**Department of Energy**

**Ohio Field Office**
**Fernald Closure Project**
**175 Tri-County Parkway**
**Springdale, Ohio 45246**
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FEB 21 2006

DOE-0073-06

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United States Environmental Protection Agency
Region V-SRF-5J
77 West Jackson Boulevard
Chicago, Illinois 60604-3590

Mr. Thomas Schneider, Project Manager
Ohio Environmental Protection Agency
Southwest District Office
401 East Fifth Street
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Mr. Bill Kurey
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Dear Mr. Saric, Mr. Schneider and Mr. Kurey:

**TRANSMITTAL OF THE 2005 CONSOLIDATED MONITORING REPORT FOR RESTORED AREAS AT THE FERNALD CLOSURE PROJECT**

Enclosed is the 2005 Consolidated Monitoring Report for restored areas at the Fernald Closure Project (FCP). This document provides the results of implementation and functional monitoring activities completed in restored areas of the FCP in 2005.

If you have any questions or require additional information, please contact me at (513) 648-3139.

Sincerely,

Johnny W. Reising
Director

Enclosure

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# ENCLOSURE

# 2005 CONSOLIDATED MONITORING REPORT FOR RESTORED AREAS AT THE FERNALD CLOSURE PROJECT NARRATIVE SUMMARY FEBRUARY 2006

The attached tables present the data collected in 2005 for Implementation and Functional monitoring of restored areas at the Fernald Closure Project (FCP). Implementation monitoring included vegetation survival and herbaceous cover within Area 1, Phase III (A1PIII) and the Phase II Wetland Mitigation Project, as well as herbaceous cover estimates across the Northern Pines. Water levels were also recorded for the Phase II Wetland Mitigation Project. Functional monitoring involved comparisons of restored forest communities in the Southern Waste Units (SWU), Area 8, Phase II (A8PII), and A1PIII to baseline conditions and reference sites.

Site precipitation data for 2005 are presented in Table 1. Monthly rainfall totals were well below average for much of the summer and fall. While this did not result in a regional drought, field conditions at the FCP required a major watering effort throughout the growing season. Restoration personnel used a combination of water tanks, water trucks, and water cannons to irrigate planted and seeded areas.

**Implementation Monitoring**

Vegetation survival for the Phase II Wetland Mitigation Project is presented in Table 2. All vegetation planted across the project area was surveyed pursuant to the methodology established in the 2002 Consolidated Monitoring Report (DOE 2003). Field survival was over 80 percent overall and at or near 80 percent for each individual patch. Increased use of deer exclosure fencing has proved very beneficial. All plants in the Phase II Wetland Mitigation project were protected with exclosure fencing or welded wire cages. As a result, vegetation survival is greatly increased, and the rate of mortality is in line with what would be expected given the scale of the project and the dry conditions experienced in 2005. As with other projects, the planned quantities sometimes differ slightly from the quantities actually installed in the field. A variety of factors can contribute to these discrepancies, including plant availability from a vendor, counting and labeling errors, theft, etc. An improved tracking process was instituted in 2005 to ensure that all planned plant quantities are addressed.

Herbaceous cover across A1PIII and the Northern Pines is presented in Table 3. Again, the methodology established in the 2002 Consolidated Monitoring Report was used to collect field data. Seven random quadrats were sampled: four in A1PIII and three in the Northern Pines. Cover in both areas is well established, as all quadrats sampled had greater than 90 percent total cover. Also, all native herbaceous species composition and relative frequency of native species calculations were greater than 50 percent. Field observations of seeded areas across the Phase II Wetland Mitigation Project demonstrate similar

findings. It is anticipated that the percentage of native vegetation should increase, given proper management of the seeded areas.

Water elevations were measured in the Phase II Wetland Mitigation Project in the spring of 2005 (Table 4). Data showed that water levels in Basins 2 and 3 were below the planned elevations. As a result, field personnel raised the water elevation of each basin by adjusting the water control structure flashboard heights. Subsequent field observations demonstrate that the wetland hydrology is now functioning pursuant to the design goals.

**Functional Monitoring**

Functional Monitoring data summaries are presented in Tables 5, 6, and 7. Area-specific species lists are found in Tables 8 through 13. Table 5 shows the native species and Floristic Quality Assessment Index (FQAI) based on the combined woody and herbaceous species lists for each area. Table 6 summarizes herbaceous data and Table 7 summarizes woody data. In general, results are in line with expectations. The SWU and A8PII are showing solid improvement over baseline conditions. For A1PIII, the 2005 dataset is comparable to the baseline successional woodlot. Nevertheless, vegetation survey results and field observations indicate that restoration activities have dramatically improved the project area. Each of these projects is discussed in more detail below.

The SWU datasets are provided in Tables 8 and 11. Two 50-meter transects were used in the SWU: one across a restored beech-maple community and one through the "Carolina Area," where riparian trees and shrubs were planted within a previously seeded excavation area in the southeast portion of the project. The herbaceous layer of the SWU was particularly good, with an FQAI approaching the riparian reference site FQAI. Table 8 shows that a large amount of high quality prairie grasses and forbs are present within the project area. Much of this is attributed to the Carolina Area, which is one of the most diverse areas onsite with respect to native forbs present. Over time, it is anticipated that this area and the other herbaceous layers in restored forest areas at the FCP will convert to a forest understory, as planted trees and volunteers grow and close canopy gaps. The woody data summary for the SWU shows continued survival and growth of planted trees and shrubs (Table 11).

For A8PII, data summaries are presented in Tables 9 and 12. A single 100-meter transect was established from the edge of the existing riparian corridor through a former grazed pasture that was planted with the mesophytic forest template. The herbaceous layer in this area has greatly improved over baseline conditions. This improvement is not due to seeding, but rather to continued expansion of the adjacent riparian corridor (Table 9). Woody vegetation also shows benefit from volunteer recruits, in addition to

restoration plantings (Table 12). With diligent maintenance of invasives, the A8PII restoration project should continue progressing towards the project goals of expanded riparian corridor and upland forest.

Data summaries for A1PIII are included in Tables 10 and 13. A 100-meter transect was surveyed within the early-successional woodlot located just north of the Phase II Wetland Mitigation Project. Restoration of this woodlot consisted of extensive removal of honeysuckle and multiflora rose, installation of a beech-maple forest template, and seeding with a woodland seed mix. The invasives removal effort was very successful, as the relative frequency of native vegetation has much improved over the baseline site (Table 7). However, the average Coefficient of Conservatism (CC) values and FQAI scores for this area more closely resemble the site baseline woodlot than the reference forest (Tables 5 through 7). There are several reasons for this. First, the area surveyed is the most recent of the three Functional Monitoring study sites to be restored. Planting and seeding took place in the fall of 2004, less than one year before Functional Monitoring data collection. Both herbaceous data (Table 10) and woody data summaries (Table 13) show some progress in establishing native seeded and planted vegetation (planted vegetation in the woody data summaries are described as "saplings" in the "Type" column). However, more time is needed to demonstrate full benefits from restoration activities. Other projects onsite have shown that native grass and forb establishment takes several years. Woodland seeding may take even longer given the habitat requirements of some species (i.e. shade tolerance). For woody data, field observations demonstrated a variety of planted native vegetation that was not included in the survey because of the sampling methodology (plants under one meter tall are not included in the woody vegetation dataset). It is anticipated that over time, planted trees and shrubs will mature and subsequently improve floristic quality calculations within A1PIII.

The second factor affecting the floristic quality of the A1PIII woodlot pertains to the condition of the woodlot prior to restoration. There is lower diversity and quality of existing trees in the A1PIII restoration area than in the baseline community [Table 13, (DOE 2003, Table C-6)]. This is one of the reasons that the woodlot was restored in the first place. Again, over time, planted vegetation and volunteer recruits will mature, thereby improving the floristic quality of the A1PIII restored forest.

In summary, restored forested areas show some present-day ecological benefit. However, as expected, forest communities will take some time to fulfill their desired ecological functions.

**Activities in 2006**

The final restoration projects will be completed at the FCP in late 2005 and early 2006. Implementation monitoring will be completed by the DOE Office of Legacy Management starting in the summer of 2006.

The Final Legacy Management and Institutional Controls Plan (DOE 2006) for the FCP identifies the specific monitoring requirements for Restored Areas to be performed after Declaration of Physical Completion. Projects that will be monitored include Paddys Run East, Paddys Run West, the Former Production Area, the Waste Pits Area, and the Silos Area. In addition, water levels and water quality sampling will be conducted for the Phase II Wetland Mitigation Project.

**References:**

U.S. Department of Energy, 2006, "Comprehensive Legacy Management and Institutional Controls Plan", Final, January.

U.S. Department of Energy, 2003, "2002 Consolidated Monitoring Report for Restored Areas at the Fernald Closure Project," 20900-RP-0017 Rev. B.

# TABLE 1
# 2005 PRECIPITATION DATA

| Month | Average Site Precipitation (in.) | Actual Site Precipitation (in.) | Monthly Departure from Average (in.) | Cumulative Departure from Average (in.) | Palmer Drought Severity Index |
|---|---|---|---|---|---|
| January | 3.14 | 6.31 | 3.17 | 3.17 | Extremely Moist |
| February | 2.80 | 1.76 | -1.04 | 2.13 | Moderately Moist |
| March | 3.90 | 4.01 | 0.11 | 2.24 | Moderately Moist |
| April | 3.80 | 3.56 | -0.24 | 2.00 | Moderately Moist |
| May | 4.23 | 3.96 | -0.27 | 1.73 | Mid-Range |
| June | 4.06 | 1.77 | -2.29 | -0.56 | Mid-Range |
| July | 4.03 | 1.51 | -2.52 | -3.08 | Mid-Range |
| August | 3.20 | 3.73 | 0.53 | -2.55 | Mid-Range |
| September | 2.79 | 0.94 | -1.85 | -4.40 | Mid-Range |
| October | 2.68 | 1.95 | -0.73 | -5.13 | Mid-Range |
| November | 3.33 | 4.17 | 0.84 | -4.29 | Mid-Range |
| December | 3.12 | 1.88 | -1.24 | -5.53 | Mid-Range |

Palmer Drought Severity Index source:
http://lwf.ncdc.noaa.gov/oa/climate/research/prelim/drought/palmer.html

# TABLE 2
## AREA 1, PHASE III, AREA 6, PHASE I VEGETATION SURVIVAL

| Patch | Planned | Actual | Vitality | Resprout | Dead | Alive | Percent Survival (planned) | Percent Survival (actual) |
|---|---|---|---|---|---|---|---|---|
| Beech-maple | 668 | 645 | 6 | 2 | 108 | 529 | 79% | 82% |
| Riparian | 270 | 265 | 0 | 4 | 41 | 220 | 81% | 83% |
| Oak-hickory 1 | 182 | 182 | 9 | 2 | 17 | 154 | 85% | 85% |
| Oak-hickory 2 | 86 | 80 | 1 | 2 | 13 | 64 | 74% | 80% |
| Oak-hickory 3 | 63 | 53 | 3 | 1 | 7 | 42 | 67% | 79% |
| Oak-hickory 4 | 165 | 162 | 6 | 9 | 25 | 122 | 74% | 75% |
| Oak-hickory 5 | 140 | 127 | 2 | 3 | 18 | 104 | 74% | 82% |
| Oak-hickory 6 | 118 | 110 | 5 | 1 | 19 | 85 | 72% | 77% |
| Oak-hickory 7 | 27 | 27 | 3 | 0 | 0 | 24 | 89% | 89% |
| Oak-hickory 8 | 36 | 36 | 0 | 0 | 5 | 31 | 86% | 86% |
| Oak-hickory 9 | 35 | 34 | 4 | 0 | 4 | 26 | 74% | 76% |
| **Totals:** | 1,790 | 1,721 | 39 | 24 | 257 | 1,401 | 78% | 81% |

# TABLE 3
# HERBACEOUS COVER SUMMARY

| Area | Average Cover Class | Native Species Composition | Native Relative Frequency |
|---|---|---|---|
| Area 1, Phase III | 6 | 53% | 53% |
| Northern Pines | 6 | 62% | 59% |

Cover class: 0=0% 1=2%-4% 2=5%-24% 3=25%-49% 4=50%-74% 5=75%-89% 6=90%-100%

# TABLE 4
# PHASE II WETLAND MITIGATION PROJECT
# WATER ELEVATIONS

| Basin | Planned Elevation | Surveyed Elevation | Adjusted Elevation |
|---|---|---|---|
| 1 | 573.0 | 572.9 | none |
| 2 | 581.4 | 579.9 | 581.1 |
| 3 | 583.0 | 581.4 | 582.4 |

Survey conducted March 10, 2005

# TABLE 5
## COMBINED WOODY AND HERBACEOUS DATA
## FUNCTIONAL MONITORING SUMMARY
## FOREST RESTORATION PROJECTS

| | Southern Waste Units | | | A8PII Forest Demonstration Project | | | Area 1, Phase III | | |
|---|---|---|---|---|---|---|---|---|---|
| Parameter | 2005 Data | Reference (UFC) | Baseline | 2005 Data | Reference (Riparian) | Baseline (Grazed Pasture) | 2005 Data | Reference (UFC) | Baseline (Woodlot) |
| *Native Species Composition* | | | | | | | | | |
| Total Species | 82 | 62 | -- | 66 | 95 | 38 | 82 | 62 | 56 |
| Native Species | 61 | 58 | -- | 44 | 85 | 15 | 58 | 58 | 42 |
| Percent Composition | 74% | 94% | -- | 67% | 91% | 39% | 71% | 94% | 75% |
| *Species Conservatism* | | | | | | | | | |
| Average Coefficient ot Conservatism | 3.0 | 3.9 | -- | 2.2 | 3.3 | 0.4 | 1.8 | 3.9 | 2.4 |
| Floristic Quality Assessment Index | 26.7 | 30.5 | -- | 17.5 | 31.8 | 2.6 | 16.7 | 30.5 | 18.0 |

# TABLE 6
# HERBACEOUS DATA
# FUNCTIONAL MONITORING SUMMARY
# FOREST RESTORATION PROJECTS

| Parameter | Southern Waste Units | | | A8PII Forest Demonstration Project | | | Area 1, Phase III | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2005 Data | Reference (UFC) | Baseline | 2005 Data | Reference (Riparian) | Baseline (Grazed Pasture) | 2005 Data | Reference (UFC) | Baseline (Woodlot) |
| *Native Species Composition* | | | | | | | | | |
| Total Species | 70 | 48 | -- | 54 | 83 | 38 | 71 | 48 | 45 |
| Native Species | 49 | 44 | -- | 32 | 73 | 15 | 47 | 44 | 31 |
| Percent Composition | 70% | 92% | -- | 59% | 88% | 39% | 66% | 92% | 69% |
| Relative Frequency | 51% | 85% | -- | 50% | 85% | 23% | 64% | 85% | 67% |
| *Species Conservatism* | | | | | | | | | |
| Average Coefficient ot Conservatism | 2.7 | 3.5 | -- | 1.7 | 3.0 | 0.4 | 1.5 | 3.5 | 1.8 |
| Floristic Quality Assessment Index | 22.4 | 24.0 | -- | 12.3 | 27.2 | 2.6 | 12.6 | 24.0 | 12.3 |

# TABLE 7
# WOODY DATA
# FUNCTIONAL MONITORING SUMMARY
# FOREST RESTORATION PROJECTS

| Parameter | Southern Waste Units | | | A8PII Forest Demonstration Project | | | Area 1, Phase III | | |
|---|---|---|---|---|---|---|---|---|---|
| | 2005 Data | Reference (UFC) | Baseline | 2005 Data | Reference (Riparian) | Baseline | 2005 Data | Reference (UFC) | Baseline (Woodlot) |
| *Native Species Composition* | | | | | | | | | |
| Total Species | 16 | 20 | -- | 21 | 23 | -- | 16 | 20 | 20 |
| Native Species | 15 | 18 | -- | 19 | 21 | -- | 14 | 18 | 18 |
| Percent Composition | 94% | 90% | -- | 90% | 91% | -- | 88% | 90% | 90% |
| Relative Density | 97% | 81% | -- | 97% | 60% | -- | 77% | 81% | 51% |
| *Species Conservatism* | | | | | | | | | |
| Average Coefficient ot Conservatism | 4.5 | 4.6 | -- | 4.0 | 3.8 | -- | 3.4 | 4.6 | 3.9 |
| Floristic Quality Assessment Index | 18.0 | 20.8 | -- | 18.1 | 18.1 | -- | 13.5 | 20.8 | 17.4 |
| *Growth* | | | | | | | | | |
| Average dbh (cm) | 4.1 | 13.9 | -- | 12.3 | 10.5 | -- | 16.1 | 13.9 | 17.6 |

# TABLE 8
## 2005 Functional Monitoring Data Summary
## Southern Waste Units Herbaceous Cover

| | | | |
|---|---|---|---|
| **Mean CC:** | 2.67 | **Native Spp.:** | 49 |
| **Total Spp.:** | 70 | **Non-Native Spp.:** | 21 |
| **FQAI:** | 22.35 | **Percent Native:** | 70% |

*(non native species are in bold)*

| Species | Common Name | Type | CC | Frequency (species/quadrat) | Relative Frequency |
|---|---|---|---|---|---|
| *Acer negundo* | box elder seedling | tree | 3 | 0.05 | 0.6% |
| *Acer rubrum* | Red maple seedling | tree | 2 | 0.1 | 1.2% |
| *Acer saccharinum* | silver maple seedling | tree | 3 | 0.05 | 0.6% |
| *Acer saccharum* | sugar maple seedling | tree | 5 | 0.05 | 0.6% |
| *Achillea millefolium* | yarrow | forb | 1 | 0.1 | 1.2% |
| *Ambrosia artemisifolia* | common ragweed | forb | 0 | 0.05 | 0.6% |
| *Andropogon gerardii* | big bluestem | grass | 5 | 0.1 | 1.2% |
| *Asclepias tuberosa* | Butterfly weed | forb | 4 | 0.1 | 1.2% |
| *Aster novae-angliae* | New England aster | forb | 2 | 0.1 | 1.2% |
| *Baptisia australis* | Blue false indigo | forb | 6 | 0.05 | 0.6% |
| *Bouteloua curtipendula* | Side oats gramma | grass | 8 | 0.05 | 0.6% |
| *Cardimine parviflora* | small flower bittercress | forb | 3 | 0.2 | 2.4% |
| *Carex frankii* | Frank's sedge | sedge | 2 | 0.05 | 0.6% |
| *Carya ovata* | shagbark hickory | tree | 6 | 0.05 | 0.6% |
| *Chamaecrista fasciculata* | Partridge pea | forb | 3 | 0.05 | 0.6% |
| *Conyza canadensis* | Horseweed | forb | 0 | 0.1 | 1.2% |
| *Dalea purpurea* | Purple prairie clover | forb | 9 | 0.05 | 0.6% |
| *Desmodium canadense* | Showy tick trefoil | forb | 4 | 0.05 | 0.6% |
| *Echinacea purpurea* | purple coneflower | forb | 6 | 0.15 | 1.8% |
| *Elymus canadensis* | canada wild rye | forb | 6 | 0.55 | 6.5% |
| *Erigeron annuus* | Daisy fleabane | forb | 0 | 0.1 | 1.2% |
| *Eryngium yuccifolium* | rattlesnake master | forb | 7 | 0.05 | 0.6% |
| *Fraxinus americana* | White ash seedling | tree | 6 | 0.05 | 0.6% |
| *Hamamelis virginiana* | Witch hazel | shrub | 5 | 0.05 | 0.6% |
| *Heliopsis helianthoides* | false sunflower | forb | 5 | 0.1 | 1.2% |
| *Juniperus virginiana* | red cedar | seedling | 3 | 0.05 | 0.6% |
| *Lactuca canadensis* | wild lettuce | forb | 1 | 0.05 | 0.6% |
| *Liriodendron tulipifera* | Tulip poplar | tree | 6 | 0.05 | 0.6% |
| *Monarda fistulosa* | bergamot | forb | 3 | 0.05 | 0.6% |
| *Monarda punctata* | dotted mint | forb | 7 | 0.05 | 0.6% |
| *Panicum virgatum* | switchgrass | grass | 4 | 0.3 | 3.6% |
| *Parthenocissus quinquefolia* | Virginia creeper | vine | 2 | 0.05 | 0.6% |
| *Plantago rugelii* | Red-stemmed plantain | forb | 0 | 0.05 | 0.6% |
| *Platanus occidentalis* | sycamore seedling | tree | 7 | 0.05 | 0.6% |
| *Populus deltoides* | cottonwood seedling | tree | 3 | 0.05 | 0.6% |
| *Prunus serotina* | black cherry seedling | tree | 3 | 0.05 | 0.6% |
| *Ratibida pinnata* | gray-headed coneflower | forb | 5 | 0.15 | 1.8% |
| *Rubus occidentalis* | black raspberry | shrub | 1 | 0.05 | 0.6% |
| *Rudbeckia hirta* | black eyed Susan | forb | 1 | 0.25 | 3.0% |
| *Schizachyrium scoparium* | little bluestem | grass | 5 | 0.1 | 1.2% |
| *Silphium perfoliatum* | cup plant | forb | 6 | 0.05 | 0.6% |
| *Solidago canadensis* | Canada goldenrod | forb | 1 | 0.05 | 0.6% |
| *Solidago rigida* | stiff goldenrod | forb | 8 | 0.05 | 0.6% |
| *Sorghastrum nutans* | indian grass | grass | 5 | 0.05 | 0.6% |
| *Tradescantia ohioensis* | Ohio spiderwort | forb | 5 | 0.05 | 0.6% |
| *Ulmus sp.* | elm sp. Seedling | tree | 2 | 0.1 | 1.2% |
| *Verbena urticifolia* | white vervain | forb | 3 | 0.05 | 0.6% |
| *Vernonia gigantea* | giant ironweed | forb | 2 | 0.05 | 0.6% |

# TABLE 8
## 2005 Functional Monitoring Data Summary
## Southern Waste Units Herbaceous Cover

| Species | Common Name | Type | CC | Frequency (species/quadrat) | Relative Frequency |
|---|---|---|---|---|---|
| *Vitis sp.* | grapevine | vine | 3 | 0.05 | 0.6% |
| ***Bromus japonicus*** | **Japanese brome** | grass | 0 | 0.05 | 0.6% |
| ***Capsella bursa-pastoris*** | **shepard's purse** | forb | 0 | 0.25 | 3.0% |
| ***Cichorium intybus*** | **Chickory** | forb | 0 | 0.2 | 2.4% |
| ***Cirsium arvense*** | **Canada thistle** | forb | 0 | 0.15 | 1.8% |
| ***Daucus carota*** | **Queen Anne's lace** | forb | 0 | 0.45 | 5.4% |
| ***Dipsacus fullonum*** | **Teasel** | forb | 0 | 0.05 | 0.6% |
| ***Draba verna*** | **whitlow grass** | grass | 0 | 0.1 | 1.2% |
| ***Lamium purpureum*** | **purple deadnettle** | forb | 0 | 0.05 | 0.6% |
| ***Lonicera maackii*** | **amur honeysuckle** | shrub | 0 | 0.15 | 1.8% |
| ***Medicago lupulina*** | **black medick** | forb | 0 | 0.35 | 4.2% |
| ***Melilotus albus*** | **white sweet clover** | forb | 0 | 0.1 | 1.2% |
| ***Melilotus officinalis*** | **Yellow sweet clover** | forb | 0 | 0.1 | 1.2% |
| ***Phleum pratens*** | **Timothy** | grass | 0 | 0.05 | 0.6% |
| ***Plantago lanceolata*** | **English plantain** | forb | 0 | 0.45 | 5.4% |
| ***Polygonum aviculare*** | **common knotweed** | forb | 0 | 0.05 | 0.6% |
| ***Rosa multiflora*** | **multiflora rose** | shrub | 0 | 0.05 | 0.6% |
| ***Taraxacum offinale*** | **dandelion** | forb | 0 | 0.6 | 7.1% |
| ***Trifolium pratense*** | **red clover** | forb | 0 | 0.1 | 1.2% |
| ***Trifolium repens*** | **white clover** | forb | 0 | 0.7 | 8.3% |
| ***Verbascum blattaria*** | **moth mullein** | forb | 0 | 0.05 | 0.6% |
| ***Veronica arvensis*** | **corn speedwell** | forb | 0 | 0.1 | 1.2% |
| | | | Native Species: | 4.25 | 50.6% |
| | | | Non-Native Species: | 4.15 | 49.4% |

CC = Coefficient of Conservatism
FQAI = Floristic Quality Assessment Index

# TABLE 9
## 2005 Functional Monitoring Data Summary
## Area 8, Phase II Herbaceous Cover

| | | | |
|---|---|---|---|
| **Mean CC:** | 1.67 | **Native Spp.:** | 32 |
| **Total Spp.:** | 54 | **Non-Native Spp.:** | 22 |
| **FQAI:** | 12.25 | **Percent Native:** | 59% |

*(non native species are in bold)*

| Species | Common Name | Type | CC | Frequency (species/quadrat) | Relative Frequency |
|---|---|---|---|---|---|
| *Acer negundo* | box elder seedling | tree | 3 | 0.6 | 8.2% |
| *Achillea millefolium* | yarrow | forb | 1 | 0.05 | 0.7% |
| *Aesculus glabra* | Ohio buckeye seedling | tree | 6 | 0.05 | 0.7% |
| *Agrimonia parviflora* | small flowered agrimony | forb | 2 | 0.05 | 0.7% |
| *Aster pilosus* | white heath aster | forb | 1 | 0.05 | 0.7% |
| *Carex blanda* | woodland sedge | sedge | 1 | 0.15 | 2.0% |
| *Carex stipata* | sawbeak sedge | sedge | 2 | 0.1 | 1.4% |
| *Celtis occidentalis* | hackberry seedling | tree | 4 | 0.05 | 0.7% |
| *Claytonia caroliniana* | spring beauty | forb | 6 | 0.05 | 0.7% |
| *Cornus racemosa* | grey dogwood | shrub | 1 | 0.05 | 0.7% |
| *Cryptotaenia canadensis* | honewort | forb | 3 | 0.05 | 0.7% |
| *Elymus virginicus* | Virginia wild rye | grass | 3 | 0.05 | 0.7% |
| *Geum canadense* | white avens | forb | 2 | 0.05 | 0.7% |
| *Hydrophyllum macrophyllum* | water leaf | forb | 6 | 0.05 | 0.7% |
| *Hypericum prolificum* | shrubby St. John's wort | forb | 3 | 0.05 | 0.7% |
| *Juglans nigra* | walnut seedling | tree | 5 | 0.05 | 0.7% |
| *Osmorhiza claytonii* | sweet cicely | forb | 4 | 0.05 | 0.7% |
| *Oxalis stricta* | yellow wood sorrel | forb | 0 | 0.15 | 2.0% |
| *Panicum clandestinum* | deer tongue panic grass | grass | 2 | 0.05 | 0.7% |
| *Parthenocissus quinquefolia* | Virginia creeper | vine | 2 | 0.05 | 0.7% |
| *Physalis heterophylla* | clammy ground cherry | forb | 1 | 0.05 | 0.7% |
| *Platanus occidentalis* | sycamore seedling | tree | 7 | 0.05 | 0.7% |
| *Prunus serotina* | black cherry seedling | tree | 3 | 0.05 | 0.7% |
| *Rubus occidentalis* | black raspberry | shrub | 1 | 0.05 | 0.7% |
| *Rudbeckia hirta* | black eyed Susan | forb | 1 | 0.05 | 0.7% |
| *Solidago canadensis* | Canada goldenrod | forb | 1 | 0.15 | 2.0% |
| *Toxicodendron radicans* | poison ivy | forb | 1 | 0.05 | 0.7% |
| *Verbesina alternafolia* | wingstem | forb | 5 | 0.05 | 0.7% |
| *Vernonia gigantea* | giant ironweed | forb | 2 | 0.2 | 2.7% |
| *Viola blanda* | sweet white violet | forb | 7 | 0.05 | 0.7% |
| *Viola sororia* | common blue violet | forb | 1 | 0.7 | 9.5% |
| *Vitis sp.* | grape vine | vine | 3 | 0.4 | 5.4% |
| ***Agrostis stolonifera*** | **creeping bentgrass** | grass | 0 | 0.15 | 2.0% |
| ***Alium vineale*** | **field garlic** | forb | 0 | 0.25 | 3.4% |
| ***Alliaria petiolata*** | **garlic mustard** | forb | 0 | 0.05 | 0.7% |
| ***Cerastium vulgatum*** | **chickweed** | forb | 0 | 0.05 | 0.7% |
| ***Cirsium arvense*** | **Canada thistle** | forb | 0 | 0.05 | 0.7% |
| ***Dactylis glomerata*** | **orchard grass** | grass | 0 | 0.05 | 0.7% |
| ***Daucus carota*** | **Queen Anne's lace** | forb | 0 | 0.05 | 0.7% |
| ***Festuca elatior*** | **tall fescue** | grass | 0 | 1 | 13.6% |
| ***Galeopsis tetrahit*** | **hemp nettle** | forb | 0 | 0.05 | 0.7% |
| ***Galium vernum*** | **spring avens** | forb | 0 | 0.05 | 0.7% |
| ***Glechoma hederacea*** | **ground ivy** | forb | 0 | 0.1 | 1.4% |
| ***Humulus japonicus*** | **Japanese hops** | vine | 0 | 0.15 | 2.0% |
| ***Lamium purpureum*** | **purple dead nettle** | forb | 0 | 0.1 | 1.4% |
| ***Lonicera maackii*** | **amur honeysuckle** | shrub | 0 | 0.05 | 0.7% |
| ***Lysimachia nummularia*** | **moneywort** | forb | 0 | 0.4 | 5.4% |
| ***Medicago lupulina*** | **black medick** | forb | 0 | 0.1 | 1.4% |
| ***Melilotus albus*** | **white sweet clover** | forb | 0 | 0.05 | 0.7% |
| ***Phleum pratens*** | **Timothy** | grass | 0 | 0.05 | 0.7% |
| ***Plantago lanceolata*** | **english plantain** | forb | 0 | 0.05 | 0.7% |

# TABLE 9
## 2005 Functional Monitoring Data Summary
## Area 8, Phase II Herbaceous Cover

| Species | Common Name | Type | CC | Frequency (species/quadrat) | Relative Frequency |
|---|---|---|---|---|---|
| ***Poa trivialis*** | **rough stalk bluegrass** | graminoid | 0 | 0.2 | 2.7% |
| ***Rosa multiflora*** | **multiflora rose** | shrub | 0 | 0.05 | 0.7% |
| ***Taraxacum officinale*** | **dandelion** | forb | 0 | 0.65 | 8.8% |
| | | Native Species: | | 3.65 | 49.7% |
| | | Non-Native Species: | | 3.7 | 50.3% |

CC = Coefficient of Conservatism
FQAI = Floristic Quality Assessment Index

# TABLE 10
## 2005 Functional Monitoring Data Summary
## Area 1, Phase III Herbaceous Cover

| | | | |
|---|---|---|---|
| **Mean CC:** | 1.49 | **Native Spp.:** | 47 |
| **Total Spp.:** | 71 | **Non-Native Spp.:** | 24 |
| **FQAI:** | 12.58 | **Percent Native:** | 66% |

*(non native species are in bold)*

| Species | Common Name | Type | CC | Frequency (species/quadrat) | Relative Frequency |
|---|---|---|---|---|---|
| *Acer negundo* | box elder | seedling | 3 | 0.05 | 0.5% |
| *Acer sacharrum* | sugar maple | seedling | 5 | 0.05 | 0.5% |
| *Achillea millefolium* | yarrow | forb | 1 | 0.05 | 0.5% |
| *Agrimonia parviflora* | small flowered agimony | forb | 2 | 0.05 | 0.5% |
| *Ambrosia artemisifolia* | common ragweed | forb | 0 | 0.05 | 0.5% |
| *Asclepias syriaca* | common milkweed | forb | 1 | 0.05 | 0.5% |
| *Aster pilosus* | white heath aster | forb | 1 | 0.4 | 4.0% |
| *Bidens frondosa* | Devil's beggar-ticks | forb | 2 | 0.05 | 0.5% |
| *Boehmeria cylindrica* | false nettle | forb | 4 | 0.05 | 0.5% |
| *Calystegia sepium* | hedge bindweed | forb | 1 | 0.05 | 0.5% |
| *Carex cristatella* | crested sedge | sedge | 3 | 0.05 | 0.5% |
| *Carex frankii* | Frank's sedge | sedge | 2 | 0.3 | 3.0% |
| *Elymus canadensis* | Canada wild rye | grass | 6 | 0.05 | 0.5% |
| *Elymus hystrix* | eastern bottlebrush grass | grass | 4 | 0.05 | 0.5% |
| *Elymus virginicus* | Virginia wild rye | grass | 3 | 0.5 | 5.0% |
| *Erigeron annuus* | daisy fleabane | forb | 0 | 0.1 | 1.0% |
| *Eupatorium rugosum* | white snakeroot | forb | 3 | 0.35 | 3.5% |
| *Euthamia graminifolia* | flat-topped goldenrod | forb | 2 | 0.05 | 0.5% |
| *Gallium aparine* | cleavers | forb | 0 | 0.05 | 0.5% |
| *Gallium asprellum* | rough bedstraw | forb | 4 | 0.05 | 0.5% |
| *Geum canadense* | white avens | forb | 2 | 0.1 | 1.0% |
| *Geum laciniatum* | rough avens | forb | 2 | 0.45 | 4.5% |
| *Heliopsis helianthoides* | false sunflower | forb | 5 | 0.35 | 3.5% |
| *Hypericum prolificum* | shrubby St. John's wort | forb | 3 | 0.05 | 0.5% |
| *Juncus tenuis* | poverty rush | forb | 1 | 0.1 | 1.0% |
| *Monarda fistulosa* | bergamot | forb | 3 | 0.1 | 1.0% |
| *Muhlenbergia schreberi* | nimblewill | grass | 0 | 0.05 | 0.5% |
| *Osmorhiza claytonii* | sweet cicely | forb | 4 | 0.05 | 0.5% |
| *Oxalis stricta* | yellow wood sorrel | forb | 0 | 0.75 | 7.5% |
| *Panicum clandestinum* | deer tongue panic grass | grass | 2 | 0.15 | 1.5% |
| *Parthenocissus quinquefolia* | Virginia creeper | vine | 2 | 0.2 | 2.0% |
| *Phacelia purshii* | Miami mist | forb | 4 | 0.35 | 3.5% |
| *Physalis heterophylla* | clammy ground cherry | forb | 1 | 0.05 | 0.5% |
| *Phytolacca americana* | pokeweed | forb | 1 | 0.05 | 0.5% |
| *Plantago rugelli* | red stemmed plantain | forb | 0 | 0.05 | 0.5% |
| *Polygonum hydropiperoides* | mild water pepper | forb | 6 | 0.05 | 0.5% |
| *Prunella vulgaris* | self heal | forb | 0 | 0.1 | 1.0% |
| *Ranunculus arbortivus* | small flowered crowfoot | forb | 1 | 0.05 | 0.5% |
| *Rubus occidentalis* | black raspberry | shrub | 1 | 0.05 | 0.5% |
| *Senecio aurens* | ragwort | forb | 4 | 0.05 | 0.5% |
| *Solidago canadensis* | Canada goldenrod | forb | 1 | 0.15 | 1.5% |
| *Toxicodendron radicans* | poison ivy | forb | 1 | 0.05 | 0.5% |
| *Verbena urticifolia* | white vervain | forb | 3 | 0.1 | 1.0% |
| *Vernonia gigantea* | giant ironweed | forb | 2 | 0.4 | 4.0% |
| *Viola sororia* | common blue violet | forb | 1 | 0.05 | 0.5% |
| *Vitis sp.* | grapevine | vine | 3 | 0.05 | 0.5% |
| *Zizea aurea* | golden Alexanders | forb | 6 | 0.05 | 0.5% |
| ***Alliaria petiolata*** | **garlic mustard** | forb | 0 | 0.2 | 2.0% |
| ***Allium vinealle*** | **field garlic** | forb | 0 | 0.1 | 1.0% |
| ***Barbarea vulgaris*** | **yellow rocket** | forb | 0 | 0.15 | 1.5% |

# TABLE 10
## 2005 Functional Monitoring Data Summary
## Area 1, Phase III Herbaceous Cover

| Species | Common Name | Type | CC | Frequency (species/quadrat) | Relative Frequency |
|---|---|---|---|---|---|
| *Cerastium vulgatum* | chickweed | forb | 0 | 0.25 | 2.5% |
| *Cirsium vulgare* | bull thistle | forb | 0 | 0.05 | 0.5% |
| *Conium maculatum* | poison hemlock | forb | 0 | 0.05 | 0.5% |
| *Festuca elatior* | tall fescue | grass | 0 | 0.1 | 1.0% |
| *Glechoma hederacea* | ground ivy | forb | 0 | 0.05 | 0.5% |
| *Lamium amplexicaule* | henbit | forb | 0 | 0.05 | 0.5% |
| *Lamium purpureum* | purple dead nettle | forb | 0 | 0.3 | 3.0% |
| *Lonicera japonica* | Japanese honeysuckle | shrub | 0 | 0.05 | 0.5% |
| *Lonicera maackii* | amur honeysuckle | shrub | 0 | 0.4 | 4.0% |
| *Lysimachia nummularia* | moneywort | forb | 0 | 0.3 | 3.0% |
| *Phleum pratens* | Timothy | grass | 0 | 0.2 | 2.0% |
| *Poa annua* | annual bluegrass | grass | 0 | 0.25 | 2.5% |
| *Poa trivialis* | rough stalk bluegrass | grass | 0 | 0.15 | 1.5% |
| *Polygonum cespitosum* | long-bristled smartweed | forb | 0 | 0.15 | 1.5% |
| *Polygonum persicaria* | spotted lady's thumb | forb | 0 | 0.1 | 1.0% |
| *Rosa multiflora* | multiflora rose | shrub | 0 | 0.2 | 2.0% |
| *Rumex crispus* | curly dock | forb | 0 | 0.05 | 0.5% |
| *Stellaria media* | common chickweed | forb | 0 | 0.25 | 2.5% |
| *Taraxacum offinale* | dandelion | forb | 0 | 0.05 | 0.5% |
| *Trifolium pratense* | red clover | forb | 0 | 0.05 | 0.5% |
| *Trifolium repens* | white clover | forb | 0 | 0.1 | 1.0% |
| | | Native Species: | | 6.4 | 64.0% |
| | | Non-Native Species: | | 3.6 | 36.0% |

CC = Coefficient of Conservatism
FQAI = Floristic Quality Assessment Index

# TABLE 11
## 2005 Functional Monitoring Data Summary
## Southern Waste Units Woody Vegetation

| | | | |
|---|---|---|---|
| **Mean CC:** | 4.50 | **Native Spp.:** | 15 |
| **Total Spp.:** | 16 | **Non-Native Spp.:** | 1 |
| **FQAI:** | 18.00 | **Percent Native:** | 94% |
| **Total Abundance:** | 38 | **avg dbh (cm):** | 4.1 |

*(non native species are in bold)*

| Species | Common Name | Type | Avg. dbh (cm ) | CC | Abundance | Density (ind./100m$^2$) | Relative Density |
|---|---|---|---|---|---|---|---|
| Acer saccharinum | Silver maple | sapling | 1.5 | 3 | 1 | 0.05 | 2.6% |
| Carya laciniosa | Shellbark hickory | sapling | 1.8 | 7 | 5 | 0.25 | 13.2% |
| Cornus racemosa | gray dogwood | sapling | 1.7 | 1 | 2 | 0.10 | 5.3% |
| Fagus grandifolia | Beech | sapling | 1.9 | 7 | 3 | 0.15 | 7.9% |
| Fraxinus americana | White ash | sapling | 2.0 | 6 | 6 | 0.30 | 15.8% |
| Fraxinus pennsylvanica | Green ash | sapling | 2.0 | 3 | 4 | 0.20 | 10.5% |
| Hamamelis virginiana | Witch hazel | shrub | na | 5 | 1 | 0.05 | 2.6% |
| Liriodendron tulipifera | Tulip poplar | sapling | 2.2 | 6 | 2 | 0.10 | 5.3% |
| Physocarpus opulifolius | Ninebark | shrub | na | 4 | 1 | 0.05 | 2.6% |
| Platanus occidentalis | Sycamore | tree | 38.4 | 7 | 2 | 0.10 | 5.3% |
| | Sycamore | sapling | 1.2 | | 1 | 0.05 | 2.6% |
| Populus deltoides | Cottonwood | sapling | 2.3 | 3 | 1 | 0.05 | 2.6% |
| Quercus alba | White oak | sapling | 1.2 | 6 | 1 | 0.05 | 2.6% |
| Quercus rubra | Red oak | sapling | 1.4 | 6 | 2 | 0.10 | 5.3% |
| Salix nigra | Black Willow | tree | 1.7 | 2 | 4 | 0.20 | 10.5% |
| Tilia americana | Linden | sapling | 1.4 | 6 | 1 | 0.05 | 2.6% |
| **Lonicera maackii** | **Amur honeysuckle** | shrub | na | 0 | 1 | 0.05 | 2.6% |
| | | | | **Native Species:** | 37 | 1.85 | 97.4% |
| | | | | **Non-Native Species:** | 1 | 0.05 | 2.6% |

CC = Coefficient of Conservatism
FQAI = Floristic Quality Assessment Index

# TABLE 12
## 2005 Functional Monitoring Data Summary
## Area 8, Phase II Woody Vegetation

| | | | |
|---|---|---|---|
| **Mean CC:** | 3.95 | **Native Spp.:** | 19 |
| **Total Spp.:** | 21 | **Non-Native Spp.:** | 2 |
| **FQAI:** | 18.11 | **Percent Native:** | 90% |
| **Total Abundance:** | 71 | **avg dbh (cm):** | 12.3 |

*(non native species are in bold)*

| Species | Common Name | Type | Avg. dbh (cm ) | CC | Abundance | Density (ind./100m$^2$) | Relative Density |
|---|---|---|---|---|---|---|---|
| *Acer negundo* | Box elder | tree | 34.4 | 3 | 2 | 0.10 | 2.8% |
| *Acer saccharinum* | Silver maple | sapling | 5.9 | 3 | 2 | 0.10 | 2.8% |
| *Aesculus glabra* | Ohio buckeye | sapling | 4.1 | 6 | 8 | 0.40 | 11.3% |
| *Carya laciniosa* | Shellbark hickory | sapling | 4.4 | 7 | 1 | 0.05 | 1.4% |
| *Celtis occidentalis* | Hackberry | tree | 33.5 | 4 | 4 | 0.20 | 5.6% |
| | Hackberry | sapling | 5.0 | | 4 | 0.20 | 5.6% |
| *Crataegus mollis* | downy hawthorn | sapling | 5.8 | 3 | 1 | 0.05 | 1.4% |
| *Fagus grandifolia* | Beech | sapling | 3.6 | 7 | 6 | 0.30 | 8.5% |
| *Fraxinus americana* | White ash | sapling | 6.6 | 6 | 3 | 0.15 | 4.2% |
| *Fraxinus pennsylvanica* | Green ash | sapling | 4.8 | 3 | 4 | 0.20 | 5.6% |
| *Juglans nigra* | Black walnut | tree | 50.0 | 5 | 2 | 0.10 | 2.8% |
| | Black walnut | sapling | 4.5 | | 3 | 0.15 | 4.2% |
| *Lindera benzoin* | Spicebush | shrub | na | 5 | 6 | 0.30 | 8.5% |
| *Platanus occidentalis* | Sycamore | sapling | 5.2 | 7 | 1 | 0.05 | 1.4% |
| *Populus deltoides* | Cottonwood | tree | 62.5 | 3 | 1 | 0.05 | 1.4% |
| *Prunus serotina* | Black cherry | tree | 46.4 | 3 | 1 | 0.05 | 1.4% |
| | Black cherry | sapling | 2.2 | | 2 | 0.10 | 2.8% |
| *Quercus coccinea* | Scarlet oak | sapling | 2.4 | 6 | 1 | 0.05 | 1.4% |
| *Rhubus occidentalis* | black raspberry | shrub | na | 1 | 9 | 0.45 | 12.7% |
| *Tilia americana* | Linden | sapling | 4.1 | 6 | 2 | 0.10 | 2.8% |
| *Ulmus americana* | American elm | tree | 19.7 | 2 | 5 | 0.25 | 7.0% |
| *Vitis sp.* | Grape vine | vine | 6.0 | 3 | 1 | 0.05 | 1.4% |
| ***Lonicera maackii*** | **amur honeysuckle** | shrub | na | 0 | 1 | 0.05 | 1.4% |
| ***Rosa multiflora*** | **Multiflora rose** | shrub | na | 0 | 1 | 0.05 | 1.4% |
| | | | | **Native Species:** | 69 | 3.45 | 97.2% |
| | | | | **Non-Native Species:** | 2 | 0.10 | 2.8% |

CC = Coefficient of Conservatism
FQAI = Floristic Quality Assessment Index

# TABLE 13
## 2005 Functional Monitoring Data Summary
## Area 1, Phase III Woody Vegetation

| | | | |
|---|---|---|---|
| **Mean CC:** | 3.38 | **Native Spp.:** | 14 |
| **Total Spp.:** | 16 | **Non-Native Spp.:** | 2 |
| **FQAI:** | 13.50 | **Percent Native:** | 88% |
| **Total Abundance:** | 192 | **avg dbh (cm):** | 16.1 |

*(non native species are in bold)*

| Species | Common Name | Type | Avg. dbh (cm ) | CC | Abundance | Density (ind./100m$^2$) | Relative Density |
|---|---|---|---|---|---|---|---|
| *Acer negundo* | Box elder | tree | 8.2 | 3 | 14 | 0.70 | 7.3% |
| *Acer rubrum* | Red maple | sapling | 0.9 | 2 | 5 | 0.25 | 2.6% |
| *Acer saccharum* | Sugar maple | tree | 13.3 | 5 | 16 | 0.80 | 8.3% |
| | Sugar maple | sapling | 1.2 | | 2 | 0.10 | 1.0% |
| *Celtis occidentalis* | Hackberry | tree | 8.8 | 4 | 8 | 0.40 | 4.2% |
| *Cornus racemosa* | Gray dogwood | tree | 4.5 | 1 | 2 | 0.10 | 1.0% |
| *Fagus grandifolia* | Beech | sapling | 0.9 | 7 | 22 | 1.10 | 11.5% |
| *Fraxinus americana* | White ash | tree | 27.4 | 6 | 36 | 1.80 | 18.8% |
| | White ash | sapling | 1.4 | | 1 | 0.05 | 0.5% |
| *Fraxinus pennsylvanica* | Green ash | tree | 25.6 | 3 | 14 | 0.70 | 7.3% |
| *Prunus serotina* | Black cherry | tree | 13.7 | 3 | 4 | 0.20 | 2.1% |
| | Black cherry | sapling | 0.7 | | 1 | 0.05 | 0.5% |
| *Quercus palustris* | Pin oak | sapling | 1.7 | 5 | 1 | 0.05 | 0.5% |
| *Quercus rubra* | Red oak | sapling | 1.1 | 6 | 3 | 0.15 | 1.6% |
| *Rubus occidentalis* | black raspberry | shrub | na | 1 | 4 | 0.20 | 2.1% |
| *Tilia americana* | Linden | sapling | 1.6 | 6 | 6 | 0.30 | 3.1% |
| *Ulmus americana* | American elm | tree | 25.4 | 2 | 8 | 0.40 | 4.2% |
| ***Lonicera maackii*** | **amur honeysuckle** | shrub | na | 0 | 36 | 1.80 | 18.8% |
| ***Rosa multiflora*** | **Multiflora rose** | shrub | na | 0 | 9 | 0.45 | 4.7% |
| | | | **Native Species:** | | 147 | 7.35 | 76.6% |
| | | | **Non-Native Species:** | | 45 | 2.25 | 23.4% |

CC = Coefficient of Conservatism
FQAI = Floristic Quality Assessment Index