

Success Story

Fernald Preserve



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Cover images: View of Fernald Preserve looking to the west from On-Site Disposal Facility [top]; Fernald Preserve Visitors Center [bottom]
(Source: U.S. Department of Energy)

Developed for the EPA by E² Inc.

Executive Summary

At the Fernald Preserve (formerly Feed Materials Production Center), a former U.S. Department of Energy uranium processing facility in rural southwest Ohio, remedial actions have addressed contamination at the site, and long-term ground water cleanup is under way. The remedial process at the site engaged community members and federal and state agencies in a process that integrated remedial planning and future land-use considerations. These collaborative efforts led to the selection and implementation of remedies for five operable units and integration of remedial actions with environmental restoration projects across the site. The innovative and cost-effective cleanup transformed a contaminated site into a publicly accessible ecological preserve where wetlands, prairie and forest ecosystems provide valuable wildlife habitat and educational exhibits that help tell the story of the site's history, cleanup and ongoing restoration. This report outlines the site's history, summarizes remedial status and current land uses, highlights key factors that helped transition the site to its current use, and details benefits of the site's reuse.



Figure 1. Location Map



Figure 2. Site Vicinity Map

Introduction

The Fernald Preserve (Fernald site), formerly known as the Feed Materials Production Center, Fernald Environmental Management Project and Fernald Closure Project, is a former uranium production facility located 18 miles northwest of Cincinnati, Ohio. The 1,050-acre facility lies in a rural residential area in Crosby and Ross Townships north of the town of Fernald. An estimated population of 14,600 resides within five miles of the Fernald site.



Figure 3. Fernald Property Map

Site History

The U.S. Department of Energy (DOE) and its predecessor agency the Atomic Energy Commission, operated the Feed Materials Production Center at the Fernald site from 1951-1991. At the facility, DOE processed uranium ore to support U.S. Department of Energy nuclear weapons programs.

In 1951, the DOE acquired 1,050 acres of land from 11 private land owners and constructed the processing facility. One year later, processing activities began. Uranium ore was transported to the site and processed in foundries to produce high-purity uranium. The purified uranium or “feed materials” were used as targets inserted into nuclear reactors at the Hanford facility in Washington state that produced plutonium for extraction and use in weapon construction. From 1952-1989, the facility produced more than 500 million pounds of uranium metal and approximately 1.5 billion pounds of waste material. During the facility’s operation, processing activities led to the contamination of site soil, surface water and ground water (underground water supplies).

Following the discovery of uranium-contaminated ground water in neighboring residential wells in the 1980s, the site drew national attention from the media and litigation from the state of Ohio and local citizens and workers. Political pressure to close and clean up the facility steadily mounted throughout the late 1980s. Geopolitical changes, signaled by the end of the Cold War in 1989, led the DOE to cease uranium production and shift its mission at the Fernald site to environmental management.

In a 22-year period from 1986-2008, uranium production at the site ended, the site’s remedial investigations were completed, remedies were selected and implemented for five operable units and the site was returned to use as a publicly accessible open space. These accomplishments were made possible by a collaborative effort among federal and state agencies, contractors and community stakeholders. The following sections of the report outline the site’s remedial status and current land use, highlight several key factors that led to the successful cleanup and reuse and identify the benefits of the site’s reuse.

Site History Timeline

1951: U.S. Atomic Energy Commission acquires property and builds facility.

1952: Uranium processing begins.

1986: State of Ohio initiates claim against the DOE for violations of multiple environmental regulations including natural resources damages; the EPA and DOE sign Federal Facilities Compliance Agreement initiating the Remedial Investigation/Feasibility Study.

1989: Site listed on the EPA’s National Priorities List.

1989: Uranium production ceases.

1991: Mission officially changed to remediation.

1993: Natural Resources Trustees named; the DOE convenes Fernald Citizens Advisory Board.

1993-1996: Records of Decision issued for site’s five operable units.

1998: The DOE issues draft Natural Resources Restoration Plan.

2006: Remedial actions complete with long-term ground water remedy in place; restoration projects under way.

2008: Fernald Preserve is open to the public.

Remedial Status

The following section summarizes the site's regulatory background, contaminants of concern, remedial status, cleanup process and institutional controls.

Regulatory Background:

In 1986, the state of Ohio filed claims against the DOE for violations of multiple environmental regulations including natural resource damages, and in that same year the DOE entered into a Federal Facilities Compliance Agreement with the U.S. Environmental Protection Agency that established the DOE as the site's responsible party with the EPA as the lead regulatory agency. This agreement also initiated Remedial Investigation activities at the site. In 1989, the EPA placed the site on the National Priorities List, making it eligible for cleanup under the Superfund program.

Site Contamination:

Uranium processing at the site led to the contamination of the site's soil, surface water and ground water. The primary contaminants of concern are listed in the sidebar on the right.

Site Operable Units:

Complex cleanup sites are often divided into smaller sections called operable units or OUs. Five OUs were designated at Fernald. A Record of Decision (ROD) was issued for each OU. A list of OUs and corresponding ROD issuance and remedial action completion dates are provided in the column to the right. Figure 4 on Page 6 illustrates the location of the five OUs.



The Feed Materials Production Center (Source: U.S. DOE, 1998)

Site Contamination

The primary contaminants of concern at the site include:

Radiological compounds
(uranium, radium, technetium, and thorium)

Inorganic compounds
(arsenic, beryllium, cadmium, silver, nickel and lead)

Organic compounds
(solvents)

Operable Units

OU1: Waste Pits

Record of Decision - 1995
Remedial Action - 2005

OU2: Other Waste Units

(solid waste landfill, lime sludge ponds, southern waste units)
Record of Decision - 1995
Remedial Action - 2004

OU3: Production Area

Interim Record of Decision - 1994
Record of Decision - 1996
Remedial Action - 2006

OU4: Silos

Record of Decision - 2000
Remedial Action - 2006

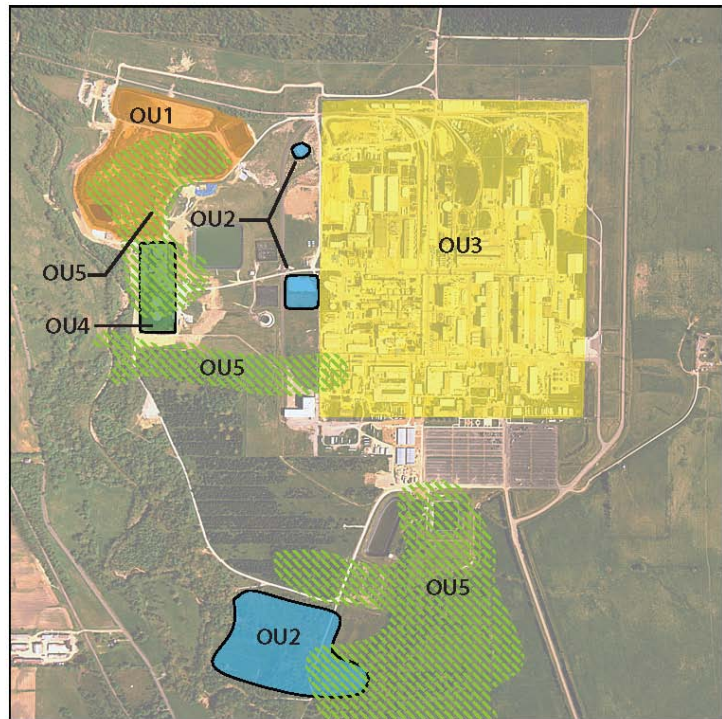
OU5: Environmental Media

(Soil, Ground water, Surface water)
Record of Decision - 1996
Remedial Action - October 2006
(soil and surface water)

Overview of Remedial Action Projects:

As of October 2006, all surface remedial action projects implementing the OU RODs are complete. Site cleanup activities were implemented through multiple remedial action projects that addressed contamination across the operable units as summarized below.

- *Waste Pits Remedial Action Project (OU1):* The waste pit contents were excavated, thermally dried and shipped by rail to a licensed, commercial disposal facility in Utah.
- *On-Site Disposal Facility (OU2, OU3, and OU5):* Approximately 2.95 million cubic yards of low-level radioactive soil and debris were excavated and disposed of in an engineered On-Site Disposal Facility (OSDF). The OSDF includes eight cells covered by a single cap measuring 950 feet wide by 3,600 feet long and 65 feet high.
- *Production Area (OU3):* More than 300 buildings, supporting equipment, inventoried hazardous material, scrap metal piles and remediation facilities were addressed under OU3. On-site buildings were decontaminated and dismantled. Debris within the waste acceptance criteria was consolidated in the OSDF. Materials with a higher level of contamination were shipped off-site for disposal.
- *Silos Project (OU4):* Silos 1 & 2 waste was solidified and placed in casks. The casks were shipped to a disposal facility in Texas. Waste from Silo 3 was removed via vacuum, conditioned for shipment, packaged in bags and sea-land containers and shipped to a licensed, commercial disposal facility in Utah.
- *Soils Characterization and Excavation Project (OU2 and OU5):* Contaminated soil exceeding the uranium cleanup level of 82 parts per million were excavated from the site and low-level soil was consolidated in the OSDF. Soil with higher levels of contamination was shipped off-site for disposal. A soil certification process using radiation scanners, physical sampling and statistical analysis was used to determine that remedial action goals had been achieved.
- *Aquifer Restoration and Waste Water Project (OU5):* Contaminated ground water in the Great Miami Aquifer is being cleaned up to restore ground water to drinking water standards (30 ppm uranium). The site's Ground Water Remediation System/Waste Water Treatment Facility, operational since 1993, utilizes an extraction and treatment system to address uranium



Operable Units

 OU1 - Waste Pits	 OU3 - Production Area
 OU2 - Other Waste Units	 OU4 - Silos
	 OU5 - Environmental Media

Figure 4. Operable Units Map (Source: U.S. DOE)

contaminated ground water extending over a 196-acre portion of the Great Miami Aquifer. That aquifer is designated as a sole-source aquifer and is a regional drinking water source. Ground water users in the area affected by site's off-site ground water contamination are served by an alternate water supply to prevent exposure to contamination.

Institutional Controls:

A large volume of soil and debris contaminated with radiological compounds is contained within the OSDF and concentrations of contamination remaining in site soil and ground water are present at levels that prevent unrestricted future use and unlimited exposure at the Fernald site, therefore institutional controls are required to restrict future uses and potential exposures. An institutional controls plan is in place at the site and requires constant monitoring and updating. The primary institutional controls outlined in the 2009 Institutional Controls Plan include:

- *Site Ownership:* Proprietary controls originate from responsibilities of site ownership. The Fernald site and OSDF will remain in federal ownership in perpetuity. DOE Office of Legacy Management is responsible for monitoring and maintenance of the OSDF and Fernald Preserve property.
- *Governmental Controls:* Institutional controls also include restrictions on the use of property. An environmental covenant contains restrictions on residential and agricultural uses of the site, ground water use and requires that the site remain in federal ownership in perpetuity. Restrictions outlined in the environmental covenant are also noted on deeds and real estate notations.
- *Preventing Unauthorized Use:* Access barriers are in place to restrict unauthorized access to the OSDF and signage and educational exhibits direct site users to authorized use of site trails, roads and the Visitors Center. Educational exhibits at the site describe the site's remedy and outline future use restrictions, including summaries of legal restrictions as well as notices about access restrictions. Site security staff conduct regular patrols of the OSDF, preserve areas, perimeter fencing and facilities to prevent unauthorized access.



The Fernald Preserve's snow covered wetlands, open water and prairie areas are visible in the foreground; the mounded OSDF area is visible in the background.

Current Use

Current land uses include more than 900 acres of restored habitat for ecological uses and limited public access and a 120-acre On-Site Disposal Facility that contains low-level radioactive waste material excavated during remedial work and 29 acres of infrastructure. A recently renovated Visitors Center, which achieved the U.S. Green Building Council's certification for Leadership in Energy and Environmental Design (LEED), fosters education about former site operations, contamination, remediation and restoration, and long-term surveillance and maintenance. Today, ecological restoration projects are underway throughout the Fernald Preserve's five ecosystems, which include upland and riparian forestlands, tallgrass prairie, savannah, wetlands and open water.

Visitors Center:

The Visitors Center is the result of a \$6.6 million renovation of a former warehouse structure. The Visitors Center houses educational exhibits documenting the history of the Fernald site from its pre-settlement use as a hunting ground for indigenous Native American tribes, to uranium production operations, to its current use as a protected green space and nature preserve. The Visitors Center also includes a state-of-the-art community meeting room and reading room.



The Fernald Preserve Visitors Center (Source: US DOE)

Current Land Uses

- Fernald Preserve Visitors Center
- 395 acres of forest
- 332 acres of prairie
- 33 acres of savanna
- 81 acres of wetland
- 60 acres of open water
- 7.4 miles of walking trails
- 120-acre On-Site Disposal Facility
- 29 acres of infrastructure

Fernald Preserve:

Trails and site habitats provide opportunities for limited public access including wildlife viewing, environmental education, birdwatching, walking, and hiking. Public access to the preserve provides learning opportunities for visitors and local educational institutions.

On-Site Disposal Facility:

The Fernald site's 120-acre OSDF is a prominent physical feature visible from trails, viewing platforms and the atrium at the Visitors Center. Access to the OSDF is restricted. However, educational exhibits illustrate the components of the containment cells, cap system and describe routine maintenance activities.

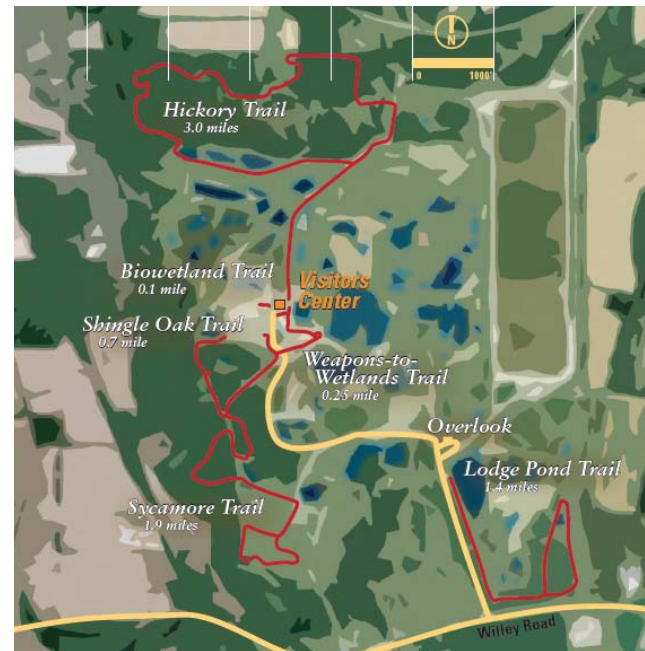


Figure 5. Fernald Preserve Trail System

(Source: U.S. DOE)

Components of Success

The following section highlights three critical factors that led to the successful cleanup and reuse of the Fernald site: community involvement in the remedial process, the integration of site remedies and natural resources restoration goals, and the development of a community-based vision for the site's reuse.

Community Involvement and Reuse Planning at Fernald:

Citizen participation played a critical role in the cleanup and restoration of the Fernald site. Community groups including the Fernald Residents for Environmental Safety and Health (FRESH), and the Fernald Citizen's Advisory Board (FCAB), were actively involved in helping to transform the site from a liability to a community asset.

Citizen Action Advocacy

In 1984, Lisa Crawford was renting property adjacent to the Fernald site when she learned that her well was contaminated with uranium. At the time, little information was provided to the public about the risks associated with contamination at Fernald. Her public health concerns and frustration with lack of communication from the DOE or its contractors led her to found Fernald Residents for Environmental Safety and Health (FRESH). According to Crawford, "When FRESH first started out, we were a group of angry moms concerned for the health of our children. And we learned very quickly how to operate effectively in Washington." From 1984-2006, Crawford and FRESH advocated for a transparent and effective cleanup process at Fernald by influencing key decision-makers, educating the larger community, and participating in the national debate on nuclear waste issues. Making annual trips to Washington, D.C., Crawford helped to ensure that adequate funding was allocated for public involvement and cleanup at the Fernald site. And locally, FRESH challenged federal and state representatives and contractors to work openly with a very active community. Crawford recognizes that,

while her individual efforts have paid off, the outcomes at the Fernald site were the result of a collaborative effort among the agencies, their contractors and local citizens.

Collaborative Decision-Making

In the early 1990's, the DOE began to recognize the need for effective and focused stakeholder input in cleanup decisions and formed site specific advisory boards at the three sites in the DOE nuclear weapons system, including the Fernald Site, the Mound Site in Miamisburg, Ohio, and the Rocky Flats Site located near Denver, Colorado. In 1993, the DOE convened the Fernald Citizens Task Force, which later became the Fernald Citizens Advisory Board (FCAB), which was composed of 14 citizen representatives as well as agency staff from the EPA, the DOE, the Ohio EPA and the federal Agency for Toxic Substance and Disease Registry (ATSDR). The DOE engaged the University of Cincinnati's Dr. Eula Bingham to serve as a neutral third-party convener, who appointed representatives to the task force and identified a chairperson. The DOE then asked the task force to make specific recommendations regarding a range of key decisions including the future use of the site, residual risk and remediation levels, waste disposal alternatives and priorities for remedial actions.



John Applegate, who served as chair of the Citizens Task Force and chair of FCAB from 1993-1998 explains the role of the advisory board in the remedial decision-making process:

“FCAB meetings provided the venue and impetus for working through complex issues in a systematic way. In order to participate effectively in the decision-making process, community members needed to understand the technical issues related to site conditions, contaminant volumes, potential cleanup alternatives and consequences of each alternative. Building educational capacity among FCAB members required participation and commitment from the DOE and its contractor Fluor-Fernald as well as the EPA and Ohio EPA staff. The learning experience of FCAB members helped clarify the key cleanup drivers for all parties and ultimately led to an elegant, consensus-based decision for the site's cleanup.”



*Fernald Citizens Task Force and Advisory Board
(Source: [top] Fernald Citizens Advisory Board;
[bottom] U.S. DOE)*

A Balanced Cleanup Approach:

Applegate recognized the challenge of integrating complex technical issues and social dynamics within the group and sought out the expertise of facilitator and environmental consultant Doug Sarno of the Perspectives Group. Sarno helped the task force to focus its efforts on the key decisions that needed to be made over a critical 18-month period of the remedy selection process. According to Sarno, “There were five operable units at the site, all of them very large, with complex issues ... the decisions that were most important were the decisions that related to soil cleanup and ground water cleanup and how clean that site would be when all was said and done and the decision of whether or not waste would be left on-site or not.”¹



FCAB members engaged in learning exercises to simulate remedial approaches for site cleanup and reuse. (Source: US DOE)

Technical discussions, remedial simulation tools and learning exercises helped advisory board members recognize that a “balanced approach” for soil remediation and disposal of site contaminants would lead to the best outcomes. As Lisa Crawford said, “We knew from visiting other nuclear sites, like the Nevada Test Site, that we didn’t want to ship all our waste to someone else’s backyard. And the game showed us that we couldn’t afford it. Community members realized that a balanced approach to cleanup was necessary and that part of the Fernald legacy had to be developing the safest possible way to manage a large amount of contamination on-site. From early on people didn’t want industry. They wanted a quiet, rural place. People accepted that the site’s reuse would have to be a protected green space.”

Remedial Simulation:

During the remedial planning process at Fernald, FCAB engaged in a learning exercise called FUTURESITE.

FUTURESITE was played like a board game with cards and chips representing cleanup costs and contamination volumes.

FUTURESITE allowed participants to align potential land use alternatives and risk exposure scenarios with the corresponding volumes of waste that would need to be removed to achieve each exposure scenario.

¹ Fernald Living History Project. Interview Transcript: Doug Sarno. March 1, 2001.

<http://www.fernaldcommunityalliance.org/FLHPinterviews/Sarno-final.pdf>

Natural Resources Restoration:

Another important component of the site's cleanup was the restoration of natural resources. The consensus decisions regarding land use that came out of FCAB's work in the mid-1990s informed the 1996 Records of Decision for OU3 – Process Area and OU5 – Soil and Ground Water. With these decisions in place, the DOE, the EPA and the Ohio EPA



Ecosystem restoration activities, such as planting aquatic vegetation, have transformed areas excavated during remediation into functional habitats. (Source: U.S. DOE)

had a clear picture of what site conditions would be post-remediation. However, the state of Ohio's 1986 natural resources damage claims against the DOE had not been settled and required a plan and set of restoration strategies.

In 1996, the Natural Resource Trustees (NRTs) formed a council with representation from the Ohio EPA, the DOE and the U.S. Department of Interior. The NRTs developed a 1998 draft Natural Resources Restoration Plan (NRRP) for the Fernald site. The NRRP outlined the strategy for ecological restoration of the Fernald Preserve and served as a framework for transitioning the site from its post-remediation status to its current land use as an undeveloped park with an emphasis on wildlife.

The NRRP outlined restoration goals and a strategy to implement restoration projects in sequence with the phasing of site remediation activities.

- *Ecological Restoration Goals:*
Given the site's post-remedial action conditions, ecological restoration was designed to use the natural dynamics of ecological systems and involved the restoration of contiguous tracts of upland and riparian forest, and tallgrass prairie interspersed with open water and wetlands.
- *Sequencing Remediation and Restoration:*
At the end of each of the Fernald site's remedial action projects, remediation areas were stabilized, soils were certified as meeting remedial action goals and grading activities were implemented to prepare for restoration projects. The strategy utilized excavated areas to support open water, wetland and vernal pool features to avoid the need for backfill.

According to Jane Powell of the DOE's Office of Legacy Management, "The Natural Resources Restoration Plan is based on a menu of ecosystems that respond to the post-remediation topography. Deep holes became open water, shallow holes became wetlands, level ground or mounded areas became prairie."

The NRRP was incorporated into the 2008 consent decree settling the state of Ohio's natural resources damages suit. Figure 6 on Page 13 illustrates the Current Land Uses at the Fernald site, as of November 2009.

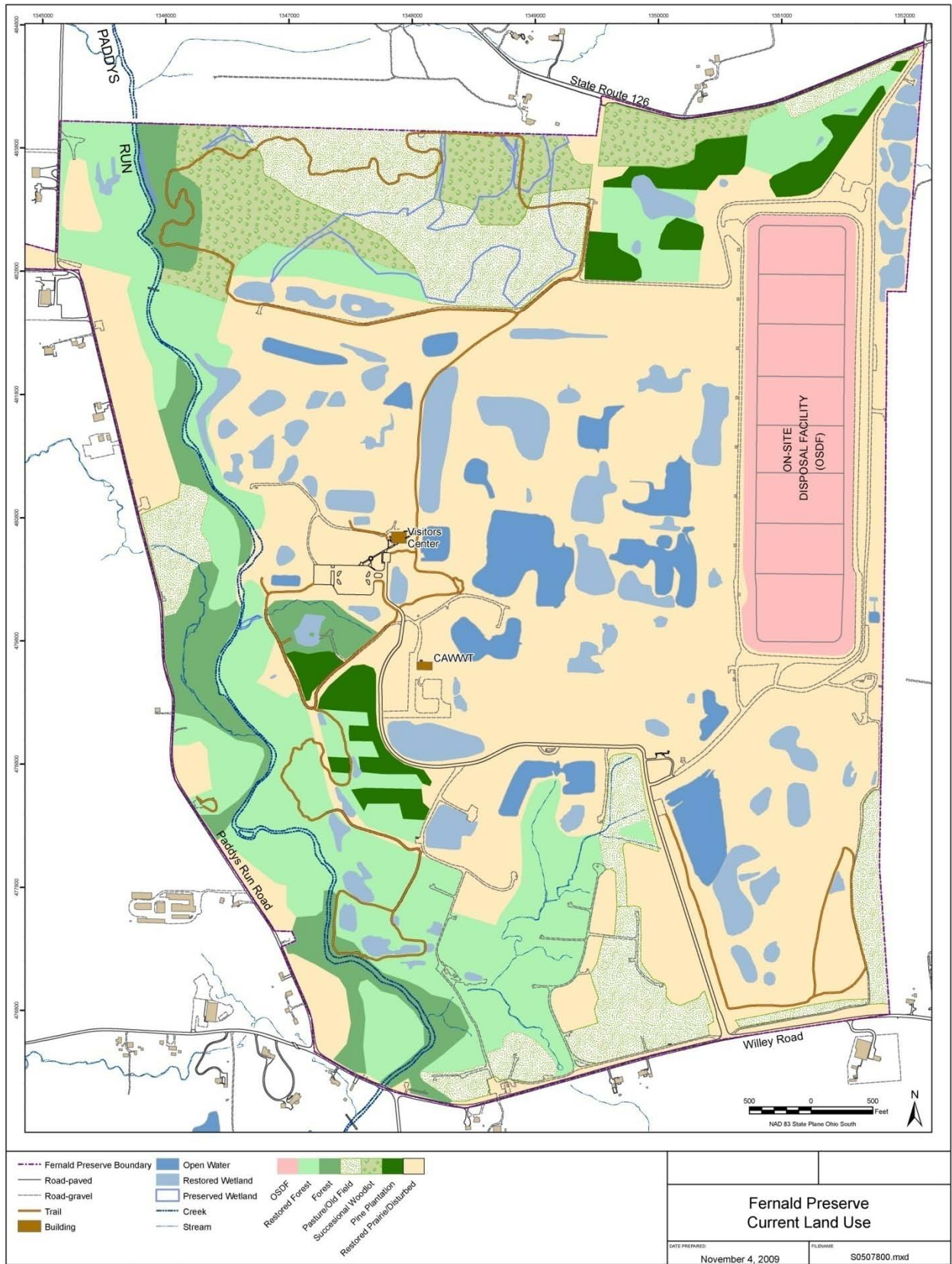


Figure 6. Fernald Preserve Current Land Use (Source: U.S. DOE, November 2009)

Future of Fernald: A community-based vision for site reuse

Through the development of the Natural Resources Restoration Plan (NRRP), DOE sought further public input on the future use of the site. In 1998, DOE released an Environmental Assessment on the Final Land Use of the Fernald Closure Project (EA). The EA proposed the dedication of 904 acres for ecological restoration to serve as an undeveloped park, 123 acres to serve as an On-Site Disposal Facility (OSDF), and 23 acres were set aside for future economic development. In 1998, a public meeting was held to obtain input on the EA and generated significant community interest and support for the public use of the site.



Interpretive exhibits in the atrium of the Fernald Preserve Visitors Center. (Source: U.S. DOE)

The FCAB held three meetings during 1999 and 2000, known as the “Future of Fernald” workshops and made the following recommendations to DOE.

- **Educational Center:** Stakeholders recommended that the Fernald site should serve as a regional educational center, with a focus on environmental, cultural and historical information about the site.
- **Public Access:** Stakeholders asserted that the Fernald site’s reuse should provide public access to restored habitat areas via designated trails, and a multi-use educational facility should be open to the public.
- **Re-internment:** Citizens recognized that the area in the vicinity of the site had been hunting and burial grounds for several Native American tribes. FCAB recommended the re-internment of Native American remains at the Fernald site.

A Stakeholder Vision for the Future of Fernald

Fernald stakeholders envision a future for the Fernald property that creates a federally owned regional destination for educating this and future generations about the rich and varied history of Fernald. We envision a community resource that serves the ongoing information needs of area residents, education needs of local academic institutions, and reinternment of Native American remains. We envision a safe, secure, and partially accessible site, integrated with the surrounding community that effectively protects human health and the environment from all residual contamination and fully maintains all aspects of the ecological restoration.

Adopted by Fernald stakeholders at the third Future of Fernald Workshop, September 26, 2000.

Benefits of Site Reuse

The reuse of the Fernald site is helping to generate significant political, financial, economic and social benefits for site stakeholders and the larger southwest Ohio region.

A Community Supported Reuse Plan

Throughout the remedial process, the DOE, the EPA and the Ohio EPA sought community input on key decisions. According to the Ohio EPA's Tom Schneider, "The community engagement process at Fernald was the most extensive and effective effort I've seen, anywhere." From 1994-1998, 60 meetings per year were held to discuss site contamination and cleanup at Fernald. The significant level of public engagement built trust among citizens and ultimately led to cleanup and reuse plans that were supported by community stakeholders, regulatory agencies and the responsible party.

A Cost Effective Cleanup

FCAB recommendations regarding cleanup levels, waste disposal and future use decisions ultimately allowed 80 percent of contaminated soil and debris to remain on-site with 20 percent shipped to off-site disposal facilities. These decisions led to a more cost effective cleanup. According to Lisa Crawford, "Early estimates for cleanup were as high as \$8 billion." The final cleanup cost at Fernald was \$4.4 billion.

Eco-system restoration

The Natural Resources Restoration Plan transitioned the site from its post-remediation condition to a nature preserve and landscape that blends in with the rural character of the area. Restored wetland, open water and native prairie habitats are bringing amphibians, reptiles, nesting and migrating bird populations back to the Fernald site. According to the DOE's Jane Powell, "One of the species we've been tracking as a keystone indicator of the prairie habitat function is the dickcissel [a small, seed-eating bird]. When the preserve first opened we had just two or three, and today we have over 100 of them. We are seeing this as evidence of a successful prairie restoration project."

Educational opportunities

As the restored habitats at the Fernald Preserve mature, the site provides an opportunity for community members and visitors to learn about and discover native species. For bird watchers, wildlife photographers and school populations, the preserve is a valuable regional resource. Since opening in 2008, the Fernald Preserve has attracted approximately 17,000 visitors.



Construction of vegetative cover on the site's OSDF [top]; waterfowl at the Fernald Preserve [bottom].

(Source: U.S. DOE)