6.0 Natural Resources

Results in Brief: Ecological Monitoring Activities

Wetland Mitigation Monitoring

- Amphibian Index of Biotic Integrity scores indicate that created wetlands that are located close to forest communities provide good habitat for amphibians.
- Hydrological monitoring results indicate that most mitigation wetlands met performance standards for the amount of time water is in the root zone, while about half of the wetlands met the average water depth performance standard.
- Soil biogeochemistry standards were not met for most mitigation wetlands. More time is needed to develop wetland soils.

Prairie Functional Monitoring

Prairie areas showed significant progress over baseline conditions and continued improvement when compared against the results from 2004.

Site and OSDF Inspections

No major issues were observed with respect to institutional controls or the integrity of the OSDF cap. Findings focused mainly on invasive plants and woody vegetation in the vicinity of the OSDF.

This section provides background information on the natural resources associated with the Fernald Preserve and summarizes the activities in 2010 relating to these resources. Included in this section is a discussion of the following:

- Ecological restoration activities.
- Fernald Preserve site and OSDF inspections.
- Affected habitat areas.
- Threatened and endangered species.
- Cultural resources.

Much of the 1,050 acres (425 hectares) of the Fernald Preserve property is undeveloped land that provides habitat for a variety of animals and plants. Wetlands, deciduous and riparian (streamside) woodlands, old fields, grasslands, and aquatic habitats are among the site's natural resources. Over 900 acres of the site have undergone ecological restoration. Figure 6–1 shows the restoration project areas that have been completed. Some of these areas provide habitat for state and federal endangered species. These endangered species are identified in Section 6.4. Cultural resources, such as prehistoric archaeological sites, can also be found at the Fernald Preserve.

Monitoring of these natural and cultural resources is addressed in the Natural Resource Monitoring Plan, which is included in the IEMP. The Natural Resource Monitoring Plan presents an approach for monitoring and reporting the status of several priority natural resources to remain in compliance with pertinent regulations and agreements. The site and OSDF inspection process, which is defined in the LMICP, also helps to evaluate the condition of natural resources at the Fernald Preserve.

The approach for monitoring and maintenance of ecologically restored areas was revised in 2009. DOE and OEPA signed a Consent Decree in November 2008 that settled a long-standing natural resource damage claim under Section 107 of CERCLA. As a result, the Fernald Natural Resource Trustees (DOE, OEPA, and the U.S. Department of Interior) have finalized the Natural Resource Restoration Plan (NRRP), which is Appendix B of the *Consent Decree Resolving Ohio's Natural Resource Damage Claim against DOE* (State of Ohio 2008). The NRRP specifies an enhanced monitoring program for ecologically restored areas at the site. These new monitoring activities continued in 2010, with amphibian and hydrological monitoring across site wetlands, along with vegetation surveys of restored prairies.

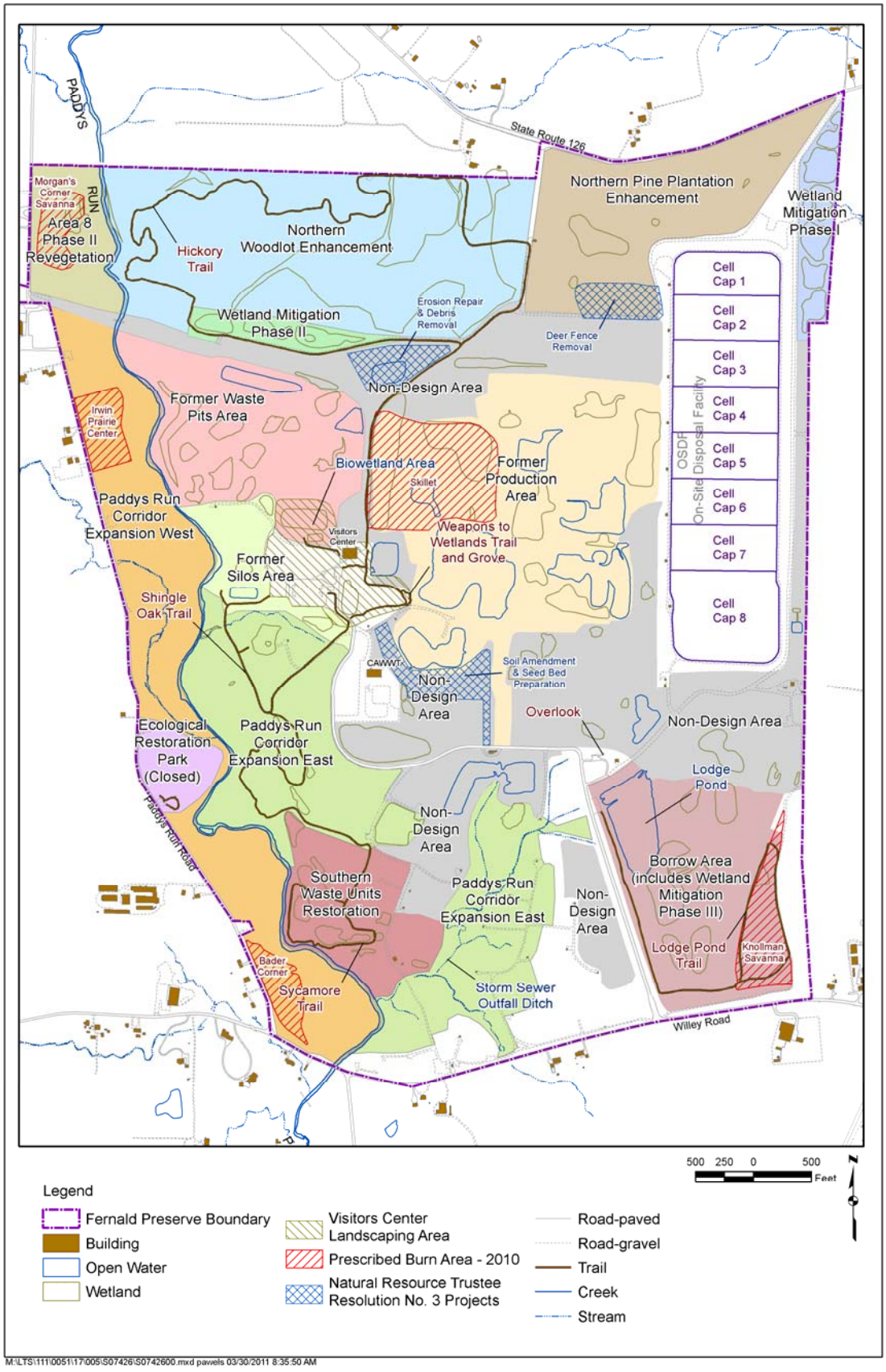

Figure 6–1. Restoration Project Areas

6.1 Ecological Restoration Activities

The Fernald Preserve's mission of long-term stewardship under LM includes the establishment, management, and monitoring of ecologically restored areas across the site. In 2010, repair and enhancement of several ecologically restored areas was undertaken as follow-up to project walkdowns by the Natural Resource Trustees in 2009. Maintenance in ecologically restored areas included continued control of noxious weeds and invasive plants, and limiting impacts due to nuisance animals (e.g., deer and geese). In addition, the use of prescribed fire continued at the Fernald Preserve in 2010.

6.1.1 Ecological Restoration Repair and Enhancement

The Fernald Natural Resource Trustees agreed on several repair and enhancement projects following walkdowns of restored areas in 2009. Work included erosion repair in several areas, removal of some deer exclosure fencing, and the addition of soil amendment and reseeding east of the CAWWT facility. Most of these efforts were completed in 2010. The projects, which became known as the Natural Resource Trustee Resolution No. 3 Projects, are identified on Figure 6–1.

Three distinct project areas are shown on Figure 6–1. The Deer Fence Removal project involved removal of approximately 1,600 ft (488 m) of deer exclosure fencing that was no longer needed. The Erosion Repair and Debris Removal project can be seen from the Hickory Trail. This effort involved erosion repair and reseeding, along with the removal of an abandoned culvert and clean concrete from a riprap spillway. About 1,600 cubic yards (1,223 cubic meters) of yard waste compost were used to amend existing soil in the Soil Amendment and Seed Bed Preparation area. Once the compost was applied, approximately 4 acres (1.6 hectares) of prairie seeding took place. All three tasks were completed successfully. Site personnel will continue to monitor all seeded areas to ensure proper vegetation establishment.

The removal of the Ecological Restoration Park along Paddys Run Road was also undertaken in the fall of 2010. The small size and remote location of the "Eco Park" had become an "attractive nuisance," with regular instances of vandalism and littering being documented during weekly inspections. Site personnel removed the decks, steps and signs, and repositioned wooden posts along the edge of the parking area to prevent unauthorized access. The gravel lot was left as an access location to the western portion of the site for field personnel.

6.1.2 Restored Area Maintenance Activities

Spot spraying with a broad-leaf herbicide, in conjunction with mowing and manual cutting, was continued in 2010 to control Canada thistle and other noxious weeds across the site. Manual cutting, followed by herbicide application to the stumps, was also used to remove bush honeysuckle and callery pear from several areas within the Wetland Mitigation Phase I project. Callery pear is an emerging nuisance at the site. Callery pear is the common name for any one of a variety of common commercial landscape trees, such as Bradford Pear. These trees have been observed in the northeastern portion of the site, as well as within the OSDF. This non-native plant crowds out more desirable native species.

The primary nuisance animals on site are white-tailed deer and Canada geese. Existing deer exclosure fencing was maintained sitewide. As with the Natural Resource Trustee Resolution

No. 3 projects, several deer fences have been targeted for removal. The trees within the fenced area have reached sufficient size and density to withstand pressure from deer browsing and rubbing.

Canada geese are an ongoing concern at the Fernald Preserve. The goose hazing program that was initiated in 2007, using trained border collies to harass the geese, was continued in 2010. The dogs, which are brought onto the Fernald Preserve by their handlers, actually try to herd the geese, but the geese see the dogs as predators and fly off, from both land and water. The goal is to keep the geese out of areas that have been seeded so that the vegetation has time to become established. Once the grasses become tall, the geese will no longer be attracted to those areas. A second goal is to make the geese too uncomfortable to want to nest at the Fernald Preserve.

The use of prescribed burns was continued at the Fernald Preserve in 2010. There are several benefits to prescribed burning. The tallgrass prairie species that have been seeded at the Fernald Preserve are well adapted to periodic fires. Most prairie species are deep-rooted. They have an extensive root system that is developed before the stem and leaf clump form above the surface. The root system allows them to be burned, eliminating the above-surface plant clump, without killing the plant. After a burn, when prairie plants grow back from the roots, they are vibrant. The burns convert the plant material to ash, reducing the accumulation of thatch. The ash is in contact with the soil and breaks down quickly, and the nutrients in the ash become available in the soil. Also, the blackened, ash-covered ground absorbs more heat from sunlight and warms the soil. As a result, the soil reaches a temperature conducive to germination and native plant growth earlier in the spring. The growing season for the grasses and wildflowers is increased, and the sunlight on the soil surface promotes the growth of new plants and increases the productivity of existing plants.

Five areas were burned in 2010, totaling 46 acres (19 hectares). Figure 6–1 shows the location of the burn areas. The “Skillet” burn, which is located in the Former Production Area, was conducted in November. All other burns were conducted in March. Each burn was conducted safely with no incidents and within the parameters of approved Prescribed Burn Plans.

Seeding activities were focused mainly on enhancement of prairie areas following prescribed burns. Additional seeding was conducted in approximately 7 acres (3 hectares) along the Visitors Center access road, south of the Soil Amendment and Seedbed Preparation area. Seeding of disturbed areas following the Utility Upgrades project was also conducted.

One additional planting activity was conducted in 2010. Approximately 2,300 bare root seedlings were planted in the Northern Pine Plantation Enhancement area. This effort was an activity specified during the 2009 Natural Resource Trustee project walkdowns.

Ecological restoration monitoring has been divided into two phases: the implementation phase and the functional phase. Implementation phase monitoring is conducted to ensure that restoration projects are completed as intended in their designs. This effort involves the mortality counts and herbaceous cover estimates that are conducted after a project is completed. No implementation activities were required in 2010.

Functional-phase monitoring is more general and considers projects in terms of their contribution to the ecological community as a whole. This is accomplished by comparing projects to pre-remediation baseline conditions and to ideal reference sites. The Natural Resource Restoration

Plan, which was finalized in November 2008 with settlement of the Natural Resource Damage Claim, reinstituted the use of functional-phase monitoring as a means of evaluating restored communities. The Natural Resource Restoration Plan also calls for an enhanced wetland mitigation monitoring program.

6.1.3 Ecological Restoration Monitoring

Vegetation Monitoring Parameters
There are a number of ways to evaluate the type and quality of vegetation within an area. At the Fernald Preserve, vegetation monitoring focuses on determining the extent of native species composition and calculating a Floristic Quality Assessment Index (FQAI). The FQAI process is described in the FQAI for vascular plants and mosses for the State of Ohio (Andreas 2004). The specific parameters used at the Fernald Preserve include the following:

Total Species: The total number of species sampled within a given area.

Native Species: The total number of species that are native to Ohio. The Ohio Vascular Plant Database is used to determine whether a species is native (Andreas 2004).

Percent Native Species: The number of native species divided into the total number of species. Relative frequency of native species has also been used in the past. This is calculated by dividing the frequency (or number of times a species is observed) into the total number of observations for a given area.

Average Coefficient of Conservatism (CC): The CC is a number from 0 to 10 that has been assigned to virtually every species that may be found in Ohio. The CC value is related to how "tolerant" a species is and what its habitat requirements are. Non-native plants have a CC of 0. Common species that can grow in a wide variety of habitats are considered "tolerant," and are scored a CC between 0 and 3. Native plants with very specific habitat requirements are scored high CC values, in the 7 to 10 range. The Ohio Vascular Plant Database lists the CC for each plant found in Ohio.

Floristic Quality Assessment Index (FQAI): The CC values described above are used to calculate the FQAI. The FQAI is the sum of CC values divided by the square root of the total number of species for a given area.

Ecological restoration monitoring in 2010 centered on continuation of the expanded wetland mitigation monitoring program. DOE has the responsibility to create 17.85 acres (7.22 hectares) of jurisdictional wetlands at the Fernald Preserve. While over 80 acres (32 hectares) of wetland habitat have been created as part of ecological restoration activities, DOE needs to demonstrate that at least 17.85 acres (7.22 hectares) of these meet the definition of a "jurisdictional" wetland. A wetland is considered "jurisdictional" if it meets specific criteria regarding vegetation, hydrology (water), and soils. To accomplish this, the *Fernald Preserve Wetland Mitigation Monitoring Plan* (DOE 2009) was developed to establish performance standards and monitoring requirements for wetland mitigation projects at the Fernald Preserve. The plan adopts existing OEPA performance standards and monitoring protocols for emergent wetlands. A series of parameters will be evaluated between 2009 and 2011, including the shape and size of wetlands, water elevations, soil and water chemistry, vegetation, amphibians, and other wildlife. Evaluation of these parameters ensures that the functions and services that wetlands provide are addressed. This new process takes the place of previous efforts that included a one-time vegetation survey and annual water quality sampling.

6.1.3.1 Wetland Mitigation Monitoring

For 2010, monitoring activities focused on characterizing amphibian communities, hydrological monitoring, and soil biogeochemical sampling. A summary of these efforts is provided below. Amphibian monitoring involves surveying wetlands using funnel traps. Ten traps are placed in a wetland basin and left for 24 hours. Amphibians and other wildlife easily crawl or swim into the traps, but have a difficult time escaping. Field personnel return the following day, record and release whatever is found. Wildlife are usually returned unharmed.

Fifteen wetland basins were included in the amphibian monitoring program. Figure 6–2 shows the location of basins surveyed. A summary of the species found is presented in Table 6–1. This amphibian information is used to calculate an Amphibian Index of Biotic Integrity (AIBI) score. AIBI scores for each wetland area surveyed are also provided in Table 6–1. While there is no numerical performance standard to compare these AIBI scores to, it is interesting to note the relatively high scores of the NPP and WM2 wetland basins. These areas have continued to demonstrate that they are good habitat for ambystomid (mole) salamander species. It is suspected that the location of more mature woodlots adjacent to the mitigation projects provides a source of amphibian species. Appendix D provides more detail in the calculation and analysis of AIBI scores.

Hydrological monitoring consists of daily water level readings from shallow wells (piezometers) that were installed in late 2009. Figure 6–2 shows the locations of piezometers within site wetlands. There are two performance standards associated with water elevations. First, the average depth to groundwater should be less than 11.6 inches (29.4 cm). Second, water should be present in the root zone (less than 11.8 inches [30 cm] deep) more than 53 percent of the time.

Table 6–2 summarizes the 2010 findings. This shows that most wetlands met the root zone standard, and about half met the average depth. These findings are as expected for surface-water-fed emergent wetlands such as those at Fernald. The low average depth in some of the wetlands is most likely due to the regional drought in the fall of 2010. Almost all the wetlands monitored showed strong seasonal variation, with low levels recorded in September and October. The low values in Wetland BAPW2 are most likely attributable to a malfunctioning transducer. The transducer has been replaced, and the data will be reevaluated in 2011.

Soil samples were also taken near each of the piezometer locations. Samples were analyzed for total nitrogen, total organic carbon, and percent solids. These parameters provide an indication of wetland soil development. Long periods of inundation cause a number of chemical changes to natural wetland soils. These unique properties help wetlands provide some of their important ecological functions, such as filtering and storing capacity.

Table 6–3 provides a summary of results. Results showed some progress, but more time will be needed to meet soil biogeochemistry performance standards. The only performance standard met in 2010 was the amount of total organic carbon present in several of the Former Production Area basins. Given the relatively young age of site mitigation wetlands (4 to 10 years old), these results are not unexpected. Previous research by OEPA has shown that the 2010 results are fairly typical for mitigation wetlands (Fennessy et al. 2004).

The 2010 water level measurement and soil sampling is an initial effort and will continue in 2011. The results discussed above will be of more value when enough data are acquired to allow comparisons over time.

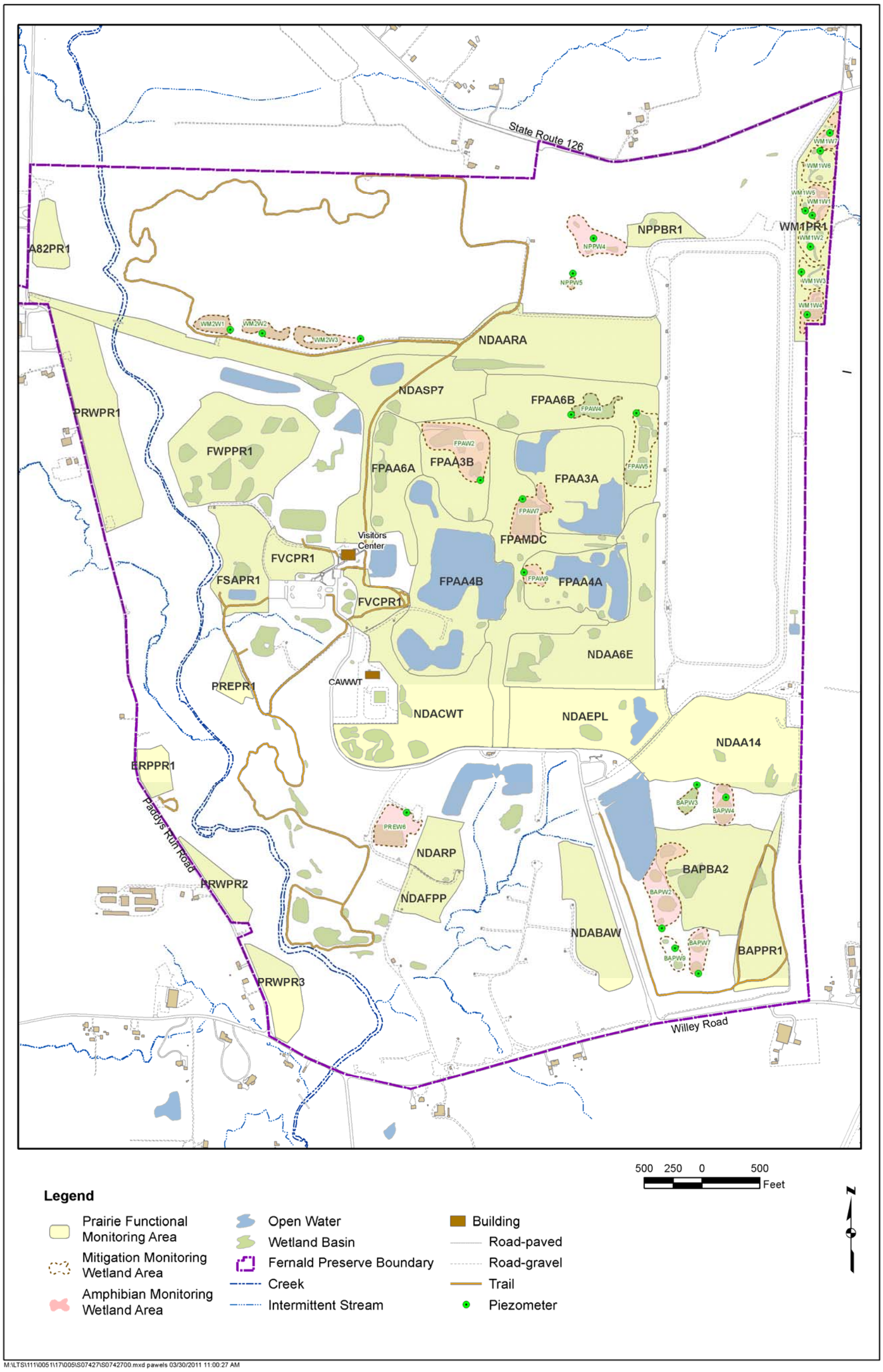

Figure 6–2. Ecological Monitoring Activities

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Table 6–1. Amphibian Monitoring Summary

Restoration Project Area	Wetland Area	AIBI[a]	Species and Number of Individuals								
			Cricket Frog (*Acris crepitans*)	Streamside Salamander (*Ambystoma barbouri*)	Marbled Salamander (*Ambystoma opacum*)	American Toad (*Anaxyrus americanus*)	Fowlers Toad (*Anaxyrus fowleri*)	American Bull Frog (*Lithobates catesbeiana*)	Green Frog (*Lithobates clamitans*)	Northern Leopard Frog (*Lithobates pipiens*)	Spring Peeper (*Pseudacris crucifer*)
Borrow Area (BAP)	BAPW2	0	0	0	0	0	83	0	0	0	0
	BAPW4	0	0	0	0	0	0	2	0	0	0
	BAPW7	0	0	0	0	0	0	4	0	0	0
Former Production Area (FPA)	FPAW2	0	0	0	0	0	0	10	0	0	0
	FPAW7	0	0	0	0	0	0	0	0	0	0
	FPAW9	0	0	0	0	0	0	4	1	0	0
	PREW6	13	19	0	0	0	0	32	0	0	31
Northern Pine Plantation Enhancement (NPP)	NPPW4	16	16	0	1	16	0	13	0	0	5
	NPPW5	24	15	0	0	0	0	6	1	0	1
Wetland Mitigation Phase I (WM1)	WM1W1	0	0	0	0	0	0	10	0	0	0
	WM1W4	13	8	0	0	0	0	27	0	0	0
	WM1W7	0	0	0	0	0	0	5	1	1	0
Wetland Mitigation Phase II (WM2)	WM2W1	3	6	0	0	480	0	9	2	0	3
	WM2W2	3	12	0	0	794	0	5	0	0	0
	WM2W3	16	10	1	0	0	0	12	0	0	3

[a]Amphibian Index of Biotic Integrity Score

Table 6–2. Hydrological Monitoring Summary

Restoration Project Area	Wetland Area	Average Depth (cm)	Percent of Time in Root Zone (<30 cm)
Borrow Area (BAP)	BAPW2	66	6%
	BAPW3	**25**	**71%**
	BAPW4	**14**	**73%**
	BAPW7	32	**68%**
	BAPW9	**28**	**67%**
Former Production Area (FPA)	FPAW2	32	**67%**
	FPAW4	**19**	**78%**
	FPAW5	**15**	**71%**
	FPAW7	**22**	**77%**
	FPAW9	53	30%
	PREW6	**13**	**75%**
Northern Pine Plantation Enhancement (NPP)	NPPW4	**28**	**65%**
	NPPW5	**28**	**67%**
Wetland Mitigation Phase I (WM1)	WM1W1	49	34%
	WM1W2	36	**67%**
	WM1W3	41	**63%**
	WM1W4	**24**	**77%**
	WM1W5	38	**53%**
	WM1W6	30	**66%**
	WM1W7	37	**61%**
Wetland Mitigation Phase II (WM2)	WM2W1	**15**	**97%**
	WM2W2	**18**	**73%**
	WM2W3	31	**66%**
Performance Standard		<29.4	>53%

Values in bold have met the performance standard

Table 6–3. Soil Biogeochemistry Sampling Summary

Restoration Project Area	Wetland Area	Percent Total Nitrogen	Percent Total Organic Carbon	Percent Solids
Borrow Area (BAP)	BAPW2	0.1	0.9	77.4
	BAPW3	0.1	1.1	65.4
	BAPW4	0.1	1.1	76.5
	BAPW7	0.1	2.0	75.0
	BAPW9	0.2	1.5	79.2
Former Production Area (FPA)	FPAW2	0.3	**5.4**	56.2
	FPAW4	0.4	**4.4**	65.1
	FPAW5	0.2	**4.1**	70.2
	FPAW7	0.3	**5.0**	60.9
	FPAW9	0.1	1.9	68.4
	PREW6	0.1	1.4	68.4
Northern Pine Plantation Enhancement (NPP)	NPPW4	0.2	2.6	62.9
	NPPW5	0.1	0.8	68.7
Wetland Mitigation Phase I (WM1)	WM1W1	0.2	2.3	65.3
	WM1W2	0.1	1.7	67.7
	WM1W3	0.1	1.3	72.1
	WM1W4	0.1	1.6	69.5
	WM1W5	0.2	2.2	69.1
	WM1W6	0.2	1.4	68.7
	WM1W7	0.3	3.6	68.1
Wetland Mitigation Phase II (WM2)	WM2W1	0.1	3.5	69.3
	WM2W2	0.1	1.4	77.7
	WM2W3	0.0	1.9	79.2
Performance Standard		>0.5	>3.9	<46.6

Values in bold have met the performance standard

Table 6–4. Prairie Functional Monitoring Summary

Functional Monitoring Area	Total Species	Native Species	Percent Native	Average CC[a]	FQAI[b]	Average Cover[c]
A82PR1	43	27	63%	2.03	13.57	87%
BAPPR1	20	13	65%	2.15	9.62	98%
BAPPR2	24	10	42%	1.20	5.88	85%
ERPPR1	39	25	64%	1.46	9.13	98%
FPAA3A	23	19	83%	2.70	12.93	84%
FPAA3B	34	24	71%	2.35	13.72	91%
FPAA4A	36	23	64%	2.22	13.33	94%
FPAA4B	43	27	63%	2.07	13.57	87%
FPAA6A	31	21	68%	2.03	11.32	94%
FPAA6B	43	31	72%	2.07	13.56	96%
FPAMDC	47	30	64%	1.74	11.96	78%
FSAPR1	44	23	52%	1.68	11.16	92%
FVCPR1	43	30	70%	2.21	14.49	75%
NDAA14	39	20	51%	1.28	8.01	88%
NDAA6E	34	18	53%	1.15	6.69	77%
NDAARA	39	19	49%	1.59	9.93	88%
NDABAW	36	21	58%	1.81	10.83	94%
NDACWT	33	18	55%	1.45	8.36	94%
NDAEPL	35	20	57%	2.06	12.17	90%
NDAFPP	35	20	57%	3.11	18.42	90%
NDARP	31	14	45%	1.52	8.44	96%
NDASP7	40	18	45%	0.88	5.53	74%
NPPBR1	32	15	47%	1.28	7.25	98%
PREPR1	41	29	71%	2.23	14.30	98%
PRWPR1	32	19	59%	1.94	10.96	97%
PRWPR2	35	20	57%	1.49	8.79	96%
PRWPR3	38	27	71%	2.13	13.14	98%
WM1PR1	25	14	56%	1.80	9.00	96%
Baseline	38	15	39%	0.42	2.60	NA
Reference	88	81	92%	3.26	30.59	NA

[a]CC = coefficient of conservatism
[b]FQAI = Florist Quality Assessment Index
[c]NA = not applicable

Table 6–5. Functional Monitoring Comparison

Year	Total Species	Native Species	Percent Native	Average CC[a]	FQAI[b]
Wetland Mitigation Phase I					
2004	64	31	48%	1.33	10.63
2011	25	14	56%	1.80	9.00
Area 8 Phase II Revegetation					
2004	53	28	53%	1.40	10.16
2011	22	12	55%	1.68	7.89
Ecological Restoration Park					
2004	66	40	61%	1.65	13.42
2011	39	25	64%	1.46	9.13

[a]CC = coefficient of conservatism
[b]FQAI = Florist Quality Assessment Index

6.1.3.2 Functional Monitoring

In addition to the enhanced wetland mitigation monitoring program, functional monitoring of restored areas resumed in 2009 as well. This process compares restored communities to pre-restoration "baseline" conditions and high-quality reference sites. Baseline and reference sites were characterized in 2001 and 2002. From 2003 to 2005, restored areas were evaluated. Instead of a project-specific data set, broader community types (i.e. wetlands, prairie, and forest) were evaluated. Wetlands were evaluated in 2003, prairie communities in 2004, and forest habitats in 2005. For 2010, a variety of restored prairie communities were characterized. Figure 6–2 shows prairie functional monitoring locations, and Table 6–4 presents summary data. Since some of the areas surveyed were established very recently (2006 to 2008), average total cover results are provided in Table 6–4 as well.

Results show much improvement over baseline conditions, with all of the restoration areas surveyed exceeding baseline in percent native species, average coefficient of conservatism (CC), and FQAI. A comparison to the 2004 functional monitoring data set also shows continued progress. Table 6–5 provides the data summary for the three areas surveyed in 2004: The Phase I Wetland Mitigation project; Area 8, Phase II Revegetation project; and the Ecological Restoration Park prairie. Percent native species and average CC values have all improved, with the exception of the Ecological Restoration Park CC. This is most likely attributable to the large amount of Canada goldenrod that has spread across the prairie. While native, Canada goldenrod has a low CC of 1.

Prairie wildflowers were abundant in 2010 across the Fernald Preserve

6.2 Fernald Preserve Site and OSDF Inspections

The LMICP sets out a routine inspection process for both the site and the OSDF. Inspections are conducted quarterly with joint participation from DOE and the regulators. Inspections document evidence of unauthorized uses of the site, the effectiveness of institutional controls, and the need for repairs. Ecologically restored areas are evaluated for the presence of noxious weeds, erosion, the condition of vegetation, and signs of damage from nuisance animals. As vegetation continues to be established across the site, findings in 2010 were focused more on weeds and less on erosion and sparse vegetation.

For the OSDF inspections, the vegetated cap is walked down and evaluated to ensure that its integrity is maintained. Erosion rills, holes from burrowing animals, noxious weeds, settlement cracks, and other indications that there may be an issue with the proper functioning of the cap are flagged and repaired. In 2010, there were no signs that the integrity of the cap had been compromised in any way. Findings consisted mainly of woody vegetation, noxious weeds, and animal burrows.

6.3 Affected Habitat and Inspection Findings

With large-scale remediation complete, the potential for unanticipated habitat impacts is limited. Nevertheless, impacts may occur during construction or maintenance activities. In 2010, no large areas of restored habitat were affected. Approximately two acres of grassland communities and several sections of trail were impacted due to the Utility Upgrades project. Trails were re-established, and most areas were reseeded in late fall 2010. About 0.5 acre of prairie area is scheduled to be seeded in spring 2011.

6.4 Threatened and Endangered Species and Species Inventories

Sloan's Crayfish—The state-listed threatened Sloan's crayfish (*Orconectes sloanii*) is found in southwest Ohio and southeast Indiana. It prefers streams with constant (though not necessarily fast) current flowing over rocky bottoms. A large, well-established population of Sloan's crayfish is found at the Fernald Preserve in the northern reaches of Paddys Run.

Indiana Brown Bat—The federally listed endangered Indiana brown bat (*Myotis sodalis*) forms colonies in hollow trees and under loose tree bark along riparian (streamside) areas during the summer. Excellent habitat for the Indiana brown bat has been identified at the Fernald Preserve along the wooded banks of the northern reaches of Paddys Run. The habitat provides an extensive mature canopy of older trees and water throughout the year. One Indiana brown bat was captured and released on the property in August 1999.

Running Buffalo Clover—The federally listed endangered running buffalo clover (*Trifolium stoloniferum*) is a member of the clover family whose flower resembles that of the common white clover. Its leaves, however, differ from those of white clover in that they are heart-shaped and a lighter shade of green. Running buffalo clover has not been identified at the Fernald Preserve; however, because running buffalo clover is found nearby in the Miami Whitewater Forest, the potential exists for this species to become established at the site. The running buffalo clover prefers habitat with well-drained soil, filtered sunlight, limited competition from other plants, and periodic disturbances. Suitable habitat areas include partially shaded former grazed areas along Paddys Run and the storm sewer outfall ditch.

Spring Coral Root—The state-listed threatened spring coral root (*Corallorhiza wisteriana*) is a white and red orchid that blooms in April and May and grows in partially shaded areas of forested wetlands and wooded ravines. This plant has not been identified at the Fernald Preserve; however, suitable habitat exists in portions of the northern woodlot.

Cave Salamander—The state-listed endangered cave salamander (*Eurycea lucifuga*) is slender, red to orange with irregular black dots. It is found in caves, springs, small limestone streams, outcrops, and old springhouses where groundwater is present. It has only been documented in Ohio in Hamilton, Butler, and Adams counties. Suitable habitat within the Fernald Preserve is limited, but populations have been observed just north of the site.

Cobblestone Tiger Beetle—The state-listed threatened cobblestone tiger beetle (*Cicindela marginipennis*) is recognized by its olive-gray back, white sides, and red abdomen. It's found on large gravel bars on medium-sized rivers. Populations have been recorded east of the Fernald Preserve along the Great Miami River.

The Endangered Species Act requires the protection of any federally listed threatened or endangered species and any habitat critical for the species' existence. Several Ohio laws mandate the protection of state-listed endangered species as well. Since 1993 a number of surveys have been conducted to determine the presence of any threatened or endangered species at the site. As a result of these surveys, the federally listed endangered Indiana brown bat and the state-listed threatened Sloan's crayfish have been found at the Fernald Preserve. In addition, suitable habitat exists for the federally listed endangered running buffalo clover, the state-listed threatened spring coral root, the state-listed endangered cave salamander, and the state-listed threatened cobblestone tiger beetle. None of these species have been found on the site, but their habitat ranges encompass the Fernald Preserve. Figure 6–3 shows the potential habitats for these species. According to provisions in the IEMP, threatened or endangered species habitat will be surveyed prior to any construction activities. If threatened or endangered species are present, appropriate avoidance or mitigation efforts will be taken.

No specific threatened or endangered species surveys were conducted in 2010. However, several other species inventories did take place. Reptile and small mammal surveys continued around a number of site wetlands using coverboards, which are 2-ft by 4-ft pieces of corrugated sheet metal. Animals are attracted to the cover and warmth the coverboards provide. Three species of snakes and five species of small mammals were observed as part of this effort.

The Fernald Preserve continued its participation in a number of bird-related data collection activities in 2010. Information on birds breeding at the Fernald Preserve was once again provided to the Ohio Breeding Bird Atlas. In 2010, 88 species were confirmed as nesting at Fernald, and another 14 species were identified as probable nesters. The large prairies that surround the open water and wetlands support a variety of grassland species, including those

listed as species in decline by the National and Ohio Audubon Societies. Nesting species observed in 2010 included northern bobwhite, dickcissel, Henslow's and grasshopper sparrows, horned lark, bobolink, and eastern meadowlark. In May 2010, a number of locally rare shore and wading birds, including black-necked stilt, Wilson's phalarope, cattle egret, and stilt sandpiper were observed in Fernald's biowetland. During the National Audubon Society's 2010 Christmas Bird Count, over 1,200 birds representing 40 species were observed at the Fernald Preserve. Fernald routinely holds 500–1,000 waterfowl during the spring and fall migrations.

6.5 Cultural Resources

The Fernald Preserve and surrounding area are located in a region of rich soil and many sources of water, such as the Great Miami River. Because of its advantageous location, the area was settled repeatedly throughout prehistoric and historical time, resulting in richly diverse cultural resources. In summary, 148 prehistoric and 40 historic sites have been identified within 1.24 miles (2 km) of the Fernald Preserve.

Several laws have been established to protect cultural resources. The National Historic Preservation Act requires DOE to consider the effects of its actions on sites that are listed or eligible for listing on the National Register of Historic Places. The Native American Graves Protection and Repatriation Act (43 CFR 10) requires that prehistoric human remains and associated artifacts be identified and returned to the appropriate Native American tribe.

To comply with these laws, DOE conducted archeological surveys prior to remediation activities in undeveloped areas of the Fernald Preserve. Figure 6–4 shows the areas of the Fernald Preserve that have been surveyed. These surveys have resulted in the identification of five sites that may be eligible for listing on the National Register of Historic Places. None of these sites were affected by construction activities, and no additional surveys were required in 2010.

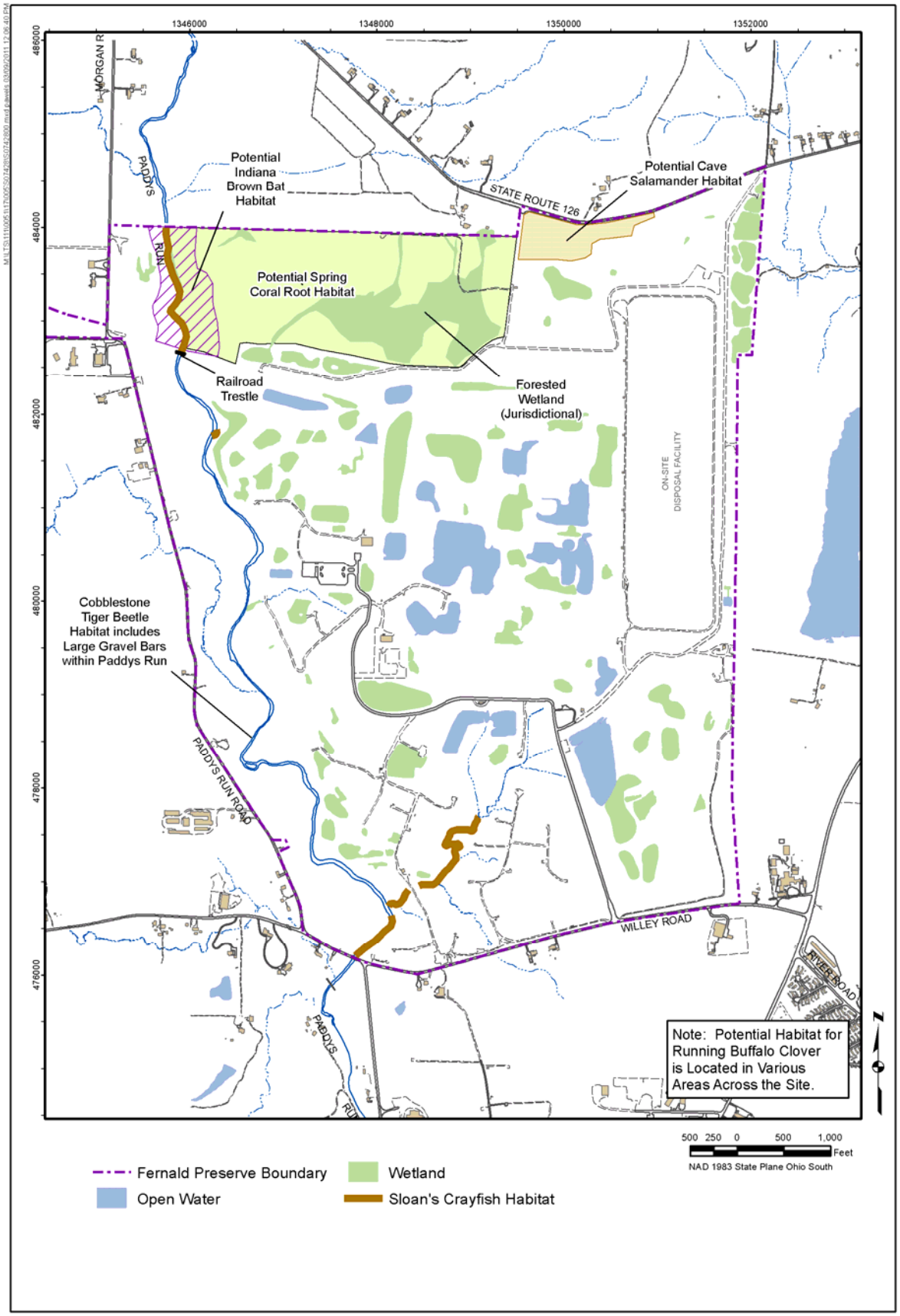

Figure 6–3. Threatened and Endangered Species Habitat Areas

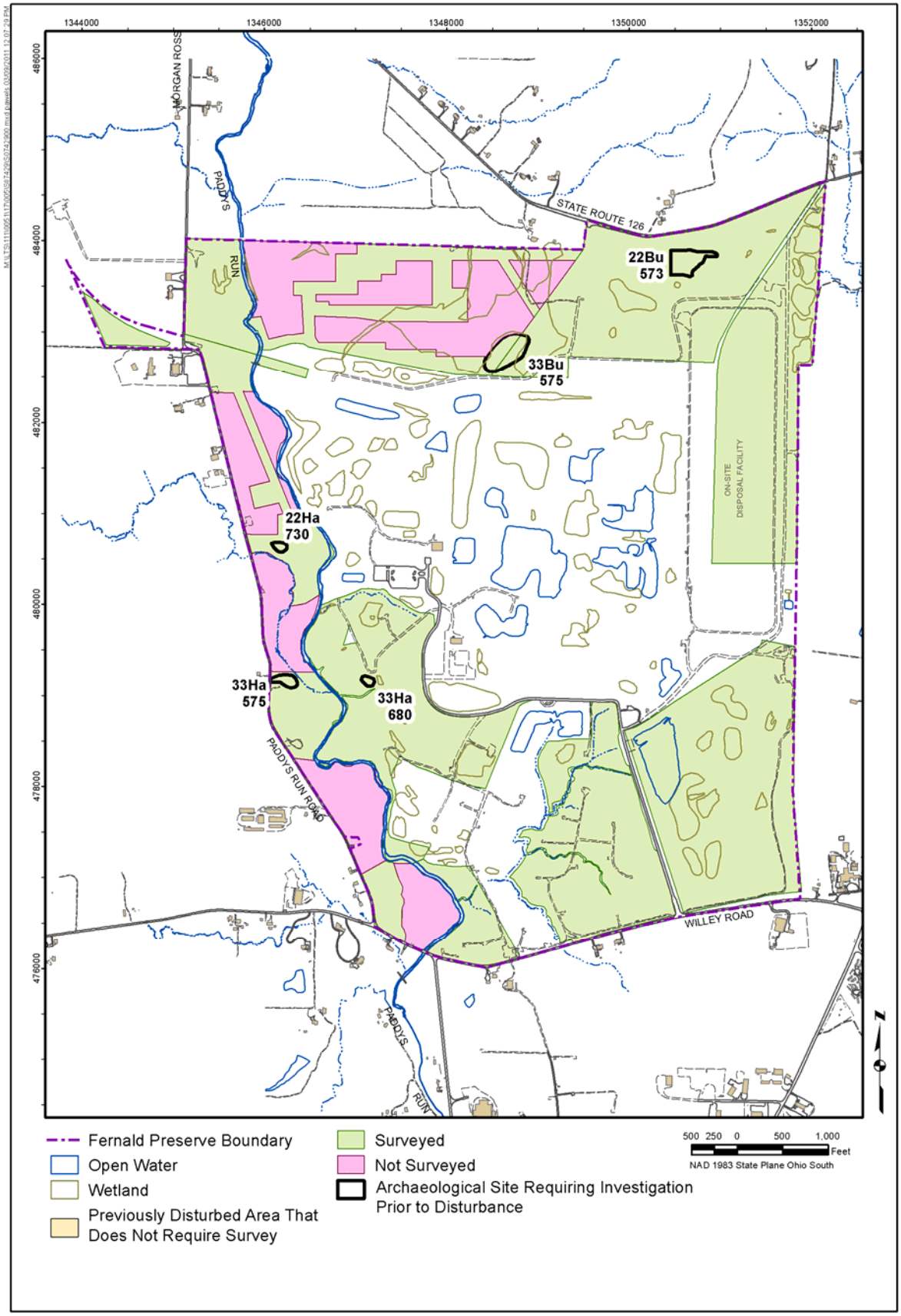

Figure 6–4. Cultural Resource Survey Area