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REMOVAL SITE EVALUATION EROSION CONTROL AT THE INACTIVE FLYASH PILE MARCH 1993

DOE-FN/FERMCO

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RESEARCH

REMOVAL SITE EVALUATION

EROSION CONTROL AT THE INACTIVE FLYASH PILE

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
U.S. DEPARTMENT OF ENERGY

MARCH 1993

INTRODUCTION

As part of the FEMP's environmental investigation and cleanup, the site has been divided into five Operable Units. The Inactive Flyash Pile (IAFAP), a subunit of Operable Unit 2, is located approximately 2000 feet southwest of the former FEMP production area and covers approximately 5 acres (See Figures 1 & 2). Its western boundary, in part, is defined by Paddys Run which parallels the area for approximately 200 feet. Access Road B and a natural drainage ditch leading to Paddys Run form the IAFAP's northern border. As part of the U.S. EPA/DOE Amended Consent Agreement, chain barrier fencing and radiological "Controlled Area" signs have been installed around the entire surface area of the IAFAP and the South Field Disposal area located to the east.

Flyash and bottom ash (hereafter referred to as flyash) from the FEMP's coal-fired boiler plant and other materials were deposited in the IAFAP area from 1952 to approximately 1968. The total quantity of ash (30% flyash and 70% bottom ash) disposed in this area has been estimated at 78,500 CY (OU2 RI, October 1992). Although the area has been covered with soil, and natural vegetation has developed, materials such as concrete, steel drum lids and asbestos containing transite are visible at the surface. These materials are particularly evident along the IAFAP and Paddys Run border where geomorphological processes (e.g., erosion due to intermittent stream flow) have impacted the eastern stream bank. In this area, the nearly vertical side walls of the stream bank extend from the stream bed up approximately 15 feet to the vegetated bank near the toe of the IAFAP. The chain barrier fence is offset approximately 2 feet from the top of the stream bank (See Figure 3).

During recent months, above average precipitation has caused a stream flow condition that has accelerated the rate of stream bank erosion. In some locations adjacent to the IAFAP, the sand and gravel side walls of the stream bank have been undercut to form an overhang of soil above it. Portions of the stream bank have slumped into the stream channel in at least three locations.

Although the IAFAP is currently intact, continuation of the erosion process at the current rate (i.e., small and slow displacements of soil) could eventually undermine the pile's western slope (estimated 1h:1v) and may, over time, result in discharge of ash and potentially contaminated waste and fill into Paddys Run. This particular stretch of Paddys Run represents one of the streams most prominent meanders. It is in the outside bend of this meander where the stream velocities are greatest and where turbulent currents are generated. These currents are impacting toe support and may render a portion of the IAFAP's western slope susceptible to a slope failure. A slope failure could potentially deposit large quantities of waste and fill material into the stream channel.

This Removal Site Evaluation (RSE) is being initiated by the Department of Energy under authority delegated by Executive Order 12580 under Section 104 of CERCLA and is consistent with Section 300.410 of the National Contingency Plan (NCP). The RSE is being conducted to determine whether conditions are present to warrant the implementation of a CERCLA Removal Action to stabilize the impacted stream bank or take other actions compatible with the proposed final remedial action.

SOURCE AND NATURE OF THE THREAT OF A RELEASE

A comprehensive radiological survey of the Inactive Flyash Pile/South Field Disposal area was completed by DOE-FN on April 30, 1992. In accordance with the US DOE Radiological Control Manual definition for "contaminated areas", Geiger-Mueller (G-M) probes and Micro R Meters were used to identify surface areas having gross beta/gamma readings of greater than 1000 DPM/100 cm^2 and gamma radiation levels exceeding 20 uR/hr above background. Site background levels were established for soils at 60 cpm and 10 micro R/hr respectively. Based on these criteria, eight "contaminated areas" were identified as having fixed or removable contamination exceeding 1000 DPM/100 cm^2 or 20 uR/hr above background. Two of these areas (See Figure 4) are located in the soil cover near the impacted area on top of the IAFAP. Aerial photography indicates soil fill material may have been placed in this area prior to flyash placement. The nature and extent of the soil fill material is not well documented.

Analytical data for the underlying soil/fill obtained during the Operable Unit 2 Remedial Investigation show levels of radionuclide contamination which may pose a threat to an individual or individuals exposed to this material. Uranium, the primary contaminant in the IAFAP, has been measured as high as 873 ppm in the soil fill below the flyash and at levels near 26,600 ppm in surface soils (See Figures 5 & 6). Exposed debris along the slope of the IAFAP's western face may also contain fixed radiological contamination. In accordance with Ohio Administrative Code 3745-30, analytical results (See Tables I & II) for samples obtained strictly of flyash indicate that the ash may be considered non-toxic.

There are three mechanisms for slope failure:

1) Circular Arc Failure
2) Wedge Failure
3) Creep.

Of the above, creep is believed to be the least likely failure mode due to the root support from the vegetation on the ash pile slope. Both the circular arc and wedge failure modes are extremely rapid with little advance warning. Postulated failure surfaces are illustrated in Figure 3. Both could result in a large uncontrolled discharge to Paddys Run.

EVALUATION OF THE MAGNITUDE OF THE POTENTIAL THREAT

There is uncertainty in predicting when a slope failure might occur. Based on the field conditions currently observed at the inactive ash pile, the following may be concluded:

1) total elevation differences from the stream channel to the IAFAP toe and from the stream channel to the head of the IAFAP are 15 feet and 45 feet respectively; the slope of the IAFAP's western dumping face is approximately 45 degrees,

2) the degree to which particle bonding has occurred between the flyash and the

underlying soil fill, and the soil fill and the native soil is unknown,

3) perched water, which has been observed in the area, can induce pore water pressures that change effective stress and reduce soil shear strength,

4) stream flow has eroded the stream bank, this bank contributes to the stability of the IAFAP's western slope,

5) two of three monitoring stakes, placed perpendicularly and three feet into the bank closest to the IAFAP on September 29, 1992 were observed to have been washed away on February 10, 1993, this corresponds to an estimated erosion of 0.75 ft./month (i.e., a total of three feet) and significantly exceeds the total erosion observed during the previous two year period. Prior to September the undercut erosional surface was observed to be a dense silty sand; the undercut erosion now extends into a loose sand and gravel layer in the bank.

The above conditions suggest that stream bank erosion in Paddys Run will continue, even during low flow conditions. As erosion continues, undercutting of the IAFAP will increase the susceptibility of this area to slope displacements that may result in sliding. If this occurs, there is a potential that IAFAP waste may be discharged into the stream channel. The primary release pathways to environmental or human receptors associated with this type of discharge are as follows:

1) Surface Water - transport of contamination off-site via Paddys Run.

2) Groundwater - Paddys Run has eroded through the glacial till downstream of the IAFAP and is in direct contact with the sand and gravel deposits of the Great Miami Aquifer. Contamination in surface water may be transported directly into the aquifer via this pathway.

3) Air - fugitive dust emissions from resuspended ash or dust particles from waste materials.

ASSESSMENT OF THE NEED FOR A REMOVAL ACTION

Section 40 CFR 300.415 (b)(2) of the NCP defines eight factors which should be considered in determining the appropriateness of a removal action. Three of these factors, listed below, are specifically applicable to this assessment.

<u>40 CFR 300.415 (b)(2)(i)</u> Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants.

<u>40 CFR 300.415 (b)(2)(ii)</u> Actual or potential contamination of drinking water supplies or sensitive ecosystems.

<u>40 CFR 300.415 (b)(2)(v)</u> Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released. (e.g., storm waters)

These factors are considered appropriate as a result of the continued erosion of the stream bank adjacent to the IAFAP and the potential release of contamination if slope failure of the IAFAP's western slope were to occur.

APPROPRIATENESS OF A RESPONSE

If it is determined that a response action is appropriate due to potential exposure to or threat of release of contaminants or hazardous substances, a removal action to address the existing conditions and the possibility of releases to the environment may be required. All documentation relevant to removal action implementation will be included in the CERCLA Administrative Record.

If a planning period of less than six months exists prior to initiation of a response, DOE will issue an Action Memorandum. The Action Memorandum will describe the selected response and provide supporting documentation for the decision.

If it is determined that there is a planning period greater than six months before a response is initiated, DOE will issue an Engineering Evaluation/Cost Analysis (EE/CA) approval memorandum. This memorandum is to be used to document the threat to public health and the environment and to evaluate viable alternative response actions.

FIGURE 1-

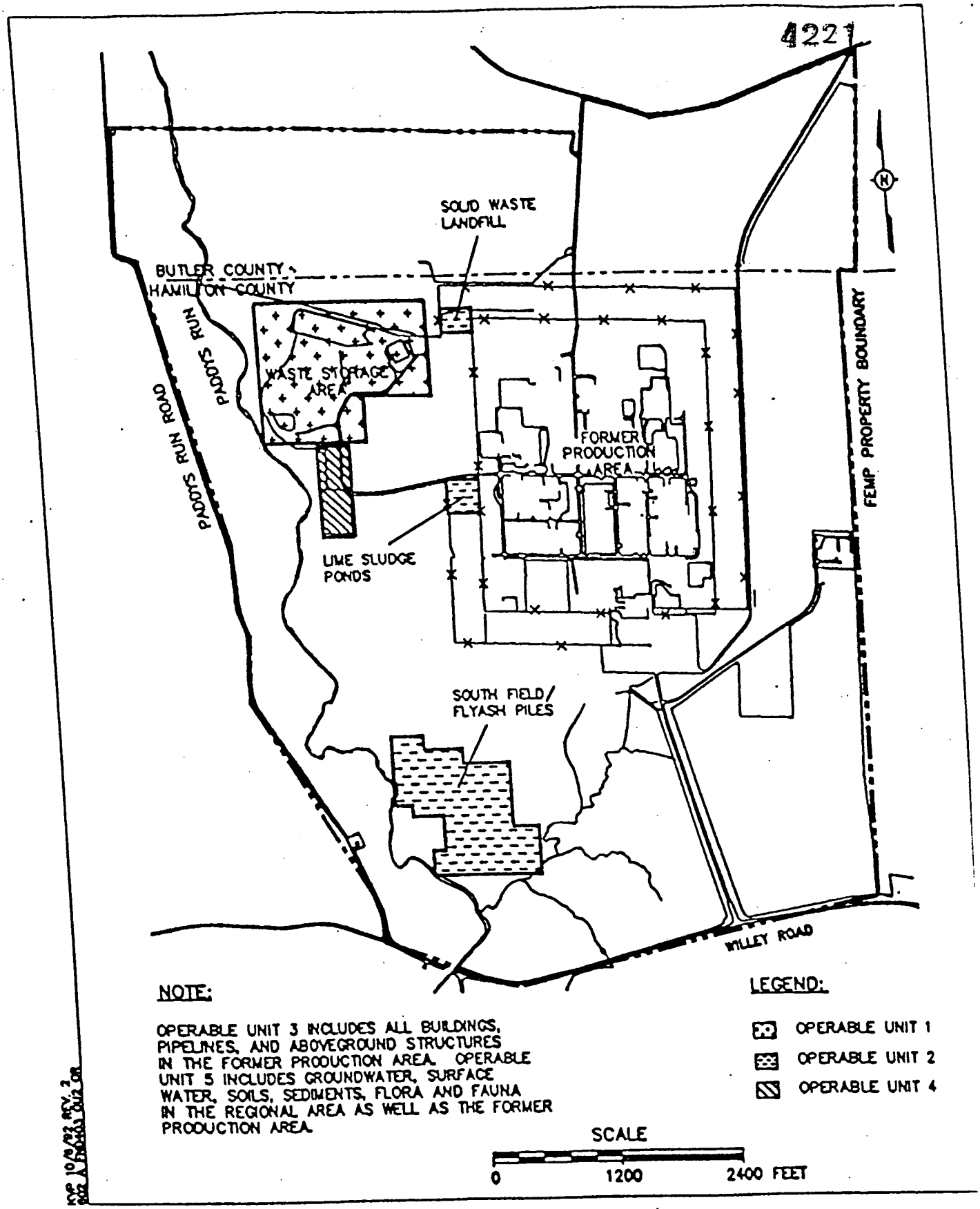

4221
SOLID WASTE LANDFILL
BUTLER COUNTY
HAMILTON COUNTY
PADDYS RUN
PADDYS RUN ROAD
WASTE STORAGE AREA
FORMER PRODUCTION AREA
FEMP PROPERTY BOUNDARY
LIME SLUDGE PONDS
SOUTH FIELD/ FLYASH PILES
WILLEY ROAD
N
NOTE:
OPERABLE UNIT 3 INCLUDES ALL BUILDINGS, PIPELINES, AND ABOVEGROUND STRUCTURES IN THE FORMER PRODUCTION AREA. OPERABLE UNIT 5 INCLUDES GROUNDWATER, SURFACE WATER, SOILS, SEDIMENTS, FLORA AND FAUNA IN THE REGIONAL AREA AS WELL AS THE FORMER PRODUCTION AREA.
LEGEND:
OPERABLE UNIT 1
OPERABLE UNIT 2
OPERABLE UNIT 4
SCALE
0
1200
2400 FEET

Figure 2

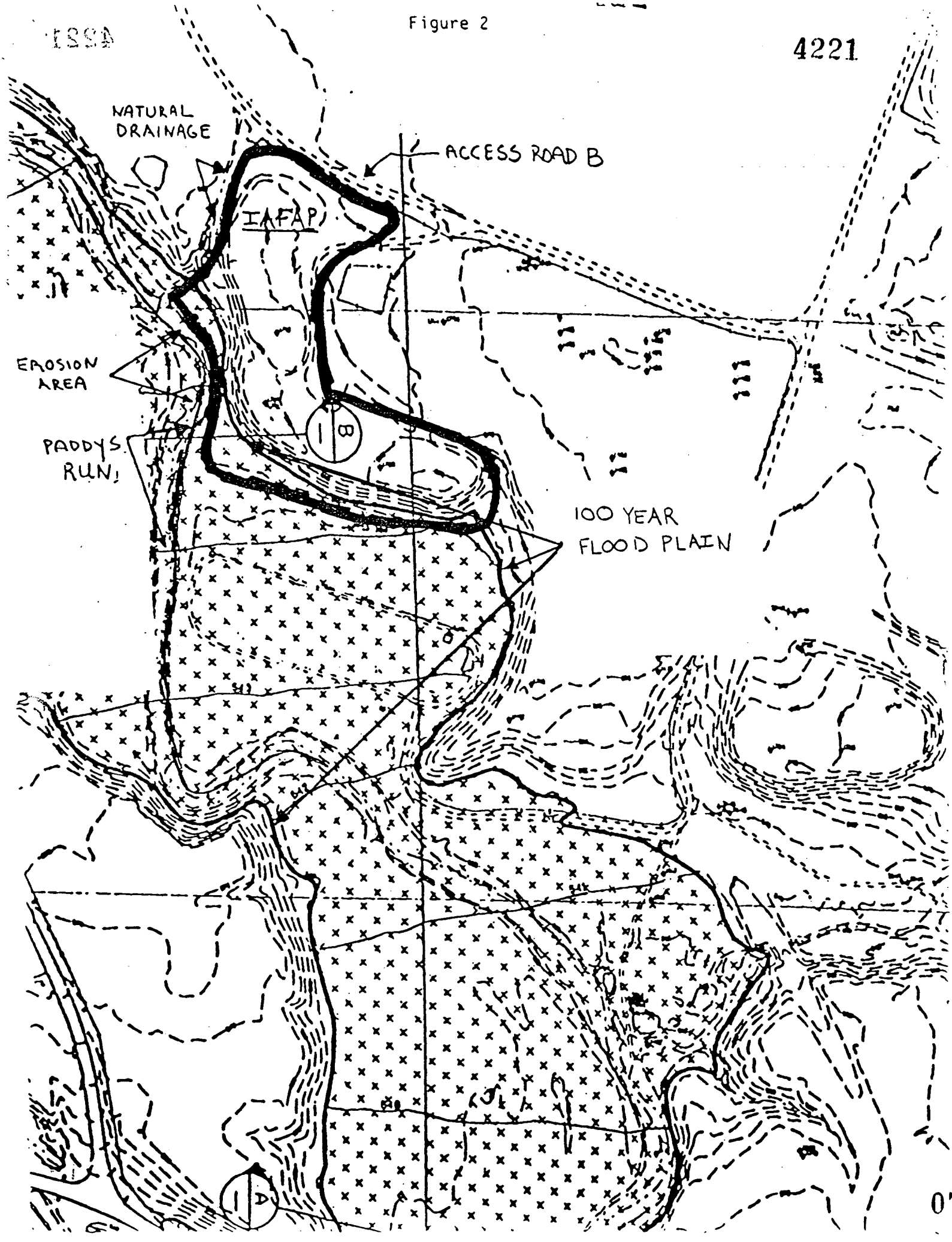

NATURAL DRAINAGE
ACCESS ROAD B
IAFAP
EROSION AREA
PADDYS RUN
B
100 YEAR FLOOD PLAIN
D

Figure 3

Cross Section - Paddys Run/Inactive Flyash Pile

(Not To Scale)

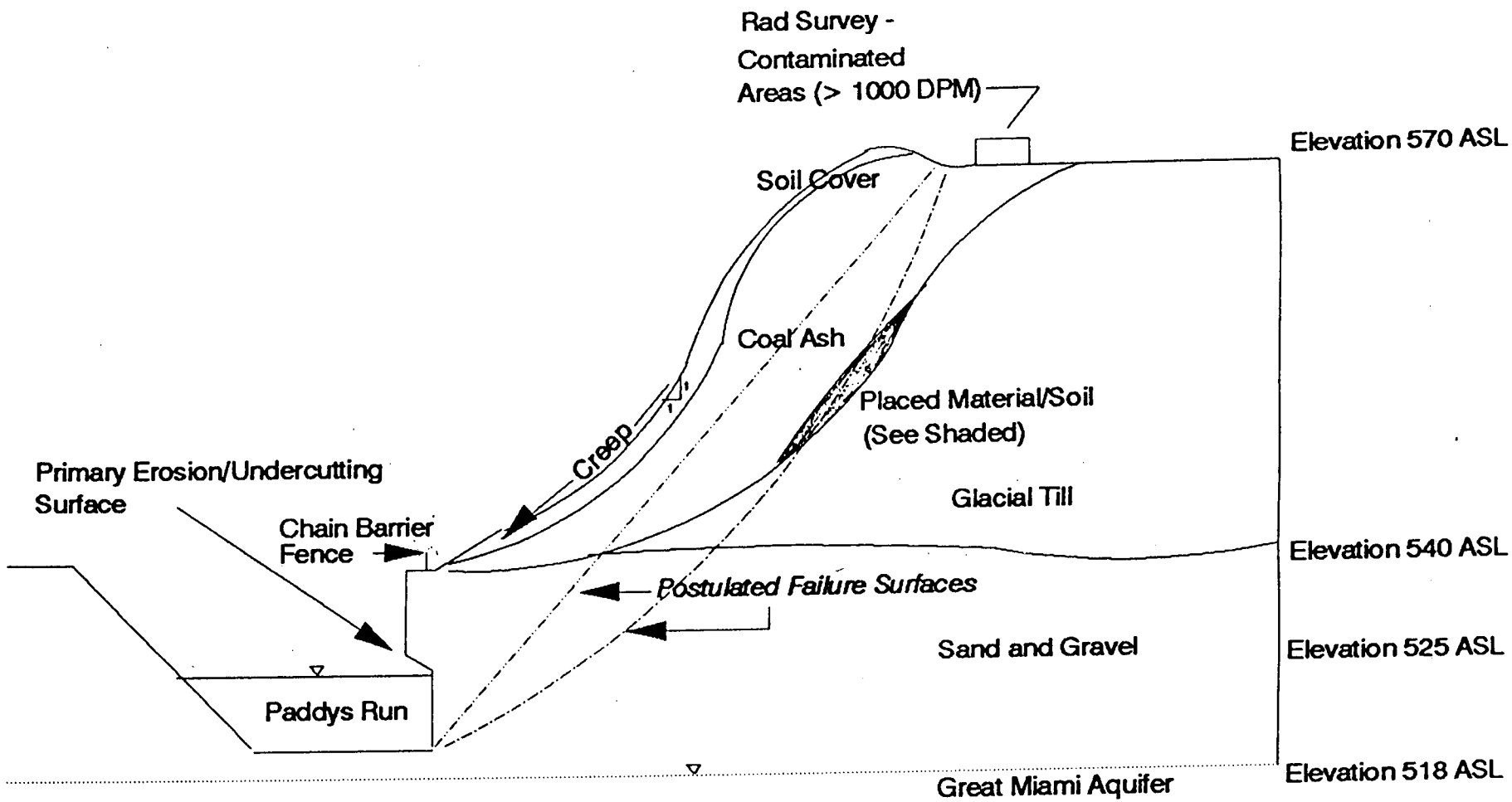
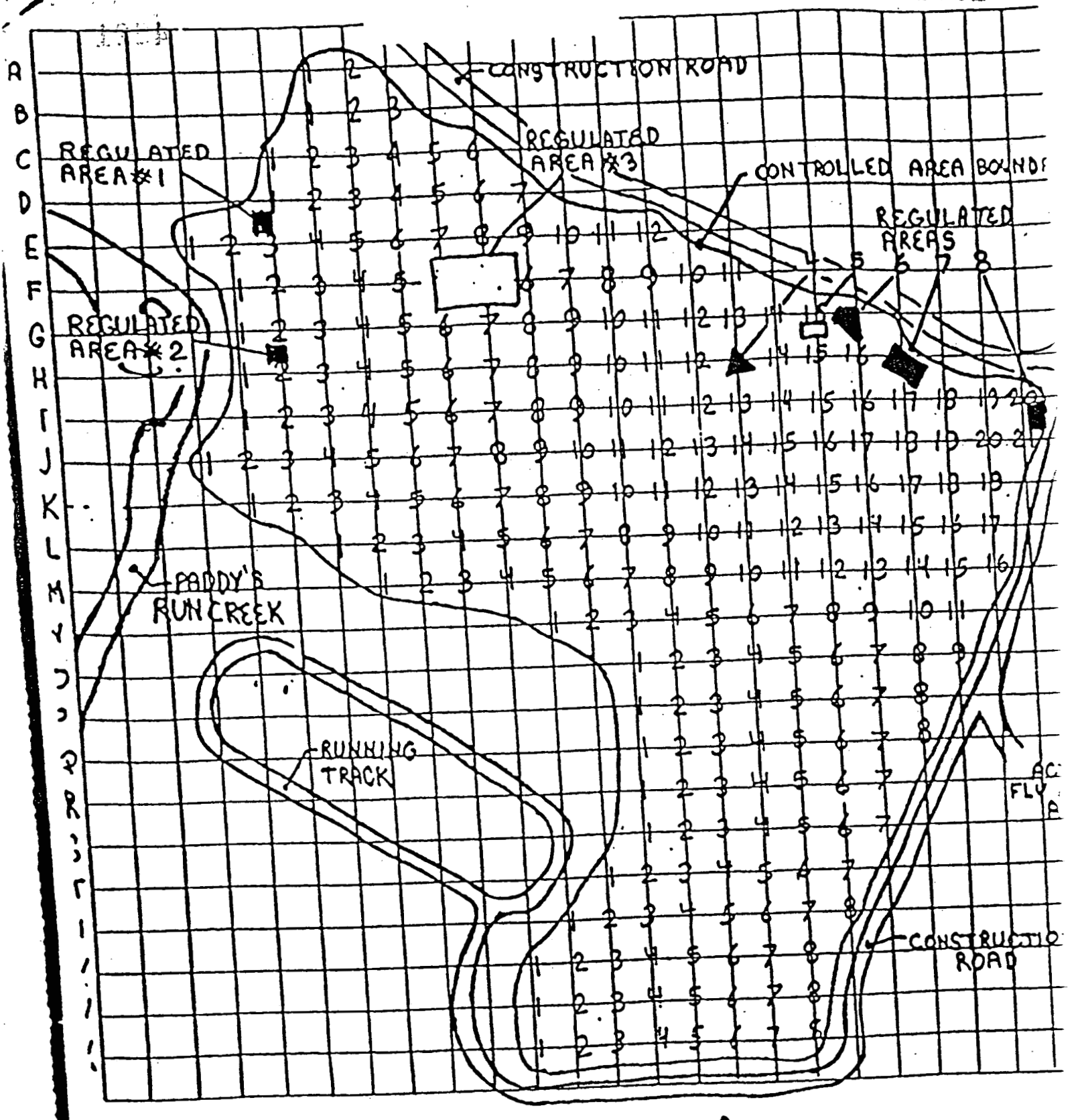
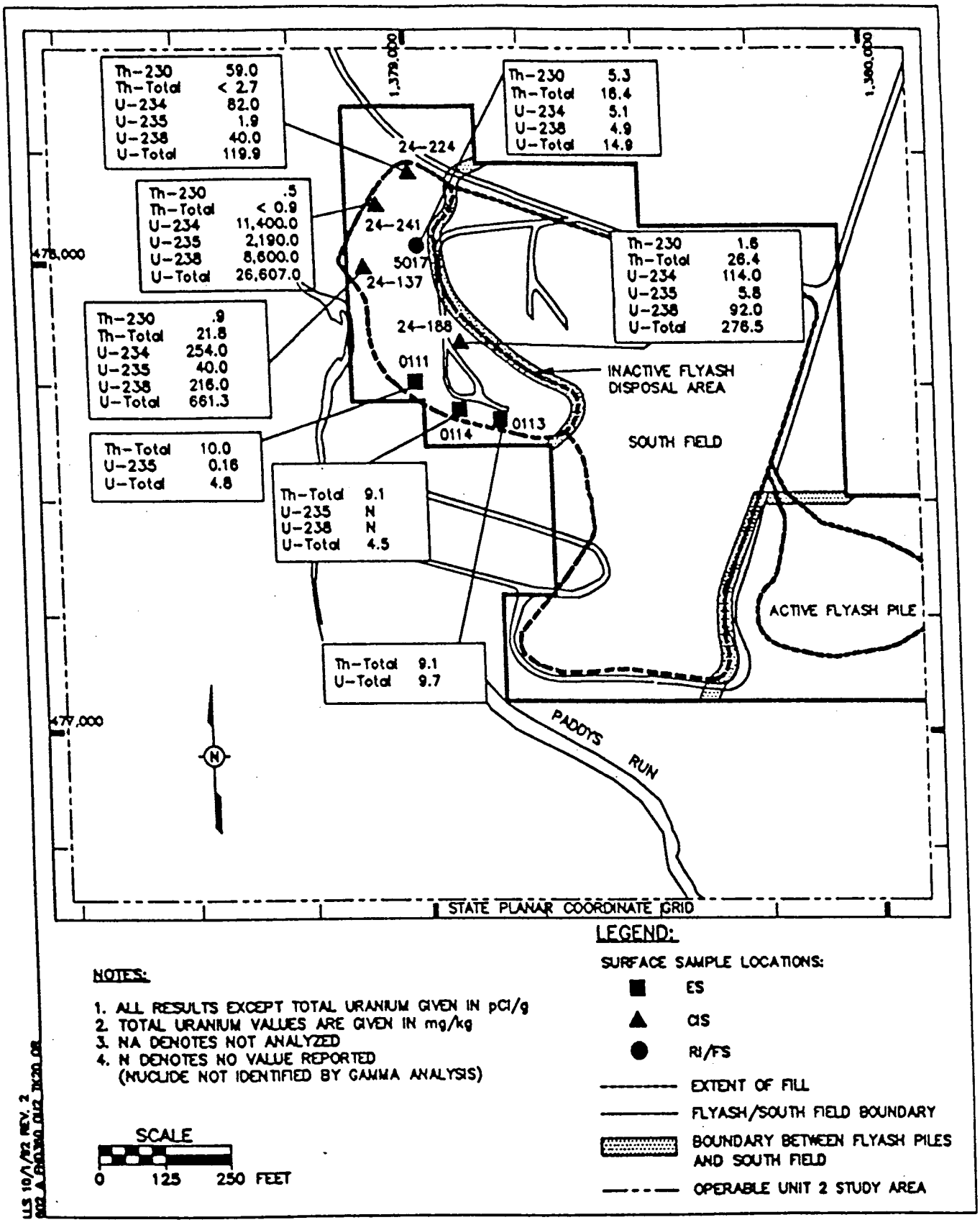


FIGURE 4

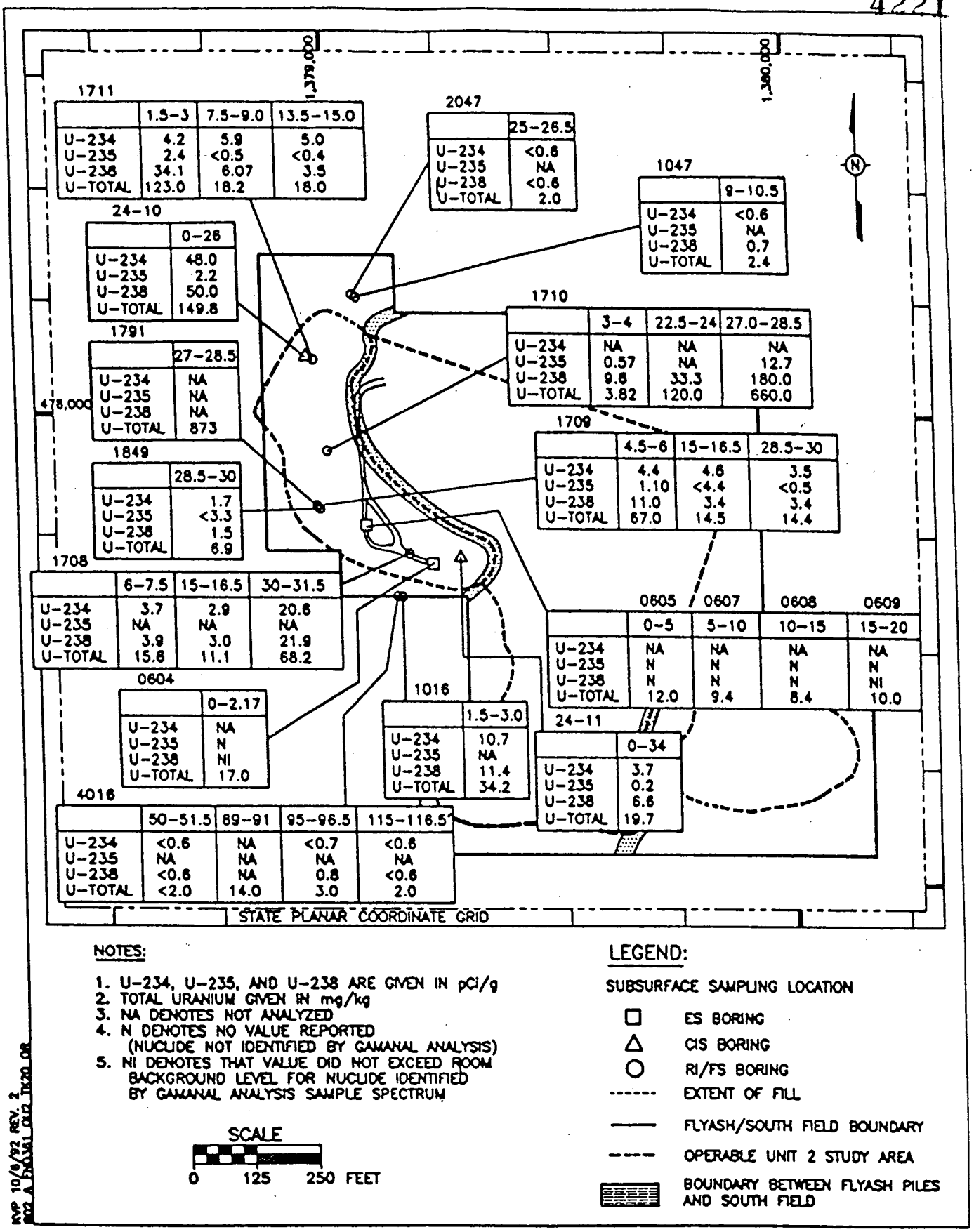


□ - PREVIOUSLY ESTABLISHED REGULATED AREAS

■ - NEWLY ESTABLISHED REGULATED AREAS



URANIUM AND THORIUM CONCENTRATIONS IN SURFACE MEDIA IN THE INACTIVE FLYASH PILE



URANIUM CONCENTRATIONS IN SUBSURFACE MEDIA SAMPLES IN THE INACTIVE FLYASH PILE STUDY AREA

TABLE I

RI/FS RADIOLOGICAL ANALYTICAL RESULTS FOR ASH SAMPLES OBTAINED FROM INACTIVE FLYASH PILE

Element	Concentration Range (ppm)	Average (1) Concentration (ppm)	Typical Element Concentrations for Flyash Samples from Bituminous Coal (ppm) (2)
Total Uranium	11.1 - 38.2	19.5	9.0 - 30.1
Total Thorium	16.3 - 28.0	22.4	20 - 50

Radionuclide	Concentration Range (pci/g)	Average (1) Concentration (pci/g)	Reference Data Provided By EPRI for Eastern Bituminous Flyash (pci/g) (3)
U_{238}	3.0 - 9.6	5.2	1.7 - 6.7
Th_{230}	2.7 - 6.9	4.1	---
Th_{232}	1.8 - 3.1	2.5	1.4 - 3.7
Ra_{226}	2.3 - 4.1	3.0	1.4 - 5.3
Ra_{228}	2.2 - 3.1	2.6	---

(1) Results obtained using radiochemical procedures and analytical methods developed by IT Laboratory.

(2) Oak Ridge National Laboratory and Virginia Polytechnic Institute studies of element concentrations for flyash samples from the Kentucky coal region (ORNL, David Klein, 1975; VPI, Furr, Parkinson et. al)

(3) EPRI: Electric Power Research Institute, from Radian Corporation "A Radio-Chemical Survey of U. S. Coals and Coal Combustion By-Products", September, 1982.

TABLE II

RI/FS INORGANIC ANALYTICAL RESULTS FOR ASH SAMPLES OBTAINED FROM INACTIVE FLYASH PILE

Element	Concentration (1) Range (ppm)	Typical Element(2) Concentrations for Flyash Samples from Bituminous Coal (ppm)
Arsenic	7.1 - 74.8	79 - 110
Barium	252 - 892	465 - 769
Cadmium	<0.49 - 1.3	0.2 - 8.0
Chromium	5.1 - 19.6	162 - 300
Lead	6.7 - 67.1	19 - 80
Mercury	<0.12 - 0.18	0.05 - 0.1
Selenium	0.74 - 4.1	16 - 25

(1) Results obtained based on solid waste test methods outlined in U.S. EPA CLP "Statement of Work," March 1990. The results are total concentrations and do not include TCLP extraction results.

(2) Oak Ridge National Laboratory and Virginia Polytechnic Institute studies of element concentrations for flyash samples from the Kentucky coal region (ORNL, David Klein, 1975; VPI, Furr, Parkinson et. al)