Revision 09/02

CORRES. CONTROL
OUTGOING LTR NO.

DOE ORDER #

- RF 00136

DIST.	LTR	ENC
DIETER, T. J.		
FERRERA, D.W.		
FERRI, M.S.		
GIACOMINI, J. J.		
LINDSAY, D. C.		
MARTINEZ, L.A.		
PARKER, A.M.		
POWERS, K.		
SHELTON, D.C.		
SPEARS, M.S.		
TRICE, K.D.		
TUOR, N.R.		
VOORHEIS, G.M.		
Mark Heser		
Jody Nelson	X	
Doug Schlagel		
David Ward	X	
COR. CONTROL	X	X
ADMIN. RECORD		
WASTE REC. CTR.		
TRAFFIC		
PATS/130		

CLASSIFICATION:
UNCLASSIFIED
CONFIDENTIAL
SECRET

AUTHORIZED CLASSIFIER

Exempt from Class
Per CEX-105-01
Date

IN REPLY TO RFP CC NO:

ACTION ITEM STATUS

☐ PARTIAL/OPEN

☐ CLOSED

LTR APPROVALS:

ORIG & TYPIST INITIALS
DAW:jcm

KAISER•HILL
COMPANY

February 7, 2005 05-RF-00136

Mr. Cliff Franklin
MV72
DOE, RFPO

TRANSMITTAL OF BIOLOGICAL ASSESSMENT FOR THE PHYTOREMEDIATION PROJECT AT THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE – DAW-008-05

Dear Cliff,

Enclosed are two copies for your review and a transmittal copy for the United States Fish and Wildlife Service of the Biological Assessment for the Phytoremediation Project. An electronic version was provided to you via e-mail on February 3, 2005.

Please contact me at 303-966-5938 or Jody Nelson at 303-966-2231 if you have any questions or need additional information.

Sincerely,

David Ward, J.D.
Environmental Systems & Stewardship

DAW:jcm

Enclosures:
As Stated

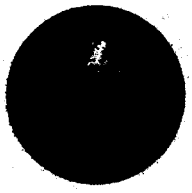
Kaiser Hill Company, L.L.C.
Rocky Flats Environmental Technology Site, 10808 Hwy. 93 Unit B, Golden CO 80403-8200 • 303-966-7000

11/14

BIOLOGICAL ASSESSMENT FOR THE PHYTOREMEDIATION PROJECT AT THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

February 2005

U.S. Department of Energy
Rocky Flats Field Office
Golden, Colorado



February 2005
Revision 1
Classification Exemption CEX-105-01

Prepared for
US Department of Energy
Rocky Flats Field Office
Golden, Colorado 80402-0464

By
Kaiser-Hill Company, LLC

Contents

List of Figures

1. Introduction

1.1 Purpose

The Department of Energy (DOE) developed this Biological Assessment (BA) for the Rocky Flats Environmental Technology Site (Site, RFETS) as part of the Section 7 consultation requirements of the Endangered Species Act of 1973, as amended (ESA). The DOE is the action agency requesting the formal consultation with the U.S. Fish and Wildlife Service (USFWS). This document is written for the Phytoremediation Project and will address the potential for this project to affect threatened and endangered species that are protected under the ESA.

Phytoremediation has been proposed as the preferred polishing alternative at two locations where contaminated groundwater plumes exist at the Site – the East Trenches Plume and Solar Pond Plume (Figures 1 and 2). At each project location, a passive groundwater treatment system was installed in 1999. Although the groundwater treatment systems continue to operate, a portion of the contaminated groundwater plume continues to persist downgradient from the treatment systems and impact the surface waters in North and South Walnut Creek. Passive phytoremediation has been shown to be an effective method for reducing the contaminant load in groundwater and is best suited to downgradient areas where deep-rooted native species can intercept shallow groundwater. Thus phytoremediation has been proposed as an additional remedy to address the contaminated groundwater downgradient from the treatment systems. The phytoremediation is proposed as a "polishing" treatment, in addition, to the groundwater treatment systems, recognizing that it will not completely resolve the problem. However, the phytoremediation is being required by the regulators, U.S. Environmental Protection Agency (EPA) and Colorado Department of Public Health and Environment (CDPHE). The project is being conducted as a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) action. The Interim Measures/Interim Remedial Action for the RFETS Groundwater document (GW IM/IRA) provides the alternatives analysis and the details for the proposed action (DOE 2004a).

Although this BA addresses the potential to impact all threatened and endangered species, most of the focus of this BA is on the Preble's meadow jumping mouse (Preble's mouse, *Zapus hudsonius preblei*) and its habitat (current protection areas at the Site, Figure 3). The current Preble's protection areas at the Site are defined as the areas delineated by the *Preble's Meadow Jumping Mouse Protection Plan* (PPP) for the Site (DOE 2004b). This plan was required under the Memorandum of Agreement (MOA, February 26, 1999) signed between DOE, USFWS, EPA, CDPHE, and the Colorado Department of Natural Resources (CDNR). The PPP was developed based on several years of Preble's mouse trapping, telemetry, and habitat characterization work at the Site and in consultation with the USFWS.

1.2 Responsibilities

To ensure compliance with the requirements of the BA and BO the following guidelines are established:

1. The project manager will be given a copy of the BA and BO and instructed on the requirements contained therein related to the project.
2. Site ecologists and/or USFWS personnel will meet regularly with project personnel to discuss and ensure that the BA and BO requirements are being followed. Meetings and project location visits will be documented.
3. Should the project require additional area, the USFWS will be consulted.
4. If the project does not disturb the entire area originally designated for disturbance, the area actually disturbed will be delineated and mapped, acreage calculated, and that area used to determine the actual amount of mitigation needed (if any) based on the mitigation ratios agreed on in this BA and associated BO. This information will be reported to the USFWS.

1.3 Species Considered In This Assessment

Based on a species list received from the USFWS, the following species have been evaluated as part of this BA. For detailed species descriptions, see Part I of the Programmatic Biological Assessment (PBA, DOE 2004b).

Animals	**Legal Status**
American burying beetle (*Nicrophorus americanus*)*	LE
Bald eagle (*Haliaeetus leucocephalus*)	LT
Black-footed ferret (*Mustela nigripes*)	LE
Black-tailed prairie dog (*Cynomys ludovicianus*)	C
Boreal toad (*Bufo boreas boreas*)	C
Canada lynx (*Lynx canadensis*)	LT
Eskimo curlew (*Numenius borealis*)*	LE
Greenback cutthroat trout (*Oncorhynchus clarki stomias*)	LT
Least tern (*Sterna antillarum*)*	LE
Mexican spotted owl (*Strix occidentalis lucida*)	LT
Mountain plover (*Charadrius montanus*)	PT
Pallid sturgeon (*Scaphirhynchus albus*)*	LT
Pawnee montane skipper (*Hesperia leonardus montana*)	LT
Piping plover (*Charadrius melodus*)*	LT
Preble's meadow jumping mouse (*Zapus hudsonius preblei*)	LT
Whooping crane (*Grus americana*)*	LE
Plants	
Colorado butterfly plant (*Gaura neomexicana coloradensis*)	LT
Ute ladies'-tresses (*Spiranthes diluvialis*)	LT
Western prairie fringed orchid (*Platanthera praeclara*)*	LT

* = Lower Platte River species

C = Candidate for listing
LT = Listed threatened
LE = Listed endangered
PT = Proposed threatened

2. Phytoremediation Project

2.1 Ecological Setting

2.1.1 Plant Communities

Within the East Trenches project area, the hillside between the B-ponds (Figure 1) and the gravel road south of the ponds is mostly reclaimed grassland dominated by smooth brome (*Bromus inermis*) with some small inclusions of mesic mixed grassland dominated by western wheatgrass (*Agropyron smithii*), blue grama grass (*Bouteloua gracilis*), Japanese brome (*Bromus japonicus*), and some Kentucky bluegrass (*Poa pratensis*). The north side of the gravel road the area was revegetated in 1999 after the groundwater treatment system was installed and still remains somewhat weedy. Along the edges of the ponds the typical vegetation includes coyote willow (*Salix exigua*), snowberry (*Symphoricarpos occidentalis*), and an occasional plains cottonwood tree (*Populus deltoides*). In addition, at many locations along South Walnut Creek including the project area, the noxious weeds, Canada thistle (*Cirsium aryense*), diffuse knapweed (*Centaurea diffusa*), musk thistle (*Carduus nutans*), and common mullein (*Verbascum thapsus*) are common.

At the Solar Pond project area (Figure 2), the hillside is mostly reclaimed grassland dominated by smooth brome and intermediate wheatgrass (*Agropyron intermedium*). Along North Walnut Creek the riparian woodland/shrubland is dominated by plains cottonwood, coyote willow, snowberry, and some occasional false indigo (*Amorpha fruticosa*). Several species of noxious weeds are present along the stream in or near the project area, including Canada thistle, diffuse knapweed, musk thistle, common mullein, dame's rocket (*Hesperis matronalis*), and hounds tongue (*Cynoglossum officinale*).

The soils on the flood plains and stream terraces at the Site are classified as Haverson loams (SCS 1980). Soils on the surrounding hillslopes are classified as Denver-Kutch-Midway clay loams (SCS 1980). Most of the soils in both of the project areas have previously been disturbed when the ponds or roads were built.

2.1.2 Wildlife

Wildlife use in the both the East Trenches and Solar Pond project areas is comparable to that documented elsewhere in the riparian and grassland areas at the Site (K-H 1997, 1998, 1999, 2000, 2001, 2002). Common wildlife species that could be encountered include small mammals such as deer mice (*Peromyscus maniculatus*), prairie voles (*Microtus ochrogaster*), meadow voles (*M. pennsylvanicus*), and house mice (*Mus musculus*), which provide forage

for predators like raptors and coyotes. Common raptors at the Site include red-tailed hawks (*Buteo jamaicensis*), Swainson's hawks (*B. swainsoni*), great horned owls (*Bubo virginianus*), and American kestrels (*Falco sparverius*). Herpetiles are represented by boreal chorus frogs (*Pseudacris triseriatus maculata*), leopard frogs (*Rana pipiens*), and prairie rattlesnakes (*Crotalus viridis*). In the B-ponds and when water is flowing in North Walnut Creek a few species of fish have been documented including fathead minnows (*Pimephales promelas*), creek chubs (*Semotilus atromaculatus*), and stonerollers (*Campostoma anomalum*). A variety of songbirds can be found utilizing the grassland and riparian woodland/shrubland habitats at different times of the year. Western meadowlarks (*Sturnella neglecta*) and vesper sparrows (*Pooecetes gramineus*) are common inhabitants of the grasslands, with Bullock's orioles (*Icterus bullockii*), red-winged blackbirds (*Agelaius phoeniceus*), American goldfinches (*Carduelis tristis*), Brewer's *blackbirds (Euphagus cyanocephalus*), and mourning doves (*Zenaida macroura*) among the common riparian corridor species. Mule deer (*Odocoileus hemionus*) and an occasional white-tailed deer (*O. virginianus*) also utilize the habitat in the project areas.

The Preble's mouse, a federally protected, listed species under the Endangered Species Act (ESA), occurs within and in the vicinity of the East Trenches and Solar Pond project areas (EG&G 1992, 1993; K-H 1998, 2000, 2001). Trapping and telemetry field work has documented the Preble's mouse within both phytoremediation project areas along North and South Walnut Creeks. The project areas are both located within the current Preble's protection area at the Site (Figure 3).

2.2 Project Description and Background

The GW IM/IRA (DOE 2004a) addresses the remaining contamination in shallow groundwater of the Upper Hydrostratigraphic Unit (UHSU) beneath the IA and adjacent BZ at RFETS. The UHSU consists of the Rocky Flats Alluvium, Valley Fill alluvium, colluvium, the underlying weathered bedrock claystones, and the Arapahoe No. 1 Sandstone. The preferred alternative for additional remediation at two contaminated groundwater plume locations, the East Trenches and Solar Ponds, is phytoremediation. A source removal was completed at the East Trenches area in 1996 and a 1,200 foot long passive groundwater collection and treatment system was installed in 1999. However, a portion of the plume to the north of the groundwater collection system is located north of the collection system and is not being collected. This portion of the plume continues to persist and impact surface water above SW PRGs. This area is immediately adjacent to South Walnut Creek and is approximately 750 feet long and up to 100 feet wide. In 2003, the maximum VOC concentrations observed at this portion of the plume were seen at well 23296. Concentrations were 408 ug/l trichloroethene and 20 ug/l tetrachloroethene, well above the RFCA groundwater action levels of 5 ug/l for each. These concentrations have not significantly declined since installation of the East Trenches Collection System.

In addition, VOC concentrations in the B ponds have been noted, particularly during winter when the ponds freeze over. In February 1997, trichloroethene in the B-2 Pond was observed at concentrations around 400 ug/l. Trichloroethene concentrations at seeps at the edge of the

B-2 Pond were up to 970 ug/l. Tetrachloroethene and cis 1,2 dichloroethene were also observed, but at lower concentrations (DOE 1999a). These data are corroborated by recent CDPHE samples at the B-2 Pond.

The Solar Ponds were closed in 2002. In 1999, a 1,100 foot long passive groundwater collection and treatment system was installed to collect and treat the contaminated groundwater plume. The contaminants of concern at the Solar Pond Plume are nitrates and uranium. However, a portion of the plume is located downgradient of the collection system and continues to persist. The area of highest groundwater contamination within the residual plume is immediately adjacent and downgradient of the previous sump and pump house for the Interceptor Trench System (ITS) that drained this hillside prior to installation of the Solar Ponds Plume Collection System. The area with the highest groundwater contamination is approximately 200 feet square and is immediately adjacent to North Walnut Creek.

The preferred alternative for additional remediation at both these locations is phytoremediation. It is recognized that this alternative will not completely solve the groundwater issues, however, it is considered a "polishing" action that is being required by the EPA and CDPHE. Passive phytoremediation is an effective method for reducing the contaminant load in groundwater and is best suited to downgradient areas where deep-rooted native species can intercept shallow groundwater. The genus *Populus*, and, to a lesser extent, other members of the willow family (*Salicaceae*) have been shown to be effective in phytoremediation applications (Licht and Schnoor, 1993; Newman, et al 1997). Several species of poplars, cottonwoods and willows are found at Rocky Flats, most of which would be suitable for phytoremediation (K-H, 2003). Additionally, several species of willow, in particular, coyote willow (*Salix exigua*), a common shrub at the Rocky Flats, may be considered for planting as well. Based on the results of previous work for the Solar Ponds Plume Project, an effective installation should have from 900 to 1,200 trees per acre (DOE, 1999a). However, the actual number of trees that will be planted will be determined based on further field evaluations to determine actual planting locations.

While much of the area suitable for the phytoremediation enhancement may sustain young plants, some areas are drier and may require supplemental irrigation for the first year. No irrigation is planned after the first year because plants that cannot be established in this timeframe will not effectively remove contaminants and will be allowed to die. Additionally, if some of the plants die during the first year, no attempts will be made to replace these as these locations would not be suitable for continuing phytoremediation. Modeling results indicate that there will be continued groundwater in this immediate area after Site closure. This groundwater is expected to be sufficient to sustain vegetation near the creek, once it is established.

Phytoremediation is a seasonal process that would address approximately 10 - 15% of the ambient concentrations for trichloroethene at the East Trenches Plume. Uptake rates for other organic compounds are higher. Effectiveness depends on the season, contaminant, hydrogeologic conditions and other factors. Phytoremediation both removes the contaminants from groundwater and reduces the volume of groundwater flowing through the area via active

uptake during the active growing season. Reduction in the contaminants during this time would have a positive impact on the groundwater quality.

Passive phytoremediation is an effective method for reducing the nitrate contaminant load in groundwater and is best suited to downgradient areas where deep-rooted native species can intercept shallow groundwater. The ability of *Populus* species to take up nitrate is well established. Some research reports up to 99% removal of nitrate from contaminated groundwater. Therefore it is the preferred additional alternative at the Solar Ponds Plume. As discussed in the Solar Ponds Plume Decision Document (DOE, 1999a), phytoremediation is also effective in reducing uranium concentrations in groundwater. Long-term, there is a possibility that removed plant material may need to be dispositioned as low level waste if uranium concentrations are sufficiently high. At the Solar Ponds Plume, phytoremediation would be a seasonal process that would address approximately one third of the contaminant loading for nitrates while reducing uranium contamination. At both locations, approximately 4 years are required to achieve this peak removal rate; however, limited remediation would take place earlier. The phytoremediation is anticipated to continue for as long as the treatment systems would operate, approximately 30 years.

Figure 1 shows the proposed planting areas at the East Trenches Plume area. Figure 2 shows the approximate location where the planting would be installed at the Solar Ponds Plume. The actual number of trees/shrubs planted would be determined after further investigation. However, up to approximately 2.5 acres could be planted at the East Trenches Plume area and up to approximately 1 acre at the Solar Ponds Plume.

Installation of the phytoremediation would be conducted at the East Trenches Plume after completion of the B-Pond sediment remediation and dam notching activities. The Solar Ponds Plume phytoremediation would take place either prior to or after the East Trenches Plume area has been planted. The initial installation would use whips or bare-root saplings. Whips would be acquired from the nursery in 8 to 10 foot lengths, a suitable length for a phytoremediation installation. In order to promote rapid growth and deep-rooting, the whips will be planted up to 6 feet deep. Planting would be accomplished with mechanical means, where-ever possible and as site conditions allow. A geoprobe equipped with an auger, a backhoe equipped with a small diameter auger, or some other similar equipment would be used to excavate the planting holes. The use of soil amendment would be minimized to encourage the plants to adapt to the existing conditions, but some soil augmentation may be needed to ensure that the plantings take hold.

Timing is critical for a successful phytoremediation project. The growers have to be prepared to supply the requisite number of trees in time for planting. Poplars and/or willows would be harvested in the late fall or early spring, and may be stored for a short period of time until needed. For this project, an early spring harvest and planting are proposed. Once this approach is approved, procurement would commence immediately to ensure that adequate nursery stock is available to meet planting requirements.

A drip irrigation system may be installed where necessary to augment and increase chances of survival and would use water supplied from a portable storage tank sized to provide water for several days between fillings during peak demand weather. The irrigation system would be a surface installation to facilitate removal once the irrigation system is no longer needed. The plantings would be monitored for health and vigor. However, as previously mentioned, replacements will not be made in areas where sufficient groundwater is not available to sustain vegetation. Replacements will only be made in the first year to replace obviously diseased or damaged plants. Once established, the plants would be able to subsist on the groundwater and, in fact, irrigation is not recommended after this initial period in order to encourage the tree roots to grow deeply.

All disturbances from the project will be temporary in nature. There will be no permanent impacts from the phytoremediation installation activities.

2.3 Best Management Practices

To minimize impacts to the Preble's mouse, project management will utilize and maintain the following best management practices (BMPs) except where regulatory and/or health and safety requirements take precedence.

- Identify and prioritize Preble's habitat areas that are subject to disturbance and design activities to avoid areas of higher habitat value[1]. For example, large willow patches will be avoided, except where the project cannot be completed without impacts.
- Reduce the impact footprint (i.e., no excessive walking in area beyond what is necessary to accomplish the work, minimizing laydown area and equipment storage locations).
- Conduct all activities during daylight hours, when the Preble's mouse is less active, when scheduling during the hibernation season of the mouse cannot be accomplished.
- Minimize the length of time spent in sensitive areas (getting work done as quickly as possible, not reentering area once work is completed).
- Explore options with project designers to avoid and/or minimize impacts to the Preble's mouse.
- Use established roads (i.e. paved, gravel, two-track, historically used routes to monitoring locations) for vehicle traffic. If an established road does not exist, use the safest and most direct route that minimizes impacts to the habitat.
- Limit equipment entrance/exit areas to the minimum necessary to accomplish the work.
- Limit vegetation disturbance through alternative actions. For example, prune trees/shrubs rather than remove trees/shrubs; cut shrub stems to allow re-growth rather than grubbing out the entire root system.
- Remove trash and unnecessary equipment in project areas after work is completed.

[1] For determination of impacts within current Preble's protection areas, habitat quality was defined based on the 1996 Site vegetation map. Higher quality habitat is defined as all woody vegetation classifications and short marsh, tall marsh, and wet meadow wetland types. Lower quality habitat is defined as all grassland classifications, mud flats, and other disturbed community types. Open water, riprap, concrete, roads, and structures are not considered habitat for the Preble's mouse.

- Revegetate disturbed Preble's habitat with native species after the activity has been completed in accordance with the Habitat Mitigation Techniques Plan (Appendix A, Part II of PBA; DOE 2004b).
- When revegetation activities cannot be completed immediately after project completion (i.e., outside optimum seeding window) use alternative erosion controls to control potential erosion and sedimentation problems. Use redundant erosion controls where appropriate.
- Use erosion controls (i.e., silt fence, erosion blankets, hay bales, mulching, tackifiers, surface roughening) to control erosion and sedimentation problems. For large areas, minimize exposed surfaces. Project personnel will be responsible to monitor erosion control effectiveness and modify control techniques as needed (especially after precipitation events). Monitoring will be conducted weekly or more frequently as needed (after precipitation events). Projects will maintain and repair erosion controls through project completion.
- Monitoring of mitigation actions will be conducted according to the Mitigation Monitoring Plan (Appendix B of Part II of the PBA; DOE 2004b).
- Prevent spilled fuels, lubricants or other toxic materials from entering Preble's habitat.
- Minimize project activities in wet areas and wet conditions to avoid damage to the habitat.
- Use the least amount of and/or smallest equipment necessary to accomplish the work.
- Do not clean equipment in Preble's mouse habitat or in areas where runoff will enter Preble's mouse habitat.
- Staging areas will be located either outside of Preble's habitat, or within the defined project footprint.
- Preble's mouse habitat will not be used as borrow areas.
- Inspect and clean equipment of weeds/seed to prevent spread of noxious weeds.

The project manager will receive a copy of the BA and BO, and be briefed on all guidelines and requirements. Project management is responsible to ensure compliance with the requirements and guidelines outlined in the BA and BO. Project management is responsible to follow and maintain the BMPs.

3. Environmental Baseline

In Jefferson County, the Preble's mouse has been captured or suitable habitat exists along portions of Coal Creek and Ralston Creek, in addition to that found in Rock Creek, Walnut Creek, Woman Creek, and Smart Ditch at the Site. Based on the availability of potentially suitable habitat and lack of trapping information, Preble's mice are assumed to occupy appropriate habitat within Jefferson County.

In Boulder County, the Preble's mouse has been captured or suitable habitat exists along portions of Coal Creek, South Boulder Creek, Saint Vrain Creek, and within the City of Boulder Open Space and Mountain Parks system. Preble's habitat also exists along South Boulder Canal, Doudy Draw, and Spring Brook. Based on the availability of potentially suitable habitat and lack of trapping information, Preble's mice are assumed to occupy appropriate habitat within Boulder County.

During 2002, the USFWS proposed critical habitat for the Preble's mouse (67 CFR 47154). On June 23rd of 2003, the USFWS finalized the critical habitat ruling for the Preble's mouse (68 FR 37275). The final rule excluded the Rocky Flats Environmental Technology Site from critical habitat designation because the Site will become a USFWS National Wildlife Refuge after closure. On January 28, 2005, the USFWS proposed to delist the Preble's mouse as a threatened species under the ESA.

4. Cumulative Effects

The Endangered Species Consultation Handbook (USFWS 1998) defines cumulative effects as "those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation" (50 CFR §402.02). A description of the surrounding lands and activities conducted on those lands is presented below.

The Site is surrounded by city, county, state, and federal lands. A variety of land use activities occurs on these lands. The land to the south of the Site is privately owned rangeland. It is currently used for grazing cattle. However, there are plans to develop portions of these properties as residential subdivision and business developments. The State of Colorado School Board land in Section 16 is also primarily rangeland, grazed by cattle throughout different times of the year. Gravel mining has occurred on this property in the past, however, none has taken place in recent years. The lands between Highway 93 and the mountain front to the west are largely City of Boulder, Boulder County, and Jefferson County open space properties used for some grazing and recreation activities. No development beyond perhaps some trails in the future is planned for these areas. Between the Site and Highway 93 there is a narrow strip of private property that the current landowner has attempted to develop in the past, with no success. If development would occur, it would most likely be some type of small business (either office space or perhaps light industry). On the western edge of the Site, within Site boundaries, two gravel mine operations are currently active. Current plans, dependent on permitting, would mine much of the western portions of the BZ at the Site.

The northwest corner of the Site is bounded by the National Renewable Energy Laboratory facility (NREL). Research on renewable wind energy is conducted at the facility. Most activities involve the installation and removal of large wind generators. To the north, the Site is bordered by City of Boulder and Boulder County open space property. On the east, most of the land is City of Broomfield and City of Westminster open space property. A small amount of development (housing and office space) has occurred along Highway 128 east of Indiana Street. Along the eastern edge of the Site, there is a measure included in the Rocky Flats Wildlife Act that would allow a 300 foot corridor for development of the C-470 highway.

Because most of the surrounding land use is either rangeland or open space, no cumulative effects are expected to the Preble's mouse from these lands. These lands actually provide additional buffer areas around the Site as habitat. Where riparian habitat exists on some of these properties, steps (e.g. the use fencing to keep cattle away from the streams) have been taken to preserve and enhance these corridors as wildlife habitat. Development activities planned for private property around the Site edges would be away from drainages at the Site and would have minimal or no effect on the mouse habitat at the Site.

The gravel mining operations on the western edge of the Site pose a potential threat to the Preble's mouse habitat at the Site. Subsurface flows provide water to the many seeps or stream flows that sustain Preble's habitat at the Site, particularly in the Rock Creek drainage. Because the drainages on Site lie largely at the headwaters of their respective watersheds, mining could potentially alter the subsurface water and surficial water flows on the Site. Currently no data exists on how the mining might impact the local hydrology. The mine operator continues to renew mining permits in order to expand mining operations.

The proposed C-470 highway would potentially cut off the eastern most edges of the Preble's habitat at the Site in both the Walnut Creek and Woman Creek drainages. However, the habitat at these locations is of much lower quality than that found further west in either drainage. Preble's mice have never been captured within the area that would potentially become the highway. Currently, there are no plans to develop the C-470 highway along the eastern edge of the Site in the near future.

Numerous easements exist at the Site for utilities such as power lines, gas lines, and telephone lines. Also water conveyance ditches for water rights owned by non-DOE parties cross the Site at various locations (McKay Ditch, Mower Ditch, Smart Ditch – D-Series Pond water rights). Mineral rights and mining operations are also present at the Site at some locations as mentioned above. Currently no planned activities at the Site related to these easements are scheduled. The responsibility for USFWS consultation for potential impacts to listed species resulting from normal operations, maintenance, and new construction activities related to these easements at the Site are the responsibility of the easement parties and would be dealt with through separate consultation with the USFWS.

Activities in areas surrounding the Rocky Flats Environmental Site will have no effect on the phytoremediation project or other DOE activities related to the cleanup of the Site.

5. Analysis Of Impacts

5.1 Definitions

The following definitions, cited from the Endangered Species Consultation Handbook (USFWS 1998), were used in categorizing the effects from the Phytoremediation project activities on the selected threatened or endangered species considered in the BA:

- "*No effect*" — the appropriate conclusion when the action agency determines its proposed action will not affect a listed species or designated critical habitat.

- "*May affect*" — the appropriate conclusion when a proposed action may pose any effects on listed species or designated critical habitat. When the Federal agency proposing the action determines that a "may affect" situation exists, then they must either initiate formal consultation or seek written concurrence from the Services that the action "is not likely to adversely affect".

- "*Is not likely to adversely affect*" — the appropriate conclusion when effects on listed species are expected to be discountable, insignificant, or completely beneficial.

- "*Is likely to adversely affect*" — the appropriate finding in a biological assessment (or conclusion during informal consultation) if any adverse effect to listed species may occur as a direct or indirect result of the proposed action or its interrelated or interdependent actions, and the effect is not: discountable, insignificant, or beneficial (see definition of "is not likely to adversely affect"). In the event the overall effect of the proposed action is beneficial to the listed species, but is also likely to cause some adverse effects, then the proposed action "is likely to adversely affect" the listed species. If incidental take is anticipated to occur as a result of the proposed action, an "is likely to adversely affect" determination should be made. An "is likely to adversely affect" determination requires the initiation of formal section 7 consultation.

- "*Jeopardize the continued existence of*" — to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species.

5.2 BA Findings (Excluding Preble's Mouse)

The activities involved in the phytoremediation project will not affect water depletions within the greater Platte River basin. Therefore, no effects on the lower Platte River species are

likely to occur from these on-Site actions. Lower Platte River species considered in this evaluation include the piping plover, the least tern, the whooping crane, the pallid sturgeon, the Eskimo curlew, the American burying beetle and the western prairie fringed orchid.

The bald eagle is a casual user of the Site. Site wildlife surveys have noted approximately one observation per year for the past six years. Bald eagle nesting has never been observed on Site. Therefore, the phytoremediation project will have no effect on the bald eagle. Black-footed ferrets, boreal toads, Canada lynx, greenback cutthroat trout, Mexican spotted owls, mountain plovers, and Pawnee montane skippers do not occur at or near the Site. Ten years of ecological monitoring have never documented these species at the Site (DOE 1992, 1994a, 1995; K-H, 1997, 1998, 1999, 2000, 2001, 2002, RMRS 1996). Therefore, the phytoremediation project will have no effect on these species. The black-tailed prairie dog occurs at the Site, but is a candidate species, which is non-statutory and therefore is not considered in this BA.

Ute ladies'-tresses, and Colorado butterfly plant, both listed species, though occurring in the Site's vicinity, have not been documented on the Site nor in off-Site areas that might be effected by this project (ESCO 1993, 1994). Therefore the phytoremediation project will have no effect on these species.

5.3 Preble's Mouse Analysis of Impacts and Findings

The Preble's mouse occurs at the Site, and has been documented and studied extensively in each of the main drainages at Rocky Flats. Studies at the Site have focused on trapping and tagging Preble's mice, and tracking their movements through the use of telemetry. In addition, habitat characterization has been done to quantify habitat parameters for the mouse at the Site. The data from these studies have yielded information on Preble's mouse habitat, areas of occupation, home ranges, and mouse movement at the Site. Using this information, Site ecologists developed the PPP (DOE 2004b) that includes a Preble's mouse protection area map and a means of evaluating Site activities for potential impacts to the mouse. These actions have been taken proactively by DOE to protect the Preble's mouse and its habitat at the Site.

Trapping and telemetry field work has documented the Preble's mouse within and in the vicinity of the phytoremediation project areas (Figure 3 shows the telemetry points). Trapping studies at the Site have captured Preble's mice in the North and South Walnut Creek drainages in 1994, 1995, 1996, 1999, (K-H 1996a, 1996b, 1999; PNHS 1996). During 1999, trapping and telemetry work captured 19 Preble's mouse individuals in Walnut Creek (K-H 1999). The average distance mice were observed to move in Walnut Creek over a 20 day period was approximately 971 feet (0.18 miles), with a maximum distance of 1,798 feet (0.34 miles).

The USFWS defines harm as "*significant habitat modification or degradation that results in death or injury to listed species by significantly impairing behavioral patterns such as breeding, feeding, or sheltering*" and harass "*as actions that create the likelihood of injury to*

listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering." (USFWS 1998).

Because Preble's mice are known to occur in both North and South Walnut Creek, the potential exists for some direct and indirect affects on the mouse resulting from the Phytoremediation Project. A total of approximately 3.5 acres of Preble's habitat may be temporarily impacted by the project activities. Of this, approximately 2.5 acres may be located along the south edge of ponds B-1, B-2, and B-3, which are already being disturbed, first by the pond remediation project and then the dam notching project. So most of this area will have already been disturbed by these projects. These activities and the locations where the phytoremediation would be placed are within the construction footprints covered under Part II of the PBA for the Pond Remediation and Removal Projects (Section 3.3, DOE 2004b). Therefore in the South Walnut Creek drainage, the phytoremediation project would be installed as part of the revegetation required for these previous projects. The end result would be an enhancement to the Preble's habitat along the southern edges of the B-ponds. Currently only a single small plains cottonwood tree exists along the southern pond edges of B-1, B-2, or B-3. So the survival of even a few trees or additional shrubs for the long-term at these locations would potentially increase the value of the habitat by providing additional vegetation structure to the area as well as providing additional habitat cover for the Preble's mouse. The planting of the trees or shrubs would serve as habitat enhancement.

In North Walnut Creek, west of the A-1 pond where the phytoremediation is planned, approximately 1 acre of habitat would be temporarily disturbed during the planting of the trees or shrubs. Portions of this area have been previously disturbed by the Water Measurement Flume Replacement Project (USFWS Biological Opinion; ES/CO: ES/GJ-6-CO-02-F-18) and are currently in an early revegetation state. The installation of the trees and irrigation system would temporarily disturb the area along the creek, but in the long-term would potentially create additional higher quality habitat along North Walnut Creek by increasing the amount of riparian woodland along the stream. The survival of even a few trees or additional shrubs for the long-term at these locations would potentially increase the value of the habitat by providing additional vegetation structure to the area as well as providing additional habitat cover for the Preble's mouse. The planting of the trees or shrubs would serve as habitat enhancement.

Although the project will temporarily disturb Preble's habitat, there will be minimal impact to the Preble's mice since they will still be in hibernation during the planting activities. To be successful, cottonwood and willow, poles or whips must be planted while still dormant. So the project will need to be completed in late March or early April to make sure the plant material has not broken dormancy. Since Preble's mice don't come out of hibernation until May there should be minimal impacts.

Previously the USFWS has required DOE to plant woody shrubs along McKay Ditch (DOE 1998; USFWS) and Woman Creek (DOE 2002) as mitigation enhancement to offset impacts from projects. The planting of the phytoremediation trees/shrubs, even with a low survival rate, will benefit the Preble's mouse habitat by potentially creating additional riparian

woodland habitat along the streams at these locations. The additional woody plant cover will provide increased vegetation structural diversity, provide taller vegetation cover, and increase the amount of higher quality habitat that should benefit the survival of the Preble's mouse in North and South Walnut Creeks. The plantings at the East Trenches Plume may be conducted as part of the revegetation for previous project disturbances in that area and a relatively small area of disturbance would be created to install the trees at the Solar Ponds Plume. The finding of this analysis of potential direct and indirect impacts, and the potential for habitat enhancement, is that the project may affect, but is not likely to adversely affect the Preble's mouse. Neither is the project expected to jeopardize the existence of the Preble's mouse at the Site.

5.4 Summary of Findings

The following table summarizes the findings of the Phytoremediation project.

Fauna	Legal Status	No Effect	May Affect, No Adverse Effects	Adverse Effects
American burying beetle*	LE	X		
Bald eagle	LT	X		
Black-footed ferret	LE	X		
Black-tailed prairie dog	C	X		
Boreal toad	C	X		
Canada lynx	LT	X		
Eskimo curlew*	LE	X		
Greenback cutthroat trout	LT	X		
Least tern *	LE	X		
Mexican spotted owl	LT	X		
Mountain plover	PT	X		
Pallid sturgeon*	LT	X		
Pawnee montane skipper	LT	X		
Piping plover*	LT	X		
Preble's meadow jumping mouse	LT		X	
Whooping crane*	LE	X		
Flora				
Colorado butterfly plant	LT	X		
Ute ladies'-tresses	LT	X		
Western prairie fringed orchid*	LT	X		

* = Lower Platte River species
C = Candidate for listing
LT = Listed threatened
LE = Listed endangered
PT = Proposed threatened

6. Conservation Measures

In accordance with the Endangered Species Consultation Handbook (USFWS 1998), conservation measures are defined as follows: "Conservation measures represent actions pledged in the project description that the action agency or applicant will implement. Since conservation measures are part of the proposed action, their implementation is required under the terms of the consultation." To offset the potential impacts of the Phytoremediation project described in this BA, the following conservation measures are proposed.

6.1 Current Conservation Measures at the Site

6.1.1 Memoradum of Agreement and Preble's Protection Plan

A memorandum of agreement for coordination of endangered species compliance for Site activities was signed by the DOE, USFWS, EPA, CDPHE, and CDNR, in 1999 (DOE 1999). The purpose of the MOA was to develop a process by which the various parties could work together to achieve compliance with the mandates of the RFCA, Site closure activities, and the ESA. One of the outcomes of the MOA was the requirement to develop a PPP for the Site. The PPP was finalized in January of 2004 with help from the USFWS. The PPP outlines the basic approach of how the Site protects the Preble's mouse and its habitat. It also contains a map that designates the current Preble's protection areas at the Site. The purpose of the PPP is to protect the Preble's mouse and its habitat at the Site. Any projects that fall within the current Preble's protection areas must be evaluated for impacts to the Preble's mouse. The map was developed based on the results of several years of trapping data, telemetry work, and habitat characterization. Preble's mouse telemetry locations were buffered using a 300 foot buffer around each point. Elsewhere at the Site, where similar habitat types exist, a 100 foot buffer was established from the edge of the woody vegetation types: riparian woodland, riparian shrubland, tall upland shrubland, and short upland shrublands (snowberry and skunkbush sumac adjacent to streams). The 1996 Site vegetation map was used to designate these areas.

6.1.2 Site Procedures

Two Site procedures also exist that help protect the Preble's mouse habitat. The two procedures are the *Identification and Protection of Threatened, Endangered, and Special-Concern Species* and *Wetland Identification and Protection* (DOE 1994b, 1997). These procedures require projects to be evaluated for ESA and wetland issues.

6.1.3 Programmatic Biological Assessment

The Site recently developed and finalized a Programmatic Biological Assessment (PBA) under Section 7 consultation with the USFWS which addresses all future Site closure activities (DOE 2004b). This document outlines the process by which specific projects that

have the potential to impact the Preble's mouse and/or its habitat may proceed. It also provides mitigative measures for impacts. Since the activities of the Phytoremediation project were not covered in the PBA, this separate BA has been written to address potential impacts.

6.1.4 Monitoring

Since the early 1990's when the Preble's mouse was first discovered to occur at the Site, DOE has actively pursued gathering scientific information on the mouse. Through the use of live trapping, tagging, and telemetry, in addition to extensive habitat characterization, the Site has provided a great deal of knowledge to the scientific community on the behavior and habitat requirements of the Preble's mouse. These data were used to develop the PPP and associated map and have been used to evaluate proposed projects. Ecology staff at the Site have contributed to the technical working group for the Preble's mouse in the past.

6.2 Proposed Conservation Measures

In addition to the current conservation measures already in place at the Site (mentioned above), the following conservation measures, are proposed to offset potential impacts from the Phytoremediation project.

6.2.1 General Conservation Measures

The general conservation measures are those to be implemented that are not project-specific.

- Education of Site personnel may be conducted to inform employees of ESA issues. The use of the Site newspaper, email system, the environmental-checklist process, and communication with project managers will be used to inform employees of ESA issues.

- Continue to use best management practices to avoid and minimize impacts to Preble's mouse habitat.

- No seeding of non-native plant species will be conducted for Preble's mitigation projects.

6.2.2 Mitigation Measures

No mitigation measures are proposed for this activity because the project itself (i.e. the planting of trees/shrubs along the North and South Walnut Creeks) will act as a habitat enhancement activity for the Preble's mouse. Additionally, no success criteria are specified for the survival of the plantings because it is acknowledged that not all of them will survive and the GW IM/IRA specifies that no replanting will be conducted for failed survival.

7. Summary

The BA was prepared in order to address activities that may affect federally listed threatened and endangered species during the Phytoremediation project. The species evaluated in this BA include the American burying beetle*, Bald eagle, Black-footed ferret, Black-tailed prairie dog, Boreal toad, Canada lynx, Eskimo curlew*, Greenback cutthroat trout, Least tern *, Mexican spotted owl, Mountain plover, Pallid , sturgeon*, Pawnee montane skipper, Piping plover*, Preble's mouse, Whooping crane*, Colorado butterfly plant, Ute ladies'-tresses, and Western prairie fringed orchid*. Species noted with an (*) are South Platte River species.

Impact analyses determined that the Phytoremediation project activities listed in the BA would have no effect on the species evaluated, with the exception of the Preble's mouse. With respect to the Preble's mouse the conclusion of the BA is that the Phytoremediation project may affect, but is not likely to adversely effect the Preble's mouse. Best management practices and conservation measures are proposed to avoid and minimize impacts to the Preble's mouse and its habitat.

8. References

DOE. 1992. Baseline Biological Characterization of the Terrestrial and Aquatic Habitats at the Rocky Flats Plant. Final Report. U.S. Department of Energy, Rocky Flats Plant, Golden, CO. September 1992.

DOE. 1994a. Fiscal Year 1993 Annual Wildlife Survey Report. U.S. Department of Energy, Rocky Flats Office, Golden, CO. April 29, 1994.

DOE. 1994b. Identification and Protection of Threatened, Endangered, and Special-Concern Species. U.S. Department of Energy, Rocky Flats Field Office, Golden CO. January 14, 1994.

DOE. 1995. 1994 Annual Wildlife Survey Report. Natural Resource Protection and Compliance Program. U.S. Department of Energy, Rocky Flats Office, Golden, CO. April 24, 1995.

DOE. 1996. Study Results of Dam Toe Slope Sand/Rock Blanket Installation Effects on the Preble's Meadow Jumping Mouse. Rocky Flats Field Office, U.S. Department of Energy, Golden, CO. January 29, 1996.

DOE. 1997. Wetland Identification and Protection. U.S. Department of Energy, Rocky Flats Field Office, Golden CO. January 3, 1997.

DOE. 1998. Biological Assessment for McKay Bypass Extension Project. . U.S. Department of Energy, Rocky Flats Field Office, Golden CO. December 1998.

DOE. 1999. Memorandum of Agreement for Coordination of Endangered Species Act Compliance with activities at Rocky Flats Environmental Technology Site between Department of Interior Fish and Wildlife Service, Department of Energy, Environmental Protection Agency, Colorado Department of Public Health and Environment, and Colorado Department of Natural Resources. U.S. Department of Energy, Rocky Flats Environmental Technology Site, Golden, CO. May 17, 1999.

DOE, 1999a *Final Solar Ponds Plume Decision Document*, RF/RMRS-98-286.UN, June.

DOE. 2002. Water Measurement Flume Replacement Project Biological Assessment and associated amendments. U.S. Department of Energy, Rocky Flats Field Office, Golden CO. January 2002.

DOE. 2004a. Interim Measures/Interim Remedial Action for Groundwater at the Rocky Flats Enviromental Technology Site. Draft Version. U.S. Department of Energy, Rocky Flats Environmental Technology Site, Golden, CO. November 2004.

DOE. 2004b. Programmatic Biological Assessment for Department of Energy activities at the Rocky Flats Environmental Technology Site. Parts I and II. U.S. Department of Energy, Rocky Flats Field Office, Golden, CO. April 2004.

EG&G. 1992. Report of Findings: Survey for the Preble's meadow jumping mouse. Prepared by Stoecker Environmental Consultants for ESCO Associates, Inc., Rocky Flats Environmental Technology Site, Golden, CO.

EG&G. 1993. Report of Findings: 2nd year survey for the Preble's meadow jumping mouse. Prepared by Stoecker Environmental Consultants for ESCO Associates, Inc., Rocky Flats Environmental Technology Site, Golden, CO.

ESCO. 1993. Report of Findings, Ute Ladies'-Tresses and Colorado Butterfly Weed Surveys. Rocky Flats Buffer Zone. ESCO Associates, Inc., Boulder, CO. September 24, 1993.

ESCO. 1994. Report of Findings, Ute Ladies'-Tresses and Colorado Butterfly Weed Surveys. Rocky Flats Buffer Zone. ESCO Associates, Inc., Boulder, CO. September 13, 1994.

K-H. 1996a. Preble's Meadow Jumping Mouse Study at Rocky Flats Environmental Technology Site, Spring 1996, Final. Prepared by PTI Environmental Services for Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. October.

K-H. 1996b. Preble's Meadow Jumping Mouse Study at Rocky Flats Environmental Technology Site, Annual Report 1996, Final. Prepared by PTI Environmental Services for Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. December.

K-H. 1997. 1996 Annual Wildlife Survey Report. Natural Resource Compliance Protection Program. Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. March 1997.

K-H. 1998. 1997 Annual Wildlife Survey Report. Natural Resource Compliance Protection Program. Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. May 1998.

K-H. 1999. 1998 Annual Wildlife Survey Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. June 1, 1999.

K-H. 2000. 1999 Annual Wildlife Survey Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. June 2000.

K-H. 2001. 2000 Annual Wildlife Monitoring Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. June 2001.

K-H. 2002. 2001 Annual Wildlife Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. August 2002.

K-H. 2003. 2002 Annual Ecology Report for the Rocky Flats Environmental Technology Site. Kaiser-Hill Company, LLC. Rocky Flats Environmental Technology Site, Golden, CO. June 2003.

Licht, L. A. and J. L Schnoor, 1993. Tree Buffers Protect Shallow Groundwater at Contaminated Sites, EPA/542/N-93/011

Newman, Lee A., Stuart E. Strand, Nami Choe, James Duffy, Gordon Ekuan, Martin Ruszaj, B. Brook Shurtleff, Jodi Wilmoth, Paul Heilman, and Milton P. Gordon, 1997. *Uptake and Biotransformation of Trichloroethylene by Hybrid Poplars*, Environmental Science Technology, *31*(4) pp 1062 - 1067

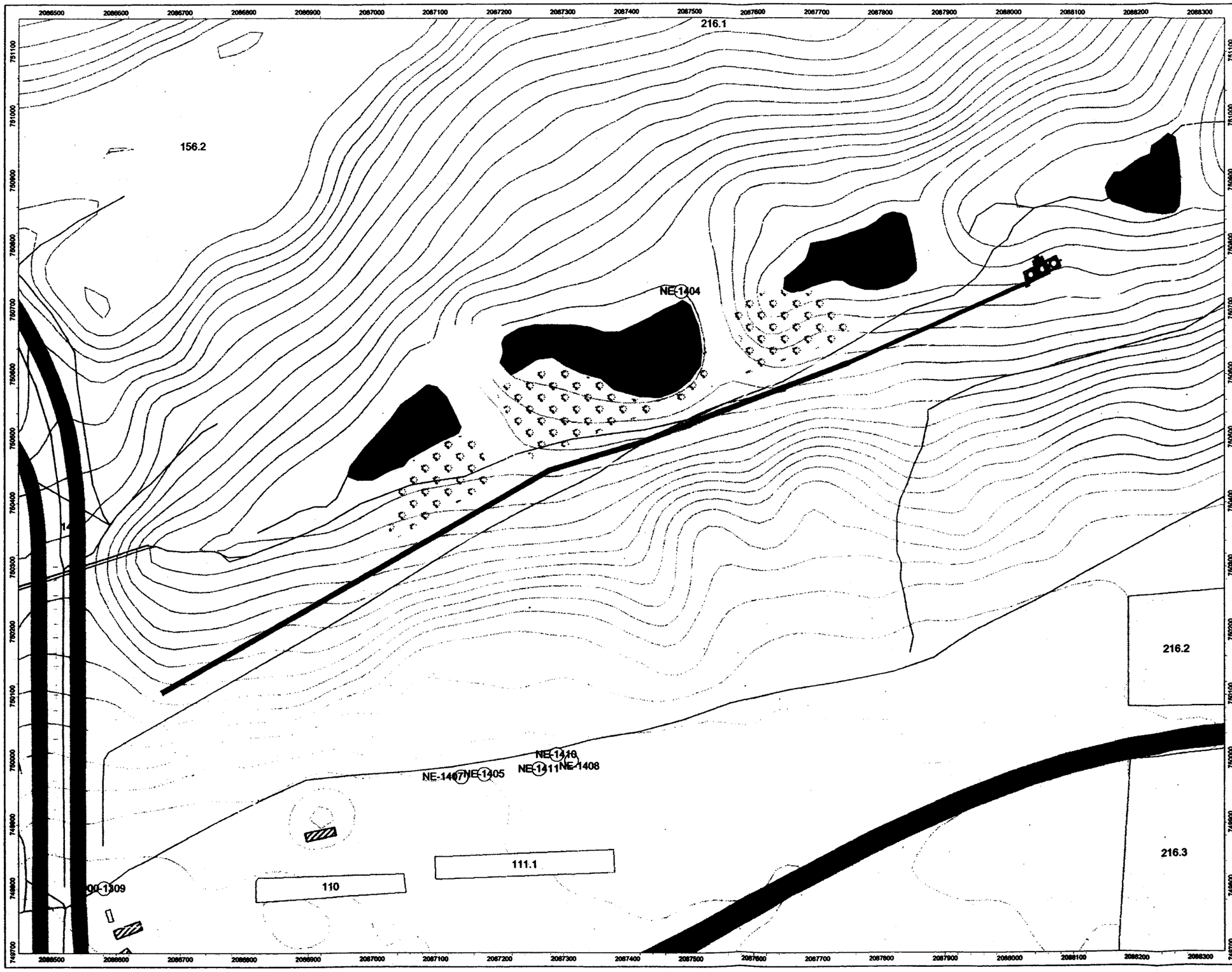
PNHS. 1996. Investigations of the Ecology and Ethology of the Preble's Meadow Jumping Mouse at the Rocky Flats Environmental Technology Site. Prepared for the U.S. Department of Energy, Rocky Flats Environmental Technology Site by The Pawnee Natural History Society and Colorado State University. Preliminary Draft. January 1996.

RMRS. 1996. 1995 Annual Wildlife Survey Report for the Rocky Flats Environmental Technology Site. Natural Resource Protection and Compliance Program. Rocky Mountain Remediation Services, LLC. Rocky Flats Environmental Technology Site, Golden, CO. April 25, 1996.

Schorr, R. 2003. 2002 Trapping Results for the Air Force Academy, Colorado Springs, CO. Presentation at the 2003 Preble's Meadow Jumping Mouse Technical Working Group Meeting, Colorado Division of Wildlife Headquarters, Denver, CO. March 12, 2003.

SCS. 1980. Soil survey of Golden area, Colorado. U.S. Department of Agriculture, Soil Conservation Service, Washington, DC.

USFWS. 1998. Endangered Species Consultation Handbook: Procedures for Conducting Consultation and Conference Activities Under Section 7 of the Endangered Species Act. U.S. Fish and Wildlife Service and National Marine Fisheries Service. Final. March 1998.



Rocky Flats Environmental Technology Site

Figure 1

Phytoremediation at the East Trenches Plume

- Proposed Phyto-remediation

Treatement Infrastructure

- Transmission Pipe
- Treatement Cell
- Future Cell
- Trreatement Cell Pad
- Treatment Cell Pipe
- Other Equipment
- Collection Trench
- Former OU2 IHSS
- Potential Area of Concern
- No Further Action PACs in 1992
- Under Building Contamination
- Composite VOC Plume
- Contours
- Dirt Roads
- Trails
- Streams
- Fence
- Demolished Structure
- Standing Structure
- Paved Surface
- Ponds

1:8,963

1 inch equals 150 feet

State Plane Coordinate Projection
Colorado Central Zone (3476)
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared By: CH2MHILL

Prepared For: KAISER-HILL COMPANY

MAP ID: GIS Dept. (303) 966-7707 June 23rd, 2004

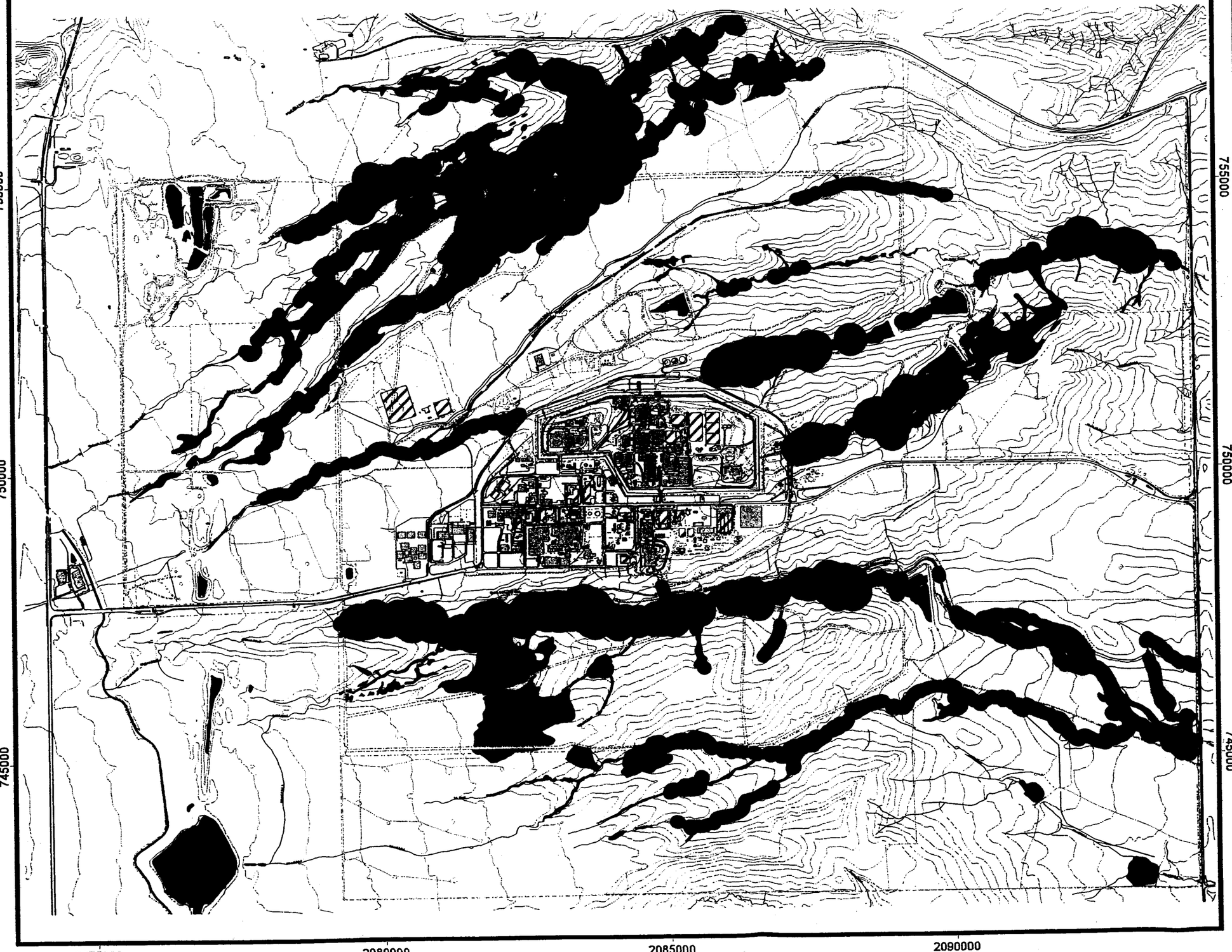
W:\Properties\fy2004\04-0617\Phyto_East_Trenches.mxd

2075000 2080000 2085000 2090000

755000

750000

745000



Preble's Meadow Jumping Mouse Current Protection Areas at RFETS December 2003

Figure 3

Legend

- Current Preble's Protection Areas
- Contiguous Wetlands
- Preble's mouse telemetry points

Standard Features

- Buildings
- Demolished Buildings
- Lakes & ponds
- Streams & ditches
- Fences
- Paved roads
- Dirt roads
- Contours (20 ft. intervals)

DATA SOURCE BASE FEATURES:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas.
Digitized from the orthophotographs, 1/95.

N

1000 0 1000 Feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by: Professional Environmental Group, L.L.C.

For: Kaiser-Hill Company, LLC

RFETS GIS Dept.
303-966-7707

MAP ID: 04-0006

December 16, 2003

G:\Projects\FY2004\04-0006\PMJM\mxd\PMJM Protection Area Map

16/16