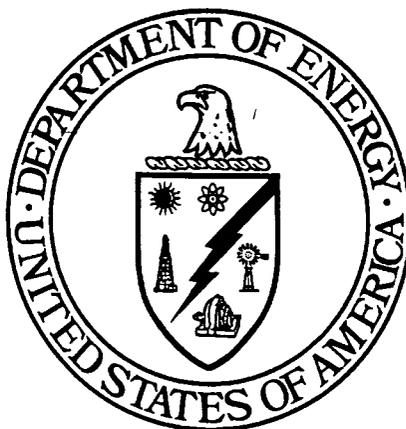


**WORK PLAN FOR ECOLOGICAL
RESTORATION RESEARCH GRANTS
OPERABLE UNIT 4 SUPPLEMENTAL PROJECT**

**FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO**



MAY 1998

**U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE**

**40300-WP-0001
REVISION 0
FINAL**

TABLE OF CONTENTS

1.0 Introduction 1

2.0 General Approach 1

3.0 Ecological Restoration Research Grants 2

 3.1 Representative Vegetation Plots (Area 8, Phase I) 2

 3.1.1 Physical Description 2

 3.1.2 Experimental Design 3

 3.1.3 Contribution to FEMP Ecological Restoration 4

 3.1.4 Schedule 4

 3.2 Establishment of Prairie Vegetation on Undisturbed Areas (Area 8, Phase I) 4

 3.2.1 Physical Description 5

 3.2.2 Experimental Design 5

 3.2.3 Contribution to FEMP Ecological Restoration 6

 3.2.4 Schedule 6

 3.3 Establishment of Prairie Vegetation on Disturbed Areas (Area 1, Phase I) 7

 3.3.1 Physical Description 7

 3.3.2 Experimental Design 7

 3.3.3 Contribution to FEMP Ecological Restoration 9

 3.3.4 Schedule 9

 3.4 American Chestnut Restoration 10

 3.4.1 Physical Description 10

 3.4.2 Experimental Design 10

 3.4.3 Contribution to FEMP Ecological Restoration 11

 3.4.4 Schedule 12

 3.5 Identification and Control of Invasive Plant Species 12

 3.5.1 Physical Description 12

 3.5.2 Experimental Design 13

 3.5.3 Contribution to FEMP Ecological Restoration 14

 3.5.4 Schedule 14

 3.6 Development of FEMP Ecological Restoration Case Study 14

 3.6.1 Web Site 15

 3.6.2 Contribution to FEMP Ecological Restoration 15

 3.6.3 Schedule 15

4.0 Schedules and Deliverables 16

5.0 Project Costs 16

6.0 Related Documents 16

7.0 Health and Safety Requirements 17

8.0 References 17

LIST OF TABLES AND FIGURES

- Table 1 Schedule for Research Grants
- Figure 1 Ecological Research Plots
- Figure 2 Ecological Research Areas

LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DOE	U.S. Department of Energy
FEMP	Fernald Environmental Management Project
MSL	Mean Sea Level
NRRP	Natural Resource Restoration Plan
OU4	Operable Unit 4
pls	pure live seed
U.S. EPA	U.S. Environmental Protection Agency

WORK PLAN FOR ECOLOGICAL RESTORATION RESEARCH GRANTS OPERABLE UNIT 4 SUPPLEMENTAL PROJECT

1.0 INTRODUCTION

As part of a Dispute Resolution Agreement regarding Operable Unit 4 (OU4) milestones for the Fernald Vitrification Facility, the U.S. Environmental Protection Agency (U.S. EPA) and the U.S. Department of Energy - Fernald Environmental Management Project (DOE-FEMP) agreed to five environmental projects and a cash penalty. One of these five projects is the establishment of ecological research grants, which will include pilot scale ecological restoration activities in the field. The Dispute Resolution Agreement included the provision that DOE would submit a work plan to U.S. EPA and Ohio EPA (the Agencies) that identifies research projects involving actual field work that would support the proposed ecological restoration efforts at the FEMP. This work plan, submitted for review and approval by U.S. EPA, summarizes the project-specific design and field activities planned for these ecological research grants.

2.0 GENERAL APPROACH

The purpose of the ecological restoration research grants is to conduct pilot scale ecological restoration activities in the field that will be representative of possible site restoration strategies. Information obtained as a result of implementing the grant projects would be used to support the planning and implementation of final ecological restoration of the FEMP. The research grants were selected based on the proposed implementation of large-scale, ecological restoration activities as outlined in the draft Natural Resource Restoration Plan (NRRP), which was developed for the Fernald Natural Resource Trustees to resolve DOE liability for damages to natural resources under CERCLA Section 107. The proposed ecological restoration activities will predominantly involve establishment and management of native forest cover and grasslands.

DOE has solicited input from interested universities and groups regarding the implementation of potential research grants. The tentative selection of universities and groups will be discussed with the Agencies prior to approval of the work plan. Upon approval of the work plan, specific tasks will be issued to the selected universities and groups to begin the implementation of the grant projects.

3.0 ECOLOGICAL RESTORATION RESEARCH GRANTS

As mentioned above, the research grants are intended to provide information to assist in the planning and implementation of final ecological restoration of the FEMP. Annual reports will accompany each research grant to provide information to the agencies regarding the status and progress of each grant. These research areas are described in more detail below.

3.1 Representative Vegetation Plots (Area 8, Phase I)

The goal of this research grant is to investigate the most effective density of seedlings and saplings required for the successful restoration of forest habitats at the Fernald site. The five year project consists of three phases: vegetation analysis (year 1), site planting and restoration (year 2), and monitoring (years 2-5).

3.1.1 Physical Description

Area 8, Phase I encompasses approximately 13 acres of formerly grazed pasture in an undeveloped buffer zone on the west side of the FEMP site (Figure 1). This area is bounded to the west by Paddys Run Road, to the east by Paddys Run, to the north by the previous stream bed of Paddys Run and to the south by leased pasture and wooded slopes. The area generally slopes to the east and north from Paddys Run Road to a broad, level floodplain associated with Paddys Run. The slopes are somewhat terrace-like, with narrow level areas separated by short, steep slopes. The terrace-like areas close to Paddys Run Road command broad views of the floodplain to the east.

Soils throughout this area are mapped by the Natural Resource Conservation Service as deep with no serious limitations to the establishment of trees. Soils on the upland terraces are mapped as Fincastle silt loam which are described as deep, early level, and somewhat poorly drained. Soils on the steep side slopes leading from the floodplain to the uplands are mapped as Hennepin silt loams with 35 to 60 percent slopes, described as deep, very steep, well drained soils typically found on slopes along streams.

Existing vegetation consists of pasture cover comprised of dense fescues interspersed with Queen Anne's lace (*Daucus carota*), common plantain (*Plantago major*), white clover (*Trifolium repens*) and other old field herbs. Existing tree cover is limited to small patches of deciduous trees on the steepest areas of slope. Most of the tree cover patches are predominately American Elm (*Ulmus americana*).

Other occasional tree species include hackberry (*Celtis occidentalis*), black locust (*Robinia pseudoacacia*), box elder (*Acer negundo*), red maple (*Acer rubrum*) and swamp white oak (*Quercus michauxii*).

3.1.2 Experimental Design

The first phase of this project will involve a vegetation analysis of in situ Fernald woodlots immediately north of the project area in order to establish a baseline and profile of the existing local vegetation.

The vegetation profile will include information on the various species, densities, ages, size classes, and spatial patterning. This profile of the existing forest will serve as a reference site or "template" for the second phase of this project and will also serve as a guide for species selection and planting density for future restoration plans related to the expansion of Riparian and Upland Forests. The current forest ecology literature indicates that 1,200 stems per acre is the target density to establish Riparian and Upland Forests in southwest Ohio (Wistendahl 1958). Information derived from the reference site will be used to confirm or revise the literature-based target density per acre.

In year 2, the second phase of this project will involve the establishment of 8 half-acre plots to test the optimal target density per acre for establishing native forest cover. All plots will measure approximately ½ acre. Four plots will be planted with a combination of balled and burlapped saplings > 2.5 cm caliper and bare root seedlings, two plots will be planted with bare root seedlings only, and two plots will serve as control plots (no woody plantings). Two plots will be based on the target density of 1,200 stems per acre and will consist of a combination of approximately 1,000 seedlings and 200 saplings (a combination of 600 seedlings and saplings per plot); two plots will be planted at 50 percent of the target density and will consist of a combination of approximately 500 seedlings and 100 saplings (a combination of 300 seedlings and saplings per plot); and two plots will consist of approximately 1,000 seedlings only (500 seedlings per plot). The two control plots will provide areas in which to monitor successive changes in the vegetation and the natural establishment rate of woody species. New plants will receive tree tubes and/or repellent spray as herbivore protection.

Prior to field planting of the seedlings and saplings, a detailed literature search will be conducted to determine optimal deer browsing control techniques. If the result of this search reports that no alternative techniques are applicable for the FEMP, seedlings will receive tree tubes and/or application of a commercially available, non-toxic, odor repellent spray.

The third phase of this project begins in year 2 and is the principle focus of years 3-5. The Area 8 vegetation plots will be monitored twice a year during the growing season, once in early spring and once in the fall. The measurements will include survivability and growth (i.e., stem diameter). Every sapling and seedling will be measured in each plot. The data collected will be averaged for each plot to get a survivability (or growth) value per treatment per species per year. Control plots will be monitored to determine the number and type(s) of tree seedlings invading the area naturally. All plots will be photographed during each monitoring event from established reference points. For field visits, all pertinent meteorological data will be recorded. Cost-benefit analyses will be conducted to examine the econometrics behind species composition, spatially patterned densities and herbivore protection treatments as related to forest restoration efforts.

3.1.3 Contribution to FEMP Ecological Restoration

The establishment of native forest cover will provide good habitat for edge-dwelling forest wildlife and will provide a portion of the viewshed for the Habitat Area Supplemental Project. The combination of seedlings and saplings will provide an immediate visible demonstration of future restoration efforts. This restoration project will contribute to the overall objectives of natural resource restoration by providing various habitats at different stages of maturity and by testing and comparing the econometrics and effectiveness of random spatial pattern densities and herbivore control techniques which could be implemented by future restoration projects.

3.1.4 Schedule

The following schedule is not an enforceable milestone. The anticipated schedule for the grant to investigate the most effective density of seedlings and saplings in Area 8, Phase 1 is:

Initiate research grant	June 16, 1998
Submit reference site report	September 1, 1998
Submit deer control report	December 1, 1998
Initiate tree planting	April 1, 1999
Submit draft annual reports	September 1, 1999 - 2002
Submit final report	December 1, 2002

3.2 Establishment of Prairie Vegetation on Undisturbed Areas (Area 8, Phase I)

The purpose of this research grant is to evaluate the optimal management method of establishing a newly-planted prairie on undisturbed areas at the FEMP. Undisturbed areas may contain high nitrogen

levels which can encourage growth of non-prairie grass species. Native prairie grass densities will be evaluated against their associated management methods.

3.2.1 Physical Description

This area is located in the same geographic area as the revegetation test plots (Figure 1, Plot 2). See Section 3.1 for a physical description.

3.2.2 Experimental Design

The management methods for establishing a newly-planted prairie on undisturbed areas will be conducted over three seasons. During the first season, the design and layout of research plots will be conducted, while the experimental planting and evaluation of management methods will be conducted over three seasons.

A portion of the study area will be prepared by application of the herbicide Roundup® at an application rate of approximately 50 gallons/day for two days. The herbicide will be hand applied using a 5-gallon tank sprayer with a wand. Other portions of the study area will be interseeded with native prairie grasses and a few aggressive forbs in an effort to eventually outcompete the existing weedy native and non-native plant species.

There will be 12 test plots, each measuring approximately (12 ft. x 50 ft.), providing for four experimental plots in triplicate. The plots consist of one control plot and three treatment plots. The control plot will be left unattended and the treatment plots will consist of the application of composted wood chips over the surface soil, multiple mowings (up to nine times per season), and selective herbicide (e.g., Plateau) application for spot treatment in the prairie grass plantings. In the event of a drought, half the plots would be watered, for a total area of 0.12 acres. Irrigation of these plots with a half-inch of water would require 0.12-acre inch of water or about 3,500 gallons (450 cu. ft.) of water. The seeding of each plot will consist of native prairie grasses and a nurse crop (e.g., buckwheat, Canada wild rye). Native prairie grasses will be seeded at a rate of 10 lbs. pure live seed (pls)/acre with a seed drill within each plot. The seed mix for each plot would remain static and consist of 2 lbs. pls Canada Wild Rye (*Elymus canadensis*); 2 lbs. pls Little Bluestem (*Schizachrium scoparius*); 3 lbs. pls Big Bluestem (*Andropogon gerardii*); 2 lbs. pls Indian Grass (*Sorghastrum nutans*); 0.5 lbs. pls Side Oats Gramma (*Bouteloua curtipendula*). Aggressive forbs will be selected [e.g.,

2.5 lbs pls New York Ironweed (*Vernonia noreboracensis*), 2.5 lbs. pls Spotted Joe-Pye Weed (*Eupatorium maculatum*), 2.5 lbs. pls Gray-Headed Coneflower (*Ratibida pinnata*), 2.5 lbs. pls Narrow-Leaved Mountain Mint (*Pycnanthemum tenuifolium*)] and applied at a rate of 10 lbs. pls/acre. The forb mix will be combined with the native prairie grass mix.

The Area 8 prairie plots would be monitored only during the growing season (approximately late April-October) over a three-year period. Initially, monitoring would occur two to three times per month during the germination period of the prairie grasses. After germination, monitoring would occur once a month. Specific measurements to be carried out during monitoring include biomass, percent cover, and species diversity. In addition, all plots will be photographed during each monitoring event from established reference points. For field visits, all pertinent meteorological data will be recorded. At the end of each growing season, an annual report will be generated containing the monitoring results and recommendations for reseeding other disturbed areas of the site based on assessment of the data collected. Measurement methods will be those described in Brower, et al. (1990).

3.2.3 Contribution to FEMP Ecological Restoration

This project will provide the necessary information required to effectively managed newly-planted prairie vegetation in undisturbed areas. This project will serve as a comparison plot to the disturbed areas under study in Area 1, Phase I. Soil located in undisturbed areas may contain high levels of nitrogen, which will decrease the survival of native prairie grasses. The evaluation of management methods for establishing newly-planted prairies on undisturbed areas at the FEMP will benefit native prairie grass diversity and density.

3.2.4 Schedule

The following schedule is not an enforceable milestone. The anticipated schedule for the grant to establish prairie vegetation on undisturbed areas is:

Initiate research grant	April 15, 1999
Submit draft annual reports	December 1, 1999 & 2000
Submit final report	December 1, 2001

3.3 Establishment of Prairie Vegetation on Disturbed Areas (Area 1, Phase I)

The purpose of this research grant is to evaluate the optimal method for revegetating prairie species on disturbed areas at the FEMP. Native prairie grass species and various techniques of soil preparation, seeding, mulching and management will be evaluated for establishing stable vegetation.

3.3.1 Physical Description

This study area encompasses approximately 2 acres of the available 4½ acres of disturbed grassland along the east boundary of the FEMP. This area is disturbed as a result of contaminated surface soil remediation. This area is rectangular, bounded to the west by the north entrance road, to east by the perimeter fence, to the north by State Route 126 and to the south by Area 1, Phase II (Figure 2). The area gently slopes to the north and south from an elevated point at 620 feet Mean Sea Level (MSL).

Soils in this area are mapped in the Fincastle and Xenia series. The Fincastle Silt Loam is characterized as deep, nearly level and somewhat poorly drained. Permeability is moderately slow to slow in the subsoil and slow in the stratum. This soil has high potential for trees and other vegetation.

The Xenia Silt Loam is characterized as deep, gently sloping and moderately well drained. It has moderately slow permeability, high available water capacity, and medium runoff. Xenia soils are well suited to trees with no limitations to planting and harvesting trees.

3.3.2 Experimental Design

The methods for establishing prairie vegetation on disturbed areas will be conducted over three seasons. The first season will focus on the design and layout of research plots, experimental planting and evaluation of various methods.

Experimental procedures during the first season include testing various site preparation methods, experimental planting and evaluation of various methods. Experimental procedures during the first season include testing various site preparation methods, soil amendments, cover crops, planting/mulching regimes and prairie grass/nurse crop seed mixes. The test plots vary in topography, soil structure and drainage, which will be taken into account when evaluating the results. Measurement and evaluation will be conducted throughout the growing season. The second season activities will focus on additional testing of the more promising methods alone and in various combinations.

Plantings started in year 1 will be further evaluated for suitability in establishing a prairie on various sites. Some plots will be cleared and planted with new combinations. Measurements and data evaluation will continue following the growing season. The third season will include some additional planting of the most promising combinations with a view to test the suitability for specific site characteristics. The third year activities will reflect what has been learned from the first two years. These test plots will be established along the southern half of Area 1, Phase I.

The study area will first be prepared by applying the herbicide Roundup® at an application rate of approximately 50 gallons/day for two days over the study area. The herbicide will be hand applied using a 5-gallon tank sprayer with a wand.

Soil preparation procedures will consist of discing and mulching. Depending on the soil quality of the study area (organic matter, soil compaction, texture, nutrients), soil amendments such as topsoil, sewage sludge, wood chips and fertilizer may be included as additional treatments.

For the first year there will be 39 test plots, each plot measures approximately (12 ft. x 50 ft.) providing for 13 experimental plots in triplicate. If needed, another ten plots could be added in the second year. In the event of a drought, half of the plots would be watered, for a total area of 0.25 acres. Irrigation of these plots with a half-inch of water would require 0.25-acre inch of water or about 7,000 gallons (900 cu. ft.) of water. The seeding of each plot will consist of cover crops and native prairie grasses. Cover crops (e.g., buckwheat, oats) which penetrate compacted soil and add organic matter to the soil will be used. Native prairie grasses will be seeded at a rate of 10 lbs. pure live seed (pls)/acre with a seed drill within each plot. The seed mix for each plot would remain static and consist of 2 lbs. pls Canada Wild Rye (*Elymus canadensis*); 2 lbs. pls Little Bluestem (*Schizachrium scoparius*); 3 lbs. pls Big Bluestem (*Andropogon gerardii*); 2 lbs. pls Indian Grass (*Sorghastrum nutans*); 0.5 lbs. pls Switchgrass (*Panicum virgatum*); 0.5 lbs. pls Side Oats Gramma (*Bouteloua curtipendula*). This study will only consist of native prairie grasses and will not include forbs. To establish native prairie grasses on disturbed soils, it will be necessary to manage undesirable aggressive plants, which would also result in extirpation of desired forbs.

Management procedures will consist of a combination of mowing, mulch/mowing and herbicide application. Mowing will be conducted six times per season, straw will be applied at 2 tons/acre and a selective herbicide (e.g., Plateau) for prairie grass plantings will be used.

Monitoring for the Area 1 Vegetation Plots would occur only during the growing season (approximately late April-October) over a period of three years. Initially monitoring would occur two to three times per month during the germination period of the prairie grasses. Once germination has occurred, monitoring would occur one time per month. Specific measurements to be carried out during monitoring include biomass, percent cover, and species diversity. In addition, all plots will be photographed during each monitoring event from established reference points. For field visits, all pertinent meteorological data will be recorded. At the end of each growing season, an annual report will be generated containing the monitoring results and recommendations for reseeding other disturbed areas of the site based on assessment of the data collected. Measurement methods will be those described in Brower, et al. (1990).

3.3.3 Contribution to FEMP Ecological Restoration

Many areas of the FEMP will undergo soil excavation to achieve site clean-up goals, which will require reclamation of these disturbed areas. This project will provide the necessary information required to effectively establish vegetation in disturbed areas. As a result of remediation activities the soil quality may be degraded such that the post-excavated soil matrix is low in organic matter, compacted and nutrient deficient. The evaluation of native prairie grass species and various techniques of soil preparation, seeding, mulching and management of establishing vegetation on disturbed areas will provide a solution based response to these anticipated problems.

3.3.4 Schedule

The following schedule is not an enforceable milestone. The anticipated schedule for the grant to establish prairie vegetation on disturbed areas is:

Initiate research grant	April 15, 1998
Submit draft annual reports	December 1, 1998 & 1999
Submit final report	December 1, 2000

3.4 American Chestnut Restoration

The purpose of this project is to re-establish a population of blight-resistant American Chestnut trees at the FEMP. These trees will be used to obtain information on the resistance and survivability of hybrid American Chestnut trees that have been exposed to the chestnut blight fungus (*Endothia parasitica*).

3.4.1 Physical Description

This area is located in the same geographic area as the revegetation test plots (Figure 1). See Section 3.1 for a physical description.

3.4.2 Experimental Design

This research grant will focus on reestablishing a population of blight resistant American Chestnut trees in southwest Ohio. Hybrid seeds, which are 7/8 pure American Chestnut, will be obtained from the American Chestnut Foundation after DOE has signed a germplasm and maintenance agreement. Seedlings will be grown in a nursery and planted in a secure area (approximately 1/2 acre) in Area 8, Phase I (Figure 1). Individual trees will be monitored for shape, growth characteristics, shade tolerance and resistance to *Endothia parasitica*. The overall health of the population will also be monitored.

To ensure applicability to site restoration activities and to avoid the repeat of existing research, a detailed literature review will be conducted regarding American Chestnut hybrid development and replanting efforts.

Seeds obtained by the Department of Energy (DOE-FEMP) through a germplasm agreement with the American Chestnut Foundation are to be cultivated in a greenhouse at the Miami University Middletown campus for one year. The majority of seeds will be from hybrid trees that are 7/8 American Chestnut. A limited number (approximately 50 each) of pure American Chestnut and Chinese Chestnut will be planted as a control. Approximately 400 seeds will be obtained from the American Chestnut Foundation. In a controlled greenhouse setting, the 5-month-old tree seedlings will be exposed to the chestnut blight fungus (*Endothia parasitica*) and the incidence of infection will be recorded.

Surviving hybrid and pure American Chestnut seedlings in year 2 will be planted in plot 1 (Figure 1) at the FEMP. This plot is approximately ½ acre and will be certified clean pursuant to Operable Unit 5 protocol established in the Sitewide Excavation Plan. A very small number (less than ten) of Chinese Chestnut seedlings will be planted for comparison purposes. All seedlings will be planted in a random pattern and individually labeled. Monitoring of the chestnut seedlings will be carried out on a monthly basis for the first two years. During year 1, the seedlings will be in the greenhouse at Miami University Middletown Campus and year 2 will be the first year that the seedlings are in the field. Parameters to be measured will include survivability, incidence of chestnut infection, and growth (i.e., stem diameter). For field visits, all pertinent meteorological data will be recorded. During years 3 through 30, monitoring will be carried out on an annual basis and will include the same measurements. Once surviving trees begin to produce nuts, the nuts will be collected from each tree for submittal to the American Chestnut Foundation. All data collected will be compiled into an annual report that will be submitted to the American Chestnut Foundation, DOE, and the Agencies.

Seedlings will also be protected from deer and small mammals through the use of repellent sprays and/or fencing. Fencing will consist of 6-foot high woven wire "poultry fence," with two strands of wire installed above. For increased visibility, ribbons will be attached to the wire strands. Commercially available, non-toxic odor repellent will be used. Other methods may be used if deemed appropriate through the literature search conducted for the Area 8 vegetation plots research. DOE-FEMP Security will periodically monitor the planting area during its perimeter patrols. There will be no public access to the planting area.

Reference points will be established for photographic documentation of seedling growth. Photographs will be taken from the established reference points at the end of each growing season. These photographs will be labeled (by year and reference point number) and supplied to DOE-FEMP for educational and additional monitoring purposes.

3.4.3 Contribution to FEMP Ecological Restoration

The cultivation of hybrid American Chestnut seeds and the long-term monitoring of their resistance and survivability in the field will help re-establish a viable population of chestnut trees and further define the backcross breeding program being implemented by the American Chestnut Foundation.

Interpretive signs will be placed near the chestnut grove to denote the importance of this species. It is

expected that increased public awareness about the severe damage associated with the spread of invasive plants and pathogens is the best way to prevent accidental introductions.

3.4.4 Schedule

The following schedule is not an enforceable milestone. The anticipated schedule for the grant to establish blight-resistant American Chestnut trees is:

Initiate research grant	February 13, 1998
Submit draft annual report	February 1, 1999
Submit final report	March 31, 1999
Submit subsequent draft annual reports	February 1 each year
Submit subsequent final reports	annually for 30 years

3.5 Identification and Control of Invasive Plant Species

The purpose of this research grant is to identify invasive plant species and evaluate control methods of their invasiveness at the FEMP. A floristic analysis will identify non-indigenous plant species, followed by an evaluation of the potential threat the invasive plant species pose to the native vegetation and a 3-year experimental study of species control and revegetation.

3.5.1 Physical Description

This area consists of approximately 85 acres of mid-successional woodland. This area is bounded to the west by Paddys Run Stream, to the east by an access road, to the north by State Route 126 and to the south by a tributary to Paddys Run Stream. The Northern elevation is about 700 feet MSL, gently sloping to 580 feet MSL. Natural surface drainage is to the west/southwest towards Paddys Run.

Soils in this area are mapped predominately as Xenia Silt Loam with some Ragsdale Silty Clay Loam. The Xenia Silt Loam is characterized as deep, gently sloping and moderately well drained. It has moderately slow permeability, high available water capacity, and medium runoff. Xenia soils are well suited to trees with no limitations to planting and harvesting trees. The Ragsdale Silty Clay Loam are deep and very poorly drained.

This mid-successional woodland is dominated by American Elm (*Ulmus americana*) in the canopy with openings of old field vegetation. Other species include slippery elm (*Ulmus ruba*), box elder (*Acer negundo*), sugar maple (*Acer saccharum*) and Ohio buckeye (*Aesculus glabra*).

3.5.2 Experimental Design

This research grant will focus on the identification of invasive plant species and evaluation of control methods related to their invasiveness over five seasons. The first season will focus on a floristic analysis during the growing season (May, June, and August). Plant specimens will be identified, dried, pressed, curated, and placed in an herbarium collection as voucher specimens. Patterns of relative species abundance will be qualitatively evaluated during site reconnaissance and transferred to a base map to depict vegetation patches. During the autumn and winter of the first season, the data will be compiled and analyzed and a literature search conducted on the invasive species of concern. During the spring of the second season, an experimental plan will be written and instituted to control the species of concern. Experimental plots will be designed and implemented based on the qualitative identification of the target species in the field. Years 3 and 4 will be devoted to monitoring the outcome of the experiment.

A floristic analysis will be performed in May, June and August of 1998 to provide an enumeration of dominant plant species in the 100-acre Northern Woodlot.

An experimental plan will be written and submitted for review in February 1999 and implemented in Spring 1999 to control the species of concern. The experimental plan will contain literature supported extirpation methods and will address the interspecific competition between indigenous and non-indigenous plant species. A vegetation map will accompany the experimental plan and will depict patches of the dominant indigenous and non-indigenous plant species.

Experimental plots will be designed and implemented in Spring 1999 as determined by the floristic analysis. The proposed experimental design is expected to contain 10 blocks of 4 treatment combinations for a total of 40 plots with each plot measuring approximately 10 ft. by 10 ft. Each block will contain one control plot and three treatment plots. The control plot will be left unattended and the treatment plots will consist of physical removal of non-indigenous plant species, the planting of native seedlings with shelter tubes followed by application of a pre-emergent herbicide, and the planting of native seedlings with shelter tubes with no herbicide application. Details of the final experimental design will be provided in the experimental plan.

Monitoring will occur over a three-year period for the project. For the first year, monitoring will occur in late summer. For the following two years, monitoring will occur twice per year in June and August. Specific measurements to taken will include vegetative response of the invasives to extirpation techniques and the measurement of species diversity and plant cover (including seedling survival) both before and after extirpation techniques have been implemented in the research plots. Measurements and evaluation will consist of both biometric (control efficacy, invasive species return, native vegetation return, diversity, seedling growth and survival) and econometric (time, money, cost-benefit) data. In addition, all plots will be photographed during each monitoring event from established reference points. For field visits, all pertinent meteorological data will be recorded. Native tree seedlings will be obtained from the State Nursery, operated by the Ohio Department of Natural Resources, and planted into the experimental plots. A final report will provide a complete management plan for the site based on species present and optimal control methods identified by experimentation and econometric analysis.

3.5.3 Contribution to FEMP Ecological Restoration

This project will demonstrate the optimal method(s) for controlling invasive plant species and evaluate the feasibility of revegetating an area previously dominated by invasive species. A complete management plan for the control of inventoried invasive plant species at the FEMP is vital to the survival of large-scale plantings. Effective control of invasive plant species will be critical in order to attain goals associated with restoration efforts.

3.5.4 Schedule

The following schedule is not an enforceable milestone. The anticipated schedule for the grant to identify and control invasive species is:

Initiate research grant	April 15, 1998
Submit draft annual reports	December 1, 1998 - 2001
Submit experimental plan	February 1, 1999
Submit final report (management plan)	December 31, 2002

3.6 Development of FEMP Ecological Restoration Case Study

The purpose of this research grant is to develop a compendium of current research and associated literature sources to support evaluation of ecological restoration alternatives and decision making at the FEMP. For example, the literature would support decisions based on considered alternatives for

herbivory techniques, establishment of native forest cover, migration corridors, bank stabilization, and success monitoring. In addition, the grant recipient would document the evolving approach to ecological restoration through descriptive logistics of coordinating engineering, design, construction and ecological activities. The documented approach will allow development of a logic flow for problem-solving associated with habitat specific areas. The information developed would be available via a web site to further the field of restoration ecology and also provide an interactive forum with restoration practitioners.

3.6.1 Web Site

This interactive case study would be available via a link on the Fernald Web Site. This would provide a national and international forum for continuous on-line discussion regarding restoration progress and technical challenges at the FEMP. The web site could include pictures to portray up-to-date progress in the field and hypertext links to various restoration activities. Periodic workshops could be offered to convey progress/lessons learned and to invite dialogue from national and international practitioners.

3.6.2 Contribution to FEMP Ecological Restoration

Published methods and guidelines for the ecological restoration process are in the formative phase. Development of an interactive case study through compilation of decision-based literature and documentation of the evolving restoration approach, would provide the desired transition from the formative to applied phase. This interactive case study will allow the merging of technical attributes required for ecological restoration (e.g., science, art, philosophy, economics). Continual dialogue with practitioners will provide the necessary expertise to accommodate the various aspects of ecological restoration.

3.6.3 Schedule

The following schedule is not an enforceable milestone. The anticipated schedule for the grant to develop an interactive case study is:

Initiate research grant	June 15, 1998
Submit draft annual reports	December 1, 1998 - 2000
Submit final report	December 1, 2001

4.0 SCHEDULES AND DELIVERABLES

The schedule for the research grants is provided in Table 1. Upon approval of the work plan, task orders/contracts will be initiated to begin field work. The task orders for each research grant will contain detailed information regarding methodology and duration of monitoring. Field work cannot be initiated until Area 8, Phase I (Figure 1) is certified as clean, which is expected to occur by July 1998. The invasive species project could be conducted in non-certified areas since ground disturbance would be minimal. The establishment of revegetation test plots in Area 1, Phase I using prairie species (Figure 2) is not contingent upon certification as the area has already been certified as clean.

TABLE 1
SCHEDULE FOR RESEARCH GRANTS WORK PLAN

Activities for Research Grants	Schedule Dates
Submit Work Plan to EPA ¹	11/21/97
EPA Review of Work Plan ²	11/24/97 - 1/26/98
Submit Final Work Plan to EPA/Public Review	3/24/98 - 4/27/98

¹ Enforceable milestone per the Dispute Resolution Agreement between U.S. EPA and U.S. DOE.

² Proposal would be made available for public inspection.

5.0 PROJECT COSTS

The estimated cost for implementing the research grants is \$245,000. The cost of each research grant is dependent upon the cost of required materials and the scope of each research grant. Discussions are being conducted with interested universities and groups to better define project scope and costs. The final version of the work plan will contain the grant recipients and associated costs.

6.0 RELATED DOCUMENTS

The research grants will enhance the proposed final land use as outlined in the draft NRRP, and will also contribute to refinement of management techniques to be implemented during large scale restoration. The NRRP is currently being developed by DOE-FEMP and the other Fernald Natural Resource Trustees and is expected to be finalized in early 1998. The NRRP identifies the majority of the FEMP, outside of the area dedicated for the On-Site Disposal Facility, as an undeveloped park. The NRRP identifies the remediated Former Production Area, Waste Pit Area and Southern Waste Units as being restored to a natural area taking advantage of the post-excavation topography to the extent possible. The riparian corridor along Paddys Run and the existing Northern Woodlot, which

will not be greatly disturbed, would be expanded and enhanced. The research grants will provide additional information for effective management and implementation of ecological restoration in these areas.

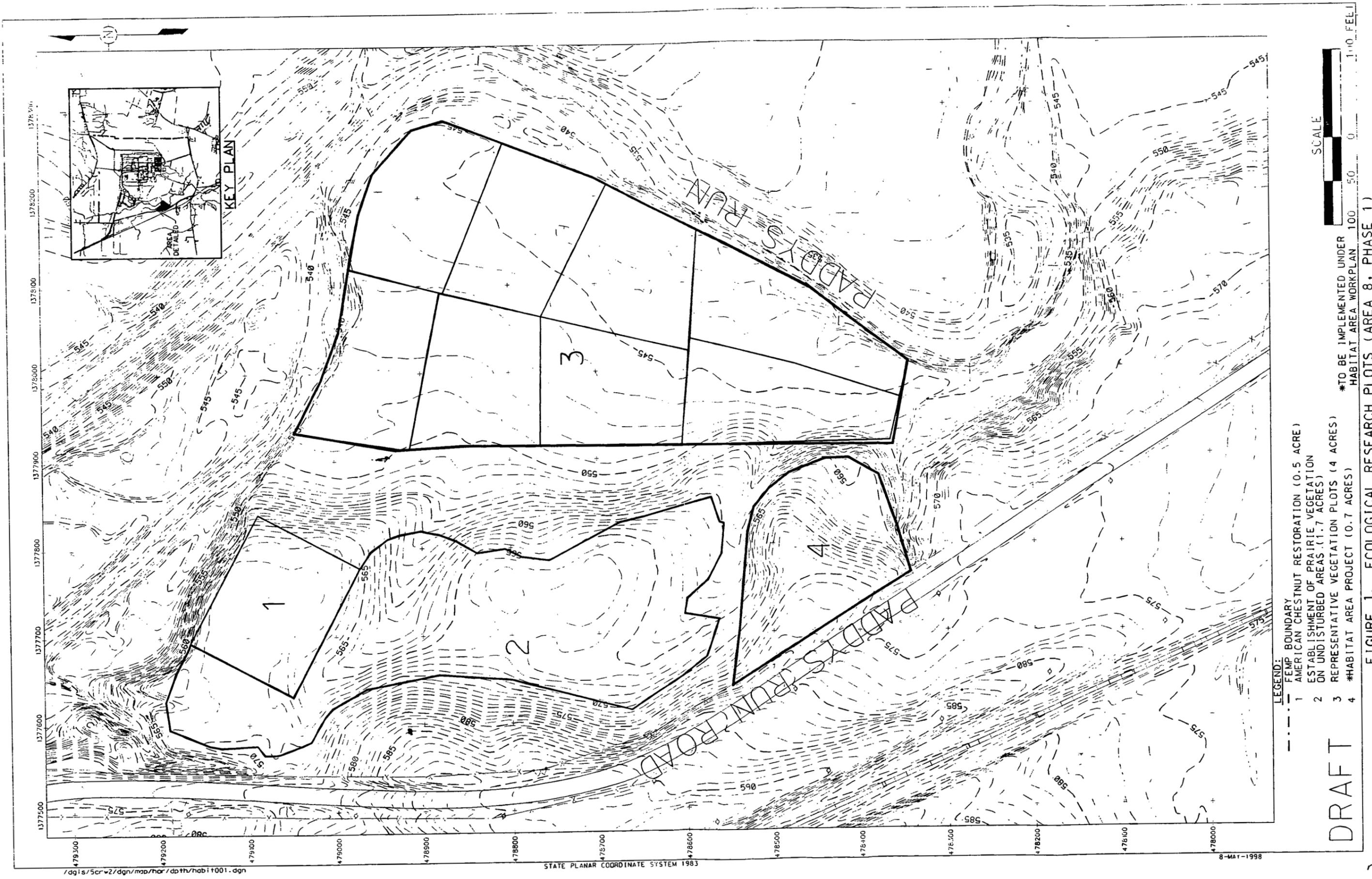
7.0 HEALTH AND SAFETY REQUIREMENTS

All personnel working on these projects will be briefed on and comply with the Project-Specific Health and Safety Matrix and required to comply with it. The Field Safety Contact will ensure that each participant has been briefed on the applicable permits and the Project-Specific Health and Safety Matrix, as applicable.

8.0 REFERENCES

Brower, J.E., J.H. Zar, C.N. vonEnde, 1990, "Field and Laboratory Methods for General Ecology" (3rd Edition), William C. Brown Publishers, Dubuque, Iowa.

Wistendahl, W.A., 1958, "Floodplain of Raritan, New Jersey," Ecological Monograph, Vol. 28, pp. 129-153.



/dgis/5crw2/dgn/map/hor/dpth/habit001.dgn

STATE PLANAR COORDINATE SYSTEM 1983

8-MAY-1998

- LEGEND:
- - - - - FEMP BOUNDARY
 - 1 AMERICAN CHESTNUT RESTORATION (0.5 ACRE)
 - 2 ESTABLISHMENT OF PRAIRIE VEGETATION ON UNDISTURBED AREAS (1.7 ACRES)
 - 3 REPRESENTATIVE VEGETATION PLOTS (4 ACRES)
 - 4 *HABITAT AREA PROJECT (0.7 ACRES)

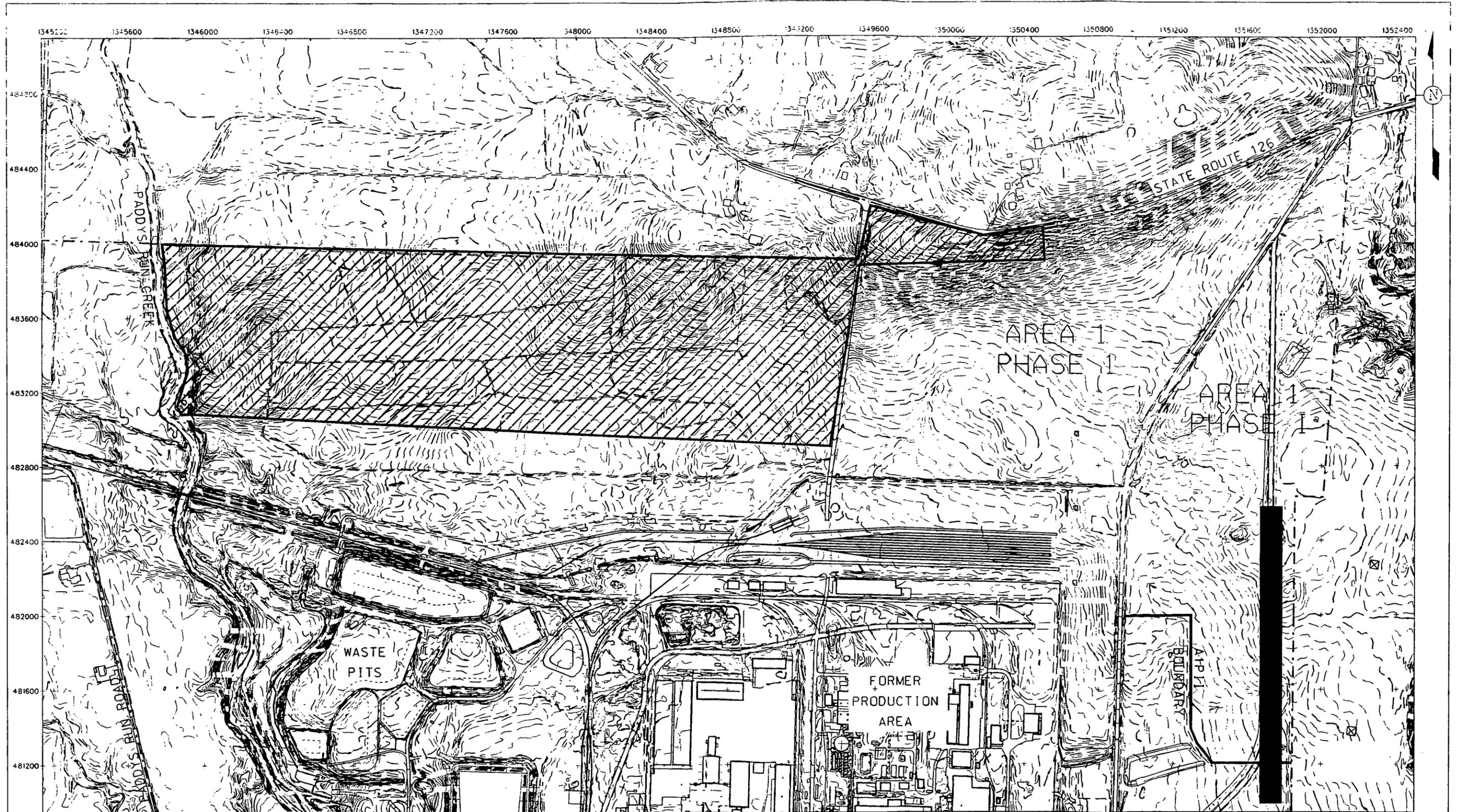


DRAFT

FIGURE 1. ECOLOGICAL RESEARCH PLOTS (AREA 8, PHASE 1)

*TO BE IMPLEMENTED UNDER HABITAT AREA WORKPLAN

21



- LEGEND:**
- - - - FEMP BOUNDARY
 - █ PROPOSED AREA FOR REVEGETATION PLOTS (4.5 ACRES)
 - ▨ PROPOSED INVASIVE SPECIES CONTROL AREAS (83.76 ACRES)

DRAFT

/dgis/srd1g/dgn/bmp/hab-res.dgn

STATE PLANAR COORDINATE SYSTEM 1983

19-MAY-1998

FIGURE 2. ECOLOGICAL RESEARCH AREAS