots appeared adequate to characterize the hydric qualities of the vegetation; little variation in wetland indicators was observed between the two years. The single transect in the forested wetland, comprising only two plots in the NAs, resulted in low CC_s values when comparing the plants in each stratum during each year. However, the wetland indicator values were again very similar for each stratum present in 1991 and 1992.

Scrub-Shrub Community. In the scrub-shrub community, within 12 to 13 months after pipeline installation, 25 species had become established on the ROW, with about 50% total areal coverage for emergent species. The floating star duckweed and lesser duckweed were abundant in the standing water. Some of the emergent species were associated with soils elevated by embedded slash used to support heavy equipment during pipeline construction. The only observable changes in the NAs were an increase in the abundance of duckweeds and cattail and the lodging of some saplings in the SNA. The beaver dam had been restored, and water depths were similar to those observed in 1991.

Emergent Marsh Community. In the emergent marsh community, 36 species had become established on the ROW within the 12-13 months since pipeline installation; the total coverage was only about 25% despite replacement of the vegetative mats. Comparing the 1992 plant community on the ROW with the community present prior to pipeline construction resulted in a CC_S of 0.65, indicating considerable similarity in species composition even though fewer species were present. More of the ROW surface was covered by standing water in 1992 than in 1991, although the percentage of the surface covered by standing water in the NAs had decreased. It is anticipated that the ROW community will soon develop into a community similar to the herb stratum observed in portions of the NAs where shrubs are absent.

Forested Wetland Community. One year after pipeline installation, the two plots within the ROW in the forested wetland contained only 21 species, 10 of which were introduced. Total vegetative cover was low; cattail was the leading dominant. The ROW surface was uneven and contained considerable standing water on the storage side of the ROW and partially embedded slash on the working side. No impacts (such as tire tracks, rip-rap, or soil piles) were observable in the NAs.

6.2 Conclusions

Considerable revegetation of the ROW had occurred within the one year after pipeline construction, particularly in the scrub-shrub community. No seeding of the ROW surface was completed following pipeline construction. Numerous species from the NAs and naturally occurring seed banks had become established on the ROW in these communities. Total coverage for all species occurring in the ROW was highest in the scrub-shrub community, where standing water was most abundant, and lowest in the forested wetland community, where shade intensity was greatest. The slash embedded in the working side of the ROW provided habitat for several mesic species in both the scrub-shrub and forested wetland communities. The unevenness of the ROW surface in the emergent marsh may have retarded revegetation, but over periods of fluctuating water levels, the effects will most likely be eliminated. Comparison of data for the NAs in 1991 and 1992 indicates that the sample design (using five transects) was adequate to provide a good general description of the vegetation in the herb and shrub strata but was less definitive for the sapling and tree strata. Wetland indicators differed little from year to year for the same stratum in the same area. This was true even for the sapling and tree strata in the NAs, where CC_S values comparing data from the 1991 and 1992 sampling events were relatively low.

The ROW in each of the three community types continued to exhibit wetland hydrology, soils, and vegetation. If woody vegetation is excluded from the ROW by future maintenance, the differences between the ROW and the NAs will be related to the proportion of woody vegetation present in the NAs. Follow-up studies are needed to determine the rate of succession on the ROW and the nature of the climax (or disclimax) community that will become established there.

While the presence of slash embedded in the substrate on the working side of the ROW in the scrub-shrub community and forested wetland contributed to species diversity, much of that diversity was the result of the slash providing habitat for more mesic species. It is not possible to

predict the impact of the slash on the future development of plant species in the ROW from a study performed just one year after pipeline construction.

7 References

Bonham, C.P., 1989, *Measurements for Terrestrial Vegetation*, John Wiley and Sons, New York, N.Y.

Brower, J., J. Zar, and C. von Ende, 1990, *Field and Laboratory Methods for General Ecology, Third Edition,* Wm. C. Brown Publishers, Dubuque, Iowa.

Cowardin, L.M., et al., 1979, *Classification of Wetlands and Deep Water Habitats of the United States,* U.S. Fish and Wildlife Service, U.S. Geological Survey, and U.S. National Oceanic and Atmospheric Administration, Washington, D.C.

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.

New York State Department of Transportation, 1986, NYS Freshwater Wetlands Map, Jefferson County Map 28 of 40, NYSDT, State Campus, Albany, N.Y. 12226.

NYSDT: see New York State Department of Transportation.

Reed, P.B., Jr., 1988, *National List of Plant Species that Occur in Wetlands, Region 1,* U.S. Department of the Interior, Biology Report 88 (26.1).

SCS: see Soil Conservation Service.

Soil Conservation Service, 1989, *Soil Survey; Jefferson County, New York* , U.S. Department of Agriculture, Washington, D.C.

Soil Conservation Service, 1991, *Hydric Soils of the United States,* U.S. Department of Agriculture, in cooperation with the National Technical Committee for Hydric Soils.

Van Dyke, G.D., L.M. Shem, and R.E. Zimmerman, 1994, *Pipeline Corridors through Wetlands — Impacts on Plant Communities: Mill Creek Tributary Crossing, Jefferson County, New York, 1991 Survey*, GRI-93/0091, prepared by Argonne National Laboratory, Argonne, Ill., for Gas Research Institute.

Wright, T., 1991, Harroun Lumber Corporation (located adjacent to the wetland), personal conversation with G.D. Van Dyke, June 13.

Zimmerman, R.E., et al., 1991, *Pipeline Corridors through Wetlands — Impacts on Plant and Avian Diversity: Boreal Wetlands, Oconto County, Wisconsin,* GRI-91/0046, prepared by Argonne National Laboratory, Argonne, Ill., for the Gas Research Institute, Chicago, Ill.

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.

Soil Conservation Service, 1988, *National Food Security Act Manual*, U.S. Department of Agriculture, Washington, D.C.

U.S. Army Corps of Engineers, 1987, *Corps of Engineers Wetlands Delineation Manual*, Technical Report Y-87-1, Waterways Experiment Station, Vicksburg, Miss.

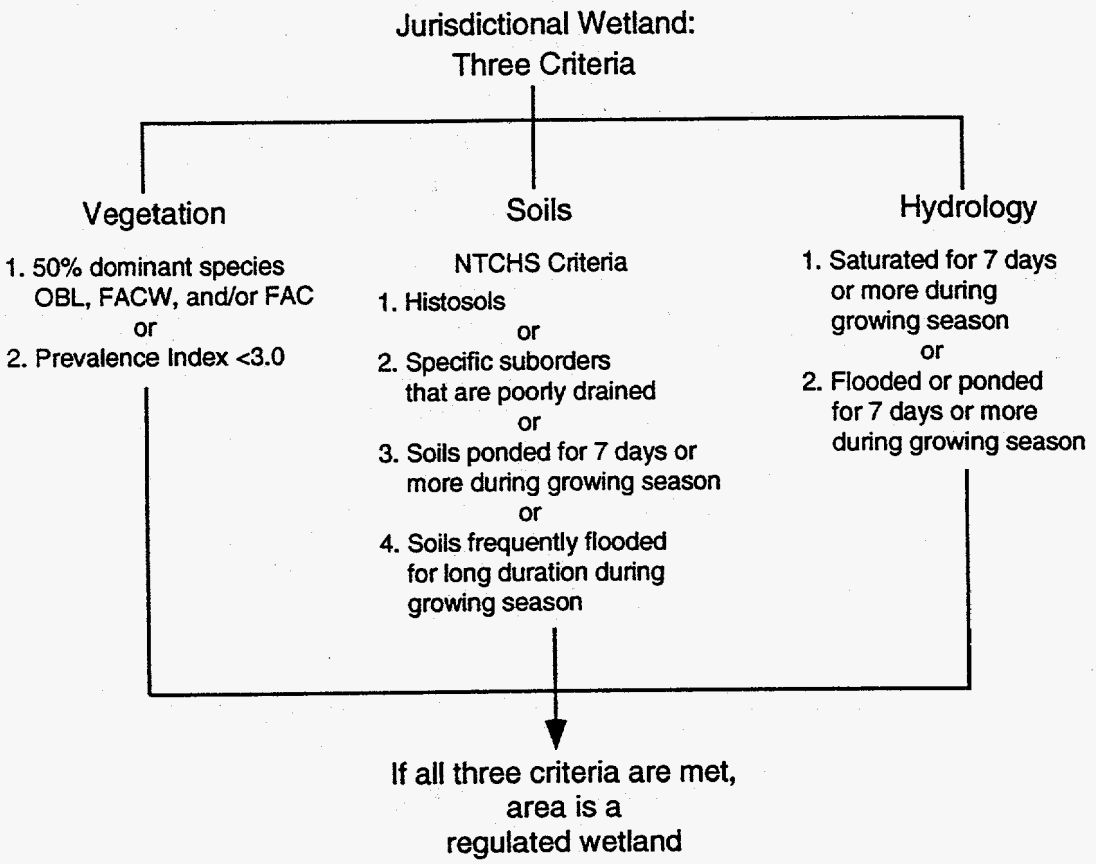

FIGURE A.1 Schematic Diagram of the Wetland Delineation Process (Source: FICWD 1989)

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.

FICWD: see Federal Interagency Committee for Wetland Delineation.

Reed, P.B., Jr., 1988, *National List of Plant Species that Occur in Wetlands, Region 1,* U.S. Department of the Interior, Biology Report 88 (26.1).

Zimmerman, R.E., et al., 1991, *Pipeline Corridors through Wetlands — Impacts on Plant and Avian Diversity: Boreal Wetlands, Oconto County, Wisconsin,* GRI-91/0046, prepared by Argonne National Laboratory, Argonne, Ill., for the Gas Research Institute, Chicago, Ill.

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 — Scrub-Shrub Community

Field Number	Species Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
41	*Acer rubrum* L.	Red maple	FAC	NT
42	*Acer saccharinum* L.	Silver maple	FACW	NT
1	*Alisma plantago-aquatica* L.	Broad-leaf water plantain	OBL	PNEF
375	*Ambrosia artemisiifolia* L.	Annual ragweed	FACU	A NF
76	*Bidens cernua* L.	Nodding beggar's-ticks	OBL	AIF
331	*Bidens frondosa* L.	Devil's beggar-ticks	FACW	A NF
342	*Calamagrostis canadensis* (Michx.) Beauv.	Blue-joint reedgrass	FACW+	PNG
305	*Carex bebbii* (L.H. Bailey) Olney ex Fernald	Bebb's sedge	OBL	PNGL
301	*Carex normalis* Mackenz	Larger straw sedge	FACU	PNGL
331	*Carex* spp.			
346	*Ceratophyllum demersum* L.	Common hornwort	OBL	PN/F
224	*Circaea lutetiana* L.	Southern broad-leaf enchanter's nightshade	FACU	PNF
6	*Cornus amomum* Mill.	Silky dogwood	FACW	NS
90	*Cornus foemina* Mill.	Stiff dogwood	FAC	NS
5	*Cornus stolonifera* Michx.	Red-osier dogwood	FACW+	NS
300	*Eleocharis obtusa* (Willd.) J.A. Schultes	Blunt spikerush	OBL	APNEGL
347	*Erigeron annuus* (L.) Pers.	White-top fleabane	FACU	A NF
27	*Eupatorium perfoliatum* L.	Common boneset	FACW+	PNF
348	*Fragaria virginiana* Duchesne	Virginia strawberry	FACU	PNF
349	*Fraxinus nigra* Marshall	Black ash	OBL	NETS
38	*Fraxinus pennsylvanica* Marshall	Green ash	FACW	NT
302	*Galium palustre* L.	Marsh bedstraw	OBL	PNF
309	*Glyceria striata* (Lam.) A. Hitchc.	Fowl manna grass	OBL	PNEG
111	*Impatiens capensis* Meerb.	Spotted touch-me-not	FACW	A NF
327	*Juncus canadensis* J.Gay	Canada rush	OBL	PNGL
365	*Juncus tenuis* Willd.	Slender rush	FAC-	PNGL
374	*Lemna minor* L.	Lesser duckweed	OBL	PN/F
373	*Lemna trisulca* L.	Star duckweed	OBL	PN/F
72	*Ludwegia palustris* (L.) Elliott	Marsh seedbox	OBL	PNEF
77	*Lycopus americanus* Muhl. ex W. Barton	American bugleweed	OBL	PNF
74	*Lysimachia thyrsiflora* L.	Tufted loosestrife	OBL	PIF
372	*Mimulus ringens* L.	Alleghany monkey-flower	OBL	PNF
374	*Pilea pumila* (L.) Gray	Canada clearweed	FACW	A NF
379	*Plantago rugelii* Decne.	Black-seed plantain	FACU	PNF

TABLE C.1 (Cont.)

Field Number	Species Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
328	*Poa pratensis* L.	Kentucky bluegrass	FACU	PNG
37	*Polygonum amphibium* L.	Water smartweed	OBL	PNE/F
353	*Polygonum pensylvanicum* L.	Pennsylvania smartweed	FACW	ANEF
337	*Potentilla norvegica* L.	Norwegian cinquefoil	FACU	ABPNF
324	*Potamogeton pectinatus* L.	Sago pondweed	OBL	PNZF
338	*Rorripa* spp.			
332	*Rumex* spp.			
106	*Salix bebbiana* Sarg.	Bebb willow	FACW	NS
39	*Salix discolor* Muhl.	Pussy willow	FACW	NS
306	*Salix fragilis* L.	Crack willow	FAC	IT
71	*Salix petiolaris* Pursh	Meadow willow	OBL	NS
304	*Sium suave* Walter	Hemlock water-parsnip	OBL	PNEF
51	*Solanum dulcamara* L.	Climbing nightshade	FAC-	PIF
369	*Sparganium* spp.			
339	*Taraxacum officinale* G.H. Weber	Common dandelion	FACU-	PIF
343	*Trifolium repens* L.	White clover	FACU-	PIF
112	*Typha x glauca* Godr.	Blue cattail	OBL	PNEF
33	*Ulmus americana* L.	American elm	FACW-	NT
378	*Urtica dioica* L.	Stinging nettle	FACU	PIF
109	*Verbena hastata* L.	Blue vervain	FACW+	PNF
55	*Vicia cracca* L.	Cow-vetch	UPL	PIF

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

[b] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins.)

TABLE C.2 Percent Areal Coverage Estimates by Stratum for Plant Species in the Scrub-Shrub Community

Field Number	Species Scientific Name	NNA					North ROW					South ROW					SNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
Standing water		99	98	98	98	99	100	100	100	100	100	95	98	98	99	80	98	98	98	98	85
Herb stratum																					
41	*Acer rubrum*	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	0.5	-	-	-	-
42	*Acer saccharinum*	1	0.5	1	-	0.5	-	-	-	-	-	-	-	2	-	0.5	-	-	-	0.5	-
1	*Alisma plantago-aquatica*	-	0.5	-	0.5	-	1	1	0.5	10	2	2	15	5	40	10	0.5	0.5	0.5	0.5	0.5
375	*Ambrosia artemisiifolia*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-
76	*Bidens cernua*	-	-	-	-	-	-	-	0.5	-	-	0.5	-	-	-	0.5	-	-	-	-	-
331	*Bidens frondosa*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	0.5	-
342	*Calamagrostis canadensis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
305	*Carex bebbii*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5
301	*Carex normalis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-
331	*Carex spp.*	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5	1	0.5	-	0.5	-
346	*Ceratophyllum demersum*	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-
224	*Circaea lutetiana*	-	-	-	-	-	-	-	0.5	-	-	0.5	-	-	-	0.5	-	-	-	-	-
6	*Cornus amomum*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-
90	*Cornus foemina*	10	0.5	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	*Cornus stolonifera*	-	0.5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
300	*Eleocharis obtusa*	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-
347	*Erigeron annuus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
27	*Eupatorium perfoliatum*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5	0.5	-	-	-
348	*Fragaria virginiana*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-
349	*Fraxinus nigra*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	*Fraxinus pennsylvanica*	1	0.5	1	0.5	0.5	-	-	-	0.5	-	0.5	-	-	-	-	0.5	-	-	-	-
302	*Galium palustre*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	0.5	0.5	0.5
09	*Glyceria striata*	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	0.5	0.5	0.5	0.5
111	*Impatiens capensis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	0.5	0.5	0.5
327	*Juncus canadensis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-
365	*Juncus tenuis*	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5	0.5	-	-	-	-	-
374	*Lemna minor*	25	85	60	40	40	40	15	5	2	10	30	25	5	30	10	80	25	50	90	80
373	*Lemna trisulca*	70	90	80	55	85	20	25	1	5	30	35	25	1	50	40	75	25	50	90	25
72	*Ludwegia palustris*	-	-	-	-	-	0.5	-	-	-	-	0.5	0.5	-	-	-	0.5	-	0.5	-	0.5
77	*Lycopus americanus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	0.5	0.5	0.5
74	*Lysimachia thyrsiflora*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-
372	*Mimulus ringens*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	0.5
374	*Pilea pumila*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	0.5
379	*Plantago rugelii*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	0.5	-	-
328	*Poa pratensis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-

TABLE C.2 (Cont.)

Field Number	Species Scientific Name	NNA					North ROW					South ROW					SNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
37	*Polygonum amphibium*	0.5	3	5	1	2	-	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-	0.5	0.5	-	0.5	0.5
353	*Polygonum pensylvanicum*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
337	*Potentilla norvegica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5
324	*Potamogeton pectinatus*	-	-	-	-	-	-	0.5	-	1	-	-	-	-	1	-	-	-	-	-	-
338	*Rorripa spp.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5
332	*Rumex spp.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-
71	*Salix petiolaris*	2	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304	*Sium suave*	0.5	-	-	0.5	-	0.5	0.5	0.5	-	0.5	0.5	0.5	-	-	2	0.5	0.5	0.5	0.5	0.5
51	*Solanum dulcamara*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	1	-	0.5
369	*Sparganium sp.*	2	-	-	0.5	0.5	-	20	2	0.5	40	10	20	20	10	25	0.5	0.5	-	0.5	0.5
339	*Taraxacum officinale*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-
343	*Trifolium repens*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-
112	*Typha x glauca*	5	0.5	0.5	0.5	-	50	40	3	0.5	30	40	20	15	20	25	1	0.5	-	0.5	3
33	*Ulmus americana*	1	0.5	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-
378	*Urtica dioica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	1
109	*Verbena hastata*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-
55	*Vicia cracca*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5	-	0.5
Shrub stratum																					
41	*Acer rubrum*	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	*Acer saccharinum*	2	5	5	3	1	-	-	-	5	-	-	-	-	-	-	10	5	-	2	2
5	*Cornus stolonifera*	-	2	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	*Fraxinus pennsylvanica*	5	2	5	2	3	-	2	-	2	-	-	-	-	-	-	1	-	-	-	1
106	*Salix bebbiana*	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	*Salix discolor*	5	5	20	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
306	*Salix fragilis*	-	5	20	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	*Salix petiolaris*	25	50	15	10	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
33	*Ulmus americana*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	0.5	1
Sapling stratum																					
42	*Acer saccharinum*	-	-	-	20	20	-	-	-	-	-	-	-	-	-	-	50	20	40	5	2
38	*Fraxinus pennsylvanica*	-	-	-	1	20	-	-	-	-	-	-	-	-	-	-	5	-	2	1	-
330	*Salix fragilis*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-	-	-
Tree stratum																					
42	*Acer saccharinum*	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	5	-	2	-	40
38	*Fraxinus pennsylvanica*	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
304	*Salix fragilis*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	50	-	20	10	40

TABLE C.3 Average Percent Coverage, Absolute Frequencies, and Distribution by Stratum for Plant Species in the Scrub-Shrub Community

Field Number	Species Scientific Name	Average Percent Coverage/ Absolute Frequency NNA	North ROW	South ROW	SNA
Standing water		98.4/5	100/5	94/5	95.2
HERB STRATUM					
	Plants found in both NAs and both sides of ROW				
1	*Alisma plantago-aquatica*	0.2/2	2.9/1	14.4/5	0.5/5
38	*Fraxinus pennsylvanica*	0.7/5	0.1/1	0.1/1	0.1/1
374	*Lemna minor*	50.0/5	14.4/5	20.0/5	65.0/5
373	*Lemna trisulca*	76.0/5	16.2/5	30.2/5	53.0/5
37	*Polygonum amphibium*	2.3/5	0.5/4	0.4/4	0.4/4
304	*Sium suave*	0.2/2	0.4/4	0.6/3	0.5/5
369	*Sparganium sp.*	0.6/3	12.5/4	17.0/5	0.4/4
112	*Typha × glauca*	1.3/4	24.7/5	24.0/5	1.0/4
	Plant found in both NAs and south side of ROW				
42	*Acer saccharinum*	0.6/4	0.0/0	0.5/2	0.1/1
	Plant found in NNA and south side of ROW				
33	*Ulmus americana*	0.3/2	0.0/0	0.1/1	0.0/0
	Plants found in NNA only				
5	*Cornus stolonifera*	0.5/3	0.0/0	0.0/0	0.0/0
71	*Salix petiolaris*	0.5/2	0.0/0	0.0/0	0.0/0
90	*Cornus foemina*	2.2/3	0.0/0	0.0/0	0.0/0
349	*Fraxinus nigra*	0.2/1	0.0/0	0.0/0	0.0/0
	Plant found in SNA and both sides of ROW				
72	*Ludwegia palustris*	0.0/0	0.1/1	0.2/2	0.3/3
	Plants found in SNA and south side of ROW				
41	*Acer rubrum*	0.0/0	0.0/0	0.1/1	0.1/1
331	*Bidens frondosa*	0.0/0	0.0/0	0.1/1	0.1/1
331	*Carex spp.*	0.0/0	0.0/0	0.2/2	0.4/3
27	*Eupatorium perfoliatum*	0.0/0	0.0/0	0.1/1	0.2/2
309	*Glyceria striata*	0.0/0	0.0/0	0.2/2	0.4/4
111	*Impatiens capensis*	0.0/0	0.0/0	0.1/1	0.4/4

TABLE C.3 (Cont.)

Field Number	Species Scientific Name	Average Percent Coverage/ Absolute Frequency			
		NNA	North ROW	South ROW	SNA
	Plants found in SNA only				
375	*Ambrosia artemisiifolia*	0.0/0	0.0/0	0.0/0	0.1/1
342	*Calamagrostis canadensis*	0.0/0	0.0/0	0.0/0	0.1/1
305	*Carex bebbii*	0.0/0	0.0/0	0.0/0	0.2/2
301	*Carex normalis*	0.0/0	0.0/0	0.0/0	0.2/2
6	*Cornus amomum*	0.0/0	0.0/0	0.0/0	0.2/2
347	*Erigeron annuus*	0.0/0	0.0/0	0.0/0	0.1/1
348	*Fragaria virginiana*	0.0/0	0.0/0	0.0/0	0.1/1
302	*Galium palustre*	0.0/0	0.0/0	0.0/0	0.5/5
327	*Juncus canadensis*	0.0/0	0.0/0	0.0/0	0.1/1
77	*Lycopus americanus*	0.0/0	0.0/0	0.0/0	0.5/5
74	*Lysimachia thyrsiflora*	0.0/0	0.0/0	0.0/0	0.2/2
372	*Mimulus ringens*	0.0/0	0.0/0	0.0/0	0.2/2
374	*Pilea pumila*	0.0/0	0.0/0	0.0/0	0.3/3
379	*Plantago rugelii*	0.0/0	0.0/0	0.0/0	0.3/3
353	*Polygonum pensylvanicum*	0.0/0	0.0/0	0.0/0	0.1/1
337	*Potentilla norvegica*	0.0/0	0.0/0	0.0/0	0.2/2
338	*Rorripa sp.*	0.0/0	0.0/0	0.0/0	0.2/2
332	*Rumex sp.*	0.0/0	0.0/0	0.0/0	0.1/1
51	*Solanum dulcamara*	0.0/0	0.0/0	0.0/0	0.5/4
339	*Taraxacum officinale*	0.0/0	0.0/0	0.0/0	0.1/1
343	*Trifolium repens*	0.0/0	0.0/0	0.0/0	0.2/2
378	*Urtica dioica*	0.0/0	0.0/0	0.0/0	0.4/3
109	*Verbena hastata*	0.0/0	0.0/0	0.0/0	0.2/2
55	*Vicia cracca*	0.0/0	0.0/0	0.0/0	0.3/3
	Plants found in both sides of ROW				
76	*Bidens cernua*	0.0/0	0.1/0	0.2/2	0.0/0
224	*Circaea lutetiana*	0.0/0	0.1/1	0.2/2	0.0/0
324	*Potamogeton pectinatus*	0.0/0	0.3/2	0.2/1	0.0/0
	Plant found in north side of ROW only				
346	*Ceratophyllum demersum*	0.0/0	0.1/1	0.0/0	0.0/0
	Plants found in south side of ROW only				
300	*Eleocharis obtusa*	0.0/0	0.0/0	0.1/1	0.0/0
365	*Juncus tenuis*	0.0/0	0.0/0	0.3/3	0.0/0
328	*Poa pratensis*	0.0/0	0.0/0	0.1/1	0.0/0

TABLE C.3 (Cont.)

Field Number	Species Scientific Name	Average Percent Coverage/ Absolute Frequency NNA	North ROW	South ROW	SNA
SHRUB STRATUM					
	Plants found in both NAs and north side of ROW				
42	*Acer saccharinum*	3.2/5	1.0/1	0.0/0	3.8/4
38	*Fraxinus pennsylvanica*	3.4/5	0.8/2	0.0/0	0.4/2
	Plant found in both NAs only				
33	*Ulmus americana*	0.1/1	0.0/0	0.0/0	0.5/3
	Plant found in NNA and north side of ROW				
71	*Salix petiolaris*	20.0/4	0.4/1	0.0/0	0.0/0
	Plants found in NNA only				
41	*Acer rubrum*	0.2/1	0.0/0	0.0/0	0.0/0
5	*Cornus stolonifera*	1.0/2	0.0/0	0.0/0	0.0/0
106	*Salix bebbiana*	0.6/2	0.0/0	0.0/0	0.0/0
39	*Salix discolor*	6.6/4	0.0/0	0.0/0	0.0/0
306	*Salix fragilis*	5.1/3	0.0/0	0.0/0	0.0/0
SAPLING STRATUM					
	Plants found in both NAs				
42	*Acer saccharinum*	8.0/2	0.0/0	0.0/0	23.4/5
38	*Fraxinus pennsylvanica*	4.2/2	0.0/0	0.0/0	1.6/3
	Plant found in SNA only				
330	*Salix fragilis*	0.0/0	0.0/0	0.0/0	2.0/1
TREE STRATUM					
	Plants found in both NAs				
42	*Acer saccharinum*	0.4/2	0.0/0	0.0/0	9.4/3
304	*Salix fragilis*	0.2/1	0.0/0	0.0/0	24.0/4
	Plant found in NNA only				
38	*Fraxinus pennsylvanica*	0.2/1	0.0/0	0.0/0	0.0/0

TABLE C.4 Plant Species List — Emergent Marsh Community

Field Number	Species Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
42	*Acer saccharinum* L.	Silver maple	FACW	NT
351	*Acorus calamus* L.	Sweetflag	OBL	PIEF
361	*Agrostis stolonifera* L.	Spreading bentgrass	FACW	PNG
1	*Alisma plantago-aquatica* L.	Broad-leaf water plantain	OBL	PNEF
23	*Asclepias incarnata* L.	Swamp milkweed	OBL	PNF
76	*Bidens cernua* L.	Nodding beggar-ticks	OBL	AIF
342	*Calamagrostis canadensis* (Michx.) Beauv.	Blue-joint reedgrass	FACW+	PNG
355	*Calystegia sepium* (L.) R.Br.	Hedge bindweed	FAC-	PIF
17	*Carex bebbii* (L.H. Bailey) Olney ex Fernald	Bebb's sedge	OBL	PNGL
367	*Carex comosa* Boott	Bearded sedge	OBL	PNEGL
36	*Carex crinita* Lam.	Fringed sedge	OBL	PNEGL
82	*Carex flava* L.	Yellow sedge	OBL	PNGL
366	*Carex hystericina* Muhl. Ex Willd.	Porpucine sedge	OBL	PNEGL
350	*Carex lasiocarpa* Ehrh.	Woolly-fruit sedge	OBL	PNEGL
12	*Carex lupulina* Muhl. ex Willd.	Hop sedge	OBL	PNEGL
66	*Carex normalis* Mackenz.	Larger straw sedge	FACU	PNGL
91	*Carex pallescens* L.	Pale sedge	UPL	PNGL
67	*Carex retrorsa* Schweinitz	Retrorse sedge	FACW+	PNGL
85	*Carex scoparia* Schkuhr ex Willd.	Pointed broom sedge	FACW	PNGL
331	*Carex* sp.			
75	*Carex suberecta* (Olney) Britton	Prairie straw sedge	OBL	PNGL
364	*Carex tenera* Dewey	Sparce-flower sedge	OBL	PNGL
19	*Carex vulpinoidea* Michx.	Fox sedge	OBL	PNEGL
7	*Carex x stipata* Muhl. ex Willd.	Stalk-grain sedge	OBL	PNGL
218	*Cicuta bulbifera* L.	Bulblet-bearing water-hemlock	OBL	PNF
53	*Cicuta maculata* L.	Spotted water-hemlock	OBL	PNF
6	*Cornus amomum* Mill.	Silky dogwood	FACW	NS
90	*Cornus foemina* Mill.	Stiff dogwood	FAC	NS
5	*Cornus stolonifera* Michx.	Red-osier dogwood	FACW+	NS
370	*Dryopteris spinulosa* (O.F. Muell.) Watt	Spinulose woodfern	FAC+	F3
333	*Eleocharis* sp.			
102	*Epilobium hirsutum* L.	Great-hairy willow-herb	FACW	PIF
20	*Equisetum arvense* L.	Field horsetail	FAC	PNH2
62	*Equisetum fluviatile* L.	Water horsetail	OBL	PNH2
29	*Eupatoriadelphus maculatus* (L.) R.M. King & H. Rob.	Spotted Joe-pye-weed	FACW	PNF
27	*Eupatorium perfoliatum* L.	Common boneset	FACW+	PNF
43	*Fraxinus pennsylvanica* Marshall	Green ash	FACW	NT
61	*Galium palustre* L.	Marsh bedstraw	OBL	PNF
325	*Glyceria striata* (Lam.) A. Hitchc.	Fowl manna grass	OBL	PNEG

TABLE C.4 (Cont.)

Field Number	Species Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life-Form/ Origin[b]
111	*Impatiens capensis* Meerb.	Spotted touch-me-not	FACW	A NF
57	*Iris versicolor* L.	Blueflag	OBL	PNF
84	*Juncus bufonius* L.	Toad rush	FACW	ANGL
371	*Juncus canadensis* J.Gay	Canada rush	OBL	PNGL
365	*Juncus tenuis* Willd.	Slender rush	FAC-	PNGL
380	*Leersia oryzoides* (L.) Swartz	Rice cutgrass	OBL	PNG
333	*Lemna minor* L.	Lesser duckweed	OBL	PN/F
373	*Lemna trisulca* L.	Star duckweed	OBL	PN/F
98	*Liparis loeselii* (L.) L.C. Rich.	Fen orchid	FACW	PNF
335	*Lolium perenne* L.	Perennial ryegrass	FACU-	PIG
72	*Ludwegia palustris* (L.) Elliott	Marsh seedbox	OBL	PNEF
77	*Lycopus americanus* Muhl. ex W. Barton	American bugleweed	OBL	PNF
93	*Lycopus uniflorus* Michx.	Northern bugleweed	OBL	PNF
26	*Lysimachia nummularia* L.	Creeping jennie	OBL	PIF
74	*Lysimachia thyrsiflora* L.	Tufted loosestrife	OBL	PIF
101	*Mentha* spp.			
97	*Nasturtium officinale* R. Br. in W.T. Ait.	True water-cress	OBL	PIZEF
8	*Onoclea sensibilis* L.	Sensitive fern	FACW	PNEF3
363	*Oxalis europaea* Jordon	Upright yellow woodsorrel	UPL	PIF
362	*Phleum pratensis* L.	Timothy	FACU	PIG
368	*Poa palustris* L.	Fowl bluegrass	FACW	PNG
80	*Poa pratensis* L.	Kentucky bluegrass	FACU	PNG
353	*Polygonum pensylvanicum* L.	Pennsylvania smartweed	FACW	ANEF
59	*Ranunculus acris* L.	Tall butter-cup	FAC+	PIF
354	*Ranunculus sceleratus* L.	Celery-leaf butter-cup	OBL	APNEF
32	*Rhamnus cathartica* L.	Common buckthorn	UPL	IS
332	*Rumex* sp.			
9	*Salix discolor* Muhl.	Pussy willow	FACW	NS
2	*Salix petiolaris* Pursh	Meadow willow	OBL	NS
10	*Scirpus atrovirens* Willd.	Green bulrush	OBL	PNEGL
96	*Scirpus validus* Vahl	Soft-stem bulrush	OBL	PNEGL
51	*Solanum dulcamara* L.	Climbing nightshade	FAC-	PIF
86	*Solidago* narrow-leaved			
87	*Solidago* wide-leaved			
0	*Toxicodendron radicans* (L.) Kuntze	Poison ivy	FAC	NWVS
343	*Trifolium repens* L.	White clover	FACU-	PIF
112	*Typha* × *glauca* Godr.	Blue cattail	OBL	PNEF
33	*Ulmus americana* L.	American elm	FACW-	NT
81	*Viburnum lentago* L.	Nannyberry	FAC	NTS
55	*Vicia cracca* L.	Cow-vetch	UPL	NIF

TABLE C.4 (Cont.)

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

[b] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins.)

TABLE C.5 Percent Areal Coverage Estimates by Stratum for Plant Species in the Emergent Marsh Community

Field Number	Species Scientific Name	ENA					North ROW					South ROW					WNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
Exposed mineral soil		-	-	-	-	-	20	15	3	1	-	10	1	5	1	-	-	-	-	-	-
Standing water		5	15	5	35	55	10	15	50	50	50	30	40	20	50	80	2	15	5	1	2
Herb stratum																					
42	*Acer saccharinum*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-
351	*Acorus calamus*	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-
361	*Agrostis stolonifera*	-	-	-	-	-	1	1	-	-	-	2	1	-	-	-	1	-	0.5	-	-
1	*Alisma plantago-aquatica*	-	0.5	-	-	-	1	1	5	12	2	10	5	5	5	1	-	-	-	-	-
23	*Asclepias incarnata*	0.5	0.5	-	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	0.5	0.5
76	*Bidens cernua*	-	-	-	-	-	0.5	0.5	-	1	0.5	-	0.5	0.5	0.5	-	-	-	-	-	-
342	*Calamagrostis canadensis*	-	-	0.5	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-
355	*Calystegia sepium*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5
17	*Carex bebbii*	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	1	-	1
367	*Carex comosa*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
36	*Carex crinita*	0.5	1	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	-
82	*Carex flava*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
366	*Carex hystericina*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
350	*Carex lasiocarpa*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	*Carex lupulina*	-	3	0.5	-	-	-	-	-	-	-	-	-	-	-	-	1	0.5	2	1	0.5
66	*Carex normalis*	0.5	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0.5	-	-
91	*Carex pallescens*	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
67	*Carex retrorsa*	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-
85	*Carex scoparia*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	1	0.5	-
331	*Carex spp.*	-	-	-	-	-	1	1	2	1	3	1	2	-	0.5	1	-	-	-	-	-
75	*Carex suberecta*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5
364	*Carex tenera*	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
19	*Carex vulpinoidea*	-	-	1	-	-	-	0.5	-	-	-	-	-	-	-	-	0.5	-	-	-	-
7	*Carex × stipata*	-	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	1	0.5
218	*Cicuta bulbifera*	-	-	-	-	0.5	-	0.5	-	0.5	-	-	-	-	-	-	-	0.5	-	0.5	-
53	*Cicuta maculata*	10	20	2	0.5	0.5	0.5	0.5	-	0.5	-	0.5	-	-	0.5	-	15	15	20	2	0.5
6	*Cornus amomum*	-	2	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	*Cornus stolonifera*	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-
370	*Dryopteris spinulosa*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
333	*Eleocharis sp.*	-	-	-	-	-	2	1	0.5	0.5	5	1	-	0.5	-	0.5	0.5	-	-	-	-
102	*Epilobium hirsutum*	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5
20	*Equisetum arvense*	15	10	20	-	-	1	0.5	4	-	-	-	-	5	-	-	3	10	-	-	-
62	*Equisetum fluviatile*	-	-	0.5	85	60	-	-	1	15	4	-	-	-	15	5	0.5	-	10	60	75
29	*Eupatoriadelphus maculatus*	10	5	10	15	5	1	-	-	0.5	1	-	0.5	-	-	0.5	25	10	20	15	25

TABLE C.5 (Cont.)

Field Number	Species Scientific Name	ENA					North ROW					South ROW					WNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
27	*Eupatorium perfoliatum*	-	-	-	-	0.5	-	1	-	-	0.5	-	-	0.5	-	-	-	0.5	-	0.5	0.5
43	*Fraxinus pennsylvanica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
61	*Galium palustre*	10	5	5	10	3	1	0.5	-	0.5	0.5	0.5	0.5	1	0.5	0.5	5	20	5	2	20
325	*Glyceria striata*	-	-	-	-	-	-	-	-	-	0.5	-	-	-	0.5	-	-	-	0.5	-	-
111	*Impatiens capensis*	10	10	20	30	30	1	-	0.5	0.5	-	-	-	1	0.5	0.5	20	20	25	60	60
57	*Iris versicolor*	1	5	0.5	0.5	1	-	0.5	-	-	-	-	-	0.5	-	-	-	2	1	1	0.5
84	*Juncus bufonius*	-	-	-	-	-	2	1	0.5	0.5	1	1	3	1	0.5	0.5	-	-	-	-	-
371	*Juncus canadensis*	-	-	-	-	-	-	0.5	0.5	0.5	0.5	0.5	1	-	-	0.5	-	-	-	-	-
365	*Juncus tenuis*	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-	-	-	-
380	*Leersia oryzoides*	-	-	1	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	10	20	-
46	*Lemna minor*	-	-	-	0.5	-	-	-	0.5	-	0.5	-	-	0.5	0.5	0.5	-	-	-	-	-
373	*Lemna trisulca*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-
98	*Liparis loeselii*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
335	*Lolium perenne*	-	-	-	-	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-
72	*Ludwegia palustris*	-	-	-	-	-	1	0.5	0.5	0.5	1	1	0.5	0.5	0.5	2	-	-	-	-	-
77	*Lycopus americanus*	-	-	0.5	-	0.5	0.5	-	-	-	-	1	-	-	-	-	0.5	0.5	-	1	0.5
93	*Lycopus uniflorus*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
26	*Lysimachia nummularia*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
74	*Lysimachia thyrsiflora*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
101	*Mentha spp.*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
97	*Nasturtium officinale*	10	-	10	0.5	-	-	0.5	0.5	-	-	-	0.5	0.5	-	-	-	-	-	-	-
8	*Onoclea sensibilis*	-	15	50	-	2	-	-	2	-	-	-	-	1	-	-	-	0.5	15	-	-
363	*Oxalis europaea*	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
362	*Phleum pratensis*	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
368	*Poa palustris*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5
80	*Poa pratensis*	-	-	0.5	-	-	-	0.5	-	-	-	0.5	-	0.5	-	-	10	0.5	-	-	-
353	*Polygonum pensylvanicum*	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-	-	0.5	-	-	-	-	-
59	*Ranunculus acris*	0.5	-	-	-	-	-	-	-	-	-	-	0.5	0.5	-	-	-	-	0.5	-	-
354	*Ranunculus sceleratus*	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	0.5	-	-	-	-	-
32	*Rhamnus cathartica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
332	*Rumex sp.*	-	-	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-	0.5
2	*Salix petiolaris*	-	-	-	-	-	0.5	-	-	-	-	1	-	0.5	-	-	-	-	-	-	-
10	*Scirpus atrovirens*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	0.5	5	1
96	*Scirpus validus*	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
51	*Solanum dulcamara*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
86	*Solidago (narrow leaves)*	0.5	-	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	0.5	1	0.5	-	0.5
87	*Solidago (wide leaves)*	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	0.5	-	0.5

TABLE C.5 (Cont.)

Field Number	Species Scientific Name	ENA					North ROW					South ROW					WNA				
		T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5
0	*Toxicodendron radicans*	-	-	-	-	-	-	0.5	-	-	-	-	-	0.5	-	-	-	-	-	-	-
343	*Trifolium repens*	-	-	-	-	-	0.5	0.5	-	-	0.5	-	0.5	0.5	0.5	-	-	-	-	-	-
112	*Typha × glauca*	35	40	80	95	95	5	1	3	10	10	1	1	2	10	5	95	75	50	75	90
33	*Ulmus americana*	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
55	*Vicia cracca*	10	1	-	-	-	0.5	-	-	-	-	-	-	-	-	-	10	-	-	0.5	-
Shrub stratum																					
6	*Cornus amomum*	2	60	30	-	2	-	-	-	-	-	-	-	-	-	-	-	20	70	0.5	-
90	*Cornus foemina*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.5	-	-
5	*Cornus stolonifera*	10	10	30	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	10	60	10
38	*Fraxinus pennsylvanica*	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0.5	-	-
32	*Rhamnus cathartica*	-	60	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
39	*Salix discolor*	-	30	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
71	*Salix petiolaris*	-	20	5	4	2	-	-	-	-	-	-	-	-	-	-	5	50	5	1	-
81	*Viburnum lentago*	-	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

TABLE C.6 Average Percent Coverage, Absolute Frequencies, and Distribution by Stratum for Plant Species in the Emergent Marsh Community

Field Number	Species Scientific Name	Average Percent Coverage/ Absolute Frequency ENA	East ROW	West ROW	WNA
Standing Water		23/5	35/5	44/5	5/5
Soil		0.0/0	7.8/4	4.25/5	0.0/0
HERB STRATUM					
	Plants found in both NAs and both sides of ROW				
53	*Cicuta maculata*	6.6/5	0.3/3	0.2/2	10.5/5
20	*Equisetum arvense*	9.0/3	1.1/3	1.0/1	2.6/2
62	*Equisetum fluviatile*	29.1/3	4.0/3	4.0/2	29.1/4
29	*Eupatoriadelphus maculatus*	9.0/5	0.5/3	0.2/2	19.0/5
27	*Eupatorium perfoliatum*	0.1/1	0.3/2	0.1/1	0.3/3
61	*Galium palustre*	6.6/5	0.5/4	0.6/5	10.4/5
111	*Impatiens capensis*	20.0/5	0.4/3	0.4/3	37.0/5
57	*Iris versicolor*	1.6/5	0.1/1	0.1/1	0.9/4
77	*Lycopus americanus*	0.2/2	0.1/1	0.2/1	0.5/4
8	*Onoclea sensibilis*	13.4/3	0.4/1	0.2/1	3.1/2
80	*Poa pratensis*	0.1/1	0.1/1	0.2/2	2.1/2
112	*Typha × glauca*	69.0/5	5.8/5	3.8/5	77.0/5
	Plants found in both NAs and east side of ROW				
342	*Calamagrostis canadensis*	0.1/1	0.1/1	0.0/0	0.1/1
19	*Carex vulpinoidea*	0.2/1	0.1/1	0.0/0	0.1/1
218	*Cicuta bulbifera*	0.1/1	0.2/2	0.0/0	0.2/2
55	*Vicia cracca*	2.2/2	0.1/1	0.0/0	2.1/2
	Plant found in both NAs and west side of ROW				
59	*Ranunculus acris*	0.1/1	0.0/0	0.2/2	0.1/1
	Plants found in both NAs only				
42	*Acer saccharinum*	0.1/1	0.0/0	0.0/0	0.1/1
23	*Asclepias incarnata*	0.4/4	0.0/0	0.0/0	0.4/4
355	*Calystegia sepium*	0.1/1	0.0/0	0.0/0	0.1/1
17	*Carex bebbii*	0.2/1	0.0/0	0.0/0	0.5/3
367	*Carex comosa*	0.1/1	0.0/0	0.0/0	0.4/2
36	*Carex crinita*	0.4/3	0.0/0	0.0/0	0.6/2
12	*Carex lupulina*	0.7/2	0.0/0	0.0/0	0.8/4
66	*Carex normalis*	0.3/2	0.0/0	0.0/0	0.5/2
67	*Carex retrorsa*	0.1/1	0.0/0	0.0/0	0.2/2
85	*Carex scoparia*	0.1/1	0.0/0	0.0/0	0.4/3
7	*Carex × stipata*	0.2/2	0.0/0	0.0/0	0.4/3

TABLE C.6 (Cont.)

Field Number	Species Scientific Name	Average Percent Coverage/ Absolute Frequency			
		ENA	East ROW	West ROW	WNA
5	*Cornus stolonifera*	0.3/3	0.0/0	0.0/0	0.1/1
102	*Epilobium hirsutum*	0.1/1	0.0/0	0.0/0	0.1/1
380	*Leersia oryzoides*	0.3/2	0.0/0	0.0/0	6.0/2
26	*Lysimachia nummularia*	0.1/1	0.0/0	0.0/0	0.1/1
368	*Poa palustris*	0.1/1	0.0/0	0.0/0	0.2/2
332	*Rumex sp.*	0.1/1	0.0/0	0.0/0	0.2/2
10	*Scirpus atrovirens*	0.1/1	0.0/0	0.0/0	1.4/4
96	*Scirpus validus*	0.4/1	0.0/0	0.0/0	0.2/1
86	*Solidago narrow leaved*	0.3/3	0.0/0	0.0/0	0.5/4
87	*Solidago wide leaved*	0.3/3	0.0/0	0.0/0	0.3/3
	Plants found in ENA and both sides of ROW				
1	*Alisma plantago-aquatica*	0.1/1	4.2/5	5.2/5	0.0/0
46	*Lemna minor*	0.1/1	0.2/2	0.3/3	0.0/0
97	*Nasturtium officinale*	4.1/3	0.2/2	0.2/2	0.0/0
	Plants found in ENA only				
82	*Carex flava*	0.1/1	0.0/0	0.0/0	0.0/0
366	*Carex hystericina*	0.1/1	0.0/0	0.0/0	0.0/0
350	*Carex lasiocarpa*	0.1/1	0.0/0	0.0/0	0.0/0
91	*Carex pallescens*	0.1/1	0.0/0	0.0/0	0.0/0
364	*Carex tenera*	0.1/1	0.0/0	0.0/0	0.0/0
6	*Cornus amomum*	0.5/2	0.0/0	0.0/0	0.0/0
363	*Oxalis europaea*	0.1/1	0.0/0	0.0/0	0.0/0
362	*Phleum pratensis*	0.1/1	0.0/0	0.0/0	0.0/0
33	*Ulmus americana*	0.1/1	0.0/0	0.0/0	0.0/0
	Plants found in WNA and both sides of ROW				
361	*Agrostis stolonifera*	0.0/0	0.4/2	0.6/2	0.3/2
333	*Eleocharis spp.*	0.0/0	1.8/5	0.4/3	0.1/1
325	*Glyceria striata*	0.0/0	0.1/1	0.1/1	0.1/1
	Plants found in WNA only				
75	*Carex suberecta*	0.0/0	0.0/0	0.0/0	0.2/2
370	*Dryopteris spinulosa*	0.0/0	0.0/0	0.0/0	0.1/1
43	*Fraxinus pennsylvanica*	0.0/0	0.0/0	0.0/0	0.1/1
51	*Solanum dulcamara*	0.0/0	0.0/0	0.0/0	0.1/1

TABLE C.6 (Cont.)

Field Number	Species Scientific Name	Average Percent Coverage/ Absolute Frequency			
		ENA	East ROW	West ROW	WNA
	Plants found in both sides of ROW				
76	*Bidens cernua*	0.0/0	0.5/4	0.3/3	0.0/0
331	*Carex spp.*	0.0/0	1.6/5	0.9/4	0.0/0
84	*Juncus bufonius*	0.0/0	1.0/5	1.2/5	0.0/0
371	*Juncus canadensis*	0.0/0	0.4/4	0.4/3	0.0/0
72	*Ludwegia palustris*	0.0/0	0.7/5	0.9/5	0.0/0
353	*Polygonum pensylvanicum*	0.0/0	0.2/2	0.1/1	0.0/0
2	*Salix petiolaris*	0.0/0	0.1/1	0.3/2	0.0/0
0	*Toxicodendron radicans*	0.0/0	0.1/1	0.1/1	0.0/0
343	*Trifolium repens*	0.0/0	0.3/3	0.3/3	0.0/0
	Plants found in east side of ROW only				
351	*Acorus calamus*	0.0/0	0.1/1	0.0/0	0.0/0
335	*Lolium perenne*	0.0/0	0.1/1	0.0/0	0.0/0
	Plants found in west side of ROW only				
365	*Juncus tenuis*	0.0/0	0.0/0	0.2/2	0.0/0
373	*Lemna trisulca*	0.0/0	0.0/0	0.1/1	0.0/0
354	*Ranunculus sceleratus*	0.0/0	0.0/0	0.2/2	0.0/0
	Plants found within site but not within plots				
98	*Liparis loeselii*	0.0/0	0.0/0	0.0/0	0.0/0
93	*Lycopus uniflorus*	0.0/0	0.0/0	0.0/0	0.0/0
74	*Lysimachia thyrsiflora*	0.0/0	0.0/0	0.0/0	0.0/0
101	*Mentha sp.*	0.0/0	0.0/0	0.0/0	0.0/0
SHRUB STRATUM					
	Plants found in both NAs				
6	*Cornus amomum*	18.8/4	0.0/0	0.0/0	18.1/3
5	*Cornus stolonifera*	10.1/4	0.0/0	0.0/0	16.0/3
71	*Salix petiolaris*	6.2/4	0.0/0	0.0/0	12.2/4
	Plants found in ENA only				
32	*Rhamnus cathartica*	12.1/2	0.0/0	0.0/0	0.0/0
39	*Salix discolor*	6.2/2	0.0/0	0.0/0	0.0/0
81	*Viburnum lentago*	0.1/1	0.0/0	0.0/0	0.0/0
	Plants found in WNA only				
90	*Cornus foemina*	0.0/0	0.0/0	0.0/0	0.1/1
38	*Fraxinus pennsylvanica*	0.0/0	0.0/0	0.0/0	0.3/2

TABLE C.7 Plant Species List — Forested Wetland Community

Field Number	Species Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life Form and Origin[b]
42	*Acer saccharinum* L.	Silver maple	FACW	NT
351	*Acorus calamus* L.	Sweetflag	OBL	PIEF
1	*Alisma plantago-aquatica* L.	Broad-leaf water plantain	OBL	PNEF
334	*Ambrosia artemisiifolia* L.	Annual ragweed	FACU	A NF
374	*Arisaema triphyllum* (L.) Schott	Swamp jack-in-the-pulpit	FACW-	PNF
392	*Aster* spp.			
113	*Athyrium filix-femina* (L.) Roth	Subarctic lady fern	FAC	PNF3
76	*Bidens cernua* L.	Nodding beggar-ticks	OBL	AIF
370	*Bidens frondosa* L.	Devil's beggar-ticks	FACW	A NF
377	*Caltha palustris* L.	Common marsh-marigold	OBL	PNF
315	*Carex bebbii* (L.H. Bailey) Olney ex Fernald	Bebb's sedge	OBL	PNGL
314	*Carex bromoides* Schkuhr	Broom-like sedge	FACW	PNGL
323	*Carex crinita* Lam.	Fringed sedge	OBL	PNEGL
321	*Carex flava* L.	Yellow sedge	OBL	PNGL
318	*Carex lupulina* Muhl. ex Willd.	Hop sedge	OBL	PNEGL
316	*Carex normalis* Mackenz.	Larger straw sedge	FACU	PNGL
320	*Carex* sp.			
352	*Cicuta bulbifera* L.	Bublet-bearing water-hemlock	OBL	PNF
53	*Cicuta maculata* L.	Spotted water-hemlock	OBL	PNF
313	*Cinna arundinacea* L.	Stout wood-reedgrass	FACW+	PNG
224	*Circaea lutetiana* L.	Southern broad-leaf enchanter's nightshade	FACU	PNF
6	*Cornus amomum* Mill	Silky dogwood	FACW	NS
370	*Dryopteris spinulosa* (O.F. Muell.) Watt	Spinulose woodfern	FAC+	F3
300	*Eleocharis obtusa* (Willd.) J.A. Schultes	Blunt spikerush	OBL	APNEGL
20	*Equisetum arvense* L.	Field horsetail	FAC	PNH2
38	*Fraxinus pennysIvanica* Marshall	Green ash	FACW	NT
319	*Galium plaustre* L.	Marsh bedstraw	OBL	PNF
216	*Geum canadense* Jacq.	White avens	FACU	PNF
312	*Glyceria striata* (Lam.) A. Hitchc.	Fowl manna grass	OBL	PNEG
111	*Impatiens capensis* Meerb.	Spotted touch-me-not	FACW	A NF
365	*Juncus tenuis* Willd.	Slender rush	FAC-	PNGL
374	*Lemna minor* L.	Lesser duckweed	OBL	PN/F
373	*Lemna trisulca* L.	Star duckweed	OBL	PN/F
393	*Lilium philadelphicum* L.	Wood lily	FACU+	PNF
376	*Lolium perenne* L.	Perennial ryegrass	FACU-	PIG
44	*Lonicera tatarica* L.	Tartarian honeysuckle	FACU	IS
72	*Ludwegia palustris* (L.) Elliot	Marsh seedbox	OBL	PNEF

TABLE C.7 (Cont.)

Field Number	Species Scientific Name and Authority	Common Name	Region 1 Wetland Indicator Category[a]	Life Form and Origin[b]
72	*Lycopus americanus* Muhl. ex W. Barton	American bugleweed	OBL	PNF
383	*Medicago lupulina* L.	Black medic	UPL	AIF
8	*Onoclea sensibilis* L.	Sensitive fern	FACW	PNEF3
237	*Parthenocisscus quinquefolia* (L.) Planch.	Virginia creeper	FACU	NWV
374	*Pilea pumila* (L.) Gray	Canada clearweed	FACW	A NF
322	*Poa palustris* L.	Fowl bluegrass	FACW	PNG
389	*Quercus bicolor* Willd.	Swamp white oak	FACW+	NT
32	*Rhamnus cathartica* L.	Common buckthorn	UPL	IS
110	*Rhamnus frangula* L.	Glossy buckthorn	FAC	IS
34	*Ribes americanum* Mill.	Wild black currant	FACW	NS
310	*Ribes cyanosbata* L.	Prickly gooseberry	UPL	NS
387	*Rosa palustris* Marshall	Swamp rose	OBL	NS
117	*Rubus pubescens* Raf.	Dwarf blackberry	FACW	PNF
388	*Rubus strigosus* Michx.	Red raspberry	NI	PNS
330	*Salix fragilis* L.	Crack willow	FAC+	IT
391	*Sambucus canadensis* L.	American elder	FACW-	NS
385	*Solanum dulcamara* L.	Climbing nightshade	FAC-	PIF
390	*Sorbus americana* Marshall	American mountain-ash	FACU	NT
369	*Sparganium* spp.			
386	*Thalictrum pubescens* Pursh.	Tall meadow-rue	FACW+	PNF
0	*Toxicodendron radicans* (L.) Knutze	Poison ivy	FAC	NWVS
343	*Trifolium repens* L.	White clover	FACU-	PIF
84	*Typha latifolia* L.	Broad-leaf cattail	OBL	PNEF
12	*Typha* × *glauca* Godr.	Blue cattail	OBL	PNEF
33	*Ulmus americana* L.	American elm	FACW-	NT
99	*Viburnum dentatum* L.	Arrow-wood	FAC	NTS
91	*Viburnum recognitum* Fernald.	Northern arrow-wood	FACW-	NS
311	*Vitis riparia* Michx.	River-bank grape	FACW	NWV

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

[b] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2 for definitions of life-forms and origins.)

TABLE C.8 Percent Areal Coverage Estimates by Stratum for Plant Species in the Forested Wetland Community

Field Number	Species Scientific Name	Average Percent Coverage NNA	North ROW	South ROW	SNA
Standing water		-	75	2	-
Exposed mineral soil		-	10	25	-
Exposed embedded logs		-	-	15	-
HERB STRATUM					
	Plants found in both NAs and south side of ROW				
42	*Acer saccharinum*	0.5	-	0.5	0.5
76	*Bidens cernua*	0.5	-	2	1
370	*Bidens frondosa*	0.5	-	0.5	0.5
312	*Glyceria striata*	1	-	0.5	10
111	*Impatiens capensis*	2	-	3	5
33	*Ulmus americana*	1	-	0.5	0.5
	Plants found in both NAs				
318	*Carex lupulina*	0.5	-	-	0.5
320	*Carex spp.*	0.5	-	-	0.5
370	*Dryopteris spinulosa*	0.5	-	-	0.5
38	*Fraxinus pennyslvanica*	0.5	-	-	3
44	*Lonicera tatarica*	0.5	-	-	0.5
8	*Onoclea sensibilis*	25	-	-	0.5
237	*Parthenocisscus quinquefolia*	3	-	-	0.5
32	*Rhamnus cathartica*	10	-	-	3
110	*Rhamnus frangula*	0.5	-	-	0.5
34	*Ribes americanum*	1	-	-	0.5
117	*Rubus pubescens*	1	-	-	3
390	*Sorbus americana*	0.5	-	-	0.5
0	*Toxicodendron radicans*	0.5	-	-	4
384	*Typha latifolia*	1	-	-	1
91	*Viburnum recognitum*	1	-	-	0.5
	Plants found in NNA and south side of ROW				
1	*Alisma plantago-aquatica*	0.5	-	0.5	-
72	*Ludwegia palustris*	0.5	-	0.5	-
	Plants found in NNA only				
113	*Athyrium filix-femina*	0.5	-	-	-
365	*Jungus tenuis*	0.5	-	-	-
393	*Lilium philadelphicum*	0.5	-	-	-
72	*Lycopus americanus*	0.5	-	-	-
310	*Ribes cyanosbata*	0.5	-	-	-

TABLE C.8 (Cont.)

Field Number	Species Scientific Name	Average Percent Coverage NNA	North ROW	South ROW	SNA
387	*Rosa palustris*	0.5	-	-	-
369	*Sparganium sp.*	2	-	-	-
99	*Viburnum dentatum*	0.5	-	-	-
311	*Vitis riparia*	0.5	-	-	-
	Plants found in SNA and north side of ROW				
351	*Acorus calamus*	-	0.5	-	0.5
112	*Typha x glauca*	-	20	-	0.5
	Plants found in SNA and south side of ROW				
352	*Cicuta bulbifera*	-	-	0.5	0.5
6	*Cornus amomum*	-	-	0.5	0.5
319	*Galium plaustre*	-	-	0.5	0.5
376	*Lolium perenne*	-	-	0.5	4
330	*Salix fragilis*	-	-	0.5	0.5
	Plants found in SNA only				
334	*Arisaema triphyllum*	-	-	-	0.5
392	*Aster spp.*	-	-	-	1
77	*Caltha palustris*	-	-	-	0.5
15	*Carex bebbii*	-	-	-	0.5
314	*Carex bromoides*	-	-	-	0.5
323	*Carex crinita*	-	-	-	0.5
321	*Carex flava*	-	-	-	0.5
316	*Carex normalis*	-	-	-	1
53	*Cicuta maculata*	-	-	-	0.5
313	*Cinna arundinacea*	-	-	-	0.5
224	*Circaea lutetiana*	-	-	-	0.5
20	*Equisetum arvense*	-	-	-	0.5
216	*Geum canadense*	-	-	-	0.5
374	*Pilea pumila*	-	-	-	1
322	*Poa palustris*	-	-	-	0.5
389	*Quercus bicolor*	-	-	-	0.5
388	*Rubus strigosus*	-	-	-	1
391	*Sambucus canadensis*	-	-	-	0.5
385	*Solanum dulcamara*	-	-	-	0.5
386	*Thalictrum pubescens*	-	-	-	0.5

TABLE C.8 (Cont.)

Field Number	Species Scientific Name	Average Percent Coverage NNA	North ROW	South ROW	SNA
	Plants found on north side of ROW only				
374	*Lemna minor*	-	0.5	-	-
373	*Lemna trisulca*	-	0.5	-	-
	Plants found on south side of ROW only				
375	*Ambrosia artemisiifolia*	-	-	0.5	-
300	*Eleocharis obtusa*	-	-	0.5	-
383	*Medicago lupulina*	-	-	0.5	-
343	*Trifolium repens*	-	-	0.5	-
SHRUB STRATUM					
	Plants found in both NAs				
38	*Fraxinus pennyslvanica*	0.5	-	-	2
32	*Rhamnus cathartica*	20	-	-	3
	Plants found in SNA only				
42	*Acer saccharinum*	-	-	-	1
33	*Ulmus americana*	-	-	-	2
SAPLING STRATUM					
	Plant found in both NAs				
42	*Acer saccharinum*	5	-	-	1
	Plant found only in NNA				
32	*Rhamnus cathartica*	2	-	-	-
TREE STRATUM					
	Plants found in both NAs				
42	*Acer saccharinum*	50	-	-	30
38	*Fraxinus pennyslvanica*	1	-	-	2
	Plants found in SNA only				
389	*Quercus bicolor*	-	-	-	2
330	*Salix fragilis*	-	-	-	40

Appendix D:

Comparisons of Plant Species Found on Each Site: 1991 and 1992

Appendix D: Comparisons of Plant Species Found on Each Site: 1991 and 1992

TABLE D.1 Plant Species Present in Study Plots in 1991 Only — Scrub-Shrub Community

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence	Percent Coverage[b]
Carex x stipata	OBL	PNGL	NAs	0.10
Onoclea sensibilis	FACW	PNEF3	NAs	0.05
Populus deltoides	FAC	NT	Both[c]	2.25 (t)
Rhamnus cathartica	UPL	IS	Both	0.40
Rhamnus frangula	FAC	IS	Both	0.10
Ribes americana	FACW	NS	NAs	0.05
Solidago sp.			NAs	0.10

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins.)

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted: (t) = tree.

[c] Plant species occurred in both the NAs and the ROW.

TABLE D.2 Plant Species Present in Study Plots in 1992 Only — Scrub-Shrub Community

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence	Percent Coverage[b]
Alisma plantago-aquatica	OBL	PNEF	Both[c]	4.50
Ambrosia artemisiifolia	FACU	ANF	NAs	0.05
Bidens cernua	OBL	AIF	ROW	0.15
Bidens frondosa	FACW	ANF	Both	0.05
Calamagrostis canadensis	FACW+	PNG	NAs	0.05
Carex bebbii	OBL	PNGL	NAs	0.10
Carex normalis	FACU	PNGL	NAs	0.10
Carex spp.			Both	0.15
Ceratophyllum demersum	OBL	PN/F	ROW	0.05
Circaea lutetiana	FACU	PNF	ROW	0.15
Eleocharis obtusa	OBL	APNEGL	ROW	0.05
Erigeron annuus	FACU	ANF	NAs	0.05
Eupatorium perfoliatum	FACW+	PNF	Both	0.08
Fragaria virginiana	FACU	PNF	NAs	0.05
Fraxinus nigra	OBL	NETS	NAs	0.10
Galium palustre	OBL	PNF	NAs	0.25
Juncus canadensis	OBL	PNGL	NAs	0.05
Lemna trisulca	OBL	PN/F	Both	43.9
Ludwegia palustris	OBL	PNEF	Both	0.15
Lycopus americanus	OBL	PNF	NAs	0.25
Lysimachia thyrsiflora	OBL	PIF	NAs	0.10
Mimulus ringens	OBL	PNF	NAs	0.10
Pilea pumila	FACW	ANF	NAs	0.15
Plantago rugelii	FACU	PNF	NAs	0.15
Poa pratensis	FACU	PNG	ROW	0.05
Polygonum pensylvanicum	FACW	ANEF	NAs	0.05
Potentilla norvegica	FACU	ABPNF	NAs	0.10
Potamogeton pectinatus	OBL	PNZF	ROW	0.25
Rorripa spp.			NAs	0.10
Rumex spp.			NAs	0.05
Sium suave	OBL	PNEF	Both	0.43
Solanum dulcamara	FAC-	PIF	NAs	0.25
Sparganium spp.			Both	7.63
Taraxacum officinale	FACU-	PIF	NAs	0.05
Trifolium repens	FACU-	PIF	NAs	0.10
Typha x glauca	OBL	PNEF	Both	12.8
Urtica dioica	FACU	PIF	NAs	0.20
Verbena hastata	FACW+	PNF	NAs	0.10
Vicia cracca	UPL	NIF	NAs	0.15

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-form and origins.)

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted.

[c] Plant species occurred in both the NAs and the ROW.

TABLE D.3 Plant Species Present in Study Plots in 1991 and 1992 — Scrub-Shrub Community

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence		Percent Coverage[b]	
			1991	1992	1991	1992
Acer rubrum	FAC	NT	Both[c]	Both	0.60	0.1 (s*)
Acer saccharinum	FACW	NT	Both	Both	13.5 (t*)	15.7 (sa*)
Cornus amomum	FACW	NS	Both	NAs	1.40 (s)	0.10
Cornus foemina	FAC	NS	Both	NAs	4.50 (s)	1.10
Cornus stolonifera	FACW+	NS	Both	NAs	0.73 (s)	0.50 (s)
Fraxinus pennsylvanica	FACW	NT	Both	Both	8.90 (s)	1.15 (s)
Glyceria striata	OBL	PNEG	Both	Both	0.10	0.15
Impatiens capensis	FACW	ANF	NAs	Both	0.10	0.13
Juncus tenuis	FAC-	PNGL	Both	ROW	0.08	0.15
Lemna minor	OBL	PN/F	Both	Both	97.3	37.4
Polygonum amphibium	OBL	PNE/F	Both	Both	0.35	0.90
Salix bebbiana	FACW	NS	Both	NAs	3.28 (s)	0.30 (s)
Salix discolor	FACW	NS	Both	NAs	12.2 (s)	3.30 (s)
Salix fragilis	FAC+	IT	Both	NAs	4.60 (t)	12.1 (t)
Salix petiolaris	OBL	NS	Both	Both	11.7 (s)	5.10 (s)
Ulmus americana	FACW-	NT	Both	Both	5.75 (s)	0.30 (s*)

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins).

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted: (s) = shrub; (s*) = shrub, NAs only; (sa) = sapling; (sa*) = sapling, NAs only; (t) = tree; (t*) = tree, NAs only.

[c] Plant species occurred in both the NAs and the ROW.

TABLE D.4 Plant Species Present in Study Plots in 1991 Only — Emergent Marsh Community

Species Scientific Name	Wetland Indicator Category	Life Form/ Origin[a]	Occurrence	Percent Coverage[b]
Acer rubrum	FAC	NT	Both[c]	0.08
Anthoxanthum odoratum	FACU	PIG	NAs	0.10
Carex gracillima	FACU	PNGL	Both	0.23
Carex lacustris	OBL	PNEGL	NAs	0.05
Poa alodes	FACW-	PNG	Both	3.63
Salix fragilis	FAC+	IT	Both	4.00 (t)
Stellaria graminea	FAC-	PNF	NAs	0.05
Viburnum dentatum	FAC	NST	NAs	0.20 (s)

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins).

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted: (s) = shrub, (t) = tree, ROW only.

[c] Plant species occurred in both the NAs and the ROW.

TABLE D.5 Plant Species Present in Study Plots in 1992 Only — Emergent Marsh Community

Species Scientific Name	Wetland Indicator Category	Life Form/ Origin[a]	Occurrence	Percent Coverage[b]
Acer saccharinum	FACW	NT	NAs	0.10
Acorus calamus	OBL	PIEF	ROW	0.05
Agrostis stolonifera	FACW	PNG	Both[c]	0.33
Calamagrostis canadensis	FACW+	PNG	Both	0.08
Carex comosa	OBL	PNEGL	NAs	0.25
Carex lasiocarpa	OBL	PNEGL	NAs	0.05
Carex spp.			ROW	1.25
Carex tenera	OBL	PNGL	NAs	0.05
Dryopteris spinulosa	FAC+	F3	NAs	0.05
Eleocharis spp.			Both	0.58
Glyceria striata	OBL	PNEG	Both	0.08
Juncus bufonius	FACW	ANGL	ROW	1.10
Juncus canadensis	OBL	PNGL	ROW	0.40
Leersia oryzoides	OBL	PNG	NAs	3.15
Lemna minor	OBL	PN/F	Both	0.15
Lemna trisulca	OBL	PN/F	ROW	0.05
Lolium perenne	FACU-	PIG	ROW	0.05
Oxalis europaea	UPL	PIF	NAs	0.05
Phleum pratensis	FACU	PIG	NAs	0.05
Poa palustris	FACW	PNG	NAs	0.15
Polygonum pensylvanicum	FACW	ANEF	ROW	0.15
Ranunculus sceleratus	OBL	APNEF	ROW	0.10
Rumex spp.			NAs	0.15
Solanum dulcamara	FAC-	PIF	NAs	0.05
Toxicodendron radicans	FAC	NWVS	ROW	0.10
Trifolium repens	FACU-	PIF	ROW	0.30

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins).

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted.

[c] Plant species occurred in both the NAs and the ROW.

TABLE D.6 Plant Species Present in Study Plots in Both 1991 and 1992 — Emergent Marsh Community

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence		Percent Coverage[b]	
			1991	1992	1991	1992
Alisma plantago-aquatica	OBL	PNEF	Both[c]	Both	0.23	2.38
Asclepias incarnata	OBL	PNF	Both	NAs	0.10	0.04
Bidens cernua	OBL	AIF	NAs	ROW	0.05	0.40
Calystegia sepium	FAC-	PIF	ROW	NAs	0.10	0.10
Carex bebbii	OBL	PNGL	NAs	NAs	0.15	0.35
Carex crinita	OBL	PNEGL	Both	NAs	0.35	0.50
Carex flava	OBL	PNGL	NAs	NAs	0.10	0.05
Carex hystericina	OBL	PNEGL	NAs	NAs	0.15	0.05
Carex lupulina	OBL	PNEGL	Both	NAs	1.30	0.75
Carex normalis	FACU	PNGL	Both	NAs	0.40	0.40
Carex pallescens	UPL	PNGL	Both	NAs	0.30	0.05
Carex retrorsa	FACW+	PNGL	NAs	NAs	0.10	0.15
Carex scoparia	FACW	PNGL	NAs	NAs	0.10	0.25
Carex suberecta	OBL	PNGL	Both	NAs	0.05	0.10
Carex vulpinoidea	OBL	PNEGL	Both	Both	0.33	0.10
Carex × stipata	OBL	PNGL	Both	NAs	1.40	0.30
Cicuta bulbifera	OBL	PNF	Both	Both	0.18	0.13
Cicuta maculata	OBL	PNF	Both	Both	7.13	4.40
Cornus amomum	FACW	NS	Both	NAs	10.5 (s)	18.5 (s)
Cornus foemina	FAC	NS	Both	NAs	5.60 (s)	0.05 (s)
Cornus stolonifera	FACW+	NS	Both	NAs	17.0 (s)	13.1 (s)
Epilobium hirsutum	FACW	PIF	Both	NAs	0.55	0.10
Equisetum arvense	FAC	PNH2	Both	NAs	29.5	5.80
Equisetum fluviatile	OBL	PNH2	Both	Both	24.3	16.6
Eupatoriadelphus maculatus	FACW	PNF	Both	Both	2.60	7.18
Eupatorium perfoliatum	FACW+	PNF	Both	Both	0.13	0.20
Fraxinus pennsylvanica	FACW	NT	Both	NAs	0.05	0.15 (s)
Galium palustre	OBL	PNF	Both	Both	2.90	4.53
Impatiens capensis	FACW	ANF	Both	Both	21.4	14.5
Iris versicolor	OBL	PNF	Both	Both	1.30	0.68
Juncus tenuis	FAC-	PNGL	NAs	ROW	0.01	0.10
Liparis loeselii	FACW	PNF	Both	NIP[d]	0.05	-
Ludwegia palustris	OBL	PNEF	Both	ROW	1.05	0.80
Lycopus americanus	OBL	PNF	Both	Both	0.68	0.25
Lycopus uniflorus	OBL	PNF	Both	NIP	0.83	-
Lysimachia nummularia	OBL	PIF	Both	NAs	0.43	0.10
Lysimachia thyrsiflora	OBL	PIF	Both	NIP	0.23	-
Mentha spp.			ROW	NIP	0.10	-
Nasturtium officinale	OBL	PIZEF	Both	Both	1.50	1.13
Onoclea sensibilis	FACW	PNEF3	Both	NAs	2.10	8.25
Poa pratensis	FACU	PNG	Both	Both	1.13	0.63
Ranunculus acris	FAC+	PIF	Both	Both	0.45	0.10
Rhamnus cathartica	UPL	IS	Both	NAs	4.90 (s)	6.05 (s)
Salix discolor	FACW	NS	NAs	NAs	1.30 (s)	3.10 (s)
Salix petiolaris	OBL	NS	Both	Both	12.2 (s)	9.20 (s*)

TABLE D.6 (Cont.)

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence 1991	Occurrence 1992	Percent Coverage[b] 1991	Percent Coverage[b] 1992
Scirpus atrovirens	OBL	PNEGL	Both	NAs	0.73	0.75
Scirpus validus	OBL	PNEGL	NAs	NAs	0.40	0.30
Solidago spp. (narrow lf.)			Both	Both	0.31	0.31
Solidago spp. (wide lf.)			Both	Both	2.40	2.38
Typha x glauca	OBL	PNEF	Both	Both	67.8	34.2
Ulmus americana	FACW-	NT	NAs	NAs	0.05	0.05
Viburnum lentago	FAC	NTS	NAs	NAs	0.20 (s)	0.05 (s)
Vicia cracca	UPL	NIF	Both	NAs	0.50	2.15

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins).

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted: (s) = shrub.

[c] Plant species occurred in both the NAs and the ROW.

[d] NIP = not in plots

TABLE D.7 Plant Species Present in Study Plots in 1991 Only — Forested Wetland Community

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence	Percent Coverage[b]
Acer rubrum	FAC	NT	Both[c]	40.0 (t*)
Carex brunnescens	FACW	PNGL	Both	1.25
Carex gracillima	FACU	PNGL	ROW	1.50
Cornus foemina	FAC	NS	NAs	10.0 (s)
Fragaria spp.			NAs	1.00
Lonicera tartarica	FACU	IS	Both	0.63
Poa alsodes	FACW	PNG	Both	10.5
Poa pratensis	FACU	PNG	NAs	1.00
Populus deltoides	FAC	NT	NAs	10.0 (t)
Ranunculus acris	FAC+	PIF	Both	0.50
Solidago spp.			Both	2.50
Viburnum lentago	FAC	NTS	ROW	1.00
Viola spp.			NAs	0.50

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins).

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted: (s) = shrub; (t) = tree; (t*) = tree, NAs only.

[c] Plant species occurred in both the NAs and the ROW.

TABLE D.8 Plant Species Present in Study Plots in 1992 Only — Forested Wetland Community

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence	Percent Coverage[b]
Acer saccharinum	FACW	NT	Both[c]	40.0 (t*)
Acorus calamus	OBL	PIEF	Both	0.25
Alisma plantago-aquatica	OBL	PNEF	Both	0.25
Ambrosia artemisiifolia	FACU	ANF	ROW	0.25
Aster spp.			NAs	0.50
Bidens cernua	OBL	AIF	Both	0.88
Bidens frondosa	FACW	ANF	Both	0.38
Caltha palustris	OBL	PNF	NAs	0.25
Carex bromoides	FACW	PNGL	NAs	0.25
Carex flava	OBL	PNGL	NAs	0.50
Carex lupulina	OBL	PNEGL	NAs	0.50
Carex normalis	FACU	PNGL	NAs	0.25
Cicuta bulbifera	OBL	PNF	Both	0.25
Cicuta maculata	OBL	PNF	NAs	0.25
Cinna arundinacea	FACW+	PNG	NAs	0.25
Circeae lutetiana	FACU	PNF	NAs	0.25
Cornus amomum	FACW	NS	Both	0.25
Dryopteris spinulosa	FAC+	F3	NAs	0.25
Eleocharis obtusa	OBL	APNEGL	ROW	0.25
Equisetum arvense	FAC	PNH2	NAs	0.25
Galium plaustre	OBL	PNF	Both	0.25
Juncus tenuis	FAC-	PNGL	NAs	0.25
Lemna minor	OBL	PN/F	ROW	0.25
Lemna trisulca	OBL	PN/F	ROW	0.25
Lilium philadelphium	FACU+	PNF	NAs	0.25
Lolium perenne	FACU-	PIG	Both	1.13
Ludwegia palustris	OBL	PNEF	Both	0.25
Lycopus americanus	OBL	PNF	NAs	0.25
Medicago lupulina	UPL	PIF	ROW	0.25
Poa palustris	FACW	PNG	NAs	0.25
Quercus bicolor	FACW+	NT	NAs	1.00 (t)
Rhamnus cathartica	UPL	IS	NAs	11.5 (s)
Rhamnus frangula	FAC	IS	NAs	0.50
Ribes cyanosbata	UPL	NS	NAs	0.25
Rosa palustris	OBL	NS	NAs	0.25
Rubus strigosus	NI	PNS	NAs	0.50
Salix fragilis	FAC+	IT	Both	20.0 (t*)
Sambucus canadensis	FACW-	NS	NAs	0.25
Solanum dulcamara	FAC-	PIF	NAs	0.25
Sorbus americana	FACU	NT	NAs	0.50
Sparganium sp			NAs	1.00
Thalictrum pubescens	FACW+	PNF	NAs	0.25

TABLE D.8 (Cont.)

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence	Percent Coverage[b]
Trifolium repens	FACU-	PIF	ROW	0.25
Typha latifolia	OBL	PNEF	NAs	1.00
Typha × glauca	OBL	PNEF	Both	5.13
Viburnum recognitum	FACW-	NS	NAs	0.75

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins).

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted: (s) = shrub, (t) = tree, (t*) = tree, NAs only.

[c] Plant species occurred in both the NAs and the ROW.

TABLE D.9 Plant Species Present in Study Plots in 1991 and 1992 — Forested Wetland Community

Species Scientific Name	Wetland Indicator Category	Life-Form/ Origin[a]	Occurrence		Percent Coverage[b]	
			1991	1992	1991	1992
Arisaema triphyllum	FACW-	PNF	Both[c]	NAs	0.88	0.25
Athyrium filix-femina	FAC	PNF3	Both	NAs	3.25	0.25
Carex bebbii	OBL	PNGL	ROW	NAs	0.25	0.25
Carex crinita	OBL	PNEGL	ROW	NAs	0.50	0.25
Fraxinus pennyslvanica	FACW	NT	Both	NAs	10.0	1.75
Geum canadense	FACU	PNF	Both	NAs	0.75	0.25
Glyceria striata	OBL	PNEG	Both	Both	1.75	2.90
Impatiens capensis	FACW	ANF	Both	Both	23.8	2.50
Lonicera tatarica	FACU+	IS	Both	NAs	0.63	0.50
Onoclea sensibilis	FACW	PNEF3	Both	NAs	2.00	12.8
Parthenocisscus quinquefolia	FACU	NWV	Both	NAs	3.50	1.75
Pilea pumila	FACW	ANF	Both	NAs	0.75	0.50
Rhamnus catharticus	UPL	IS	Both	NAs	28.0 (s)	11.5 (s)
Ribes americana	FACW	NS	Both	NAs	2.00	0.75
Rubus pubescens	FACW	PNF	Both	NAs	3.50	2.00
Toxicodendron radicans	FAC	NWVS	NAs	NAs	1.00	2.25
Ulmus americana	FACW-	NT	Both	Both	5.00 (t*)	1.00 (s*)
Viburnum dentatum	FAC	NTS	Both	NAs	0.38	0.25
Vitis riparia	FACW	NWV	ROW	NAs	1.00	0.25

[a] Plant characteristics and life-forms assigned to each species, as indicated in this column, are explained in Reed (1988). (See Appendix B, Section B.2, for definitions of life-forms and origins).

[b] The species' greatest percent coverage is in the herb stratum unless otherwise noted; (s) = shrub; (s*) = shrub, NAs only; (t*) = tree, NAs only.

[c] Plant species occurred in both the NAs and the ROW.