

**AREA 8, PHASE II
NATURAL RESOURCE RESTORATION
DESIGN PLAN**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO**



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**U.S. DEPARTMENT OF ENERGY
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LIST OF ACRONYMS AND ABBREVIATIONS

A1P3	Area 2, Phase III
A8P2	Area 8, Phase II
A8P3	Area 8, Phase III
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DBH	diameter breast-height
DOE	U.S. Department of Energy
FEMP	Fernald Environmental Management Project
IEMP	Integrated Environmental Monitoring Plan
NRRDP	Natural Resource Restoration Design Plan
NRRP	Natural Resource Restoration Plan
NRTs	Natural Resource Trustees
ODOT	Ohio Department of Transportation
OEPA	Ohio Environmental Protection Agency
QAJSP	Quality Assurance Job-Specific Plan
S&H	Safety and Health
SCS	Soil Conservation Service
SEP	Sitewide Excavation Plan
USDA	U.S. Department of Agriculture

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1.0 INTRODUCTION

The Fernald Environmental Management Project (FEMP) is a former uranium processing plant owned by the U.S. Department of Energy (DOE) that is undergoing extensive environmental remediation under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). DOE is liable under CERCLA for injuries to natural resources resulting from a release or threat of release of hazardous substances. DOE, in concert with other CERCLA-appointed Natural Resource Trustees (NRTs), are actively working to resolve the liability through implementation of natural resource (i.e., ecological) restoration projects integrated with the CERCLA remedial action process.

The FEMP NRTs have tentatively agreed to an approach for restoration of the site as set forth in the Natural Resource Restoration Plan (NRRP; DOE 1998a). The NRRP establishes the components of, and provides conceptual plans for, 12 ecological restoration projects at the FEMP along with an implementation schedule for the majority of the 1,050-acre site. This Natural Resource Restoration Design Plan (NRRDP) for Area 8, Phase II (A8P2) is the third of the 12 natural resource restoration projects planned across the site. The NRRDP includes all of the details and information necessary to implement, monitor, and maintain the ecological restoration of A8P2.

1.1 PROJECT OVERVIEW

Ecological restoration of A8P2 will include the establishment of several types of habitat native to southwestern Ohio, including three different forest types and an oak savanna. Also, the existing riparian corridor will be expanded and enhanced. A 4-acre materials handling area will be established within A8P2 as well. This area will be used to temporarily stockpile woodchips and other organic materials for use in this and other ecological restoration projects. Components of the materials handling area include the addition of a gravel access road and several drainage swales to control runoff. The swales drain to a series of ponds and filter wetland that will remove organic matter from the surface water runoff. An additional small vernal pool will also be constructed to provide available habitat for amphibians.

1.2 SITE DESCRIPTION

A8P2 is a 20-acre, grazed, or property pasture located in the northwest corner of the FEMP site. It is bounded to the west by Paddys Run Road, and to the east by Paddys Run (Figure 1-1). A8P2 lies within the historic floodplain of Paddys Run, and an existing riparian corridor is present along the

length of the A8P2 reach. An off-property cultivated farm field borders the site to the north. The southern boundary consists of a drainage ditch that flows west to east toward Paddys Run, adjacent to train tracks that provide rail access to the FEMP. Until recently, A8P2 was leased to a farmer by DOE and used to graze cattle. The site is part of a predominantly rural, agricultural landscape. A mosaic of cropland, deciduous hedgerows, and small patches of successional hardwood forest make up the surrounding area.

1.2.1 Topography

The topography of A8P2 has been altered in several locations. It appears from historical aerial photographs and the current site topography that approximately 6 feet of soil has been removed from a good portion of the materials handling area (Figure 1-1). A 1954 aerial photo shows a significant amount of earthwork being conducted in this area. Also, shovel tests across A8P2 in support of the cultural resource survey (conducted in November 1999) confirmed that the area had been disturbed.

The main water feature across A8P2 are two man-made ditches used to control surface water runoff. Both are configured in a straight line running west to east across A8P2 towards Paddys Run (Figure 1-1). Both drainageways begin to meander near the confluence with Paddys Run. Both ditches appear on early aerial photos (ca. 1950), so they have been in place for some time. This ditch drains residential and agricultural land west of the FEMP boundary.

In areas where the A8P2 topography has not been significantly altered (i.e., south of the northernmost drainage ditch), rolling slopes set back from an historic floodplain terrace are present. These features are typical along Paddys Run at the FEMP. In general, all of A8P2 drains to Paddys Run.

A good portion of A8P2 lies within the 100-year floodplain of Paddys Run. However, actual floodplain habitat is limited because of the steep cut banks located along much of the western edge of Paddys Run that allows flooding only when a flood event close to the 100-year event occurs.

1.2.2 Vegetation

Much of A8P2 is characteristic of grazed pasture. Isolated patches of trees exist across A8P2, which are represented on Figure 1-2 as "Existing Forest," consisting of black cherry (*Prunus serotina*), sycamore (*Platanus occidentalis*), cottonwood (*Populus deltoides*), silver maple (*Acer saccharinum*),

boxelder (*Acer negundo*), honeylocust (*Gleditsia triacanthos*), red cedar (*Juniperus virginiana*), and American elm (*Ulmus americana*). The understory and shrub layer within these areas is limited primarily to multiflora rose (*Rosa multiflora*). Typical pasture grasses such as fescue (*Festuca spp.*) and bluegrass (*Poa spp.*) are present across A8P2. Some noxious weeds are present (i.e., thistle), but tall ironweed (*Vernonia fasciculata*) is present in good numbers within some areas where the topsoil is intact.

Woody vegetation is more dense along the Paddys Run riparian corridor. These areas (shown as "Existing Riparian" on Figure 1-2) include black walnut (*Juglans nigra*), chinquapin oak (*Quercus muhlenbergii*), Ohio buckeye (*Aesculus glabra*), shellbark hickory (*Carya laciniosa*), osage orange (*Maclura pomifera*), sycamore, boxelder, and hackberry. As with the pasture areas, the woody understory and shrub layers are dominated by multiflora rose and bush honeysuckle (*Lonicera mackii*). A closed canopy and leaf layer has built up in some areas, resulting in suppression of pasture grasses. However, grazing has apparently limited the formation of a woodland herbaceous layer.

1.2.3 Soils

Soils throughout the site are mapped by the Soil Conservation Service (SCS) as deep, well drained, with no serious limitations to the establishment of trees. All of the soils are described as ranging from slightly acid to slightly alkaline, a range conducive to establishment of almost all plants indigenous to southwestern Ohio. The SCS considers all of the soils within A8P2 as good candidates for the establishment of upland forest and wildlife habitat (SCS 1980). All of the soils are well drained and considered poorly suited for wetland establishment, so a small amount of clay may need to be imported to hold water in the wetland and vernal pool.

The majority of A8P2 is mapped as Genesee loam. Genesee soils are described as deep, nearly level, well-drained soils typical of floodplains. Soils in the Genesee series are well suited to establishment of a broad spectrum of plants other than those associated with the wettest and driest of sites (SCS 1980). It should be noted that most of the historic topography alterations in A8P2 has occurred within the Genesee soils. However, the materials handling area occupies the majority of the scraped area, so most planting areas are not affected by the loss in topsoil.

A narrow band of Henepin silt loam is located along Paddys Run. Hennepin soils are described as deep, well drained, and typically found on slopes along streams (SCS 1980). Most of the Hennepin soils found in A8P2II have existing woody vegetation in place.

Uniontown silt loam is found on the southwest portion of A8P2II along Paddys Run Road. Uniontown soils are described as deep, gently sloping, and well drained (SCS 1980). Uniontown soils are well suited for the establishment of grasses; thus, an oak savanna is planned for corresponding areas in A8P2II.

Surface soil was sampled in the summer of 1999 to evaluate soil quality characteristics. The findings from this effort reinforced the SCS descriptions except for an area with low pH (5.6) in the northwest corner of the site. This result was attributed to intense livestock operation, since a cattle feeding trough and holding pen were located near the sample location. A high concentration of cow manure is visible in this area. All other areas within A8P2II had pH ranging from 6.8 to 7.8. Soil samples taken in A8P2II shows that organic material in the soil averaged around 3 percent.

1.2.4 Hydrology and Wetlands

No part of the site was identified as wetland during a sitewide wetland delineation of the entire FEMP property completed in 1993 (Ebasco 1993). None of the three soil series mapped on the site (Genesee, Hennepin, or Uniontown) are classified as hydric soils. Surface water features are limited to the two drainage ditches cutting across the bottom third of A8P2II, and Paddys Run along the eastern edge of the project area (Figure 1-1). These features are described in Section 1.2.1.

1.2.5 Wildlife

Between 1986 and 1987, Miami University tabulated 132 families of terrestrial invertebrates, 47 families of benthic macroinvertebrates, 21 species of fish, 10 species of amphibians and reptiles, 98 species of birds, and 8 species of mammals. Typical wildlife species found in the grazed pastures at the FEMP include the bobwhite quail (*colinus virginianus*), eastern meadowlark (*sturnella neglecta*), red-winged blackbird (*agelaius phoeniceus*), meadow vole (*microtos pennsylvanicus*), red fox (*Vulpes folva*), and whitetail deer (*odocoileus virginianus*).

Wildlife use of A8P2 is typical of grazed pasture and open woodlands. Facemire et. al. (1990) provide a comprehensive list of wildlife present at the FEMP, including A8P2. Several threatened and endangered wildlife species have been found within A8P2. The federally-endangered Indiana bat (*Myotis sodalis*) has been identified along the Paddys Run corridor on the eastern edge of the project site. Also, the state-threatened Sloan's crayfish (*Orconectes sloanii*) is located within Paddys Run. Revegetation and erosion control measures are considered in this NRRDP in order to protect and enhance the habitat for these special-status species.

1.3 REMEDIAL ACTION STATUS

A8P2 has undergone soil certification pursuant to the Sitewide Excavation Plan (SEP; DOE 1998b). Since A8P2 is located in a remote area of the FEMP, primarily upgradient and upwind of the Former Production Area, no contaminated soil was anticipated and the area was sampled for soil certification. As expected, certification samples revealed that no contamination was present, and A8P2 achieved "Certified Area" status on September 23, 1999.

1.4 RELATIONSHIP TO THE NRRP CONCEPTUAL RESTORATION APPROACH

The general goals for ecological restoration at the FEMP will be met through this project. These goals include the establishment of the early stages of a multi-use forest by planting native, presettlement plant communities and the enhancement of wildlife habitat (DOE 1998b). However, the functional objectives specific to A8P2 restoration have been refined since the last submittal of the NRRP. Originally, A8P2 reforestation was described simply as a combination of upland forest and riparian forest establishment. For this NRRDP, revegetation has evolved to include specific forest types found throughout the region. An oak savanna, which was not discussed in the NRRP, has also been added. Lastly, the materials handling area was not envisioned in the NRRP, but was determined necessary for this and future restoration of A8P3.

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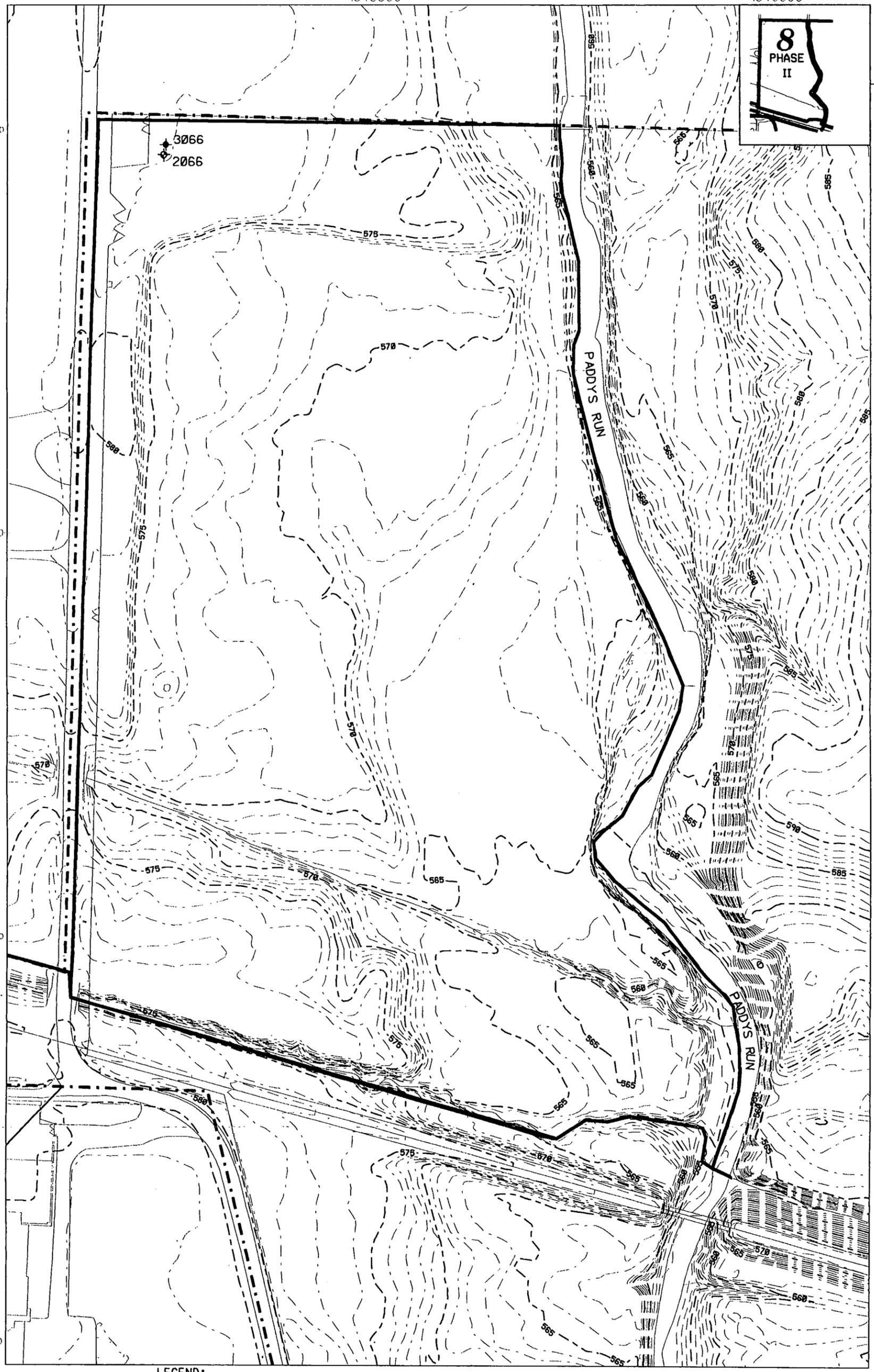
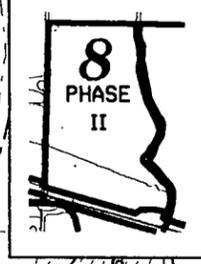
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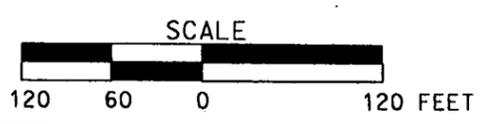


FIGURE 1-1. AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN
 CURRENT TOPOGRAPHY AND SITE FEATURES

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2.0 DESIGN COMPONENTS AND GOALS

This section describes the major components and goals for A8P2 ecological restoration. In general, there are two main phases: construction of the materials handling area and revegetation of the remainder of the site. These components are discussed in more detail below.

2.1 MATERIALS HANDLING AREA

A materials handling area will be constructed in order to manage excess woodchips and other organic material generated from other projects across the FEMP to be used in the restoration of Area 8, Phase III (A8P3). Since the material handling area will be used as a staging area for incoming plant material, it must be constructed before revegetation efforts in A8P2 can begin. Therefore, construction of the material handling area has been broken out into a separate phase of the project, and implementation is planned for early Spring 2000.

Soil in the materials handling area is less suitable for ecological restoration than other portions of A8P2 due to the prior disturbance of that area. The use of the area for organic material handling and management will result in the improvement of soil quality over time. The approach for restoring this portion of A8P2 when the location is no longer needed for organic material management is presented in Section 4.2.8 of this NRRDP.

2.2 REVEGETATION

Pursuant to the NRRP, revegetation of A8P2 is designed to restore presettlement plant communities native to southwest Ohio. Figure 1-2 shows the location of the habitat types to be restored in A8P2. These include three forest types (oak-maple, beech-maple, and mesophytic), and an oak savanna, as well as enhancement of the existing riparian corridor and the installation of a wetland and vernal pool. A visual buffer area and a small grassland patch are also included in the vicinity of the materials handling area.

2.2.1 Forest Types

Several references have been used to determine the appropriate plant communities, including Braun (1950), Gordon (1966, 1969), Harker et. al. (1998), Sears (1925), and Yahner (1995). As stated above, forest types chosen for A8P2 ecological restoration include beech-maple, oak-maple, and mesophytic.

On a large scale, the FEMP is located in a transition zone between these forest types. This transition is driven by several major historic changes in climate and geology, which are briefly discussed below. Glaciation is a major factor in the distribution of forests across Ohio (Braun 1941, Yahner 1995). Following the last period of glaciation – the Wisconsin – changes in climate dictated the formation of the forest types present today. After the Wisconsin Glacier retreated (around 15,000 years ago), a warming and drying trend occurred. This period resulted in the eastern expansion of the tallgrass prairie and oak-hickory forest (Braun 1941). Over time, the climate became more humid, and a more diverse deciduous forest developed and expanded into prairie areas (Braun 1934). Several of these dry to moist shifts in vegetational composition have occurred over time, resulting in the assemblage of forests over glaciated areas that are present today. In contrast, unglaciated areas have not experienced the dramatic changes in soil composition, topography, and moisture that glaciers caused. Forests in unglaciated areas have had much more time to develop into the complex, diverse systems that are present today (Braun 1941). This historical context has led to the selection of the specific forest types to be established in A8P11.

2.2.1.1 Mesophytic Forest

The mixed mesophytic forest has developed in unglaciated areas with adequate moisture. Perhaps the best example of this type of forest is found in the Allegheny and Cumberland mountains and plateaus (Braun 1941). Farther west is a broad transition to the drier oak-hickory forest. Braun (1950) terms this transition zone the “western mesophytic forest.” Western mesophytic and mixed mesophytic regions are differentiated by Gordon (1969), particularly in the extensive referencing of Braun’s work. Gordon does not make a distinction of the two forest types on his 1966 map of Ohio’s vegetation. The mesophytic forest plots proposed in this NRRDP were developed to reflect the western mesophytic forest types described by Gordon (1969) and Braun (1941).

Southwest Ohio represents the southern edge of Wisconsin glaciation. Because of this, mesophytic forests typically are limited to dissected portions of earlier Illinoian glaciation, where adequate moisture is present (Braun 1950). The increased development time afforded by the mesophytic forest has led to a very diverse assemblage of plants that lack any particular dominant species. Table 2-1 shows that the A8P11 mesophytic forest type consists of more species (36) than any other forest type.

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2.2.1.2 Beech-Maple Forest

The beech-maple forest represents the climax community of glaciated areas. Braun (1941) describes the beech-maple forest as the "northern mesophytic expression of the deciduous forest." Shade-tolerant beech (*Fagus grandifolia*) were able to take over the established oak-hickory forests once moisture increased after glaciation (Braun 1934). Sugar maple (*Acer saccharum*) co-dominates this forest type, except where moisture is too great. This appears to be a primary area of distinction between beech-maple and mesophytic forest. Sugar maple comprises 25 to 50 percent of beech-maple forest and less than 1 percent of mesophytic forest (Braun 1950). This distinction is reflected in the A8P11 forest-type planting lists (Tables 2-1 and 2-2).

2.2.1.3 Oak-Maple Forest

The oak-maple forest type represents a drier component of post-glacial forests. In this area, the formation of the Oak-maple forest is similar to that of the beech-maple forest, except that complete transition to beech-maple is limited by comparatively dry conditions (Harker et. al., 1998). The oak-hickory forest type became dominant in the Ozark and interior plateaus as temperatures rose and humidity levels dropped in the middle of North America (Gordon 1969). Post glacial periods of drying encouraged the eastward and northward movement of the oak hickory forests with the northwestern extent of the movement residing in southwest Ohio (Braun 1941). Oak-sugar maple forests are characterized by Gordon (1969) as the expression of the oak-hickory forest that dominates this portion of southwest Ohio.

2.2.2 Oak Savanna

Oak savanna represents a transition between tallgrass prairie and oak-hickory forest (Packard 1997) and is one of the most endangered ecosystems in the nation. As discussed above, these habitats moved north and east as conditions became warmer and drier following glaciation. At one point, at least 300 prairies were present across Ohio (Gordon 1969). Almost all have been destroyed, with only isolated remnants existing today. Oak savannas were found in Wisconsin till plains in the western portion of the state (Gordon 1969). Native Americans maintained some areas as savannas through periodic burning. Packard (1997) shows that the transition areas from prairie to forest extended from western Kentucky and southern Indiana into southwestern and central Ohio, and that the glacial till that composes local soils provides an excellent opportunity for oak savanna restoration.

2.3 PLANTING STRATEGY

A restoration approach has been developed for A8P11 that takes into account elements of soils, topography, hydrology, and ecological succession into account. The main considerations that drive the restoration approach are discussed below.

2.3.1 Habitat Type Placement

Since A8P11 is composed of similarly-derived soils, the location of forest types is generally driven by hydrology. The mesophytic forest occupies relatively wetter areas, while the oak-maple is located in drier portions of the project area (Figure 1-2). This habitat placement through hydrological gradient is also related with topography. The drier oak-maple forest is located on elevated sites, while the beech-maple forest is located on slopes and the mesophytic forest in low-lying areas. The topography is appropriate for the beech-maple and oak-maple forests, but not ideal for the mesophytic forest. Braun (1950) limited the location of mesophytic forests around Cincinnati to steeper sloped areas. However, given that A8P11 is considered a demonstration project that illustrates forest types across the FEMP, the mesophytic forest is included.

The oak savanna is situated in an area that provides a gradient from a drier hilltop to streamside habitat (Figure 1-2). This arrangement is appropriate, since oak savannas can be found in a wide range of conditions (Packard 1997).

A visual buffer area has been strategically placed to screen the view of the materials handling area from Paddys Run Road (Figure 1-2). This placement is driven by aesthetics rather than habitat requirements. However, all species used in the buffer planting are appropriate for the topography and hydrology present.

2.3.2 Selection of Species

Specific species to be planted within each plant community were determined through Braun (1961), Facemire et. al. (1990), Hamilton County Park District (1998), and the Fernald NRTs (OEPA 1998). Table 2-3 lists the master plant list for A8P11. Plants were excluded from use in A8P11 if they were not listed in at least one of the references above. A special effort was made to include species listed in the 1819 land survey of Crosby Township (OEPA 1998). This early record of local vegetation is a good source for the composition of presettlement plant communities.

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2.3.3 Planting Densities

Ideal planting densities should be obtained from local reference information (Harker et. al. 1998). Reference information was collected in support of the Wetland Mitigation Design. This effort resulted in an average density of 430 plants per acre (Munro 1999). The overall planting densities for A8P2II forests approximate these findings. By adding the number of saplings per acre (165), one-half of the seedlings per acre (200), and the shrubs per acre (92), the desired forest planting density is reached. The establishment of the early stages of a multi-use forest is one of the goals of this restoration approach. These densities are discussed in greater detail below.

2.3.3.1 Saplings

Sapling trees will be planted at a density of 165 trees per acre. Large-scale planting of sapling species is expensive and is not commonly practiced in ecological restoration (Harker et. al. 1998). However, there are several benefits to the use of sapling species in this project. First, deer browsing impacts are minimized. Saplings are too tall to be completely browsed. Second, sapling trees will produce the desired canopy closure and self-propagation much sooner than seedling species. For instance, white oak (*Quercus alba*), a mast-producing tree which will be planted in all three forest types, may produce viable seed within 20 years (Rogers 1990). By planting saplings, the benefits of mast production (propagation, wildlife forage, etc.) will be gained almost twice as fast. Saplings also immediately provide perches for birds, thus hastening the recruitment of volunteer plant seed dispersal (Sauer 1998). The use of natural bird perches has proven successful in increasing seed dispersal on other restoration projects (Holl 1998). Lastly, saplings do not compete with grasses and weeds for similar resources.

2.3.3.2 Seedlings

Tree seedlings will be planted at a density of 400 per acre. The use of seedlings in addition to saplings will provide the immediate advantage of age stratification. An uneven-age stand of trees is most similar to what is found naturally and thus provides a greater benefit for wildlife (Yahner 1995). The establishment of seedlings also lessens the dependence of volunteer recruitment to increase overall stem densities. Seedlings are more susceptible to drought, competition from grasses and weeds, and deer browsing. Therefore, seedlings are planted at roughly twice their ultimately desired density. The exact species mix of seedlings will be determined by availability and will consist of 75 percent dominants and 25 percent associates for each forest type. Blue Ash (*fraxinus quadrangulata*) and chestnut (*castanea*

dentata) seeds will be either directly planted or grown and transported into mesophytic and beech-maple patches. The exact number will be determined by seed availability.

2.3.3.3 Shrubs

Shrub species will be planted at a density of approximately 92 per acre. This density was obtained from the forest restoration design for the Ecological Restoration Park (DOE 1998c). Roughly half of the forest patches will not be planted with shrubs. This approach will allow for several research efforts that will benefit future restoration work at the FEMP. First, some unplanted patches will be surveyed to determine the extent of volunteer recruitment. Several variables may be factored, including the use of native ground covers and the effectiveness of invasive species control. The effects of deer browsing may also be investigated through the use of deer repellents. A research plan will be developed for A8P2 and will be submitted to the NRTs by August 1, 2000.

2.3.3.4 Oak Savanna

The oak savanna is designed at a much lower density than the forest types. This habitat will be planted at a density of 34 trees and 34 shrubs per acre (OEPA 1999). All the trees planted will be large sapling size. No seedlings will be planted, in anticipation of periodic burns as part of maintenance.

2.3.3.5 Existing Riparian Forest

The existing riparian woods will be planted at an average density of approximately 40 trees and 40 shrubs per acre. This density is lower than the forest type density because of the presence of existing trees. No seedlings will be planted in the riparian forest.

2.3.4 Grasses and Forbs

All planted areas will be seeded with a native mix of grasses and/or forbs, with the exception of the existing riparian forest. Table 2-4 lists the grass mix for the forest types while Table 2-5 lists the oak savanna grass and forb species and Table 2-6 lists wetland species for use in the vernal pools. Existing grasses will be eradicated prior to seeding with the use of herbicide. Two applications are planned, one in Fall 1999 and one in Spring 2000.

AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 2-1
Mesophytic Forest Type

Patch	MM8	MM9	MM10	MM11	MM12	MM13	MM14	MM19	MM20	MM21	MM22	Total
Trees	43	48	48	47	45	45	45	41	40	45	48	495
Shrubs	24	0	27	0	25	0	25	23	0	25	0	149
Acres	0.26	0.26	0.26	0.25	0.26	0.25	0.26	0.25	0.23	0.25	0.26	2.79

Scientific Name	Common Name	Plant Type												
<i>Acer rubrum</i>	red maple	overstory tree	3	3	3	4	4	3	4	3	4	3	4	38
<i>Acer saccharinum</i>	silver maple	overstory tree	1	1	1	2			1					6
<i>Acer saccharum</i>	sugar maple	overstory tree								1	1	1		3
<i>Aesculus glabra</i>	Ohio buckeye	overstory tree	1	1	1	1								4
<i>Aesculus octandra</i>	yellow buckeye	overstory tree	6	6	5	5	5	6	6	6	5	6	6	62
<i>Carya ovata</i>	shagbark hickory	overstory tree		1	1	1	1	2	1	1	1	1	2	12
<i>Celtis occidentalis</i>	hackberry	overstory tree	3	2	2	2	2	2	3	3	2	2	2	25
<i>Cornus racemosa</i>	grey dogwood	understory tree		3	3	3	3							12
<i>Fagus grandifolia</i>	American beech	overstory tree	5	5	5	5	5	5	5	5	4	4	4	52
<i>Fraxinus americana</i>	white ash	overstory tree	5	5	5	5	5	5	5	5	5	5	6	56
<i>Fraxinus pennsylvanica</i>	green ash	overstory tree						3				3	2	8
<i>Gymnocladus dioica</i>	Kentucky coffee tree	overstory tree	1				1		1					3
<i>Juglans cinerea</i>	butternut	overstory tree	1	1	1	1	1	1	1	1		1	1	10
<i>Juglans nigra</i>	black walnut	overstory tree	1	1	1	1	1	1	1		1	1		9
<i>Liquidambar styraciflua</i>	sweetgum	overstory tree									1	1	1	3
<i>Liriodendron tulipifera</i>	tulip poplar	overstory tree								1		1	1	3
<i>Nyssa sylvatica</i>	sourgum	overstory tree					1	1	1					3
<i>Platanus occidentalis</i>	sycamore	overstory tree	1	1	1									3
<i>Prunus serotina</i>	black cherry	overstory tree	2	2	2	2	2	2	2			2	2	20
<i>Quercus alba</i>	white oak	overstory tree									1		1	2
<i>Quercus imbricaria</i>	shingle oak	overstory tree						1						1
<i>Quercus muhlenbergii</i>	chinquapin oak	overstory tree	1								1			2
<i>Quercus palustris</i>	pin oak	overstory tree		3	3	3					2	2	2	15
<i>Quercus rubra</i>	red oak	overstory tree			1	1	1	1	1	1	1	1	1	9
<i>Quercus shumardii</i>	Shumard oak	overstory tree					1	1	1	1				4
<i>Sassafras albidum</i>	sassafras	understory tree		1								1	1	3
<i>Tilia americana</i>	American basswood	overstory tree	10	10	10	9	9	9	10	9	9	8	10	103
<i>Ulmus americana</i>	American elm	overstory tree	2	2	3	2	3	2	2	2	2	2	2	24
<i>Corylus americana</i>	hazel	shrub	5						5	4		5		19
<i>Hamamelis virginica</i>	witch-hazel	shrub	5		5		4		4					18
<i>Hypericum spathulatum</i>	shrubby St. John's wort	shrub			5		4		5			4		18
<i>Ilex veticallata</i>	winterberry	shrub					6			5		4		15
<i>Lindera benzoin</i>	spice bush	shrub	5				6		5	5				21
<i>Rosa palustris</i>	swamp rose	shrub			5		5			5				15
<i>Rubus occidentalis</i>	black raspberry	shrub	4		6							6		16
<i>Viburnum prunifolium</i>	black-haw viburnum	shrub	5		6				6	4		6		27

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**Table 2-2
Beech - Maple Forest Type**

Patch	BS23	BS24	BS25	BS26	BS27	BS28	BS29	BS30	Total
Trees	43	38	49	36	39	35	32	32	304
Shrubs	24	0	27	0	22	0	17	0	90
Acres	0.25	0.22	0.29	0.21	0.23	0.21	0.18	0.18	1.77

Scientific Name	Common Name	Plant Type								
<i>Acer nigrum</i>	black maple	overstory tree						1		1
<i>Acer rubrum</i>	red maple	overstory tree			1					1
<i>Acer saccharinum</i>	silver maple	overstory tree	2	1	2	2	2			9
<i>Acer saccharum</i>	sugar maple	overstory tree	11	9	13	9	9	9	7	8
<i>Aesculus glabra</i>	Ohio buckeye	overstory tree					1			1
<i>Asimina triloba</i>	pawpaw	understory tree	1							1
<i>Carpinus caroliniana</i>	ironwood	understory tree						1	1	2
<i>Carya cordiformis</i>	bitternut hickory	overstory tree			1					1
<i>Carya laciniosa</i>	shellbark hickory	overstory tree		1						1
<i>Carya ovata</i>	shagbark hickory	overstory tree	1	1					2	4
<i>Celtis occidentalis</i>	hackberry	overstory tree	1	1	1					3
<i>Cornus florida</i>	flowering dogwood	understory tree							1	1
<i>Fagus grandifolia</i>	American beech	overstory tree	21	20	24	16	19	19	16	17
<i>Fraxinus americana</i>	white ash	overstory tree	2	2	2	1	2	1	1	1
<i>Liriodendron tulipifera</i>	tulip poplar	overstory tree	2	2	3	2	2	2	2	1
<i>Nyssa sylvatica</i>	sourgum	overstory tree		1	1	1	1	1	1	6
<i>Ostrya virginiana</i>	hop hornbeam	understory tree						1	1	1
<i>Prunus serotina</i>	black cherry	overstory tree			1	1	1			3
<i>Quercus alba</i>	white oak	overstory tree				1	1			2
<i>Quercus imbricaria</i>	shingle oak	overstory tree						1		1
<i>Quercus prinus</i>	chestnut oak	overstory tree				1				1
<i>Quercus velutina</i>	black oak	overstory tree				1				1
<i>Tilia americana</i>	American basswood	overstory tree	1							1
<i>Ulmus americana</i>	American elm	overstory tree	1			1	1	1	1	1
<i>Hamamelis virginica</i>	witch-hazel	Shrub			6				4	10
<i>Rhus aromatica</i>	fragrant sumac	Shrub	5		5		4			14
<i>Rhus glabra</i>	smooth sumac	Shrub			5				3	8
<i>Rosa carolina</i>	Carolina rose	Shrub	5				5			10
<i>Salix humila</i>	pussy willow	Shrub	4				4		3	11
<i>Sambucus canadensis</i>	elder	Shrub			5				4	9
<i>Staphylea trifolia</i>	bladdernut	Shrub			6				3	9
<i>Symphoricarpos orbiculatus</i>	corralberry	Shrub	5				5			10
<i>Viburnum acerifolium</i>	maple-leaf viburnum	Shrub	5				4			9

AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 2-3 Master Plant List

Scientific Name	Common Name	Plant Type	Qty.	Scientific Name	Common Name	Plant Type	Qty.
<i>Acer nigrum</i>	black maple	overstory tree	23	<i>Liriodendron tulipifera</i>	tulip poplar	overstory tree	26
<i>Acer rubrum</i>	red maple	overstory tree	62	<i>Nyssa sylvatica</i>	sourgum	overstory tree	11
<i>Acer saccharinum</i>	silver maple	overstory tree	15	<i>Ostrya virginiana</i>	hop hornbeam	understory tree	3
<i>Acer saccharum</i>	sugar maple	overstory tree	98	<i>Physocarpus opulifolius</i>	ninebark	shrub	23
<i>Aesculus glabra</i>	Ohio buckeye	overstory tree	22	<i>Platanus occidentalis</i>	sycamore	overstory tree	17
<i>Aesculus octandra</i>	yellow buckeye	overstory tree	62	<i>Populus deltoides</i>	cottonwood	overstory tree	21
<i>Asimina triloba</i>	pawpaw	understory tree	8	<i>Prunus serotina</i>	black cherry	overstory tree	34
<i>Carpinus caroliniana</i>	ironwood	understory tree	5	<i>Quercus alba</i>	white oak	overstory tree	39
<i>Carya cordiformis</i>	bitternut hickory	overstory tree	11	<i>Quercus bicolor</i>	swamp white oak	overstory tree	13
<i>Carya laciniosa</i>	shellbark hickory	overstory tree	20	<i>Quercus imbricaria</i>	shingle oak	overstory tree	3
<i>Carya ovata</i>	shagbark hickory	overstory tree	34	<i>Quercus macrocarpa</i>	bur oak	overstory tree	64
<i>Castanea dentata</i>	chestnut	overstory tree	0*	<i>Quercus muhlenbergii</i>	chinquapin oak	overstory tree	2
<i>Ceanothus americanus</i>	New Jersey tea	shrub	24	<i>Quercus palustris</i>	pin oak	overstory tree	26
<i>Celtis occidentalis</i>	hackberry	overstory tree	28	<i>Quercus prinus</i>	chestnut oak	overstory tree	4
<i>Cephalanthus occidentalis</i>	buttonbush	shrub	18	<i>Quercus rubra</i>	red oak	overstory tree	34
<i>Cercis canadensis</i>	redbud	understory tree	13	<i>Quercus shumardii</i>	Shumard oak	overstory tree	4
<i>Cornus drummondii</i>	roughleaf dogwood	understory tree	4	<i>Quercus velutina</i>	black oak	overstory tree	4
<i>Cornus florida</i>	flowering dogwood	understory tree	13	<i>Rhus aromatica</i>	fragrant sumac	shrub	20
<i>Cornus racemosa</i>	grey dogwood	understory tree	30	<i>Rhus glabra</i>	smooth sumac	shrub	18
<i>Corylus americana</i>	hazel	shrub	41	<i>Rosa carolina</i>	Carolina rose	shrub	21
<i>Crataegus mollis</i>	hawthorn	understory tree	4	<i>Rosa palustris</i>	swamp rose	shrub	15
<i>Euonymus atropurpureus</i>	burning bush	shrub	2	<i>Rosa setigera</i>	prairie rose	shrub	15
<i>Fagus grandifolia</i>	American beech	overstory tree	204	<i>Rubus occidentalis</i>	black raspberry	shrub	16
<i>Fraxinus americana</i>	white ash	overstory tree	87	<i>Salix humila</i>	pussy willow	shrub	15
<i>Fraxinus pennsylvanica</i>	green ash	overstory tree	41	<i>Sambucus canadensis</i>	elder	shrub	13
<i>Fraxinus quadrangulata</i>	blue ash	overstory tree	0*	<i>Sassafras albidum</i>	sassafras	understory tree	3
<i>Gymnocladus dioica</i>	Kentucky coffee tree	overstory tree	7	<i>Smilax rotundifolia</i>	greenbrier	shrub	5
<i>Hamamelis virginica</i>	witch-hazel	shrub	28	<i>Staphylea trifolia</i>	bladdernut	shrub	30
<i>Hypericum spathulatum</i>	shrubby St. John's wort	shrub	33	<i>Symphoricarpos orbiculatus</i>	corralberry	shrub	20
<i>Ilex veticallata</i>	winterberry	shrub	17	<i>Tilia americana</i>	American basswood	overstory tree	112
<i>Juglans cinerea</i>	butternut	overstory tree	10	<i>Ulmus americana</i>	American elm	overstory tree	33
<i>Juglans nigra</i>	black walnut	overstory tree	30	<i>Viburnum acerifolium</i>	maple leaf viburnum	shrub	14
<i>Juniperus virginiana</i>	red cedar	understory tree	30	<i>Viburnum prunifolium</i>	black-haw viburnum	shrub	27
<i>Lindera benzoin</i>	spicebush	shrub	29	<i>Xanthoxylum americanum</i>	prickly ash	shrub	31
<i>Liquidambar styraciflua</i>	sweetgum	overstory tree	3				

Total = 1,792

*Will be planted as seedlings only

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AREA 8, PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 2-4
Grass/Forb Mix - Upland Forest Patches (6 Acres Total Area)

Scientific Name	Common Name	Type	Rate (lb pls/ac.)	Rate (oz/ac.)	Seeds/oz.	Lbs. Req.	Oz. Req.
n/a	Re-Green	grass	10		n/a	60	
<i>Andropogon gerardii</i>	big bluestem	grass	3		n/a	18	
<i>Bouteloua curtipendula</i>	side-oats grama	grass	0.5		n/a	3	
<i>Elymus canadensis</i>	Canada wild rye	grass	3		n/a	18	
<i>Panicum virgatum</i>	switch grass	grass	0.5		n/a	3	
<i>Schizachyrium scoparium</i>	little bluestem	grass	2		n/a	12	
<i>Sorghastrum nutans</i>	Indian grass	grass	2		n/a	12	
<i>Asclepias tuberosa</i>	butterfly weed	forb		1.0	3,500		6
<i>Cassia fasciculata</i>	partridge pea	forb		1.0	3,800		6
<i>Echinacea purpurea</i>	purple cone flower	forb		0.5	6,600		3
<i>Heliopsis helianthoides</i>	ox-eye sunflower	forb		0.5	6,500		3
<i>Penstemon digitalis</i>	foxglove beardtongue	forb		0.25	100,000		1.5
<i>Ratibida pinnata</i>	grey-headed cone flower	forb		0.5	27,000		3
<i>Rudbeckia hirta</i>	black-eyed susan	forb		0.25	100,000		1.5
Totals =			21	4		126	24

000022

AREA 8, PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 2-5

Grass/Forb Mix - Upland Savanna Patches (2.5 Acres Total Area)

Scientific Name	Common Name	Type	Rate (lb pls/ac.)	Rate (oz/ac.)	Seeds/oz.	Lbs. Req.	Oz. Req.
n/a	Re-Green	grass	10		n/a	25	
<i>Andropogon gerardii</i>	big bluestem	grass	3		n/a	7.5	
<i>Bouteloua curtipendula</i>	side-oats grama	grass	0.5		n/a	1.25	
<i>Elymus canadensis</i>	Canada wild rye	grass	3		n/a	7.5	
<i>Panicum virgatum</i>	switch grass	grass	0.5		n/a	1.25	
<i>Schizachyrium scoparium</i>	little bluestem	grass	2		n/a	5	
<i>Sorghastrum nutans</i>	Indian grass	grass	2		n/a	5	
<i>Spartina pectinata</i>	prairie cordgrass	grass	1		n/a	2.5	
<i>Asclepias sulivantii</i>	Sullivant's milkweed	forb		1.0	4,500		2.5
<i>Calamagrostis canadensis</i>	blue-joint grass	grass		1.0	280,000		2.5
<i>Carex festucacea</i>	fescue sedge	sedge		3.0	36,000		7.5
<i>Carex lacustris</i>	lake bank sedge	sedge		3.0	32,000		7.5
<i>Carex normalis</i>	large straw sedge	sedge		3.0	25,000		7.5
<i>Carex stricta</i>	tussock sedge	sedge		3.0	53,000		7.5
<i>Hypoxis hirsuta</i>	yellow star grass	forb		0.25	80,000		0.625
<i>Lilium michiganense</i>	Michigan lilly	forb		1.0	10,000		2.5
<i>Lobelia spicata</i>	pale spiked lobelia	forb		0.125	900,000		0.3125
<i>Lysmachia quadriflora</i>	narrow leaved loostrife	forb		0.25	90,000		0.625
<i>Sisyrinchium agustifolium</i>	pointed blue-eyed grass	forb		0.5	30,000		1.25
<i>Amorpha canescens</i>	lead plant	shrub		0.5	17,000		1.25
<i>Asclepias tuberosa</i>	butterfly weed	forb		1.0	3,500		2.5
<i>Baptisia bracteata lecophaea</i>	cream wild indigo	forb		1.0	1,700		2.5
<i>Cassia fasciculata</i>	partridge pea	forb		1.0	3,800		2.5
<i>Echinacea purpurea</i>	purple coneflower	forb		0.5	6,600		1.25
<i>Eryngium yuccifolium</i>	rattlesnake master	forb		1.0	8,000		2.5
<i>Lespedeza capitata</i>	round-headed bush clover	forb		1.0	10,000		2.5
<i>Liatris aspera</i>	rough blazing star	forb		1.0	13,500		2.5
<i>Monarda fistulosa</i>	wild bergamot	forb		0.25	78,000		0.625
<i>Penstemon digitalis</i>	foxglove penstemon	forb		0.25	100,000		0.625
<i>Ratibida pinnata</i>	grey-headed coneflower	forb		0.5	27,000		1.25
<i>Rudbeckia hirta</i>	black-eyed Susan	forb		0.25	100,000		0.625
<i>Siliphium terebinthinaceum</i>	prairie dock	forb		1.0	1,100		2.5
<i>Solidago rigida</i>	stiff goldenrod	forb		0.25	46,000		0.625
<i>Tradescantia ohiensis</i>	Ohio spiderwort	forb		1.0	8,000		2.5
<i>Veronicastrum virginicum</i>	Culver's root	forb		0.125	750,000		0.3125
<i>Didecantheon meadia</i>	shooting star	forb		0.25	60,000		0.625
<i>Dalea purpureum</i>	purple prairie clover	forb		(unavailable - Ernst had it in 1999, but not 2000)			

Totals = 22 27.0 55 67.5

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AREA 8, PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 2-6

Grass/Forb Mix - Wetland Areas (1.0 Acre Approximate Total Area)

Scientific Name	Common Name	Type	Rate (lb pls/ac.)	Rate (oz/ac.)	Seeds/oz.	Lbs. Req.	Oz. Req.
n/a	Re-Green	grass	10		n/a	10	
<i>Andropogon gerardii</i>	big bluestem	grass	3		n/a	3	
<i>Elymus canadensis</i>	Canada wild rye	grass	3		n/a	3	
<i>Panicum virgatum</i>	switch grass	grass	0.5		n/a	0.5	
<i>Scirpus cyperinus</i>	woolgrass	grass	2		n/a	2	
<i>Spartina pectinata</i>	prairie cordgrass	grass	2		n/a	2	
<i>Carex lacustris</i>	lake sedge	sedge		3.0	32,000		3.0
<i>Carex lurida</i>	bottlebrush sedge	sedge		4.0	12,000		4.0
<i>Carex stipata</i>	awl-fruited sedge	sedge		3.0	34,000		3.0
<i>Carex stricta</i>	tussock sedge	sedge		3.0	53,000		3.0
<i>Carex vulpinoidea</i>	fox sedge	sedge		2.0	100,000		2.0
<i>Glyceria striata</i>	fowl manna grass	grass		2.0	160,000		2.0
<i>Juncus effusus</i>	soft rush	grass		1.0	1,000,000		1.0
<i>Scirpus atrovirens</i>	dark green bulrush	grass		1.0	460,000		1.0
<i>Aster novae-angliae</i>	New England aster	forb		1.0	70,000		1.0
<i>Cassia Herbcarpa</i>	wild senna	forb		2.0	1,400		2.0
<i>Desmodium canadense</i>	Canda tree tick-foil	forb		2.0	4,500		2.0
<i>Eupatorium maculatum</i>	spotted Joe-pye weed	forb		1.0	85,000		1.0
<i>Lobelia cardinalis</i>	cardinal flower	forb		0.25	300,000		0.25
<i>Lobelia siphilitica</i>	great blue lobelia	forb		0.25	470,000		0.25
<i>Monarda fistulosa</i>	bergamot	forb		1.0	78,000		1.0
<i>Rudbeckia hirta</i>	black-eyed Susan	forb		1.0	100,000		1.0
<i>Verbena hastata</i>	blue vervain	forb		1.0	100,000		1.0
<i>Carex frankii</i>	Frank's sedge	sedge	2		n/a	2	
Totals =			22.5	28.5		22.5	29

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3.0 GRADING PLAN

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Grading requirements for A8P2II consist of two main components: access into the area and road construction; and surface water runoff control from the materials handling area. A vernal pool will also be constructed in order to diversify habitat within A8P2II. Each component is discussed in more detail below.

3.1 ACCESS

Access into the material handling area will consist of a gravel road, suitable for use by semi-trailers, with sufficient area to turn around. Figure 3-1 shows the location of the access road and turnaround area. This access road will be used to deliver plant material for A8P2II restoration, as well as woodchips for stockpile and management to and from the A8P2III Restoration Project.

3.1.1 Grading Requirements

Earthwork for access construction will require the cut of approximately 750 cubic yards of soil to lessen the slope from Paddys Run road into the materials handling area. The access road grade will be leveled everywhere else. Minimal leveling is anticipated to the existing topography, except where several trees will need to be cleared.

3.1.2 Road Construction

The access road will consist of a typical gravel construction road used across the FEMP. This type of construction will include the placement of a geotextile liner, covered by Ohio Department of Transportation (ODOT) Type 304 crushed limestone aggregate. Approximately 700 square yards of geotextile liner and 400 tons of limestone aggregate will be required to construct the 400-foot access road. Proper drainage along the road must be maintained. This is particularly important with respect to protection of existing monitoring wells that are shown on Figure 3-1. The road construction must not result in surface water runoff toward the wells. Also, drainage along Paddys Run road must not be altered. Butler County will issue any requirements through their road access permitting program.

3.1.3 Fence/Gate Modifications

An existing gate will be utilized for access control into the project area. The existing perimeter fence will be set back from the road in order to allow for easier access by larger vehicles.

3.2 MATERIALS HANDLING AREA

The materials handling area will be used to stockpile woodchips and other organic material generated from FEMP activities for use during ecological restoration projects. The area encompasses approximately 4 acres (Figure 1-2). Woodchips will primarily be used as mulch cover for all planted trees, shrubs and seedlings. Approximately 32,000 cubic yards of woodchips can be stockpiled within the material handling area. However, only that needed for completion of A8PII and A8PIII is anticipated to be stored there. This amount of woodchips is estimated at less than 2,000 cubic yards. Woodchips will be delivered to the area via dump truck and managed in piles and windrows. Stockpiles will be turned as necessary to reduce odor and fire hazard. A portion of the materials handling area may be used in the future for staging and/or growing plant stock for other restoration projects. Details regarding plant stock staging/growing would be submitted in future NRRDPs.

3.2.1 Grading Requirements

Earthwork will be required to control runoff from the material handling area. Figure 3-1 shows the location of four shallow drainage swales that direct runoff into a series of vernal pools. Two pools outflow to a shallow wetland prior to release into the restored mesophytic forest type. Approximately 1,200 cubic yards will be moved to construct these drainage features. Six inches of clay will be compacted and used to line the ponds and wetlands.

3.3 VERNAL POOL

A vernal pool will be constructed at a location east of the filter wetland within the mesophytic and/or existing riparian forest types. This feature consists of a shallow depression approximately 10 feet in diameter and 3 feet deep that will become inundated with water during wet periods in the spring and fall. Several types of amphibians should benefit from this additional habitat.

The general location of the vernal pool is identified on Figure 3-1. The NRTs will determine the exact location of the pool in the field. The amount of soil removal required to excavate a 10-foot diameter, 3-foot deep depression with 3:1 side slopes formed on level ground is approximately 40 cubic yards.

3.4 FIELD IMPLEMENTATION

As stated in the Introduction, construction of the materials handling area has been broken out into a separate phase of the ecological restoration of A8PII. All earthwork and construction activities will take

place in the early spring, while revegetation efforts will take place later in Spring 2000. The intent is to use the completed materials handling area as the primary access and staging area for all revegetation efforts in the spring. In order to take advantage of the mobilized heavy equipment, the vernal pool discussed in Section 3.3 will be constructed as well.

3.4.1 Roles and Responsibilities

All earthwork and construction activities will be conducted by Fluor Fernald through the utilization of their on-site construction services contractor. Fluor Fernald will ensure that all applicable policies, procedures, and regulations will be met in the planning and implementation of the work. The NRTs have approval authority for this NRRDP.

3.4.2 Soils Handling

An excess of soil from grading is anticipated. All topsoil (6 inches deep) within grading areas will be removed and stockpiled within the materials handling area. Excess subsoil will be wasted as generated within the materials handling area without any alteration in drainage patterns. Topsoil will be replaced within each drainage swale and the ponds and wetlands. Hydric soil from the Trap Range will be imported to A8P2, if it is available.

3.4.3 Revegetation

The permanent seed mixes outlined in Tables 2-4 through 2-6 will be used to seed disturbed areas as early as possible after earthwork is complete in Spring 2000. The appropriate seed mix will be applied to the appropriate area via seed drill, hydroseeder, and/or hand broadcast. Straw mulch will be applied to all hand seeded areas. Weed free straw will be applied if available.

3.4.4 Sequencing

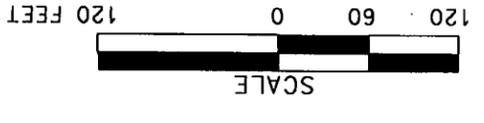
All earthwork for the road access and runoff control will be undertaken first, followed by road construction and fence/gate modifications. Drainage swales and the vernal pools will be constructed next. The additional vernal pool construction will occur last. Seeding of all disturbed areas will occur after all the earthwork is complete.

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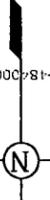
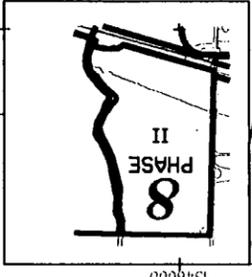
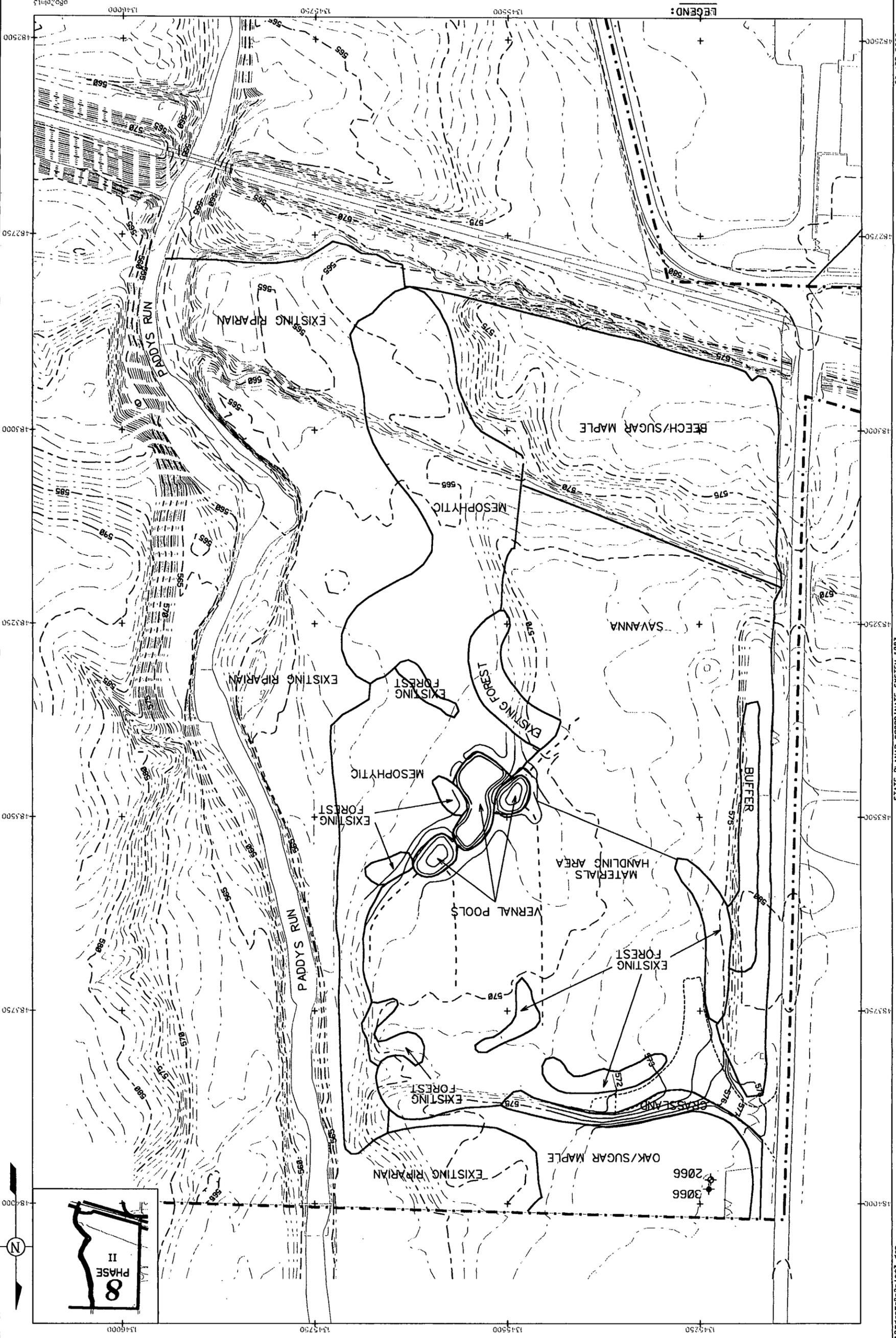
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FIGURE 3-1. AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN ACCESS ROAD AND MATERIALS HANDLING AREA



- LEGEND:
- FEMP BOUNDARY
 - - - ACCESS ROAD BOUNDARY
 - - - DRAINAGE SWALE (CENTERLINE)
 - - - GENERAL LOCATION OF ADDITIONAL VERNAL POOL



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4.0 PLANTING PLAN

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This section describes the specific approaches that will be used to plant the various habitats and features specified for A8P2.

4.1 PLOT DESIGN

Figure 4-1 shows the location of forest and savanna patches for A8P2. Each patch is comprised of a distinct mixture of native vegetation. As stated in Section 2.3.3.3, shrubs will be planted in approximately half of the patches. Details regarding the selection of forest types, species mixes, and planting densities can be found in Section 2.0 of this NRRDP. The specific habitat type patches are described below. Field implementation regarding all planting activities will be coordinated through the use of patch pages, which are included in Appendix B. The patch pages document the number and types of species to be planted in each patch, as well as the amount of mulch and seed required. Also, patch pages provide a means of documenting the schedule of water applied to a particular patch. Appendix B provides additional detail regarding the use of patch pages.

4.1.1 Oak-Maple Forest

The oak-maple forest type is comprised of four patches located in the northern portion of A8P2 (Figure 1-2). Table 4-1 provides the list of species to be planted in each patch. This forest type encompasses approximately 1 acre of A8P2. Because a cattle feeding trough and holding pen were located within this area, it has seen the highest concentration of cows across the site. Surface soil samples collected in the summer of 1999 showed that the soil in this area was slightly acidic (pH = 5.6). Therefore, an application of lime may be required to raise the soil pH prior to planting. A decision will be made regarding this or any other soil amendments prior to field implementation. Any potential soil amendments must be evaluated to ensure that CERCLA soil certification will not be compromised.

4.1.2 Mesophytic Forest

The mesophytic forest type is comprised of 11 patches totaling approximately 2.8 acres along the length of A8P2 (Figure 4-1). It is the largest and most diverse forest type to be planted. Table 2-1 provides the list of species to be planted in each patch. The materials handling area wetland will outfall into several mesophytic forest patches.

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4.1.3 Beech-Maple Forest

The beech-maple forest type is comprised of eight patches totaling approximately 1.8 acres (Figure 4-1). Table 2-2 provides the list of species to be planted in each patch. Plantings of this forest type are dominated by American beech and sugar maple. Several patches are located within the scraped area discussed in Section 1.2.3. To compensate for this, excess topsoil resulting from road access and drainage construction may be spread across patches BS23 through BS26 during the Fall 1999 grading work.

4.1.4 Oak Savanna

The oak savanna is comprised of ten patches totaling approximately 2.5 acres (Figure 4-1). Table 4-2 provides the list of species to be planted in each patch. Bur oak (*Quercus macrocarpa*) dominates this habitat type, which is planted at a much lighter density than the forest types. Large-size saplings (greater than 2 inches caliper diameter) will be planted in order to withstand periodic burning. The northern drainage described in Section 1.2.1 bisects the savanna habitat type. Plantings will be adjusted to account for the streamside conditions.

4.1.5 Buffer

A single 0.25-acre aesthetic barrier will be planted in order to reduce the visibility of the materials handling area (Figure 4-1). Table 4-3 lists the species that comprise the buffer. A large proportion of red cedar will be planted in a high density within this patch.

4.1.6 Existing Riparian Forest

The existing riparian forest comprises approximately 4.4 acres along Paddys Run on the eastern edge of A8P11 (Figure 4-1). The forest will be enhanced through five existing patches. Table 4-4 provides the list of species to be planted in each patch. The planting list is designed to supplement rather than replace existing trees. The one exception is osage orange, which is non-native. All osage orange located in the riparian forest will be girdled and left in place to create snags. Shellbark hickory and shagbark hickory (*Carya ovata*) will be planted in this (and other forest types) to facilitate Indiana bat habitat.

4.1.7 Erosion Control Areas

Five cow paths have been cut into the western bank of Paddys Run. Pursuant to the NRRP, these erosion-prone areas will be repaired through bioengineering techniques. Coir fabric will be staked over

eroded areas, and dormant willow cuttings will be planted on 2-foot centers throughout the area. An equal mix of black willow (*Salix nigrum*) and silky willow (*Salix sericea*) will be planted in each area. Several paths are narrow, deeply incised channels. These areas will be repaired by the use of branch packing.

4.1.8 Ponds and Wetlands

As stated in Section 3.2.1, drainage from the materials handling area will be diverted into two small pools that will outflow into a shallower filter wetland (Figure 3-1). This drainage feature will serve to filter out organics accumulated in woodchip stockpile runoff. These pools and an additional vernal pool constructed during Fall 1999 should provide habitat for amphibians and reptiles. It is anticipated that these pools will hold water during periods of increased rainfall. The areas will be seeded with the seed mix identified in Table 2-6 as soon as possible after construction activities are complete in the following spring. In addition to the seeding, the following plugs will be planted on 2-foot centers: bottlebrush sedge (*Carex lurida*), awl-fruited sedge (*Carex stipata*), fox sedge (*Carex vulpinoidea*), Joe pye weed (*Eupatorium maculatum*), Soft Rush (*Juncus effusus*), cardinal flower (*Lobelia cardinalis*), great blue lobelia (*Lobelia siphilitica*), dark green bulrush (*Scirpus atrovirens*), and woolgrass (*Scirpus cyperinus*). The use of material handling area should not have an adverse impact on the ponds and filter wetland.

4.2 FIELD IMPLEMENTATION

Planting activities for A8P2 are scheduled to begin in Spring 2000. Some planting may be delayed until Fall 2000 if specified plant material or suitable substitutes cannot be acquired for spring planting. The completed materials handling area will be used as a staging area for all plant material and associated equipment and materials. All revegetation efforts will take place in accordance with the procedures outlined below.

4.2.1 Roles and Responsibilities

All revegetation activities will be conducted by Fluor Fernald through their onsite labor force. Fluor Fernald will ensure that all applicable policies, procedures, and regulations will be met in the planning and implementation of the work. The NRTs have approval authority for this NRRDP. Fluor Fernald will assign a Restoration Ecologist that is responsible for coordinating the handling, planting, maintenance, and monitoring of A8P2 vegetation.

4.2.2 Planting Window

The planting window extends from the approval of this NRRDP through May 15, 2000. It is anticipated that all plant material will be installed from March to May. If all planting is not completed by May 15, 2000, planting will be suspended until the fall planting window starting on October 1, 2000. If some material can be purchased before Spring 2000 and the weather is permitting, revegetation of some stock may occur sooner. Plants will not be installed if the ground is frozen. The Restoration Ecologist will determine whether conditions are appropriate for planting.

4.2.3 Sequencing

The first step in the project will be erosion control work along Paddys Run. The planting sequence is designed to minimize travel through completed patches. Balled and burlapped and container grown stock will be planted in the existing riparian forest patches first, followed by the mesophytic patches, the beech-maple patches, the oak-maple patches, the savanna patches, and the buffer. After planting, all areas will then be seeded. Lastly, seedlings will be planted across the entire area. Plant material orders have been staggered to accommodate this approach.

Ideally, each patch will be completely planted before the next one is undertaken. However, alterations in the sequence may occur due to plant material delivery. Installation of plant material will take precedence over maintaining the proper sequence of patches. Trees and shrubs will usually be planted as soon as possible after delivery in order to minimize the time a plant spends out of the ground.

4.2.4 Plant Material Availability/Substitutions

All plant material for A8PII was ordered in Fall 1999, when availability was high. However, there is no guarantee that all the specified plant species, quantities, and sizes will be procured. Plant bid packages include the possibility of substitutions proposed by the vendor. Each tree and shrub species was assigned a substitution category that any substitution must meet in order to fulfill the same habitat role as the original species. Substitution categories include cover, mast, diversity, aesthetics, and fruit. No cultivars, hybrids, or plants non-native to southwest Ohio will be accepted as substitutes. It may be necessary to adjust plant quantities in order to meet the desired densities within each patch.

4.2.5 Planting Procedure

Each habitat patch will be flagged for species placement by the Restoration Ecologist. Usually, species will be randomly distributed throughout the patch. A few species will be specified for a clumped distribution, where several of the individual plants are placed closely together. The Restoration Ecologist will adjust species locations according to patch-specific hydrological and topographical conditions.

All plant material will be installed in accordance with the specifications included in Appendix A. In general, laborers will dig sapling planting holes mechanically or by hand, install the plant to the appropriate height, backfill by hand, and water. Transport materials (flagging, twine, etc.) will be removed prior to installation. Slow release fertilizer tablets will be placed in each planting hole at the manufacturer's specified rate.

Seedlings will be randomly placed by the laborers under the supervision of the Restoration Ecologist. Seedlings will be planted by hand with a dibble bar or spade. Mycorrhizal fungi will be utilized in the planting of wetland plugs and all seeding activities. Wetland plugs will be inoculated with endomycorrhizal fungi by the vendor prior to delivery. All grass/forb seeding will be supplemented with endomycorrhizal inoculation as well. Inoculate will be mixed into the seed mix prior to drilling or broadcasting. Balled and burlapped saplings and container grown trees and shrubs will not be inoculated.

A 70-foot "no plant zone" will be established around Air Monitoring Station No. 7. This area is required pursuant to the Integrated Environmental Monitoring Plan (IEMP; DOE 1999), so that air monitoring measurements will not be affected by nearby trees. This area will be seeded with the native grass/forb mix listed in Table 2-5.

Erosion control areas along Paddys Run will have dormant cuttings staked by hand into coir fabric on 2-foot centers. For the narrow gullies, branch packing will be used. This technique consists of installing alternating layers of dormant cuttings and compacted backfill at 6-inch intervals for the length of the gully. Cuttings are laid in a criss-cross formation, with the basal ends lower than the growing tips and touching undisturbed soil on the gully bed (SCS 1992).

4.2.6 Mulching

All planted vegetation will be mulched prior to project completion. Tree saplings and shrubs will receive a woodchip mulch ring at least 4 feet in diameter, 4 inches thick. Seedlings will receive a mulch ring at least 2 feet in diameter, 4 inches thick. Mulch will not be piled against the stem of the vegetation.

4.2.7 Seeding Procedure

All planting patches (except for the existing riparian forest patches) will be seeded with a native grass and forb mix after all plant material is installed. The seed mix for the oak savanna is listed in Table 2-5, while the seed mix for all other forest types is listed in Table 2-4. The vernal pool seed mix is listed in Table 2-6.

All existing grasses will be sprayed with herbicide prior to planting in the spring. If possible, all areas that will eventually be seeded will be raked to scarify the soil surface. Individual patches will be seeded after all tree saplings and shrubs have been installed, but before seedlings are planted. Forest types and the wetland will be broadcast seeded with a carrying medium such as sand. A small grassland strip (GL32) will also be seeded by hand using the forest type grass seed mix outlined in Table 2-4. The oak savanna will be seeded with the onsite seed drill. Since existing dead grasses will be left in place, seeded areas will only be straw-mulched in bare soil areas.

4.2.8 Restoration of the Materials Handling Area

The materials handling area will be restored once it is no longer needed for material handling to support FEMP ecological restoration. A revegetation plan will be produced that is similar to the planting plan in this NRRDP. Soils will have already been amended as a result of woodchip stockpile management. Therefore, the plan will consist primarily of establishing forest and/or savanna habitats across the materials handling area. The uneven age of restored habitats resulting from the later restoration will further increase diversity within A8P2. The access road will be used as a public and/or maintenance access if determined necessary.

AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 4-1
Oak - Sugar Maple Forest Type

Patch	OS1	OS2	OS3	OS4	Total
Trees	44	49	47	46	186
Shrubs	25	0	26	0	51
Acres	0.25	0.26	0.26	0.25	1.02

Scientific Name	Common Name	Plant Type					
<i>Acer nigrum</i>	black maple	overstory tree	5	5	5	5	20
<i>Acer saccharum</i>	sugar maple	overstory tree	5	5	5	5	20
<i>Aesculus glabra</i>	Ohio buckeye	overstory tree	1	1		1	3
<i>Asimina triloba</i>	pawpaw	understory tree		1	1	1	3
<i>Carpinus caroliniana</i>	ironwood	understory tree	1	1	1		3
<i>Carya cordiformis</i>	bitternut hickory	overstory tree	2	3	3	2	10
<i>Carya laciniosa</i>	shellbark hickory	overstory tree	1	3	3	4	11
<i>Carya ovata</i>	shagbark hickory	overstory tree	2	3	2	3	10
<i>Fraxinus americana</i>	white ash	overstory tree	3	4	4	4	15
<i>Juglans nigra</i>	black walnut	overstory tree	5	5	5	6	21
<i>Liriodendron tulipifera</i>	tulip poplar	overstory tree	1	1	1		3
<i>Prunus serotina</i>	black cherry	overstory tree	3	3	3	2	11
<i>Quercus alba</i>	white oak	overstory tree	5	5	5	5	20
<i>Quercus imbricaria</i>	shingle oak	overstory tree		0		1	1
<i>Quercus prinus</i>	chestnut oak	overstory tree	1	1	1		3
<i>Quercus rubra</i>	red oak	overstory tree	6	5	5	5	21
<i>Quercus velutina</i>	black oak	overstory tree	1	1	1		3
<i>Tilia americana</i>	American basswood	overstory tree	2	2	2	2	8
<i>Ceanothus americanus</i>	New Jersey tea	shrub			5		5
<i>Corylus americana</i>	hazel	shrub			5		5
<i>Rhus glabra</i>	smooth sumac	shrub	4				4
<i>Rosa carolina</i>	Carolina rose	shrub			5		5
<i>Salix humila</i>	pussy willow	shrub	4				4
<i>Sambucus canadensis</i>	elder	shrub	4				4
<i>Smilax rotundifolia</i>	greenbrier	shrub	5				5
<i>Symphoricarpos orbiculatus</i>	corralberry	shrub	5				5
<i>Viburnum acerifolium</i>	maple-leaf viburnum	shrub			5		5
<i>Xanthoxylum americanum</i>	prickly ash	shrub	3		6		9

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AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 4-2
Oak Savanna Habitat Type

Patch	SV1	SV2	SV3	SV4	SV5	SV6	SV7	SV8	SV9	SV10	Total
Trees	6	8	8	9	7	11	11	8	8	8	84
Shrubs	6	8	8	9	7	11	11	8	8	8	84
Acres	0.27	0.26	0.25	0.27	0.24	0.23	0.22	0.23	0.28	0.24	2.49

Scientific Name	Common Name	Plant Type										
<i>Quercus alba</i>	white oak	overstory tree		3	3				3	3	3	15
<i>Quercus bicolor</i>	swamp white oak	overstory tree				3	2	2	2			9
<i>Quercus macrocarpa</i>	bur oak	overstory tree	6	5	5	6	5	9	9	5	5	60
<i>Ceanothus americanus</i>	New Jersey tea	shrub	2	2	2	3		3	2	2	3	19
<i>Cephalanthus occidentalis</i>	buttonbush	shrub				3	4	3	3		3	18
<i>Corylus americana</i>	hazel	shrub	2	3	3			2		3	2	17
<i>Hypericum spathulatum</i>	shrubby St. John's wort	shrub				3	3	3	4			15
<i>Rosa setigera</i>	prairie rose	shrub	2	3	3				2	3		15

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AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

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Table 4-3
Buffer

Patch	BF31
Trees	77
Shrubs	23
Acres	0.25

Scientific Name	Common Name	Plant Type	
<i>Cercis canadensis</i>	redbud	understory tree	8
<i>Cornus florida</i>	flowering dogwood	understory tree	8
<i>Crataegus mollis</i>	hawthorne	understory tree	4
<i>Fraxinus americana</i>	white ash	overstory tree	4
<i>Gymnocladus dioica</i>	Kentucky coffee tree	overstory tree	4
<i>Juniperus virginiana</i>	red cedar	understory tree	30
<i>Liriodendron tulipifera</i>	tulip poplar	overstory tree	4
<i>Populus deltoides</i>	cottonwood	overstory tree	4
<i>Quercus macrocarpa</i>	bur oak	overstory tree	4
<i>Quercus rubra</i>	red oak	overstory tree	4
<i>Ulmus americana</i>	American elm	overstory tree	3
<i>Rhus glabra</i>	smooth sumac	shrub	6
<i>Rhus aromatica</i>	fragrant sumac	shrub	6
<i>Rosa carolina</i>	Carolina rose	shrub	6
<i>Symphoricarpos orbiculatus</i>	coralberry	shrub	5

AREA 8 PHASE II NATURAL RESOURCE RESTORATION DESIGN PLAN

Table 4-4
Existing Riparian Forest

Patch	RP1	RP2	RP3	RP4	RP5	Total
Trees	30	73	20	20	28	171
Shrubs	0	49	12	0	17	78
Acres	0.37	1.01	1.09	1.42	0.50	4.39

Scientific Name	common Name	Plant Type					
<i>Acer nigrum</i>	black maple	overstory tree			2		2
<i>Acer rubrum</i>	red maple	overstory tree	5	13		5	23
<i>Aesculus glabra</i>	Ohio buckeye	overstory tree	3	8		3	14
<i>Asimina triloba</i>	pawpaw	understory tree			2	2	4
<i>Carya laciniosa</i>	shellbark hickory	overstory tree			4	4	8
<i>Carya ovata</i>	shagbark hickory	overstory tree			4	4	8
<i>Cercis canadensis</i>	redbud	understory tree		3		2	5
<i>Cornus drumondii</i>	roughleaf dogwood	understory tree			2	2	4
<i>Cornus florida</i>	flowering dogwood	understory tree			2	2	4
<i>Cornus racemosa</i>	grey dogwood	understory tree	5	10		3	18
<i>Fraxinus pennsylvanicum</i>	green ash	overstory tree	7	17		2	33
<i>Nyssa sylvatica</i>	black gum	overstory tree			2		2
<i>Platanus occidentalis</i>	sycamore	overstory tree	3	6		5	14
<i>Populus deltoides</i>	cottonwood	overstory tree	4	8		5	17
<i>Quercus bicolor</i>	swamp white oak	overstory tree			2	2	4
<i>Quercus palustris</i>	pin oak	overstory tree	3	8			11
<i>Euonymus atropurpureus</i>	burning bush	shrub			2		2
<i>Ilex verticillata</i>	winterberry	shrub			2		2
<i>Lindera benzoin</i>	spicebush	shrub		4	4		8
<i>Physocarpus opulifolius</i>	ninebark	shrub		15	2	6	23
<i>Staphylea trifolia</i>	bladdernut	shrub		14	2	5	21
<i>Xanthoxylum americanum</i>	prickly ash	shrub		16		6	22

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84000

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82500

STATE PLANAR COORDINATE SYSTEM 1983

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LEGEND:

--- FEMP BOUNDARY

MM = MESOPHYTIC
 BS = BEECH/SUGAR MAPLE
 OS = OAK/SUGAR MAPLE
 BF = BUFFER
 GL = GRASSLAND

SV = SAVANNA
 RP = EXISTING RIPARIAN
 EF = EXISTING FOREST

SCALE

120 60 0 120 FEET

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AREA 8, PHASE 2, NATURAL RESOURCE RESTORATION STATEMENT OF WORK - SAPLING PLANTINGS
 FIGURE 4-1. PLANTING PLAN

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5.0 MONITORING AND MAINTENANCE

Monitoring and maintenance will be carried out to ensure that the restoration of A8P2 is successful and meets the stated goals of the project. All monitoring and maintenance will be carried out by the Fluor Fernald Natural Resource Team, utilizing site labor as needed, with oversight provided by DOE.

5.1 MONITORING

Monitoring will be carried out in two phases. The initial phase of monitoring will last 3 years (2001 – 2003) and will focus on the survival of the tree sapling and shrub species planted. The second phase of monitoring will last 7 years (2004 – 2010) and will be less intensive, focusing on the continued growth of the trees and general useage of the area. Monitoring will be focused on the planted saplings and shrubs only. Seedlings will be overplanted assuming 50 percent mortality to reach the desired stem density per acre. Because the seedlings will be overplanted and a high mortality is expected, quantitative monitoring of a representative sample of seedlings will be included in the long-term monitoring.

5.1.1 Near-Term Success Criteria

The near-term success criteria is based on the survival of the trees and shrubs that are planted. The goal of the project as explained earlier in this design is to plant the right mix and density of plants to help the development of a multi-use habitat to support habitat quality enhancement. The first step towards successfully reaching that goal is to ensure survival of planted material. The results of the monitoring outlined below will be submitted to the NRTs by September 1 in each of the first 3 years of monitoring. The first monitoring report will be due by September 1, 2001.

5.1.1.1 Saplings/Shrubs

For the first 3 years after planting, monitoring will be carried out to ensure 80 percent survival of all planted saplings and shrubs. Each planted forest, savanna and riparian plot must maintain 80 percent survival of saplings and shrubs with the exception of selected patches that will not receive applications of deer repellent sprays as part of a study to determine mortality due to deer browsing. The severity of deer browsing in patches that do not receive treatment with deer repellent will be compared with the extent of browsing damage in the treated patches to determine the intensity of deer control warranted for this and

future forest restoration projects. Due to the absence of repellent sprays in these patches, relatively high mortality rates are expected and may exceed 20 percent of the planted shrub and sapling population.

Monitoring will be carried out once per year in early summer to determine the amount of living plant material. Mortality counts will be conducted in each planted plot. Trees and shrubs that have a majority (i.e., greater than 50 percent) of the plant die back into the crown or beyond a normal pruning line shall be considered dead. Any plot that has less than 80 percent survival of planted saplings and shrubs will require the planting of replacement species to bring the number of living saplings and shrubs up to a number not less than 80 percent of the original number of saplings and shrubs planted in the plot. After monitoring is conducted in early summer, any required replacements will be ordered and planted in the fall of the same year. In the event that replacements can not be received during the fall planting window, replacement planting will occur the following spring.

5.1.1.2 Grasses and Forbs

There will be a requirement for 90 percent coverage of grasses at the end of the first growing season after project completion. It is anticipated that the first growing season will be dominated by the growth of the cover crop and the permanent grasses and forbs will establish by the end of the second growing season. All disturbed areas (e.g., area adjacent to parking areas and the access road) will be seeded as specified in Section 4.2.7. Seeding will also occur in all of the forest plots and in the savanna. The coverage requirement will not apply to the riparian corridor or the material handling area. The disturbed portions of the project, the forest plots, and the savanna will be monitored to ensure that 90 percent cover is achieved.

Percent cover will be determined pursuant to the methods used in the Wetland Mitigation Project (Munro 1999). If 90 percent cover is not achieved and sustained in later growing seasons, additional grasses and forbs will be interseeded into growth grasses at a rate to be determined.

5.1.1.3 Invasive/Aggressive Species

The presence of invasive species will be identified during the monitoring carried out from 2001 – 2003. The invasive species of concern include, but are not limited to, the following: bush honeysuckle, wild grape, multiflora rose, cattail (*Typha spp.*), thistle (*Cirsium spp.*) and garlic mustard. Management to extirpate honeysuckle, wild grape and thistle will be carried out as described in Section 5.2.2.1. Other

invasive species will be managed only if significant problems develop as determined by DOE in consultation with the NRTs on a case-by-case basis.

5.1.2 Long-Term Monitoring Parameters

The long-term monitoring parameters will focus on the continued growth of the saplings and the use of the area by wildlife. The monitoring will be conducted every year for a period of 7 years to ensure that the saplings are growing within normal parameters. The saplings will be the focus of the long-term monitoring since the development of the forest canopy is a key element in the natural succession process. Tip growth in a representative sample of seedling will occur on an annual basis. The other important indicator regarding the long-term health of the system is the type of wildlife that is using the area and the presence of invasive/aggressive species being established in the restored area.

5.1.2.1 Sapling Growth

For 7 years following the initial 3-year monitoring period, growth of the saplings will be monitored in the forest plots and in the savanna. The growth of the saplings will be measured by taking caliper readings for diameter breast-height (DBH) measuring tip growth and identifying fruit production on a statistically significant, random subset of the saplings in each forest plot and in the savanna. The measurements will be conducted in summer (i.e., June or July) in each of the monitoring years. Baseline caliper readings will be taken in Summer 2003 to serve as a basis for comparison during the monitoring events. Trees selected for the baseline caliper reading will be flagged with weatherproof tags and will comprise the subset monitored in the following 7 years. The results of the baseline caliper readings will be presented in the monitoring report prepared in 2003. Reports from the long-term monitoring events will be submitted by September 1 in each of the years that monitoring is conducted.

The caliper readings are not being proposed from 2001 through 2003 during the near-term success monitoring to allow the trees time to acclimate with the new location and avoid taking caliper readings on trees that may die. The assumption is that a 3-year period should allow adequate time for the trees to recover from the transplanting activity and begin normal growth patterns. In addition, the trees that are alive after the initial 3-year period should be well established and survive.

5.1.2.2 Seed Propagation/Volunteer Recruitment

During the long-term monitoring events, qualitative observations will be made regarding seed propagation and volunteer recruitment in the project area. The propagation of seeds and the presence of volunteer species will be a sign that the natural succession process is working. As part of the study of volunteer recruitment, half of the forest plots will be planted with shrub species and half without. The general condition of the shrub plots versus the non-shrub plots will be evaluated during the long-term monitoring. The amount of invasive species and volunteer recruitment will be evaluated qualitatively and comments will be included in the long-term monitoring reports.

5.1.2.3 Wildlife Use

Observations will also be made during the long-term monitoring events regarding wildlife using the area. A list of the wildlife observed in the project area will be compiled by DOE and the Fluor Fernald Natural Resource Team and will be presented as part of the long-term monitoring reports. Wildlife use will also be compared against baseline wildlife data on the area.

5.2 MAINTENANCE

Regularly scheduled maintenance activities will be required to ensure both the near-term and long-term success of A8P2 ecological restoration. These activities are discussed below.

5.2.1 Watering

Each plant will be watered at the time of installation as described in Section 4.2.5. Watering will be carried out beyond the initial planting if normal rainfall conditions do not occur (approximately 1 inch per week). Watering will be carried out using one of the following methods: direct watering of tree/shrub with hose or watering using tree gator or bucket. Water may be carried out during the second growing season if significant drought conditions occur similar to the summer of 1999. Under normal rainfall conditions, watering after planting should not be necessary.

5.2.2 Invasive/Aggressive Species Control

The establishment of invasive and aggressive species can be a significant problem in restored areas because they can out-compete desired species. Efforts will be employed to control invasive and aggressive species in the years immediately following restoration to give planted material the best chance to become established.

5.2.2.1 Near-Term Control

As part of the monitoring carried out during the first 3 years following restoration, invasive or aggressive species that require removal will be identified and flagged by the Fluor Fernald Natural Resource Team. A8P2 will be surveyed twice a year; once before June 1 and once after October 1. Honeysuckle and multiflora rose will be removed and/or sprayed. The first sweep is proposed for after October 1, 2000. Semi-annual sweeps would continue until 2003. An initial herbicide application (Roundup®) of all existing grasses within planting areas will take place in early Spring 2000.

5.2.2.2 Long-Term Control

During each long-term monitoring event, an assessment of invasive/aggressive species becoming established in A8P2 will be made. Species that should be extirpated (e.g., bush honeysuckle, wild grape and thistle) will be identified. Site labor will be used to extirpate selected invasive/aggressive species using the E-Zject Lance or cutting as soon after the monitoring event as possible.

5.2.3 Deer Control

The deer population at the FEMP is currently under evaluation. The questions of whether deer populations are at levels high enough to warrant some type of population control is being evaluated. An evaluation of the impact of deer on the planted shrubs will be conducted as part of the near-term monitoring of the project area (e.g., mortality counts/plant survival). If the shrub plots show signs of significant mortality due to deer damage, DOE will implement more intensive deer controls. Tree tubes will be used on all saplings to minimize the chances of damage due to "deer rubs."

5.2.4 Savanna Maintenance

In order for a savanna community to become established, periodic maintenance is required (Packard 1997). Controlled burning is optimal method for the maintenance of savannas and will be pursued as the maintenance tool for the A8P2 oak savanna. Burning is the preferred method of maintenance for savannas because it rejuvenates prairie grasses by increasing available nutrients from the ash, it eliminates accumulated leaf litter that reflects sunlight, and if conducted in the spring, accelerates soil warming that will extend the growing season for prairie grasses (Packard 1997). A burn plan will be developed for A8P2 and will be submitted to the NRTs by August 1, 2000. In the event that controlled burns are not determined feasible at the FEMP, mowing and thatch removal will be used as a maintenance tool for the A8P2 savannas.

The A8P11 Oak Savanna will be burned or mowed in two sections to minimize impacts to the insect population. One of the two sections will be burned or mowed every 3 years. If mowing is used as the maintenance tool, it will be accompanied by thatch removal using a rake or equivalent method. Maintenance of the savanna will occur until at least 2008, when restoration at the FEMP is scheduled to be complete.

6.0 PROJECT MANAGEMENT AND OVERSIGHT

The following sections describe the steps necessary to ensure that implementation of this NRRDP is conducted in a safe, quality manner, in accordance with all DOE, federal, state, and local requirements.

6.1 ENVIRONMENTAL COMPLIANCE

Applicable environmental control requirements for the project will be limited to the installation of erosion and sedimentation controls in accordance with the requirements specified in PL-3083, FEMP Stormwater Pollution Prevention Plan, and the control and abatement of fugitive dust emissions in accordance with RM-0047, Fugitive Dust Control Requirements.

Given the limited amount of soil disturbance associated with the project, project-specific erosion and sedimentation controls will consist of silt fence installed at the locations shown on the attached project drawings. Erosion and sedimentation controls will be inspected on a weekly basis under the PL-3083 construction inspection program. The wetland will be sized pursuant to Ohio Department of Natural Resources stormwater control requirements.

Fugitive dust control requirements specified under RM-0047 were developed from OEPA's fugitive dust control best available technology determination. Project-specific fugitive dust controls will consist primarily of water spray on exposed/working soil surfaces. Visual emission monitoring will be conducted and documented in accordance with the requirements specified in RM-0047.

6.2 SAFETY AND HEALTH

One person from the Occupational Safety and Health Department will be assigned to the project on a part-time basis. The Safety and Health (S&H) Representative will be responsible for integrating health and safety into all aspects of the project.

Safety and Health requirements for the construction phase of the project will be communicated in a Project Specific Health and Safety Matrix or Traveler Packet in accordance with RM-0021, Safety Performance Requirements Manual, and SH-0001, Development and Issue of Project Specific Health and Safety Requirements. SH-0001 also describes the Fluor Fernald Work Permit process. Additionally, the S&H Representative assists in implementation of safety measures, and evaluation of process changes for

safety compliance. The S&H Representative conducts thorough preconstruction inspections of the work site and periodic walk-throughs once construction activities have begun.

Fluor Fernald Fire Protection will provide consultation and guidance regarding fire protection and Life Safety Issues. As appropriate, Fire Protection provides necessary emergency response personnel and equipment for emergencies which could adversely affect people, property, or the environment. The FEMP Fire Protection functional area shall provide guidance to ensure that fire hazard issues are properly addressed and proper safeguards are in place for all activities associated with this project.

The S&H representative assigned to this project is responsible for integration and compliance with fire protection requirements as defined in PL-3020, FEMP Emergency Plan, and in RM-0013, Fire Protection Requirements Manual.

6.3 QUALITY ASSURANCE

Activities related to the implementation of the park will be conducted in accordance to the Quality Assurance Job-Specific Plan (QAJSP), described in Appendix E of the SEP (DOE 1998b). Quality Assurance personnel will ensure compliance with the QAJSP by performing surveillances and inspections necessary to verify work plan and construction design requirements. Objective evidence of assessments will be documented and become part of the park project records.

6.4 WASTE MANAGEMENT

During construction activities, field personnel will generate wastes. Management of waste streams will be coordinated with Waste Acceptance Organization through the Project Waste Identification Document process.

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APPENDIX A

PLANTING SPECIFICATIONS

APPENDIX A PLANTING SPECIFICATIONS

A.1 INSTALLATION OF PLANT MATERIAL

A.1.1 Planting Locations

Planting locations will be flagged in the field by the FEMP Restoration Ecologist. The Restoration Ecologist is the FDF Personnel responsible for identifying the location of all plant material installation, verifying acceptance of delivered plant material, and ensuring proper installation.

A.1.2 Plant Installation Season

A.1.2.1 Unless otherwise approved by the Restoration Ecologist, all plant installation shall take place between September 15 and December 15 or February 15 and May 15.

A.1.2.2 Restoration Ecologist may restrict planting activities in response to actual conditions (e.g., droughts, unseasonable freezes).

A.1.2.3 No plant installation may take place while the soil surface is frozen.

A.1.3 Installation of Balled and Burlapped Trees and Shrubs (Detail A-1)

A.1.3.1 Excavate planting pit to a depth such that the top of the ball, when planted, extends 1 to 2 inches above ground surface.

A.1.3.2 Excavate planting pit so that it is wider than root ball by 9 inches on each side.

A.1.3.3 Scarify sides of planting pit with shovel.

A.1.3.4 Loosen burlap from around base of trunk, but do not remove.

A.1.3.5 Set trees and shrubs such that the top of ball extends 1-2 inches above ground surface and that trunk is vertical. Trunks shall have no more than 10 percent lean.

A.1.3.6 Backfill with a mixture of the topsoil and subsoil removed when the pit was excavated. Gently tamp the backfill as it is placed into pit.

A.1.3.7 Water immediately after planting to saturate the upper 12 inches of soil.

A.1.3.8 Remove any tags, labels, and strings from the plant.

A.1.4 Installation of Container-Grown Trees and Shrubs (Detail A-1)

- A.1.4.1 Excavate planting pit to a depth such that the top of the root ball, when removed from the container and planted, extends 1 to 2 inches above ground surface.
 - A.1.4.2 Excavate planting pit so that it is wider than root ball (when removed from the container) by 9 inches on each side.
 - A.1.4.3 Scarify sides of planting pit with shovel.
 - A.1.4.4 Remove plant by carefully inverting the container, cutting if necessary. Attempt to keep the ball as intact as possible.
 - A.1.4.5 Set the plant such that the top of ball extends 1 to 2 inches above ground surface and that trunk is vertical. Trunks shall have no more than 10 percent lean.
 - A.1.4.6 Backfill with a mixture of the topsoil and subsoil removed when the pit was excavated. Gently tamp the backfill as it is placed into pit.
 - A.1.4.7 Water immediately after planting to saturate the upper 12 inches of soil.
 - A.1.4.8 Remove any tags, labels, and strings from the plant.
- A.1.5 Installation of Bareroot Plants (Detail A-2)
- A.1.5.1 Carry bareroot plants in a bucket of water (or moist sand or other moist medium) in the field to keep roots from drying out.
 - A.1.5.2 Excavate planting pit only broad enough to accommodate the roots when fully extended and only deep enough such that the uppermost roots will be just below ground surface.
 - A.1.5.3 Set the plant and spread the roots in a natural pattern such that the roots are fully extended without touching the sides of the planting pit and that the uppermost roots are just below ground surface.
 - A.1.5.4 Carefully work backfill (mix of topsoil and subsoil removed from the planting pit) through the fully spread root systems and water while backfilling.
 - A.1.5.5 Firmly tamp backfill with heel of shoe when complete.
 - A.1.5.6 Remove any tags, labels, and strings from the plant.
- A.1.6 Pruning
- A.1.6.1 Once trees and shrubs are planted, prune off any dead or damaged limbs.
 - A.1.6.2 All pruning shall involve removal of limbs back to a lateral branch or bud.

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A.1.6.3 Perform additional pruning at the request of the Restoration Ecologist.

A.2 MULCHING

Apply a 4-inch layer of hardwood mulch over a circular area 4 feet in diameter surrounding balled and burlapped and container grown trees and shrubs. At the discretion of the Restoration Ecologist, straw may be used as a substitute for hardwood mulch.

A.2.1 Apply a 4-inch layer of hardwood mulch over a circular area 2 feet in diameter surrounding each bare root or peat pot plant. At the discretion of the Restoration Ecologist, straw may be used as a substitute for hardwood mulch.

A.2.2 Mulch shall be placed so as to not physically contact the plants.

A.3 STAKING AND GUYING

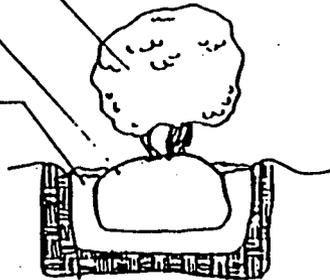
Trees shall only be staked and guyed at the request of the Restoration Ecologist.

Detail A-1: Installation of Balled and Burlapped and Container-Grown Trees and Shrubs

SHRUB SET VERTICAL
WITH NO MORE THAN
10% LEAN

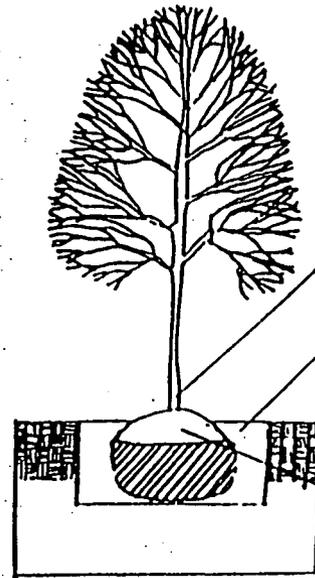
BALL SET SO THAT
ITS TOP IS APPROX.
1-2" ABOVE SOIL LINE

PLANTING PIT EXCAVATED
9" WIDER THAN BALL
ON ALL SIDES



TRUNK SET VERTICAL
WITH NO MORE THAN
10% LEAN

PLANTING PIT EXCAVATED
9" WIDER THAN BALL ON
ALL SIDES



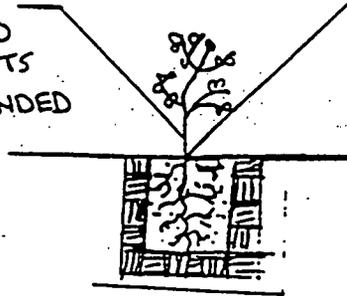
BALL SET SO THAT
ITS TOP IS APPROXIMATELY
1-2" ABOVE SOIL LINE

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Detail A-2: Installation of Bareroot Plants

PLANTING POT
LARGE ENOUGH TO
ACCOMMODATE ROOTS
IN A FULLY EXTENDED
POSITION



SET PLANT SUCH
THAT UPPER MOST
ROOTS ARE JUST
BELOW THE SOIL
SURFACE

APPENDIX B

PLANTING FIELD CONTROL

APPENDIX B PLANTING FIELD CONTROL

This appendix describes the mechanisms used to place, install, and maintain all plant material required within Area 8, Phase II (A8P2). Details regarding the rationale behind the selection of habitat types and species are found in Section 2 of the A8P2 Natural Resource Restoration Design Plan (NRRDP). Section 4 provides the specific approaches that will be used to plant the various habitats and features specified for A8P2. Field control of all planting activities will be accomplished primarily through the use of patch pages, which are described in more detail below.

Patch pages have been developed for each patch to be planted within A8P2. Each patch page provides the following information: the size of the patch, the number of trees and shrubs to be planted, the amount of mulch required, the amount of grass/forb seed mix required, and the number, size, and form of each plant to be installed. Most of this information is summarized on Tables 2-1 through 2-2 and 4-1 through 4-4 of the NRRDP. Each patch page provides a means of recording when each plant is installed, watered, and mulched. Ancillary information will also be recorded, such as the date a patch was delineated, the color of the flagging and tags used, and the date the patch was seeded. The patch pages that will be used for the sapling plantings in the spring of 2000 are included in this appendix. Additional patch pages will be developed when planting of shrubs and seedlings is resumed the following fall.

Patch pages will be used in the following manner. Prior to delivery, patches will be delineated with flagging and/or spray paint in the field pursuant to the layout shown on Figure 2-2 of the NRRDP. Flags will be made corresponding to the number of each species to be planted within a particular patch. Each species will be letter-coded for easy identification in the field. A distinct color will be used for each patch.

The Restoration Ecologist will determine the location of each plant based on the specific conditions found within the particular patch. In general, all plants will be randomly placed within the patch, with no intentional clumping or development of pure stands. However, specific ecological factors may require the concentration of a particular species within a patch. For instance, if a particular patch is found on a slope, species more suited to wet conditions could be concentrated at the bottom of the slope rather than throughout the entire patch.

Once plants are delivered to the field, they will be inspected and set aside for field placement or healed into the existing mulch pile. Plants that are not specified for the current habitat type will be healed in. The plants for each patch will be tagged with plastic flagging that is color and letter-coded to the specific flag within a given patch. The Restoration Ecologist will oversee the field placement of all plant material to ensure that species are properly handled and placed. Once all plants are installed, mulched, and watered, the patch will be broadcast seeded in accordance with Section 4.2.7 of the NRRDP.

All pertinent information from the above process will be recorded on each patch page. In addition, patch pages will be used to document post-installation watering and other maintenance activities. Watering of patches will be recorded on specific patch pages for the duration of field activities. Once fieldwork is completed, watering will be recorded on a separate form. This form is found after the patch pages in this appendix. The Restoration Ecologist will direct watering activities pursuant to Section 5.2.1 of the NRRDP.

All field data collected on patch pages and watering forms will be maintained by the Restoration Ecologist in the A8P11 Field Binder.

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RP1

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size	0.37 Acres
No. trees	30
Mulch required (cy)	5
Seed required	na

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	5			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	3			
Q	<i>Cornus racemosa</i>	grey dogwood	B&B	1.5" cal.	5			
U	<i>Fraxinus pennsylvanicum</i>	green ash	B&B	1.5" cal.	7			
EE	<i>Platanus occidentalis</i>	sycamore	B&B	1.5" cal.	3			
FF	<i>Populus deltoides</i>	cottonwood	Cont.	2 gal.	4			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	3			

Notes

RP2

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size	1.01 Acres
No. trees	73
Mulch required (cy)	11
Seed required	na

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	13			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	8			
N	<i>Cercis canadensis</i>	redbud	B&B	1.5" cal.	3			
Q	<i>Cornus racemosa</i>	grey dogwood	B&B	1.5" cal.	10			
U	<i>Fraxinus pennsylvanicum</i>	green ash	B&B	1.5" cal.	17			
EE	<i>Platanus occidentalis</i>	sycamore	B&B	1.5" cal.	6			
FF	<i>Populus deltoides</i>	cottonwood	Cont.	2 gal.	8			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	8			

Notes

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RP3

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size	1.09 Acres
No. trees	20
Mulch required (cy)	3
Seed required	na

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	2			
G	<i>Asimina triloba</i>	pawpaw	B&B	1.5" cal.	2			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	4			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	4			
O	<i>Cornus drumondii</i>	roughleaf dogwood	B&B	1.5" cal.	2			
P	<i>Cornus florida</i>	flowering dogwood	B&B	1.5" cal.	2			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	2			
II	<i>Quercus bicolor</i>	swamp white oak	B&B	1.5" cal.	2			

Notes

RP4

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size	1.42 Acres
No. trees	20
Mulch required (cy)	3
Seed required	na

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
G	<i>Asimina triloba</i>	pawpaw	B&B	1.5" cal.	2			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	4			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	4			
N	<i>Cercis canadensis</i>	redbud	B&B	1.5" cal.	2			
O	<i>Cornus drumondii</i>	roughleaf dogwood	B&B	1.5" cal.	2			
P	<i>Cornus florida</i>	flowering dogwood	B&B	1.5" cal.	2			
U	<i>Fraxinus pennsylvanicum</i>	green ash	B&B	1.5" cal.	2			
II	<i>Quercus bicolor</i>	swamp white oak	B&B	1.5" cal.	2			

Notes

2946

RP5

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size	0.50 Acres
No. trees	28
Mulch required (cy)	4
Seed required	na

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	5			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	3			
Q	<i>Cornus racemosa</i>	grey dogwood	B&B	1.5" cal.	3			
U	<i>Fraxinus pennsylvanicum</i>	green ash	B&B	1.5" cal.	7			
EE	<i>Platanus occidentalis</i>	sycamore	B&B	1.5" cal.	5			
FF	<i>Populus deltoides</i>	cottonwood	Cont.	2 gal.	5			

Notes

MM8

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	43
Mulch required (cy)	7
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	3			
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	1			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	6			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	3			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
W	<i>Gymnocladus dioica</i>	Kentucky coffee tree	B&B	1.5" cal.	1			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
EE	<i>Platanus occidentalis</i>	sycamore	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
LL	<i>Quercus muhlenbergii</i>	chinquapin oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	10			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

2946

MM9

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	48
Mulch required (cy)	7
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	3			
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	1			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	6			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
Q	<i>Cornus racemosa</i>	grey dogwood	B&B	1.5" cal.	3			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
EE	<i>Platanus occidentalis</i>	sycamore	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	3			
RR	<i>Sassafras albidum</i>	sassafras	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	10			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

MM10

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	48
Mulch required (cy)	7
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	3			
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	1			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	5			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
Q	<i>Cornus racemosa</i>	grey dogwood	B&B	1.5" cal.	3			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
EE	<i>Platanus occidentalis</i>	sycamore	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	3			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	10			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	3			

Notes

2946

MM11

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	47
Mulch required (cy)	7
Seed required (lb)	5.3125

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	4			
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	2			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	5			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
Q	<i>Cornus racemosa</i>	grey dogwood	B&B	1.5" cal.	3			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	3			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	9			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

MM12

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	45
Mulch required (cy)	7
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	4			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	5			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
Q	<i>Cornus racemosa</i>	grey dogwood	B&B	1.5" cal.	3			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
W	<i>Gymnocladus dioica</i>	Kentucky coffee tree	B&B	1.5" cal.	1			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
PP	<i>Quercus shumardii</i>	Shumard oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	9			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	3			

Notes

2946

MM13

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	45
Mulch required (cy)	7
Seed required (lb)	5.3125

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	3			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	6			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	2			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
U	<i>Fraxinus pennsylvanicum</i>	green ash	B&B	1.5" cal.	3			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
JJ	<i>Quercus imbricaria</i>	shingle oak	B&B	1.5" cal.	1			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
PP	<i>Quercus shumardii</i>	Shumard oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	9			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

MM14

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	45
Mulch required (cy)	7
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	4			
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	6			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	3			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
W	<i>Gymnocladus dioica</i>	Kentucky coffee tree	B&B	1.5" cal.	1			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
PP	<i>Quercus shumardii</i>	Shumard oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	10			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

2946

MM19

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	41
Mulch required (cy)	6
Seed required (lb)	5.3125

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	3			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	6			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	3			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
PP	<i>Quercus shumardii</i>	Shumard oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	9			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

MM20

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.23
No. trees	40
Mulch required (cy)	6
Seed required (lb)	4.8875

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	4			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	5			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	4			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
AA	<i>Liquidambar styraciflua</i>	sweetgum	B&B	1.5" cal.	1			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	1			
LL	<i>Quercus muhlenbergii</i>	chinquapin oak	B&B	1.5" cal.	1			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	2			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	9			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

2946

MM21

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	45
Mulch required (cy)	7
Seed required (lb)	5.3125

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	3			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	1			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	6			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	4			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	5			
U	<i>Fraxinus pennsylvanicum</i>	green ash	B&B	1.5" cal.	3			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	1			
AA	<i>Liquidambar styraciflua</i>	sweetgum	B&B	1.5" cal.	1			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	2			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
RR	<i>Sassafras albidum</i>	sassafras	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	8			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

MM22

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	48
Mulch required (cy)	7
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	4			
F	<i>Aesculus octandra</i>	yellow buckeye	B&B	1.5" cal.	6			
K	<i>Carya ovata</i>	shagbark hickory	B&B	1.5" cal.	2			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	2			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	4			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	6			
U	<i>Fraxinus pennsylvanicum</i>	green ash	B&B	1.5" cal.	2			
X	<i>Juglans cinerea</i>	butternut	B&B	1.5" cal.	1			
AA	<i>Liquidambar styraciflua</i>	sweetgum	B&B	1.5" cal.	1			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	1			
MM	<i>Quercus palustris</i>	pin oak	B&B	1.5" cal.	2			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	1			
RR	<i>Sassafras albidum</i>	sassafras	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	10			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	2			

Notes

2946

BS23

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	43
Mulch required (cy)	7
Seed required (lb)	5.3125

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	2			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	11			
G	<i>Asimina triloba</i>	pawpaw	B&B	1.5" cal.	1			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	1			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	21			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	2			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	2			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	1			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	1			

Notes

BS24

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.22
No. trees	38
Mulch required (cy)	6
Seed required (lb)	4.675

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	1			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	9			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	2			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	1			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	20			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	2			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	2			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			

Notes

2946

BS25

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.29
No. trees	49
Mulch required (cy)	8
Seed required (lb)	6.1625

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
B	<i>Acer rubrum</i>	red maple	B&B	1.5" cal.	1			
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	2			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	13			
I	<i>Carya cordiformis</i>	bitternut hickory	B&B	6'	1			
M	<i>Celtis occidentalis</i>	hackberry	B&B	1.5" cal.	1			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	24			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	2			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	3			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	1			

Notes

BS26

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.21
No. trees	36
Mulch required (cy)	6
Seed required (lb)	4.4625

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	2			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	9			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	16			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	1			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	2			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	1			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	1			
NN	<i>Quercus prinus</i>	chestnut oak	B&B	1.5" cal.	1			
QQ	<i>Quercus velutina</i>	black oak	B&B	1.5" cal.	1			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	1			

Notes

2946

BS27

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.23
No. trees	39
Mulch required (cy)	6
Seed required (lb)	4.8875

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
C	<i>Acer saccharinum</i>	silver maple	B&B	1.5" cal.	2			
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	9			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	19			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	2			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	2			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	1			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	1			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	1			

Notes

BS28

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.21
No. trees	35
Mulch required (cy)	5
Seed required (lb)	4.4625

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	9			
H	<i>Carpinus caroliniana</i>	ironwood	B&B	1.5" cal.	1			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	19			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	1			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	2			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
DD	<i>Ostrya virginiana</i>	hop hornbeam	B&B	1.5" cal.	1			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	1			

Notes

2946

BS29

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.18
No. trees	32
Mulch required (cy)	5
Seed required (lb)	3.825

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	8			
H	<i>Carpinus caroliniana</i>	ironwood	B&B	1.5" cal.	1			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	16			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	1			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	2			
CC	<i>Nyssa sylvatica</i>	black gum	B&B	1.5" cal.	1			
DD	<i>Ostrya virginiana</i>	hop hornbeam	B&B	1.5" cal.	1			
JJ	<i>Quercus imbricaria</i>	shingle oak	B&B	1.5" cal.	1			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	1			

Notes

BS30

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.18
No. trees	32
Mulch required (cy)	5
Seed required (lb)	3.825

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	8			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	2			
P	<i>Cornus florida</i>	flowering dogwood	B&B	1.5" cal.	1			
S	<i>Fagus grandifolia</i>	American beech	B&B	1.5" cal.	17			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	1			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	1			
DD	<i>Ostrya virginiana</i>	hop hornbeam	B&B	1.5" cal.	1			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	1			

Notes

2946

OS1

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	44
Mulch required (cy)	7
Seed required (lb)	5.3125

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	10			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
H	<i>Carpinus caroliniana</i>	ironwood	B&B	1.5" cal.	1			
I	<i>Carya cordiformis</i>	bitternut hickory	B&B	6'	2			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	3			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	3			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	5			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	3			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	5			
NN	<i>Quercus prinus</i>	chestnut oak	B&B	1.5" cal.	1			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	6			
QQ	<i>Quercus velutina</i>	black oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	2			

Notes

OS2

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	49
Mulch required (cy)	8
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	10			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
G	<i>Asimina triloba</i>	pawpaw	B&B	1.5" cal.	1			
H	<i>Carpinus caroliniana</i>	ironwood	B&B	1.5" cal.	1			
I	<i>Carya cordiformis</i>	bitternut hickory	B&B	6'	3			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	6			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	4			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	5			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	3			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	5			
NN	<i>Quercus prinus</i>	chestnut oak	B&B	1.5" cal.	1			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	5			
QQ	<i>Quercus velutina</i>	black oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	2			

Notes

-- 2946

OS3

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	47
Mulch required (cy)	7
Seed required (lb)	5.525

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	10			
G	<i>Asimina triloba</i>	pawpaw	B&B	1.5" cal.	1			
H	<i>Carpinus caroliniana</i>	ironwood	B&B	1.5" cal.	1			
I	<i>Carya cordiformis</i>	bitternut hickory	B&B	6'	3			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	5			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	4			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	5			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	1			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	3			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	5			
NN	<i>Quercus prinus</i>	chestnut oak	B&B	1.5" cal.	1			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	5			
QQ	<i>Quercus velutina</i>	black oak	B&B	1.5" cal.	1			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	2			

Notes

OS4

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	46
Mulch required (cy)	7
Seed required (lb)	5.3125

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
D	<i>Acer saccharum</i>	sugar maple	B&B	1.5" cal.	10			
E	<i>Aesculus glabra</i>	Ohio buckeye	B&B	1.5" cal.	1			
G	<i>Asimina triloba</i>	pawpaw	B&B	1.5" cal.	1			
I	<i>Carya cordiformis</i>	bitternut hickory	B&B	6'	2			
J	<i>Carya laciniosa</i>	shellbark hickory	B&B	4'	7			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	4			
Y	<i>Juglans nigra</i>	black walnut	B&B	1.5" cal.	6			
GG	<i>Prunus serotina</i>	black cherry	B&B	1.5" cal.	2			
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	5			
JJ	<i>Quercus imbricaria</i>	shingle oak	B&B	1.5" cal.	1			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	5			
SS	<i>Tilia americana</i>	American basswood	B&B	1.5" cal.	2			

Notes

2946

SV1

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.27
No. trees	6
Mulch required (cy)	1
Seed required (lb)	6.40

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	6			

Notes

SV2

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.26
No. trees	8
Mulch required (cy)	1
Seed required (lb)	6.16

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	3			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	5			

Notes

2946

SV3

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	8
Mulch required (cy)	1
Seed required (lb)	5.93

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	3			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	5			

Notes

SV4

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.27
No. trees	9
Mulch required (cy)	1
Seed required (lb)	6.40

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
II	<i>Quercus bicolor</i>	swamp white oak	B&B	1.5" cal.	3			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	6			

Notes

2946

SV5

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.24
No. trees	7
Mulch required (cy)	1
Seed required (lb)	5.69

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
II	<i>Quercus bicolor</i>	swamp white oak	B&B	1.5" cal.	2			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	5			

Notes

SV6

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.23
No. trees	11
Mulch required (cy)	2
Seed required (lb)	5.45

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
II	<i>Quercus bicolor</i>	swamp white oak	B&B	1.5" cal.	2			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	9			

Notes

2946

SV7

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.22
No. trees	11
Mulch required (cy)	2
Seed required (lb)	5.21

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
II	<i>Quercus bicolor</i>	swamp white oak	B&B	1.5" cal.	2			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	9			

Notes

SV8

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.23
No. trees	8
Mulch required (cy)	1
Seed required (lb)	5.45

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	3			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	5			

Notes

2946

SV9

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.28
No. trees	8
Mulch required (cy)	1
Seed required (lb)	6.64

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	3			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	5			

Notes

SV10

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.24
No. trees	8
Mulch required (cy)	1
Seed required (lb)	5.69

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
HH	<i>Quercus alba</i>	white oak	B&B	1.5" cal.	3			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	2.5" cal.	5			

Notes

2946

BF31

Item	Date
Herbicide applied	
Patch delineated	
Locations flagged	
Color	
Plants installed	
Installation QC'd	
Mulch applied	
Seed applied	
Patch raked	
Patch watered	

Size (acres)	0.25
No. trees	77
Mulch required (cy)	12
Seed required (lb)	5.31

ID	Scientific Name	Common Name	Form	Size	Qty.	Installed	Watered	Mulched
N	<i>Cercis canadensis</i>	redbud	B&B	1.5" cal.	8			
P	<i>Cornus florida</i>	flowering dogwood	B&B	1.5" cal.	8			
R	<i>Crataegus mollis</i>	hawthorn	B&B	1.5" cal.	4			
T	<i>Fraxinus americana</i>	white ash	B&B	1.5" cal.	4			
W	<i>Gymnocladus dioica</i>	Kentucky coffee tree	B&B	1.5" cal.	4			
Z	<i>Juniperus virginiana</i>	red cedar	B&B	1.5" cal.	30			
BB	<i>Liriodendron tulipifera</i>	tulip poplar	B&B	1.5" cal.	4			
FF	<i>Populus deltoides</i>	cottonwood	Cont.	2 gal.	4			
KK	<i>Quercus macrocarpa</i>	bur oak	B&B	1.5" cal.	4			
OO	<i>Quercus rubra</i>	red oak	B&B	1.5" cal.	4			
TT	<i>Ulmus americana</i>	American elm	B&B	1.5" cal.	3			

Notes

