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INTEGRATED ENVIRONMENTAL MONITORING PLAN

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

AUGUST 1997

U.S. DEPARTMENT OF ENERGY
FERNALD AREA OFFICE

2505-WP-0002
REV. 0
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LIST OF ACRONYMS

ALARA	as low as reasonably achievable
ALS	Analytical Laboratory Services
AMS	air monitoring station
ARAR	applicable or relevant and appropriate requirement
ASL	analytical support level
AWWT	advanced wastewater treatment facility
BTVs	benchmark toxicity values
CAWQC	chronic ambient water quality criteria
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
CPC	constituent of potential concern
CPRD	continuous passive radon detector
CRARE	comprehensive response action risk evaluation
CT	central tendency
D&D	decontamination and dismantlement
DFOs	Director's Findings and Orders
DMEPP	Design, Monitoring, and Evaluation Program Plan
DOE	U.S. Department of Energy
DQO	Data Quality Objective
EDMP	Environmental Data Management Plan
EMP	Fernald Site Environmental Monitoring Plan
EPA	U.S. Environmental Protection Agency
FDF	Fluor Daniel Fernald
FEMP	Fernald Environmental Management Project
FERMCO	Fernald Environmental Restoration Management Corporation
FFA	Federal Facility Agreement
FFCA	Federal Facilities Compliance Agreement
FRL	final remediation level
FRVP	Fernald Residues Vitrification Plant
FS	feasibility study
FY	fiscal year
GMA	Great Miami Aquifer
GMR	Great Miami River
gpm	gallons per minute
GPMPP	Groundwater Protection Management Program Plan
HI	hazard index
HQ	hazard quotient
ID	identification
IEMP	Integrated Environmental Monitoring Plan
ILCR	incremental lifetime cancer risk

LIST OF ACRONYMS
(Continued)

IRDP	integrated remedial design package
IROD	Record of Decision for Interim Actions
LDR	land disposal restriction
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
MEI	Maximally Exposed Individual
MTR	minimum technology requirements
NAAQS	National Ambient Air Quality Standard
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NESHAP	National Emissions Standards Hazardous Air Pollutant
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRC	U.S. Nuclear Regulatory Commission
NRIMP	National Resource Impact Monitoring Plan
NTS	Nevada Test Site
O&M	operations and maintenance
OAC	Ohio Administrative Code
OEPA	Ohio Environmental Protection Agency
ORC	Ohio Revised Code
OSDF	on-site disposal facility
OSHA	Occupational Safety and Health Act
OU	operable unit
PAH	polynuclear aromatic hydrocarbons
ppb	parts per billion
ppm	parts per million
PPE	personal protection equipment
PRRS	Paddys Run Road Site
PSP	project-specific plan
QA	quality assurance
QC	quality control
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RD	remedial design
RD/RA	remedial design/remedial action
RfD	reference dose
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RME	reasonable maximum exposure
ROD	record of decision
RWP	Radiation Work Permit

LIST OF ACRONYMS
(Continued)

SARA	Superfund Amendment and Reauthorization Act
SCQ	Site-Wide CERCLA Quality Assurance Project Plan
SER	Site-Wide Environmental Report
SSOD	storm sewer outfall ditch
SWPPP	Storm Water Pollution Prevention Program
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TLD	thermoluminescent dosimeter
TSP	total suspended particulates
TSS	total suspended solids
UMTRCA	Uranium Mill Tailing Radiation Control Act
V/FCN	Variance/Field Change Notice
VOC	volatile organic compound
WAC	Waste Acceptance Criteria

1.0 INTRODUCTION

1.1 BACKGROUND

The Department of Energy's (DOE's) Fernald Environmental Management Project (FEMP) has completed its sitewide Remedial Investigation/Feasibility Study (RI/FS) obligations, and final Records of Decision for all five of the FEMP's operable units are now in place. With the conclusion of the FEMP's RI/FS and remedy selection process, focus is now being directed to the safe and efficient implementation of site remediation activities and facility decontamination and demolition (D&D) operations. In recognition of this shift in emphasis toward remedy implementation, the FEMP's site Environmental Monitoring Plan (EMP) is being revised and tailored accordingly to accommodate the sitewide remediation monitoring needs brought into play by the FEMP's final remedy decision documents.

This plan presents the revisions to the FEMP's existing sitewide monitoring program that are tailored to the remediation activities planned for the FEMP. The revised plan has been designated as the Integrated Environmental Monitoring Plan (IEMP) and is the successor to the Fernald site EMP. The EMP historically has provided comprehensive on-property and off-property environmental surveillance capabilities that specifically addressed the monitoring and reporting needs associated with active uranium production at the facility. The IEMP will provide a remediation-specific focus by redirecting existing environmental monitoring program elements toward sitewide remediation activities and by incorporating any new regulatory requirements for sitewide monitoring, reporting, and remedy performance tracking that have been activated by the formal Applicable or Relevant and Appropriate Requirements (ARARs) that are part of the FEMP's remedy selection documents. Ultimately, the IEMP also will serve as the reporting link for the project-specific emission control monitoring activities that will accompany the individual remediation and D&D projects as needed over the life of the FEMP remediation program.

A key element in directing the focus of the IEMP is the depth of understanding of site environmental conditions that have been gained from nearly 10 years of detailed site characterization efforts at the site. These detailed environmental evaluations recently culminated in a final remedy decision for the FEMP's environmental media, with the issuance of the final Operable Unit 5 Record of Decision in February 1996. Operable Unit 5 represents all of the FEMP's environmental media, contaminant

transport pathways, and environmental receptors (soil, groundwater, surface water, sediment, air, and biota) that have been affected by past uranium production operations at the site. The selected remedy for Operable Unit 5 designates the FEMP's final sitewide cleanup levels and establishes the areal extent of on-property and off-property actions necessary to provide permanent solutions to environmental concerns posed by the site. As a result of the cleanup decisions reached for Operable Unit 5 and the site characterization activities conducted over the past 10 years, the FEMP now has a much more clearly defined picture of the scope and intensity of the sitewide environmental monitoring activities that are necessary to accommodate remediation activities planned for the site.

The IEMP is a formal remedial design deliverable required to fulfill Task 9 of the Operable Unit 5 Remedial Design Work Plan (DOE 1996c). Following approval, the IEMP will replace the June 1995 (current) version of the EMP as the FEMP's sitewide monitoring plan.

1.2 PROGRAM OBJECTIVES AND SCOPE

As the various remediation projects move beyond the engineering design phase and are implemented or operated concurrently, the need for accurate, accessible, and manageable environmental monitoring information will increase substantially. The IEMP has been formulated to meet this need and will serve several comprehensive functions for the site over the life of the FEMP's accelerated remediation program:

- Maintain the FEMP's continued commitment to an effective remediation-focused environmental surveillance monitoring program that is consistent with DOE Orders 5400.1 and 5400.5 (both orders are listed as "to be considered" [TBC] criteria in the FEMP's Records of Decision, and therefore remain in effect as key drivers for the scope of the monitoring program).

- Fulfill any additional sitewide monitoring and reporting requirements that are activated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) ARARs for the FEMP's signed Records of Decision.

- Provide the mechanism for assessing the performance of the Great Miami Aquifer groundwater remedy, including the determination of when restoration activities are complete.

- Provide a consolidated reporting mechanism for the FEMP's individual environmental regulatory compliance monitoring activities (e.g., Resource Conservation and Recovery Act [RCRA] property boundary and on-site disposal facility groundwater monitoring; Federal Facilities Consent Agreement [FFCA] and National Pollutant Discharge

Elimination System [NPDES] discharge reporting; and the total dose and air-pathway-specific dose estimates required under National Emissions Standards for Hazardous Air Pollutants [NESHAP] Subparts H and Q) with the environmental reporting for DOE Order 5400.1.

- Provide a reporting interface for the various project-specific emissions control monitoring activities that, because of ARAR requirements, will be implemented at the locations of the projects under approved project-specific remedial design plans.

In concept, the IEMP is responsible for maintaining a baseline data set of environmental conditions at the FEMP and for documenting that contaminant releases attributable to the implementation of the FEMP's sitewide remedial actions remain within established thresholds. To fulfill its documentation responsibility, the IEMP brings together the ingredients necessary to provide an independent appraisal of the collective effectiveness of the administrative and engineering emission controls accompanying the individual remediation projects.

Figure 1-1 summarizes the overall scope of the IEMP and the major program elements assembled under its umbrella. As stated previously and as shown in Figure 1-1, the FEMP's current EMP program (that has historically provided sitewide monitoring under DOE Orders 5400.1 and 5400.5) was used as the primary conceptual model for development of the IEMP. Figure 1-1 also shows a planned interface with project-specific monitoring that will occur throughout the life of FEMP remediation.

It is important to recognize that several remediation-based environmental activities fall outside the scope of the IEMP. These activities are:

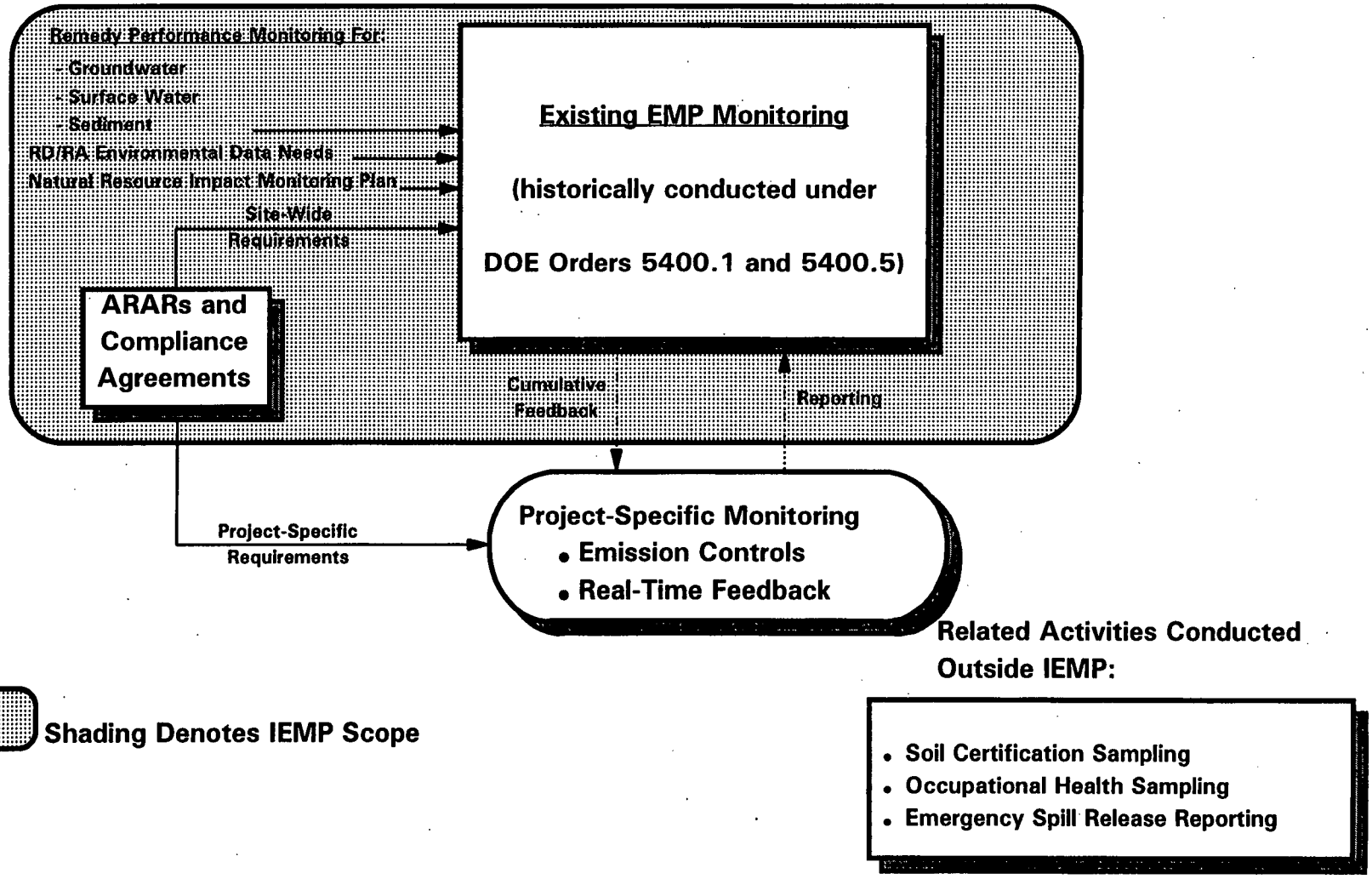
- Certain project-specific emission-control monitoring activities which, because of ARAR requirements, are being implemented under project-specific design plans outside of the IEMP. These key projects and accompanying remedial design plans are identified in subsequent sections of this document, along with their reporting interface(s) with the IEMP.

- The soil remediation precertification and certification sampling program which will be conducted as part of the work scope of the Soil Characterization and Excavation Project

- The ambient air sampling and direct radiation measurements conducted for worker health and safety purposes as part of the FEMP's occupational monitoring program

- The FEMP's spill and chemical release reporting required under SARA Title III.

Figure 1-1
Development of IEMP Scope



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Each of these efforts will continue to be conducted outside the formal scope of the IEMP, although the results of the efforts will be factored into the sitewide interpretations provided by the IEMP.

1.3 RELATIONSHIP TO PROJECT-SPECIFIC REMEDIAL PROGRAMS

As shown in Figure 1-1, the IEMP will provide a summary reporting link (to assist with sitewide interpretations) and a cumulative feedback function for the project-specific monitoring that is to be conducted by the individual remediation projects. Each remediation project will continue to be responsible for the design and execution of its own monitoring activities (under their own remedial action work plans outside of the IEMP) to demonstrate compliance with its respective project-specific emission-control ARARs and to obtain the necessary immediate feedback required to track the effectiveness of these controls.

To define the boundaries of the IEMP and the interface with the individual remediation projects, an evaluation of the ARARs that are contained in each of the FEMP's Records of Decision was conducted to identify the subset of ARARs that possess specific monitoring requirements. As part of the ARARs analysis, an evaluation was made to determine whether the monitoring requirements had sitewide implications (and therefore fall under the purview of the IEMP) or whether they pertained to project-specific monitoring as part of the project emission controls to be implemented by the individual remediation projects. The results of these evaluations are presented in detail for each of the individual environmental media in Sections 3.0 through 7.0.

Boundary designations are as follows:

- Administrative Boundary - Refers to the administrative boundary established between the DOE remedial actions for groundwater south of the FEMP and those potential remedial actions associated with the Paddys Run Road Site. This boundary was introduced in the Operable Unit 5 FS and Proposed Plan.

- Programmatic Boundary - Refers to the delineation of the scope and responsibility associated with the design, implementation and documentation of monitoring activities. Monitoring activities are designated as project-specific (associated with emission controls at the project) or IEMP (associated with monitoring the collective impact on a particular environmental media resulting from all remediation activities). The designation is based on an evaluation of the pertinent regulatory drivers and DOE policies which have monitoring implications.

- Sitewide monitoring - Refers to monitoring of the collective environmental impacts resulting from all remediation activities. In the Draft Final IEMP, this term is used to refer to IEMP monitoring programs.

- Geographic Boundary - Refers to the physical boundary of a project or activity.

1.4 PLAN ORGANIZATION

The IEMP is comprised of seven sections and four appendices. The remaining sections and their contents are as follows:

Section 2.0	Summary of the FEMP Remedial Strategy: provides a description of the individual remediation projects for each of the FEMP's five operable units, a status summary of the project-specific monitoring that is planned for each project, and a two-year (fiscal years 1997 and 1998) forecast of the remediation activities planned for each major project.
Section 3.0	Groundwater Monitoring Program: provides a description of the monitoring activities necessary to track the progress of the restoration of the Great Miami Aquifer and ultimately to determine when restoration activities are complete. Also discusses the groundwater monitoring activities necessary to maintain compliance with RCRA requirements at the FEMP property boundary; and the groundwater monitoring program for the on-site disposal facility.
Section 4.0	Surface Water Monitoring Program: provides a description of the routine sitewide surface water monitoring to be performed during active remediation of the FEMP and to maintain compliance with treated-effluent surface water discharge requirements.
Section 5.0	Sediment Monitoring Program: provides a description of the routine sitewide sediment monitoring activities to independently verify the overall effectiveness of the sediment controls accompanying the FEMP's remedial construction and excavation activities.
Section 6.0	Air Monitoring Program: provides a description of the sitewide air monitoring to be conducted during active remediation of the FEMP. Includes a description of the plan for particulate, radon, and direct radiation measurements and the continuation of the FEMP's Meteorological Monitoring Program.
Section 7.0	Biota Monitoring Program: identifies the scope of monitoring activities that will be maintained during remediation to verify the continued protection of local produce grown in proximity to the FEMP.
Section 8.0	Program Summary and Reporting: summarizes the program design, scope of each media monitoring program, and provides a phased plan to consolidate the FEMP's individual compliance reporting activities into a single reporting strategy.

Appendix A	Detailed Explanation of Parameter Selection for the Groundwater Monitoring Program.
Appendix B	Surface Water FRL and BTV Exceedances
Appendix C	Dose Assessment: summarizes the IEMP's responsibility for preparing the FEMP's annual dose assessment related to remediation activities to comply with NESHAP Subparts H and Q requirements and the intention of DOE Order 5400.5.
Appendix D	Natural Resource Impact Monitoring Plan (NRIMP): provides the regulatory requirements and strategy for the monitoring of ecological impacts to wetlands, threatened and endangered species, and terrestrial and aquatic habitats. The NRIMP also will outline additional provisions for reporting these monitoring results to FEMP Natural Resource Trustees. Additionally, the NRIMP will identify the relationship of this monitoring effort with other relevant documents, such as the Natural Resource Impact Assessment and the Sloan's Crayfish Management Plan.

As this format indicates, the IEMP is organized according to the principal environmental media and contaminant migration pathways to be examined routinely under the program. For each of the media comprising the program, evaluations of the regulatory drivers and pertinent DOE policies that govern environmental monitoring for that media were conducted. Findings were made regarding those drivers that have sitewide implications and those that are project-specific in scope (and, therefore, fall outside the domain of the IEMP). This evaluation was used to define, for each media, the ARAR-driven administrative boundaries that separate the project-specific emission control monitoring activities from those sitewide environmental monitoring activities that are the responsibility of the IEMP. The results of these responsibility- and boundary-definition evaluations are presented in detail for each respective media in Sections 3.0 through 7.0.

Following the review of the regulatory drivers, the scope of the monitoring activities conducted under the existing environmental monitoring program were evaluated against the remediation work scope contemplated under the FEMP's sitewide accelerated remediation schedule. Any reductions or alterations in existing scope that were deemed appropriate were made, based on the knowledge of environmental conditions gained through the RI/FS process, the many years of sitewide monitoring conducted under the EMP during and after full-scale uranium production operations, and the expectations of stakeholders for continued surveillance monitoring. The existing scope of the environmental monitoring program also was evaluated to determine whether any existing effluent

monitoring elements are project specific in intent and are, therefore, best accommodated by the individual remediation projects. The results of these evaluations, coupled with the evaluation of the regulatory drivers and pertinent DOE policies, were used to define the initial scope of the IEMP for each of the individual media. Finally, a media-specific plan was prepared for each media to define detailed program implementation requirements. The details and results of this process are presented individually for each media in the media-specific sections of the plan (Sections 3.0 through 7.0).

1.5 ROLE OF THE IEMP IN REMEDIAL ACTION DECISION MAKING

As indicated in Section 1.2, one of the primary responsibilities of the IEMP is to document that the FEMP's cumulative environmental emissions resulting from the implementation of multiple, concurrent, remedial-action projects at the site do not exceed the FEMP's regulatory-based limits or result in unacceptable off-site conditions. Fundamental to this role is the recognition that each individual remedial action project at the FEMP is expected to be implemented and operated in full compliance with its project-specific emission control requirements for the respective environmental pathways of concern. It is, thus, the responsibility of the individual remedial design documents (required by the CERCLA Remedial Design Work Plans for each of the FEMP's five operable units) to convey the project-specific measures for satisfying the worker health and safety, process-control, and environmental-protection requirements accompanying each remedial action project. Under this fundamental expectation, the IEMP can then serve to provide independent "oversight" assurance that there are no undesirable compounding environmental effects resulting from the concurrent implementation and operation of otherwise fully compliant individual projects.

In light of this oversight responsibility, the data generated through the IEMP are expected to support a number of management decisions regarding the progressive implementation strategy, sequence, and overall management control of the FEMP's individual remedial action projects. This subsection highlights 1) the key management decisions that will be supported by the IEMP; 2) the organizational responsibilities for making the decisions; 3) the framework and criteria needed to facilitate the decisions; and 4) the communication process for conveying the results of the decisions internally to the respective project organizations, and externally to the FEMP's primary stakeholders. Each of the individual environmental media sections of this plan (Sections 3.0 through 7.0) will provide detailed discussions of the specific IEMP data-use and decision-making criteria that are relevant to that particular media.

1.5.1 What are the Management Decisions that the IEMP Will Support?

In its role as the compiler of information necessary to assess cumulative "multiple-project" sitewide impacts, the IEMP will be expected to support the following key management decisions:

- From a sitewide perspective, is the FEMP maintaining compliance with its various regulatory requirements for emission control and environmental monitoring?
- Are there any trends in the sitewide environmental monitoring data that indicate the potential for an unacceptable future condition?
- In the event of a regulatory non-compliance situation or potentially unacceptable cumulative trend, what activities or projects are the principal contributors to the situation?
- What specific response actions must be taken to address the situation, and which projects are affected?
- What communications are necessary with regulatory agencies or other concerned stakeholders as a result of the situation and/or decisions made?

The response action decisions necessary to address potentially undesirable cumulative effects could involve:

- Upgrading project-specific emissions controls (beyond those that are regulatory based) for one or more projects to reduce cumulative emissions further
- Slowing the pace of activities within one or more remedial projects for a specified period of time
- Altering the number or variety of active projects underway at a particular time
- Continued monitoring of cumulative data trends.

As discussed in the next subsection, FEMP decision-makers will be conducting ongoing evaluations of the data generated by both the projects and the IEMP to ensure satisfactory operating conditions are maintained during remedy implementation.

1.5.2 Who is Responsible for Making the Decisions?

It is anticipated that the FEMP's sitewide environmental data will be used routinely by FEMP management personnel to closely monitor the acceptability of the mix of remedial projects underway at any particular time. Thus, the bulk of the day-to-day planning and routine operating decisions will be

internal to the FEMP, with process adjustments implemented as necessary on a situation-specific, as-needed basis.

It is anticipated that in the vast majority of cases, the data evaluation will conclude that all regulatory requirements are being met and that no unacceptable cumulative trends in the monitoring data are present. The FEMP's evaluation and conclusions will be documented for regulatory agency concurrence through the normal reporting mechanisms described in this plan.

The FEMP will notify EPA and OEPA immediately (prior to taking an action internally) for three important, albeit unlikely, situations:

- The FEMP's evaluation indicates that a regulatory schedule milestone is in jeopardy of attainment because of the mitigative actions necessary to address an adverse cumulative situation
- For the air pathway, the FEMP's data evaluation indicates that an actual *current* condition has resulted in an exceedance of a NESHAP regulatory compliance limit (as opposed to an undesirable data trend indicating the potential for an unacceptable hypothetical *future* condition)
- For the air pathway, a projected exceedance of a NESHAP regulatory compliance level is believed to be imminent.

For these three special cases, the FEMP will: 1) identify the root cause of the unacceptable situation; 2) determine the options for addressing the problem; and 3) meet with EPA and OEPA to arrive at a mutually acceptable decision concerning the follow-up actions to be taken. For all remaining situations (i.e., those involving the FEMP's responses to undesirable data trends for any of the environmental media), the FEMP will identify and implement appropriate actions internally and will document the decisions and resultant response actions quarterly (via the IEMP quarterly reports) and again in the IEMP annual report (see Section 1.5.4).

From an organizational perspective, the cumulative data evaluation and resultant response action decisions will be facilitated by a FEMP oversight organization that operates independently from the remedial projects. Specifically, Fluor Daniel Fernald's (FDF) Oversight and Program Integration (OPI) Division will be responsible for evaluating independently the project-specific and sitewide environmental data to determine the need for follow-up response actions or project-level process

adjustments consistent with the media-specific criteria established in this document. In addition, if the potential for an unacceptable future situation is identified, the OPI Division will facilitate the process of identifying alternatives for addressing the problem. (Along with its responsibility for tracking and resolving IEMP response-action decisions, one of the key roles of this organization is to independently assess the regulatory compliance status of the FEMP as a whole.) The OPI Division will work closely with DOE to finalize the decisions, assess their implications, and communicate the results of the evaluations as necessary to the FEMP's stakeholders and regulatory agencies.

1.5.3 What are the General Criteria for the Decisions?

The IEMP establishes, on a media-specific basis, the types of data and threshold response-action criteria required to support the management decisions described above (see Sections 3.0 through 7.0 for the media-specific details.) Each set of media-specific criteria are handled uniquely because of the varying media-specific locations where the regulatory criteria are applied. For example, the FEMP's most-restrictive air-monitoring criterion (the 10 millirem [mrem] NESHAP requirements discussed in Section 6.0) is applied at locations beyond the site's fence line, where actual receptors are located; other media-specific criteria, such as the FEMP's sediment-control performance criteria, apply at the geographic boundaries of the individual projects, themselves.

The media-specific sections of this plan review which monitoring requirements are to be met at the project boundaries (and thus fall under the domain of the individual projects) and which requirements fall outside the project boundaries and, because of their cumulative nature, fall under the domain of the IEMP. This responsibility distinction is facilitated by an in-depth ARAR review for each environmental medium to identify applicable compliance locations and the resultant responsibilities for meeting them. Additionally, the media-specific sections define the criteria to be used to identify trends in the data that could indicate an imminent, unacceptable situation. Each of the media-specific sections specify the frequency of the data evaluations to satisfy the FEMP's overall remedial planning and decision-making requirements.

DOE and the FDF OPI Division will evaluate the FEMP's remediation data accordingly, and will report the results according to the approach summarized below.

1.5.4 How Will IEMP Decisions Be Communicated?

Each media section of this IEMP (Sections 3.0 through 7.0) present media-specific reporting components and Section 8.0 summarizes the reporting strategy for the IEMP. Both quarterly and annual reports will be issued as part of the IEMP program. The reports will provide a reporting mechanism for both IEMP data and the project-specific environmental data that is gathered to meet project-specific regulatory compliance requirements pertinent to sitewide interpretation.

As indicated above, the majority of the management decisions made from IEMP data evaluations will be executed internally by the FEMP, as part of the FEMP's internal remedial planning and operations control practices. These internal decisions fall into two categories:

- Routine "process-adjustment" decisions, which will be made by the FEMP's lead project organizations to react and respond to project-specific operating conditions and process-control objectives
- Major "project-control" decisions, which are the responsibility of the FEMP's OPI Division (in collaboration with the affected project organizations) to respond to a pending adverse cumulative situation that, for one reason or another, is developing

The routine "process-adjustment" decisions will not be reported as part of the IEMP quarterly or annual reporting cycles. These types of routine decisions will be maintained as part of the project organizations' daily operations logs and are considered to be a normal course of day-to-day practice to achieve project-specific operating objectives. The major "project-control" decisions that are the ultimate responsibility of the OPI Division will be summarized in the IEMP quarterly reports and tallied for the record in the annual reports. The decision reporting format will include a description of the pending adverse conditions; the actions taken to respond to the situation; and the mitigative results obtained. All such internal decisions will be made consistent with the FEMP's enforceable work plans and ARAR compliance requirements.

Three special circumstances were identified in Section 1.5.2 that require agency input before response actions are taken by FEMP management. For these three circumstances, EPA and OEPA concurrence will be sought before the actions are taken. Once a mutually agreeable decision is reached, the actions will be implemented. The decision process, actions taken, and results obtained will be summarized in the next available quarterly report and tallied in the annual report.

The quarterly and annual reports will be furnished to EPA and OEPA in accordance with the provisions summarized in Section 8.0. The reports also will be available for inspection by the FEMP's stakeholders as part of the FEMP's administrative record at the Public Environmental Information Center.

IEMP-related decisions will be communicated internally through regular project integration meetings sponsored by the OPI Division. The OPI Division will participate in the annual planning of the remedial activities envisioned for the FEMP at the beginning of each year, review the projected level of emissions accompanying the planned project mix, and assist in the review and evaluation of the IEMP data as it is accumulated for each media over the course of the year. If, in the unlikely event a decision is necessary to adjust the acceptable mix of projects underway at a particular time or curtail a planned activity to respond to a pending unacceptable cumulative situation, the OPI Division will seek concurrence from all of the affected projects prior to making the decision and, once concurrence is reached, communicate the decision to all affected parties through the OPI Division project integration meetings.

1.6 PROGRAM MODIFICATIONS AND REVISIONS

Following approval, the IEMP will remain in place throughout the duration of the FEMP's remediation activities. Accordingly, the IEMP will function as a living document with periodic revisions as necessary to accommodate the initiation of new projects and the completion of others. As part of this living document concept, the initial IEMP focuses primarily on the remedial activities forecasted for the forthcoming two years; assuming a July 1, 1997 start date, this two-year period will begin in July 1997. However, in order to establish a calendar-year-based review (every year) and revision (every two years) cycle, this first IEMP will be reviewed in July 1998 and revised prior to the start of 1999. Yearly reviews will focus on appropriateness of IEMP scope. This two-year revision cycle will provide for any change in program emphasis or allow for the scale back of monitoring activities deemed no longer appropriate based on project needs, accumulated results, or stakeholder concerns. If necessary, immediate, specific modifications to the IEMP will be made as data are reviewed. The two-year revision cycle for the IEMP also will fulfill the formal commitment for revision of the FEMP's sitewide environmental monitoring program at least every three years as intended by DOE Order 5400.1.

2.0 SUMMARY OF FEMP REMEDIAL STRATEGY

This section presents a summary of the FEMP remedial strategy, including descriptions of the FEMP's five operable units, the newly organized remediation projects, and similar large-scale remediation activities; and a two-year (1997 and 1998) forecast of the remediation activities planned for each major project.

The discussion will span the entire accelerated remediation case but will focus on the first two-year time-frame. The information provided in this section will assist in developing a collective understanding of the remediation activities, schedule, and project responsibilities that were used as the framework for developing the integrated environmental monitoring approach.

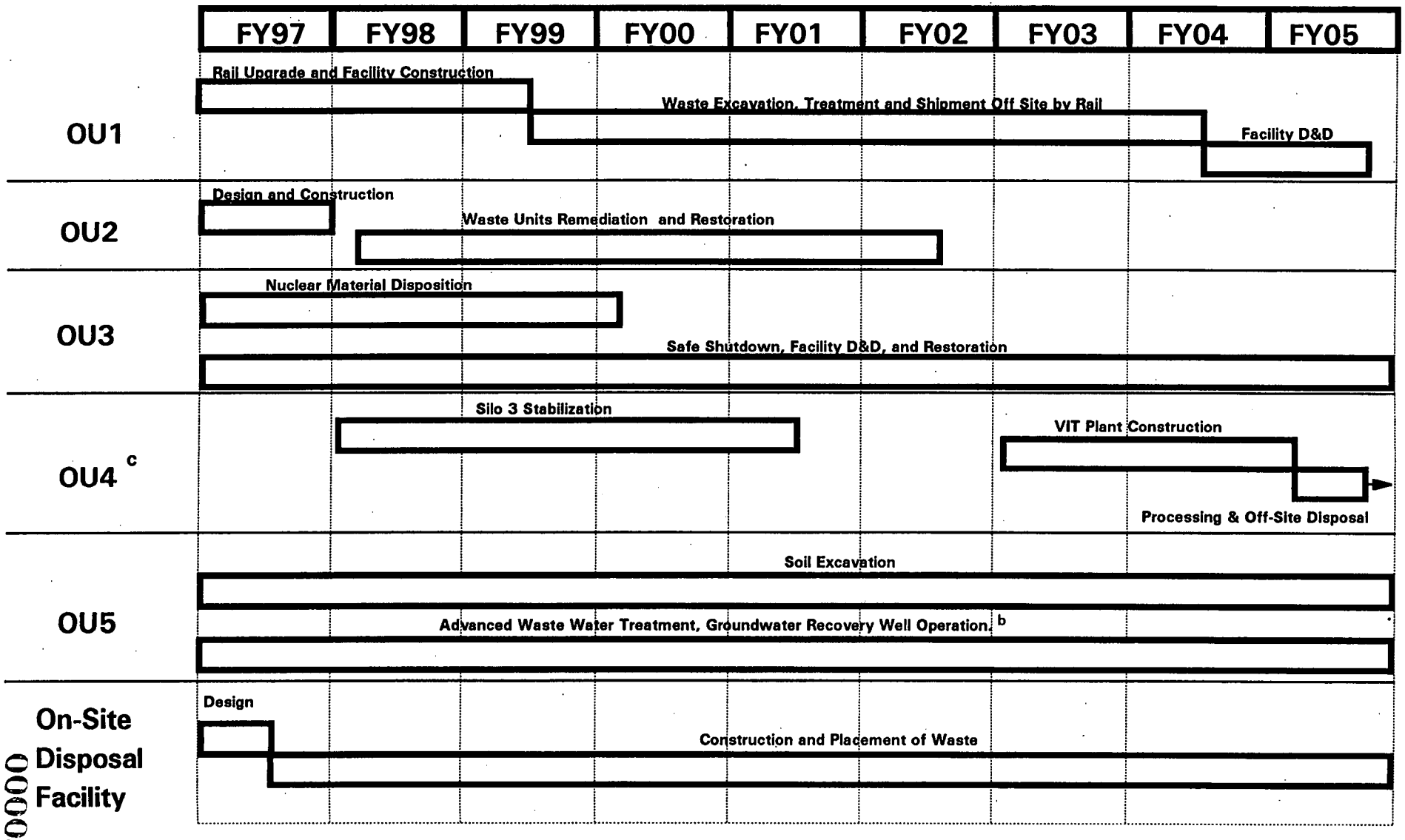
2.1 FEMP REMEDIATION STRATEGY

The FEMP remedial strategy reflects the culmination of nearly 10 years of CERCLA activities at the site, including extensive site characterization activities to determine the nature and extent of contamination, baseline risk assessments, and detailed evaluation and screening of remedial alternatives leading to a final remedy selection as documented in the record of decision for each operable unit. As a management approach to streamlining the remedial investigation/feasibility study decision-making process under CERCLA and expediting implementation of cleanup activities, the site was divided into five operable units. The definitions of the operable units were established considering factors such as geographic location, similarity in waste forms, and the availability of data on discrete waste units or areas.

As the remedy selection process is nearly complete, the FEMP has developed an integrated remediation strategy focusing on accelerated remedial design and action. At the heart of this strategy is integrated project planning which consolidates cleanup activities and schedules across the projects to accelerate remediation (referred to as the accelerated remediation case). Successful implementation of the accelerated remediation case is dependent upon the close coordination and sequencing of remediation activities, such as on-site disposal facility preparation, facilities decontamination and dismantlement and final soil and groundwater remediation, among all project organizations throughout the remedial design/remedial action process. The FEMP accelerated remediation strategy is reflected in the site master schedule, which is summarized in Figure 2-1.

Figure 2-1

FEMP Accelerated Remediation Case Master Schedule[a]



FINAL

a = Based on FY97 Replan Phase I.

b = Environmental M[illegible]ring is ongoing.

c = OU4 Soil and Facilities D & D scheduled [illegible]08

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While the operable unit management approach was successful for completing the remedial investigation/feasibility study process, it does not represent the most effective organization of site responsibility to complete remedial design/remedial action. In order to align sitewide responsibilities and regulatory obligations across the five operable units to most efficiently complete remedial design/remedial action, the site has established fully integrated project organizations. The intent of this projectized approach is to integrate activities among the operable units to ensure that the final adopted sitewide remedy is well reasoned, cost effective, and ensures long-term protection of human health and/or the environment. Realignment into project organizations reflects the actual work processes and operations to be performed during remediation, and does not alter the requirements of the FEMP's Records of Decision (ROD). Table 2-1 provides the crosswalk between each operable unit remedy and the FEMP project organizations' responsibilities for implementing each remedy. The project organizations with primary responsibilities for CERCLA remediation are as follows:

- Waste Pits Remedial Action Project: Completion of remedial actions for the excavation, drying (as required), loading, and rail transport of contents of waste pits 1-6, the burn pit, and the clearwell to an off-site disposal facility, and responsibility for the off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility.

- Soil Characterization and Excavation Project: Completion of remedial actions to address contaminated soil at the FEMP and miscellaneous waste units including the south field, flyash piles, lime sludge ponds, and the solid waste landfill; also excavation/removal of building foundations, roadways, underground utilities and piping systems, and sitewide restoration activities and management of perched water encountered during remediation.

- Facilities D&D Project: This work scope includes the completion of the D&D of the above-grade portion of the former uranium processing facilities and all remedial action facilities.

- Silos Project: Completion of remedial actions for the contents of Silos 1-3, including the removal, vitrification/stabilization, and transport of the inventoried residues for off-site disposal.

- Aquifer Restoration Project: Completion of activities necessary to restore the water quality in the affected portions of the Great Miami Aquifer including the pumping, treating, reinjecting, and discharging of extracted groundwater. This project will continue to maintain responsibility for all sitewide fate-and-transport modeling, and groundwater monitoring.

- Advanced Waste Water Treatment (AWWT) and Wastewater Project: Design, construction, and operation of all wastewater, storm water, and drinking water holding, conveyance, treatment, and discharge systems at the FEMP. (Note that each project is responsible for containing and transporting remediation wastewater to the AWWT facility for treatment.)

TABLE 2-1

FEMP OPERABLE UNIT REMEDIES AND ASSOCIATED PROJECT RESPONSIBILITIES[b]

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
OU1	• Waste pits 1 - 6 • Clearwell • Burn pit • Berms, liners, caps and soil within the OU boundary	ROD Approved: March 1995 Excavation of materials with COCs above FRLs, waste processing and treatment by thermal drying (as necessary), off-site disposal at a permitted facility, and site restoration.	Primary Project: Waste Pits Remedial Action Project responsible for rail upgrade, excavation of OU1 waste units, waste processing and drying, loading, rail transport, and off-site disposal of contaminated soil and debris that exceed the waste acceptance criteria for the on-site disposal facility. (Note: This project will be performed by the Alternative Remedial Action Subcontracting Approach subcontractor.) Related Projects: Soil Characterization and Excavation Project responsible for sampling, excavation, and disposition of contaminated soil beneath the waste pits, as well as at- and below-grade remediation facilities, including the railroad. AWWT and Wastewater Project responsible for treating contaminated runoff and perched water collected during waste pit excavation; each project is responsible for containing and transporting remediation wastewater to the AWWT facility for treatment. Facilities D&D Project responsible for D&D of all OU1 remediation facilities.
OU2	• Solid waste landfill • Inactive flyash pile • Active flyash pile (now inactive) • North and south lime sludge ponds • Other south field disposal areas • Berms, liners and soil within the OU boundary	ROD Approved: May 1995 Excavation of all materials with COCs above FRLs, treatment for size reduction and moisture control as required, onsite disposal in the OSDF, off-site disposal of a small fraction of excavated material that exceeds the WAC for the OSDF and lead-contaminated soil from the south field firing range, and site restoration.	Primary Project: Soil Characterization and Excavation Project responsible for excavation and disposition of waste from all OU2 subunits. Related Projects: On-Site Disposal Facility Design Project responsible for design, installation, and closure of the on-site disposal facility that will contain OU2 subunit wastes; OU5 soil and debris, and OU3 debris; responsible for monitoring leachate within the on-site disposal facility and perched groundwater in the till beneath the on-site disposal facility. AWWT and Wastewater Project responsible for treating contaminated runoff and perched water collected during excavation of OU2 subunit wastes; each project is responsible for containing and transporting remediation wastewater to the AWWT facility for treatment.

TABLE 2-1
(Continued)

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
OU3	Former production area and associated facilities and equipment (includes all above- and below-grade improvements) including, but not limited to: • All structures, equipment, utilities, effluent lines, K-65 transfer line • Wastewater treatment facilities • Fire training facilities • Coal pile • Scrap metals piles • Drums, tanks, solid waste, waste product, feedstocks, thorium	ROD Approved: September 1996 Adoption of OU3 IROD; alternatives to disposal through the unrestricted or restricted release of materials, as economically feasible for recycling, reuse, or disposal; treatment of material for on-site or off-site disposal; required off-site disposal for process residues, product materials, process-related metals, acid brick, concreted from specific locations, and any other material exceeding the OSDF WAC; on-site disposal for material that meets the OSDF WAC; and site restoration.	Primary Project: Facilities D&D Project responsible for D&D of all above-grade buildings and facilities at the FEMP. Related Projects: Soil Characterization and Excavation Project responsible for certification sampling of soil beneath excavated facilities and for removal of at- and below-grade structures. AWWT and Wastewater Project responsible for treating decontamination and other wastewaters during D&D activities; each project is responsible for containing and transporting remediation wastewater to the AWWT facility for treatment. On-Site Disposal Facility Design Project responsible for design, installation, and closure of the on-site disposal facility that will contain OU3 debris, OU2 subunit wastes, and OU5 soils.
OU4	• Silos 1 and 2 (containing K-65 residues) • Silo 3 (containing cold metal oxides) • Silo 4 (empty and never used) • Decant tank system • Berms and soil within the OU boundary	ROD Approved:[c] December 1994 Removal of silo residues and decant sump tank sludges with on-site vitrification/stabilization of residues and sludges followed by off-site disposal; demolition and decontamination, to the extent possible, of silos and remediation facilities; excavation of contaminated soil above the FRLs with on-site disposal for contaminated soils and debris that meet the OSDF WAC; and site restoration. Contaminated soil and debris that exceed the OSDF WAC will be disposed of off-site.	Primary Project: FRVPP responsible for silo content removal, treatment, and transport off-site. Related Projects: Soil Characterization and Excavation Project responsible for verification sampling, excavation and disposition of contaminated soil beneath the silos and for removal of subsurface structures (i.e., sub-grade silo decant system). AWWT and Wastewater Project responsible for treating decontamination and other wastewaters during D&D activities; each project is responsible for capturing and transporting remediation wastewater to the AWWT facility for treatment. Facilities D&D Project responsible for D&D of all OU4 remediation facilities.

TABLE 2-1
(Continued)

Operable Unit	Description	Remedy Overview[a]	Project Organization/Responsibilities
OU5	• Groundwater • Surface water and sediments • Soil not included in the definitions of OUs 1 - 4 • Flora and fauna	ROD Approved: January 1996 Extraction of contaminated groundwater from the Great Miami Aquifer to meet FRLs at all affected areas of the aquifer. Treatment of contaminated groundwater, storm water, and wastewater to attain mass-based discharge limits and FRLs in the Great Miami River. Excavation of contaminated soil and sediment to meet FRLs. Excavation of contaminated soil containing perched water that presents an unacceptable threat, through contaminant migration, to the underlying aquifer. Onsite disposal of contaminated soils and sediment that meet the OSDF WAC. Soil and sediment that exceed the WAC for the on-site disposal facility will be treated, where possible, to meet the OSDF WAC or will be disposed of at an off-site facility. Site restoration, institutional controls, and post-remediation maintenance.	Primary Projects: Aquifer Restoration Project responsible for designing, installing, and operating the pumping systems for the Great Miami Aquifer groundwater restoration; responsible for groundwater monitoring in the Great Miami Aquifer, including the groundwater monitoring program for the on-site disposal facility. AWWT and Wastewater Project responsible for designing, constructing, and operating all treated effluent discharge systems, and for treating and discharging contaminated groundwater, storm water, runoff water, and remedial action wastewaters at the FEMP. Soil Characterization and Excavation Project responsible for verification sampling of sitewide soil; excavation and disposition of contaminated soil, sediment, perched groundwater and below-grade structures; and final site restoration. Related Project: Facilities D&D Project responsible for D&D of all OU5 remediation facilities. On-Site Disposal Facility Design Project responsible for design, installation, and closure of the on-site disposal facility that will contain OU3 debris; OU2 subunit wastes; and OU5 soils.

[a] Each remedy includes institutional controls.
[b] Source of information is each operable unit's ROD and RD/RA documents.
[c] The OU4 ROD is being considered for modification to specify stabilization/solidification of the Silo 3 contents, consistent with the OU4 revised path forward as recommended by the Independent Review Team in March 1997.

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- On-Site Disposal Facility Design Project: Design, installation, and closure of the on-site disposal facility; and monitoring leachate within the on-site disposal facility and perched groundwater in the till beneath the on-site disposal facility.

The realignment of the implementing organizations into an integrated project structure concentrated on remedy design and implementation is a critical step in positioning the site to accelerate final cleanup as reflected in the FEMP remediation strategy. While this realignment will facilitate efficient implementation of the FEMP remedial strategy, it will not affect cleanup levels that the DOE is required to meet. All final remediation levels (FRLs) identified in each operable unit Record of Decision will be addressed for all media.

2.2 REMEDIATION ACTIVITIES

As indicated in Table 2-1, there are several similar large-scale activities that will occur during each remediation project. These activities include site preparation, excavation, construction, remedial facility operation, wastewater management and treatment, transportation of waste materials, D&D, and site restoration. Each activity is explained in detail below:

- Site Preparation: Prior to full-scale remedial activities, there will be extensive site preparation activities, such as construction of haul roads to facilitate movement of waste, construction, and demolition materials; excavation of borrow areas; construction of parking lots and access roads; development of laydown areas and soil stockpile areas; as well as project-specific preparations for construction of remedial facilities.

- Waste and Soil Excavation: Excavation will be performed to remove all constituents of concern (COCs) above FRLs. The movement of waste and soil will create dust throughout remediation. The following locations will be excavated: in Operable Unit 1, each of the waste pits, the clear well, and the burn pit; in Operable Unit 2, the solid waste landfill, inactive and active flyash piles, lime sludge ponds, the south field, and all Operable Unit 2 associated berms, and liners; and in Operable Unit 5, all affected contaminated soil (including affected soils beneath demolished structures in Operable Units 3 and 4) on the FEMP property.

- Construction of Remedial Facilities: Construction will involve large-scale movement of materials, generation of dust, and development of project-specific controls such as collection of surface water runoff. Remedial facilities will be constructed to support three remedies: a waste processing and treatment facility to dry and segregate waste pit waste will be constructed in the waste storage area; vitrification and stabilization facilities will be built near the K-65 silos; and the AWWT facility will be expanded to handle increased capacities of water generated during site remediation.

- Operation of Remedial Facilities: The remediation facilities that will be constructed will operate during most of the remediation project life. They will require controls and monitoring for point-source air emissions and surface water. The facility that will handle waste pit materials will include the capability to sort, crush, size, and shred the waste, as well as treatment by thermal

drying. The vitrification plant will treat Silo 1 and 2 contents and decant sludges by glassifying the silo residues and sludges in a super-heating process; Silo 3 contents will be stabilized (see footnote C on page 2-6).

- Wastewater Management: Wastewater generated during remediation must be collected, monitored, discharged, and if necessary, transported to the AWWT. Wastewaters include pumped groundwater, decontamination water, storm water, and other wastewaters.

- Transportation of Treated and Untreated Waste to On- and Off-Property Disposal Facilities: All materials and soils with COCs above FRLs on the FEMP property will be transported following excavation, treatment, or both, to on- or off-property disposal facilities. This activity will generate dust throughout the life of the remediation.

- Decontamination and Demolition (D&D): Along with all facilities in the former production area, all facilities constructed to implement remedies will undergo D&D. D&D, which is already in process within the former production area, will continue throughout the life of the remediation.

- Site Restoration: Once all facilities have undergone D&D, the 1,050-acre FEMP site will be restored. This activity will involve movement and grading of soil, planting and seeding, erection of fences, and related activities.

2.3 TWO-YEAR PROJECTION

The extensive environmental characterization performed during the past 10 years, in conjunction with the scope of the current sitewide environmental monitoring program, has been used as the technical foundation for aligning the integrated environmental monitoring approach with the site accelerated remediation strategy. The two-year IEMP focus and revision schedule limits the uncertainties associated with long-range project planning and provides flexibility to customize monitoring programs to align with the current mix of remediation activities and actively incorporate stakeholder input. Table 2-2 identifies remediation activities for this two-year period (design activities, such as submittal of required design documents, are not included). As Table 2-2 indicates, in 1997 concurrent activities include site preparation, excavation, construction, safe shutdown and D&D, treatment facility operation, and recovery well operations. In 1998, concurrent activities include continued site preparation, construction and operation of remediation facilities, continued excavation, continued safe shutdown and D&D, and continued recovery well operations. This two-year focus on remediation activities provides the basis to estimate monitoring needs, both on a project-specific and sitewide basis. A detailed description of remedial activities scheduled for 1997 and 1998 is provided in Table 2-2. The scope of the activities detailed above was a fundamental consideration in developing the IEMP monitoring approach and media specific sampling programs.

TABLE 2-2

FEMP INTEGRATED REMEDIATION ACTIVITIES[a] 1997-1998

Remediation Project	1997	1998
Waste Pits Remedial Action Project	Continue existing rail upgrade and remediation facility construction	Begin construction of remediation facility Begin pit excavation, treatment, shipment, and off-site disposal by rail
On-Site Disposal Facility Project	Start construction of on-site disposal facility - Phase 1 Begin construction of haul road Completion of site preparation	Begin and continue waste placement Complete construction of haul road
Soils Characterization and Excavation Project	Begin waste unit site prep	Complete waste unit site preparation Begin waste units excavation Begin Area 1, Phase II A & B excavation
Facilities D&D Project	Continue utility relocations Safe Shutdown Complete Plant 5 Complex Continue Plant 2/3 Complex Begin Plant 6 Complex and Plant 8 Complex D&D Complete Plant 1 Complex, Phase I Begin Boiler and Water Plant Complex, and Thorium/Plant 9 Complex	Continue utility relocations Safe Shutdown Complete Plant 2/3 Complex Continue Plant 6 Complex and Plant 8 Complex D&D Complete Tank Farm Complex Continue Boiler and Water Plant Complex, and Thorium/Plant 9 Complex Begin Plant 3 Complex, Maintenance Complex, Plant 5 Complex, and Tank Farm Area Complex
Silos Projects	Continue Pilot Plant Operations	Begin silo superstructure construction Begin Silo 3 superstructure site prep and treatability study

TABLE 2-2
(Continued)

Remediation Project	1997	1998
Aquifer Restoration Project	Sitewide environmental monitoring	Sitewide environmental monitoring
	AWWT operations continue; AWWT Expansion - begin construction	AWWT Expansion - complete construction/startup
	Continue South Plume recovery well operations	AWWT operations continue
	Construction of Sewage Treatment Plant	Begin startup of Sewage Treatment Plant
	Parking Lot Storm water Diversion construction	Sludge Removal System design/construction/startup
	Injection Demonstration System construction	VOC Treatment System construction
		Continue South Plume recovery well operations
		South Plume Optimization System construction
		South Field extraction system construction
		Injection Demonstration System-operational testing

[a]All schedule information is from the FY97 Phase I Replan Site Master Schedule. Remediation activities listed include physical activities. Associated design and documentation activities may not fall within the identified time-frame.

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3.0 GROUNDWATER MONITORING PROGRAM

Section 3.0 presents the monitoring strategy for tracking the progress of the restoration of the Great Miami Aquifer and the IEMP's integration strategy for satisfying the FEMP's site-specific agreements related to groundwater monitoring. A media-specific plan for conducting all groundwater monitoring activities is provided, along with a phased plan to integrate the FEMP's groundwater-related regulatory compliance reports into a single IEMP-sponsored report. Program expectations for 1997 and 1998 are outlined in Section 3.4, and the program design for 1997 and 1998 is presented in Section 3.5.

3.1 INTEGRATION OBJECTIVES FOR GROUNDWATER

As discussed in Section 1.2, the IEMP has been designated as the primary vehicle for tracking the performance of the full-scale Great Miami Aquifer groundwater restoration remedy to be implemented under Operable Unit 5. This performance monitoring will be an expansion of the existing Design, Monitoring, and Evaluation Program Plan (DMEPP) (DOE 1993c) concept that is currently in place for the South Plume Removal Action Recovery System. In effect, the DMEPP strategy and technical approach will be expanded to encompass each of the new groundwater extraction and reinjection modules that are scheduled to be brought on line over the life of the remedy. Aquifer restoration modules include:

- The South Plume/Optimization Module
- The Injection Demonstration Module
- The South Field Extraction System Module
- The Waste Storage Area Module
- The Plant 6 Area Module.

An overview of each of these modules is provided in Section 3.4.

The initial focus of the monitoring program will be to address remedy performance tracking responsibilities for 1997 and 1998. Ultimately, the IEMP will be used to document the approach for determining when the various modules can be removed from service, once remedial action objectives for the Great Miami Aquifer provided in the Operable Unit 5 Record of Decision are achieved. The IEMP will later serve as the vehicle for verifying the completion of the aquifer

restoration. The sampling program which will be used to verify completion will be presented in future revisions of the IEMP.

Along with this performance-based responsibility, the IEMP also will serve to integrate several other existing compliance-based groundwater monitoring or protection programs:

- RCRA Director's Findings and Orders property boundary groundwater monitoring
- KC-2 warehouse well sampling
- Homeowner well sampling
- Groundwater Protection Management Program Plan.

As discussed in Section 3.7, these multiple activities will be brought together under a single reporting structure to facilitate regulatory agency review of the progressive success of the Operable Unit 5 remedy and the long-term protection strategy for the Great Miami Aquifer.

3.2 SUMMARY OF REGULATORY DRIVERS, DOE POLICIES, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents a summary evaluation of the regulatory-based requirements and policies governing monitoring of the Great Miami Aquifer. The intent of the section is to identify the pertinent regulatory drivers, including ARAR and TBC-based requirements, for the scope and design of the Great Miami Aquifer groundwater monitoring system. These requirements will be used to confirm that the program design will: 1) satisfy the regulatory obligations for monitoring that have been activated by the Operable Unit 5 Record of Decision; and 2) achieve the intentions of other pertinent criteria (such as DOE Orders and the FEMP's existing agreements, as appropriate) that have a bearing on the scope of groundwater monitoring.

The results of the analysis also will be used to define, as appropriate for this media, the administrative boundaries between the IEMP and the project-specific source control monitoring conducted by other FEMP organizations.

3.2.1 Approach

The analysis of the regulatory drivers and policies for groundwater monitoring was conducted by examining the suite of ARARs and TBC requirements in the FEMP's approved CERCLA operable unit Records of Decision to identify the subset with specific groundwater monitoring requirements.

The FEMP's existing compliance agreements issued outside the CERCLA process, such as the September 10 1993, OEPA Director's Findings and Orders (OEPA 1993), were also reviewed.

3.2.2 Results

The following regulatory drivers, compliance agreements, and DOE policies were found to govern the monitoring scope and reporting requirements for remedy performance monitoring and general surveillance of the protectiveness of the Great Miami Aquifer groundwater remedy:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5 (DOE 1996a), which requires the extraction and treatment of Great Miami Aquifer groundwater above final remediation levels (FRLs) until the full beneficial use potential of the aquifer is achieved; this includes use as a drinking water source. The FRLs are established by considering chemical-specific ARARs, hazard indices, background, and detection limits for each contaminant. Many Great Miami Aquifer FRLs are based on established or proposed Safe Drinking Water Act maximum contaminant levels (MCLs), which are ARARs for groundwater remediation. For those FEMP-related contaminants that do not have an established MCL under the Safe Drinking Water Act, a concentration equivalent to an incremental lifetime cancer risk (ILCR) of 10^{-5} for carcinogens or a hazard index (HI) = 1 for noncarcinogens will be used as the FRL, unless background concentrations or detection limits are such that health-based limits cannot be attained (in these cases the background or detection limit becomes the FRL). The FRLs will be tracked throughout all affected areas of the aquifer and will be the basis for determining when the Great Miami Aquifer restoration objectives have been met. By definition, the Operable Unit 5 Record of Decision incorporates the requirements of the FEMP's existing CERCLA South Plume Removal Action (which is the regulatory driver for the FEMP's DMEPP groundwater monitoring and reporting program) and the Abandonment and Plugging of the KC-2 Warehouse/Well No. 67 Groundwater Sampling Work Plan Addendum (which is the regulatory driver for the sampling of the KC-2 warehouse well).

- The September 10, 1993, Ohio EPA Director's Findings and Orders (OEPA 1993), which requires groundwater monitoring at the FEMP's property boundary to satisfy RCRA facility groundwater monitoring requirements. The agreement requires the sampling of 33 property boundary wells on a quarterly basis for a suite of prescribed parameters. Currently, the agreement requires the issuance of a report each March summarizing the previous year's monitoring results. Of note, the March 1996 annual report provided recommendations to update and align the monitoring parameters evaluated for the RCRA property boundary program with the FRLs for groundwater contained in the February 1996 Operable Unit 5 Record of Decision. The IEMP has adopted this recommendation in the selection of analytical parameters for the groundwater program.

- DOE Order 5400.1, General Environmental Protection Program, which establishes the requirement for a Groundwater Protection Management Program Plan (GPMPP) for DOE facilities. The required informational elements of a GPMPP is fulfilled by the Operable

Unit 5 Remedial Investigation and Feasibility Study documents; the groundwater monitoring program requirement will be fulfilled by the IEMP.

- DOE Order 5400.5, Radiation Protection of the Public and Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Demonstration of compliance with these limits and guidelines for radiological dose are based generally on calculations that make use of information obtained from the site's monitoring and surveillance program. This program is based on guidance in the Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance, January 1991. The FEMP's private well sampling program for the Great Miami Aquifer (that was previously in the EMP) is conducted to satisfy the intention of this order with respect to groundwater. While most private well water users are now hooked into a public water supply, a limited private well sampling program will be maintained.

- The 1986 Federal Facilities Compliance Agreement (FFCA), which requires that the FEMP maintain a sampling program for daily flow and uranium at the South Plume Recovery Wells and report the results quarterly to the EPA, OEPA, and Ohio Department of Health. The sampling program conducted to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996. This agreement became effective May 1, 1996.

The IEMP for the Great Miami Aquifer has been developed in full consideration of these regulatory drivers and responsibilities.

Project-specific groundwater monitoring is required only for one project -- the On-site Disposal Facility (OSDF). The IEMP will not be utilized as the mechanism for conducting OSDF performance monitoring within the till and the Great Miami Aquifer. A leak-detection monitoring program plan, which includes both leachate and groundwater monitoring as part of a leak-detection program, will be submitted separately as part of the remedial design for the OSDF project. The OSDF monitoring requirements include the regulatory drivers and the ARARs and TBC criteria that have a bearing on the design and execution of a groundwater monitoring program for the disposal facility and are listed below:

- Ohio Solid Waste Disposal Facility Groundwater Monitoring Rules, OAC 3745-27-10, which specify groundwater monitoring program requirements for sanitary landfills.

- RCRA/Ohio Hazardous Waste Groundwater Monitoring Requirements for Regulated Units, 40 CFR 264.90 through .99 (OAC 3745-54-90 through 99) and 40 CFR 265.90 through .94 (OAC 3745-65-90 through 94), which specify groundwater monitoring program requirements for surface impoundments, landfills, and land treatment units that manage hazardous wastes.

- Uranium Mill Tailings Reclamation and Control Act (UMTRCA) Regulations, 40 CFR 192.32(A)(2), which specify standards for uranium byproduct materials in piles or impoundments. This regulation requires conformance with the RCRA groundwater monitoring performance standard in 40 CFR 264.92. Compliance with RCRA/Ohio Hazardous Waste rules for groundwater monitoring will fulfill the substantive requirements for groundwater monitoring in the UMTRCA regulations.

- DOE Order 5820.2A Chapter III.3.k, Environmental Monitoring, which requires low-level radioactive waste disposal facilities to perform environmental monitoring for all media, including groundwater. Compliance with RCRA/Ohio Hazardous Waste and Ohio Solid Waste rules for groundwater monitoring will fulfill the requirement for groundwater monitoring in this order.

- Ohio Solid Waste Disposal Facility Rules, OAC 3745-27-19(M)(4) and (5), which require submittal of an annual operational report, including a summary of the quantity of leachate collected for treatment and disposal, location of leachate treatment, verification that the leachate management system is operating properly, and the results of analytical testing of an annual grab sample of leachate for groundwater monitoring constituents listed in Appendix I of OAC 3745-27-10.

The groundwater monitoring plan provided in this IEMP has been developed in full consideration of the above regulatory drivers. Each of these drivers and the associated monitoring conducted to comply with these drivers is listed in Table 3-1. Table 3-1 also lists each regulatory requirement for the OSDF groundwater monitoring program and the project-specific plan that will describe the monitoring program. The FEMP's current and long-range plan for complying with the reporting requirements involved by the IEMP drivers is provided in Sections 3.7 and 8.0.

3.3 PROGRAMMATIC BOUNDARY FOR THE IEMP GROUNDWATER PROGRAM

This section identifies the programmatic boundary(s) that have been established between the IEMP and the project-specific activities to be conducted by others. The intent behind the boundary definition is to: 1) clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility; and 2) establish a recognized interface between the sitewide focus of the IEMP and the predominant emission control focus of the project-specific monitoring.

The programmatic boundary for each of the FEMP's environmental media will be unique, and for certain media, time-dependent. The media-specific boundary is defined by one or more of the following:

TABLE 3-1

FEMP GROUNDWATER MONITORING PROGRAM REGULATORY DRIVERS AND RESPONSIBILITIES

DRIVER	ACTION
CERCLA Record of Decision for Operable Unit 5 Ensure acheivement of GMA FRLs	The IEMP describes routine monitoring to ensure remedy performance and to evaluate impacts of remedial activities to the GMA. Toward completion of the remedial action the IEMP will be modified to include a sampling plan to certify achievement of the FRLs
Ohio EPA Director's Final Findings and Orders RCRA/Hazardous Waste Facility Groundwater Monitoring	The IEMP describes routine monitoring at wells located at the property boundary to ensure remedy performance and to evaluate impacts of remedial activities to the GMA
DOE Order 5400.1 Groundwater Protection Managment Plan	The IEMP describes routine monitoring to ensure remedy performance and to evaluate impacts of remedial activities to the GMA
DOE Order 5400.5 Radiation Protection of Public and Environment	The IEMP describes monitoring private wells to support the annual dose assessment which evaluates the contribution of the groundwater pathway to the annual dose to the public
Federal Facilities Compliance Agreement Radiological Monitoring	The IEMP describes the routine sampling of extraction wells for radiological parameters

TABLE 3-1

FEMP GROUNDWATER MONITORING PROGRAM REGULATORY DRIVERS AND RESPONSIBILITIES (Continued)

DRIVER	ACTION	PROJECT PLAN
OAC 3745-27-10 Ohio Solid Waste Disposal Facility Groundwater Monitoring	A leak detection monitoring program in the glacial overburden and the GMA will be conducted for the OSDF	Groundwater, Leak Detection, and Leachate Monitoring Plan for the OSDF
40 CFR 264.90-.99 (OAC 3745-54-90 through 99); 40 CFR 265.90-.94 (OAC 3745-65-90 through 94) RCRA/Ohio Hazardous Waste Disposal Facility Groundwater Monitoring	A leak detection monitoring program in the glacial overburden and the GMA will be conducted for the OSDF	Groundwater, Leak Detection, and Leachate Monitoring Plan for the OSDF
UMTRCA Groundwater Monitoring for Disposal Facilities	A leak detection monitoring program in the GMA will be conducted for the OSDF	Groundwater, Leak Detection, and Leachate Monitoring Plan for the OSDF
DOE Order 5820.2A Monitoring at Low-Level Radioactive Waste Disposal Facilities	A leak detection monitoring program in the GMA will be conducted for the OSDF	Groundwater, Leak Detection, and Leachate Monitoring Plan for the OSDF
OAC 3745-27-19(M)(4) and (5) Ohio Solid Waste Disposal Facility Leachate Detection and Collection Systems	Monitoring of OSDF leachate detection and collection systems is included in the OSDF leak detection monitoring program	Groundwater, Leak Detection, and Leachate Monitoring Plan for the OSDF

- Regulatory monitoring requirements for the media
- Physical boundaries (i.e., geologic, hydrogeologic, or surface boundaries imposed by the remediation projects)
- Media-specific monitoring requirements specifically assigned to the IEMP by administrative decision.

Because of these unique considerations, the boundary definitions are provided for each media to clearly convey the "line of responsibility" for that media under the IEMP. For groundwater, three programmatic boundaries require definition for the IEMP:

- The responsibility boundary between the Great Miami Aquifer and the perched groundwater remediation efforts
- The administrative boundary between the FEMP and the Paddys Run Road Site contaminant plumes (Figure 3-1)
- The responsibility boundary between the On-Site Disposal Cell Design Project and the Aquifer Restoration Project for performance monitoring of the OSDF.

3.3.1 Responsibility Boundary between Great Miami Aquifer and Perched Groundwater Remediation Efforts

For the FEMP's Great Miami Aquifer plume, all of the geographic areas that are to be restored under the Operable Unit 5 Record of Decision (or routinely monitored beyond the restoration area) reside within the scope of the Aquifer Restoration Project. For the perched groundwater remediation, all remedial responsibilities reside within the Soil Characterization and Excavation Project. The pre-certification and certification sampling activities that will accompany the excavation of affected perched groundwater zones (to demonstrate the attainment of cross-media based soil FRLs) will be performed by the Soil Characterization and Excavation Project.

3.3.2 Administrative Boundary between the IEMP and Paddys Run Road Site Contaminant Plumes

As described in the Operable Unit 5 Remedial Investigation Report (Section 4.8.2), the Paddys Run Road Site consists of two facilities, Albright & Wilson Americas, Inc. and Ruetgers-Nease Chemical Company Inc. Albright and Wilson occupies the northern portion of the property and manufactures phosphate compounds. The Paddys Run Road Site Remedial Investigation Report released in September 1992 documented releases to the Great Miami Aquifer of inorganics,

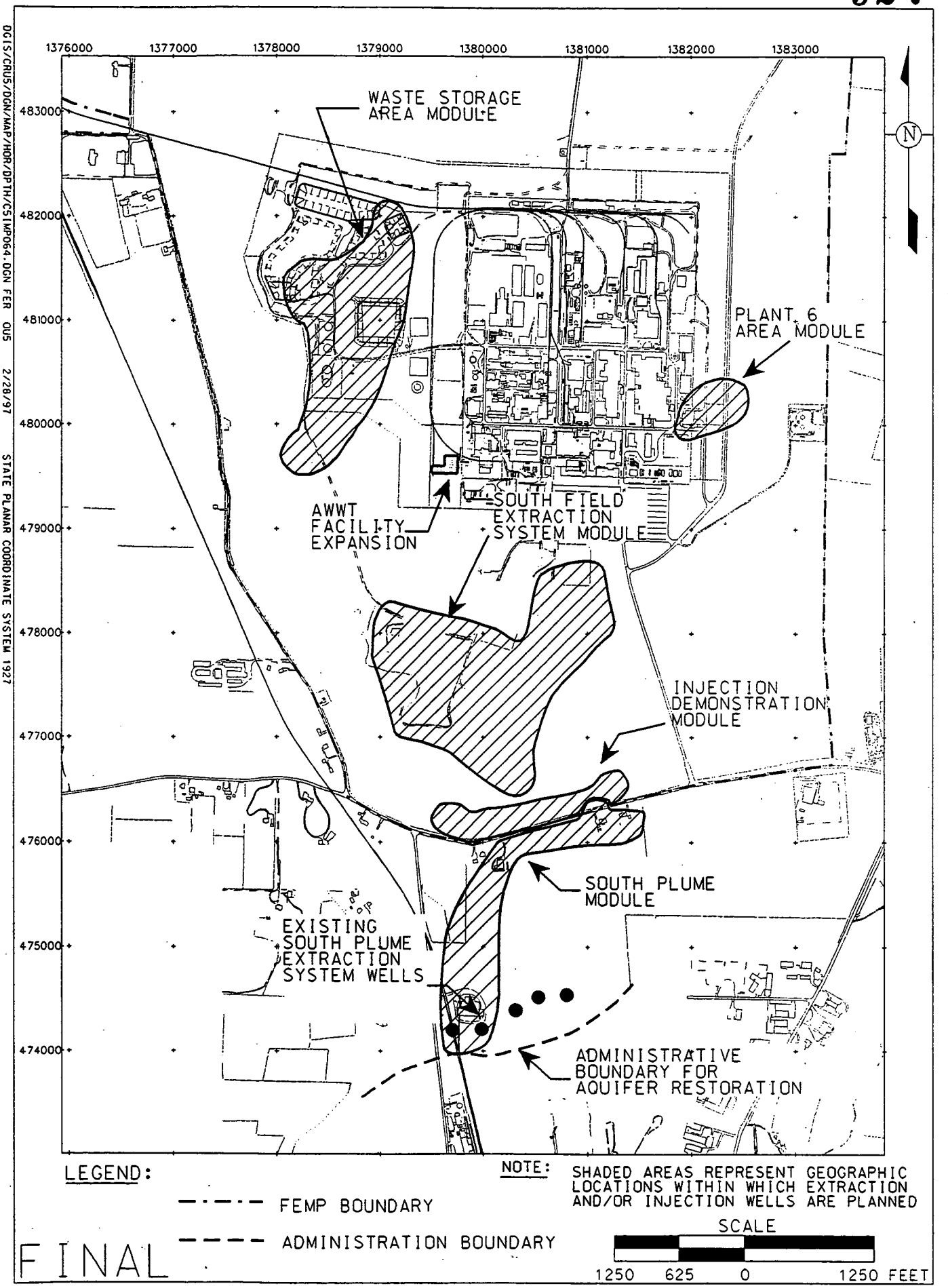

FIGURE 3-1. LOCATION OF AQUIFER RESTORATION MODULES

volatile-organic compounds (VOCs), and semivolatile organic compounds. In the Operable Unit 5 Proposed Plan (DOE 1995h), it was acknowledged that DOE's role and involvement in OEPA's ongoing assessment and/or cleanup of the Paddys Run Road Site plume, if any, would be defined separately as part of the Paddys Run Road Site response obligations and in accordance with the Paddys Run Road Site project schedule. Groundwater monitoring will continue south of the administrative boundary until such time as the need for action is established and implemented. This monitoring will assess the nature of the 20 μg/L uranium plume south of the administrative boundary and the impact that pumping of the South Plume extraction wells has on the Paddys Run Road Site plume. Monitoring is further discussed in Section 3.5.1.1.

3.3.3 Responsibility Boundary between OSDF and the Aquifer Restoration Project for Performance Monitoring at the OSDF

Monitoring of the performance of the on-site disposal facility, including the monitoring of groundwater in the Great Miami Aquifer, is a project-specific responsibility of the OSDF Design Project. The interpretation of groundwater data, in relation to the performance of the OSDF, is a joint responsibility of the OSDF Design Project and the Aquifer Restoration Project. The IEMP annual report will be utilized to provide an annual summary of the data collection and interpretation effort.

3.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

3.4.1 Program Expectations

The IEMP groundwater monitoring program for 1997 and 1998 is being designed to provide a comprehensive monitoring network that will fulfill a variety of expectations. These expectations are:

- Provide groundwater data to assess the capture and restoration of the 20 μg/L total uranium plume
- Provide groundwater data to assess the capture and restoration of non-uranium FRL constituents
- Provide a groundwater monitoring network that will continue to meet existing compliance-based groundwater monitoring obligations (e.g., RCRA property boundary monitoring)

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- Provide groundwater data that is sufficient to verify groundwater model predictions of the remedy performance (model verification is further discussed in Section 3.7.1)
- Provide groundwater data to assess the impact that the aquifer restoration is having on the Paddys Run Road Site plume
- Continue to fulfill DOE Order 5400.1 requirements to maintain an environmental monitoring plan for groundwater
- Continue to address concerns of the community regarding the progress of the aquifer restoration.

Design considerations for post cleanup groundwater monitoring will be incorporated into later revisions of the IEMP. The following section provides the design considerations required to fulfill each of these expectations for 1997 and 1998.

3.4.2 Design Considerations

3.4.2.1 The Modular Approach to Aquifer Restoration

The Great Miami Aquifer is contaminated with uranium and other constituents as reported in the Operable Unit 5 Remedial Investigation Report (DOE 1995f). One portion of the Great Miami Aquifer (i.e., the South Plume) has been undergoing pump-and-treat remediation since 1993. A groundwater remediation strategy which relies on pump-and-treat technology has been selected to conduct a concentration based clean up of the Great Miami Aquifer (DOE 1996a). In an effort to improve upon the performance of this pump-and-treat remedy, a groundwater injection demonstration is also planned. If the injection demonstration is a success, injection will be used to accelerate the restoration. The restoration strategy focuses primarily on the removal of uranium, but has also been designed to limit the further expansion of the plume, achieve removal of all targeted contaminants to concentrations below designated FRLs, and prevent undesirable drawdown impacts beyond the FEMP property.

The distribution of uranium and other constituents in the Great Miami Aquifer has been extensively characterized in the Operable Unit 5 Remedial Investigation Report (DOE 1995f). The primary sources of contamination at the FEMP that contributed to the present geometry of the plume are: the waste pits in the waste storage area, the inactive and active flyash piles in the south field area, deep soil contamination in the vicinity of Plant 6, and the previously uncontrolled surface water runoff from the former production area that had direct access to the aquifer through the Storm

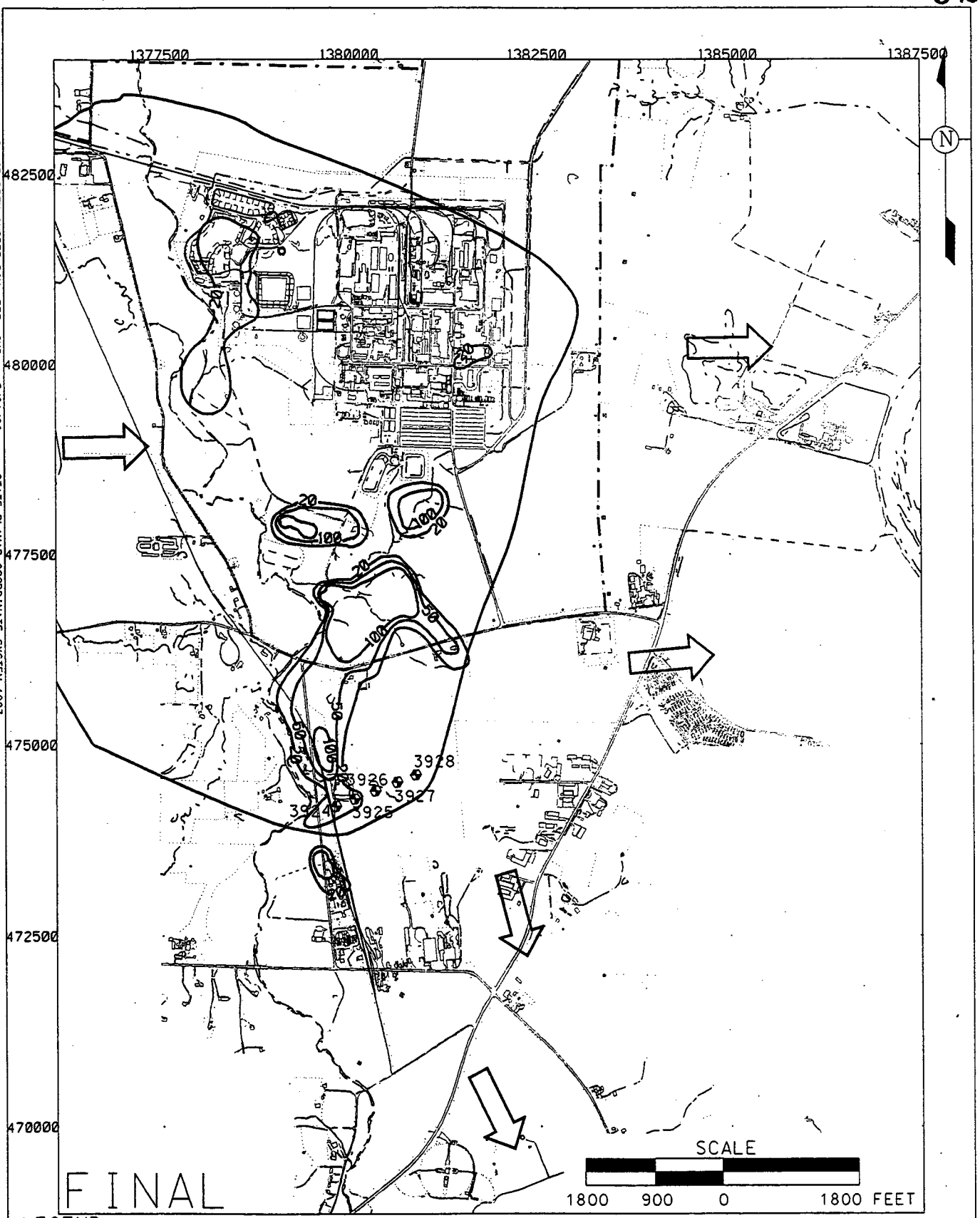
Sewer Outfall Ditch and Paddys Run. Uranium is the principal constituent of concern in the Great Miami Aquifer and drives the overall extent and duration of the aquifer restoration program. Uranium contamination is most extensive and concentrated at the Type 2 well depths (Great Miami Aquifer water table) and generally less extensive and concentrated with depth below the water table. Figures 3-2 and 3-3 show the total uranium concentrations from unfiltered groundwater samples in Type 2 and Type 3 wells, respectively.

Restoration of the Great Miami Aquifer will be accomplished by using a series of area-specific groundwater restoration modules and a centralized water treatment facility (Figure 3-1). Area-specific modules include:

- The South Plume/Optimization Module
- The Injection Demonstration Module
- The South Field Extraction System Module
- The Waste Storage Area Module
- The Plant 6 Area Module.

Each area-specific module will be brought on line as scheduled during the life of the remedy, and withdrawn from service once remedial objectives within an area are achieved. The pumping that is needed to capture the 20 μg/L total uranium plume will create a capture zone that is larger than the actual dimension of the 20 μg/L total uranium plume. This capture zone is called the uranium based aquifer restoration footprint. Figures 3-2 and 3-3 illustrate the relationship between the uranium-based aquifer restoration footprint, which will be created when all planned restoration modules are operating, and the 20 μg/L total uranium plume.

The groundwater monitoring program described in this IEMP is designed around the modular remediation strategy presented in the Operable Unit 5 Baseline Remedial Strategy Report, which details the pump-and-treat systems for each module.



LEGEND:

FEMP BOUNDARY

ISOCONCENTRATION CONTOUR (µg/L) BASED ON 1993 SNAPSHOT DATA AND 1995 DMEPP DATA

INDICATES REGIONAL GROUNDWATER FLOW

3926 EXTRACTION WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

FIGURE 3-2. TOTAL URANIUM PLUME IN TYPE 2 WELLS

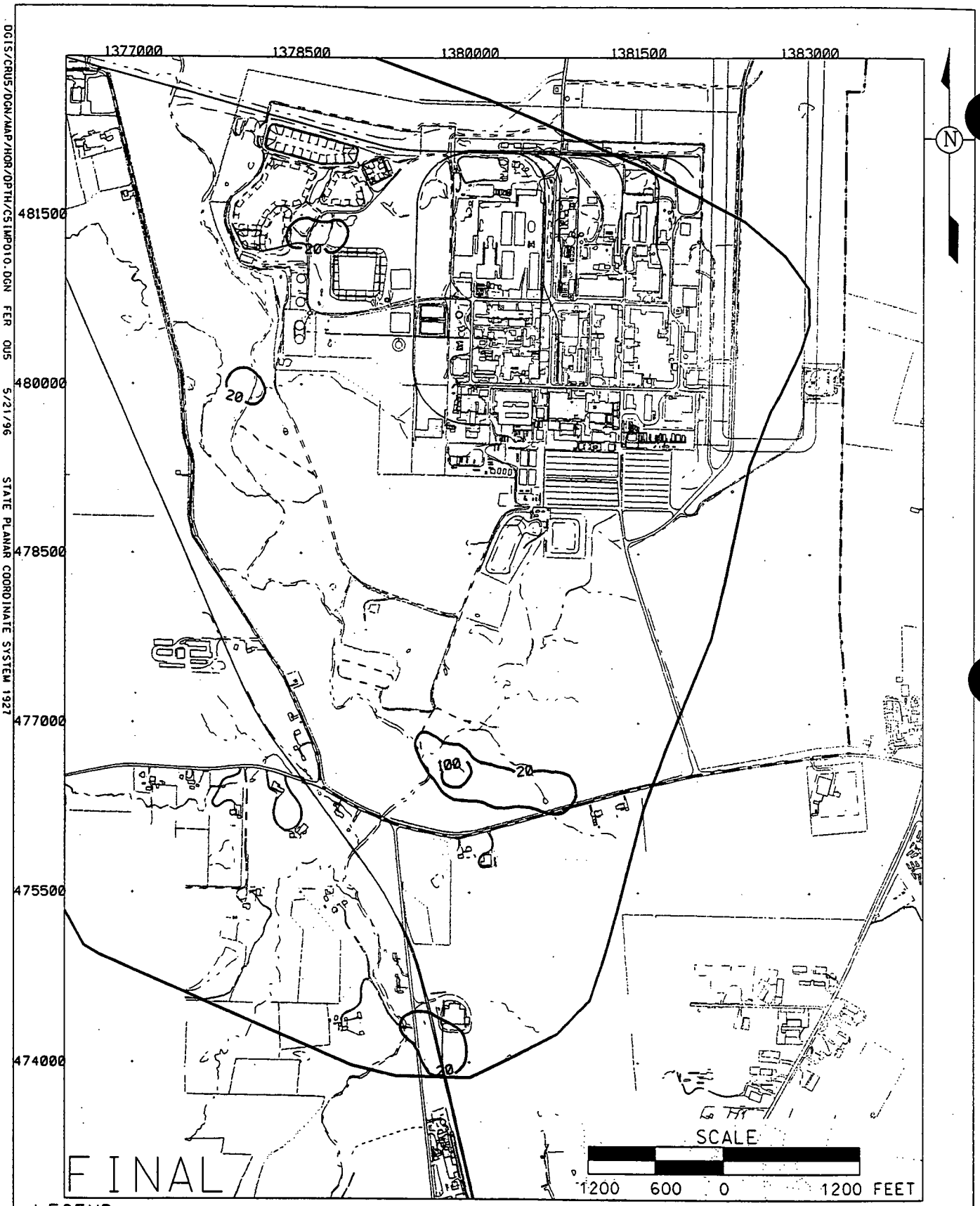


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FIGURE 3-3. TOTAL URANIUM PLUME IN TYPE 3 WELLS

Although the additional modeling work that is being done to complete the Baseline Remedial Strategy Report might result in a few minor changes to the pumping schemes presented in the October draft, the overall design of the restoration system is expected to remain the same. For instance, there will still be South Plume, South Field, Waste Storage Area, Plant 6 area and Injection Demonstration modules. Therefore, the monitoring program which is being proposed in this version of the IEMP should be adequate to meet system monitoring needs. If, however, the Baseline Remedial Strategy Report, when final, indicates the need for altering the groundwater design for years 1997 and 1998, then the IEMP will be revised to incorporate the necessary design changes.

The South Plume Module, which was initiated as part of Removal Action 3, has been in operation since 1993. The existing four extraction wells currently in operation which comprise the South Plume Module were installed to create a hydraulic barrier and prevent the further southern migration of the uranium plume (DOE 1992). According to the Operable Unit 5 Remedial Design Work Plan, the South Plume Module will be enhanced by installing additional extraction wells to supplement the existing wells. This enhancement, once installed, will incorporate and/or replace the South Plume Module, and is known as the South Plume Optimization Module.

During 1997, the four extraction wells comprising the South Plume Module will continue to be pumped at a combined rate of 1,400 gallons per minute (gpm). Figure 3-4 illustrates where these four wells are located. In 1998, the Injection Demonstration Module is scheduled to become operational, and the remedy will include both extraction and an injection demonstration (Figure 3-5). In the South Plume, four extraction wells will be pumped at a combined rate of 1,400 gpm. In the Injection Demonstration area, treated water will be injected into five wells at a combined rate of 1,000 gpm. The net groundwater extraction rate during this time period will be 400 gpm.

After 1998 (the South Field Module, the South Plume Optimization Module, the Waste Storage Area Module and the Plant 6 Area Module) are scheduled to become operational. The final design of these systems is presented in the Baseline Remedial Strategy Report.

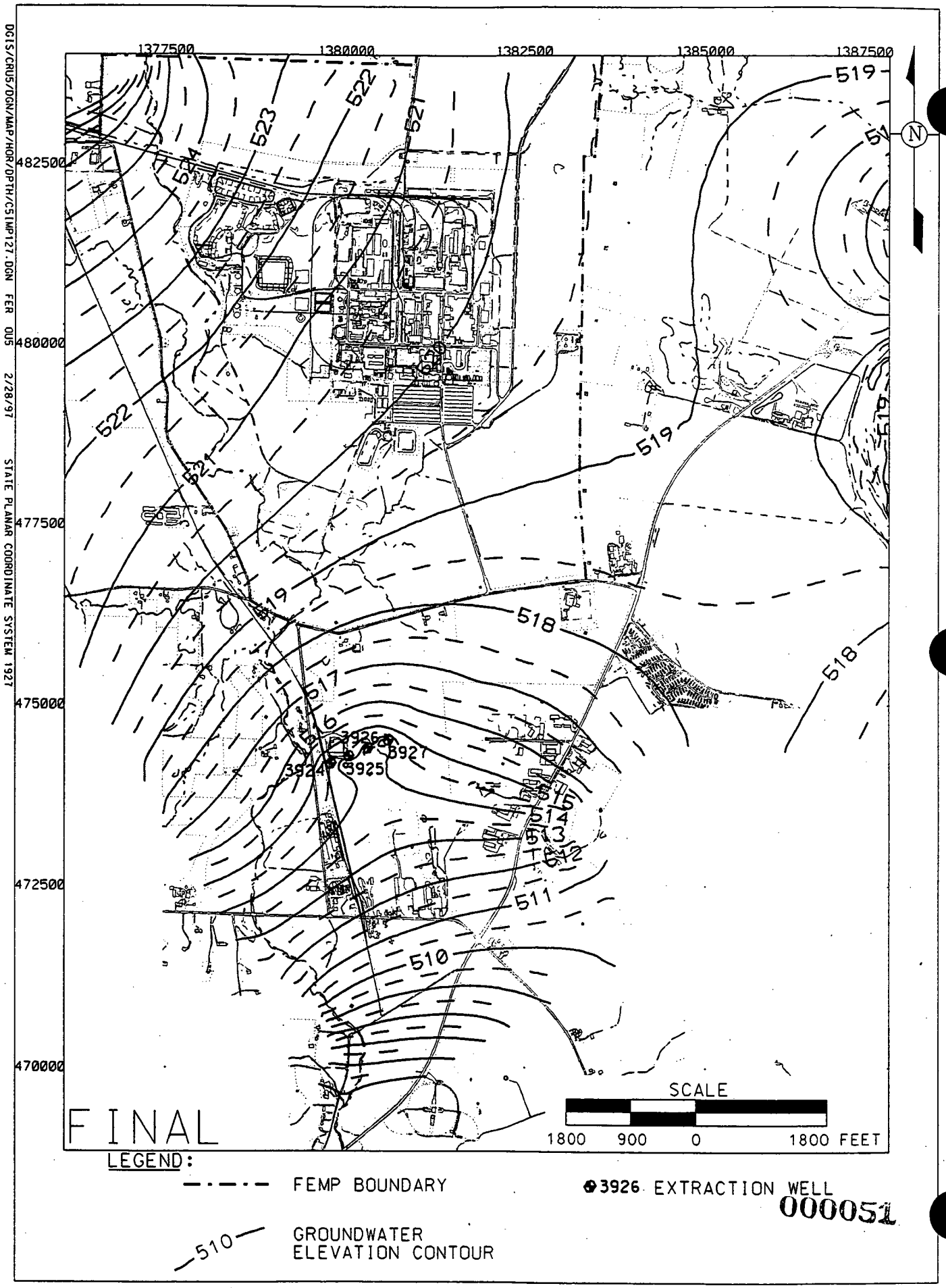
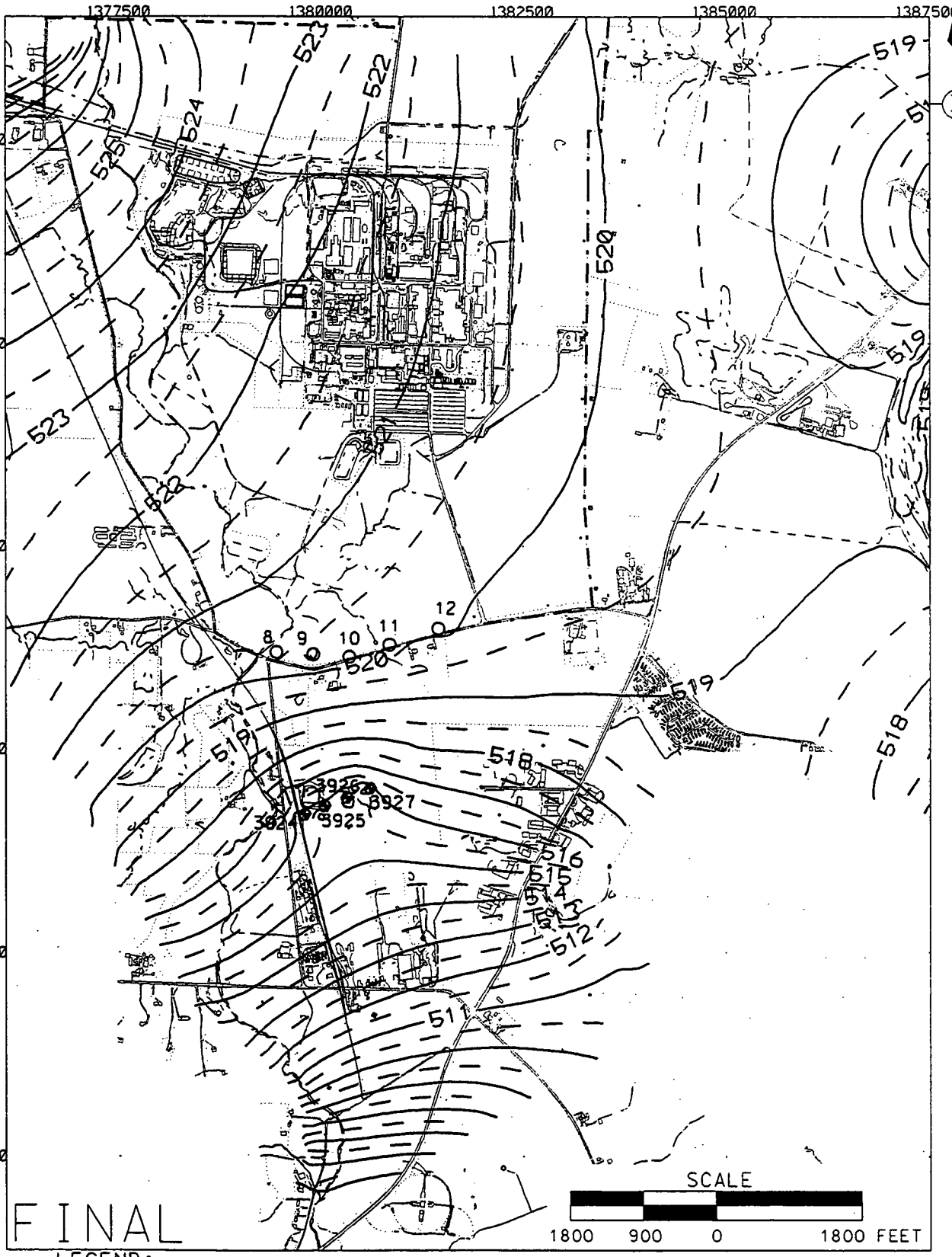


FIGURE 3-4. EXTRACTION WELLS AND MODELED GROUNDWATER ELEVATIONS FOR 1997

DGIS/CRU5/DGN/MAP/HOR/DPTH/C5IMP128.DGN FER OU5 2/28/97 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

3926 EXTRACTION WELL

12 INJECTION WELL

510 GROUNDWATER ELEVATION CONTOUR

FIGURE 3-5. EXTRACTION/INJECTION WELLS AND MODELED GROUNDWATER ELEVATIONS FOR 1998

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For modeling and monitoring purposes, the uranium groundwater plume was divided into five zones referred to as aquifer zones (Figure 3-6). These zones were used to evaluate the predicted performance (both individually and collectively) at the aquifer restoration modules. Four of the five zones (Zones 1 through 4) contain remediation modules. Zone 0 (the fifth zone) is the area outside the other four zones. The location of the restoration modules is as follows:

- The South Plume Module is located in Zones 2 and 4
- The South Field Extraction and Injection Demonstration Modules are located in Zone 2
- The Waste Storage Area Module is located in Zone 1
- The Plant-6 Area Module is located in Zone 3.

The pumping that is needed to capture the 20 μg/L total uranium plume will create a capture zone that is larger than the actual dimension of the 20 μg/L total uranium plume. This capture zone is called the uranium-based aquifer restoration footprint. The uranium-based aquifer restoration footprint is shown on Figure 3-6, so that its relationship to the aquifer zones can be seen. As explained in Section 3.4.2.3, these aquifer zones were used to help sort and select groundwater monitoring parameters.

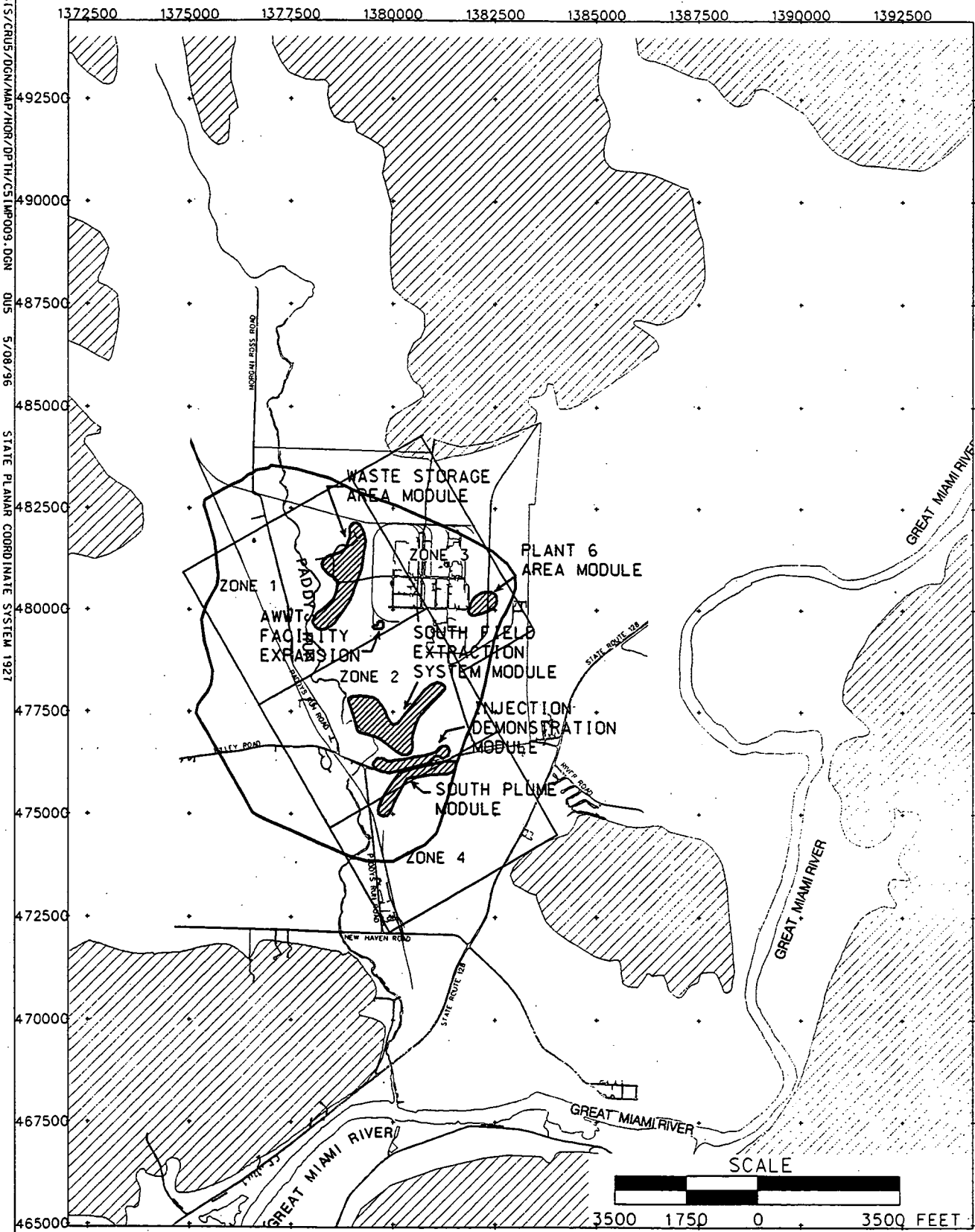
3.4.2.2 Well Selection Criteria

Geologic and hydrogeologic properties, predicted groundwater flow (during remediation), and contaminant distribution within the Great Miami Aquifer, characterized in the Operable Unit 5 remedial investigation/feasibility study process, have served as input to the design of the IEMP groundwater monitoring program. Field measurements and computer simulations have been conducted to support the design efforts. All the available information was reviewed to select appropriate monitoring well locations. In general, the monitoring well locations for the IEMP were selected according to the following criteria:

- Monitor within the uranium-based aquifer restoration footprint unless a compliance-based monitoring obligation or an operational concern (i.e., the close proximity of the South Plume extraction wells to the Paddys Run Road Site plume) requires a monitoring location to be outside of the capture zone

- Use existing monitoring wells and avoid installing new monitoring wells until remediation modules are operational and operational knowledge can be used to help select new locations

DGIS/CRU5/DGN/MAP/HOR/DPTH/C51MP009.DGN OU5 5/08/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
SHADED AREAS REPRESENT GEOGRAPHIC LOCATIONS WITHIN WHICH EXTRACTION AND/OR INJECTION WELLS ARE PLANNED
ZONE 0 CONSISTS OF ALL AREAS OUTSIDE ZONES 1, 2, 3, AND 4.

FINAL

FIGURE 3-6. GROUNDWATER AQUIFER ZONES AND AQUIFER RESTORATION FOOTPRINT

- Provide adequate areal coverage across each remediation module area
- Include monitoring wells which are needed to meet regulatory and other site-specific monitoring commitments
- Avoid selecting monitoring well locations which would interfere with surface remediation activities such as soil excavations
- Select monitoring well locations that will provide data needed to verify groundwater model predictions.

Using these criteria, it is proposed that 128 of 368 available wells be monitored during the first two years of the IEMP. Currently, 123 monitoring wells are monitored (DMEPP, RCRA, KC-2 Warehouse, and private wells). The IEMP program will remove 30 of the private wells and add 35 FEMP wells to the overall monitoring effort. The 30 private wells can be removed from the monitoring program because a public water supply is now available. Section 3.5.2.1 provides more information on the Private Well Monitoring Program.

The 35 wells added to the IEMP monitoring program are near the South Field, Waste Storage, and Plant 6 remediation module areas. These wells will document water quality changes that may be occurring in the aquifer that could impact the design or start-up of the restoration modules. Once a restoration module begins to operate in these areas, the wells will provide a preliminary monitoring network. It is anticipated that additional monitoring wells will be needed once systems become operational, but as stated earlier, new locations will not be selected until some operational experience has been obtained. Further discussion of the selection of specific monitoring locations for individual monitoring modules or programs is presented in Sections 3.5.1 and 3.5.2.

3.4.2.3 Parameter Selection Criteria

Restoration of the aquifer will be verified against FRLs. FRLs for the aquifer are presented in the Operable Unit 5 Record of Decision for 50 constituents of concern (COCs). Groundwater monitoring will focus on these 50 FRL constituents to assess the progress of the aquifer remedy. These 50 FRL constituents either have concentrations that have been detected in the aquifer or have the potential to reach the aquifer within 1,000 years and pose an unacceptable risk to human health and/or the environment.

000055

The groundwater monitoring program for the Great Miami Aquifer consists of 128 monitoring wells distributed over the restoration modules, along the FEMP's downgradient property boundary, and at three private well locations. If all 128 of these wells were monitored quarterly for the full suite of the FEMP's groundwater FRL constituents (50 constituents total), the analytical costs alone are estimated to exceed 16 million dollars over the life of the FEMP's groundwater restoration program. It does not appear to be cost effective to monitor the full suite of parameters at each successive monitoring interval at all available wells during the active restoration process.

For the IEMP, a representative list of FRL parameters was developed that can be used to track successfully the progress of the remedy, satisfy regulatory requirements, and ultimately determine when restoration activities are complete for each module. The FEMP recognizes its obligation to verify that all 50 FRL constituents are below their corresponding FRL values in order to deem the restoration activities complete. During the active restoration process, the FEMP is proposing to track the progressive success of the remedy using a logical "short list" of indicator parameters (developed through the methodology described in Appendix A), and then verify the completion of the remedy (step-wise for each module, as appropriate) using the full suite of 50 FRL constituents identified in the Operable Unit 5 Record of Decision. The parameter list presented in this version of the IEMP focuses on monitoring for 1997 and 1998. Subsequent versions of the IEMP are expected to focus on the monitoring activities and the parameters needed to support a collective decision on the part of DOE, EPA, and OEPA that restoration activities are complete for each module. Later versions will also define the FEMP's long-term groundwater monitoring activities (such as post cleanup groundwater monitoring).

For this version of the IEMP, the 50 FRL constituents presented in the Operable Unit 5 Record of Decision were organized into four categories for the purpose of monitoring appropriately and cost effectively. Specific monitoring objectives were considered in subdividing the parameters into specific groups:

- Is the success of the groundwater remedy proceeding satisfactorily at the pace that is desired?
- Are engineering adjustments to the system (flow rates, well locations, etc.) needed?
- Are FRL constituents migrating beyond the hydraulic zone of capture created by the restoration system?

- Are new FRL constituents arriving in the aquifer as a result of migration through the glacial overburden or as a result of surface water infiltration?
- Is sufficient information being gathered to ultimately demonstrate that remedial objectives contained in the Operable Unit 5 Record of Decision have been obtained?
- Have all specific regulatory-based monitoring requirements for specific parameters been satisfied in the selection process?

By categorizing the data, it was possible to identify a "short list" of indicator parameters. This "short-list" of parameters will be monitored more frequently than the other FRL constituents. To select the short list and establish monitoring frequencies for the other FRL constituents, the following factors were determined:

- Presence in the aquifer, based on one or more validated FRL exceedance in the aquifer. The Operable Unit 5 remedial investigation/feasibility study data set and 1994 and 1995 groundwater data sets were evaluated.
- Presence in the glacial overburden, ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and the environment based on Operable Unit 5 Feasibility Study modeling results.

Constituents were then organized into specific monitoring parameter lists based upon the above noted monitoring objectives and the geographic locations of the monitoring module/program. The parameter selection strategy, approach, and results are presented in Appendix A. A summary of the results of the parameter selection process is presented in Table 3-2.

The following is a description of the information contained in Table 3-2, and how the information in the table was used to determine the most appropriate parameters for a particular module/program.

- Column 1, Constituents: This column represents the suite of constituents considered for monitoring in the groundwater modules/activities as a result of the remedial investigation/feasibility study process at the FEMP. It consists of the constituents for which an FRL was established in the Operable Unit 5 Record of Decision.
- Column 2, Groundwater FRLs: This column represents the human-health protective remediation levels for groundwater that were established in the Operable Unit 5 Record of Decision.

TABLE 3-2

CATEGORIZATION OF GROUNDWATER FRL CONSTITUENTS BASED ON EXCEEDANCES, MOBILITY, AND PERSISTENCE

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Characterization by Zone[d]				
				Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
General Chemistry	**mg/L**							
Fluoride	4	3	MP	<MP	<MP	<MP	>MP	<MP
Nitrate[e]	11	0,1,2,4	MP	>MP	>MP	>MP	<MP	>MP
Inorganics	**mg/L**							
Antimony	.0060	0,1,2,3,4	N	>N	>N	>N	>N	>N
Arsenic	.050	0,1,2,3,4	N	>N	>N	>N	>N	>N
Barium	2.0	4	N	<N	<N	<N	<N	>N
Beryllium	.0040	1,3,4	N	<N	>N	<N	>N	>N
Boron	.33	-[f]	MP	>MP[f]	>MP[f]	>MP[f]	>MP[f]	>MP[f]
Cadmium	.014	0,1,2,3,4	N	>N	>N	>N	>N	>N
Chromium VI[g]	.022	-[h]	MP	>MP[h]	<MP	<MP	>MP[h]	<MP
Cobalt	.17	1,3,4	N	<N	>N	<N	>N	>N
Copper	1.3	-	N	<N	<N	<N	<N	<N
Lead	0.015	0,1,2,3,4	N	>N	>N	>N	>N	>N
Manganese	.90	0,1,2,3,4	N	>N	>N	>N	>N	>N
Mercury	.0020	0,1,2,3,4	MP	>MP	>MP	>MP	>MP	>MP
Molybdenum	.10	1,3	N	<N	>N	<N	>N	<N
Nickel	.10	0,1,2,3,4	N	>N	>N	>N	>N	>N
Selenium	.050	1,2,3,4	N	<N	>N	>N	>N	>N
Silver	.050	0,1,4	N	>N	>N	<N	<N	>N
Vanadium	.038	0,1,3,4	N	>N	>N	<N	>N	>N
Zinc	.021	0,1,2,3,4	N	>N	>N	>N	>N	>N
Radionuclides	**pCi/L**							
Neptunium-237	1.0	0,2,4	MP	>MP	<MP	>MP	<MP	>MP
Radium-226	20	4	N	<N	<N	<N	<N	>N
Radium-228	20	-	N	<N	<N	<N	<N	<N
Strontium-90	8.0	0,1,3,4	MP	>MP	>MP	<MP	>MP	>MP
Technetium-99	94.0	0,1	MP	>MP	>MP	<MP	<MP	<MP
Thorium-228	4.0	0,1,2,3,4	N	>N	>N	>N	>N	>N
Thorium-230	15	-	N	<N	<N	<N	<N	<N
Thorium-232	1.2	0,2,4	N	>N	<N	>N	<N	>N
	µg/L							
Total Uranium	20	0,1,2,3,4	MP	>MP	>MP	>MP	>MP	>MP

TABLE 3-2
(Continued)

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Characterization by Zone[d]				
				Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Organics	**mg/L**							
Alpha-chlordane	.0020	-	MP	<MP	<MP	<MP	<MP	<MP
Aroclor-1254	.00020	-[i]	N	<N	<N	<N	<N	<N
Benzene	.0050	0	N	>N	<N	<N	<N	<N
Bis(2-chloroisopropyl)ether	.0050	-[i]	N[j]	<N	<N	<N	<N	<N
Bis(2-ethylhexyl)phthalate[k]	.0060	-	N	<N	<N	<N	<N	<N
Organics (Contd.)	**mg/L**							
Bromodichloromethane	.1	-	MP	<MP	<MP	<MP	<MP	<MP
Bromomethane	.0021	-	N	<N	<N	<N	<N	<N
Carbazole	.011	-	N[j]	<N	<N	<N	<N	<N
Carbon disulfide	.0055	1,2,3	N	<N	>N	>N	>N	<N
Chloroethane	.0010	-[i]	N[l]	<N	<N	<N	<N	<N
Chloroform	.10	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethane	.28	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethene	.0070	4	N	<N	<N	<N	<N	>N
1,2-Dichloroethane	.0050	4	MP	<MP	<MP	<MP	<MP	>MP
Methylene chloride	.0050	-	N	<N	<N	<N	<N	<N
4-Methylphenol	.029	-	N	<N	<N	<N	<N	<N
4-Nitrophenol	.32	-	N[l]	<N	<N	<N	<N	<N
Octachlorodibenzo-p-dioxin	.0000001	-[i,m]	N	<N	<N	<N[m]	<N	<N[m]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	.000010	-[m]	N[l]	<N	<N	<N[m]	<N	<N[m]
Trichloroethene	.0050	0,1,2,4	N	>N	>N	>N	<N	>N
Vinyl Chloride	.0020	-	MP	<MP	<MP	<MP	<MP	<MP

Shading indicates short list of indicator parameters.
[a]From Table 9-3 in OU5 ROD. Fluoride and lead FRLs were proposed in the Restoration Area Verification Sampling Program PSP.
[b]0,1,2,3,4 indicate the zone(s) where constituent was detected in the aquifer above the FRL. From OU5 RI/FS data set and supplemented by 1994 and 1995 groundwater data.
- indicates that the constituent was not detected in the aquifer above the FRL.
[c]From OU5 FS Report Table F.2-2. A constituent that failed modeling (model screening predicted that it has the ability to migrate to the aquifer) is considered mobile and persistent, and is listed as MP. A constituent that passed modeling (model screening indicated that it could not reach the aquifer) is considered not mobile and persistent, and is listed as N.
[d]>MP = Has been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate to the aquifer.
>N = Has been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate to the aquifer.
<MP = Has not been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate to the aquifer.
<N = Has not been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate to the aquifer.
[e]Nitrate/Nitrite will be analyzed in future modules/programs.
[f]Not analyzed in Zones 0, 1, 2, 3 or 4, but categorized as having a valid FRL exceedance in these zones since it has been predicted to have the ability to migrate to the aquifer and create an unacceptable risk.

TABLE 3-2
(Continued)

[g]Total chromium will be analyzed in future modules/programs.
[h]Not analyzed in Zones 0 or 3, but categorized as having a valid FRL exceedance in these zones since it has been predicted to have the ability to migrate to the aquifer and create an unacceptable risk.
[i]Analyses of constituent had method detection limit above FRL, but categorized as not having a valid FRL exceedance since model predictions indicate that it does not have the ability to migrate to the aquifer and create an unacceptable risk.
[j]Failed modeling in F.2-2. Constituent was since remodeled with updated information and passed modeling. It was therefore assigned an N.
[k]This constituent showed FRL exceedances in three samples (.015- mg/L, Well 3043 in Zone 1; .013- mg/L, Well 3016 in Zone 2, .007J mg/L, Well 2037 in Zone 3). Confirmatory sampling indicated that each exceedance was due to laboratory contamination.
[l]Not in Table F.2-2. Constituent assigned an N based on literature review which shows high degradation rates for chloroethane and 4-nitrophenol and low water solubility for 2,3,7,8 tetrachlorodibenzo-p-dioxin.
[m]Not analyzed in Zones 2 or 4, but categorized as not having a valid FRL exceedance in these zones since it does not have the ability to migrate to the aquifer and create an unacceptable risk.

- Column 3, Zones with Groundwater Concentrations > FRL: This column identifies, by aquifer zone, the constituents that have been detected in the aquifer at concentrations above their established FRL. In order to determine the location of FRL exceedances in the aquifer, the analytical data was sorted into the same four zones (Zones 1 through 4) used to model the aquifer remediation (described in Appendix F.7 of the Operable Unit Feasibility Study Report). A fifth zone (Zone 0) includes the area outside of Zones 1 through 4 (refer to Figure 3-6).

- Column 4, Mobility/Persistence Characteristic: This column identifies which constituents failed or passed the model screening (Operable Unit 5 Feasibility Study Report, Table F.2-2). FRL constituents predicted to have the ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and the environment are identified as letter MP. Section A.4.2 contains information that clarifies the "MP" and "N" designations.

- Columns 5-9, Characteristic by Zone: These columns present a combination of the information presented in Column 3 (FRL exceedance) and Column 4 (Mobility/Persistence characteristic). The constituents are categorized into four characteristics by zone. These four characteristics are:

  - **>MP** The constituent has been detected in the aquifer at concentrations "greater than its established FRL" and is considered "Mobile and Persistent." It has been predicted to be able to migrate from the glacial overburden to the aquifer and has already caused a FRL exceedance in the aquifer.

  - **>N** The constituent has been detected in the aquifer at concentrations "greater than its established FRL" but is "Not considered mobile and persistent." This constituent is not predicted to be able to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk. Background conditions and/or surface water infiltrations may be the cause of the isolated FRL exceedances noted in the historical record.

  - **<MP** The constituent has "not been detected in the aquifer at concentrations greater than its established FRL," but is considered both "Mobile and Persistent." This constituent is predicted to be able to migrate through the glacial overburden to the aquifer (if no source actions are taken), but as yet has not caused exceedances of its established FRL.

  - **<N** The constituent has "not been detected in the aquifer at concentrations greater than its established FRL" and is "Not considered mobile and persistent."

A zone-specific breakdown of the number of constituents in each of the four categories is presented below.

BREAKDOWN OF FRL CATEGORY CONSTITUENTS BY AQUIFER ZONE

Constituent Characteristic	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
>MP	8	6	5	6	7
>N	13	16	12	14	18
<MP	5	7	8	7	6
<N	24	21	25	23	19

The constituents that are in the >MP category in at least one zone are:

- Fluoride
- Nitrate
- Boron
- Chromium VI
- Mercury
- Neptunium-237
- Strontium-90
- Technetium-99
- Total Uranium
- 1,2-Dichloroethane.

These constituents are considered to be the master short list of indicator parameters from which zone-specific short lists will be developed. These short list parameters will be monitored more frequently than the other constituents in order to track the progress of the remedy. These parameters have been detected in the aquifer at concentrations above their established FRLs and they are both mobile and persistent.

Each of the four categories of constituents will be targeted for monitoring at the following frequency:

- **>MP** Are to be monitored quarterly in source areas and at the property boundaries because they have been detected in the Great Miami Aquifer above their established FRL and are considered mobile and persistent.

- **>N** Are to be monitored quarterly at the property boundaries so that sufficient data will be available to evaluate water quality trends. Are to be monitored annually in source areas because they have been detected in the Great Miami Aquifer above their established FRLs and because they are not considered mobile and persistent.

- **<MP** Are to be monitored annually because they have not been detected in the Great Miami Aquifer above their established FRL and because they are considered mobile and persistent.

- **<N** Are to be monitored every five years to verify that these lowest-priority FRL constituents remain below their established FRL.

Exception:

- The constituents with the >MP characteristic in the two areas where groundwater cleanup is not expected to begin in the next five years (Plant 6 and Waste Storage Area modules) will be

monitored semi-annually instead of quarterly. The frequency will be increased to quarterly one year before the groundwater remediation begins in these areas.

Parameter lists for the monitoring modules/activities were developed using Columns 5 through 9 of Table 3-2. These module-/activity-specific parameter lists can be found in Section 3.5.1 and 3.5.2 of the IEMP. Columns 5 through 9 indicate how constituents have been categorized for each aquifer zone. Specific monitoring modules and activities fall in one or more of these zones as follows:

- South Plume Module is located in Zones 2 and 4
- Injection Demonstration Modules are located in Zone 2
- Waste Storage Area Module is located in Zone 1
- Plant 6 Area Module is located in Zone 3
- RCRA Boundary Monitoring monitors downgradient of Zones 0 through 3.

Exceptions:

- KC-2 Warehouse well, private well monitoring, and Paddys Run Road Site activity of the South Plume Module have established parameter lists that were put together to meet specific objectives.

In addition to the analytical constituents, several field parameters will be monitored during each groundwater sample collection event. These field parameters include dissolved oxygen, pH, specific conductance, temperature and turbidity and serve as indicators of aquifer conditions and are used to verify that groundwater samples are representative.

Groundwater monitoring for the IEMP will begin with all constituents characterized as ">MP", ">N", and "<MP" being sampled. After a year of data is collected and reviewed, the parameter list for each module/activity will be reevaluated using the same logic outlined previously in this section. The new data collected may indicate that it is necessary to increase or decrease the monitoring frequency for some of the constituents. The following are possible changes that would indicate a necessity to modify parameter frequencies. In general, if in any zone, a constituent is categorized as:

- <MP becomes >MP - indicating a FRL exceedance -- increase sampling frequency to quarterly

- <N becomes >N - indicating a FRL exceedance -- increase sampling frequency to annual

- >MP becomes <MP - indicating no longer a FRL exceedance -- decrease sampling frequency to annual

- >N becomes <N - indicating no longer a FRL exceedance -- decrease sampling frequency to every five years.

Note: As identified earlier, the Plant 6 and Waste Storage Area Modules along with the RCRA Property Boundary activity have some exceptions to the above monitoring frequencies.

Modifying and revising parameter lists and sampling locations will be an ongoing process for the groundwater monitoring program, as more data are obtained and trends become apparent. Formal revisions to the IEMP will occur every two years and annual modifications will be identified in the IEMP annual reports. No parameter will be removed from a sampling list until the EPA and OEPA have concurred with the decision.

3.5 DESIGN OF THE IEMP GROUNDWATER MONITORING PROGRAM

Groundwater monitoring to assess performance of the aquifer remedy and to maintain an understanding of contaminant conditions in the aquifer where active remediation has not yet begun is organized around the individual restoration modules that will be used to implement the aquifer remedy:

- The South Plume Module (Section 3.5.1.1)
- The South Field Extraction System Module (Section 3.5.1.2)
- The Injection Demonstration Module (Section 3.5.1.3)
- The Waste Storage Area Module (Section 3.5.1.4)
- The Plant 6 Area Module (Section 3.5.1.5).

Performance monitoring will be conducted by monitoring each individual remediation module separately and by assessing the impact of individual modules on the total remediation system. Performance monitoring will be an expansion of the existing DMEPP (DOE 1993c) concept that is currently in place for the South Plume Module. In effect, the DMEPP strategy and technical approach will be expanded to encompass each of the new groundwater extraction and injection modules that will be brought on line over the life of the remedy.

A water-level monitoring program which encompasses all of the module areas (presented in Section 3.5.1.6) will be conducted to assess how the individual modules interact with one another to capture contaminants in the aquifer.

Groundwater monitoring to meet compliance-based monitoring obligations is organized into individual activities:

- Private Well Monitoring, Section 3.5.2.1
- RCRA Property Boundary Monitoring, Section 3.5.2.2
- KC-2 Warehouse Monitoring, Section 3.5.2.3

3.5.1 Groundwater Restoration Module Monitoring for 1997 and 1998

During 1997 and 1998, only the existing South Plume wells and the Injection Demonstration wells will be operating. Therefore, groundwater monitoring for remedy performance during 1997 and 1998 will focus on tracking the progress of the Injection Demonstration Module, and the South Plume Module. The performance monitoring will be based on the South Plume monitoring strategy, which has evolved since the system startup in August 1993, as a result of the operational experience with the South Plume extraction system.

3.5.1.1 South Plume Module

The South Plume Module is located in Aquifer Zones 2 and 4 (Figure 3-6). Aquifer Zone 4 is located mostly south of FEMP property. Pumping from this module will also effect the southern portion of Aquifer Zone 2. The aquifer in this area is contaminated with a uranium plume that resulted from infiltration through Paddys Run where contaminants were carried southward and eastward into the aquifer (Figure 3-2). Remediating this off-property uranium plume and preventing it from mixing with a separate non-FEMP plume, located further to the south (Paddys Run Road Site Plume), is a high priority of the Aquifer Restoration Project. As explained in Section 3.3, an administrative boundary has been established between the FEMP and Paddys Run Road Site contaminant plumes. Groundwater monitoring to assess the area of uranium contamination (above 20 μg/l) south of the FEMP administrative boundary, and to determine the impact that pumping from the South Plume Extraction wells has on the Paddys Run Road Site Plume, will continue until the need for action is established and implemented.

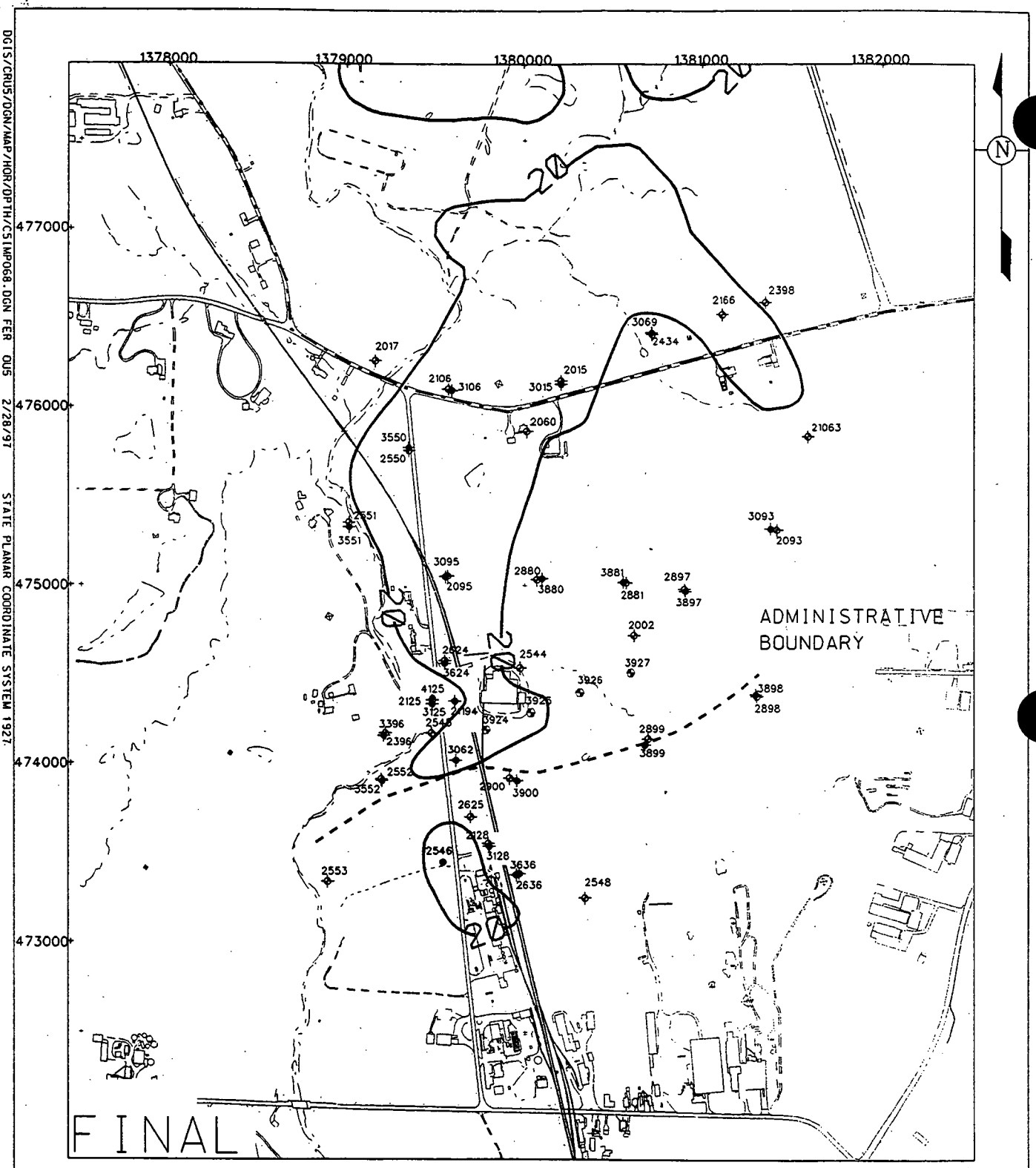
Four groundwater monitoring activities will be conducted during 1997 and 1998 in the South Plume Module area to:

- Document the amount of uranium that is being removed from the aquifer through the extraction wells and determine the efficiency of the extraction wells in removing uranium from the aquifer (Activity 1)
- Document the effectiveness of the pumping in maintaining a hydraulic barrier that limits the further southern migration of the uranium plume and document the area of uranium contamination (above 20 μg/L) south of the administrative boundary (Activity 2)
- Begin to document how other FRL constituent concentrations within the uranium plume are being reduced by the pumping effort. Monitoring the concentration of other FRL constituents in the uranium plume north of the administrative boundary (defined in Section 3.3) currently is not performed in the DMEPP (Activity 3)
- Document the degree to which the Paddys Run Road Site Plume is being affected by the operation of the South Plume System (Activity 4).

Groundwater monitoring for the existing system is currently conducted according to the South Plume Groundwater Recovery System Design, Monitoring, and Evaluation Program Plan (DMEPP)(DOE 1993c) as amended in subsequent South Plume removal action design, monitoring, evaluation program plan system evaluation reports. This program plan has proven successful at the FEMP in monitoring the uranium plume so the monitoring strategies and data evaluation processes described in this plan will be expanded and used during the active aquifer restoration, not only for the South Plume but for the other restoration modules as well.

During 1997 and 1998, 57 existing monitoring wells will continue to be monitored in the South Plume area. Data collected from many of the wells will be used to address more than one monitoring objective. The wells that will be monitored, frequency of sampling, and the corresponding activity for which the monitoring is being conducted are presented in Table 3-3. During 1997 and 1998, as is currently done in the DMEPP, uranium will continue to be monitored monthly in the four extraction wells (Activity 1, Table 3-3).

Currently water samples are collected quarterly from 57 monitoring wells and analyzed for total uranium. These same 57 wells will continue to be sampled in 1997 and 1998 for the IEMP. A list of the 57 wells that will be sampled is presented in Table 3-3 under Activity 2. The locations of the 57 monitoring wells are shown in Figure 3-7. Eight of these 57 monitoring wells (Wells 2881, 3881,



LEGEND:

- FEMP BOUNDARY
- 2900 TYPE 2 MONITORING WELL
- 3900 TYPE 3 MONITORING WELL
- 3926 EXTRACTION WELL
- 20 ISOCONCENTRATION CONTOUR (μg/L)

BASED ON 1993 SNAPSHOT DATA

SCALE

800 400 0 800 FEET

FIGURE 3-7. SOUTH PLUME MODULE PERFORMANCE MONITORING AND EXTRACTION WELLS, ACTIVITY 2

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TABLE 3-3

SOUTH PLUME MODULE

		Sampling Frequency			
		Monitor Uranium in Extraction Wells	Monitor Uranium Across Module Area	Monitor Other Target FRL Constituents Across Module Area[b]	Monitor PRRS Constituents
Well No.	Well ID	Activity 1	Activity 2	Activity 3	Activity 4
1	2002		Quarterly		
2	2015		Quarterly		
3	2017		Quarterly		
4	2060		Quarterly		
5	2093		Annually	Quarterly	
6	2095		Quarterly	Quarterly	
7	2106[a]		Quarterly		
8	2125		Quarterly	Quarterly	
9	2128		Quarterly		Quarterly
10	2166		Quarterly		
11	2396		Quarterly		
12	2398[a]		Quarterly		
13	2434[a]		Quarterly		
14	2544		Quarterly		
15	2545		Quarterly		
16	2546		Quarterly		
17	2548		Quarterly		Quarterly
18	2550		Quarterly		
19	2551		Quarterly	Quarterly	
20	2552		Quarterly	Quarterly	
21	2553		Quarterly		
22	2624		Quarterly	Quarterly	
23	2625		Quarterly		Quarterly
24	2636		Quarterly		Quarterly
25	2880		Quarterly	Quarterly	
26	2881		Annually	Quarterly	
27	2897		Annually	Quarterly	

TABLE 3-3
(Continued)

		Sampling Frequency			
		Monitor Uranium in Extraction Wells	Monitor Uranium Across Module Area	Monitor Other Target FRL Constituents Across Module Area[b]	Monitor PRRS Constituents
28	2898		Annually	Quarterly	Quarterly
29	2899		Quarterly	Quarterly	Quarterly
30	2900		Quarterly	Quarterly	Quarterly
31	3015		Quarterly		
32	3062		Quarterly	Quarterly	
33	3069[a]		Quarterly		
34	3093		Annually	Quarterly	
35	3095		Quarterly	Quarterly	
36	3106[a]		Quarterly		
37	3125		Quarterly	Quarterly	
38	3128		Quarterly		Quarterly
39	3396		Quarterly		
40	3550		Quarterly		
41	3551		Quarterly	Quarterly	
42	3552		Quarterly	Quarterly	
43	3624		Quarterly	Quarterly	
44	3636		Quarterly		Quarterly
45	3880		Quarterly	Quarterly	
46	3881		Annually	Quarterly	
47	3897		Annually	Quarterly	
48	3898		Annually	Quarterly	Quarterly
49	3899		Quarterly	Quarterly	Quarterly
50	3900		Quarterly	Quarterly	Quarterly
51	3924	Monthly	Quarterly		
52	3925	Monthly	Quarterly		
53	3926	Monthly	Quarterly		
54	3927	Monthly	Quarterly		
55	4125		Quarterly		

TABLE 3-3
(Continued)

		Sampling Frequency			
		Monitor Uranium in Extraction Wells	Monitor Uranium Across Module Area	Monitor Other Target FRL Constituents Across Module Area[b]	Monitor PRRS Constituents
56	21063		Quarterly		
57	21194		Quarterly		

[a]These wells are sampled under the RCRA Boundary Monitoring Program. The data are also used for the South Plume Module.
[b]While samples are collected quarterly, some constituents are only analyzed annually, per the list of constituents that will be analyzed in the South Plume monitoring wells for Activity 3.

2897, 3897, 2093, 3093, 2898, and 3898) north and east of the current extraction system historically have shown uranium concentrations well below the uranium FRL, with no significant increasing trends. The IEMP proposes that these wells be sampled annually for uranium instead of quarterly.

Beginning in 1997 with the start of the IEMP, an additional monitoring activity will begin that will document how the concentration of other FRL constituents within the uranium plume are being reduced by the restoration effort. Groundwater samples will be collected from 25 of the 57 wells that are being sampled for uranium and analyzed for 31 constituents other than uranium. The wells that will be sampled are listed in Table 3-3 under Activity 3. The locations of the 25 wells are shown in Figure 3-8. The 31 constituents (listed below) are those which have been categorized as >MP, <MP, or >N in Zones 2 and/or 4. Section 3.4.2.3 and Appendix A provide additional information on the parameter selection process. The >MP constituents will be analyzed quarterly and the 19 >N, and 6 <MP constituents will be analyzed annually.

LIST OF CONSTITUENTS THAT WILL BE ANALYZED IN THE SOUTH PLUME MONITORING WELLS FOR ACTIVITY 3

Constituents Categorized as >MP Shown in **Bold** are Analyzed Quarterly
Other Constituents are Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	**Neptunium-237**	Alpha-Chlordane
Nitrate/Nitrite	Arsenic	Radium-226	Bromodichloromethane
	Barium	**Strontium-90**	Carbon Disulfide
	Beryllium	Technetium-99	1,1-Dichloroethene
	Boron	Thorium-228	**1,2-Dichloroethane**
	Cadmium	Thorium-232	Trichloroethene
	Total Chromium		Vinyl Chloride
	Cobalt		
	Lead		
	Manganese		
	Mercury		
	Nickel		
	Selenium		
	Silver		
	Vanadium		
	Zinc		

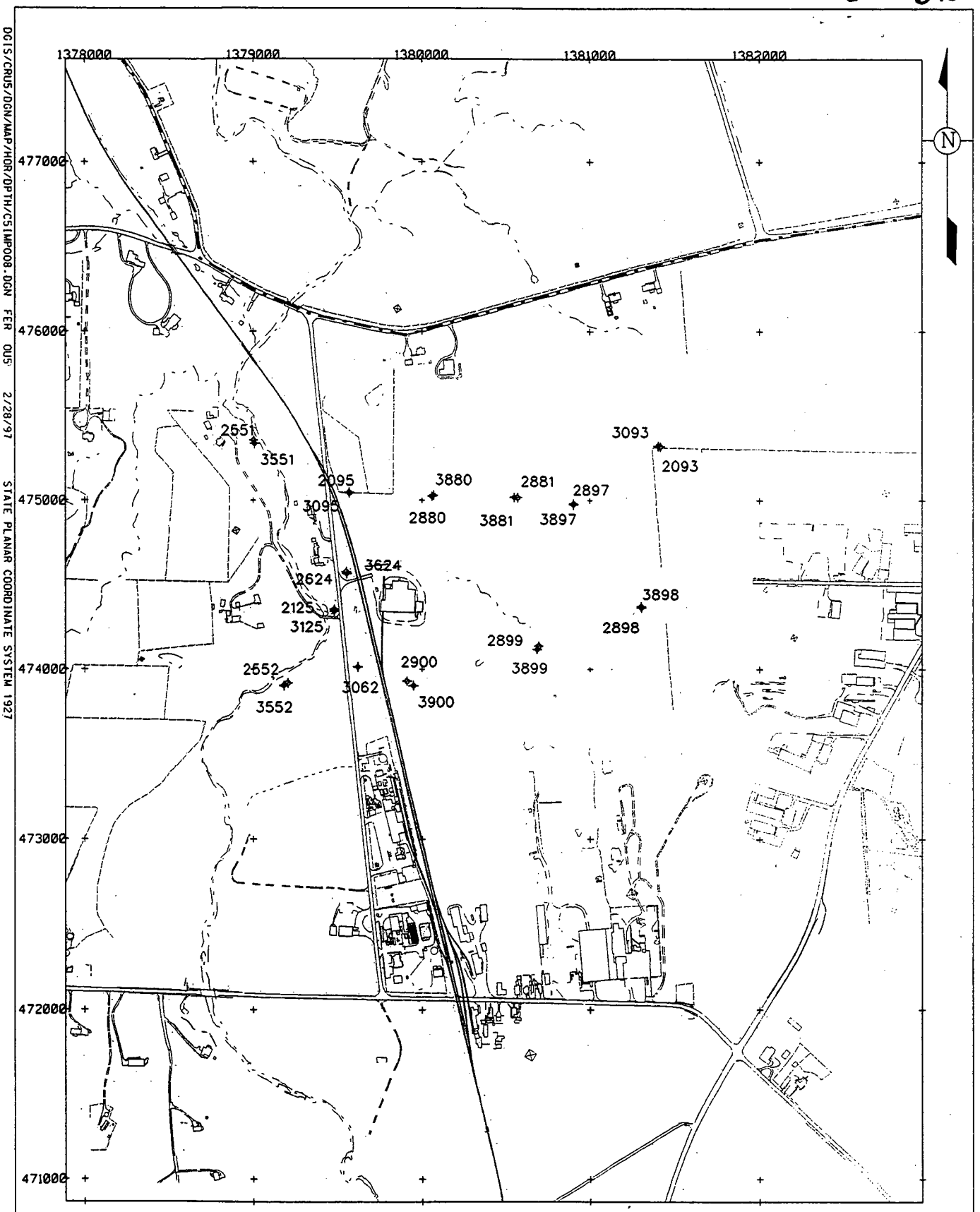


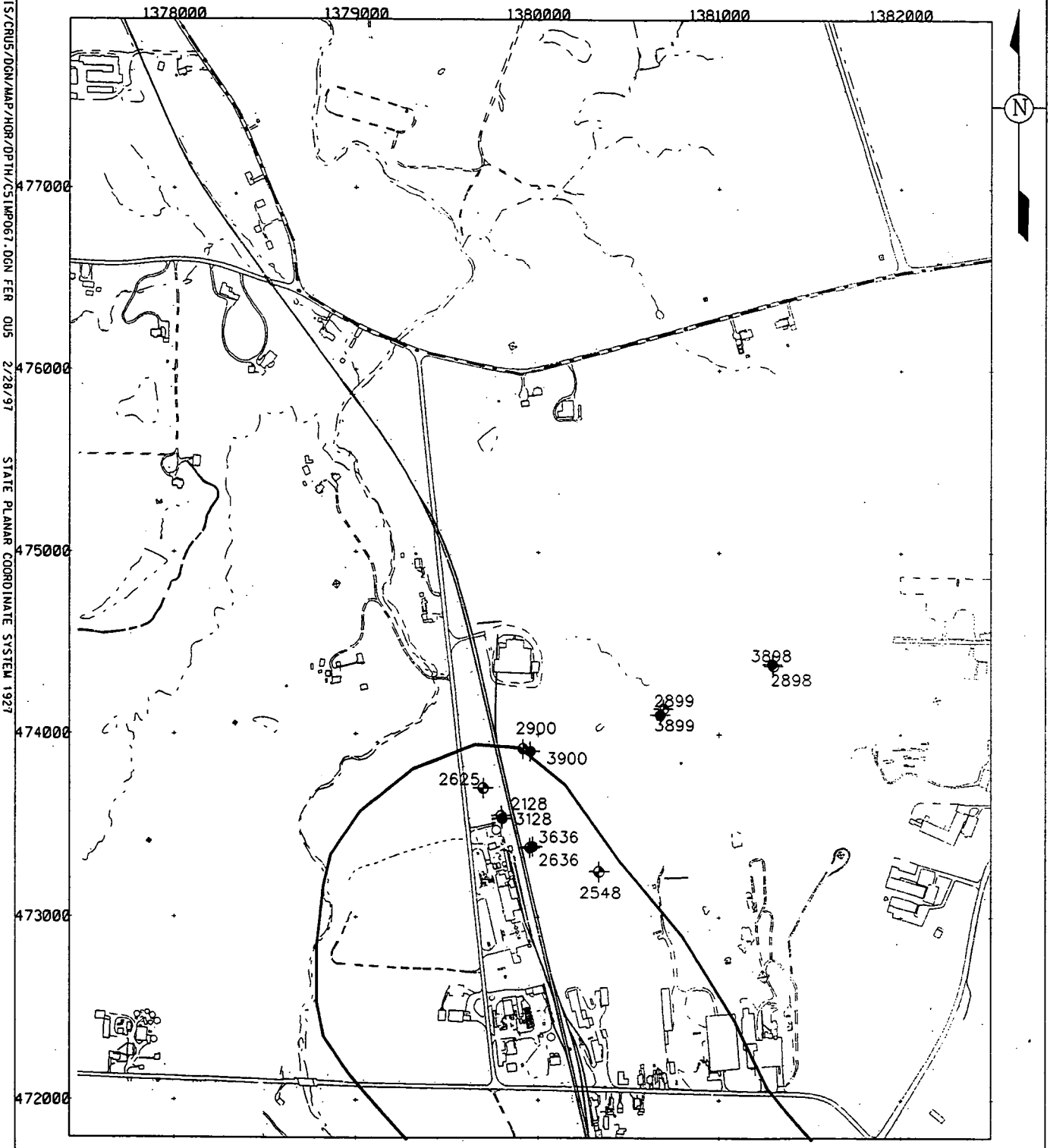
FIGURE 3-8. SOUTH PLUME MODULE PERFORMANCE MONITORING WELLS, ACTIVITY 3

The well locations shown in Figure 3-8 were selected to provide good areal coverage around the existing South Plume extraction wells. These locations provide a line of monitoring wells north and south of the existing South Plume extraction wells. The intent of this monitoring is to determine the effect the pumping is having on these constituents, and to better define which of the constituents need to be monitored for the duration of the aquifer restoration.

As discussed in Appendix A, Groundwater Monitoring Parameter Selection, several of these constituents have been categorized as having FRL exceedances in the aquifer. Some of the FRLs were based on aquifer background values, which could be overly conservative. A formal Operable Unit 5 activity identified in the Operable Unit 5 Remedial Design Work Plan, the Restoration Verification Sampling (DOE 1996b), will be conducted to better define how these FRL exceedances fit into the aquifer restoration effort. After this evaluation is completed, a determination will be made as to whether or not this sampling effort needs to be modified.

The South Plume Module will continue to pump groundwater from the aquifer immediately north of the Paddys Run Road Site; and it remains important to document the influence that the pumping is having on the Paddys Run Road Site plume. Groundwater samples are currently collected quarterly from 12 monitoring wells and analyzed for Paddys Run Road Site constituents as part of the DMEPP. Groundwater samples are also currently collected weekly from seven wells (2128, 2548, 2625, 2636, 2900, 3924 and 3925) and analyzed for arsenic. Arsenic sampling was increased to weekly after it was determined that changes to the flow rates in Wells 3924 and 3925 affected the arsenic concentrations. Enough data has been collected to determine that as long as Wells 3924 and 3925 are pumped at 300 gpm each or less, arsenic concentrations are relatively stable. It is recommended that starting in 1997 sampling for arsenic be returned to a quarterly frequency. If pumping rates or pumping scenarios in the South Plume System are changed after this date, arsenic sampling will be temporarily increased to weekly to ensure that the new pumping rates have not impacted the Paddys Run Road Site. The weekly sampling will be done for a minimum of three weeks after a pumping rate change and if no changes in arsenic concentration trends are observed, sampling will be returned to quarterly. Therefore, the current monitoring to analyze for Paddys Run Road Site constituents quarterly will continue during 1997 and 1998. The 12 wells which are being sampled quarterly in 1996 are listed in Table 3-3 under Activity 4. The locations of the monitoring wells are shown in Figure 3-9. The Paddys Run Road Site

DGIS/CRUS/DGN/MAP/HOR/DPTH/CS1MP067.DGN FER OU5 2/28/97 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

2900 TYPE 2 MONITORING WELL

3900 TYPE 3 MONITORING WELL

PADDYS RUN ROAD SITE PLUME

SCALE

800 400 0 800 FEET

FINAL

FIGURE 3-9. SOUTH PLUME MODULE MONITORING WELLS, ACTIVITY 4

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constituent list used in 1996 will be carried over into 1997 and 1998. The constituent list presented below represents Paddys Run Road Site constituents to be monitored.

LIST OF PADDYS RUN ROAD SITE CONSTITUENTS THAT WILL BE ANALYZED FOR ACTIVITY 4

All Constituents Analyzed Quarterly

General Chemistry	Inorganic	Radionuclide	Organic
Phosphorus	Arsenic Potassium Sodium		Benzene Ethyl Benzene Isopropyl Benzene Toluene Total Xylene

3.5.1.2 South Field Extraction System Monitoring Module

The South Field Extraction System is located in Aquifer Zone 2 (Figure 3-6). The aquifer in this area is contaminated with a uranium plume which resulted from infiltration of contamination through the South Field Inactive Flyash Pile, Paddys Run and the Storm Sewer Outfall Ditch (Figure 3-2). The source of contamination in the glacial overburden and wastes within the South Field inactive and active flyash piles in this area will be remediated through the Soil Characterization and Excavation Program beginning in 1998. Unlike the South Plume area, restoration of the aquifer in this area has not yet begun. It is scheduled to begin after 1998, when nine extraction wells will begin pumping around the planned excavation area and near the Storm Sewer Outfall Ditch (South Field Extraction System).

Groundwater monitoring during 1997 and 1998 will be conducted to:

- Document water quality changes that may be occurring in the aquifer that could impact the design or start-up of the South Field Extraction system
- Verify contamination conditions within the aquifer immediately before the start of pumping.

Twenty-one existing monitoring wells were selected to monitor the South Field Extraction area in 1997 and 1998. The 21 wells are listed below and shown in Figure 3-10.

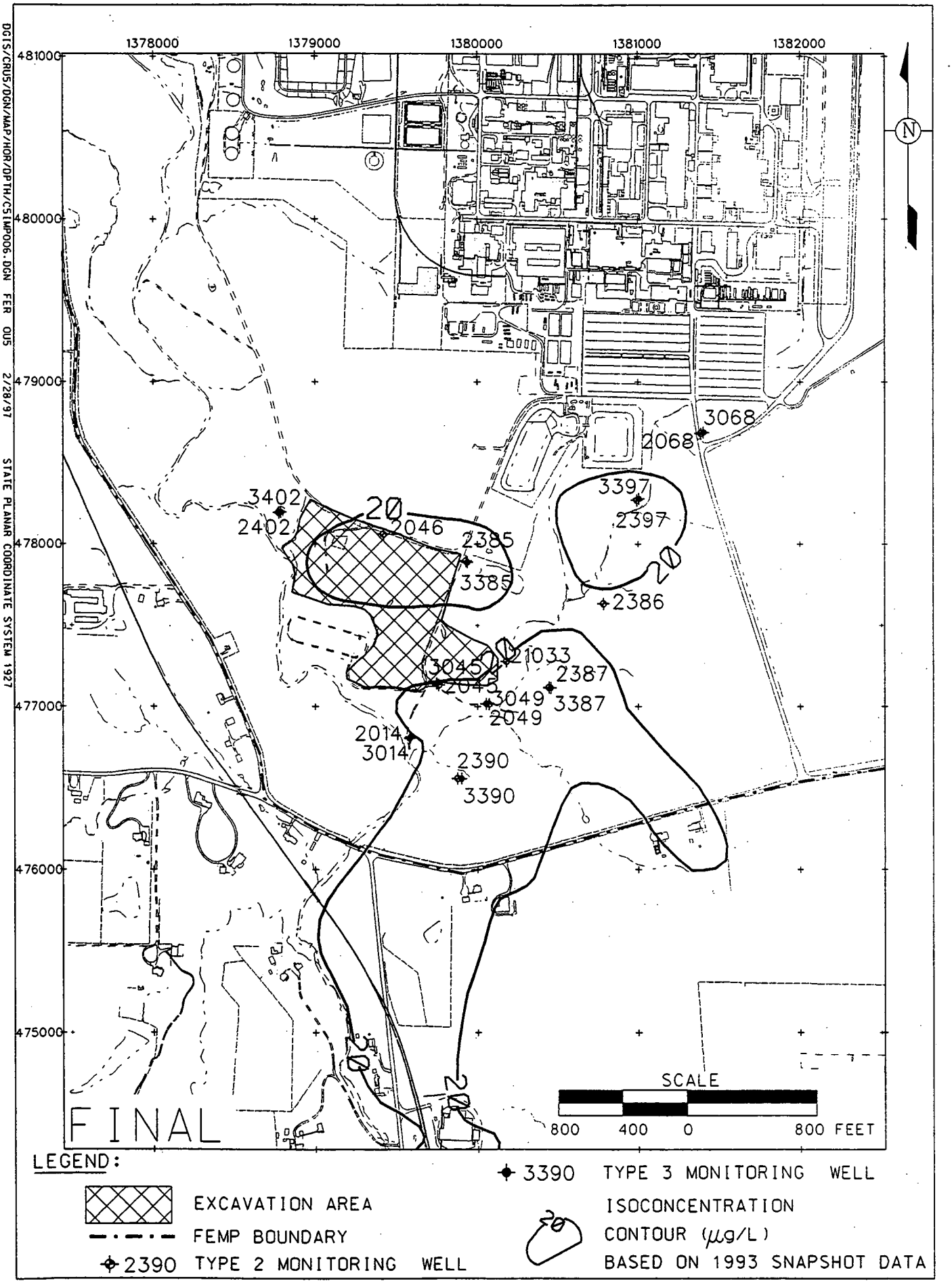

FIGURE 3-10. SOUTH FIELD EXTRACTION SYSTEM MONITORING WELLS

LIST OF SOUTH FIELD EXTRACTION SYSTEM MONITORING WELLS

2014	2045	2046	2049	2068	2385	2386	2387
2390	2397	2402	3014	3045	3049	3068	3385
3387	3390	3397	3402	21033			

These existing monitoring wells are located along the Storm Sewer Outfall Ditch; a few of the wells are located along the northern edge of the excavation area. All 21 wells are located outside or very close to the edge of the surface excavation area. Surface excavation activities will be ongoing in 1997 and 1998, so with few exceptions, existing monitoring wells located in the excavation areas cannot be used for groundwater monitoring. The excavation area is shown in Figure 3-10. Most existing monitoring wells in the excavation areas will need to be plugged and abandoned to make way for excavation activities.

Once the South Field Extraction module becomes operational and the Operable Unit 2 wastes are removed, it is anticipated that additional monitoring wells will need to be installed to help track the restoration. So that new monitoring wells can be installed in the most useful locations, the selection of new locations will be delayed until some operational experience has been obtained. The number and location of these additional monitoring wells will be selected after evaluating the monitoring data collected to that point and comparing the results to groundwater modeling predictions. The number and location of additional monitoring wells (as well as technical justification for each of the proposed monitoring wells) will be described in a work plan (under the IEMP umbrella) which will be submitted to the EPA and OEPA for approval before the wells are installed.

Groundwater monitoring will focus on FRL constituents that have been detected in Zone 2 of the Great Miami Aquifer at concentrations above the established FRL, and FRL constituents that are predicted to migrate from the glacial overburden to the aquifer due to their mobility and persistence (Table 3-2). Section 3.4.2.3 and Appendix A provide additional information on the parameter selection process. Groundwater samples will be collected quarterly and analyzed for the five constituents categorized as >MP in Zone 2 (see Table 3-2). These constituents have been detected in the Great Miami Aquifer at concentrations above the FRL and are mobile and persistent. The five constituents are in bold type in

the list below. A quarterly sampling frequency was selected so that seasonal concentration changes could be monitored. In addition to the quarterly sampling, groundwater samples will be collected annually and analyzed for the 12 constituents categorized as >N and the eight constituents categorized as <MP in Zone 2. A yearly sampling frequency was selected for these constituents because they are less mobile (>N) or not currently present in the aquifer (<MP) above their FRL.

LIST OF CONSTITUENTS WHICH WILL BE ANALYZED IN THE SOUTH FIELD EXTRACTION SYSTEM MONITORING WELLS

Constituents Categorized as >MP Shown in **Bold** are Analyzed Quarterly
Other Constituents are Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	**Neptunium-237**	Alpha-Chlordane
Nitrate/Nitrite	Arsenic	Strontium-90	Bromodichloromethane
	Boron	Technetium-99	Carbon Disulfide
	Cadmium	Thorium-228	1,2 Dichloroethane
	Total Chromium	Thorium-232	Trichloroethene
	Lead	**Total Uranium**	Vinyl Chloride
	Manganese		
	Mercury		
	Nickel		
	Selenium		
	Zinc		

When the South Field extraction wells begin operation, uranium samples will be collected from the nine extraction wells (Wells 31550, 31560, 31561, 31562, 31563, 31564, 31565, 31566, and 31567) to determine flow rates and to manage water treatment flow. A start-up monitoring Project Specific Plan (PSP) will be developed for each new module to define start-up monitoring activities and necessary adjustments in flow rates based on initial in-the-ground field performance. Once the start-up phase has been completed, the extraction wells will be sampled monthly for total uranium to monitor system performance, as is currently done for the South Plume System. This activity will be addressed in the next revision of the IEMP.

3.5.1.3 Injection Demonstration Monitoring Module

The Injection Demonstration Module is located in Aquifer Zone 2 (Figure 3-6). The aquifer in this area is contaminated with a uranium plume that resulted from infiltration of contamination through

Paddys Run and the Storm Sewer Outfall Ditch (Figure 3-2). Restoration of the aquifer in this area has not yet begun. It is scheduled to begin in 1998 when five injection wells will begin injection along the southern FEMP property boundary.

Groundwater monitoring during 1997 and part of 1998 (before injection begins), will be conducted to:

- Document water quality changes that may be occurring in the aquifer that could impact the design or start-up of the Injection Demonstration Module
- Document contamination conditions within the aquifer immediately before the start of injection.

In 1998, after injection has begun, groundwater monitoring will be conducted to determine if injection is causing undesirable spreading of the plume either laterally or vertically.

Nine of the RCRA boundary monitoring system wells (Wells 2106, 3106, 2434, 3069, 2398, 3398, 4398, 2070, and 3070) and five wells from the South Plume monitoring network (2017, 2015, 3015, 2060, and 2166) are located in the same area where the Injection Demonstration Module will be installed (see Section 3.5.2.2). These nine RCRA boundary monitoring wells (details of the South Plume monitoring program are presented in Section 3.5.1.1) and five South Plume monitoring wells will be used to monitor the Injection Demonstration Module area in 1997 and 1998. The total uranium data collected quarterly from these wells will be used to document pre-injection plume conditions in the Injection Demonstration area.

Once the Injection Demonstration Module becomes operational, it is anticipated that additional monitoring wells may need to be installed to help track the injection process. So that new monitoring wells can be installed in the most useful location, the selection of any new locations will be delayed until some operational experience has been obtained.

3.5.1.4 Waste Storage Area Monitoring Module

The Waste Storage Area is located in Aquifer Zone 1 (Figure 3-6) and contains a uranium plume that has been targeted for restoration (Figure 3-2). The Waste Storage Area Module is not scheduled to be operational in 1997 or 1998. The installation of the system will begin after the source which rests above the aquifer has been remediated. Until pumping actually begins in this area, water quality

conditions need to be monitored to document water quality changes that may be occurring in the aquifer which could impact the design and installation of the restoration module. In the waste storage area, groundwater samples will be collected from 14 locations along the downgradient edge of the waste pit excavation area and the 20 μg/L total uranium plume. Monitoring locations are listed below and shown in Figure 3-11.

LIST OF WASTE STORAGE AREA MONITORING WELLS

2008	2009	2027	2032	2033	2034
2648	2649	2821	3009	3027	3032
3034	3821				

Wells 2008, 2027, 3027, 2648, 2821, and 3821 are positioned downgradient from various portions of the waste storage area. Wells 2032, 3032, 2033, 2034, and 3034 were selected for monitoring because they are close to the Operable Unit 4 area. If a release occurs during excavation of the silos, these wells are in a good position to detect it. Finally, wells 2009 and 3009 were selected because they are located in the southern tip of the >20 μg/L uranium plume that is present in the waste storage area.

Water samples will be collected semi-annually from the 14 locations and analyzed for the six constituents which have been characterized as >MP in this area (Zone 1). In addition, samples will be collected annually from the 14 locations and analyzed for the 16 constituents characterized as >N and the seven constituents categorized as <MP in Zone 1 (Table 3-2). Section 3.4.2.3 and Appendix A provide additional information on the parameter selection process. Since no active pumping will be taking place in the area and the restoration module will not be installed for several years, semi-annual monitoring for the >MP constituents should be adequate to monitor conditions. It is anticipated that a year or two before the Waste Storage Area Module becomes operational, the monitoring frequency for the six >MP constituents will be increased to quarterly. The 28 constituents to be monitored in this area are listed below. The <N constituents will be sampled once every five years.

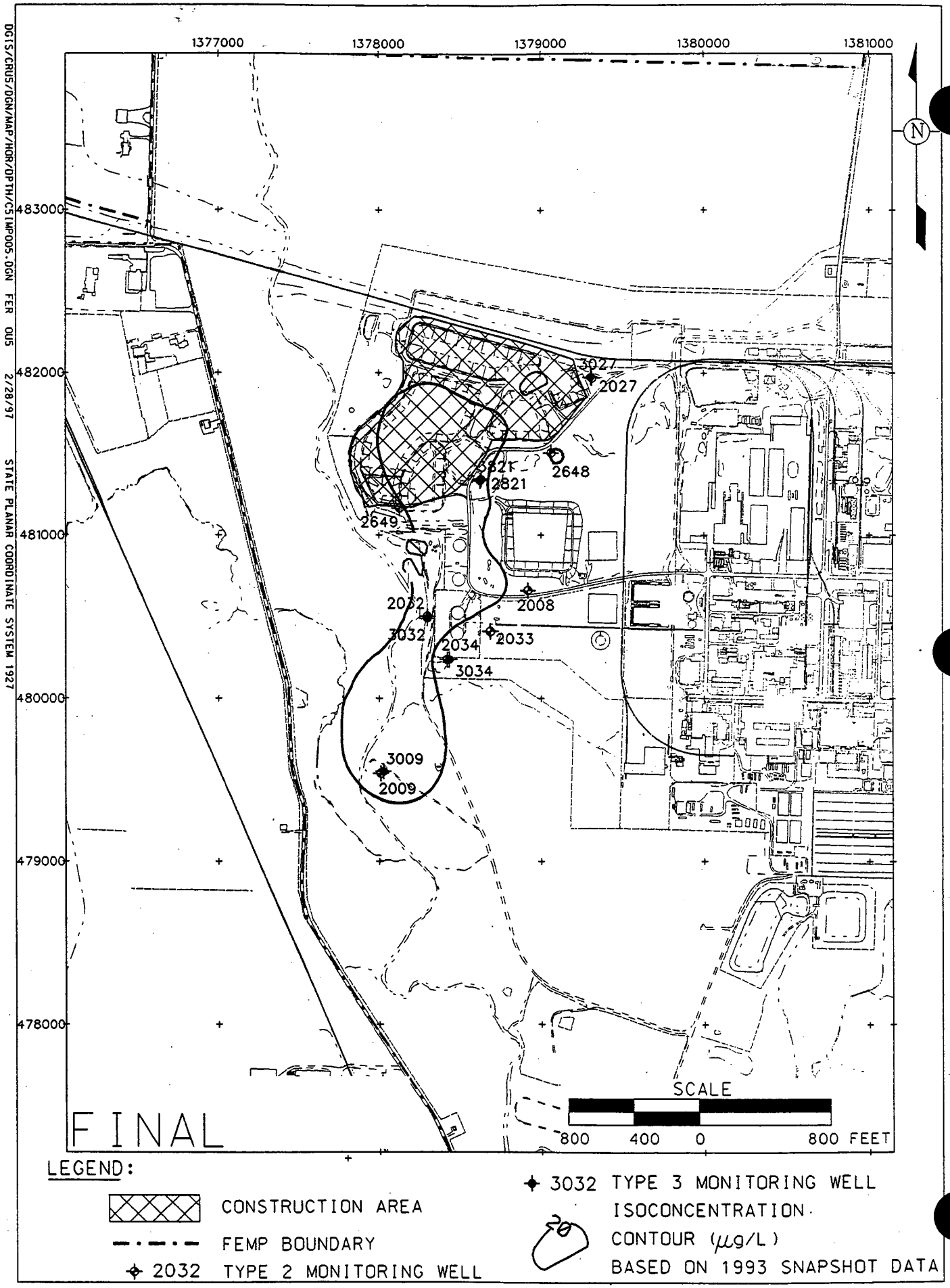

FIGURE 3-11. WASTE STORAGE AREA MONITORING WELLS

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LIST OF CONSTITUENTS WHICH WILL BE ANALYZED IN THE WASTE STORAGE AREA MONITORING WELLS

Constituents Categorized as >MP Shown in **Bold** are Analyzed Semi-Annually
All Other Constituents are Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	Neptunium-237	Alpha-chlordane
Nitrate/Nitrite	Arsenic	**Strontium-90**	Bromodichloromethane
	Beryllium	**Technetium-99**	Carbon Disulfide
	Boron	Thorium-228	1,2 Dichloroethane
	Cadmium	**Total Uranium**	Trichloroethene
	Total Chromium		Vinyl Chloride
	Cobalt		
	Lead		
	Manganese		
	Mercury		
	Molybdenum		
	Nickel		
	Selenium		
	Silver		
	Vanadium		
	Zinc		

3.5.1.5 Plant 6 Area Monitoring Module

The Plant 6 Area is located in Aquifer Zone 3 (Figure 3-6). This area contains a uranium plume that is targeted for restoration (Figure 3-2). The Plant 6 Area Module is not scheduled to be operational in 1997 or 1998. The installation of this system will begin after the source, which rests above the aquifer, has been remediated. Until pumping actually begins in this area, water quality conditions need to be monitored to document water quality changes that may be occurring in the aquifer which could impact the design and installation of the restoration module.

In the Plant 6 area, water samples will be collected in 1997 and 1998 annually from 4 locations which encircle the area where the Plant 6 extraction wells will be installed. Monitoring locations are listed below and shown in Figure 3-12.

LIST OF PLANT 6 AREA MONITORING WELLS

2054	2118	2389	3054

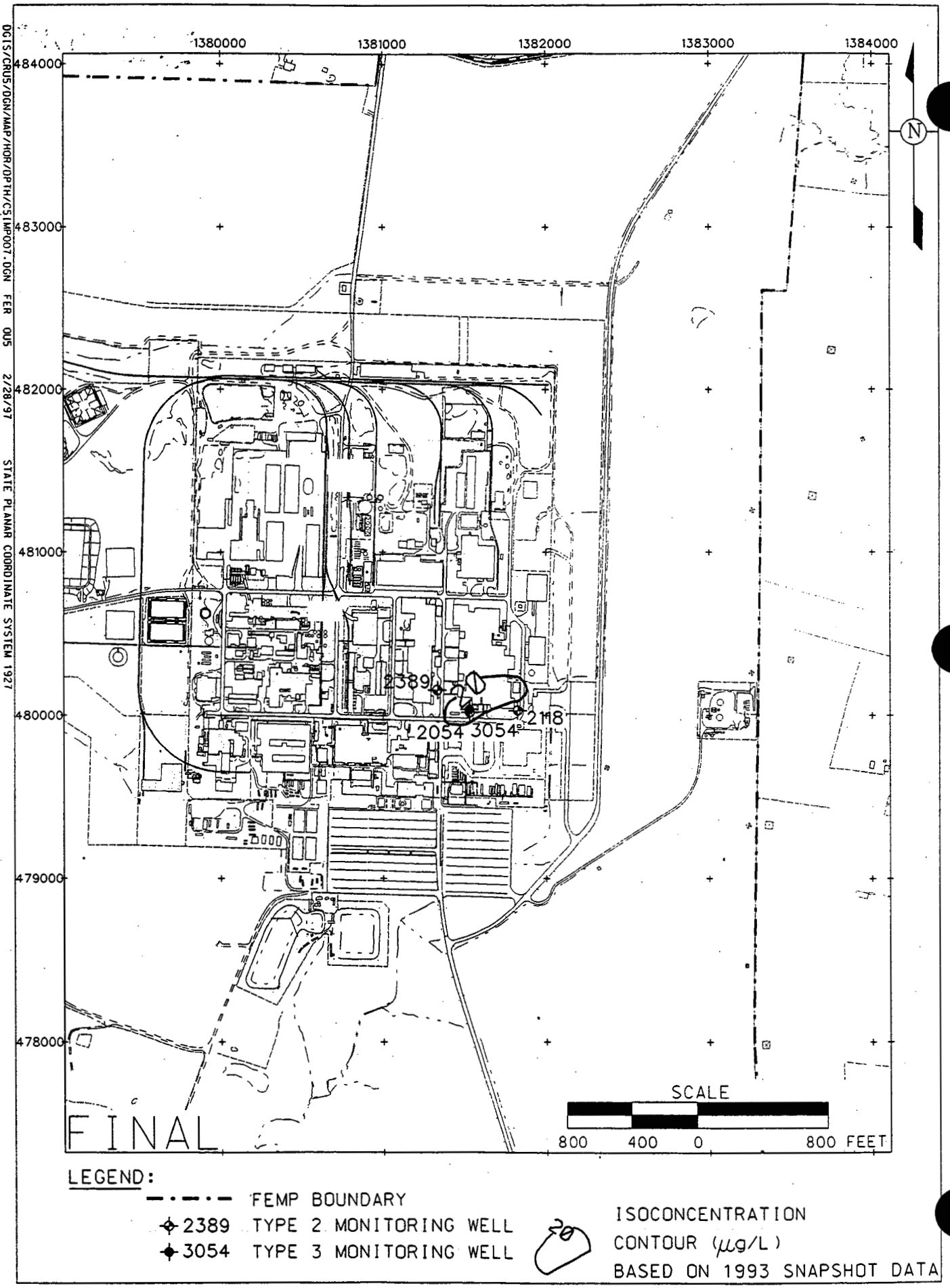

FIGURE 3-12. PLANT 6 AREA MONITORING WELLS

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Water samples will be collected semi-annually from the four locations and analyzed for the six constituents which have been characterized as >MP in Zone 3. In addition, samples will be collected annually from the four locations and analyzed for the 14 constituents characterized as >N and the seven constituents categorized as <MP in Zone 3 (Table 3-2). Section 3.4.2.3 and Appendix A provide additional information on the parameter selection process. Since no active pumping will be taking place in the area and the restoration module will not be installed for several years, semi-annual monitoring should be adequate to monitor the >MP constituents. It is anticipated that a year or two before the Plant 6 Area Module becomes operational, the frequency of the six >MP analyses will be increased to quarterly. The 27 constituents to be monitored in this area are listed below.

LIST OF CONSTITUENTS WHICH WILL BE SAMPLED IN THE PLANT 6 AREA MONITORING WELLS

Constituents Categorized as >MP Shown in **Bold** are Analyzed Semi-Annually
All Other Constituents Analyzed Annually

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	Neptunium-237	Alpha-chlordane
Nitrate/Nitrite	Arsenic	**Strontium-90**	Bromodichloromethane
	Beryllium	Technetium-99	Carbon Disulfide
	Boron	Thorium-228	1,2-Dichloroethane
	Cadmium	**Total Uranium**	Vinyl Chloride
	Total Chromium		
	Cobalt		
	Lead		
	Manganese		
	Mercury		
	Molybdenum		
	Nickel		
	Selenium		
	Vanadium		
	Zinc		

3.5.1.6 Routine Water-Level Monitoring Program

The location of the water-table in the Great Miami Aquifer and the water-table response to seasonal fluctuations has been well characterized in the Operable Unit 5 Remedial Investigation Report. Water-level data have been collected routinely for the FEMP since 1988. Water-level data are used to determine groundwater flow and direction. This is accomplished by preparing hydrographs and maps of the water-level surface in the Great Miami Aquifer. During the remediation phase of the CERCLA process, water levels will be monitored across the site to assess the effects of extraction and injection operations on flow conditions within the Great Miami Aquifer.

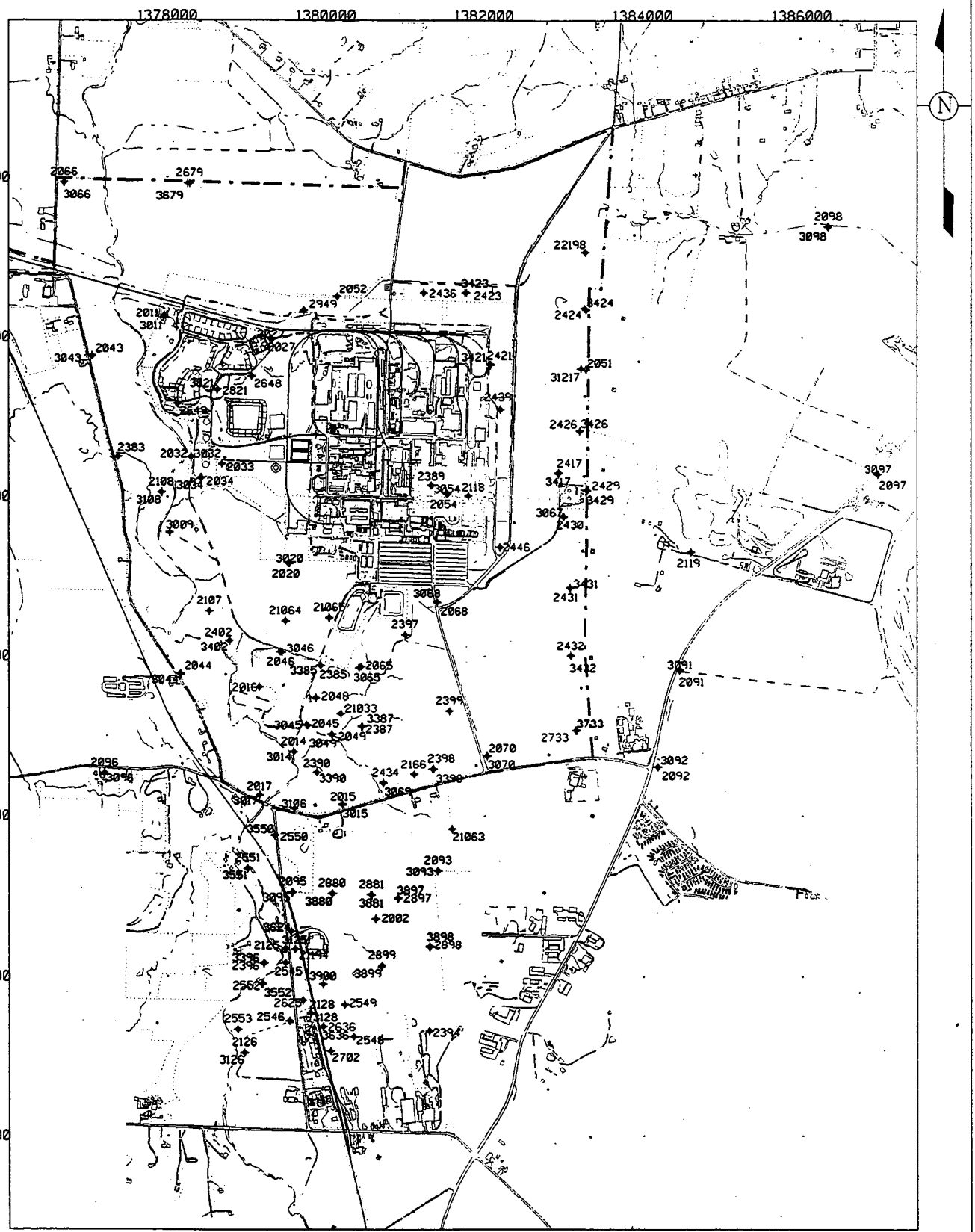
The Great Miami Aquifer is an unconfined aquifer and responds rapidly to recharge events. Data collected at the FEMP and reported in the Operable Unit 5 Remedial Investigation Report documents that no strong vertical gradients exist in the area of the FEMP. However, with the implementation of the remedy and the stresses placed on the aquifer by the additional pumping, water level monitoring during the remediation will use both Type 2 wells which are screened at the water table surface as well as Type 3 wells which are screened deeper within the aquifer.

The monitoring wells which were selected for water level monitoring in 1997 and 1998 are shown in Figure 3-13 and listed below.

LIST OF GROUNDWATER ELEVATION MONITORING WELLS

2002	2095	2423	2821	3049	3421
2009	2096	2424	2880	3054	3423
2011	2097	2426	2881	3065	3424
2014	2098	2429	2897	3066	3429
2015	2106	2430	2898	3067	3431
2016	2108	2431	2899	3068	3432
2017	2118	2432	2900	3069	3550
2020	2119	2434	2949	3070	3551
2027	2125	2436	21033	3091	3552
2032	2126	2446	21063	3092	3624
2033	2128	2544	21064	3093	3636
2034	2166	2545	21065	3095	3679
2043	2383	2546	21194	3096	3733
2044	2384	2548	22198	3097	3821
2045	2385	2549	3009	3098	3880
2046	2386	2550	3011	3106	3881
2049	2387	2551	3014	3108	3897
2051	2389	2552	3015	3125	3898
2052	2390	2553	3017	3126	3899
2054	2394	2624	3020	3128	3900
2065	2396	2625	3027	3385	31217
2066	2398	2636	3032	3387	
2068	2399	2648	3034	3390	
2070	2400	2649	3043	3396	
2091	2402	2679	3044	3398	
2092	2417	2702	3045	3402	
2093	2421	2733	3046	3417	

DGIS/SCRW2/DGN/MAP/HOR/OPTH/C5IMPELV.DGN FER OU5 2/28/97 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

✦ 2046 TYPE 2 MONITORING WELL

✦ 3046 TYPE 3 MONITORING WELL

SCALE

1800 900 0 1800 FEET

FINAL

FIGURE 3-13. GROUNDWATER ELEVATION MONITORING WELLS

These locations were selected to provide areal coverage across all areas of the FEMP site with an increasing density of wells in areas surrounding active aquifer restoration modules. Groundwater elevations will be measured quarterly in these wells, following approval of the IEMP, to provide data for construction of water table elevation maps. These maps will be used to determine the location of flow divides, capture zones, and stagnation zones created by the operation of remediation modules. Additional monitoring wells and more frequent measurement intervals may be used near aquifer remediation modules as they become operational and as sensitive capture zones or stagnation zones are identified, or if unpredicted fluctuations in contaminant concentrations are observed.

A continuous model performance evaluation process is critical to ensure that model predictions are accurate and reliable. Therefore, water table maps with capture zones, flow divides and stagnation zones will be produced from the collected field data and will be compared to annual model predictions to determine how well the groundwater model is predicting actual aquifer responses during remediation. If the model predictions of groundwater elevations consistently (two or more consecutive quarters) do not match the observed groundwater elevations to within five feet (one-half the approximate seasonal variation in groundwater elevations as defined by historical data) for at least two thirds of the monitoring wells within the capture zone of the remedial system, the need for model recalibration will be evaluated.

3.5.2 Compliance Based Monitoring

3.5.2.1 Private Well Monitoring

The oldest monitoring effort (still ongoing) is the Radiological Environmental Monitoring (private well) Program. As explained below, the existing formal program will be modified upon approval of the IEMP.

Sampling of private wells began on a routine basis in 1982, but the program was not formalized until 1984. In the past, at a property owner's request, any drinking water well near the site would be sampled for uranium. The one-time results were reported to the well owner. If any "special request" sample showed a questionable or significant total uranium concentration, or if the well was believed to be representative of an area based on its location, the property owner had the option to participate in the routine sampling program. This program grew to 33 wells in 1996. Wells were either sampled

monthly or quarterly, depending upon the location. Sampling results were reported yearly in the Site Environmental Report.

When the program was initiated, a public water supply to the area did not exist. If the total uranium concentration of the water in the private well was above the upper limit of what was considered background for uranium, the private well user was offered bottled drinking water to preclude the use of affected wells for a drinking water source. In 1996, with the arrival of the DOE-funded public water supply, the need for the affected wells and bottled water was eliminated, ending the need for the sampling program. DOE will continue to sample wells that are not yet hooked up to the public water supply or equipped with a back-flow preventor until the IEMP is approved. Once the IEMP is approved, the program will be reduced to the three wells shown in Figure 3-14. Continuing the historical database at a few private well locations is beneficial for facilitating discussions with area stakeholders on the progress of the aquifer restoration. The three locations are located immediately downgradient of the FEMP property boundary. Two of the wells are located within the 20 μg/L total uranium plume. The other well is used periodically for irrigation. One of three locations is also the location where the off-property uranium contamination problem in the Great Miami Aquifer was first detected in the early 1980s. These three wells will be sampled quarterly for total uranium.

3.5.2.2 RCRA Property Boundary Monitoring

The focus of the current RCRA groundwater monitoring program is to detect and assess potential changes in groundwater conditions at the Fernald property boundary. This is accomplished through quarterly sampling of 33 wells at three different depths (Type 2, Type 3, and Type 4 wells) located along the downgradient property boundary for approximately 90 site-specific radiological and nonradiological constituents. An annual report of the results is issued in March of each year.

The RCRA groundwater monitoring program was first initiated near Waste Pit 4 in 1985 to comply with federal and state RCRA hazardous waste regulations to determine if the hazardous waste unit was impacting groundwater. By 1988, monitoring results from the program indicated that Waste Pit 4 was impacting the groundwater. In 1991, additional waste management units at the Fernald site were identified as requiring groundwater monitoring under RCRA regulations. It was necessary to develop a monitoring strategy to integrate CERCLA and RCRA monitoring activities in order to eliminate redundancies. For this reason, the DOE proposed an alternate monitoring approach which was

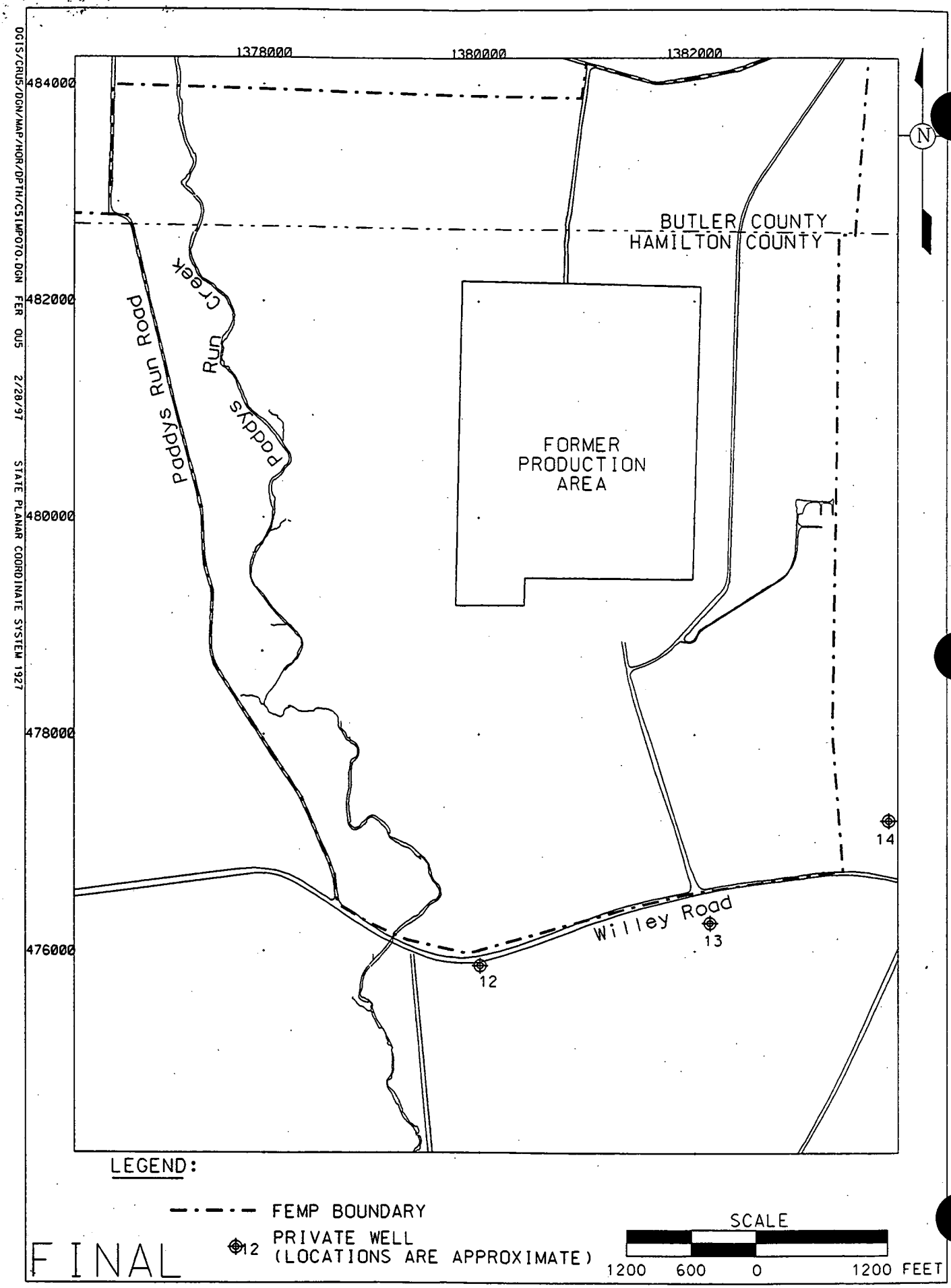


FIGURE 3-14. PRIVATE WELL MONITORING LOCATIONS

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accepted by the State of Ohio in September 1993. The alternate monitoring approach consisted of groundwater contaminant characterization under CERCLA, and groundwater monitoring at the downgradient facility boundary under RCRA to detect and assess potential changes in groundwater conditions at the Fernald property boundary while the CERCLA characterization efforts were underway. The list of 33 wells and analytical parameters currently analyzed under the program were specified in the FEMP's September 1993, OEPA Director's Findings and Orders (DFO) compliance agreement and accompanying Project-Specific Plan for the Routine Groundwater Monitoring Program Along the Downgradient Boundary of the FEMP, Revision 1.

The 1996 results from the RCRA monitoring program continue to confirm that, other than the contamination comprising the South Plume (currently addressed with the South Plume Removal Action Wells), there are no concentrations of contaminants detected through the program that trigger the need for action ahead of the final groundwater remedy. This finding is consistent with the findings for the previous years (1993, 1994, and 1995).

Monitoring at the downgradient property boundary during the initial two-year phase of the IEMP will document if any contamination greater than the remediation FRLs is leaving the property boundary and entering the public domain. The 33 property boundary monitoring wells which will be sampled in 1997 and 1998 are shown in Figure 3-15 and listed below.

LIST OF RCRA PROPERTY BOUNDARY MONITORING WELLS

2051	2070	2106	2398	2417	2424	2426
2429	2430	2431	2432	2434	2733	3067
3069	3070	3106	3398	3417	3424	3426
3429	3431	3432	3733	4067	4398	4424
4426	4432	31217	41217	22198		

The parameter list currently defined in the DFO's decision making will be modified beginning in 1997 to address final remediation level constituents. The proposed new constituent list for this monitoring activity is presented below. Section 3.4.2.3 and Appendix A provide additional information on the parameter selection process. Monitoring will focus on the FRL constituents that have had an FRL exceedance in the aquifer. Those constituents that have not yet caused an FRL exceedance will be

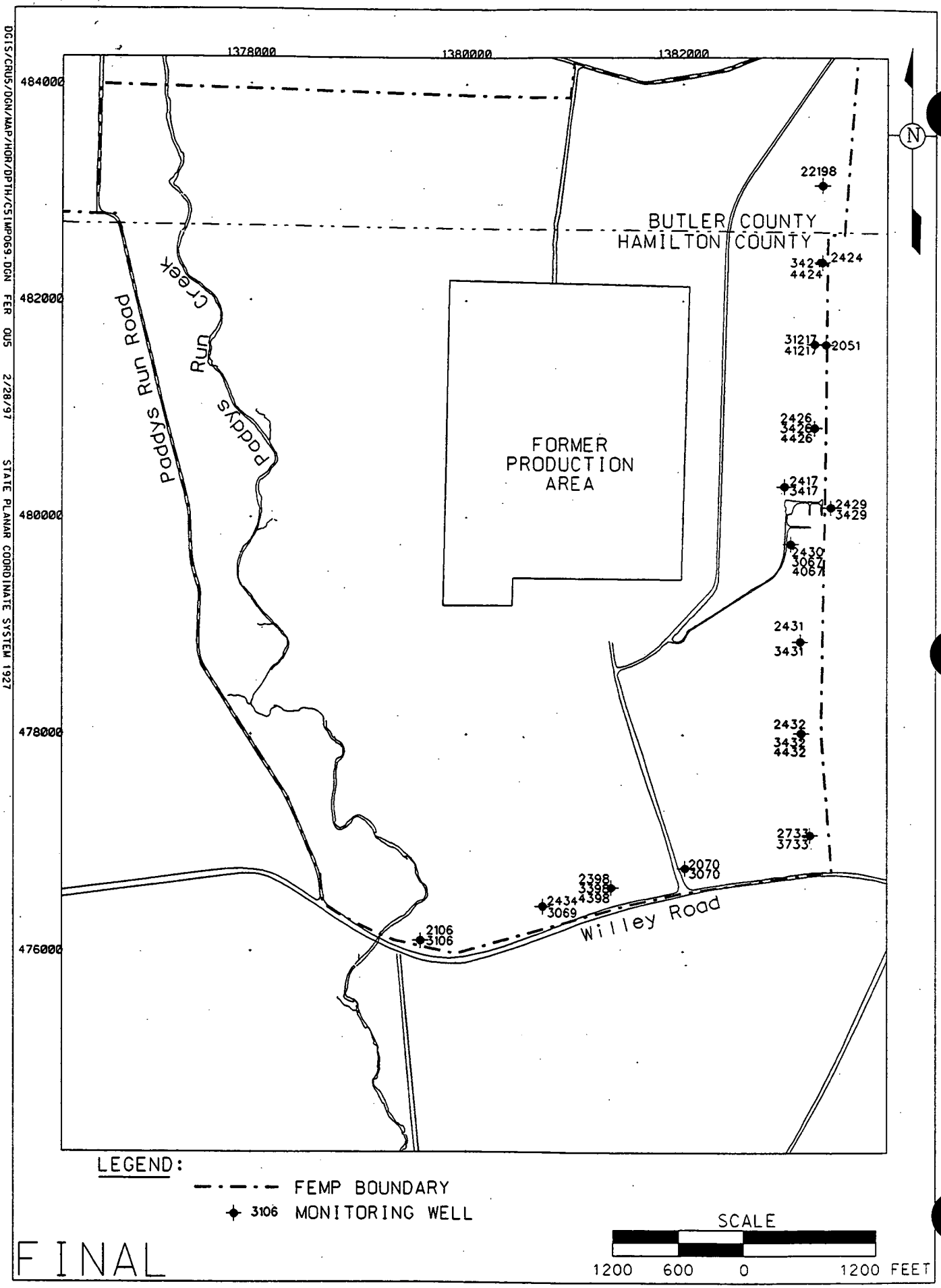


FIGURE 3-15. RCRA PROPERTY BOUNDARY MONITORING WELLS

monitored upgradient of the boundary wells. Should a new exceedance be documented, the constituents will be added to the RCRA Boundary Monitoring Program. Quarterly sampling will be conducted for the nine constituents categorized as >MP in Aquifer Zones 0, 1, 2, or 3 and the 18 constituents categorized as >N in Aquifer Zones 0, 1, 2, or 3. The <MP and <N constituents will be monitored once every five years. Upon approval of the IEMP by the EPA and the OEPA, the IEMP will replace the Project-Specific Plan for the Routine Groundwater Monitoring Program Along the Downgradient Boundary of the FEMP, Revision 1.

LIST OF CONSTITUENTS WHICH WILL BE ANALYZED QUARTERLY IN THE RCRA BOUNDARY MONITORING WELLS

General Chemistry	Inorganic	Radionuclide	Organic
Fluoride	Antimony	Neptunium-237	Benzene
Nitrate/Nitrite	Arsenic	Strontium-90	Carbon Disulfide
	Beryllium	Technetium-99	Trichloroethene
	Boron	Thorium-228	
	Cadmium	Thorium-232	
	Total Chromium	Total Uranium	
	Cobalt		
	Lead		
	Manganese		
	Mercury		
	Molybdenum		
	Nickel		
	Selenium		
	Silver		
	Vanadium		
	Zinc		

Beginning in 1998, operation of the South Field Extraction System and Injection Demonstration Module will alter groundwater flow conditions along the eastern FEMP property boundary. The boundary monitoring program will continue in 1998, for the purpose of verifying that the flow conditions have changed as predicted. It is anticipated that a recommendation may be made to alter the boundary monitoring strategy with the first revision of the IEMP in 1999.

3.5.2.3 KC-2 Warehouse Monitoring

The KC-2 Warehouse Monitoring Program was initiated in July of 1993 (DOE 1992). The controlling document was the Abandonment and Plugging of the KC-2 Warehouse/Well No. 67 Groundwater Sampling Work Plan Addendum. This monitoring program will continue as part of the IEMP up to the

point in time that the KC-2 warehouse is decontaminated and demolished, and the well is plugged and abandoned. Figure 3-16 shows where this well is located. The original scope of the monitoring effort was to sample Well No. 67 on a semi-annual basis for uranium and HSL metals. Well No. 67 is an old well located in the KC-2 Warehouse. The bottom of the well contains contaminated sediment. Monitoring is conducted to document water quality conditions in the well until the well can be plugged and abandoned. Sampling of Well No. 67 is currently taking place annually. Rather than modifying the sampling list based on characterization by zone (Table 3-2), the well will continue to be sampled annually in August of each year for uranium and the same metals that have been sampled for in the past. These are presented below.

LIST OF CONSTITUENTS WHICH WILL BE SAMPLED ANNUALLY IN THE KC-2 WAREHOUSE MONITORING WELL
Constituents Analyzed Annually

General Chemistry	Inorganics		Radionuclides
Cyanide	Antimony	Magnesium	Total Uranium
	Aluminum	Manganese	
	Arsenic	Mercury	
	Barium	Nickel	
	Beryllium	Potassium	
	Cadmium	Selenium	
	Calcium	Silver	
	Total Chromium	Sodium	
	Cobalt	Thallium	
	Copper	Vanadium	
	Iron	Zinc	
	Lead		

3.6 MEDIA-SPECIFIC PLAN FOR GROUNDWATER MONITORING IN 1997 AND 1998

This section serves as the media-specific plan for implementation of the sampling, analysis and data management activities associated with the sitewide environmental groundwater monitoring program. The design of the program is presented in Section 3.5. The sampling, analytical, and data management activities described in this media-specific plan have been designed to provide groundwater data of sufficient quality to meet the program expectations as defined in Section 3.1. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the FEMP Sitewide CERCLA Quality Assurance Project Plan (SCQ).

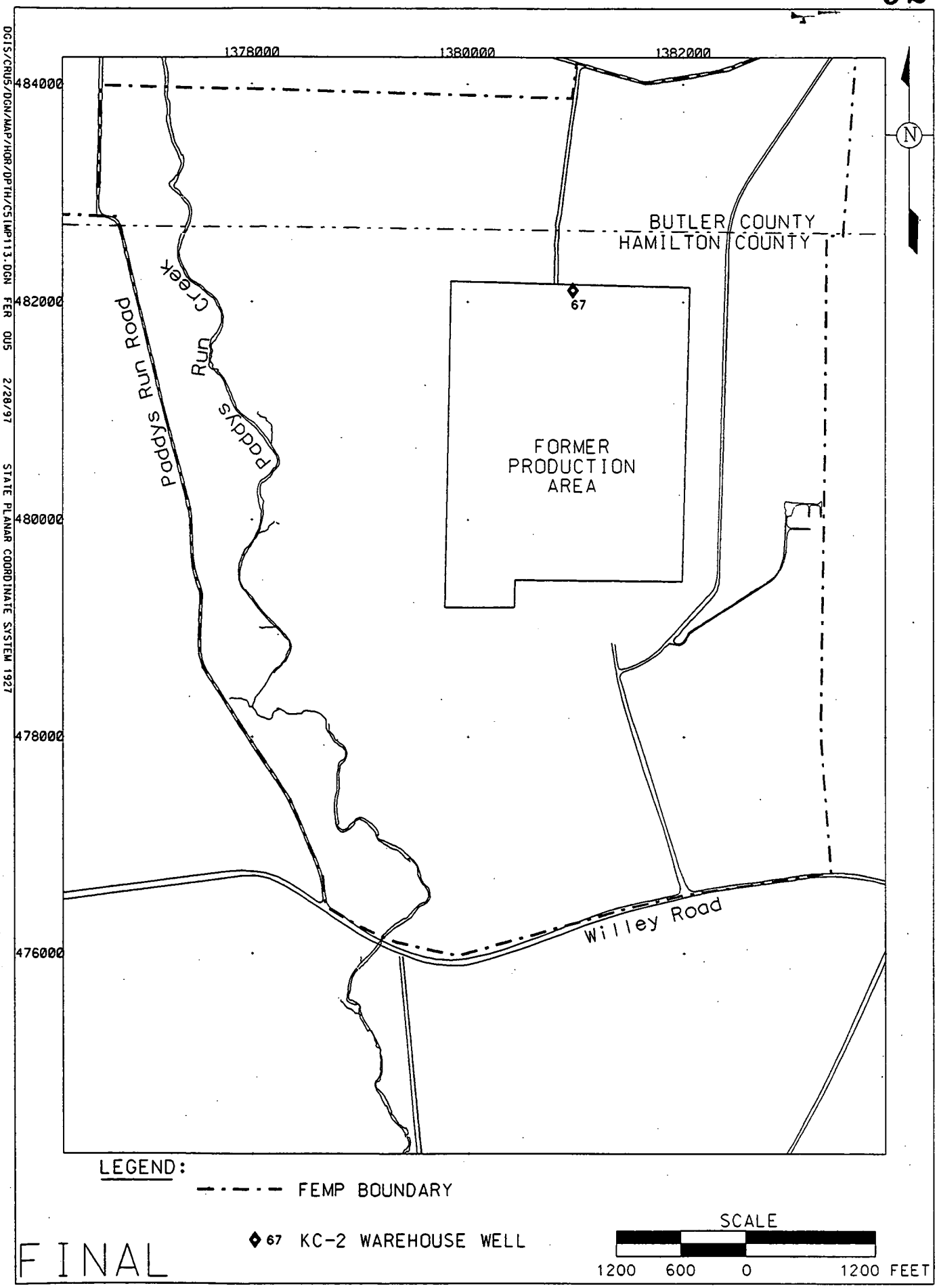


FIGURE 3-16. KC-2 WAREHOUSE WELL

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

3.6.1 Project Organization

A multidiscipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements defined by the Program Oversight and Integration Division. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to media activities must be approved by the team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standard and assist in evaluating and resolving all quality related concerns.

3.6.2 Sampling Program

The information derived from the field investigation should suffice to produce a clear understanding of groundwater quality in the Great Miami Aquifer. The groundwater sampling process will be controlled

so that collected samples are representative of groundwater quality. All procedures for monitoring well development, sample collection, and shipment will be performed in accordance with directives established in the SCQ. The summary listing of the monitoring wells that comprise the overall sampling program (sorted numerically by well number) is provided in Table 3-4.

Figure 3-17 shows where all of the sampling points for 1997 and 1998 are located. Individual well lists, constituent lists, and location maps are presented in Sections 3.5.1 through 3.5.2.

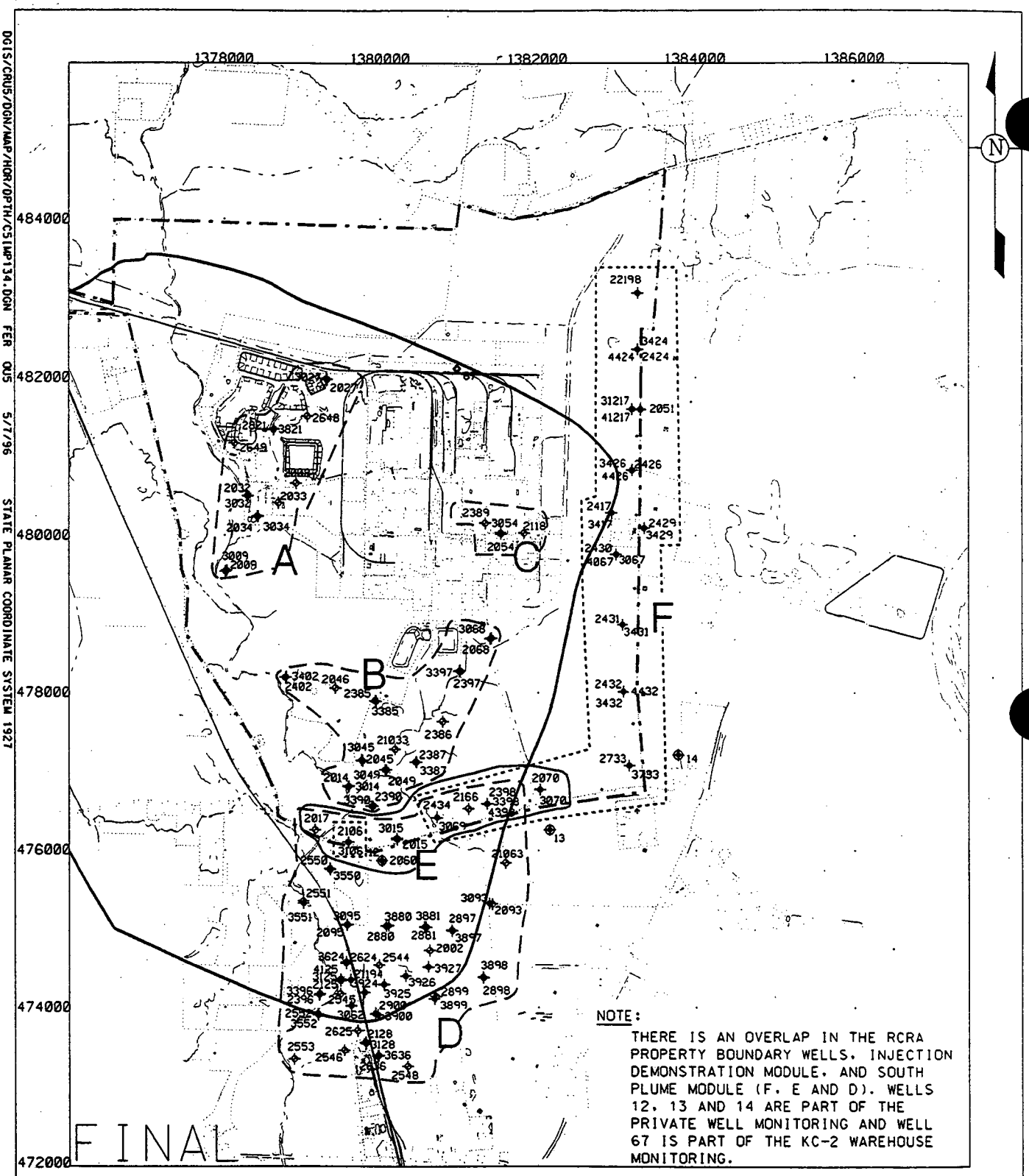
Groundwater samples will be collected and analyzed in 1997 and 1998 to:

- Track remedy performance of the South Plume Module and the Injection Demonstration Module when they become operational
- Document that no water quality changes are occurring in the aquifer that could impact the design or start-up of Restoration Modules
- Monitor water levels across the entire aquifer restoration area
- Continue sampling at three private well locations
- Assess potential changes in groundwater conditions at the Fernald property boundary
- Monitor the water quality of Well No. 67 in the KC-2 Warehouse.

3.6.2.1 Sample Collection

For each constituent, the sample type, ASL, holding time, preservative, container requirement, and analytical method for groundwater samples are summarized in Table 3-5.

All monitoring wells will be purged and sampled using the guidelines specified in SCQ Section 6.2. All analyses will be conducted by the appropriate FEMP or contract laboratory using procedures which meet the standards for these analytical support levels as established in the SCQ as referenced in Table 3-5. The rationale for specifying ASL B for this program is that the data will be used for surveillance monitoring purposes. ASL B provides qualitative, semi-qualitative, and quantitative data with some QA/QC checks. Sample collection protocols are identified in the SCQ and in specific



DGIS/CRU5/DGN/MAP/HOR/DPTH/C5IMP134.DGN FER OU5 5/7/96 STATE PLANAR COORDINATE SYSTEM 1927

LEGEND:

A - WASTE STORAGE AREA MODULE
B - SOUTH FIELD EXTRACTION SYSTEM MODULE
C - PLANT 6 AREA MODULE
D - SOUTH PLUME MODULE
E - INJECTION DEMONSTRATION MODULE
F - RCRA PROPERTY BOUNDARY

—·—·— FEMP BOUNDARY
——— 10 YEAR CAPTURE ZONE

SCALE
1800 900 0 1800 FEET

FIGURE 3-17. IEMP WATER QUALITY MONITORING WELLS FOR 1997 AND 1998

000097

TABLE 3-4

LISTING OF IEMP GROUNDWATER MONITORING WELLS

Well No.	Well ID	Monitoring Activity[a]
1	12	Private Well Monitoring
2	13	Private Well Monitoring
3	14	Private Well Monitoring
4	67	KC-2 Warehouse
5	2002	South Plume Module
6	2008	Waste Storage Area Module
7	2009	Waste Storage Area Module
8	2014	South Field Extraction System Module
9	2015	South Plume Module Injection Demonstration Module
10	2017	South Plume Module Injection Demonstration Module
11	2027	Waste Storage Area Module
12	2032	Waste Storage Area Module
13	2033	Waste Storage Area Module
14	2034	Waste Storage Area Module
15	2045	South Field Extraction System Module
16	2046	South Field Extraction System Module
17	2049	South Field Extraction System Module
18	2051	RCRA Boundary Monitoring
19	2054	Plant 6 Area Module
20	2060	South Plume Module Injection Demonstration Module
21	2068	South Field/ Extraction System Module
22	2070	RCRA Boundary Monitoring Injection Demonstration Module
23	2093	South Plume Module
24	2095	South Plume Module
25	2106	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
26	2118	Plant 6 Area Module
27	2125	South Plume Module
28	2128	South Plume Module
29	2166	South Plume Modules Injection Demonstration Module
30	2385	South Field Extraction System Module
31	2386	South Field Extraction System Module
32	2387	South Field Extraction System Module
33	2389	Plant 6 Area Module
34	2390	South Field Extraction System Module
35	2396	South Plume Module

TABLE 3-4
(Continued)

Well No.	Well ID	Monitoring Activity[a]
36	2397	South Field Extraction System Module
37	2398	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
38	2402	South Field Extraction System Module
39	2417	RCRA Boundary Monitoring
40	2424	RCRA Boundary Monitoring
41	2426	RCRA Boundary Monitoring
42	2429	RCRA Boundary Monitoring
43	2430	RCRA Boundary Monitoring
44	2431	RCRA Boundary Monitoring
45	2432	RCRA Boundary Monitoring
46	2434	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
47	2544	South Plume Module
48	2545	South Plume Module
49	2546	South Plume Module
50	2548	South Plume Module
51	2550	South Plume Module
52	2551	South Plume Module
53	2552	South Plume Module
54	2553	South Plume Module
55	2624	South Plume Module
56	2625	South Plume Module
57	2636	South Plume Module
58	2648	Waste Storage Area Module
59	2649	Waste Storage Area Module
60	2733	RCRA Boundary Monitoring
61	2821	Waste Storage Area Module
62	2880	South Plume Module
63	2881	South Plume Module
64	2897	South Plume Module
65	2898	South Plume Module
66	2899	South Plume Module
67	2900	South Plume Module
68	3009	Waste Storage Area Module
69	3014	South Field Module
70	3015	South Plume Module Injection Demonstration
71	3027	Waste Storage Area Module
72	3032	Waste Storage Area Module
73	3034	Waste Storage Area Module

TABLE 3-4
(Continued)

Well No.	Well ID	Monitoring Activity[a]
74	3045	South Field Extraction System Module
75	3049	South Field Extraction System Module
76	3054	Plant 6 Area Module
77	3062	South Plume Module
78	3067	RCRA Boundary Monitoring
79	3068	South Field Extraction System Module
80	3069	RCRA Boundary Monitoring Injection Demonstration Module
81	3070	RCRA Boundary Monitoring Injection Demonstration Module
82	3093	South Plume Module
83	3095	South Plume Module
84	3106	South Plume Module RCRA Boundary Monitoring Injection Demonstration Module
85	3125	South Plume Module
86	3128	South Plume Module
87	3385	South Field Extraction System Module
88	3387	South Field Extraction System Module
89	3390	South Field Extraction System Module
90	3396	South Plume Module
91	3397	South FieldExtraction System Module
92	3398	RCRA Boundary Monitoring Injection Demonstration Module
93	3402	South FieldExtraction System Module
94	3417	RCRA Boundary Monitoring
95	3424	RCRA Boundary Monitoring
96	3426	RCRA Boundary Monitoring
97	3429	RCRA Boundary Monitoring
98	3431	RCRA Boundary Monitoring
99	3432	RCRA Boundary Monitoring
100	3550	South Plume Module
101	3551	South Plume Module
102	3552	South Plume Module
103	3624	South Plume Module
104	3636	South Plume Module
105	3733	RCRA Boundary Monitoring
106	3821	Waste Storage Area Module
107	3880	South Plume Module
108	3881	South Plume Module
109	3897	South Plume Module
110	3898	South Plume Module
111	3899	South Plume Module

TABLE 3-4
(Continued)

Well No.	Well ID	Monitoring Activity[a]
112	3900	South Plume Module
113	3924	South Plume Module
114	3925	South Plume Module
115	3926	South Plume Module
116	3927	South Plume Module
117	4067	RCRA Boundary Monitoring
118	4125	South Plume Module
119	4398	RCRA Boundary Monitoring Injection Demonstration Module
120	4424	RCRA Boundary Monitoring
121	4426	RCRA Boundary Monitoring
122	4432	RCRA Boundary Monitoring
123	21033	South Field Extraction System Module
124	21063	South Plume Module
125	21194	South Plume Module
126	31217	RCRA Boundary Monitoring
127	41217	RCRA Boundary Monitoring
128	22198	RCRA Boundary Monitoring

[a] Refer to Section 3.5 for details on monitoring.

TABLE 3-5
SAMPLING PROCEDURES FOR ALL CONSTITUENTS IN THE GROUNDWATER MONITORING PROGRAM

Constituent	Method	Sample Type	ASL	Holding Time[a]	Preservation[a]	Container[a,b]
General Chemistry:						
Cyanide	9010[c], 9020[c], 335.2[d], or 335.3[d]	Grab	B	14 days	Cool to 4°C, NaOH to pH > 12	Plastic or glass
Fluoride	340.2[d] or 4500C[e]	Grab	B	28 days	None	Plastic
Nitrate/Nitrite	353.1[d], 353.2[d], 4500D[e], or 4500E[e]	Grab	B	28 days	Cool to 4°C, H_2SO_4 to pH < 2	Plastic or glass
Phosphorus	365.(all)[d] or 4500Ee	Grab	B	28 days	Cool to 4°C, H_2SO_4 to pH < 2	Plastic or glass
Inorganics:						
Metals Excluding Mercury	7000[c] or 6010[c]	Grab	B	6 months	HNO_3 to pH < 2	Plastic or glass
Mercury	7470A[c]	Grab	B	28 days	HNO_3 to pH < 2	Plastic or glass
Radionuclides: (All Radiological)	SCQ[f]	Grab	B[g]	Six months or 5 x half-life, whichever is less	HNO_3 to pH < 2	Plastic or glass
Volatile Organics:	8260[c]	Grab	B	7 days	Cool to 4°C	Glass vial with Teflon lined septum cap
		Grab	B	14 days	Cool to 4°C H_2SO_4, HCl, or solid $NaHSO_4$ to pH < 2	Glass vial with Teflon lined septum cap
Pesticides[h]:	8080[c]	Grab	B	7 days to extraction 40 days from extraction to analysis	Cool to 4°C	Amber glass bottle with teflon lined cap
Field Parameters[i]:		Grab	A	NA[j]	NA[j]	NA[j]

[a]Appropriate preservative, holding time, and container requirements will be used for the corresponding method.
[b]Container size is left to the discretion of the individual laboratory.
[c]"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846.
[d]"Methods for Chemical analysis of Water and Wastes, EPA 600/4-79-020.
[e]"Standard Methods for the Analysis of Water and Wastewater," 17th edition.
[f]Radionuclide analyses do not have standard methods; however, the analytical specifications for these parameters are provided in Appendix G of the SCQ.
[g]The ASL may become more conservative, if it is necessary to meet detection limits.
[h]The pesticide that will be analyzed is alpha-chlordane.
[i]Field parameters include dissolved oxygen, pH, specific conductance, temperature and turbidity.
[j]NA = Not applicable.

procedures referenced in the SCQ. The following procedures and guidance sections of the SCQ are used to conduct groundwater monitoring:

Standard Operating Procedures

ADM-02	Field Project Prerequisites
SC-GWM-FO-201	Groundwater Sampling Activities
EP-GWM-202	Groundwater Sample Shipment

Sitewide CERCLA Quality (SCQ) Assurance Project Plan

Section 5	Field Activities
Section 6	Sampling Requirements
Section 7	Sample Custody
Section 9	Analytical Procedures
Appendix I	Field Calibration Requirements
Appendix J	Field Activity Methods
Appendix K	Sampling Methods

Once samples are taken, they will be sent to either an on-site or "acceptable" off-site laboratory. Samples will be sent to the FEMP on-site laboratory if capacity is available, if the analyses can be performed, and if detection limits can be achieved. Analyses cannot be performed on-site for:

- Cyanide
- Dioxins: 2,3,7,8-tetrachlorodibenzo-p-dioxin and octachlorodibenzo-p-dioxin
- Pesticide/PCBs: alpha-chlordane and aroclor-1254
- Radionuclides: cesium-137, strontium-90
- Semi-volatiles: bis(2-chloroisopropyl)ether, bis(2-ethylhexyl)phthalate, carbazole, 4-methylphenol, and 4-nitrophenol

Analyses which cannot be performed on site will be sent to an "acceptable" off-site laboratory for analysis. Acceptable off-site laboratories must meet SCQ-specified performance assessment criteria. Requirements include possessing a sufficient Nuclear Regulatory Commission license, satisfying pre-award and annual audits by FEMP quality assurance and procurement personnel, as well as demonstrating continued turnaround and accuracy performance through participation in an inter-laboratory data comparability program.

The list of "acceptable" off-site laboratories is subject to change. Additional laboratories may be added to the list upon proof of qualifications and some laboratories may be removed from the list if they prove to be unsatisfactory. A current listing of "acceptable" off-site laboratories can be made available upon request.

3.6.2.2 QA Sampling Requirements

Field quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination or sampling technique, may be responsible for introducing bias in the project's analytical results. The following types of quality control samples will be collected: sampling equipment rinsates, trip blanks, field blanks and duplicate samples as outlined in Section 6 and Appendix K of the SCQ. Each QC sample is preserved using the same method for groundwater samples. The QC sample frequencies will be tracked for each groundwater area program (i.e., RCRA routine monitoring) to ensure the proper frequency requirements are met as follows:

- Trip Blanks: Prepared for each sampling team on each day of sampling when volatile organic compounds are included in the respective analytical program.
- Equipment Rinsates: Collect one rinsate sample for every 20 groundwater samples that are collected using reusable sampling equipment. If the specific sampling program (e.g., RCRA routine monitoring) consist of less than 20 groundwater samples, a rinsate sample is still required. Rinsates are not required when dedicated well equipment or disposable sampling equipment is utilized.
- Field Blanks: Collect one field blank for each day of groundwater sampling
- Field Duplicates (blind): One duplicate sample will be collected for every 20 groundwater samples or fraction thereof if the specific sampling program consists of less than 20 samples.

The field samples associated with each QC sample also will be tracked to ensure traceability in the event that contaminants are detected in the QC samples.

3.6.2.3 Decontamination

Sampling equipment shall be decontaminated following sample collection from each well to prevent cross-contamination of samples. The decontamination of equipment shall be performed in accordance with the Level II method referenced in Appendix K.11 and described in Section 6.4.1 of the SCQ.

3.6.2.4 Waste Disposition

The following wastes will be generated during sampling activities:

- Purge water
- Contact wastes
- Equipment decontamination solutions.

The following subsections provide the proposed disposition methodology for each type of waste generated.

Purge Water and Decontamination Solutions

Groundwater purged from the wells and solutions used to decontaminate equipment used during sampling will be contained and transported to the FEMP for proper disposal. If historic data for a well indicate the purge water is potentially a RCRA waste, the purge water will be drummed at the well and moved to the FEMP's controlled holding area until analytical results are returned.

Contact Wastes

Contact wastes such as personal protective equipment (PPE), paper towels, and other solid, investigation-derived waste will be placed in plastic bags or 55-gallon drums and transported to the FEMP for appropriate disposition.

3.6.2.5 Monitoring Well Maintenance

During the restoration of the FEMP, surface cleanup activities will create adverse conditions around several groundwater monitoring wells. Extra effort will be taken on the part of FEMP personnel to safeguard and inspect groundwater monitoring wells during the FEMP restoration. Monitoring well maintenance will center around two questions:

1) Is the monitoring well protective of the environment?
2) Does the monitoring well yield a representative groundwater sample?

Well Maintenance Inspections

Routine inspections of Great Miami Aquifer groundwater monitoring wells will be conducted during sampling or collection of water levels (at a minimum of once a year if the well is not being sampled routinely) to determine if the well is protective of the environment. Wells may be inspected more frequently if they are located in an area of active surface restoration. All assessment and maintenance activities will be recorded on applicable field data forms or logbooks. The inspections will include, but not be limited to, the following:

- Ensure that the well identification number is painted in white or welded to the top of the lid.

- Inspect the ground surrounding the well for depressions and channels that allow surface water to collect and flow towards the wellhead, and for debris and foreign material that could leach contaminates into the subsurface or otherwise interfere with well sampling.
- Ensure visibility and accessibility to the well.
- Inspect locking lids and padlocks to check for rust and ease of operation.
- Inspect the exposed (protective) well casing to ensure that: it is free of cracks and signs of corrosion, it is reasonably plumb with the ground surface, it is painted bright orange, the drain hole is clear, it is free of debris, and it has no sharp edges.
- Remove and inspect the well cap to: ensure that it is free of debris, fits securely and the vent hole is clear; and, if a ground-flush cap, ensure that it is water-tight to prevent surface water from entering the well.
- Inspect concrete surface seals for settling and cracking.
- If exterior guards are used to protect the well, inspect the guards periodically for visibility and repaint if necessary.

At least once per year, an assessment will be made of wells that are sampled as to whether or not the well is yielding a representative sample. This assessment will include, but not be limited to:

- Determine how much sediment has entered the well screen and accumulated in the well. This will be done by measuring the well depths for those wells that do not have dedicated packers. Depth measurements will be reviewed over time to determine if the well is filling with sediment.
- Evaluate turbidity within the sample.

Well Evaluation

If the turbidity and amount of sediment measured in the well and/or the visual inspection indicate a potential problem with the well, then the following work may be performed to evaluate the cause of the sedimentation or other problems:

- Review existing well installation documentation
- Review well history to identify whether it produces consistently clear or turbid samples
- Review groundwater sampling field records
- Conduct a downhole camera survey to inspect the integrity of the screen and casing.

Well Maintenance Corrective Actions

Corrective actions to address problems identified in the well maintance inspections will be conducted on-the-spot or as soon as feasible. Corrective maintenance to address excessive turbidity may include:

- Removal of sediment from the well, and
- Re-development of the well.

The possibility exists that minerals can precipitate on well screens. If it is determined that minerals have precipitated in the well or on the well screen, and they are affecting the representativeness of the groundwater sample, the limited use of chemicals (e.g., chlorine, HCL, etc.) to remove the incrustants may be considered. It is understood that chemicals have a very limited application in the rehabilitation of monitoring wells because the chemicals can cause changes such that the well will no longer yield a representative sample (Aller et. al., 1989). Changes resulting from the use of chemicals could last for a short time or be permanent. If chemical rehabilitation is attempted it will only be attempted as a last resort and parameters, such as Eh, pH, temperature and conductivity, will be measured prior to the application of the chemicals and following the use of the chemicals. These measurements will serve as values for comparison of water quality before and after well maintenance.

If a groundwater monitoring well has been damaged in such a way that it is no longer protective of the environment, and it cannot be repaired, then the well will be plugged and abandoned. If it is determined that the well is not yielding a representative groundwater sample, and re-habilitation efforts are not effective in correcting the condition, then the well will be considered for plugging and abandonment. If the well is still protective of the environment, it might be used for the collection of water level data even though it does not yield representative groundwater samples.

3.6.3 Change Control

Changes to the media-specific plan will be at the discretion of the team leader. Prior to implementation of field changes, the team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the team leader or designee and QA prior to implementation. Media-specific plan changes shall be documented on the Variance/Field Change Notice within 24 hours of verbal approval. The completed Variance/Field Change Notice must be approved by QA. The Variance/Field Change Notice form shall be controlled and included in the field data package and become part of the project record. Permanent media-specific plan changes will incorporate applicable Variance/Field Change Notices in annual media-specific plan revisions. Scope changes to the media-specific plan will require respective document changes.

3.6.4 Health and Safety Considerations

The Fluor Daniel Fernald (FDF) Health and Safety Department is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Daily safety meetings will be conducted prior to beginning field work to address specific health and safety issues.

All FDF employees and subcontractor personnel who will be performing field work required by this Media-specific plan are required to have completed all site required training.

For areas subject to more restrictive radiological controls where the potential for exposure is greater, Radiation Work Permits (RWPs) are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring an RWP.

3.6.5 Data Management

Field and analytical data will be managed to meet the IEMP data reporting and quality objectives. The field documentation and analytical data results shall be verified to ensure conformance to the appropriate SCQ sections and appendices. The process for management of the field and analytical data is described in the Environmental Data Management Plan (EDMP) (FDF, 1996).

Field documentation will be verified for accuracy and completeness by the sampling team followed by an independent field data validation in accordance with SCQ requirements for the corresponding ASL. The project team leader must have processes in place to verify that chemical and radiological data results meet all applicable quality requirements specified in the SCQ for the respective ASL (SCQ Section 11.0 and Appendix F). The quality of analytical data shall be evaluated by independent project personnel qualified to determine accuracy, completeness and applicable statistical data necessary to evaluate data useability and data quality required for environmental monitoring reporting.

Both the field and analytical data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project files in accordance with FEMP record keeping procedures and DOE orders.

3.6.6 Quality Assurance

Independent assessments of work processes shall be conducted to verify quality of performance. Such assessments may include audits, surveillances, inspections, tests, data verification and field validation, and peer reviews. Assessments shall include performance based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance to the IEMP, the SCQ, applicable DQOs, and FEMP Quality Assurance Program (RM-0012) requirements.

Independent assessments are the responsibility of designated project Quality Assurance personnel. The project team leader and QA will coordinate independent assessment oversight activities and comply with SCQ Section 12. Recommended quarterly QA surveillances shall be performed on some tasks specified in the media-specific plan. The QA representative shall have "stop work" authority if significant adverse quality conditions are identified or work conditions are unsafe. In accordance with SCQ Section 3, QA shall review and have approval signatures of plans, procedures, and final documents supporting IEMP programs.

Only laboratories on the Approved Laboratory List will be used for FEMP sample analyses in accordance with SCQ Section 12 and Appendix E.

3.7 IEMP GROUNDWATER MONITORING DATA EVALUATION AND DATA REPORTING

This section provides a methodology for analyzing IEMP groundwater monitoring data generated during the first two years of implementation. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for the IEMP groundwater data is presented. The reporting subsection also provides the specific information to be reported at the quarterly meeting/reports and in the comprehensive annual report. Given that this is a new program, it is recognized that the data evaluation and reporting will evolve over the first few quarterly meetings/reports as consensus is reached on the desired content of the meetings/reports.

3.7.1 Data Evaluation

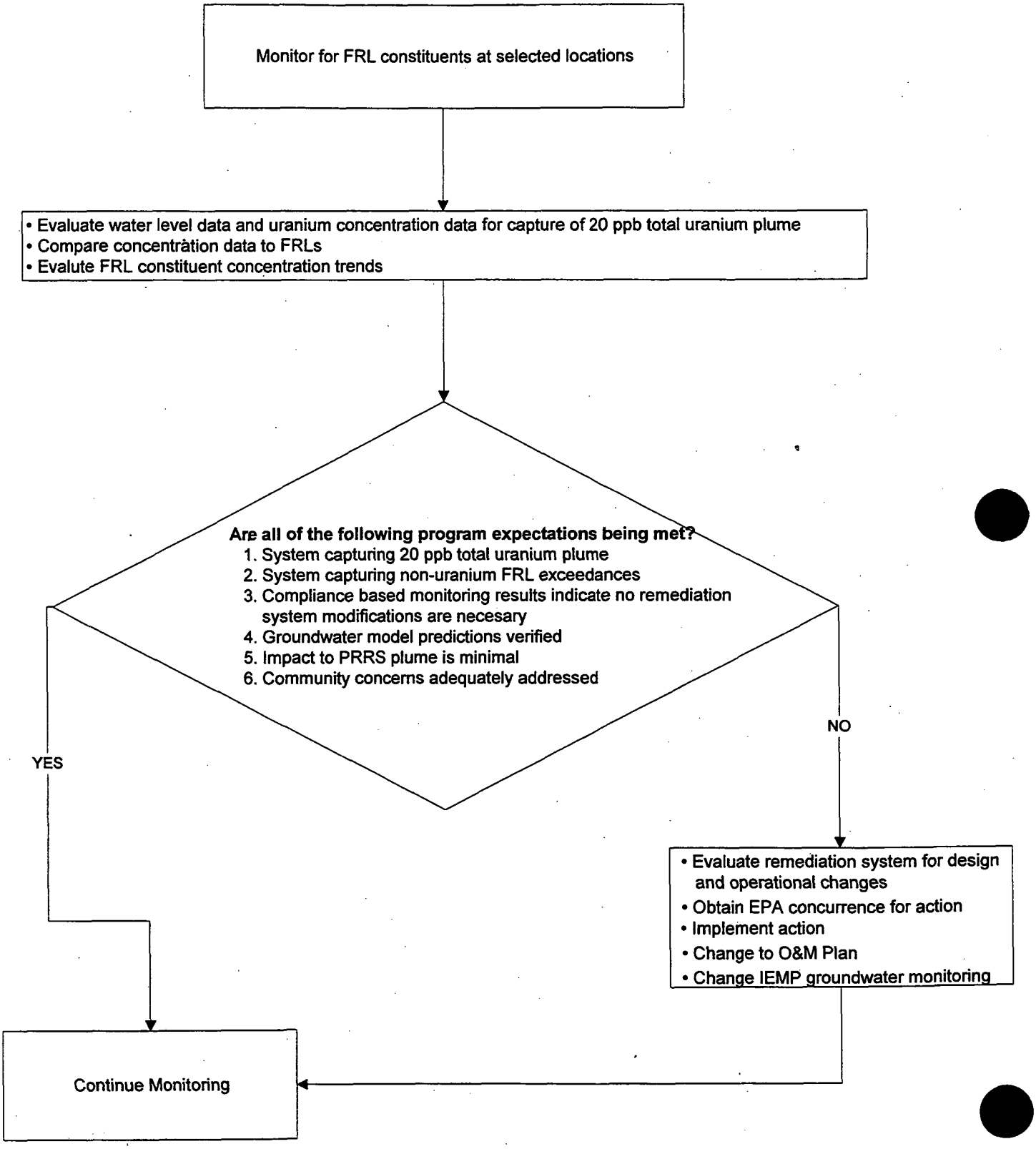
The initial focus of the IEMP groundwater monitoring program will be to address remedy performance tracking and regulatory responsibilities for 1997 and 1998. Ultimately the IEMP will be used to document the approach for determining when various modules can be removed from service, once remedial action objectives for the Great Miami Aquifer (provided in the Operable Unit 5 Record of Decision) are achieved. It is too early to begin the process of removing modules from the aquifer restoration system during 1997 and 1998. Therefore, methods for verifying remedy completion are not included in this IEMP. However, the IEMP will later serve as the vehicle for verifying the completion of the aquifer restoration. The sampling and data evaluation methods which will be used to verify restoration will be presented in future revisions of the IEMP.

Figure 3-18 illustrates the overall framework for the decision-making process for 1997 and 1998. Groundwater monitoring will be conducted at selected monitoring locations during the aquifer remediation. If it is determined that program expectations for 1997 and 1998 are not being met, then the design and operation of the aquifer restoration system will be evaluated to determine if a change needs to be implemented. A change to the operation of the aquifer restoration system would be implemented through the system O&M Plan. A groundwater monitoring change, if found to be necessary, would be implemented through the yearly reviews and revisions of the IEMP. If additional characterization data are needed (i.e., to determine the nature of a newly detected FRL exceedance), a modification to the IEMP would be implemented, or a new sampling plan would be prepared depending upon the anticipated size of the activity. Additional sampling activities may utilize other sampling techniques, such as a Geoprobe™ sampling tool, which has been used successfully at the FEMP to obtain groundwater samples without the use of a permanent monitoring well.

For approximately the past two years, the DMEPP reports and the groundwater section of the RCRA Annual Reports have presented and evaluated data in the following manner:

- Concentration versus time plots for specific constituents
- Tables identifying wells with constituents above FRL concentrations
- Mann-Kendall trend analyses for specific constituents.

FIGURE 3-18
GROUNDWATER MONITORING DECISION MAKING PROCESS FOR 1997 AND 1998



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Through the lifetime of the aquifer restoration, large quantities of data will be collected and evaluated. As in the past, DOE has assembled the data in order to easily determine necessary actions. In order to evaluate the results of the sampling, the data collected for the IEMP modules/activities will be presented and evaluated using the above formats. The findings of data evaluations will be shared with project personnel. The EPA and OEPA have identified that this is a successful method of evaluating and presenting the data.

During 1997 and 1998, the IEMP will collect groundwater data to answer two key questions concerning the aquifer restoration; 1) How is the groundwater restoration system operating?, and 2) Are aquifer restoration program expectations for 1997 and 1998 being met?

How is the Groundwater Restoration System Operating?

Operation of the groundwater restoration system will be assessed by tracking:

- Pumping/injection rates
- Volumes of water pumped/injected
- Pounds of uranium removed
- Efficiency of each well at removing uranium
- Efficiency of entire groundwater extraction modules
- Maximum, minimum, and average uranium concentrations sent to treatment and discharged to the Great Miami River
- Total uranium concentration data collected from extraction/injection wells
- Total uranium concentration data collected from monitoring wells.

Treatment decisions will be based on the total uranium concentration measured at the extraction well.

As is currently done in the DMEPP, most of the data will be either tabulated, or presented in graphs. Well efficiencies will be determined by dividing the pounds of uranium removed by the millions of gallons of water pumped. Daily total uranium concentration in the discharge water, the monthly

average total uranium concentration in the water discharged to the Great Miami River, and the total uranium removed versus water pumped will all be presented in graphs.

Are Aquifer Restoration Program Expectations for 1997 and 1998 being Met?

A variety of expectations were presented in Section 3.4.1 for the IEMP groundwater monitoring system. To achieve these expectations, groundwater monitoring program data will be evaluated to:

- Assess progress in capturing and restoring the area containing the greater than 20 μg/L total uranium plume
- Assess progress in capturing and restoring the areas affected by non-uranium FRL exceedances
- Meet existing compliance based groundwater monitoring obligations (i.e., RCRA property boundary monitoring, KC-2 warehouse well, and private wells)
- Verify groundwater model predictions of remedy performance
- Assess the impact that the aquifer restoration is having on the Paddys Run Road Site plume
- Adequately address community concerns.

Aquifer restoration is being designed to reduce the concentration of uranium and non-uranium FRL constituents in the aquifer to concentrations that are at or below their FRL. Uranium is the principal constituent of concern. The aquifer restoration system is initially being designed to capture the 20 μg/L total uranium plume, with the understanding that the system may need to be modified in the future to capture and remediate non-uranium FRL constituents.

Extraction and injection wells have been positioned within each restoration module with this first objective in mind. Operational decisions and pumping/injection changes will focus on this first objective in 1997 and 1998. Operational changes to meet non-uranium FRL concentrations is considered to be a secondary objective in 1997 and 1998. However, evaluation of the need for an operational change to address non-uranium FRL constituents will be an ongoing process throughout the course of the aquifer remediation and is expected to gain in importance as the achievement of the uranium objective approaches.

Capturing and Restoring the Area Containing the Greater than 20 μg/L Total Uranium Plume

Capture and restoration of the area containing the greater than 20 μg/L total uranium plume will be evaluated for each groundwater restoration module. Capture of the 20 μg/L total uranium plume will be evaluated using groundwater elevation data and the most current uranium plume depiction based on the sampling data. When a restoration module begins operating, water levels will be collected very frequently (i.e., daily, weekly) until conditions have stabilized. Once conditions have stabilized, monitoring will for the most part fall back to a quarterly schedule. Individual module start-up plans will provide specifics on the frequency of water level and water quality data collection during start-up. Groundwater elevation maps with capture zones and flow divides will be prepared to evaluate the extent of capture.

Remediation of the 20 μg/L total uranium plume will be assessed by monitoring total uranium concentrations within each restoration module. The 20 μg/L total uranium plume will be mapped and compared against modeling predictions of plume size and concentration to evaluate whether or not design expectations for uranium restoration are being achieved.

If a new total uranium FRL exceedance is detected in the aquifer, an attempt will be made to determine the cause of the exceedance. Considerations will include:

- Movement of known uranium contamination in response to pumping, injection, or natural migration
- New contamination reaching the aquifer as a result of FEMP restoration activity
- Previously undetected uranium contamination that has now moved into a monitoring zone as a result of pumping, injection, or natural migration.

Capturing and Restoring the Areas Affected by Non-Uranium FRL Exceedances

The Operable Unit Record of Decision identifies 49 FRL constituents, other than total uranium, that also need to be tracked as part of the aquifer restoration. These 49 constituents are collectively refereed to as the non-uranium FRL constituents. During the aquifer restoration, groundwater monitoring will take place in each restoration module for the non-uranium FRL constituents. Constituents that have been detected in the aquifer above their respective FRL will be monitored more frequently than those which have not been detected above their respective FRL. As explained in Section 3.4.2.3, entitled Parameter Selection Criteria, non-uranium FRL constituents are monitored

quarterly, semi-annually, annually, or once every five years depending on the particular constituent and the monitoring locations.

Non-uranium FRL concentrations in the Great Miami Aquifer will be assessed through trend analysis when enough data has been obtained. Concentrations versus time will be graphed to determine how the concentrations are trending. The Mann-Kendall statistical test will be utilized on a select group of data to facilitate the trending interpretation.

If a new non-uranium FRL exceedance is detected in the aquifer, an attempt will be made to try to determine the cause of the exceedance. Considerations will include:

- Movement of known contamination in response to pumping, injection, or natural migration
- New contamination reaching the aquifer as a result of FEMP restoration activity
- Previously undetected contamination that has now moved into a monitoring zone as a result of pumping, injection, or natural migration.

Appendix A and Section 3.4.2.3 outline protocols which will be utilized to change the sampling frequency of a non-uranium FRL constituent, if an FRL exceedance is recorded.

Meeting Existing Compliance based Groundwater Monitoring Obligations (i.e., RCRA Boundary Monitoring, KC-2 Warehouse)

Three compliance-based groundwater monitoring obligations need to be addressed; 1) RCRA Property Boundary Monitoring, 2) KC-2 Warehouse Well Sampling, and 3) Private Well Sampling.

Data collected from the FEMP property boundary monitoring system, to satisfy the directors findings and orders for RCRA, will be tabulated and compared to FRL values. This will facilitate the detection and monitoring of FRL exceedances and determining if interim actions are warranted, in addition to implementing the sitewide aquifer restoration. Groundwater data collected at the KC-2 Warehouse well will be tabulated and compared against FRLs. Total uranium data collected at private wells will be evaluated using trend analysis to determine if any actions in addition to restoration are necessary.

Verifying Groundwater Model Predictions of Remedy Performance

The aquifer restoration target is concentration based, rather than mass-based. Success will be measured by achieving concentration-based FRLs in the aquifer. To verify groundwater model predictions of remedy performance, groundwater concentrations obtained from monitoring and extraction wells will be compared to groundwater concentrations which have been predicted through modeling (Figure 3-19). During 1997 and 1998, total uranium plume maps of the 20 μg/L plume will be compared against modeled predictions in the Baseline Remedial Strategy Report to begin to evaluate if the initial stages of the restoration are proceeding on track.

Modeled capture predictions will also be assessed to verify model predictions. Capture zones defined by water level maps will be prepared using elevation data collected through monitoring and compared to capture zone delineations derived from elevations predicted by the groundwater model.

It is understood that the groundwater model may need to be recalibrated in the future if monitoring indicates that the model predictions are not correct. Experience obtained from calibrating and applying the current groundwater model during the RI/FS process was utilized to select reasonable criteria for determining whether or not the model needs to be recalibrated in the future to facilitate restoration. The criteria are presented below.

Predicted water level values from the current groundwater model have an acceptable range of variance from actual field measurements. The decision to recalibrate the groundwater model in the future for water levels will be based on whether or not this current acceptable range of water level variances is being exceeded.

The difference between the maximum and minimum groundwater elevation defines the range of groundwater elevations expected for a particular well. The range results from seasonal variations and longer term water level trends which have been recorded in the aquifer. A range of water levels has been established for each monitoring well included in the IEMP groundwater elevation program.

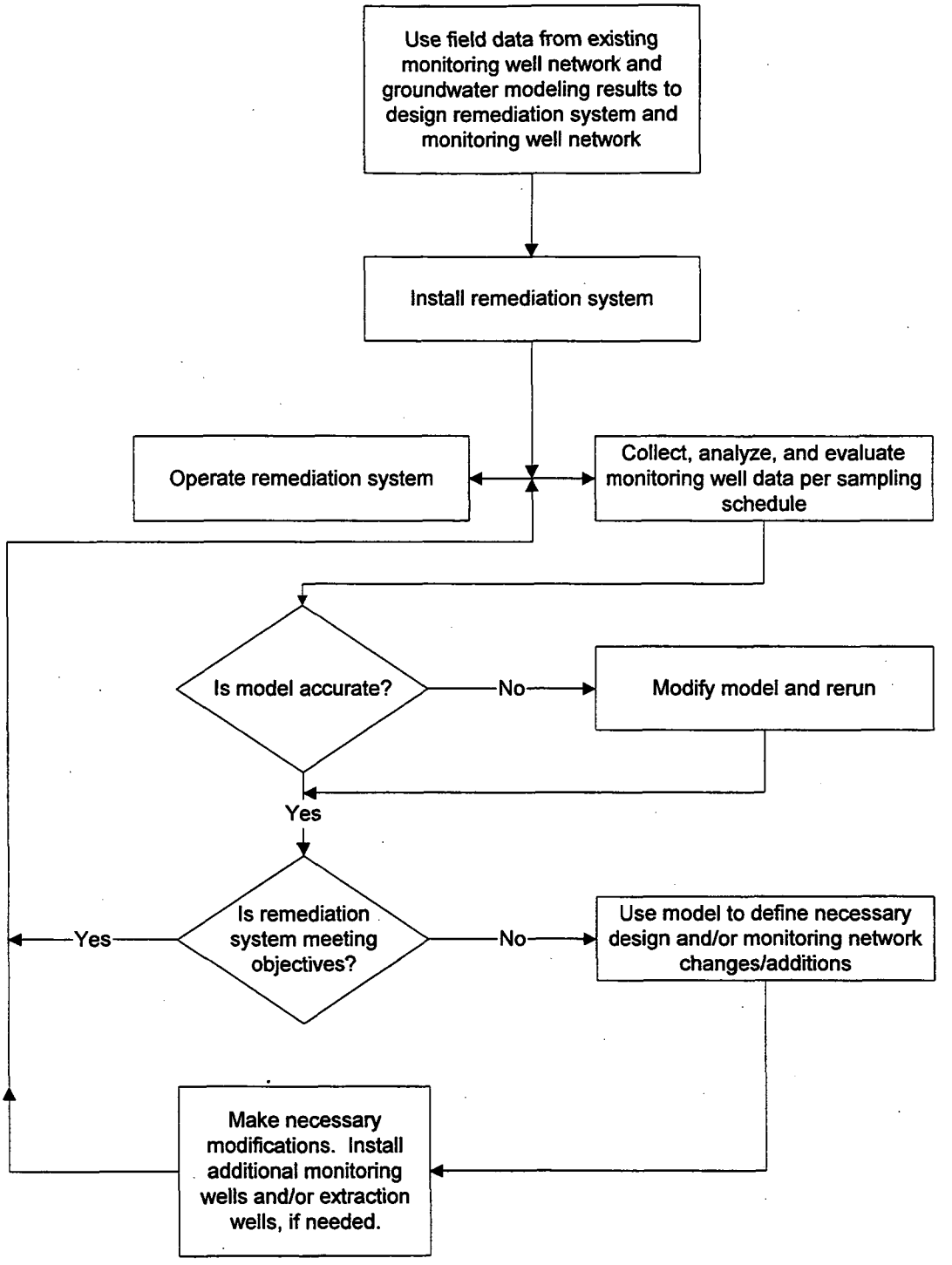


FIGURE 3-19. MODELING PERFORMANCE EVALUATION PROCESS

Modeled groundwater elevations for a given year will be compared to actual groundwater elevations measured quarterly in the monitoring well during the same year. If the difference between the actual quarterly measurement and the modeled groundwater elevation for that year is consistently (two or more consecutive quarters) greater than five feet for more than one third of the monitoring wells within the capture zone, then the need to implement model recalibration for the affected area of the model will be evaluated.

Because predicted values only represent average conditions within a model block and because monitoring wells are usually not located at the center of a model block, the modeled elevations from a block containing the monitoring well and the surrounding eight model blocks will be used to compare with actual measured elevations.

Total uranium data collected from monitoring and extraction wells will also be used to check the groundwater model. Predicted contaminant concentration profiles over time will be checked yearly using water quality data collected from designated monitoring wells. Model predictions of concentration through time at various monitoring points will be compared to actual field conditions to determine if concentrations are being lowered or increased as the model predicts. Differences between model predictions and measured conditions may be the result of inaccurate transport parameter values and/or actual operational conditions (i.e., pumping and injection rates) not being the same as assumed in the model. Field data will be used to determine when pumping adjustments need to be evaluated. Pumping adjustments will be evaluated using the groundwater model.

The groundwater model has been used initially to design pumping strategies, and will be used to design necessary system operational changes throughout the life of the remediation. If field data show a discrepancy with what has been modeled, the model parameters and/or operational conditions assumed in the model will be adjusted to match actual operational conditions. Additional information from the monitoring network will be incorporated into the model so that the model can be re-run. The results of the updated model and the monitoring data will be used to determine if the system as a whole is meeting design objectives. If the system is not meeting design objectives, then the updated model will be used to define the necessary changes that will be made to the remediation system and the accompanying monitoring program.

Assess the Impact that the Aquifer Restoration is Having On The Paddys Run Road Site Plume

As is currently done in the DMEPP reports, concentration data collected for key Paddys Run Road Site constituents will be tabulated, and evaluated using trend analysis. Water level maps will be produced to determine where capture is occurring due to pumping in the South Plume Restoration Module.

Adequately Address Community Concerns

The concerns of the community focus on monitoring the impact of remedial activities on groundwater. Therefore, data resulting from the IEMP groundwater program and integration with project-specific monitoring information will address the concerns of the community. Results of the data evaluation will be made available for public review at the Public Environmental Information Center. Public comments received over the life of the IEMP program regarding the IEMP groundwater program will be considered in future revisions of the IEMP.

3.7.2 Data Reporting

For groundwater monitoring, the quarterly status reports will provide an operational assessment of the aquifer restoration system and an assessment of the restoration progress in the format of figures, graphs, tables, and maps. The following questions will be addressed by the reports:

OPERATIONAL ASSESSMENT

- What was the "set point" pumping rate for each extraction well during the quarter?
- What was the "set point" injection rate for each injection well and module during the quarter?
- How many hours during the past quarter did each extraction and injection well operate?
- What percentage of available operating time did each extraction or injection operate during the past quarter?
- How much water was pumped from each extraction well during the quarter?
- How much water was injected into each injection well during the quarter?
- Given the amount of water pumped and the amount of water injected during the last quarter, what is the net water balance?
- How many pounds of uranium were removed during the last quarter?

- How many pounds of uranium have been removed from the aquifer since the start of remediation?
- What was the maximum, minimum, and average uranium concentration sent to treatment during the last quarter?
- What was the monthly average uranium concentration discharged to the Great Miami River during the last quarter?

RESTORATION ASSESSMENT

- What did the area of capture look like during the most recent quarter?
- What did the uranium plume look like during the previous quarter?
- How did pumping effect the Paddys Run Road Site plume during the previous quarter?

The quarters will correspond to calendar years, and begin in January of each year. Quarterly meetings with associated letter reports will be submitted within 60 days of the close of each quarter. The format of the quarterly reports will be limited to figures, graphs, tables, and maps with little to no text. Text will be reserved for the annual comprehensive report.

Two questions which will be answered by the quarterly reports cannot be addressed with 60 days of the close of the quarter. Determining the latest geometry of the 20 μg/L total uranium plume, and the effect that the restoration is having on the Paddys Run Road Site plume requires the analysis of a large amount of data derived from monitoring well samples. Reporting of this data requires several steps: analysis, validation, organization, interpretation, summary of interpretation, and finally issuance of a report. Experience at the FEMP shows that the steps required to report large amounts of analytical data takes approximately six months following completion of the data collection. Therefore, it is proposed that the answer to these two questions be delayed one quarter. For example, the 2nd quarterly status report for a given year (approximately September 1) would address these two questions for data collected during the first quarter of the year (January through March). All other data contained in the quarterly report would pertain to the second quarter (April through June). This schedule for reporting analytical data is consistent with the schedule that is currently being used for the DMEPP.

A comprehensive annual report will be issued each year. The comprehensive annual report will include all of the data that is normally reported in the quarterly reports plus additional data that will be used to answer the following questions:

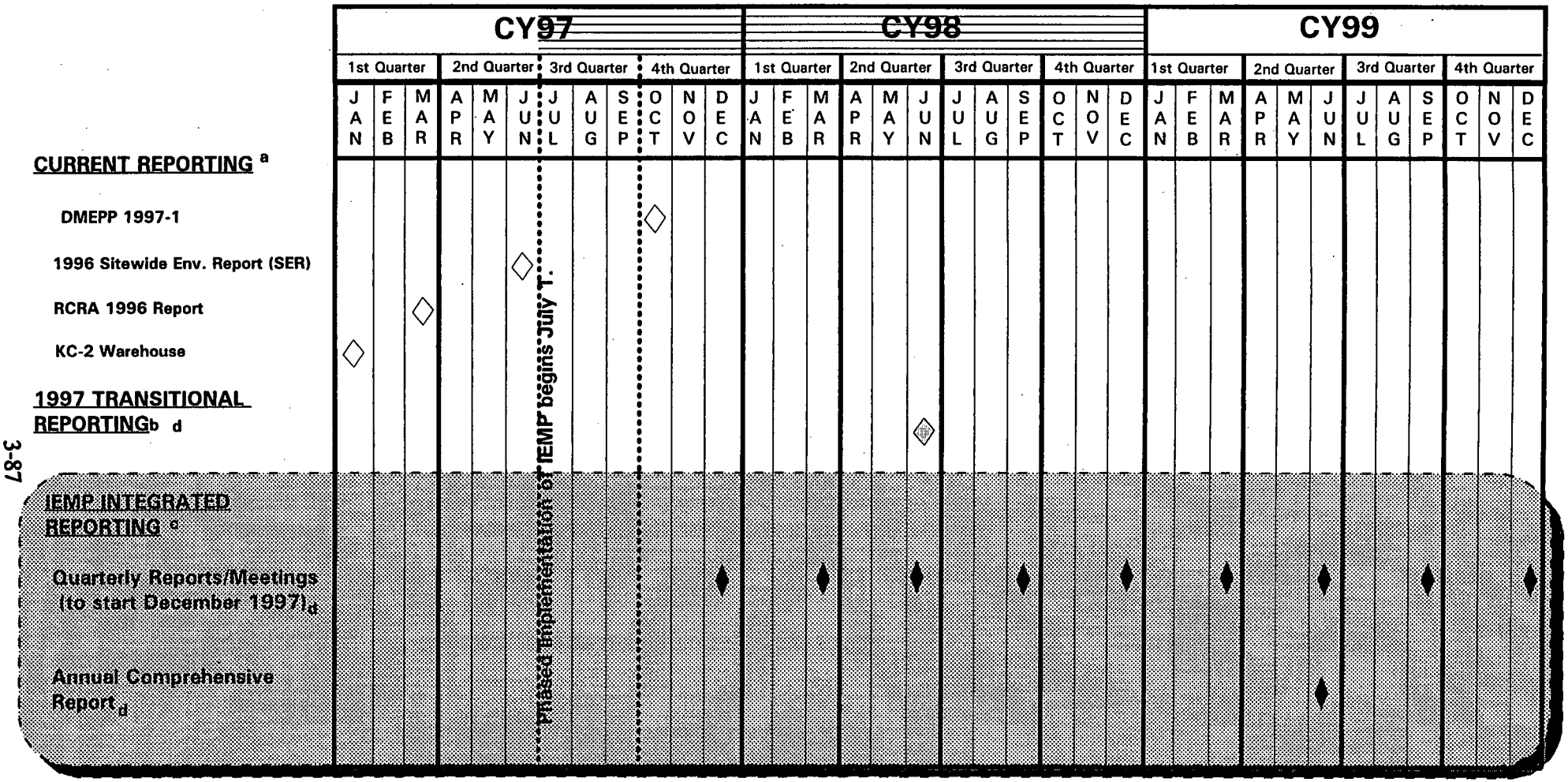
- What is the status of non-uranium FRL exceedances, including any newly detected FRL exceedances?
- Have any new areas of FRL exceedances been identified?
- Is the groundwater restoration proceeding on track as indicated by model predictions established in the Baseline Remediation Strategy Report?
- If necessary, what changes were made to the operation or design of the system to get the restoration back on schedule?

Groundwater monitoring activities are currently reported in various documents on a semi-annual and an annual basis. Figure 3-20 identifies the current reporting schedule for these documents and identifies when IEMP reporting will assume responsibility for groundwater monitoring reporting. Current reports include:

- Performance monitoring of the South Plume Removal Action pumping system is reported semi-annually in the South Plume Removal Action System Evaluation Report which is required by the DMEPP.
- RCRA boundary monitoring program results and analyses are presented annually in the RCRA Annual Report as required by the DFO's decision making of September 1993 and the Project-Specific Plan for the Routine Groundwater Monitoring Program Along the Downgradient Boundary of the FEMP, issued in October 1993.
- The KC-2 Warehouse/Well 67 monitoring program is reported annually in a letter report to the OEPA and the EPA as required by the Abandonment and Plugging of the KC-2 Warehouse/Well No. 67 Groundwater Sampling Work Plan Addendum.
- The Site Environmental Monitoring program for groundwater reports private well sampling results on an annual basis in the Site Environmental Report, as required by DOE Order 5400.1.

With the approval of the IEMP groundwater sampling program, these groundwater sampling programs and reports will be incorporated into one annual IEMP groundwater report. It will document the

FIGURE 3-20
IEMP GROUNDWATER REPORTING SCHEDULE



a = Reporting of all CY96 EMP data by June 1997.

b = Reporting CY97 EMP data and IEMP program data as implemented.

c = Includes the first complete year of reporting IEMP data, CY98 (Assuming IEMP fully implemented by January 1, 1998).

d = Includes RCRA, DMEPP, and KC-2 Warehouse Well No. 67 data, as well as any additional groundwater data that is available.

CY97-98, the timeframe covered in this version of the IEMP

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various groundwater sampling activities presented in the groundwater section of the IEMP. Furthermore, the documents mentioned above which contain program and reporting requirements will be superseded by the IEMP which, upon approval, will become the groundwater sampling program document for the site.

Since these groundwater reports are prepared on different schedules with different due dates, a transition period during 1997 and 1998 will be used to phase out the distinct groundwater reports and move to the annual IEMP groundwater monitoring report. Specifically:

- The next semi-annual South Plume Removal Action System Evaluation Report for the period of January 1 to June 30, 1997 will be prepared and submitted in October 1997, according to the existing schedule. The sampling and analysis results from July 1 to December 31, 1997, which would have been scheduled for release in April 1997, will be incorporated into the transitional environmental monitoring report to be released in June 1998.

- The 1997 RCRA Annual Report scheduled for release March 1, 1998, will be incorporated into the transitional environmental monitoring report to be released in June of 1998.

- The groundwater data for the 1996 Site Environmental Report, scheduled for release in June 1997, will be submitted as scheduled. Groundwater data collected in 1997 will be published in June of 1998 in a report that is transitional from the Site Environmental Report to the IEMP Annual Comprehensive Report.

- The next KC-2 Warehouse Removal Action/Well No. 67 Report scheduled for release in January 1998 will be incorporated into the transitional environmental monitoring report to be released in June of 1998.

Beginning with 1998, groundwater data will be published in the new IEMP Annual Comprehensive Report.

4.0 SURFACE WATER AND TREATED EFFLUENT MONITORING PROGRAM

Section 4.0 provides a description of the routine sitewide surface water and treated effluent monitoring to be performed during active remediation of the FEMP, a strategy for integrating the FEMP's numerous compliance-based monitoring and reporting obligations for surface water and treated effluent, and a media-specific plan for conducting all surface water and treated effluent monitoring activities. The section concludes with a phased plan to integrate the FEMP's existing surface water and treated effluent compliance reports into a single IEMP-sponsored reporting structure.

4.1 INTEGRATION OBJECTIVES FOR SURFACE WATER/TREATED EFFLUENT

Unlike groundwater and soil, no direct restoration of the FEMP's surface water resources (i.e., Paddys Run and the Great Miami River) is required to achieve the surface water FRLs specified in the Operable Unit 5 Record of Decision (DOE 1996). However, because surface water represents both a contaminant transport pathway and an environmental receptor, routine monitoring of surface water is necessary to confirm that the FEMP's point and non-point discharges from other remedial operations to receiving waters fall within established thresholds. The monitoring activities for surface water will thus serve both a surveillance and a compliance function over the life of remediation at the FEMP. These measures will help document that the FEMP's remedial operations are protective of both groundwater (via the surface water cross-media pathway) and the intended use designations for surface water in the vicinity of the FEMP.

The IEMP is the designated vehicle for conducting the FEMP's sitewide surface water surveillance and compliance monitoring downstream from project specific controls. The initial focus is intended to accommodate remedial construction and operation activities taking place in 1997 and 1998. Ultimately, the IEMP will be used to verify and document that the conclusion of the FEMP's sitewide remedial actions result in a condition that no longer poses any long-term threat to human health and/or the environment through the surface water pathway. In this comprehensive role, the IEMP will serve to integrate several compliance-based monitoring and reporting programs currently in existence for the FEMP:

- The discharge monitoring and reporting program related to the site National Pollutant Discharge Elimination System (NPDES) permit.

- The radiological monitoring of and reporting for the treated effluent mandated by the FFCA.
- The existing Environmental Monitoring Program which has been ongoing at the FEMP since the 1950s and which is being updated in the IEMP to accommodate surface water monitoring needs during remediation.

As discussed in Section 4.6, these multiple programs are intended to be brought together under a single reporting structure to facilitate review of the performance of the FEMP's surface water protection actions and measures.

4.2 ANALYSIS OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents a summary evaluation of the regulatory drivers governing the monitoring of the FEMP's point and non-point discharges to Paddys Run and the Great Miami River. The intent of this section is to identify the pertinent regulatory requirements, including ARARs and TBC-based requirements, for the scope and design of the surface water monitoring program. These requirements will be used to confirm that the program: (1) satisfies the regulatory obligations for monitoring that have been activated by the FEMP's Record of Decisions; and (2) will achieve the intentions of other pertinent criteria (such as DOE Orders and the FEMP's existing agreements and permits as appropriate) that have a bearing on the scope of surface water monitoring.

The results of the analysis will also be used to define, as appropriate for this media, the administrative boundaries between the IEMP and the project-specific emission control and runoff monitoring conducted by other FEMP organizations.

4.2.1 Approach

The analysis of the regulatory drivers and policies for surface water and treated effluent was conducted by examining the suite of ARARs and TBC requirements in the Operable Unit 5 Record of Decision to identify the subset with specific environmental monitoring requirements. The FEMP's existing compliance agreements issued outside the CERCLA process (such as the NPDES permit requirements and the Federal Facilities Compliance Agreement [FFCA]) were also reviewed.

4.2.2 Results

The following summary of regulatory drivers, compliance agreements, and DOE Orders were found to govern the monitoring scope and reporting requirements for surface water and treated effluent:

- The CERCLA Record Of Decision For Remedial Actions at Operable Unit 5, which requires remediation of the site such that the surface water pathway is protective of the underlying Great Miami Aquifer and protective of the various surface water environmental receptors. The surface water FRLs provided in the Operable Unit 5 Record of Decision considered and incorporated all chemical-specific ARARs and TBCs for the protection of human health via the surface water pathway.

- The CERCLA Feasibility Study Report for Operable Unit 5, which stated that if the concentrations of constituents remain above benchmark toxicity values (BTVs) after completion of the remedial action, then further investigation and remediation may be warranted. The surface water BTVs listed in the Feasibility Study Report were identified as contaminant concentrations that are protective of ecological receptors.

- The current NPDES permit for the FEMP, which triggers a variety of site-specific surface water and treated effluent sampling, analysis, and reporting requirements for non-radiological discharges. The current NPDES permit became effective November 1, 1995, and expires March 31, 1998.

- The Storm Water Pollution Prevention Plan (SWPPP), submitted under the current NPDES permit, which requires a sampling program to indicate how construction and excavation activities outside of the controlled storm water runoff area may impact the downgradient NPDES storm water discharge points to Paddys Run.

- The 1986 FFCA, which requires that the FEMP maintain a continuous sample collection program for radiological constituents at the FEMP's treated-effluent discharge points and report the results quarterly to the EPA, OEPA, and the Ohio Department of Health. The sampling program to address this requirement has been modified over the years and is currently governed by an agreement reached with EPA and OEPA in early 1996 (DOE 1996a). This agreement became effective May 1, 1996. This agreement requires sampling at the Parshall Flume and the storm water retention basin spillway for radiological parameters.

- DOE Order 5400.1, General Environmental Protection Program Requirements, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility. The FEMP's existing EMP provides the initial basis for the development of the IEMP strategy that is responsive to the changing site mission and associated remedial needs while still DOE Order compliant.

- DOE Order 5400.5, Radiation Protection of the Public and the Environment, which obligates the FEMP to perform surveillance monitoring of surface water to ensure that radiological dose limits to the public in the order are not exceeded. Under these requirements, the exposure to members

of the public associated with activities at DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent greater than 100 mrem. Studies in support of the Operable Unit 5 Feasibility Study (DOE 1995a) demonstrated for all media that combined exposure to FEMP radiological COCs at their respective FRLs falls well below the DOE dose requirement. Therefore, monitoring designed to track and document the CERCLA FRL-based remediation of the site meets the intent of DOE Order 5400.5.

Three other regulatory drivers were found to have surface water monitoring implications, but only of a project-specific surface water control nature. These drivers fall outside the scope of the IEMP, but are within the scope of one or more of the FEMP's individual remediation projects. Some of the drivers pertain to surface water controls and do not explicitly require monitoring; however, monitoring may be conducted during the project to demonstrate the effectiveness of the emission control. The project-specific surface water monitoring drivers include:

- The 1986 FFCA, which requires that the FEMP maintain a continuous sample collection program for radiological constituents at specific on-site discharge points and report the results quarterly to the EPA, OEPA, and the Ohio Department of Health. This requirement is also listed above as an IEMP-related regulatory driver for the surface water monitoring program. The FFCA and the subsequent 1996 agreement requires sampling at the inactive flyash pile and the storm water retention basin bypass.

- The SWPPP, submitted under the current NPDES permit, which requires engineering controls to protect down-gradient areas during construction and excavation activities conducted outside of the controlled storm water runoff area. Monitoring will be conducted to determine whether effluent (or overflow) from the installed project control structures presents an unacceptable impact to the surface water.

- The NPDES permit for the FEMP, which triggers a variety of process control monitoring for non-radiological parameters. The NPDES permit became effective November 1, 1995, and expires March 31, 1998.

The surface water and treated-effluent monitoring plan provided in this IEMP has been developed in full consideration of these regulatory drivers. Each of these drivers and the associated monitoring conducted to comply with them are listed in Table 4-1. Table 4-1 also lists each regulatory driver for project-specific surface water monitoring and the project-specific plan that addresses monitoring conducted to meet the requirement. The FEMP's current and long-range plan for complying with the reporting requirements invoked by these drivers is provided in Sections 4.6 and 8.0.

TABLE 4-1
FEMP SURFACE WATER MONITORING
REGULATORY DRIVERS AND RESPONSIBILITIES

IEMP

DRIVER	ACTION
DOE Order 5400.1 Environmental Monitoring Plan for all media	The IEMP describes effluent and surveillance monitoring as required by the Order
DOE Order 5400.5 Radiation Protection of Public and Environment	The IEMP includes a description for routine sampling of Paddys Run and on-site drainage ditches for radionuclides
OU5 ROD Surface water FRLs	The IEMP will be modified toward completion of the remedial action to include sampling to certify FRL achievement
OU5 FS Surface water BTVs	The IEMP will be modified toward completion of the remedial action to include sampling for BTV constituents
NPDES Permit	The IEMP describes routine sampling of permit-designated effluent discharges and stormwater drainage points for NPDES permit parameters
Stormwater Pollution Prevention Plan Impacts to Paddys Run from uncontrolled area	The IEMP describes the sampling of drainage ditches leading to Paddys Run
FFCA Radionuclide monitoring	The IEMP describes routine sampling at Parshall Flume and Stormwater Retention Basin Spillway for radiological parameters

PROJECT

		PROJECT PLAN
FFCA Radionuclide monitoring	Routine sampling at Inactive Flyash Pile and Stormwater Retention Basin bypass	Sitewide Excavation Plan; Operations and Maintenance Plan for Aquifer Restoration and Wastewater Treatment Projects
Stormwater Pollution Prevention Plan Monitoring of Engineering Controls	Routine sampling of project-specific sediment traps & basins for Total Suspended Solids and Uranium	Sitewide Excavation Plan
NPDES Permit Operational Monitoring	Routine sampling for process control parameters in AWWT	Operations and Maintenance Plan for Aquifer Restoration and Wastewater Treatment Projects

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4.3 PROGRAMMATIC BOUNDARIES FOR THE SURFACE WATER AND TREATED EFFLUENT MONITORING PROGRAM

This section identifies the programmatic boundaries established between the IEMP and the project-specific activities to be conducted by others. The intent behind the boundary definition is to: 1) clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility; and 2) establish a recognized interface between the sitewide focus of the IEMP and the predominant emission-control focus of project-specific monitoring.

It is important to emphasize that the IEMP program boundary for each of the FEMP's environmental media is unique and, for portions of surface water program, time dependent. The boundary is the combined result of:

- Regulatory monitoring requirements
- The physical configuration of the site, and planned remediation areas (which will change over time for soil excavation occurring in various areas of the site shown in Figure 4-1, and the associated project-specific controls/monitoring of surface water runoff).
- The surface water/treated effluent monitoring responsibilities assigned to the IEMP.

For surface water, the programmatic boundary requiring definition for purposes of the IEMP is the line of demarcation between the areas where surface water is currently controlled (former production area, Operable Unit 3; waste storage areas, Operable Units 1 and 4; and portions of the inactive flyash pile and the south field in Operable Unit 2 shown in Figure 4-2), or will be controlled as a result of soil remedial activities and construction of the on-site disposal facility. As noted above, these boundaries will be transient during remediation as the soil remediation progresses across the site and as individual cells of the on-site disposal facility are developed. In essence, the IEMP will provide surveillance monitoring downstream from the areas where project-specific controls are in place. IEMP surface water and treated effluent monitoring also includes all FFCA and NPDES surface water and treated effluent sampling requirements.

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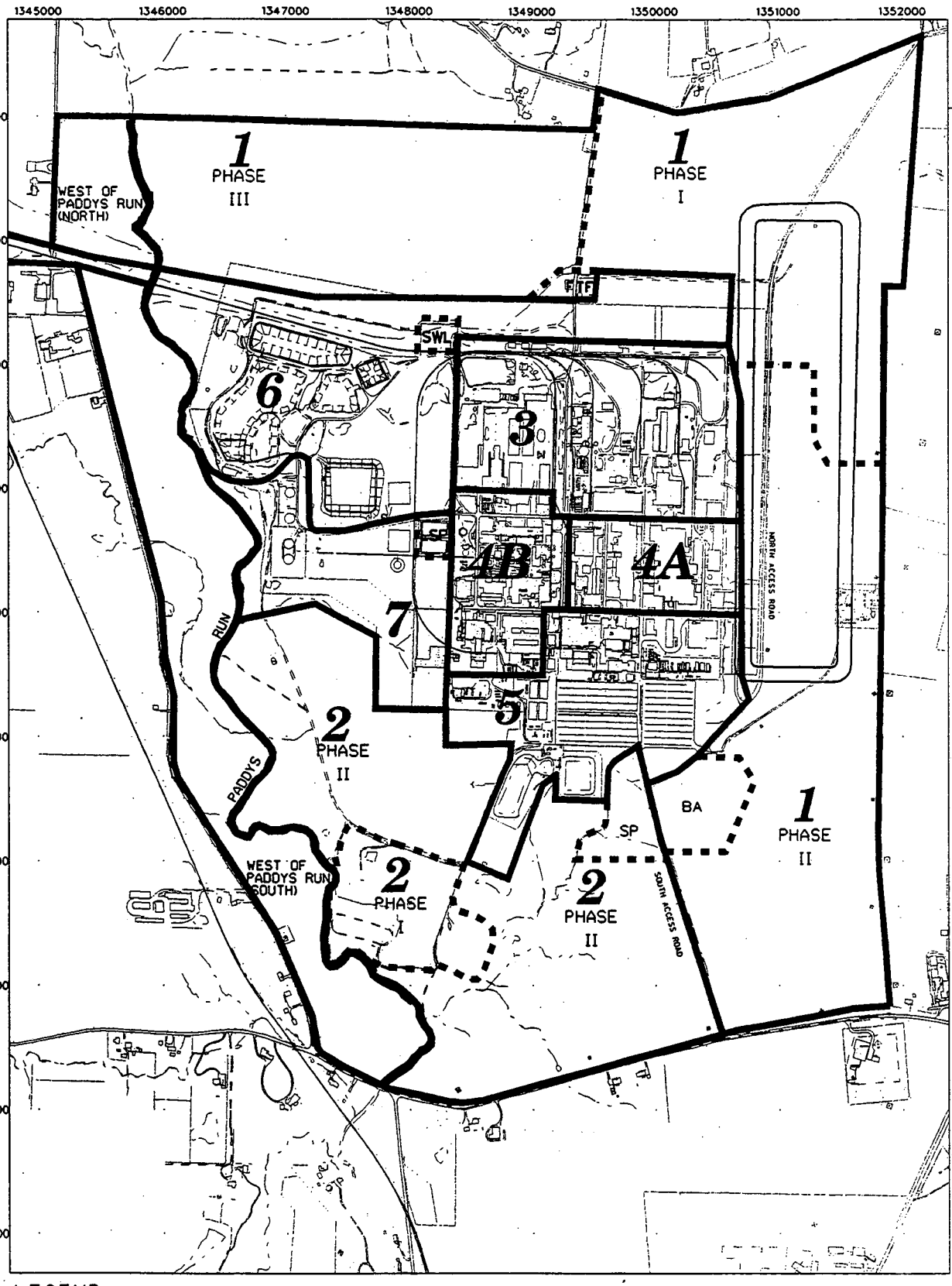


LEGEND:

- - - - - - PHASE BOUNDARIES

— · — · — FEMP BOUNDARY

1 REMEDIATION AREA

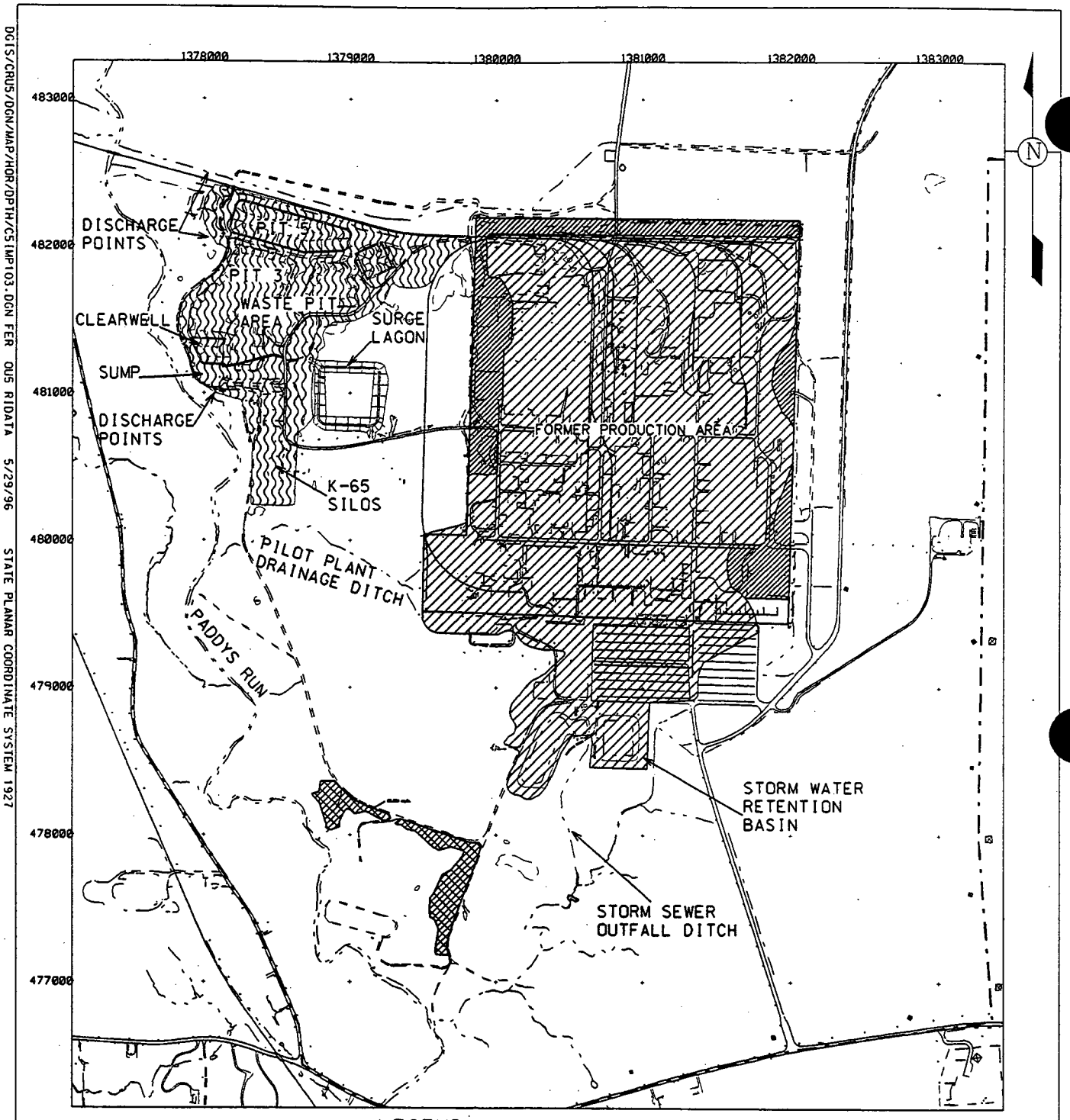
SCALE

1200 600 0 1200 FEET

FINAL

FIGURE 4-1. SITEWIDE REMEDIATION AREAS

000130



LEGEND:

- FEMP BOUNDARY
- REMOVAL ACTION 16
- PRE-REMOVAL ACTION CONTROLLED AREA
- REMOVAL ACTION 2
- REMOVAL ACTION 30

NOTE:

DRAWING IS BASED ON 1992 AERIAL PHOTOGRAPHS.

SCALE

1000 555 0 1000 FEET

FINAL

FIGURE 4-2. CONTROLLED AREA SURFACE WATER RUNOFF

000131

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To assist in interpretation of IEMP surface water data collected downstream from the project-specific controls, the project-specific monitoring data will be integrated as appropriate. This is discussed further in Section 4.6 (IEMP Surface Water Monitoring Data Evaluation and Reporting.)

4.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

4.4.1 Program Expectations

The IEMP surface water and treated-effluent monitoring program is being designed to collect data sufficient to meet the following expectations for 1997 and 1998:

- Provide an ongoing assessment of the potential for cross-media impacts from surface water to the underlying Great Miami Aquifer, at locations near the point where the protective glacial overburden has been breached by site drainages
- Document whether the sporadic exceedances of FRLs and benchmark toxicity values (BTVs) in various site drainages (noted in the Operable Unit 5 Feasibility Study) continue to occur at key on-property locations, at the property boundary on Paddys Run, and in the Great Miami River outside the mixing zone
- Provide an assessment of impacts to surface water due to uncontrolled runoff and implementation of site remedial activities, which is also required under the SWPPP
- Provide data to determine if certain constituents exceed the FRL. This is necessary for some constituents because 1) there is an insufficient number of historical analyses or 2) historical analyses had a detection limit which exceeded the FRL
- Provide additional data at background locations on Paddys Run and the Great Miami River to refine the FEMP's ability to distinguish site impacts from background as remediation progresses
- Continue to fulfill monitoring and reporting requirements associated with the site NPDES permit
- Continue to fulfill monitoring and reporting requirements associated with the FFCA
- Continue to fulfill DOE Order 5400.1 requirements to maintain an environmental monitoring plan for surface water
- Continue to address the concerns of the community regarding the magnitude of the FEMP's discharges to surface water (i.e., to Paddys Run and the Great Miami River).

The following section provides the design considerations required to fulfill each of these expectations.

4.4.2 Design Considerations

4.4.2.1 Parameter Selection Criteria

A comprehensive summary of site-specific information and data was assembled to determine the most appropriate site-specific indicator parameters for surface water and treated-effluent sampling under the IEMP. This information is presented in Table 4-2. The following is a description of each of the columns in Table 4-2 and how the information in the table was used to determine the most appropriate parameters for a particular location. Additional details regarding a particular portion of parameter selection criteria are provided in Appendix B as noted below. Note that the information provided in Table 4-2 was utilized to select parameters at key locations identified in Sections 4.4.2.2 through 4.4.2.5 and was not applied to some of the NPDES sampling locations as sampling at the NPDES locations follows the current NPDES permit sampling requirements.

- Column 1, Constituent: This column represents the suite of constituents considered for monitoring in the surface water pathway as a result of the remedial investigation/feasibility study process at the FEMP. It represents the summation of the constituents for which a BTV was documented in the Operable Unit 5 Feasibility Study and/or a FRL was established in the Operable Unit 5 Record of Decision.

- Column 2, Number of Analyses: This column depicts the number of analyses for a particular constituent available for evaluation. The analyses were compiled by combining surface water data from the Operable Unit 5 Remedial Investigation, EMP data from 1990 through 1995, and NPDES/FFCA data from November 1995 through April 1996. Constituents with no historical analyses or no analyses with method detection limits above the FRL were added to the list of constituents to be analyzed at property boundary sampling locations.

- Column 3, Final Remediation Levels: This column represents the human-health-protective remediation levels for surface water that were established in the Operable Unit 5 Record of Decision.

- Column 4, FRL Basis: This column is the basis for establishment of the FRL as defined in the Operable Unit 5 Feasibility Study.

- Column 5, Number of Analyses above FRL: This column identifies the number of analyses in Column 2 which exceeded the FRL. The location of each FRL exceedance was evaluated with respect to the drainage basin and is shown in Appendix B. Constituents that exceeded the FRL were added to the parameter list at surface water sample locations downstream of the FRL exceedance location.

- Column 6, Benchmark Toxicity Value: This column represents the surface water BTVs from the Sitewide Ecological Risk Assessment (as documented in the Operable Unit 5 Feasibility Study). BTVs are used to predict the toxicity of chemicals to ecological receptors.

TABLE 4-2

SURFACE WATER PARAMETER SELECTION CRITERIA SUMMARY[a]

Constituent	No. of Analyses	Final Remediation Levels[b] (FRL)	FRL Basis[b]	No. of Analyses Above FRL[c]	Benchmark Toxicity Value (BTV)	No. of Analyses Above BTV[c]	No. of Areas Failed Modeling	95th Percentile Background Level in Surface Water[d]	
								Paddys Run	Great Miami River
Radionuclides (pCi/L)									
Cesium-137+1d	78	1.0×10^{1}	0.00	0.00	-	-	-	3.1	ND
Neptunium-237+1d	143	2.1×10^{2}	0.00	0.00	-	-	-	-	ND
Lead-210+2d	0.00	1.1×10^{1}	R	-	-	-	-	-	-
Plutonium-238	152	2.1×10^{2}	0.00	0.00	-	-	-	ND	ND
Plutonium-239/240	152	2.0×10^{2}	0.00	0.00	-	-	-	0.09	ND
Radium-226+8d	364	3.8×10^{1}	R	0.00	0.00	0	2	0.35	0.41
Radium-228+1d	368	4.7×10^{1}	0.00	0.00	-	-	-	2.1	2.2
Strontium-90+1d	183	4.1×10^{1}	0.00	0.00	-	-	10	0.96	ND
Technetium-99	185	1.5×10^{2}	R	0.00	-	-	14	ND	ND
Thorium-228+7d	228	8.3×10^{2}	0.00	0.00	0.00	0	-	ND	0.62
Thorium-230	229	3.5×10^{3}	0.00	0.00	0.00	0	-	ND	0.36
Thorium-232+10d	230	2.7×10^{2}	R	0.00	0.00	0	0	ND	ND
Uranium, total (mg/L)	340	5.3×10^{-1}	R	25	8.9×10^{-1}	18	10	0.001	0.001
Chemicals (mg/L)									
Alpha-chlordane	23	3.1×10^{-4}	0.00	0.00	-	0	-	-	-
Aluminum	95	-	-	0.00	8.7×10^{-2}	37	34	-	-
Ammonia	94	-	0.00	0.00	1×10^{0}	4	-	-	-
Antimony	88	1.9×10^{-1}	0.00	0.00	0.00	0	-	ND	ND
Aroclor-1254	23	2.0×10^{-4}	0.00	0.00	-	-	-	-	-
Aroclor-1260	23	2.0×10^{-4}	0.00	0.00	-	-	-	-	-
Arsenic	145	4.9×10^{-2}	R	0.00	0.00	0	-	ND	0.0036
Barium	145	1.0×10^{2}	0.00	0.00	0.00	2	0	0.053	0.1
Benzene	48	2.8×10^{-1}	0.00	0.00	-	-	-	-	-
Benzo(a)anthracene	47	1.0×10^{-3}	D	0.00	-	-	-	-	-

TABLE 4-2
(Continued)

Constituent	No. of Analyses	Final Remediation Levels[b] (FRL)	FRL Basis[b]	No. of Analyses Above FRL[c]	Benchmark Toxicity Value (BTV)	No. of Analyses Above BTV[c]	No. of Areas Failed Modeling	95th Percentile Background Level in Surface Water[d]	
								Paddys Run	Great Miami River
Chemical (mg/L) - Cont'd.									
Benzo(a)pyrene	47	1.0×10^{-3}	0.00	0.00	-	-	-	-	-
Beryllium	86	1.2×10^{-3}	0.00	5	1.5×10^{-1}	0	-	ND	ND
Bis(2-chloroisopropyl)ether	47	2.8×10^{-1}	R	0.00	-	-	-	-	-
Bis(2-ethylhexyl)phthalate	47	8.4×10^{-3}	0.00	9	8.4×10^{-3}	9	-	-	-
Bromodichloromethane	49	2.4×10^{-1}	0.00	0.00	-	-	-	-	-
Bromomethane	49	1.3×10^{0}	R	0.00	-	-	-	-	-
Cadmium	143	9.8×10^{-3}	0.00	1	3.5×10^{-3}	19	0	ND	0.01
Carbon disulfide	49	-	0.00	0.00	1.49×10^{0}	0	-	-	-
Chloroform	49	7.9×10^{-2}	A	0.00	-	-	-	-	-
Chromium VI[e]	0.00	1.0×10^{-2}	0.00	25	1.1×10^{-2}	25	-	ND	ND
Copper	143	1.2×10^{-2}	0.00	8	3.4×10^{-2}	0	-	ND	0.012
Cyanide	81	1.2×10^{-2}	A	4	1.2×10^{-2}	4	35	ND	0.005
Dibenzo(a,h)anthracene	47	1.0×10^{-3}	0.00	0.00	-	-	2	-	-
3,3-Dichlorobenzidene	47	7.7×10^{-3}	0.00	0.00	-	-	-	-	-
Di-n-butylphthalate	47	6.0×10^{0}	R	0.00	-	-	-	-	-
1,1-Dichloroethene	49	1.5×10^{-2}	0.00	0.00	-	-	-	-	-
1,2-Dichloroethene (total)	49	-	-	0.00	3.1×10^{-1}	0	-	-	-
Dieldrin	23	2.0×10^{-5}	0.00	0.00	-	-	-	-	-
Di-n-octylphthalate	6	5.0×10^{-3}	0.00	2	-	-	-	-	-
Fluoride	94	2.0×10^{0}	0.00	0.00	-	-	-	0.22	0.9
Lead	94	1.0×10^{-2}	0.00	13	3.0×10^{-2}	9	0	ND	0.010
Manganese	138	1.5×10^{0}	R	0.00	0.00	19	-	0.035	0.08
Mercury	145	2.0×10^{-4}	0.00	12	2.0×10^{-4}	12	35	ND	ND
Methylene chloride	49	4.3×10^{-1}	0.00	0.00	0.00	0	-	-	-

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TABLE 4-2
(Continued)

Constituent	No. of Analyses	Final Remediation Levels[b] (FRL)	FRL Basis[b]	No. of Analyses Above FRL[c]	Benchmark Toxicity Value (BTV)	No. of Analyses Above BTV[c]	No. of Areas Failed Modeling	95th Percentile Background Level in Surface Water[d]	
								Paddys Run	Great Miami River
Chemical (mg/L) - Cont'd.									
4-Methylphenol	47	2.2×10^{0}	R	0.00	-	-	-	-	-
Molybdenum	143	1.5×10^{0}	0.00	0.00	0.00	0	-	ND	0.02
Nickel	143	1.7×10^{-1}	0.00	0.00	4.7×10^{-1}	0	-	ND	0.023
Nitrate	64	2.4×10^{3}	R	0.00	-	-	-	1.7	6.6
4-Nitrophenol	44	7.4×10^{3}	0.00	0.00	-	-	-	-	-
Selenium	123	5.0×10^{-3}	0.00	1	5×10^{-3}	1	-	ND	ND
Silver	128	5.0×10^{-3}	D	15	1.3×10^{-3}	16	12	ND	ND
Tetrachloroethene	49	4.5×10^{-2}	0.00	1	7.3×10^{-2}	1	-	-	-
Thallium	85	-	0.00	-	1.6×10^{-2}	0	-	ND	ND
1,1,1-Tricholoroethane	49	1.0×10^{-3}	D	1	-	-	-	-	-
1,1,2-Tricholoroethane	49	2.3×10^{-1}	0.00	0.00	-	-	-	-	-
Trichloroethene	49	-	0.00	0.00	7.5×10^{-2}	0	2	-	-
Vanadium	103	3.1×10^{0}	R	0.00	4.1×10^{-2}	0	-	ND	ND
Zinc	84	1.1×10^{-1}	0.00	2	2.8×10^{-1}	1	1	ND	0.045

[a] = Shading indicates parameters selection for IEMP surface water target analytes and associated reason for selection
[b] = Derived from Operable Unit 5 Record of Decision Table 9-5
A = ARAR values
B = Background concentrations
D = Analytical detection limit
R = Human health risk
[c] = Additional information is provided in Appendix B
[d] = For small data sets (≤ 7 Samples), the maximum detected concentration is used as the 95th percentile
[e] = FRL and BTV are based on chromium VI; however, the analytical results are for total chromium
U = Number of analyses above FRL is unknown because method detection limits for all analyses were above the FRL
ND= Non-detect
- = Not applicable/not available

- Column 7, Number of Analyses above BTV: This column represents the number of analyses in Column 2 which exceeded the BTV. An analyte was added to the parameter list for all surface water sample locations downstream of the BTV exceedence. Additional detail is provided in Appendix B.

- Column 8, Number of Areas Failed Modeling: This column represents, by constituent, the total number of on-property site drainage areas that failed modeling for cross-media impacts (35 specific drainage areas were evaluated, see Figure 4-3). Fate-and-transport modeling of on-property soil contaminants was conducted on an area-by-area basis for those areas of the FEMP east of Paddys Run (including source operable unit areas) to determine what area-specific constituents in soil have the potential to affect a surface water receptor or could cause a cross-media impact to groundwater during remediation. Specifically, if a particular constituent was found to have the potential to exceed the surface water BTV or FRL for that constituent, it failed the modeling and was therefore selected for monitoring at key downstream locations. Also, if a constituent was found to have a potential to cause a cross-media impact to groundwater via the surface water pathway (i.e., cause an FRL exceedence in groundwater), it failed.

  This information was used as part of the parameter selection process for each of the proposed IEMP surface water sampling locations. If a constituent failed the modeling in any drainage area "upstream" from a particular sampling location, then the respective "downstream" sampling location target analyte list includes the failed constituent.

- Column 9, 95th Percentile Background Level in Surface Water: This column represents the 95th percentile background level in surface water as presented in the Operable Unit 5 Remedial Investigation (DOE 1995f) for Paddys Run and the Great Miami River. This information is provided for comparison purposes.

4.4.2.2 Surface Water Cross-Media Impact

To assess the cross-media impact that contaminated surface water has on the underlying Great Miami Aquifer, the following design considerations are necessary:

- Samples should be collected at those points near where the glacial overburden has been breached by site drainages. As described in the Operable Unit 5 Remedial Investigation, the majority of the FEMP is underlain by clay-rich glacial overburden, which, where present, provides a measure of protection to the underlying sand-and-gravel aquifer. Where the protective glacial overburden (Figure 4-4) has been eroded by site drainages (primarily in the lower reaches of Paddys Run and in the storm sewer outfall ditch), a direct pathway exists for surface water and associated contaminants to reach the underlying sand-and-gravel Great Miami Aquifer. In the Operable Unit 5 Remedial Investigation, contaminant migration via this pathway was determined to be responsible for the formation of the South Plume. Specifically, the South Plume was formed over the years when contaminated surface water runoff infiltrated through the streambeds of the storm sewer outfall ditch and Paddys Run.

- Parameters analyzed should represent those area-specific COCs identified in the Operable Unit 5 Feasibility Study (DOE 1995a) and subsequent fate-and-transport modeling as having the potential for cross-media impact to groundwater via the surface water pathway.

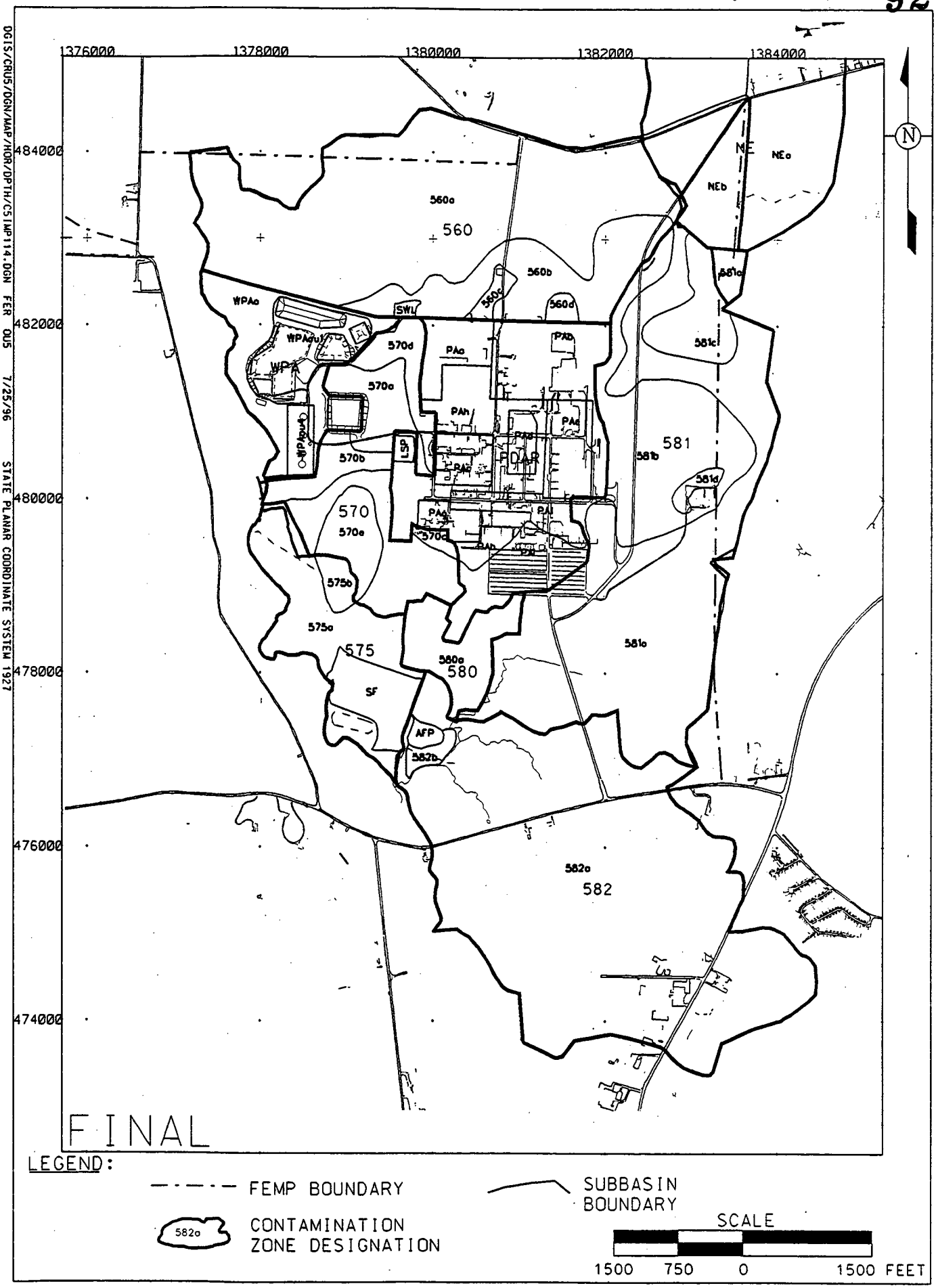
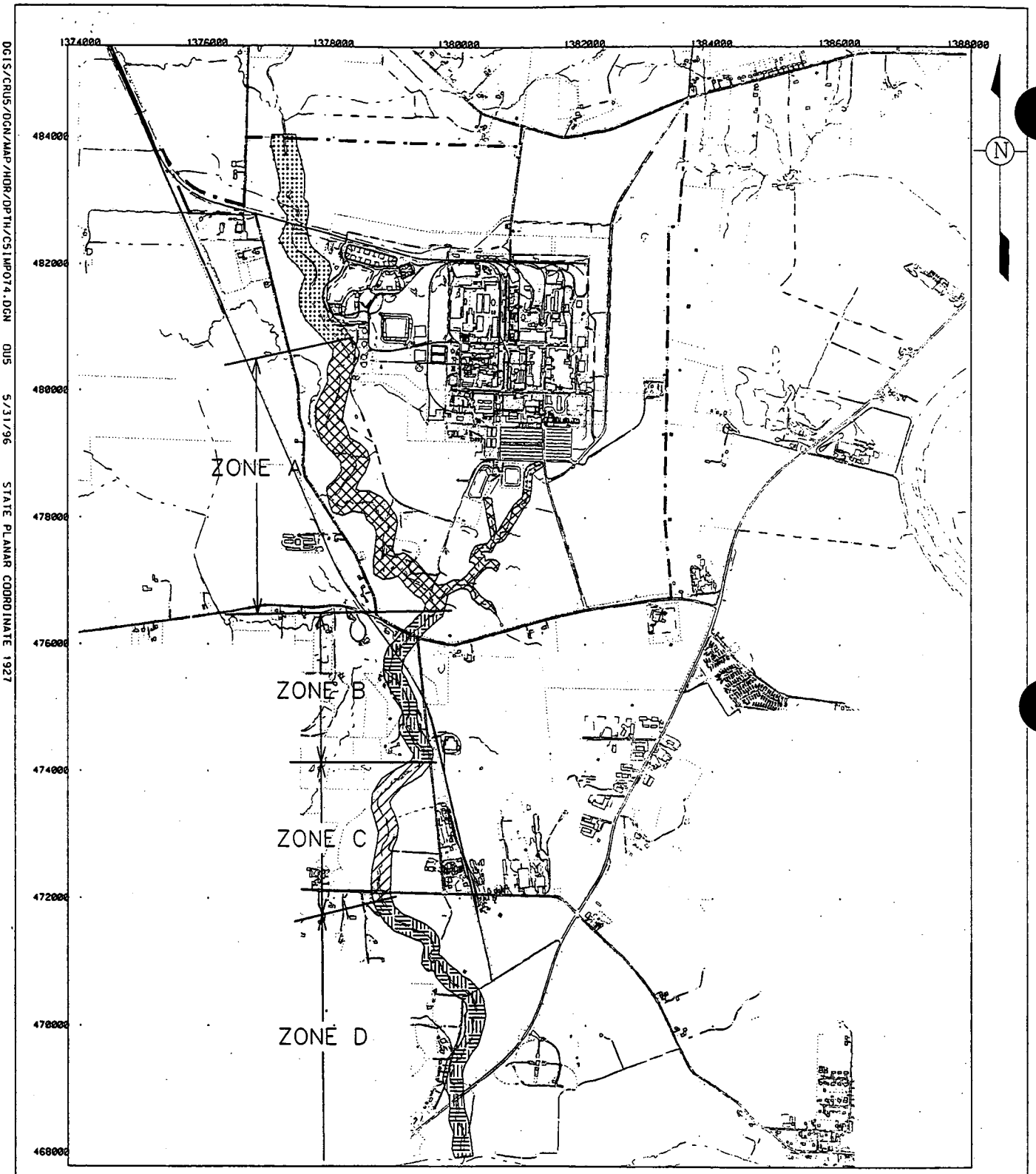


FIGURE 4-3. DRAINAGE SUB-BASINS WHICH COVER THE FEMP



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NOTE:
ZONE AREAS ARE APPROXIMATE AND BASED ON AVERAGE WATER LEVELS

LEGEND:
- GLACIAL OVERBURDEN MINIMUM INFILTRATION
- INFILTRATION ALWAYS OCCURS
- INFILTRATION DEPENDENT ON WATER TABLE ELEV.
- GROUNDWATER DISCHARGE IN ALL SEASONS
- FEMP BOUNDARY

SCALE
2250 1125 0 2250 FEET

FINAL

FIGURE 4-4. SURFACE WATER INFILTRATION TO THE GREAT MIAMI AQUIFER ALONG PADDYS RUN AND THE STORM SEWER OUTFALL DITCH

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- Sampling frequency should be such that seasonal fluctuations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed.

4.4.2.3 Sporadic Exceedances of FRLs and BTVs

To assist in the development of the scope and focus of the IEMP surface water program, a review of the FEMP's existing sitewide surface water characterization database was conducted. This review identified a limited number of constituents that occasionally and sporadically exceed their respective FRL or BTV established through the Operable Unit 5 Remedial Investigation/Feasibility Study process. Maps detailing surface water locations with historical FRL or BTV exceedances are provided in Appendix B. Table 4-2 provides the total number of FRL and/or BTV exceedances by constituent. To comply with the requirements of the Operable Unit 5 Record of Decision, all surface water FRLs must be achieved and maintained at the completion of the FEMP's remedial actions. (It was acknowledged in the Operable Unit 5 Feasibility Study that the BTVs were not a formal part of the FRL development process.) To address the BTVs, the Operable Unit 5 Feasibility Study provided a provision that if, following remediation of the site to achieve FRLs, the concentrations of constituents remained above BTVs for ecological receptors, further investigation and remediation may be warranted. The plan for accommodating the BTVs, as established in the Operable Unit 5 Feasibility Study, is therefore a necessary design consideration for development of the surface water monitoring plan under the IEMP. Additionally, surface water BTVs are currently being evaluated in the Sitewide Excavation Plan. Any changes to the BTVs and/or ecological COCs resulting from this evaluation will be included in future revisions of the IEMP.

During site remediation, those constituents that have occasionally exceeded FRLs and/or BTVs should be monitored to document whether the exceedances continue to occur, or, as expected, dissipate as remediation progresses. Because active remediation will be occurring in and near on-property drainages, it is appropriate to monitor for exceedances of the FRLs and BTVs downstream from the remedial areas and upstream from the off-property receptors. Therefore, sampling points should be located at: (1) on-property locations downstream of historical FRL or BTV exceedances; (2) the point where Paddys Run flows off the FEMP property; (3) the northeast drainage as it leaves the property; and (4) the treated-effluent water as it leaves the FEMP destined for the Great Miami River. To determine the concentration of the treated effluent constituents outside the mixing zone in the Great Miami River, a conservative calculation using the 10-year low-flow conditions will be necessary. To provide surveillance monitoring for FRL and BTV exceedances, samples should be collected monthly

and analyzed for those constituents identified in Table 4-2 as having exceeded FRLs or BTVs within the respective drainage areas upstream of the sampling point. The monthly sampling should be conducted such that contaminant concentrations under a range of flow conditions are assessed.

4.4.2.4 Impacts to Surface Water due to Uncontrolled Runoff and Remedial Activities

As stated in Section 4.3, IEMP surface water monitoring will occur outside of and downstream from areas where surface water is controlled. As shown in Figure 4-2, the majority of highly contaminated surface water drainage from the site (i.e., from the former production area [Operable Unit 3], the waste storage area [Operable Units 1 and 4], and portions of Operable Unit 2 [inactive flyash pile/south field]) has been identified and controlled through contaminant abatement and formal removal actions from 1986 to 1995.

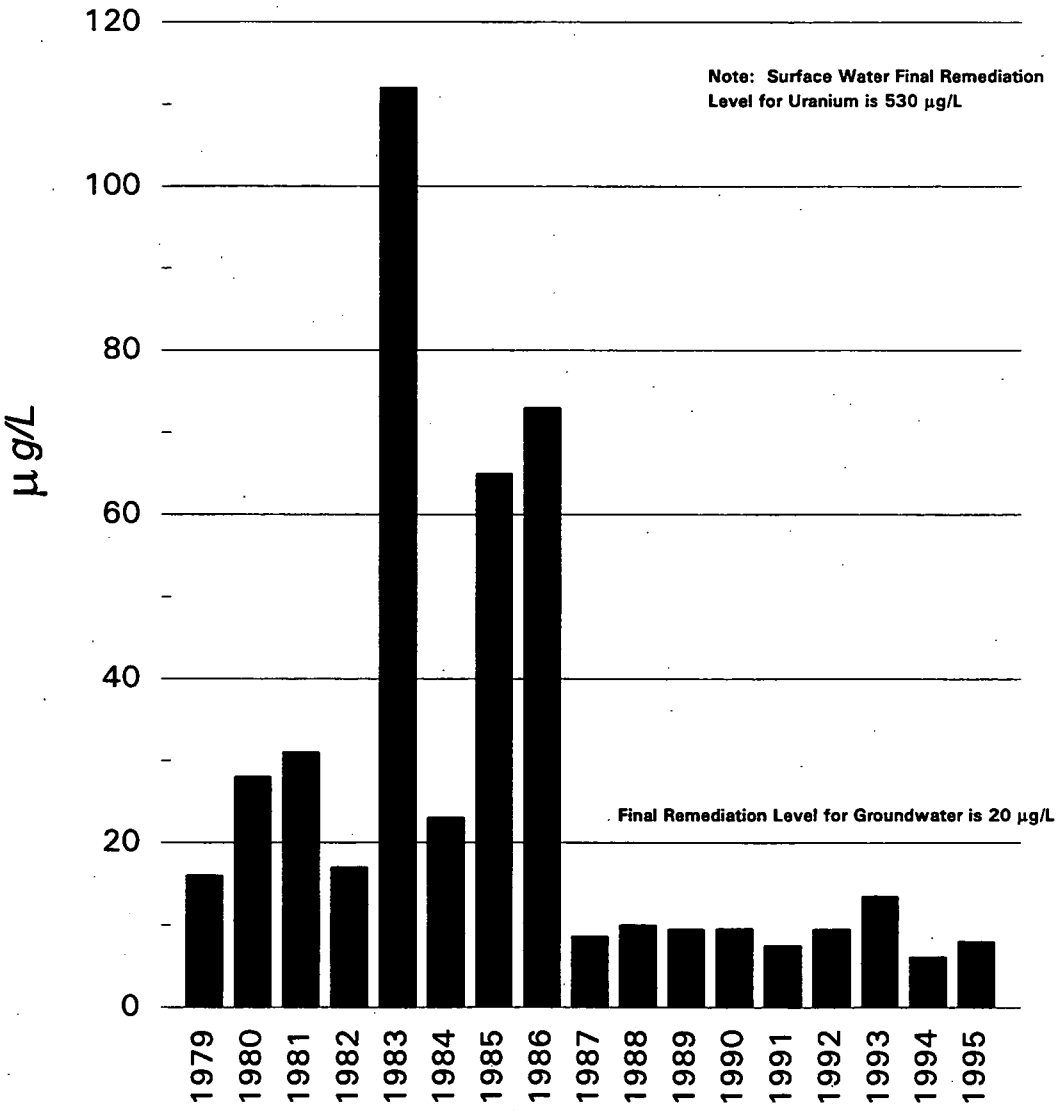
Figure 4-5 shows the dramatic effect contaminated runoff controls have had in lowering the concentrations of uranium, the principal site contaminant, in surface water leaving the FEMP via Paddys Run. EMP surface water sample locations are shown in Figure 4-6. Other important distinctions regarding uranium in surface water leaving the site to Paddys Run, based on the data in Figure 4-5, are that:

- Average concentrations have been far below the human-health-protective surface water FRL concentration of 530 μg/l in each year since 1979. (This includes nine years while the site was in production.)
- Average annual concentrations have been consistently below the human-health-protective groundwater FRL of 20 μg/l for each of the nine years since the storm water retention basin began collecting contaminated runoff in 1986.

It is anticipated that the controls currently in place will remain until remediation of the respective areas is complete. Therefore, it will not be necessary to monitor within these controlled areas for purposes of the IEMP. Storm water runoff from these areas is collected and treated. Monitoring of the effluent is covered by the NPDES and FFCA programs discussed in Section 4.4.2.6.

Additional controls on surface water runoff are mandated by the SWPPP for construction activities, which includes areas where soil remedial excavations will occur and the area where the on-site disposal facility is being constructed. As noted in Section 4.3, responsibility for these controls and monitoring

Figure 4-5
Comparison of Average Total Uranium Concentrations
at Paddys Run at Willey Road



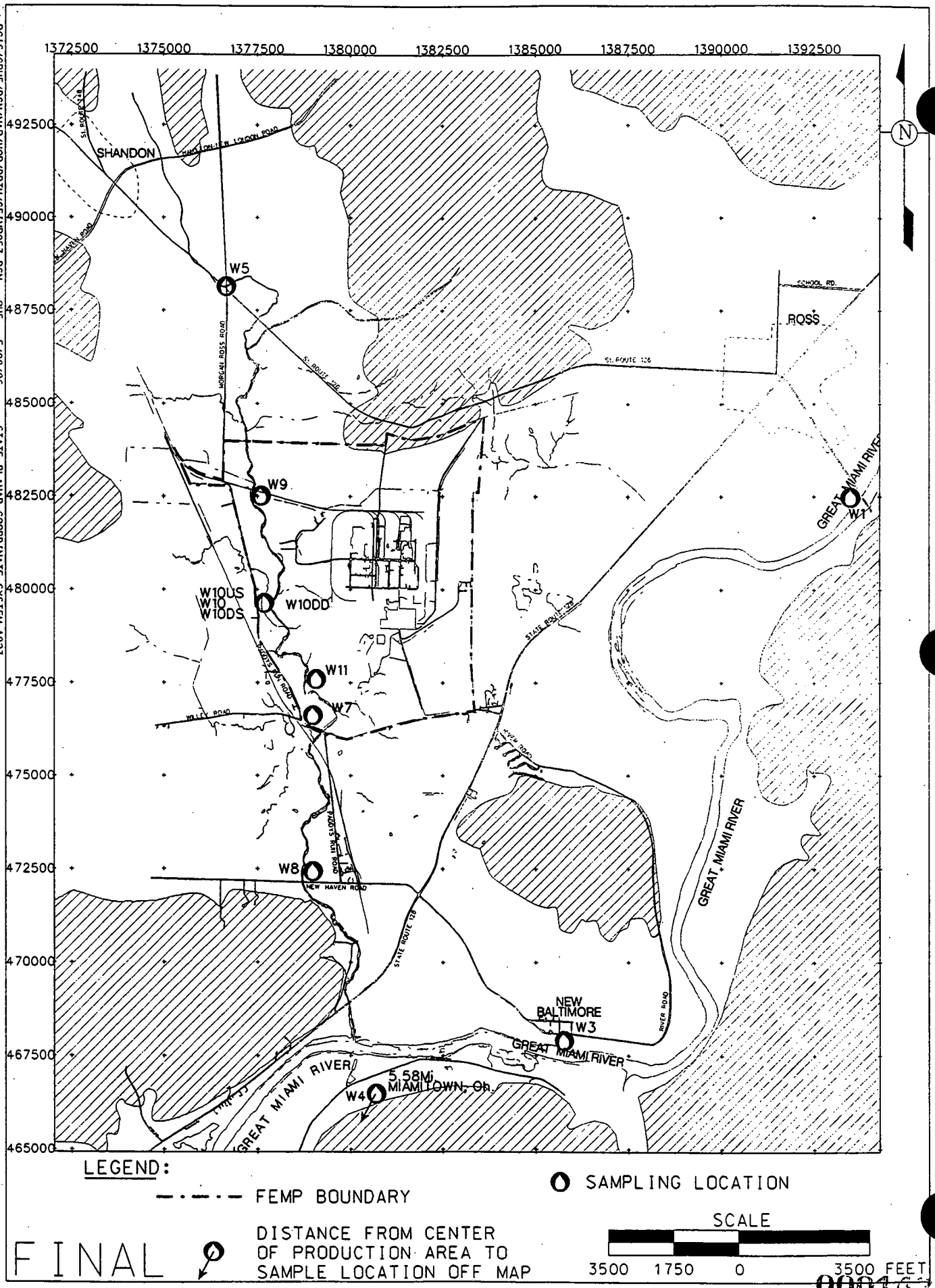


FIGURE 4-6. EMP SURFACE WATER SAMPLING LOCATIONS

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for the effectiveness of the controls is the responsibility of each individual project. The specifications of these controls and associated performance monitoring of the controls will be outlined in Operable Unit 5 soil remediation remedial action work plans and other project-specific remedial action documentation, as warranted.

Effective sampling points for this surveillance monitoring need to be:

- At points downstream of the controls and activities
- At the FEMP site boundary in Paddys Run
- In the treated effluent routed to the Great Miami River as it leaves the facility
- At the storm water retention basin spillway, during overflow conditions.

Parameters for this surveillance monitoring need to be those constituents that:

- Exceed surface water FRLs or BTVs upstream from the monitoring points, and

- Are present in sufficient concentration upstream of the monitoring points and are mobile to the degree such that they have the potential for: 1) cross-media impact to groundwater; 2) affecting surface water to the degree that human-health-protective FRLs are exceeded; and 3) impact surface water above BTVs.

The frequency of sampling to fulfill this expectation should be such that seasonal variations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed. To adequately assess the impact of storm water overflows from areas where surface water is controlled, the frequency of sampling at the storm water retention basin shall be such that each overflow is characterized.

Unlike the relatively low concentrations of uranium documented at the property boundary, uranium concentrations in the Pilot Plant drainage ditch have consistently exceeded the surface water FRL for uranium (Figure 4-7, Location W10DD). Additionally, a portion of Paddys Run in the vicinity of the waste storage area (Figure 4-6, Location W10US) has consistently shown elevated levels of uranium with averages above background, but below FRL (as shown in Figure 4-8). These surface water data were collected in support of the EMP and the Remedial Investigation/Feasibility Study. Figure 4-8 identifies the average annual uranium concentrations for the past 5 years at environmental monitoring points along Paddys Run.

Figure 4-7
Average Annual Total Uranium Concentrations
at Pilot Plant Drainage Ditch Sampling Location

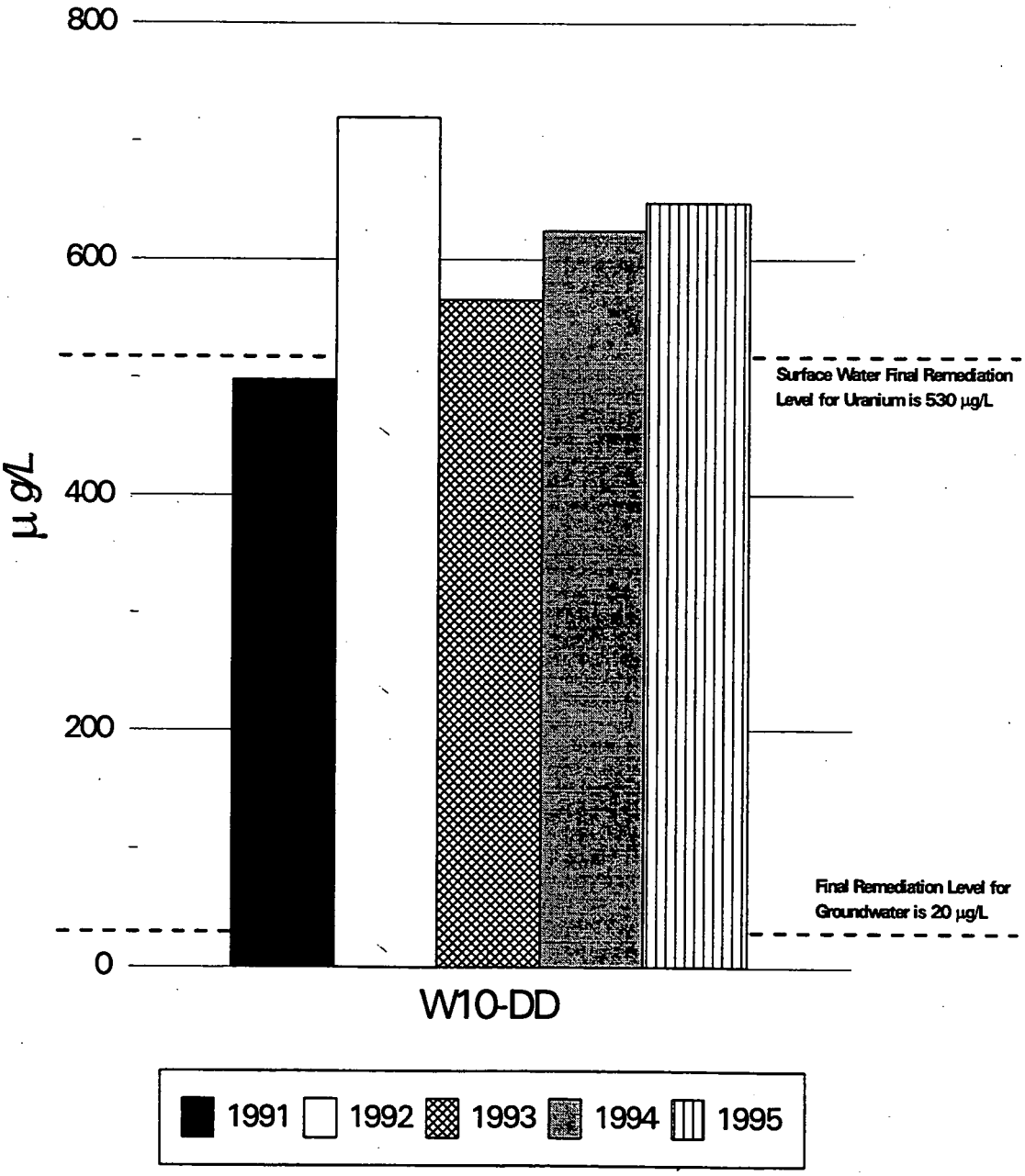

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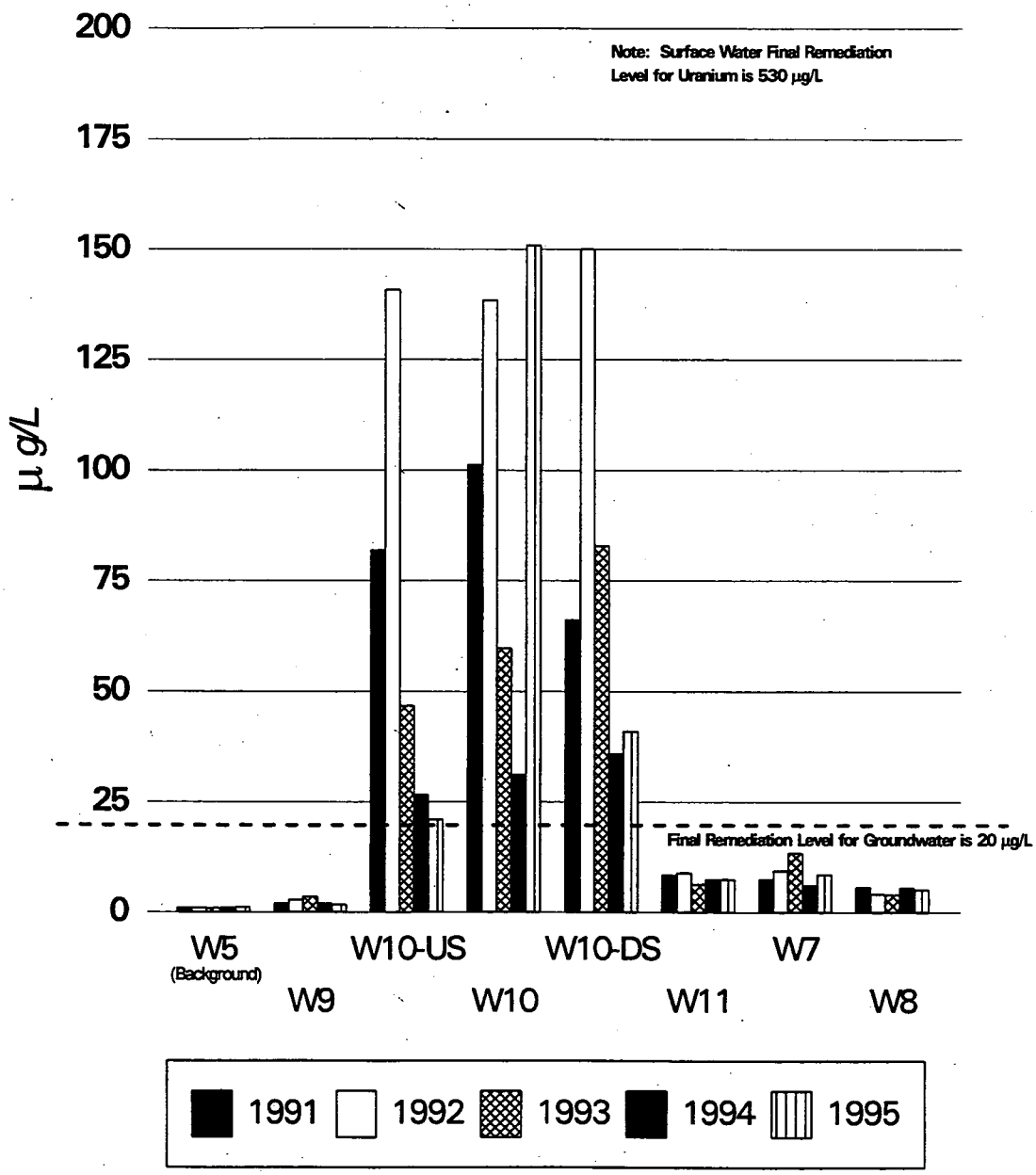
Figure 4-8

Average Annual Total Uranium Concentrations at Paddys Run Sampling Locations



In the spring of 1996, a sump was installed at the Pilot Plant drainage ditch to reroute contaminated surface water to treatment. Under the IEMP, surface water will be monitored monthly for total uranium at two locations (Figure 4-9, SWD-03 and STRM 4005) to determine the effectiveness of this control and to determine if an ongoing problem exists from runoff originating in the area between the waste storage area and the former production area.

4.4.2.5 Insufficient Number of Historical Analyses

Due to insufficient data for a limited number of constituents with FRLs (i.e., method detection limits for all analyses were above the FRL or there was an insufficient number of analyses), it cannot be adequately determined whether they exceed the FRLs and/or BTVs. These constituents are: benzo(a)anthracene, benzo(a)pyrene, dibenzo(a,h)anthracene, 3,3-dichlorobenzidine (identified with a U on Table 4-2). FRLs and BTVs were developed after sampling in support of the remedial investigation was completed. FRLs developed for several constituents were based on the lowest reasonable and achievable method detection limits. For several constituents, the resulting FRLs were below the method detection limits used for the samples collected during the remedial investigation. Additionally, lead-210 has not historically been sampled in surface water at the FEMP.

Therefore, to adequately assess whether these parameters are a concern, effective sampling points need to be:

- At the FEMP site boundary in Paddys Run, and
- In the treated effluent routed to the Great Miami River as it leaves the facility.

The frequency of sampling to fulfill this expectation should be such that seasonal variations in contaminant concentrations (as well as fluctuations due to varying flow conditions) can be assessed.

4.4.2.6 Ongoing Background Evaluation

As shown in the Operable Unit 5 Remedial Investigation, the remedial investigation/feasibility study background data set for Paddys Run and the Great Miami River surface water was limited both by the number of samples and temporal variability represented by the samples. In addition to this remedial investigation/feasibility study data limitation, background surface water quality is by nature transient (i.e., background surface water quality is subject to variations over time due to changes in activities

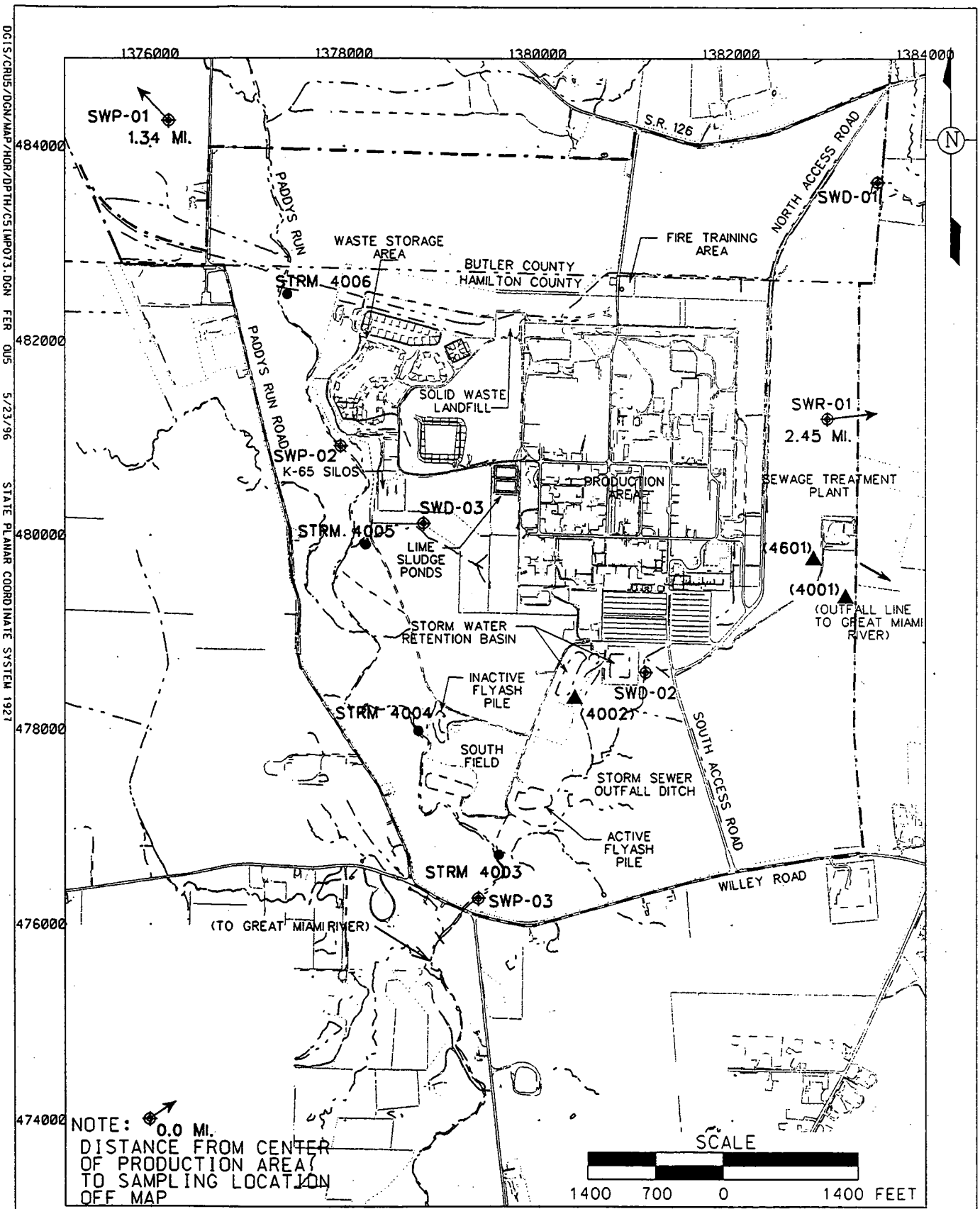


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FIGURE 4-9. IEMP SURFACE WATER SAMPLE LOCATIONS

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and runoff conditions within the watershed). To address the limited background data for Paddys Run and the Great Miami River, the following considerations are recommended for the establishment of the IEMP surface water background sampling program for 1997 and 1998:

- Sampling points shall be consistent with those locations established for the existing environmental monitoring program and the remedial investigation/feasibility study
- Parameters analyzed shall represent the parameters for which the Operable Unit 5 Record of Decision established surface water FRLs and those parameters for which the Sitewide Ecological Risk Assessment documented BTVs
- Sampling frequency shall be such that seasonal variations (as well as variations due to varying flow conditions) can be assessed.

These considerations define the IEMP program for surface water sampling of background locations provided in the following program design section.

4.4.2.7 Continue to Fulfill National Pollutant Discharge Elimination System Requirements

As noted in Section 4.2, wastewater and storm water discharges from the FEMP are regulated under the state-administered NPDES program. The current permit (OEPA Permit 1I000004*ED) was issued on September 27, 1995, became effective November 1, 1995, and expires March 31, 1998. All surface water and treated-effluent sampling and analysis requirements as they are defined in the current permit will be carried forward and integrated in the IEMP shown in Section 4.4.3; however, it is anticipated that when the site NPDES permit is renewed in 1998, the permit requirements will be refined based on the progressive findings of the IEMP and ongoing remedial activities of the site.

To better assess the impacts of treated effluent on the surface water with respect to FRLs and BTVs, the IEMP recommends that lower detection limits be implemented for two constituents analyzed in the NPDES program. In the future, analytical methods 220.2 and 272.2 from Methods for Chemical Analysis of Water and Wastes (EPA 1983), will be used for the analysis of copper and silver, respectively. These methods are both approved for use in NPDES programs under 40 CFR 136.3 (Table 1B) and will provide sufficiently low detection limits.

4.4.2.8 Continue to Fulfill Federal Facilities Compliance Agreement Requirements

As noted in Section 4.2.2, the current FFCA sampling and reporting requirements became effective May 1, 1996. These requirements specify sampling at the following locations: 1) the Parshall Flume; 2) the storm water retention basin spillway; 3) the storm water retention basin bypass; 4) the South Plume recovery wells; and 5) the inactive fly ash pile. In addition to these sampling requirements, a calculation of the amount of uranium reaching Paddys Run via uncontrolled runoff is also performed. Based on the programmatic boundary definition described in Section 4.3, the IEMP would incorporate sampling at above-described locations 1 and 2, and would include the uranium calculation for the uncontrolled runoff, the Parshall Flume, and at the storm water retention basin spillway. Sampling at above-described locations 3, 4, and 5 are project-specific responsibilities and, therefore, outside the purview of IEMP sampling. However, as discussed in Section 8.0, monitoring data for each of the five FFCA monitoring locations and calculations of the amount of uranium reaching Paddys Run will be incorporated into a comprehensive IEMP reporting structure that will be phased in during 1997 and 1998.

The sampling agreement implemented May 1, 1996 (DOE 1996a) noted that, pending further evaluation, several radiological parameters may be deleted from the FFCA sampling of treated effluent. Further evaluation was performed in the comprehensive point-by-point parameter selection evaluation completed in support of this IEMP surface water and treated-effluent sampling program; the radiological parameters selected for the treated-effluent sampling point at the Parshall Flume IEMP are a composite of:

- Those radiological COCs that have been detected above their respective human-health-based surface water FRL or above the ecologically protective BTVs at any point upstream from the Parshall Flume, and
- Those radiological COCs that were found to be: 1) present in those areas where surface water is controlled and ultimately routed to the storm water retention basin and/or Parshall Flume; and 2) mobile to a degree such that surface water may be impacted above FRLs or BTVs during remediation as indicated by fate-and-transport modeling.

These parameters are listed in Section 4.4.3, Program Design; also listed are all other parameters deemed necessary to fulfill the program expectations outlined in Section 4.4.1, for the Parshall Flume treated-effluent sampling point, as a result of the IEMP parameter-selection process.

4.4.2.9 Continue to Fulfill DOE Order 5400.1 Requirements

The design considerations provided above, which were based on information and conclusions derived from the existing DOE-compliant environmental monitoring program, as well as the comprehensive findings of the FEMP remedial investigation/feasibility study process, are sufficient to meet or exceed the requirements of DOE Order 5400.1, as summarized in Section 4.2.2.

4.4.2.10 Continue to Address Concerns of the Community

The monitoring derived from Section 4.4.2.4 (Impacts to Surface Water due to Uncontrolled Runoff and Remedial Activities) will be sufficient to address the concerns of the community. These concerns focus on limiting the amount of FEMP related contamination entering Paddys Run and the Great Miami River. This monitoring will provide a comprehensive monitoring program on Paddys Run at the facility boundary and in the treated effluent that is destined for the Great Miami River to document the reduction in FEMP related contamination entering these streams that is anticipated to occur as the remediation progresses.

4.4.3 Program Design

This section provides the IEMP surface water and treated-effluent sampling program derived from the design considerations provided in Section 4.4.2. The IEMP surface water and treated effluent sampling locations are shown on Figures 4-9 and 4-10. Table 4-3 summarizes the program design by providing the sampling locations, the frequency, and the parameters to be sampled for at each location. This table also provides the basis for the locations, and parameters with respect to program expectations identified in Section 4.4.1.

In summary, the site EMP has been restructured to assess the impact of site remedial activities on surface water. The nonradiological discharge monitoring and reporting related to the NPDES permit has been incorporated into the IEMP. The radiological discharge monitoring related to the FFCA has been incorporated into the IEMP with minor modifications to include all of the constituents that exceeded FRLs and BTVs in areas where storm water runoff is controlled.

The analytical support level (ASL) for the data collected in this IEMP surface water and treated effluent program will be level B. ASL B provides qualitative, semi-qualitative, and quantitative data with some

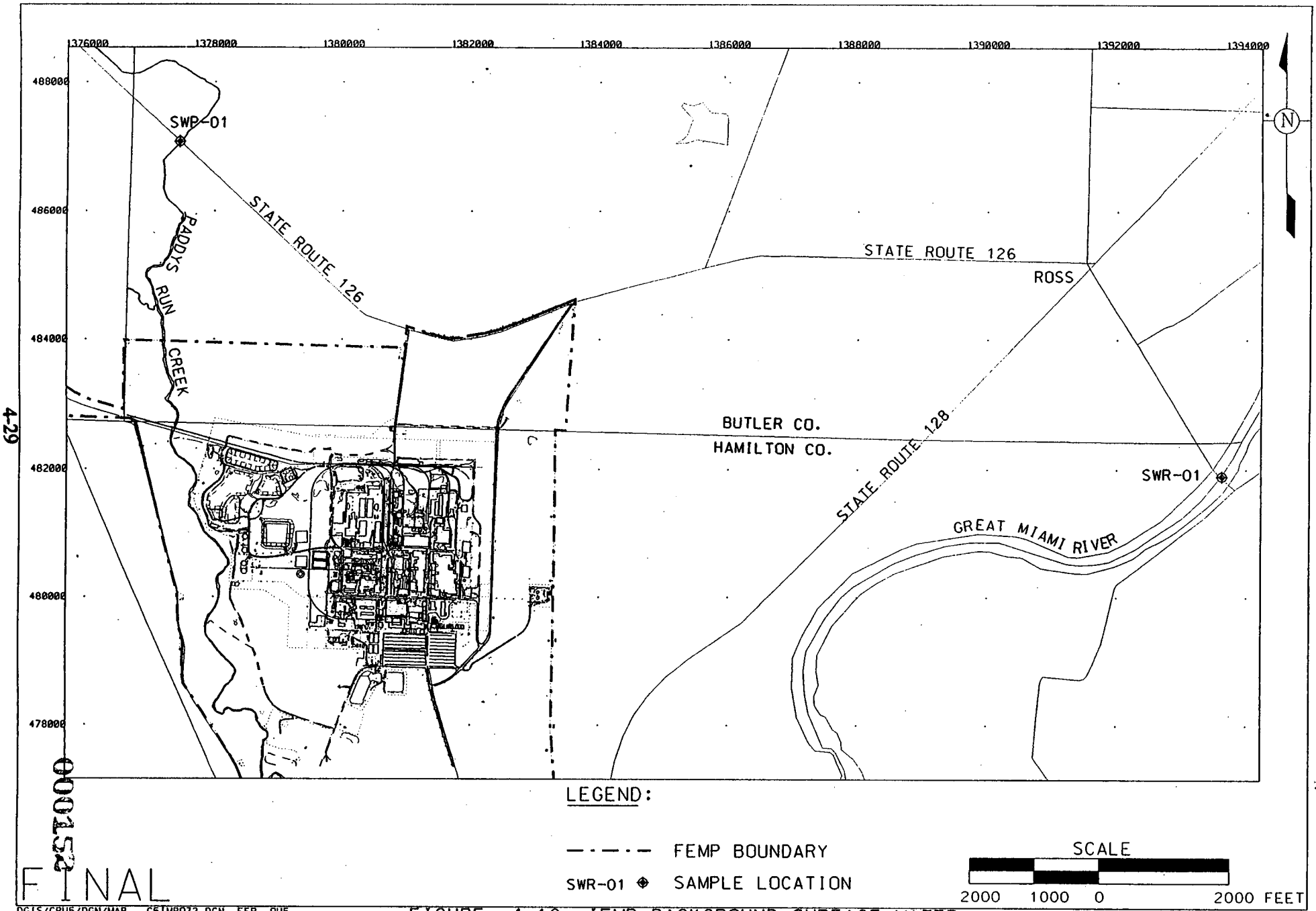

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FIGURE 4-10. IEMP BACKGROUND SURFACE WATER SAMPLE LOCATIONS

TABLE 4-3

SUMMARY OF SURFACE WATER SAMPLING PROGRAMS

Location	Parameter	Basis for Parameter Selection: Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Ongoing Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Monthly	Quarterly	Quarterly	Various[a]	Various[a]
SWP-01 (Paddys Run Background)	All parameters listed in Table 4-2				♦		
SWP-02 (Paddys Run)	Aluminum		♦				
	Beryllium		♦				
	Cadmium		♦				
	Chromium, Total		♦				
	Copper		♦				
	Manganese		♦				
	Mercury		♦				
	Technetium-99	♦	♦				
	Uranium, Total		♦				
SWP-03 (Paddys Run at Downstream Property Boundary)	Aluminum	♦	♦				
	Barium		♦				
	Benzo(a)anthracene			♦			
	Benzo(a)pyrene			♦			
	Beryllium		♦				
	Bis(2-ethylhexyl)phthalate		♦				
	Cadmium		♦				
	Chromium, Total		♦				
	Copper		♦				
	Cyanide	♦					
	Dibenzo(a,h)anthracene			♦			
	3,3-Dichlorobenzidine			♦			
	Di-n-octylphthalate		♦				
	Lead		♦				
	Lead-210			♦			
	Manganese		♦				

TABLE 4-5
(Continued)

Location	Parameter	Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Ongoing Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
		Basis for Parameter Selection					
	Frequency:	Quarterly	Monthly	Quarterly	Quarterly	Various[a]	Various[a]
SWP-03 (Paddys Run at Downstream Property Boundary) - Cont'd.	Mercury	♦					
	Radium-226	♦	♦				
	Selenium		♦				
	Silver	♦	♦				
	Strontium-90	♦					
	Technetium-99		♦				
	Tetrachloroethene		♦				
	1,1,1-Trichloroethane		♦				
	Uranium, Total	♦	♦				
	Zinc	♦					
SWD-01 (Northeast Drainage)	Aluminum	♦					
	Beryllium		♦				
	Cyanide	♦	♦				
	Lead		♦				
	Manganese		♦				
	Mercury	♦					
	Zinc		♦				
SWD-02 (Storm Sewer Outfall Ditch)	Aluminum		♦				
	Bis(2-ethylhexyl)phthalate		♦				
	Cadmium		♦				
	Manganese		♦				
	Strontium-90	♦					
	Technetium-99	♦					
	Uranium, Total	♦	♦				
SWD-03 (Waste Storage Area)	Aluminum	♦					
	Barium		♦				
	Bis(2-ethylhexyl)phthalate		♦				
	Chromium, Total		♦				

TABLE 4-3
(Continued)

Location	Parameter	Basis for Parameter Selection: Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Ongoing Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Monthly	Quarterly	Quarterly	Various[a]	Various[a]
SWD-03 (Waste Storage Area) - Contd.	Copper		♦				
	Cyanide	♦					
	Lead		♦				
	Manganese		♦				
	Mercury	♦					
	Silver	♦					
	Technetium-99	♦					
	Tetrachloroethene		♦				
	1,1,1-Trichloroethane		♦				
	Uranium, Total		♦				
	Zinc	♦					
SWR-01 (Great Miami River Background)	All parameters listed in Table 4-10				♦		
4001 (Parshall Flume - Treated Effluent)	Aluminum	♦	♦				
	Ammonia					♦	
	Benzo(a)anthracene			♦			
	Benzo(a)pyrene			♦			
	Beryllium		♦				
	Biochemical Oxygen Demand, Carb.					♦	
	Cadmium		♦				
	Chromium, Dissolved Hexavalent					♦	
	Chromium, Total		♦				
	Copper		♦			♦	
	Cyanide	♦	♦				
	Dibenzo(a,h)anthracene			♦			
	Di-n-octylphthalate			♦			
	3,3-Dichlorobenzidine			♦			
	Flow Rate					♦	
	Fluoride					♦	

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TABLE 4-5
(Continued)

Location	Parameter	Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Ongoing Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
		Basis for Parameter Selection					
	Frequency:	Quarterly	Monthly	Quarterly	Quarterly	Various[a]	Various[a]
4001 (Parshall Flume - Treated Effluent) - Contd.	Lead-210			♦			
	Manganese		♦				
	Mercury	♦	♦				
	Nitrate/Nitrite					♦	
	Oil and grease					♦	
	Radium-226	♦					
	Radium-228		♦				♦
	Silver	♦					
	Solids, Total Suspended					♦	
	Strontium-90	♦					
	Technetium-99	♦	♦				♦
	Trichloroethene	♦					
	Uranium, Total	♦	♦				♦
4002 (Storm Water Retention Basin)	Aluminum	♦[b]	♦[b]				
	Ammonia					♦	
	Beryllium		♦[b]				
	Cadmium		♦[b]				
	Chlorine, Residual					♦	
	Chromium, Total					♦	
	Chromium, Dissolved Hexavalent					♦	
	Copper					♦	
	Cyanide	♦[b]	♦[b]				
	Flow Rate					♦	
	Fluoride					♦	
	Manganese		♦[b]				
	Mercury	♦[b]	♦[b]				
	Nickel					♦	
	Nitrate/Nitrite					♦	

TABLE 4-3
(Continued)

Location	Parameter	Basis for Parameter Selection: Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Ongoing Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Monthly	Quarterly	Quarterly	Various[a]	Various[a]
4002 (Storm Water Retention Basin) - Contd.	Oil and grease					♦	
	Phosphorus					♦	
	Radium-226	♦[b]					
	Radium-228		♦[b]				
	Silver					♦	
	Solids, Total Suspended					♦	
	Strontium-90	♦[b]					
	Technetium-99	♦[b]	♦[b]				
	Trichloroethene	♦[b]					
	Uranium, Total	♦[b]					♦
STRM 4003, STRM 4004, STRM 4005, STRM 4006 (Drainages to Paddys Run)	Ammonia					♦	
	Chromium, Total					♦	
	Chromium, Dissolved Hexavalent					♦	
	Copper					♦	
	Flow Rate					♦	
	Fluoride					♦	
	Lead					♦	
	Nickel					♦	
	Nitrate/Nitrite					♦	
	Oil and grease					♦	
	Phosphorus					♦	
	Silver					♦	
	Solids, Total Suspended					♦	
	Uranium, Total		♦[c]				

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TABLE 4-3
(Continued)

Location	Parameter	Basis for Parameter Selection: Potential Surface Water or Groundwater FRL or Surface Water BTV Exceedance Based on Modeling	Sporadic Exceedances of FRLs and BTVs	Insufficient Number of Historical Analyses	Ongoing Background Evaluation	Continue to Fulfill NPDES Requirements	Continue to Fulfill FFCA Requirements
	Frequency:	Quarterly	Monthly	Quarterly	Quarterly	Various[a]	Various[a]
4601 (Sewage Treatment Plant Effluent)	Ammonia					♦	
	Cadmium					♦	
	Biochemical Oxygen Demand, Carb.					♦	
	Chromium, Total					♦	
	Chromium, Dissolved Hexavalent					♦	
	Copper					♦	
	Fecal Coliform					♦	
	Flow Rate					♦	
	Lead					♦	
	Mercury					♦	
	Nickel					♦	
	Solids, Total Suspended					♦	
	Zinc					♦	

[a]Refer to Tables 4-10 through 4-15 for frequencies.
[b]Parameter to be analyzed at each overflow event.
[c]Total uranium is to be sampled only at location STRM 4005 to assess effectiveness of surface water control recently in emplaced within the Pilot Plant drainage ditch.

QA/QC checks. The rationale for specifying ASL B for this program is that the data will be used for surveillance monitoring purposes. Validation of the analytical data will occur on an annual basis for one round of data from all sample locations.

All parameters from one of the monthly or quarterly samples at each location will be validated to fulfill this requirement. Near the completion of site remediation, sampling will occur to certify that the surface water pathway at the FEMP is meeting the obligations set forth in the Operable Unit 5 Record of Decision. Samples collected for this certification process will undergo a higher level of analytical scrutiny and validation than the current surveillance program.

4.5 MEDIA-SPECIFIC PLAN FOR SURFACE WATER SAMPLING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the IEMP surface water sampling program. The sampling, analytical, and data management activities described in this media-specific plan were designed to provide surface water data of sufficient quality to meet the program expectations as stated in Section 4.4.4. The program expectations in conjunction with the design considerations presented in Section 4.4.4 were used as the framework for developing the monitoring approach presented in this media-specific plan. To ensure that the specific data quality objectives are met for this program, all sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the FEMP SCQ.

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

4.5.1 Project Organization

A multidiscipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

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The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements defined by the Oversight and Program Integration Division. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standard and assist in evaluating and resolving all quality related concerns.

4.5.2 Surface Water Sampling Program

As discussed in Section 4.1, the surface water sampling program integrates three existing programs required to document the effects of the FEMP's remedial actions on surface water. The three existing programs are:

- Environmental monitoring of surface water mandated by DOE Order 5400.1
- Nonradiological monitoring of treated effluent mandated by the NPDES permit
- Radiological monitoring of non-project-specific treated effluent mandated by the FFCA.

To fulfill the requirements of the integrated surface water program, surface water samples shall be collected from eight locations on Paddys Run and associated drainages, one location on the northeast drainage, and one location on the Great Miami River, and treated effluent shall be sampled at the Parshall Flume and the sewage treatment plant. Sample locations are shown on Figure 4-9 and Figure 4-10. Surface water sampling frequency is summarized in Table 4-3.

Samples collected from each location shall be analyzed for the parameters listed in Tables 4-4 through 4-15. The analyte lists and locations may be refined by the project team lead based on the results of the IEMP and the ongoing remedial activities at the site.

4.5.2.1 Water Collection Procedure

Surface Water Sampling

Surface water samples shall be collected from locations on Paddys Run, drainage ditches to Paddys Run, the northeast drainage, and the Great Miami River. A qualitative assessment of flow conditions (i.e., base flow or storm flow or something between storm and base flow) will be documented at the time of sample collection at each of these locations. Sampling personnel will ensure that access to the sampling locations will not result in the inadvertent introduction of foreign materials into the water sample. Additional precautions will be taken to avoid the introduction of floating organic material such as leaves or twigs during sample collection. Samples will be collected without disturbing bottom sediment. Sample technicians shall approach sampling locations from downstream of the location or if sample locations are accessed by way of a bridge, samples shall be collected on the upstream side of the bridge.

Surface water sampling will be conducted according to Appendix K of the SCQ and the following procedures:

- Liquid Sampling, SMPL-24
- Horiba Water Quality Meter - Calibration, Operation, and Maintenance, EQT-02
- Collection of Field Quality Control Samples, SMPL-21
- Chain of Custody/Request for Analysis Record for Sample Control, EW-0002.

Samples will be collected using an appropriate container (e.g., teflon stainless steel, etc.). As necessary, a length of rope will be attached to the container handle. A sample aliquot will be collected at each location and will be transferred to a separate container for field parameter analysis of temperature, specific conductance, pH, and dissolved oxygen. The water in the aliquot used for field parameter measurement will be returned to the stream. Water samples will then be collected, carefully transferred from the aliquot to the appropriate sample containers, preserved, and capped. To prevent dissolution of radionuclides from suspended solids, the amount of preservative added to highly

TABLE 4-4

QUARTERLY SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION SWP-01 (PADDYS RUN BACKGROUND)

Analyte	Analytical Method	ASL	Holding Time	Preservative	Container
Total Metals: Aluminum Antimony Arsenic Barium Beryllium Cadmium Chromium Copper Lead Manganese Molybdenum Nickel Selenium Silver Thallium Vanadium Zinc	7000[a], 3500[b], or 6010A[a]	B	6 Months	HNO_3, pH < 2	Plastic or glass
Mercury	7470A[a]	B	28 Days		
Fluoride	340.2[c], 340.3[c], or 4500C[b]	B	28 Days	None	Plastic
Cyanide	9010[a], 9020[a], 335.2[c], or 335.3[c]	B	14 Days	Cool 4°C NaOH, pH > 12	Plastic or glass
Pesticides/Polychlorinated Biphenyls: Alpha-chlordane Aroclor-1254 Aroclor-1260 Dieldrin	8080[a]	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4°C	Glass (amber)
Nitrate/Nitrite	350.1[c], 350.3[c], 4500D[b] 4500E[b],	B	28 Days	Cool 4°C	Plastic or glass
Volatiles: Benzene Bromodichloromethane Bromomethane Carbon disulfide Chloroform 1,1-Dichloroethene 1,2-Dichloroethene Methylene chloride Tetrachloroethene 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethene	8260[a]	B	7 Days or 14 Days	Cool 4°C or Cool 4°C H_2SO_4, HCl, or solid $NaHSO_4$, pH < 2	Glass (Teflon)

TABLE 4-4
(Continued)

Analyte	Analytical Method	ASL	Holding Time	Preservative	Container
Semi-Volatiles: Benzo(a)anthracene Benzo(a)pyrene Bis(2-chloroisopropyl)ether Bis(2-ethylhexyl)phthalate Dibenzo(a,h)anthracene 3,3-dichlorobenzidine Di-n-butylphthalate Di-n-octylphthalate 4-Methylphenol 4-Nitrophenol	8270[a]	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4°C	Glass (amber)
Ammonia	350.1[c], 350.3[c], 4500C[b], or 4500F[b]	B	28 Days	Cool 4°C H_2SO_4, pH < 2	Plastic or glass
Cesium-137	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Neptunium-237	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Lead-210	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Plutonium-238	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Plutonium-239/240	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-226	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-228	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Strontium-90	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Technetium-99	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Thorium-228	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Thorium-230	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Thorium-232	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Total Uranium	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Field Parameters[e]	SCQ[d]	A	NA[f]	NA[f]	NA[f]

[a]Test methods for evaluating solid waste, physical/chemical methods, SW-846.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th edition.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[d]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[e]Field parameter include temperature, specific conductance, pH, and dissolved oxygen.
[f]NA = Not applicable
[g]The ASL may become more conservative, if it is necessary to meet detection limits.

TABLE 4-5

SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION SWP-02 (PADDYS RUN)

Analyte	Analytical Method	Sampling Frequency	ASL	Holding Time	Preservative	Container
Total Metals: Aluminum, Beryllium, Cadmium, Chromium, Copper, Manganese	7000[a], 3500[b], or 6010A[a]	Monthly	B	6 Months	HNO_3, pH<2	Plastic or glass
Mercury	7470A[a]			28 Days		Plastic or glass
Technetium-99[d]	SCQ[c]	Monthly	B[g]	6 Months	HNO_3, pH<2	Plastic or glass
Total Uranium	SCQ[c]	Monthly	B[g]	6 Months	HNO_3, pH<2	Plastic or glass
Field Parameters[e]		Monthly	A	NA[f]	NA[f]	NA[f]

[a]Test methods for evaluating Solid Waste, Physical/Chemical Methods, SW-846.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[c]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[d]This constituent also meets quarterly requirements.
[e]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[f]NA = Not applicable
[g]The ASL may become more conservative, if it is necessary to meet detection limits.

TABLE 4-6

SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION SWP-03 (PADDYS RUN)

Analyte	Analytical Method	Sampling Frequency	ASL	Holding Time	Preservative	Container
Total Metals: Aluminum[e] Barium Beryllium Cadmium Chromium Copper Lead Manganese Selenium Silver[e] Zinc Mercury[e]	7000[a], 3500[b], or 6010A[a] 7470A[a]	Monthly Quarterly Monthly	B	6 Months 28 Days	HNO_3, pH < 2	Plastic or glass
Cyanide	9010[a], 9020[a], 335.2[c], or 335.3[c]	Quarterly	B	14 Days	Cool 4°C NaOH, pH > 12	Plastic or glass
Volatiles: Tetrachloroethene 1,1,1-Trichloroethane	8260[a]	Monthly	B	7 Days or 14 Days	Cool 4°C or Cool 4°C H_2SO_4, HCl, or solid $NaHSO_4$, pH < 2	Glass (Teflon)
Semi-Volatiles: Di-n-octylphthalate bis(2-ethylhexyl)phthalate	8270[a]	Monthly	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4°C	Glass (amber)
Semi-Volatiles: 3,3-Dichlorobenzidine Dibenzo(a,h)anthracene Benzo(a)anthracene Benzo(a)pyrene	8270[a]	Quarterly	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4°C	Glass (amber)
Total Uranium[e]	SCQ[d]	Monthly	B[h]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-226	SCQ[d]	Quarterly	B[h]	6 Months	HNO_3, pH < 2	Plastic or glass
Technetium-99	SCQ[d]	Monthly	B[h]	6 Months	HNO_3, pH < 2	Plastic or glass
Strontium-90	SCQ[d]	Quarterly	B[h]	6 Months	HNO_3, pH < 2	Plastic or glass
Lead-210	SCQ[d]	Quarterly	B[h]	6 Months	HNO_3, pH < 2	Plastic or glass
Field Parameters[f]		Monthly	A	NA[g]	NA[g]	NA[g]

[a]Test Methods for Evaluating Solid Waste Physical/Chemical Methods, SW-846.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 60014-79-020.
[d]Radionuclide analyses do not have standard methods; specifications are provided in the SCQ.
[e]These constituents also meet quarterly requirements.
[f]Field Parameters include temperature, specific conductance, pH, and dissolved oxygen.
[g]NA = Not applicable
[h]The ASL may become more conservative, if it is necessary to meet detection limits.

TABLE 4-7

SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION SWD-01 (NORTHEAST DRAINAGE)

Analyte	Analytical Method	Sampling Frequency	ASL	Holding Time	Preservative	Container
Total Metals:	7000[a], 3500[b], or		B	6 Months	HNO_3, pH < 2	Plastic or glass
Aluminum	6010A[a]	Quarterly				
Beryllium		Monthly				
Lead		Monthly				
Manganese		Monthly				
Zinc		Monthly				
Mercury	7470A[a]	Quarterly		28 Days		
Cyanide[d]	9010[a], 9020[a], 335.2[c], or 335.3[c]	Monthly	B	14 Days	Cool 4°C	Plastic or glass
Field Parameters[e]		Monthly	A	NA[f]	NA[f]	NA[f]

[a]Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[d]This constituent also meets quarterly requirements.
[e]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[f]NA = Not applicable

TABLE 4-8

SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION SWD-02 (STORM SEWER OUTFALL DITCH)

Analyte	Analytical Methods	Sampling Frequency	ASL	Holding Time	Preservative	Container
Strontium-90	SCQ[a]	Quarterly	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Technetium-99	SCQ[a]	Quarterly	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Total Uranium[d]	SCQ[a]	Monthly	B[g]	6 Months	HNO3, pH < 2	Plastic or glass
Semi-Volatile: Bis(2-ethylhexyl)phthalate	8270[b]	Monthly	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4° C	Glass (amber)
Total Metals: Aluminum Cadmium Manganese	7000[b], 3500[c], or 6010A[b]	Monthly	B	6 Months	HNO_3, pH < 2	Plastic or glass
Field Parameters[e]		Monthly	A	NA[f]	NA[f]	NA[f]

[a]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[b]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[c]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[d]This constituent also meets quarterly requirements.
[e]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[f]NA = Not applicable
[g]The ASL may become more conservative, if it is necessary to meet detection limits.

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TABLE 4-9

SURFACE WATER ANALYTICAL REQUIREMENTS
AT SAMPLE LOCATION SWD-03
(WASTE STORAGE AREA)

Analyte	Analytical Methods	Sampling Frequency	ASL	Holding Time	Preservative	Container
Total Metals:	7000[a], 3500[b], or 6010A[a]		B	6 Months	HNO_3, pH < 2	Plastic or glass
Aluminum		Quarterly				
Barium		Monthly				
Chromium		Monthly				
Copper		Monthly				
Lead		Monthly				
Manganese		Monthly				
Silver		Quarterly				
Zinc		Quarterly				
Mercury	7470A[a]	Quarterly		28 Days		
Cyanide	9010[a], 9020[a], 335.2[c], or 335.3[c]	Quarterly	B	14 Days	Cool 4° C NaOH, pH > 12	Plastic or glass
Volatiles: Tetrachloroethene 1,1,1-Trichloroethane	8260[a]	Monthly	B	7 Days or 14 Days	Cool 4° C or Cool 4°C H_2SO_4, HCl, or solid $NaHSO_4$, pH < 2	Glass (Teflon)
Semi-volatile: Bis(2-ethylhexyl)phthalate	8270[a]	Monthly	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4° C	Plastic or glass
Total Uranium	SCQ[d]	Monthly	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Technetium-99	SCQ[d]	Quarterly	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Field Parameters[e]		Monthly	A	NA[f]	NA[f]	NA[f]

[a]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[d]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[e]Field parameter include temperature, specific conductance, pH, and dissolved oxygen.
[f]NA = Not applicable
[g]The ASL may become more conserative, if it is necessary to meet detection limits.

TABLE 4-10

QUARTERLY SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION SWR-01 (GREAT MIAMI RIVER)

Analyte	Analytical Method	ASL	Holding Time	Preservative	Container
Total Metals: Aluminum Antimony Arsenic Barium Beryllium Cadmium Chromium Copper Lead Manganese Molybdenum Nickel Selenium Silver Thallium Vanadium Zinc	7000[a], 3500[b], or 6010A[a]	B	6 Months	HNO_3, pH < 2	Plastic or glass
Mercury	7470[a]	B	28 Days		
Fluoride	340.2[c], 340.3[c], or 4500C[b]	B	28 Days	None	Plastic
Cyanide	9010[a], 9020[a], 335.2[c], or 335.3[c]	B	14 Days	Cool 4°C NaOH, pH > 12	Plastic or glass
Pesticides/Polychlorinated Biphenyls: Alpha-chlordane Aroclor-1254 Aroclor-1260 Dieldrin	8080[a]	B	7 Days	Cool 4°C	Glass (amber)
Nitrate/Nitrite	350.1[c], 350.3[c], 4500D[b] or 4500E[b]	B	28 Days	Cool 4°C H_2SO_4, pH < 2	Plastic or glass
Volatiles: Benzene Bromodichloromethane Bromomethane Carbon disulfide Chloroform 1,1-Dichloroethene 1,2-Dichloroethene Methylene chloride Tetrachloroethene 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethene	8260[a]	B	7 Days or 14 Days	Cool 4°C or Cool 4°C H_2SO_4, HCl, or solid $NaHSO_4$, pH < 2	Glass (Teflon)

TABLE 4-10
(Continued)

Analyte	Analytical Method	ASL	Holding Time	Preservative	Container
Semi-Volatiles: Benzo(a)anthracene Benzo(a)pyrene Bis(2-chloroisopropyl)ether Bis(2-ethylhexyl)phthalate Dibenzo(a,h)anthracene 3,3-Dichlorobenzidene Di-n-butylphthalate Di-n-octylphthalate 4-Methylphenol 4-Nitrophenol	8270[a]	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4°C	Glass (amber)
Ammonia	350.1[c], 350.3[c], 4500C[b], or 4500F[b]	B	28 Days	Cool 4°C H_2SO_4, pH < 2	Plastic or glass
Cesium-137	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Neptunium-237	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Lead-210	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Plutonium-238	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Plutonium-239/240	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-226	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-228	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Strontium-90	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Technetium-99	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Thorium-228	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Thorium-230	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Thorium 232	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Total Uranium	SCQ[d]	B[g]	6 Months	HNO_3, pH < 2	Plastic or glass
Field Parameters[e]		A	NA[f]	NA[f]	NA[f]

[a]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[d]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[e]Field parameters include temperature, specific conductance, pH, and dissolved oxygen.
[f]NA = Not applicable
[g]The ASL may become more conservative, if it is necessary to meet detection limits.

TABLE 4-11

TREATED EFFLUENT ANALYTICAL REQUIREMENTS AT LOCATION 4001 (PARSHALL FLUME)

Analyte	Analytical Method	Sampling Frequency	Sample Type	ASL	Holding Time	Preservation	Container
Total Metals: Aluminum[g] Beryllium Cadmium Chromium Manganese Silver	7000[a], 3500[b], 6010A[a], or 272.2[c]	Monthly	24 Hour composite[d]	B	6 Months	HNO_3, pH < 2	Plastic or glass
Mercury[g]	7470A[a]		Grab		28 Days		
Cyanide[g]	9010[a], 9020[a], or 335.2[c], or 335.3[c]	Monthly	Grab	B	14 Days	Cool 4°C NaOH, pH > 12	Plastic or glass
Volatiles: Trichloroethene	8260[a]	Quarterly	Grab	B	7 Days or 14 Days	Cool 4°C or Cool 4°C H_2SO_4, HCl, or solid $NaHSO_4$, pH < 2	Glass
Semi-Volatiles: Di-n-octylphthalate	8270[a]	Quarterly	Grab	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4°C	Glass (amber)
Semi-Volatiles: 3,3-Dichlorobenzidine Dibenzo(a,h)anthracene Benzo(a)anthracene Benzo(a)pyrene	8270[a]	Quarterly	Grab	B	7 Days to extraction 40 Days from extraction to analysis	Cool 4°C	Glass (amber)
Total Uranium[g]	SCQ[e]	Daily	24 Hour Composite	B[i]	6 Months	HNO_3, pH < 2	Plastic or glass
Lead-210	SCQ[e]	Quarterly	Grab	B[i]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-226	SCQ[e]	Quarterly	Grab	B[i]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-228	SCQ[e]	Monthly	Grab	B[i]	6 Months	HNO_3, pH < 2	Plastic or glass
Technetium-99[g]	SCQ[e]	Monthly	Grab	B[i]	6 Months	HNO_3, pH < 2	Plastic or glass
Strontium-90	SCQ[e]	Quarterly	Grab	B[i]	6 Months	HNO_3, pH < 2	Plastic or glass

TABLE 4-11
(Continued)

Analyte	Analytical Method	Sampling Frequency	Sample Type	ASL	Holding Time	Preservation	Container
Oil and grease	9070[a]	Weekly	Grab	B	28 Days	Cool 4°C H_2SO_4, pH < 2	Glass
Ammonia	350.1[c], 350.3[c], 4500C[b], or 4500F[b]	Weekly	24 Hour composite[d]	B	28 Days	Cool 4°C H_2SO_4, pH < 2	Plastic or glass
Nitrate/Nitrite	350.1[c], 350.3[j], 4500D[b], or 4500E[b]	Weekly	24 Hour composite[d]	B	28 Days	Cool 4°C H_2SO_4, pH < 2	Plastic or glass
Fluoride	340.2[c], 340.3[c], or 4500E[b]	Weekly	24 Hour composite[d]	B	28 Days	None	Plastic
Chromium, dissolved hexavalent	7195[a]	Weekly	Grab	B	24 Hours	Cool 4°C	Plastic or glass
Copper, total	220.2[c]	Weekly	24 Hour composite[d]	B	6 Months	HNO_3, pH < 2	Plastic or glass
Biochemical Oxygen Demand, Carb.	5210B[b]	Weekly	24 Hour composite[d]	B	48 Hours	Cool 4°C	Plastic or glass
Total suspended solids	160.2[c] or 2540D[b]	Daily	24 Hour composite[d]	B	7 Days	Cool 4°C	Plastic or glass
Flow rate	NA[h]	Daily	24 Hour total	NA[h]	NA[h]	NA[h]	NA[h]
Field Parameters[g]			Grab	A	NA[h]	NA[h]	NA[h]

[a]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[d]Flow-weighted composite sample over a 24 hour period.
[e]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[f]pH will be sampled continuously; dissolved oxygen will be measured from a weekly grab and temperature will be measured from a daily grab for NPDES.
[g]These parameters also meet quarterly requirements.
[h]NA = Not applicable
[i]The ASL may become more conservative, if it is necessary to meet detection limits.

TABLE 4-12

SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION 4002 (STORM WATER RETENTION BASIN)

Analyte	Analytical Method	Sampling Frequency	Sample Type	ASL	Holding Time	Preservation	Container
Total suspended solids	160.2[a], 2540D[b]	Daily, during overflow conditions	Composite[c]	B	7 Days	Cool, 4°C	Plastic or glass
Oil and grease	9070[d]	Daily, during overflow conditions	Grab	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Glass
Phosphorus	365.(all)[a], or 4500E[b]	Daily, during overflow conditions	Composite[c]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Ammonia	350.1[a], 350.3[a], 4500C[b], or 4500F[b]	Daily, during overflow conditions	Composite[c]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Nitrate/Nitrite	353.1[a] or 353.2[a], 4500D[b] or 4500E[b]	Daily, during overflow conditions	Composite[c]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Total Metals:	7000[d], 3500[b],	Daily, during overflow conditions		B	6 Months	HNO_3, pH < 2	Plastic or glass
Chromium	6010A[d]		Composite[c]				
Copper	272.2[a]		Composite[c]				
Nickel	220.2[a]		Composite[c]				
Silver			Composite[c]				
Fluoride	340.2[a], 340.3[a], or 4500C[b]	Daily, during overflow conditions	Composite[c]	B	28 Days	None	Plastic
Chromium, dissolved hexavalent	7195[d]	Daily, during overflow conditions	Grab	B	24 Hours	Cool, 4°C	Plastic or glass
Chlorine, residual	4500[b]	Daily, during overflow conditions, summer only (May-October)	Grab	B	Analyze Immediately	None	Plastic or glass
Flow rate	NA[i]	Daily, during overflow conditions	24 Hour total	NA[i]	NA[i]	NA[i]	NA[i]
Total Uranium[g]	SCQ[e]	Daily, during overflow conditions	Composite[c]	B[j]	6 Months	HNO_3, pH < 2	Plastic or glass
Total Metals:	7000[d], 3500[b], or	Daily, during overflow conditions	Grab	B	6 Months	HNO_3, pH < 2	Plastic or glass
Aluminum[g,h]	6010A[d]						
Cadmium[h]							
Beryllium[h]							
Manganese[h]							
Mercury[g,h]	7470A[d]				28 Days		

TABLE 4-12
(Continued)

Analyte	Analytical Method	Sampling Frequency	Sample Type	ASL	Holding Time	Preservation	Container
Cyanide[g,h]	9010[d], 9020[d], 335.2[a], or 335.3[a]	Daily, during overflow conditions	Grab	B	14 Days	$NaOH_3$, pH > 12	Plastic or glass
Radium-226[g]	SCQ[e]	Daily, during overflow conditions	Grab	B[j]	6 Months	HNO_3, pH < 2	Plastic or glass
Radium-228[h]	SCQ[e]	Daily, during overflow conditions	Grab	B[j]	6 Months	HNO_3, pH < 2	Plastic or glass
Strontium-90[g]	SCQ[e]	Daily, during overflow conditions	Grab	B[j]	6 Months	HNO_3, pH < 2	Plastic or glass
Technetium-99[g,h]	SCQ[e]	Daily, during overflow conditions	Grab	B[j]	6 Months	HNO_3, pH < 2	Plastic or glass
Trichloroethene[g]	8260[d]	Daily, during overflow conditions	Grab	B	7 Days or 14 Days	Cool, 4°C or Cool 4°C H_2SO_4, HCl, or solid $NaHSO_4$, pH < 2	Glass
Field Parameters[f]		Daily, during overflow conditions	Grab	A	NA[i]	NA[i]	NA[i]

[a]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[b]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[c]Composite samples shall be comprised of four samples collected at intervals of at least 30 minutes, but not more than 2 hours.
[d]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[e]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[f]pH will be sampled daily, during overflow conditions (grab) for NPDES.
[g]These constituents also meet quarterly requirements.
[h]These constituents also meet monthly requirements.
[i]NA = Not applicable
[j]The ASL may become more conservative, if it is necessary to meet detection limits.

TABLE 4-13

SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATIONS STRM 4003, STRM 4004, AND STRM 4006

Analyte	Analytical Method	Sampling Frequency	Sample Type	ASL	Holding Time	Preservation	Container
Oil and grease	9070[a]	Semiannually	Grab	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Glass
Total Suspended Solids	160.2[b] or 2540D[c]	Semiannually	Composite[d]	B	7 Days	Cool, 4°C	Plastic or glass
Ammonia	350.1[b], 350.3[b], 4500C[c], or 4500F[c]	Semiannually	Composite[d]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Nitrate/Nitrite	350.1[b], 350.3[b], 4500D[c], or 4500E[c]	Semiannually	Composite[d]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Phosphorus	365.(all)[b], or 4500E[c]	Semiannually	Composite[d]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Fluoride	340.2[b], 340.3[b], or 4500E[c]	Semiannually	Composite[d]	B	28 Days	None	Plastic
Total Metals: Chromium Copper Lead Nickel Silver	7000[a], 3500[c], 6010A[a], 220.2[b], or 272.2[b]	Semiannually	Composite[d]	B	6 Months	HNO_3, pH < 2	Plastic or glass
Chromium, dissolved hexavalent	7195[a]	Semiannually	Grab	B	24 Hours	Cool, 4°C	Plastic or glass
Flow rate	NA[f]	Semiannually	24 Hour total estimate	NA[f]	NA[f]	NA[f]	NA[f]
Field Parameters[e]		Semiannually	Grab	A	NA[f]	NA[f]	NA[f]

[a]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[b]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[c]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[d]Composite samples shall be comprised of four samples collected at intervals of at least 30 minutes, but not more than 2 hours.
[e]pH will be sampled semiannually (grab) for NPDES.
[f]NA = Not applicable

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TABLE

SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION STRM 4005

Analyte	Analytical Method	Sampling Frequency	Sample Type	ASL	Holding Time	Preservation	Container
Oil and grease	9070[a]	Semiannually (June, December)	Grab	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Glass
Total Suspended Solids	160.2[b] or 2540D[c]	Semiannually	Composite[d]	B	7 Days	Cool, 4°C	Plastic or glass
Ammonia	350.1[b], 350.3[b], 4500C[c], or 4500F[c]	Semiannually	Composite[d]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic of glass
Nitrate/Nitrite	350.1[b], 350.3[b], 4500D[c], or 4500E[c]	Semiannually	Composite[d]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Phosphorus	365.(all)[b], or 4500E[c]	Semiannually	Composite[d]	B	28 Days	Cool, 4°C H_2SO_4, pH < 2	Plastic or glass
Fluoride	340.2[b], 340.3[b], or 4500E[c]	Semiannually	Composite[d]	B	28 Days	None	Plastic
Total Metals: Chromium, Copper, Lead, Nickel, Silver	7000[a], 3500[c], 6010A[a], 220.2[b], or 272.2[b]	Semiannually	Composite[d]	B	6 Months	HNO_3, pH < 2	Plastic or glass
Chromium, dissolved hexavalent	7195[a]	Semiannually	Grab	B	24 Hours	Cool, 4°C	Plastic or glass
Flow rate	NA[g]	Semiannually	24 Hour total estimate	NA[g]	NA[g]	NA[g]	NA[g]
Total Uranium	SCQ[e]	Monthly	Grab	B[h]	6 Months	HNO_3, pH<2	Plastic or glass
Field Parameters[f]		Monthly/Semiannually	Grab	A	NA[g]	NA[g]	NA[g]

[a]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[b]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[c]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[d]Composite samples shall be comprised of four samples collected at intervals of at least 30 minutes, but not more than 2 hours.
[e]Radionuclide analyses do not have standard methods; performance specifications are provided in the SCQ.
[f]pH will be sampled semiannually (grab) for NPDES. Temperature, specific conductance, pH and dissolved oxygen will be measured monthly.
[g]NA = Not applicable
[h]The ASL may become more conservative, if it is necessary to meet detection limits.

TABLE 4-15
SURFACE WATER ANALYTICAL REQUIREMENTS AT SAMPLE LOCATION 4601
(SEWAGE TREATMENT PLANT)

Analyte	Analytical Method	Sampling Frequency	Sample Type	ASL	Holding Time	Preservation	Container
Biochemical Oxygen Demand, Carb.	5210B[a]	Twice a week	Composite[b]	B	48 Hours	Cool 4°C	Plastic or glass
Total Suspended Solids	160.2[c] or 2540D[a]	Twice a week	Composite[b]	B	7 Days	Cool 4°C	Plastic or glass
Ammonia	350.1[c], 350.3[c], 4500C[a], or 4500F[a]	Once every 2 weeks	Composite[b]	B	28 Days	Cool 4°C H_2SO_4, pH < 2	Plastic or glass
Total Metals: Cadmium, Chromium, Copper, Lead, Nickel, Zinc	7000[d], 3500[a], 6010A[d], or 220.2[c]	Semiannually	Composite[b]	B	6 Months	HNO_3, pH < 2	Plastic or glass
Mercury	7470A[d]		Grab		28 Days		
Chromium, dissolved hexavalent	7195[d]	Semiannually	Grab	B	24 Hours	Cool 4°C	Plastic or glass
Mercury		Semiannually	Grab	B	28 Days	HNO_3, pH < 2	Plastic or glass
Fecal coliform	9222D[a]	Weekly (summer only) May-October	Grab	B	6 Hours	Cool 4°C	Plastic or glass (sterile)
Flow rate	NA[f]	Daily	NA[f]	NA[f]	NA[f]	NA[f]	NA[f]
Field Parameters[e]		Daily	Grab	A	NA[f]	NA[f]	NA[f]

[a]Standard Methods for the Analysis of Water and Wastewater, 17th Edition.
[b]Flow weighted composite sample ofver a 24-hour period.
[c]Methods for Chemical Analysis of Water and Wastes, EPA 600/4-79-020.
[d]Test Methods for Evaluation Solid Wastes, Physical/Chemical Methods, SW-846.
[e]pH will be sampled daily (grab) for NPDES
[f]NA = Not applicable

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from suspended solids, the amount of preservative added to highly buffered samples will be minimized. Sample preservative, volume, and container requirements for each location are listed on Tables 4-4 through 4-15.

Treated Effluent Sampling

Treated effluent is sampled by flow-proportional samplers at the Parshall Flume (location 4001) and at the sewage treatment plant (Location 4601). Sampling will be conducted according to Appendix K of the SCQ and the following procedures:

- Chain of Custody/Request for Analysis Record for Sample Control, EW-0002
- Sampling and Analyzing FEMP Water Supplies, Procedure 43-C-324.

After every 24 hours of operation, the collected liquid is removed from the automatic sampler to provide a daily flow-weighted sample of the effluent. A portion of each daily sample is analyzed to determine the estimate of total uranium discharged to the Great Miami River for the day. The Parshall Flume samples will be analyzed for the parameters listed in Table 4-11. The samples collected at the Sewage Treatment Plant will be analyzed for the parameters listed in Table 4-15.

4.5.2.2 QA Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as sampling technique, may be responsible for introducing bias in the project's analytical results. Duplicates and trip blank (quality control) samples will be collected as outlined in the SCQ, Section 6.0 and Appendix K.

A duplicate sample shall be collected each quarter at a randomly selected sampling location by collecting the total volume to fulfill analytical requirements into one compositing container. The sample contained in the compositing container shall then be transferred to the required sample containers. The portion of the duplicate sample to be analyzed for volatile organic compounds shall not be composited, but shall be collected from the same aliquot used to collect the sample to be duplicated.

Trip blanks shall be placed in coolers containing samples for volatile organic compound analysis and shall accompany the samples from collection to receipt at the laboratory.

4.5.2.3 Decontamination

Sampling equipment shall be decontaminated prior to transport to the sample field site, between sample locations, and after all sampling is completed to prevent cross contamination and to protect worker safety and health. The decontamination of equipment shall be a Level II Decontamination as referenced in Section K.11 of the SCQ and as described in Section 6.4.1 of the SCQ.

4.5.3 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the designee and QA prior to implementation. The completed Variance/Field Change Notice must be approved by QA within one week of verbal approval. The Variance/Field Change Notice form shall be controlled and included in the field data package and become part of the project record. Permanent media-specific plan changes will incorporate applicable Variance/Field Change Notice in annual media-specific plan revisions. Scope changes to the media-specific plan will require respective document changes.

4.5.4 Health and Safety Considerations

The Fluor Daniel Fernald (FDF) Health and Safety Department is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Daily safety meetings will be conducted prior to beginning field work to address specific health and safety issues.

All FDF employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed applicable site training.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, RWPs are necessary and will be obtained prior to the field work being performed in those

areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring an RWP.

4.5.5 Data Management

Field and analytical data will be managed to meet the IEMP data reporting and quality objectives, including specific provisions for data management and recordkeeping in the NPDES permit. The field documentation and analytical data results shall be verified to ensure conformance to the appropriate SCQ sections and appendices. The process for management of the field and analytical data is described in the Environmental Data Management Plan (FERMCO 1996).

Field documentation will be verified by the sampling team for accuracy and completeness, followed by an independent field data validation in accordance with SCQ requirements for the corresponding ASL. The project team leader must have processes in place to verify that chemical and radiological data results meet all applicable quality requirements specified in the SCQ for the respective ASL (SCQ Section 11.0 and Appendix F). The quality of analytical data shall be evaluated by independent project personnel qualified to determine accuracy, completeness and applicable statistical data necessary to evaluate data useability and data quality required for environmental monitoring reporting.
Both the field and analytical data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project files in accordance with FEMP record keeping procedures and DOE Orders.

4.5.6 Quality Assurance

Independent assessments of work processes shall be conducted to verify quality of performance. Such assessments may include audits, surveillances, inspections, tests, data verification and field validation, and peer reviews. Assessments shall include performance based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance to IEMP, SCQ, applicable DQOs, and FEMP Quality Assurance Program (RM-0012) requirements.

Independent assessment is the responsibility of designated project quality assurance personnel. The project team leader and QA will coordinate independent assessment oversight activities and comply

with SCQ Section 12. Recommended quarterly QA surveillances shall be performed on some task specified in the media-specific plan. The QA representative shall have "stop work" authority if significant adverse effects to quality conditions are identified or work conditions are unsafe. In accordance with SCQ Section 3, QA shall review and have approval signature of plans, procedures, and final documents supporting IEMP programs.

Only laboratories on the FEMP-Approved Laboratory List will be used for FEMP sample analyses in accordance with SCQ Section 12 and Appendix E.

4.6 IEMP SURFACE WATER MONITORING DATA EVALUATION AND REPORTING

This section provides the currently envisioned methods to be utilized in analyzing the data generated during the first two years of the IEMP surface water sampling program. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP generated surface water data is presented. The reporting subsection also provides the specific information to be reported at the quarterly meetings/reports and in the comprehensive annual report. Given that this is a new program, it is recognized that the data evaluation and reporting will evolve over the first few quarterly meetings/reports as consensus is reached on the desired content of the meetings/reports.

4.6.1 Data Evaluation

Data resulting from the IEMP surface water program will be evaluated with respect to the program expectations identified in Section 4.4.1. Based on these expectations, the following questions will be answered through the surface water data evaluation process as indicated by the text following each of the questions:

- Has uncontrolled runoff and implementation of site remedial activities caused an undue adverse impact to the surface water?

Data evaluation to determine the impact of site remedial activities on surface water will consist of direct comparison of the data to surface water FRLs and/or BTVs. Additionally, trend analyses of data will be used to identify trends that may require implementation of additional surface water controls to avoid exceedance of FRLs and BTVs (Figure 4-11). If increasing trends are observed, then project-specific data will be evaluated to determine which project(s) are adversely affecting surface water quality. Data

evaluation findings will be communicated to "source" project personnel, as appropriate.

- Are surface water contaminant concentrations such that cross-media impacts to the underlying aquifer could be expected?

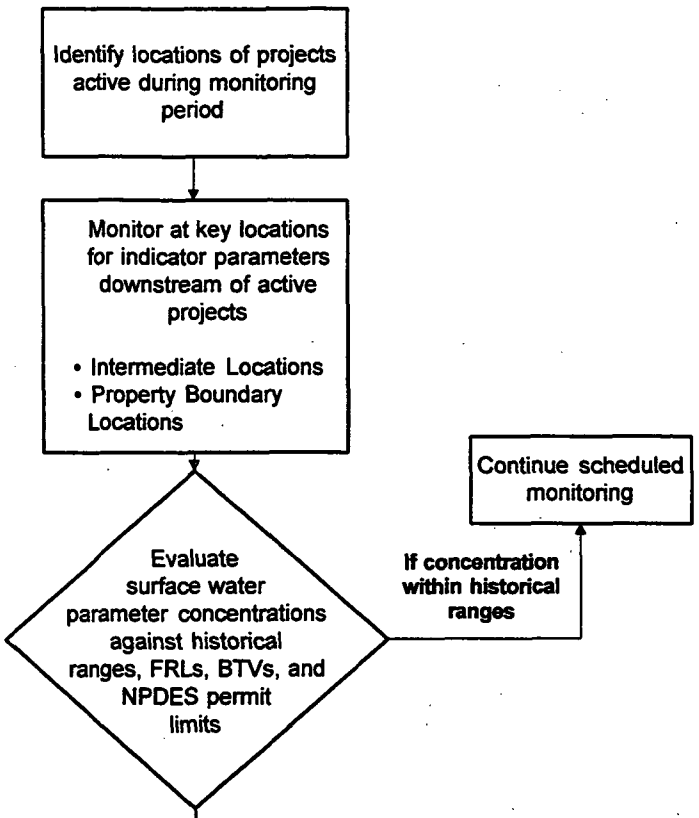
Data from sampling points near areas where the glacial overburden is breached by site drainages will be compared to surface water and groundwater FRLs to assess potential impacts to the Great Miami Aquifer. Basic statistics (i.e., minimum, maximum, and mean) will be generated on a yearly basis. The data generated from individual sampling events will be trended by sample location over time via graphical and, if determined necessary, statistical methods (when sufficient data has been generated). Should trends above the historical ranges or above FRLs be observed, actions shown in Figure 4-11 will be implemented. Integration of surface water information generated by project-specific monitoring will occur as necessary to determine which project(s) may have caused the observed trend. The findings of data evaluations will be shared with project personnel. Those personnel responsible for the restoration of the Great Miami Aquifer will be informed so that any potential adverse cross-media impacts can be factored into the site groundwater remedy. The soil characterization and excavation project and other "source" projects will be informed of the findings such that the actions indicated on Figure 4-11 can be implemented.

- Are the requirements of the NPDES permit being fulfilled?

Data collected to fulfill the site NPDES permit requirements will be evaluated for compliance with the NPDES permit provisions. This evaluation will serve to identify if immediate reporting of noncompliance to the OEPA is necessary, and to determine the appropriate corrective action to address the noncompliance.

- Has sufficient data been collected to determine if FRLs are exceeded for 1) constituents with a paucity of historic analysis or 2) constituents with historic detection levels were above the FRL?

FIGURE 4-11
IEMP SURFACE WATER DATA EVALUATION AND ASSOCIATED ACTIONS



If concentration > historical ranges, but < FRLs, BTVs and NPDES permit limits[a]	
IEMP Actions	Potential Project Actions
• Identify probable sources and alert associated projects	• Review performance/ inspection data for engineered controls
• Continue scheduled monitoring	• Determine if engineered controls meet design specifications
• Trend data to determine potential for unacceptable future conditions	• Repair engineered controls, if necessary
• Report information to EPA/OEPA in next quarterly and in the annual report	
• Notify ARP of potential cross-media impacts	

If concentration > FRL, BTVs, or NPDES permit limit	
IEMP Action	Potential Project Action
• Identify probable source areas and alert associated projects	• Review performance/ inspection data for engineered controls
• Conduct confirmatory sampling to determine persistence	• Determine if engineered controls meet design specifications
• Continue scheduled monitoring	• Repair engineered controls, if necessary
• Report information to EPA/ OEPA in next quarterly and in the annual report.	• Estimate duration of source activities
• Report NPDES noncompliance to OEPA immediately.	• Field modification of controls
• Notify ARP of potential cross-media impacts.	• Quantify release

[a] For those parameters/locations with limited historical data, IEMP data will be compared to background concentrations.

Data evaluation to address these questions will consist of direct comparison of the data to their respective FRL and/or BTV. Analysis of constituents for which little historic data exists or for which the detection limit exceeded the FRL or BTV will continue until sufficient data exists to determine whether the FRLs and/or BTVs for these constituents are exceeded. If these constituents are not detected above FRLs in the surface water for one calendar year of sampling (a minimum of four quarterly samples), then the constituent will be removed from the IEMP surface water monitoring program unless the constituent was also identified as having the potential to cause an exceedance of a surface water FRL or BTV based on modeling (Table 4-2). Area-specific COCs having the potential to exceed a surface water or groundwater FRL, or a surface water BTV based on modeling will continue to be monitored until the sources within the drainage area being monitored are certified as being remediated and the surface water and sediment pathways have been certified as achieving the FRLs specified in the Operable Unit 5 Record of Decision.

- Do the sporadic exceedances of FRLs and/or BTVs continue to occur, decrease, or increase?

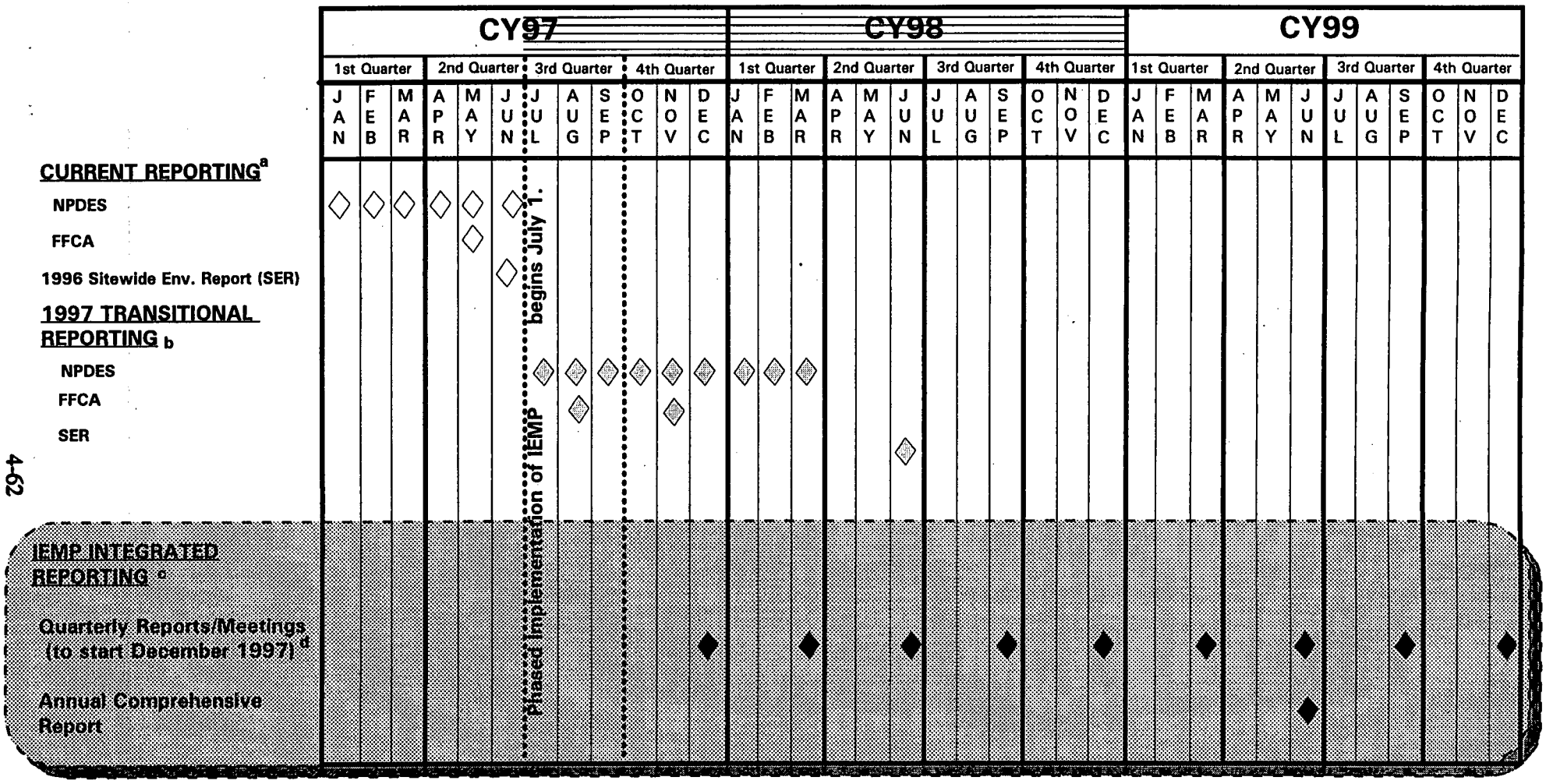
Data evaluation will consist of direct comparison of the data to the FRLs and/or BTVs. If constituents identified as sporadic exceedances are no longer detected above FRLs/BTVs in the surface water for one calendar year of sampling (a minimum of four quarterly samples), the constituent will be removed from the IEMP surface water monitoring program unless the constituent also was identified as having the potential to cause an exceedance of surface water FRLs or BTVs based on modeling (Table 4-2). Area-specific COCs having the potential to cause an exceedance of a surface water or groundwater FRL, or a surface water BTV based on modeling will continue to be monitored until the sources within the drainage area being monitored are certified as being remediated and the surface water and sediment pathways have been certified as achieving the remediation goals (FRLs) specified in the Operable Unit 5 Record of Decision.

Data evaluation to address any remaining expectations identified in Section 4.4.1 is encompassed in the data evaluation techniques described above.

4.6.2 Reporting

Figure 4-12 identifies the current reporting schedule for these documents and identifies when IEMP reporting will assume responsibility for surface water monitoring reporting. Data from the surface water monitoring program previously were provided in three reports:

FIGURE 4-12
IEMP SURFACE WATER REPORTING SCHEDULE



a = Reporting of all CY96 EMP data by June 1997.

b = Reporting CY97 EMP data and IEMP program data as implemented.

c = Includes the first complete year of reporting IEMP data, CY98 (Assuming IEMP fully implemented by January 1, 1998).

d = Includes FFCA quarterly report starting in December 1997; includes NPDES quarterly report starting June 1998, pending OEPA approval.

CY97-98, the timeframe covered in this version of the IEMP

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- Monthly reports are prepared to demonstrate FEMP compliance with the NPDES permit.
- Since May 1996, quarterly reports have been prepared to meet the terms of the FFCA.
- Annual reporting is presented in the Site Environmental Report, which is published in June for the period covering the previous year.

All three reporting requirements will be incorporated into the IEMP reporting strategy. The following list identifies the transition point between current surface water reports and IEMP reporting:

- The NPDES monthly report will continue through March 1998. Beginning with the start of 1998, and pending OEPA approval of quarterly reporting in the next permit negotiations, the NPDES data will be reported quarterly in the IEMP status to regulators.
- Quarterly FFCA reporting will continue on the May, August, and November schedule through 1997. The quarterly FFCA reporting frequency will be realigned to match the quarterly IEMP report starting in December 1997.
- Surface water data for 1996 will be reported in the 1996 Site Environmental Report to be published in June 1997. Due to implementation of the IEMP in July 1997, surface water data for 1997 will be reported in a transitional report to be issued in June 1998. Beginning with 1998, surface water data will be published in the new IEMP annual comprehensive report.

Quarterly meetings will be held to coincide with the quarterly report submittals. The quarterly status reports/meetings will be submitted/scheduled at approximately 60 days of the end of the quarter. Data and information pertaining to the surface water program will be presented in the quarterly meetings and will consist of the following:

- Summary-level information on the effectiveness of the project-specific sediment control structures, as necessary for interpretation of IEMP results
- Status of Operable Unit 5 Record of Decision Great Miami River effluent limits which include the 20 ppb and 600 pound total uranium limits to be presented graphically
- Status of regulatory compliance of the NPDES permit
- Observed trends and results of the data comparison to FRLs/BTVs.

The surface water portion of the IEMP annual comprehensive report will consist of the following:

- Constituent concentrations for each sample location
- Statistical analysis summary for each constituent

- Status of Operable Unit 5 Record of Decision Great Miami River effluent limits, to be presented graphically, which include the 20 μg/L and 600 pound total uranium limits

- Status of regulatory compliance of the NPDES permit

- Summary-level information on the effectiveness of the project-specific sediment control structures, if necessary for interpretation of IEMP results

- Actions taken to mitigate unacceptable surface water conditions revealed by the IEMP surface water sampling program.

5.0 SEDIMENT PROGRAM

Section 5.0 discusses the monitoring strategy for assessing the impact of remediation activities at the FEMP on sediments deposited along area surface water drainages. The focus of this program will be on sediment outside the areas where surface water and/or sediment controls are in place as a result of the FEMP's active remediation efforts. This strategy identifies integration objectives for the sediment program and the activities necessary to satisfy requirements for sediment monitoring. A media-specific plan for sediment monitoring activities is provided, along with a discussion of sediment data evaluation. The section concludes with a plan to integrate the FEMP's existing sediment reporting into a single IEMP-sponsored reporting structure.

5.1 INTEGRATION OBJECTIVES FOR THE SEDIMENT MONITORING PROGRAM

Unlike the groundwater and surface water programs (which were obligated to bring together a variety of existing compliance and reporting programs under the IEMP umbrella), the sitewide sediment monitoring program is a continuation of the existing EMP sediment monitoring program. However, the IEMP sitewide sediment monitoring program must be conducted in light of results from the previous sediment sampling programs conducted at the site and in light of site surface water (and, thereby, sediment) controls that are in place now and those planned during remediation. The IEMP sediment monitoring program also must build on monitoring programs that have historically evaluated the sediment pathway at the FEMP. The design considerations for the IEMP sediment monitoring program (discussed in Section 5.4), especially the location of sampling points, incorporate these factors. The sitewide sediment pathway historically has been evaluated under two closely knit programs:

- The site's environmental monitoring program, which began in 1974, has provided comprehensive data in the storm sewer outfall ditch, Paddys Run, and the Great Miami River for site-specific radiological constituents.
- The remedial investigation/feasibility study characterization of sediment which focused on a broader range of constituents (both radiological and non-radiological) in site drainages as well as in the storm sewer outfall ditch, Paddys Run, northeast drainage, and the Great Miami River.

The information produced by these two FEMP programs through 1993 was reported and evaluated in the Operable Unit 5 Remedial Investigation Report (DOE 1995f) and carried forward into the Operable

Unit 5 Feasibility Study (DOE 1995a) for the development of sediment clean-up levels. The Operable Unit 5 Record of Decision (DOE 1996) established health-protective FRLs for sediment. Achievement of these FRLs will be accomplished within on-site drainages as site soil and sediment are remediated and contaminated source materials are removed. This presents an opportunity for integration between remediation activities and sediment sampling. For sediment, further investigation to refine remediation needs in the on-property drainages (which feed into Paddys Run) will be conducted, if determined necessary; this investigation would be part of the project-specific soil excavation planning to confirm the extent of sediment to be excavated, along with the contaminated soil in a specific area.

For sediment in Paddys Run and the Great Miami River, the Operable Unit 5 Feasibility Study concluded that while constituents of concern (COCs) above FRLs or BTVs were detected intermittently at some locations, the data demonstrate no discernable trend of contamination to indicate that remediation of this sediment would be required (i.e., the current residual concentration of contaminants in the sediment is such that it is not a significant threat to human health or the environment). It is recognized, however, that sediment in Paddys Run and the Great Miami River is dynamic (i.e., conditions continually change, especially following a hard rain when sediment is washed out and replaced by new sediment) and that the sediment data set is limited.

Therefore, although the Operable Unit 5 Feasibility Study concluded, for planning purposes, that remediation of sediment in Paddys Run or the Great Miami River is not likely to be required, verification sampling of sediment will be performed to ensure that sediment remedial actions are not required. The sediment verification sampling is expected to be conducted following the completion of on-property soil remedial actions to ensure that sources which could release additional contaminated sediment to the environment are removed prior to the verification. This sediment verification sampling will be completed within Paddys Run and the Great Miami River as part of the IEMP and will be defined in a future version of the IEMP when soil and source operable unit remediation is nearly complete. Ultimately, the IEMP will be used to verify and document that the FEMP's sitewide remedial actions result in a condition that no longer poses any long-term threat to human health and the environment through the sediment pathway.

In the interim, to address concerns of the community, the FEMP proposes to continue the current environmental monitoring sediment program in the IEMP for an initial period of two years

(1997 and 1998), as site remediation is implemented. Monitoring during this period will provide an assessment concerning the sufficiency of the project-specific surface water and sediment controls. If the results of this two-year program are consistent with past sediment sampling programs (i.e., the concentration of any residual contamination detected in the sediment is determined to be such that it is not a significant threat to human health or to the environment as a result of remedial activities), then the sediment sampling program conducted as part of the IEMP likely may be reduced

5.2 ANALYSIS OF REGULATORY DRIVERS, DOE POLICIES, AND OTHER FEMP-SPECIFIC AGREEMENTS

This section presents an evaluation of the regulatory drivers governing sediment monitoring during site remediation. The intent of this section is to identify any pertinent regulatory requirements, including ARARs and TBC-based requirements, for the scope and design of the sediment monitoring program. These requirements will be used to confirm that the design specifications: 1) satisfy the regulatory obligations stated below; and 2) will achieve the intentions of other pertinent criteria (such as DOE Orders and the FEMP's existing agreements, as appropriate) that have a bearing on the scope of this monitoring. The results of the evaluation also are used to define, as appropriate for this media, the programmatic boundaries between the IEMP and project-specific emissions-control monitoring conducted by individual project organizations.

5.2.1 Approach

The analysis of the regulatory drivers and policies was conducted by examining the FEMP's approved CERCLA Records of Decision to identify any sediment-specific monitoring requirements. An evaluation of the FEMP's regulatory drivers for sediment monitoring was conducted to confirm that the EMP monitoring scope (which historically has satisfied public concerns and DOE Order 5400.1 and 5400.5 requirements) also meets the additional requirements (if any) for sediment monitoring that may have been activated by the FEMP's CERCLA operable unit Records of Decision.

5.2.2 Results

The evaluation of regulatory drivers for sediment monitoring resulted in two regulatory requirements governing the technical scope and reporting for the IEMP sediment monitoring program at the FEMP:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5 which requires remediation of the site such that the sediment pathway is protective of the underlying Great

Miami Aquifer and environmental receptors. The FRLs for sediment are specified in the Operable Unit 5 Record of Decision; however, a specified volume or area of sediment to be remediated was not identified due to the sporadic and isolated detections of contaminants above FRLs in sediment. Attainment of sediment FRLs in the northeast drainage, Paddys Run, and the Great Miami River will be determined by monitoring at the end of site remedial actions, as committed to in the Operable Unit 5 Feasibility Study Report.

- The CERCLA Feasibility Study Report for Operable Unit 5, which stated that if the concentrations of constituents remain above sediment BTVs after completion of the remedial action, then further investigation and remediation may be warranted. The sediment BTVs listed in the Feasibility Study Report were identified as contaminant concentrations that are protective of ecological receptors.

One other regulatory driver was found to have sediment monitoring implications but only of a project-specific nature. The project-specific sediment monitoring driver is:

- The CERCLA Record of Decision for Remedial Actions at Operable Unit 5, which requires remediation of the site such that the sediment pathway is protective of the underlying Great Miami Aquifer and environmental receptors. The FRLs for sediment are specified in the Operable Unit 5 Records of Decision; however, a specified volume or area of sediment to be remediated was not identified due to the sporadic and isolated detections of contaminants above FRLs in sediment. Further investigation to refine the extent of excavation in the storm sewer outfall ditch and other on-site drainages will be conducted, as necessary, by sampling sediment for FRL constituents (see Section 5.1).

DOE Order 5400.1, General Environmental Protection Program, and DOE Order 5400.5, Radiation Protection of the Public, were also evaluated for any TBC criteria that may drive environmental monitoring of sediment at the FEMP. This evaluation concluded that, although sediment sampling has been conducted under the DOE Order-driven EMP, continued sediment monitoring is not mandated by DOE Orders in light of the well-characterized current site conditions, planned actions regarding IEMP surface water sampling, and the planned sediment verification sampling both on and off property.

To summarize, there are no regulatory requirements mandating continued EMP sediment monitoring as part of the IEMP monitoring program during remediation. However, due to public concern expressed during meetings, the site EMP sediment sampling scope will be incorporated into the IEMP for a minimum of two years, as noted in Section 5.1. Sampling conducted to verify FRL and BTV attainment will occur under the IEMP only after remediation has been completed. Table 5-1 lists the drivers for the scope of the sediment monitoring program for the IEMP, as well as for project-specific

TABLE 5-1
FEMP SEDIMENT MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES

	DRIVER	ACTION	PROJECT PLAN
IEMP	OU5 ROD Sediment FRLs	The IEMP will be modified toward completion of the remedial action to include sampling to certify FRL achievement	
IEMP	OU5 FS Sediment BTVs	The IEMP will be modified toward completion of the remedial action to include sampling for BTV constituents	
PROJECT	OU5 ROD Sediment FRLs	Sampling of on-site drainage ditches, as necessary, to refine excavation depth	Sitewide Excavation Plan Environmental Reference Support Documents

sediment monitoring. The FEMP's current and long-range plan for complying with the reporting requirements invoked by the above regulatory requirements is provided in Sections 5.6 and 8.0.

5.3 PROGRAMMATIC BOUNDARY FOR THE SEDIMENT PROGRAM

This section identifies the programmatic boundary that has been established between the IEMP and project-specific activities. The intent behind the boundary definition is to: 1) clearly delineate the scope and geographic extent of the IEMP monitoring responsibility; and 2) establish a recognized interface between the "downstream" surveillance focus of the IEMP and the predominant emission-control and verification (in on-property drainages as part of soil remediation) focus of project-specific monitoring.

The IEMP sediment sampling program will be confined to the storm sewer outfall ditch, Paddys Run and the Great Miami River. The IEMP sediment sampling in these streams will provide surveillance downstream from the project specific sediment controls currently in place or planned.

Project-specific sediment investigation to refine remediation needs in the storm sewer outfall ditch and other on-property drainages will be conducted, if determined necessary, as part of the project-specific soil excavation planning. This determination and any followup sampling necessary for purposes of verifying the extent of excavation will be defined in the final Sitewide Excavation Plan (SEP) and/or environmental reference documents. If project-specific sampling is determined to be required in the storm sewer outfall ditch, it will be coordinated with the IEMP monitoring of the sediments in the storm sewer outfall ditch. As described in Section 5.1, verification sampling of sediment in Paddys Run, the northeast drainage and the Great Miami River will be performed as part of a future version of the IEMP to confirm that remedial actions for sediment are not required.

5.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

5.4.1 Program Expectations

The 1997-1998 IEMP sediment monitoring program is essentially a two-year continuation of the current EMP sediment surveillance monitoring program. The expectations for the program for 1997 and 1998 are to collect data sufficient to:

- Determine if substantive changes to current residual contaminant conditions (as defined by the current environmental sampling program) occur in the sediments found in the storm sewer outfall ditch, Paddys Run, and the Great Miami River as a result of runoff and treated effluent from the site

- Determine if the program should continue as is or be refined in scope as remediation progresses

- Continue to address the concerns of the community associated with remedial construction activity at the FEMP.

5.4.2 Sediment Program Design Considerations

The design considerations to address the above-listed expectations are as follows:

- Sample locations should, in general, be consistent with current environmental monitoring locations so that comparable areas are evaluated.

- Sampling frequency, parameters analyzed, and analytical support level should be consistent with the current environmental monitoring program so that appropriate comparisons can be made and the findings of the annual assessment can be reported to the public.

Regarding public concerns of contaminated sediment mobilization, it should be noted that controls currently in place (and planned future controls) for site surface water and sediment runoff from the more highly contaminated areas reduce the contamination leaving the site. This is explained in detail for surface water in Section 4.0. As expected, the sediment sampling results from the 1994 and 1995 EMP indicate reductions of uranium contamination in sediment when compared to remedial investigation/feasibility study and earlier EMP program data collected in the late 1980s. These reductions are attributable to the control of contaminated surface water that began in 1986 with the installation of the storm water retention basins as described in Section 4.0. The 1994 and 1995 EMP sediment data indicate:

- Average uranium concentrations measured in sediment from Paddys Run, the storm sewer outfall ditch, and Great Miami River samples were far below the human-health-protective sediment FRL of 210 mg/kg for uranium (highest average was 8 mg/kg based on nine samples from the storm sewer outfall ditch in 1995).

- The maximum uranium detected was in the storm sewer outfall ditch, at 23 mg/kg.

- The maximum uranium concentration in Paddys Run, downstream from the confluence with the storm sewer outfall ditch, was 10 mg/kg in 1995.

In reviewing the sediment data for Ra-226, Th-228, Th-230, and Th-232, from 1991 through 1996 that is contained within the annual Site Environmental Reports (SERs), the following observations are noted:

- For Radium-226, out of the 117 samples collected in the SSOD and in Paddys Run north of the SSOD, there were no observed occurrences above the Radium-226 sediment FRL of 2.9 pCi/g. Out of the 117 samples, a maximum concentration of 2.3 pCi/g was observed in 1992. The annual averages of the Radium-226 samples collected from 1991 through 1996 ranged from 0.17 pCi/g to 0.97 pCi/g.

- For Thorium-228, out of the 112 samples collected in the SSOD and in Paddys Run north of the SSOD, there were no observed occurrences above the Thorium-228 sediment FRL of 3.2 pCi/g. Out of the 112 samples, a maximum concentration of 1.9 pCi/g was observed in 1996. The annual averages of the Thorium-228 samples collected from 1991 through 1996 ranged from 0.35 pCi/g to 1.26 pCi/g.

- For Thorium-230, out of the 112 samples collected in the SSOD and in Paddys Run north of the SSOD, there were no observed occurrences above the Thorium-230 sediment FRL of 18,000 pCi/g. Out of the 112 samples, a maximum concentration of 4.0 pCi/g was observed in 1996. The annual averages of all the Thorium-230 samples collected from 1991 through 1996 ranged from 0.45 pCi/g to 2.44 pCi/g.

- For Thorium-232, out of the 112 samples collected in the SSOD and in Paddys Run north of the SSOD, there was only one observed occurrence above the Thorium-232 sediment FRL of 1.6 pCi/g. Out of the 112 samples, a maximum concentration of 1.8 pCi/g was observed in the SSOD in 1996. The annual averages of all the Thorium-232 samples collected from 1991 through 1996 ranged from 0.33 pCi/g to 1.13 pCi/g.

Based on the above data, in conjunction with the remedial investigation/feasibility study findings, it has been concluded that sediments from the FEMP currently do not pose an unacceptable risk to the public. However, continued monitoring at the current level is recommended in this IEMP to determine if this conclusion remains valid during the initial stages of remediation.

5.4.3 Sediment Program Design

The sediment monitoring program that will continue during fiscal years 1997 and 1998 will collect samples from the areas shown on Figure 5 -1, as follows: one background location along Paddys Run, north of the site boundary; 10 locations along Paddys Run (five north of the storm sewer outfall ditch and five south of the storm sewer outfall ditch) taken at strategic locations to ensure that the most recent sediment deposited is collected; five locations along the storm sewer outfall ditch; and five

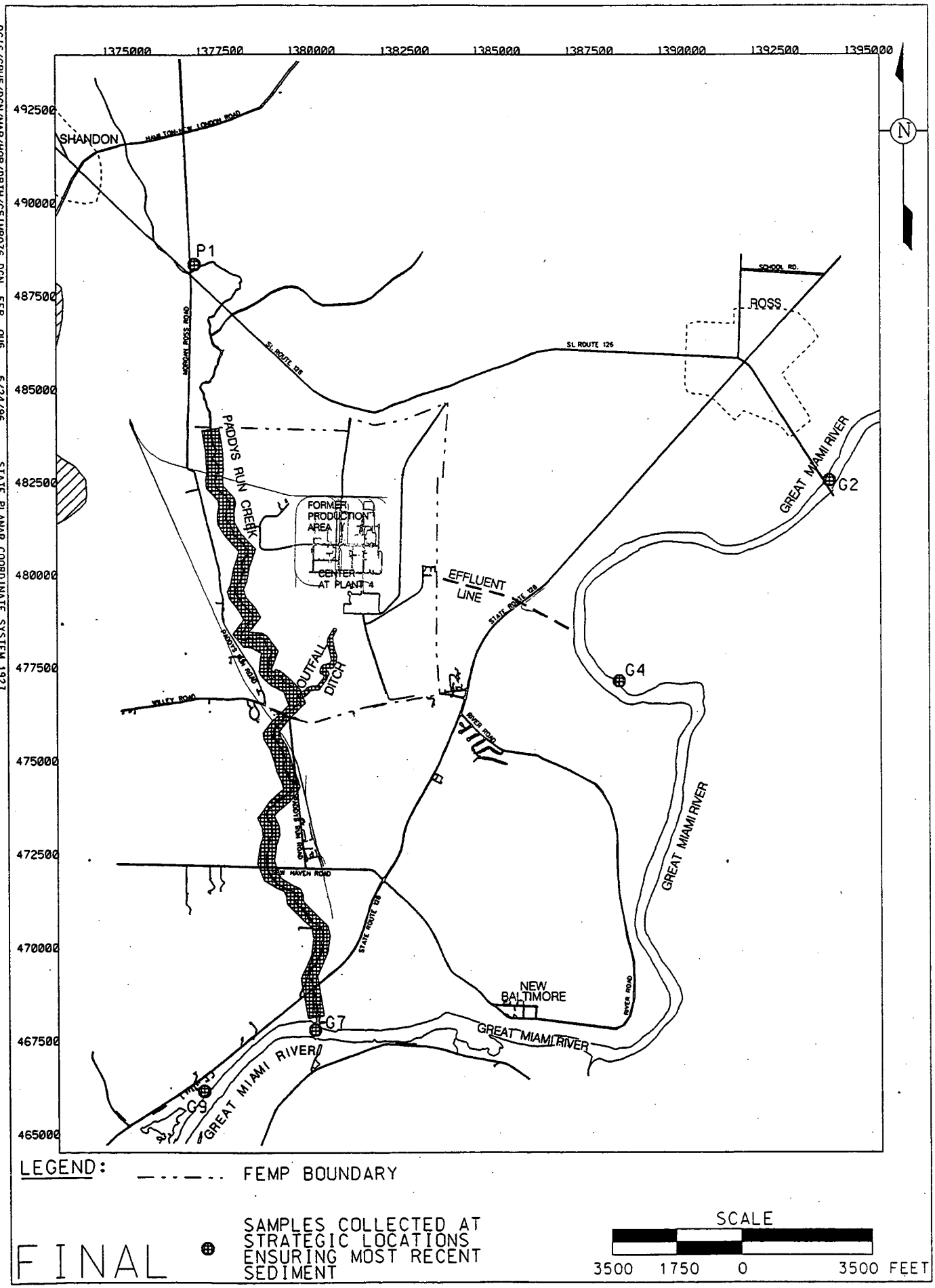


FIGURE 5-1. SEDIMENT MONITORING LOCATIONS

locations along the Great Miami River (two background locations upstream of the FEMP treated effluent discharge point, one location just below the FEMP treated-effluent discharge point inside the Big Bend, one just downstream of the confluence with Paddys Run, and one additional downstream location).

Because radium-226, thorium, and uranium are primary contaminants in Operable Unit 1, Operable Unit 4, and the former production area, these constituents will be analyzed for at locations just downstream of these areas (i.e., Paddys Run north of the confluence with the storm sewer outfall ditch and in the storm sewer outfall ditch). Historical data indicate radium-226 and isotopic thorium have not been consistently detected at levels above sediment FRLs in Paddys Run south of the storm sewer outfall ditch and in the Great Miami River; therefore, samples collected from these areas will be analyzed only for total uranium. The program design is summarized in Table 5-2.

TABLE 5-2

ANNUAL SEDIMENT SAMPLING PROGRAM DESIGN

Location	Analyte	Expectation
Paddys Run background (1 sample)	Total uranium, isotopic thorium, radium-226	Establish range of background concentrations in Paddys Run
Paddys Run north of storm sewer outfall ditch (5 samples)	Total uranium, isotopic thorium, radium-226	Measure the impact of surface water runoff from western portion of the site, including the waste pits and K-65 areas
Paddys Run south of storm sewer outfall ditch (5 samples)	Total uranium	Measure impact of surface water runoff from the site
Storm sewer outfall ditch (5 samples)	Total uranium, isotopic thorium, radium-226	Measure the impact of any overflows of the storm water retention basin, surface water runoff from the eastern portion of the site, and residual contaminant concentrations from past releases
Great Miami River (3 samples)	Total uranium	Measure the impact of the site effluent
Great Miami River background (1 sample)	Total uranium	Establish range of background concentrations in Great Miami River

5.5 MEDIA-SPECIFIC PLAN FOR SEDIMENT MONITORING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental sediment monitoring program. The sampling, analytical, and data management activities described in this media-specific plan were designed to provide sediment data of sufficient quality to meet the program expectations as stated in Section 5.4.1. The program expectations, in conjunction with the design considerations presented in Section 5.4.2, were used as the framework for developing the monitoring approach presented in this media-specific plan. To ensure that the specific DQOs are met for this program, all sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the SCQ.

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Health and safety
- Change control
- Data management
- Project quality assurance.

5.5.1 Project Organization

A multidisciplinary project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this PSP, in compliance with all regulatory specifications and sitewide programmatic requirements defined by the Fluor Daniel Fernald (FDF) Oversight and Program Integration Division. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support, and to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standard, and to assist in evaluating and resolving all quality-related concerns.

5.5.2 Sampling Program

Sediment samples are collected annually in the spring from approximately 20 locations within the storm sewer outfall ditch, Paddys Run, and the Great Miami River. Sampling is performed in the spring in order to take advantage of the abundance of fresh sediment deposited during flood conditions that commonly occur after winter. Figure 5-1 illustrates the following locations for sediment sample collection:

- Five locations are planned for the storm sewer outfall ditch and connecting drainage ditches to measure the impact of any overflows of the storm water retention basin, surface water runoff from the eastern portions of the site, and residual contaminant concentrations from past. Samples collected from this area are analyzed for total uranium, isotopic thorium, and radium-226.

- Three locations are planned along the Great Miami River downstream of the effluent line (locations G4, G7, and G9), to measure the impact of the site effluent. The first location is downstream of the effluent line inside of the Big Bend; the second location is just downstream of the confluence with Paddys Run to determine any additional influence from this stream on the river; the third location is collected farther downstream to identify any settling out of uranium downstream of the first two locations. Samples collected from the Great Miami River will be analyzed for total uranium.

- Ten locations are planned for Paddys Run, from the waste storage area to the confluence with the Great Miami River, to measure impacts of surface water runoff from the western section of the site. Paddys Run locations are separated into two groups: 1) north of the confluence with the storm sewer outfall ditch and 2) south of this confluence. Samples collected to the north are analyzed for total uranium, isotopic thorium, and radium-226. Samples collected from the south are analyzed for total uranium.

- One background location is planned upstream of the site along Paddys Run (Location P1). Background locations along Paddys Run are analyzed for total uranium, isotopic thorium, and radium-226.

- One background location upstream of the site effluent line from the Great Miami River (Location G2) is planned. The background location along the Great Miami River is analyzed for total uranium.

5.5.2.1 Sediment Sample Collection and Procedures

Sample collection is performed according to Solid Sampling, SMPL-01. Sample handling and transfer is governed by Chain of Custody/Request for Analysis Record for Sample Control, EW-0002. Project-specific sampling considerations are outlined below:

- Only recently deposited surface sediment shall be collected, typically from deposition locations such as slow flow-rate areas (e.g., obstructions in the stream bed).

- Samples shall be collected from the top few centimeters and consist of fine-grained material.

- Sample collection shall begin at the farthest downstream location and proceed upstream.

- Any non-sediment materials shall be discarded from the sample, the sample shall be mixed thoroughly, and placed in the sample container.

- Sediment samples shall be dried in a clean, controlled area to prevent contamination.

The locations of the sediment sample points are approximate and change from year to year, based on where stream flow has deposited sufficient material for sampling. Sediment samples are analyzed according to Table 5-3. An ASL of B was selected because the results will provide surveillance monitoring data. ASL B provides qualitative, semi-qualitative, and quantitative data with some QA/QC checks.

Sampling equipment decontamination is addressed in procedure EP-REM-010, Sediment Sampling. Calibration of analytical equipment and disposition of wastes generated during analysis are per the requirements of the SCQ.

5.5.2.2 Quality Assurance Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed to evaluate the possibility that some controllable practice, such as decontamination or sampling technique, may be responsible for introducing bias in the project's

TABLE 5-3

SEDIMENT SAMPLE ANALYTICAL REQUIREMENTS

Location	Number of Samples[a]	Frequency	Analyte	ASL	Container	Hold Time	Preservative
Storm sewer outfall ditch	5	Annual	Total uranium, isotopic thorium, radium-226	B	500 mL glass jar or plastic bag	6 months	none
Great Miami River	3	Annual	Total uranium	B	500 mL glass jar or plastic bag	6 months	none
Paddys Run north of storm sewer outfall ditch	5	Annual	Total uranium, isotopic thorium, radium-226	B	500 mL glass jar or plastic bag	6 months	none
Paddys Run south of storm sewer outfall ditch	5	Annual	Total uranium	B	500 mL glass jar or plastic bag	6 months	none
Great Miami River background	1	Annual	Total uranium	B	500 mL glass jar or plastic bag	6 months	none
Paddys Run background	1	Annual	Total uranium, isotopic thorium, radium-226	B	500 mL glass jar or plastic bag	6 months	none

[a]The number of samples for each surface water stream or river may vary depending on the availability of recently deposited sediment.

analytical results. Additionally, approximately one field duplicate will be collected for every 20 samples.

The State of Ohio, through its Agreement in Principle with the DOE, empowers the OEPA to take samples that are independent of the split-sampling program. In addition, sediment samples are split annually in accordance with the Agreement in Principle. These samples further supplement the quality assurance program by providing a means to evaluate comparability between laboratories. Samples collected with the OEPA are analyzed for the same parameters as those established for the background sample locations.

5.5.3 Change Control

Changes to the media specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designated authority shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by.the designated project authority and QA prior to implementation. The completed Variance/Field Change Notice must be approved by QA. The Variance/Field Change Notice form shall be controlled and included in the field data package and become part of the project record. Permanent media-specific plan changes will incorporate applicable Variance/Field Change Notice in annual media-specific plan revisions. Scope changes to the media-specific plan will require respective document changes.

5.5.4 Health and Safety Considerations

The FDF Health and Safety Department is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed.

All involved personnel will receive adequate training on the health and safety requirements prior to implementation of the field work required by this media-specific plan. Daily safety meetings will be conducted prior to beginning field work to address specific health and safety issues.

All FDF employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to have completed all required site training.

For areas subject to more restrictive radiological controls where the potential for exposure is greater, radiation work permits (RWPs) are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring a RWP.

5.5.5 Data Management

Field and analytical data will be managed to meet the IEMP data reporting and quality objectives. The field documentation and analytical data results shall be verified to ensure conformance to the appropriate SCQ sections and appendices. The process for management of the field and analytical data is described in the Environmental Data Management Plan (FERMCO 1996).

Field documentation will be verified for accuracy and completeness by the sampling team, followed by an independent field data validation in accordance with SCQ requirements for the corresponding ASL. The project team leader must have processes in place to verify that chemical and radiological data results meet all applicable quality requirements specified in the SCQ for the respective ASL (SCQ Section 11.0 and Appendix F). The quality of analytical data shall be evaluated by independent project personnel qualified to determine accuracy, completeness, and applicable statistical data necessary to evaluate data useability and data quality required for environmental monitoring reporting. Both the field and analytical data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project files in accordance with FEMP recordkeeping procedures and DOE Orders.

5.5.6 Quality Assurance

Independent assessments of work processes shall be conducted to verify quality of performance. Such assessments may include audits, surveillances, inspections, tests, data verification and field validation, and peer reviews. Assessments shall include performance-based evaluation of compliance to technical and procedural requirements, and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment

documentation shall verify that work was conducted in accordance to IEMP, SCQ, applicable DQOs, and FEMP Quality Assurance Program (RM-0012) requirements.

Independent assessment is the responsibility of designated project quality assurance personnel. The project team leader and QA will coordinate independent assessment oversight activities and comply with SCQ Section 12. Recommended quarterly QA surveillances shall be performed on some tasks specified in the media-specific plan. The QA representative shall have "stop work" authority if significant adverse-to-quality conditions are identified or work conditions are unsafe. In accordance with SCQ, Section 3, QA shall review and have approval signature of plans, procedures, and final documents supporting the IEMP program.

Only laboratories on the Approved Laboratory List will be used for FEMP sample analyses in accordance with SCQ Section 12 and Appendix E.

5.6 IEMP SEDIMENT MONITORING DATA EVALUATION AND REPORTING

This section provides the methods to be utilized in analyzing the data generated for the IEMP sediment sampling program. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated sediment data is presented. The reporting subsection also provides the information to be reported in the comprehensive annual report.

5.6.1 Data Evaluation

Data resulting from the IEMP sediment program will be evaluated with respect to the program expectations identified in Section 5.4.1. Based on these expectations, the following questions will be answered through the sediment data evaluation processes indicated by the text following each of the questions:

- Have changes in the residual contaminant concentrations occurred in sediments found in the storm sewer outfall ditch, Paddys Run, and the Great Miami River as a result of runoff and treated effluent from the site?

Data evaluation will consist of basic statistical analysis (i.e., minimum, maximum, and mean) and comparison to historical data and FRLs. This evaluation will identify long-term trends of targeted radiological constituents in sediment to determine if the potential exists for an FRL exceedance in the future due to site remedial activities. As indicated in Figure 5-2, results of the data interpretation will be communicated to project personnel to implement appropriate actions, as necessary.

- Should the sediment program be refined in scope as remediation progresses?

Data evaluation to determine if the IEMP sediment program should be revised will be based on comparison to historic ranges. If data exceeds historical ranges, then program modifications will be considered.

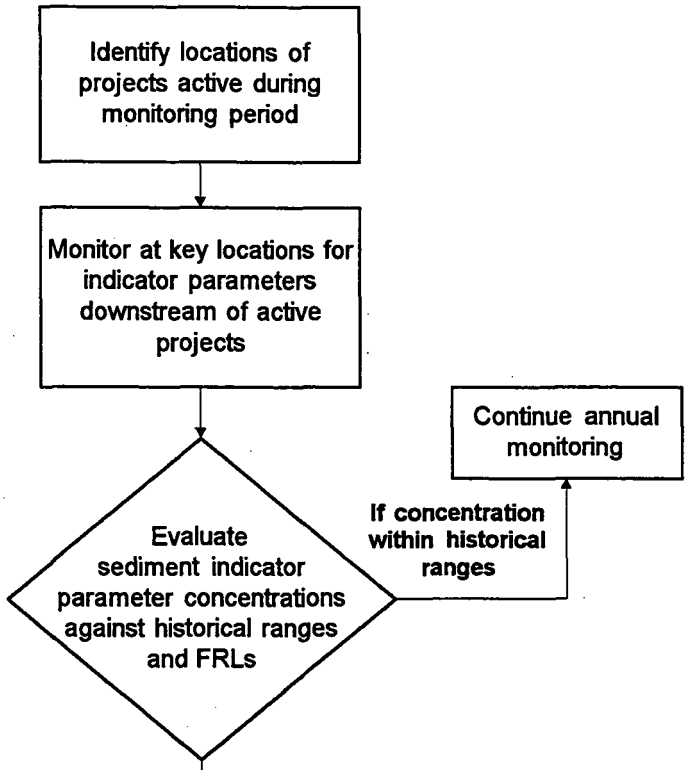
Data evaluation to address any remaining expectations identified in Section 4.4.1 is encompassed in the data evaluation techniques described above.

5.6.2 Reporting

Data from the sediment monitoring program were published annually in the Site Environmental Report. Figure 8-1 identifies the current reporting schedule for sediment and identifies when IEMP reporting will assume responsibility for sediment monitoring reporting. Sediment data for calendar year 1996 will be reported in the 1996 Site Environmental Report to be published in June 1997. Sediment data for calendar year 1997 will be published in June 1998 in a report that is transitional from the Site Environmental Report to the IEMP annual report. Beginning with calendar year 1998, sediment data will be published in the new IEMP annual comprehensive environmental report.

Quarterly meetings will be held to coincide with the quarterly report submittals. The quarterly status reports/meetings will be submitted within 60 days of the end of the quarter. A quarterly results summary of the sediment sampling, conducted between April and June 1998, will be presented in the third quarterly meeting of the year (i.e., in September 1998).

FIGURE 5-2
IEMP SEDIMENT DATA EVALUATION AND ASSOCIATED ACTIONS



If concentration > historical ranges,[a] but < FRLs

IEMP Actions	Potential Project Actions
• Identify probable sources and alert associated projects • Continue annual monitoring • Trend data to determine potential for unacceptable future conditions. • Report information to EPA/OEPA in next quarterly and in the annual report	• Review performance/ inspection data for engineered controls • Determine if engineered controls meet design specifications • Repair engineered controls, if necessary

If concentration > FRL

IEMP Action	Potential Project Action
• Identify probable source areas and alert associated projects • Conduct confirmatory sampling to verify exceedance • Conduct sampling to determine extent of exceedance • Continue annual monitoring • Report information to EPA/ OEPA in next quarterly and in the annual report.	• Review performance/ inspection data for engineered controls • Determine if engineered controls meet design specifications • Repair engineered controls, if necessary • Estimate duration of source activities • Redesign engineered controls • Quantify release • Remediate sediment, if necessary

[a] Historical range established by sediment data collected from 1990-1995

I:\IEMP-NEW\FIGURES\TBL5-2.VSD

Data and information pertaining to the IEMP sediment sampling program to be presented in the annual report will consist of the following:

- Graphical presentation of data trends over time at each sample location
- Statistical summary by constituent (i.e., minimum, maximum, and mean), by stream
- Summary-level information on the effectiveness of the project-specific sediment control structures (to include sediment control efficiency data, if necessary for interpretation of sitewide impacts.

6.0 AIR MONITORING PROGRAM

Section 6.0 discusses the monitoring strategy for assessing the sitewide impact of the FEMP's remediation activities on the air pathway. The strategy identifies the activities conducted to satisfy requirements for particulate, radon and direct radiation monitoring. A media-specific plan for conducting sitewide and off-property air monitoring activities is provided, along with a phased plan to integrate several of the FEMP's air-related reports into a single IEMP-sponsored report.

6.1 INTEGRATION OBJECTIVES FOR AIR

Unlike the groundwater and surface water programs (which combine a variety of existing compliance and reporting programs together under the IEMP umbrella), the sitewide air pathway has historically been evaluated under two closely knit programs:

- The EMP program, which provided physical air monitoring at the K-65 silos, FEMP property boundary, and critical off-property locations of concern to public stakeholders.
- The 40 CFR 61, Subpart H (NESHAP) air pathway dose assessment program which provides calculated estimates of the FEMP's radiological impacts beyond the fence line to comply with Clean Air Act provisions.

The information produced by these two FEMP programs was reported together in the FEMP's annual Site Environmental Report that historically satisfied DOE Orders 5400.1 and 5400.5 environmental monitoring and total dose assessment obligations. The NESHAP calculated dose estimates were also reported to EPA as a stand-alone report to satisfy the requirements of 40 CFR 61, Subpart H. The IEMP will continue with the responsibility of physically monitoring the air pathway and providing dose assessments to satisfy 40 CFR 61 Subpart H and the intentions of DOE Orders.

This plan presents an alternate, monitoring-based approach for demonstrating compliance with the requirements of 40 CFR 61, Subpart H. This approach represents a fundamental change in the technical basis used for demonstrating compliance with Subpart H, which historically has been accomplished through computer modeling, as described in 40 CFR 61.93 (a). The change to a monitoring based approach reflects the nature of emission sources expected during remedial action. During the production years at the facility, emissions were primarily from point sources (i.e., stacks and vents), where direct, continuous, measurements of point source emission rates and contaminant

concentrations served as direct inputs to the CAP88 dispersion model used for demonstrating NESHAP Subpart H compliance. As remedial actions are initiated, the primary emission sources will be fugitive emissions resulting from a diverse range of activities including large scale excavations, material handling and waste processing operations. It is difficult to predict or measure with certainty emissions from such diffuse sources. Monitoring at or near the potential receptor locations will provide a direct measure of the environmental conditions resulting from the full range of planned remedial activities at the FEMP and therefore provides a reliable, accurate assessment of dose received by off-site receptors via the air pathway.

The initial focus of the program will be to monitor the collective sitewide effects of remediation activities contemplated for calendar years 1997 and 1998. The results will be evaluated on a continual basis to provide necessary feedback to the projects to ensure that cumulative sitewide impacts remain below established thresholds. Ultimately, this initial information will assist in tracking trends during remediation to help identify changes in the air monitoring program emphasis and/or design.

A reporting plan is provided in Section 6.6 to combine the results of the air monitoring program and the NESHAP dose assessments into a single reporting mechanism to facilitate regulatory agency review of the sitewide remedial activities and associated emission controls. The FEMP's plan for demonstrating NESHAP Subpart H compliance and producing required dose assessments during remediation are provided in Appendix C.

6.2 SUMMARY OF REGULATORY DRIVERS, PERTINENT DOE POLICIES, AND FEMP-SPECIFIC AGREEMENTS

The intent of this section is to identify the pertinent regulatory requirements, including ARARs and TBC-based requirements, for the scope and design of the air monitoring program. These requirements will be used to confirm that the program: 1) satisfies the regulatory obligations for monitoring that have been activated by the FEMP's Records of Decision; and 2) will achieve the intentions of other pertinent criteria (such as DOE Orders and the FEMP's existing agreements, as appropriate) that have a bearing on the scope of air monitoring.

The results of the evaluation are also used to define the programmatic boundaries between the sitewide IEMP responsibilities and the project-specific emissions-control monitoring conducted by the individual

project organizations. (Note: During the active uranium production years of the FEMP, the historical EMP program also monitored source emissions as part of its broad air effluent responsibility. Now these former EMP source characterization responsibilities reside within the scope of individual remediation projects).

6.2.1 Approach

The analysis of the additional regulatory drivers and policies for air monitoring was conducted by identifying the suite of ARARs and TBC-based requirements in the FEMP's approved CERCLA Records of Decision and FEMP legal agreements that contain specific air-monitoring requirements. This subset was then further divided to identify those monitoring requirements with sitewide implications (and which, therefore, fall under the scope of the IEMP) and those which pertain to emission controls/emission control monitoring that would be the responsibility of the individual remediation projects.

6.2.2 Results

The following regulatory drivers were found to govern the technical scope and reporting requirements for the IEMP's sitewide air monitoring program, and include:

- DOE Order 5400.1, General Environmental Protection Program, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility. The FEMP's EMP provides the initial basis for the development of the IEMP strategy that is responsive to the changing site mission and associated remediation needs while still DOE Order compliant.

- DOE Order 5400.5, Radiation Protection of the Public and Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Under this requirement, the exposure to members of the public associated with activities from DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent of 100 mrem. For radiological dose due to airborne emissions only, the order requires compliance with the 40 CFR 61, Subpart H, limit of an effective dose equivalent of 10 mrem per year to a member of the public. Demonstration of compliance with this standard is to be based on an air monitoring approach. The order also provides guidelines for radionuclide concentrations in air, known as Derived Concentration Guides (DCGs), and radon concentration limits for interim storage of sources during remediation. These radon limits are: 100 pCi/L at any given point, 30 pCi/L annual average sitewide, 3 pCi/L annual average at the facility fence line, and 20 pCi/m^2-sec flux rate for storage of radon generating wastes (per 40 CFR 61, subpart Q). The guidance document associated with this Order (DOE 1991) recommends confirmatory air

monitoring surveillance, which was previously conducted under the EMP and will be incorporated into the IEMP.

- Proposed 10 CFR 834, DOE Facilities Radiation Protection of the Public and Environment, is similar in intent to DOE Order 5400.5. However, differences include: deletion of the 100 pCi/L limit and 30 pCi/L annual limit, lowering the fence line limit to 0.5 pCi/L above background, changes to facility and site/facility boundary definitions, and clarifications to the definition of point of compliance. Because this is only a proposed rule, these limits are to be used as guidelines and should not override the requirements of DOE Order 5400.5, above. When the rule is promulgated, a compliance strategy will be developed to accommodate the FEMP's site-specific circumstances relative to meeting the new standards.

- National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart H, which provides national emissions standards for radionuclides other than radon. Per this requirement, emissions of radionuclides (excluding radon) to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/year. Demonstration of compliance with this standard is to be based on an air monitoring approach.

- Federal Facility Agreement (FFA), Control and Abatement of Radon-222 Emissions, signed November 19, 1991, which ensures that DOE takes all necessary actions to control and abate radon-222 emissions at the FEMP, under the authority of 40 CFR 61, Subpart Q. This agreement acknowledges that the K-65 silos (Operable Unit 4) exceed the radon emission of 20 pCi/m2/s , but allows the FEMP to address this exceedance by implementing a removal action to bring radon emissions from the silos to a level ALARA, and to attain the NESHAP Subpart Q standard upon completion of final remediation. The remediation work plan included a radon monitoring system, which was previously monitored under the predecessor EMP, and which will be incorporated into the IEMP. The FFA also requires demonstration of compliance with the Subpart Q standard (upon completion of remedial actions) for the waste pits, clearwell, and any other sources found to emit radon in excess of 20 pCi/m^2-sec.

- DOE Order 5820.2A Chapter III.3.k, Environmental Monitoring, which requires low-level radioactive waste disposal facilities to perform environmental monitoring that meets requirements in DOE Order 5400.1 for all media, including the air pathway. This requirement applies to the On-site Disposal Facility (OSDF), as it is the only disposal facility at the FEMP. Instead of a separate monitoring plan for the OSDF, the air monitoring program for the OSDF will be integrated and incorporated into the IEMP's air monitoring program.

Upon evaluating the IEMP ARARs in consideration of protection of human health and the environment, the 10 mrem/yr dose limit was determined to be the most stringent emission limit. Therefore, the 10 mrem/yr NESHAP standard provides a reasonable benchmark for ensuring compliance with all other air standards (excluding radon) and ensuring an adequate level of protectiveness.

Twelve other regulatory drivers have air monitoring implications, of a project-specific emissions-control nature, which fall outside the scope of the IEMP. These requirements pertain to the monitoring of fugitive area emission controls and the monitoring of point source emissions. The project-specific air monitoring drivers for fugitive dust include:

- Permit to Install New Sources, Criteria for Decision by Director, OAC 3745-31-05(A)(3), which requires the use of Best Available Technology (BAT) when installing, modifying, and operating an air contaminant source. The BAT Determination for Remedial Construction Activities on the FEMP Site provides a method for using BAT as it applies to fugitive dust sources.

- Ohio General Provisions on Air Pollution Control, Air Pollution Nuisances Prohibited, OAC 3745-15-07 and ORC 3704.01-.05, which prohibits the emission or escape into the open air of smoke, ashes, dust, dirt, grime, acids, fumes, gases, vapors, and odors in such amounts that may cause a public nuisance. Control of such emissions is the responsibility of the projects through source control, as described in the BAT Determination for Remedial Construction Activities on the FEMP Site.

- Ohio Emissions of Particulate Matter, Restriction of Emission of Fugitive Dust, OAC 3745-17-08, which provides for the restriction of emission of fugitive dust by the use of control measures. Such control measures include, for example, water or dust suppression chemicals for control of fugitive dust from demolition of buildings or on dirt or gravel roads, the use of hoods or fans to enclose and control fugitive dust, and the use of canvas or other coverings for stockpiles. Such control measures are the responsibility of the remedial action project and are described in the BAT Determination for Remedial Construction Activities on the FEMP Site.

- Ohio Emissions of Particulate Matter, Control of Visible Particulate Emissions from Stationary Sources, OAC 3745-17-07(B)(4) through (6), which is the standard used by OEPA to restrict particulate emissions from paved and unpaved roadways and parking areas, and material storage piles. For paved roadways and parking areas, there shall be no visible particulate emissions except for 6 minutes or less in any 60 minute period; for unpaved roadways and parking areas, there shall be no visible particulate emissions except for 13 minutes or less in any 60 minute period; and, for material storage piles, there shall be no visible emissions except for 13 minutes or less in any 60 minute period. Such emissions are subject to fugitive dust emission controls described in OAC 3745-17-08 and will be addressed in the BAT Determination for Remedial Construction Activities on the FEMP Site.

The project-specific regulatory drivers for point and other sources include:

- National Emissions Standards for Hazardous Air Pollutants (NESHAP), 40 CFR 61, Subpart Q, which provides national emissions standards for radon. The standard for this regulation is that no source at a DOE facility shall emit more than 20 pCi/m2-s of radon-222, as an average for the entire source, into the air. A source is defined in the regulation as any building structure, pile, impoundment, or area used for storage or disposal that contains sufficient quantities of radium so as to exceed the standard. To demonstrate compliance with the standard, radon

monitoring is conducted at the source. Such source monitoring, with the exclusion of that conducted at the K-65 silos, will be addressed within project remedial design and remedial action documents. The K-65 silo monitoring will be conducted under the IEMP.

- National Emissions Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart H, which provides national emissions standards for radionuclides other than radon. Per this requirement, emission measurements shall be made at point sources with a potential to discharge radionuclides into the air in quantities which could cause an effective dose equivalent in excess of one percent the standard (10 mrem/year).

- Ohio Particulate Matter Standards, Restrictions on Particulate Emissions from Industrial Processes, OAC 3745-17-11, which describes emission restrictions for particulates from industrial processes. These restrictions apply to operations, processes, or activity other than those subject to fugitive dust regulations in OAC 3745-17-08 (discussed above) and are therefore applicable to process units.

- Particulate Matter Standards, Control of Visible Emissions from Stationary Sources, OAC 3745-17-07(A), which sets visible particulate emission limitations for stacks. Visible particulate emissions from any stack cannot exceed 20 percent opacity, as a six-minute average.

- Air Quality Standards, Control of Emissions of Organic Materials from Stationary Sources, OAC 3745-21-07(G)(2), which sets a discharge limit of 40 lbs of organic material per day, and no more than 8 lbs per hour, for any article, machine, equipment, or other contrivance used for applying, evaporating, or drying and photochemically reactive material.

- Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities, Miscellaneous Units, 40 CFR 264.601 through .603, and OAC 3745-57-91 through 93, which requires that miscellaneous units be designed, operated, and maintained to prevent releases to the air pathway. Monitoring may be necessary to evaluate the effectiveness of air emission controls. Operable Unit 1 remedial actions may require the use of miscellaneous units for the management or treatment of RCRA-regulated hazardous waste.

- Permit to Install New Sources, Criteria for Decision by Director, OAC 3745-31-05(A)(3), which requires the use of BAT when installing, modifying, and operating an air contaminant source. Any treatment units for remedial action activities will be designed to include BAT.

- General Provisions on Air Pollution Control, Malfunction of Equipment, Scheduled Maintenance, Reporting, OAC 3745-15-06(A)(1) and (2), which requires scheduled maintenance of air pollution control equipment in order to prevent a malfunction. Shutdown of the operating unit, if required to conduct the maintenance, must be accompanied by the shutdown of the associated air pollution sources. Project-specific remedial design and remedial action work plans will include a maintenance program to address this requirement.

- Ohio Standards for Active and Inactive Asbestos Disposal Sites, OAC 3745-20-06 and OAC 3745-20-07(A) and (C), which prohibit visible emissions of asbestos during and after placement. Asbestos management is primarily limited to asbestos removal conducted prior to building demolition and disposal either off-site or in the OSDF. The visible emission standard for asbestos is closely tied to asbestos management, and is not within the scope of the IEMP.

All of the above requirements are listed in Table 6-1. Table 6-1 includes each of the air monitoring regulatory requirements to be conducted under the IEMP and the associated monitoring designed to comply with each requirement. Also listed in Table 6-1 is each regulatory driver for project-specific air monitoring, the monitoring conducted to meet the requirement, and the project-specific plan that will describe the monitoring program. The FEMP's current and long-range plan for complying with the reporting requirements invoked by the IEMP regulatory drivers is provided in Sections 6.6 and 8.

6.3 BOUNDARY DEFINITION

This section identifies the programmatic boundary(s) that have been established between the IEMP and the project-specific activities. The intent behind the boundary definition is to: (1) clearly delineate the scope of the IEMP's monitoring responsibility; and (2) establish a recognized interface between the sitewide focus of the IEMP and the fugitive and point source emission-control focus of the project-specific monitoring.

In general, the program boundaries for air monitoring are defined in the following two fundamental areas:

1) Fugitive Emissions Monitoring
   As stated earlier, the air monitoring program presented in the IEMP will serve as the vehicle for demonstrating compliance with the NESHAP Subpart H limit ensuring that no member of the public receives an effective dose equivalent of 10 mrem/year from radionuclide emissions (excluding radon) as a result of FEMP operations. As such, the air monitoring approach presented in this plan will provide a continual measurement of the collective effectiveness of fugitive and point source emissions from the site relative to this health protective standard. Each project is responsible for implementing the sitewide BAT determination for the control of fugitive dust, as appropriate. This determination outlines the administrative and engineering controls for mitigating fugitive dust and includes specific EPA methods for conducting visual monitoring that must be conducted and documented by the effected project. Additional air monitoring at the project level to determine the effectiveness of specific administrative and engineering controls for fugitive dust abatement (above those required under the BAT determination) are not necessary to ensure protection of the public or support compliance with NESHAP, Subpart H. However, the air monitoring information maintained by the projects will be used as necessary to support the data interpretations conducted through the IEMP. Likewise, the air monitoring data collected through the IEMP will be used to provide continual feedback to the remediation projects on the effectiveness of emission controls.

TABLE 6-1
FEMP AIR MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES

DRIVER	ACTION
DOE Order 5400.1, General Environmental Protection Program Environmental Monitoring Plan for all media	The IEMP describes effluent and surveillance monitoring as required by the order
DOE Order 5400.5 Proposed 10 CFR 834 Radiation Protection of the Public and Environment	The IEMP describes on-site and off-site monitoring for radon and other radionuclides, and monitoring to determine annual dose from the air pathway
NESHAP 40 CFR 61, H Emission standards for radionuclides (excluding radon)	The IEMP includes an assessment of the annual dose to the public from the air pathway by employing a fence-line and off-site air monitoring program
Federal Facility Agreement Control and Abatement of Radon-222 Emissions	The IEMP describes radon monitoring at the OU4 Ore Silos and the OU1 Waste Pits
DOE Order 5820.2A Environmental Monitoring for Low-Level Radioactive Waste Disposal Facilities	The IEMP fenceline air monitoring includes air monitoring at locations adjacent to the OSDF

TABLE 6-1
FEMP AIR MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES
(CONTINUED)

DRIVER	ACTION	PROJECT PLAN
NESHAP 40 CFR 61, Q Emission standards for radon for storage and disposal units or areas	Air monitoring at stacks/vents for OU1 and OU4 storage and disposal units, as determined necessary by modeling	OU1 Remedial Design/Remedial Action Documents Package; OU4 Design Criteria Package
OAC 3745-17-11 Ohio Particulate Matter Standards Industrial Processes	Visible emission monitoring for OU1 Waste Pit Treatment Unit Stacks/Vents and OU4 FVRP and VITPP Stacks/ Vents, as determined necessary by modeling	OU1 Remedial Design/Remedial Action Documents Package; OU4 Design Criteria Package and Vitrification Plant Design Package
40 CFR 264.601-.603; OAC 3745-57-91 through 93 Miscellaneous Hazardous Waste Management Units	Monitoring at vents/stacks at OU1 hazardous waste treatment or storage units, as determined necessary by modeling	OU1 Remedial Design/Remedial Action Documents Package
OAC 3745-31-05(A)(3) BAT for New Air Sources	Air monitoring at stacks/vents for OU1 and OU4 treatment units, as determined necessary by modeling	OU1 Remedial Design/Remedial Action Documents Package; OU4 Design Criteria Package and Vitrification Plant Design Package
OAC 3745-15-06(A)(1) and (2) Maintenance of Air Pollution Control Equipment	Monitoring of the air pollution control equipment at OU1 and OU4 treatment units	OU1 Remedial Design/Remedial Action Documents Package; OU4 Design Criteria Package and Vitrification Plant Design Package
OAC 3745-20-06 & 07(A) & (C) Ohio Standards for Active and Inactive Asbestos Disposal Sites	Visible emissions monitoring of free asbestos during handling and disposal	OU3 Integrated RD/RA Work Plan; OSDF Impacted Materials Placement Plan
OAC 3745-17-07(A) Ohio Particulate Matter Standards Visible Particulate Emissions for Stacks	Visible emission monitoring for OU1 Waste Pit Treatment Unit Stacks/Vents and OU4 FVRP and VITPP Stacks/ Vents, as determined necessary by modeling	OU1 Remedial Design/Remedial Action Documents Package; OU4 Design Criteria Package and Vitrification Plant Design Package
OAC 3745-21-07(G)(2) Ohio Air Quality Standards for Organics	Air monitoring at stacks/vents for OU1 treatment units, as determined necessary by modeling	OU1 Remedial Design/Remedial Action Documents Package

TABLE 6-1
FEMP AIR MONITORING PROGRAM
REGULATORY DRIVERS AND RESPONSIBILITIES
(CONTINUED)

	DRIVER	ACTION	PROJECT PLAN
PROJECT FUGITIVE DUST CONTROL	OAC 3745-31-05(A)(3) BAT for New Air Sources	Visible emission monitoring for roadways and parking areas, and storage piles associated with the OU1 Waste Pits, Soil Excavation, and OSDF projects, and other construction activities	BAT Determination for remedial construction activiities on the FEMP site
	OAC 3745-15-07; ORC 3704.01-.05 Ohio General Provisions on Air Pollution Control, prohibition of public nuisance	Visible fugitive emission monitoring for waste pit excavation, soil excavation areas, and OSDF construction and waste placement	BAT Determination; Site-Wide Excavation Plan Support Documents
	OAC 3745-17-08 Ohio Emissions of Particulate Matter Control of emissions of fugitive dust	Visible fugitive emission monitoring for waste pit excavation, soil excavation areas, and OSDF construction and waste placement	BAT Determination; Site-Wide Excavation Plan Support Documents; OSDF Impacted Materials Placement Plan, and Borrow Area Management and Restoration Plan
	OAC 3745-17-07(B)(4) through (6) Ohio Emissions of Particulate Matter roadways, parking areas, and storage piles	Visible emission monitoring for roadways, parking areas, and storage piles associated with the OU1 Waste Pits, Soil Excavation, and OSDF projects	BAT Determination; OU1 Remedial Action Documents Package; Site-Wide Excavation Plan Support Documents

2) Point Source Monitoring
Point source monitoring (i.e. stacks and vents) is designated as a project responsibility due to the direct emission and process control nature of this monitoring activity. The technical approach and design of stack monitoring systems will be an integral part of the process control scheme and overall system design for future remediation treatment units. The data collected from stack monitoring systems will provide critical information that will serve as process control feedback on unit operations. As such, the individual remediation project responsible for the process must maintain responsibility for the monitoring system design and operation. However, the data collected from point source emissions will be integrated into the IEMP reporting framework as necessary to support sitewide data interpretations and the collective decision making process discussed in Section 1.

6.4 PROGRAM EXPECTATIONS AND DESIGN

6.4.1 Program Expectations

The IEMP air monitoring program has been designed to collect data sufficient to meet the following expectations for calendar years 1997 and 1998:

- Provide a program that will provide a continual assessment of the collective emissions accompanying multiple concurrent remediation projects at the FEMP and provide necessary "early warning" feedback regarding the cumulative sitewide effectiveness of project-specific emission controls relative to applicable protective health standards.
- Provide monitoring data sufficient to demonstrate compliance with 40 CFR 61 Subpart H requirements ensuring that no member of the public receives an annual effective dose equivalent of 10 mrem.
- Provide data sufficient to determine compliance with the radon concentration limits of DOE Order 5400.5.
- Provide measurements of direct radiation sufficient to support the annual dose assessment calculations required under DOE Order 5400.5 accounting for all significant exposure pathways.
- Provide a program that promotes the continued confidence of the public and is responsive to concerns raised by stakeholders regarding forthcoming remediation activities.
- Provide a program capable of assessing trends from year to year so that necessary modifications or adjustments in program focus can be accommodated.

6.4.2 Program Design

The IEMP air monitoring program is comprised of three distinct components:

- Radiological particulate air monitoring
- Radon monitoring
- Direct radiation monitoring.

Each component of the sitewide air monitoring program is designed to address a unique aspect of air pathway monitoring, and as such, reflects distinct sampling methodologies and analytical procedures. The following sections and Appendix C provide a detailed discussion on the design of the IEMP air monitoring program.

6.4.2.1 Radiological Air Particulate Monitoring Design Summary

The radiological air particulate monitoring program for 1997 and 1998 is designed to fulfill the following primary program expectations:

- Provide a continual assessment of the collective emissions accompanying multiple concurrent remediation projects at the FEMP and provide necessary "early warning" feedback regarding the cumulative sitewide effectiveness of project-specific emission controls relative to the health protective NESHAP standard of 10 mrem.
- Provide sufficient monitoring data to demonstrate compliance with 40 CFR 61 Subpart H requirements ensuring that no member of the public receives an annual effective dose equivalent of 10 mrem.

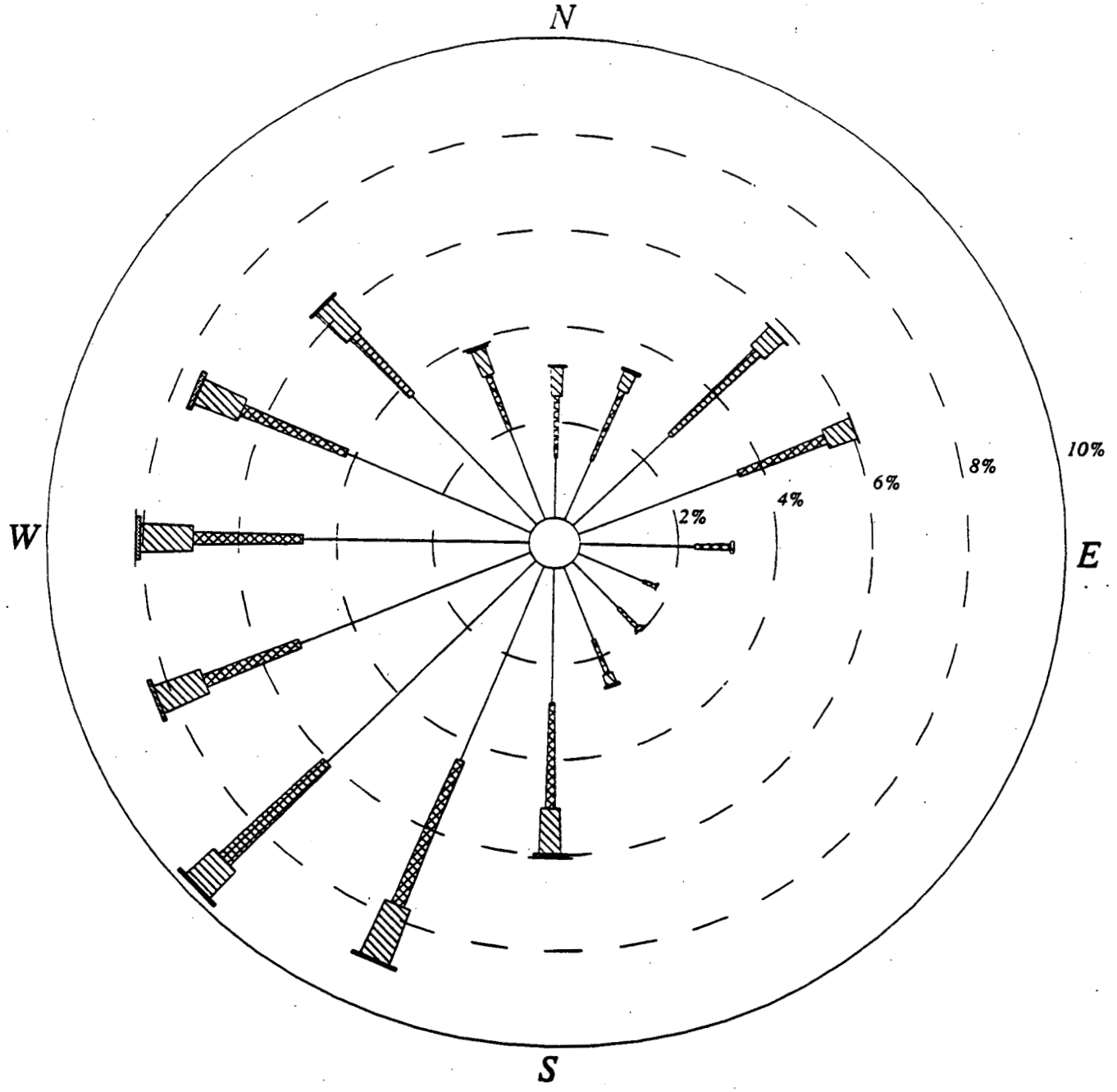
To meet these expectations, the program design is based on taking direct measurements of radionuclide concentrations in the environment at or near potential receptor locations Figure 6-2). A network of 18 high-volume air monitors will be sited based on the location of potential off-site receptors and in consideration of the 16 primary wind rose sectors (Figure 6-1). The monitoring network encompasses all the current and expected diffuse and point sources at the FEMP. Since the point of compliance under NESHAP Subpart H is the receptor location, monitoring locations are designated at the FEMP property boundary in wind rose sectors where potential receptors are immediately located adjacent to the property boundary (primarily in the south and west). In sectors where the closest potential receptors are located away from the FEMP property boundary (primarily northwest and east), monitors are designated at the FEMP property boundary in line with these receptor locations. DOE guidance (DOE 1991) and EPA siting criteria (40 CFR 58, Appendix E) were considered when selecting these locations.

The analytical regime and sampling frequency for this program is designed to meet the following two fundamental criteria:

1) Provide routine analysis that supports a timely evaluation of the effectiveness of sitewide emission controls.

FEMP 92-95 (10 m level)

January 1-December 31; Midnight-11 PM



CALM WINDS 12.58%

NOTE: Frequencies indicate direction from which the wind is blowing.

WIND SPEED (KNOTS)

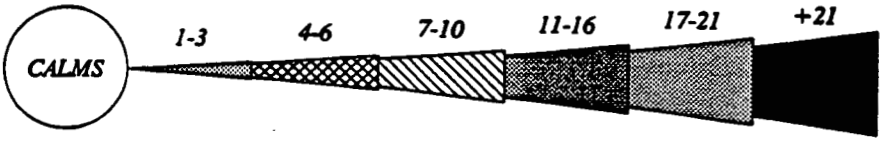


FIGURE 6-1. AVERAGE FEMP WIND ROSE, 1992-1995

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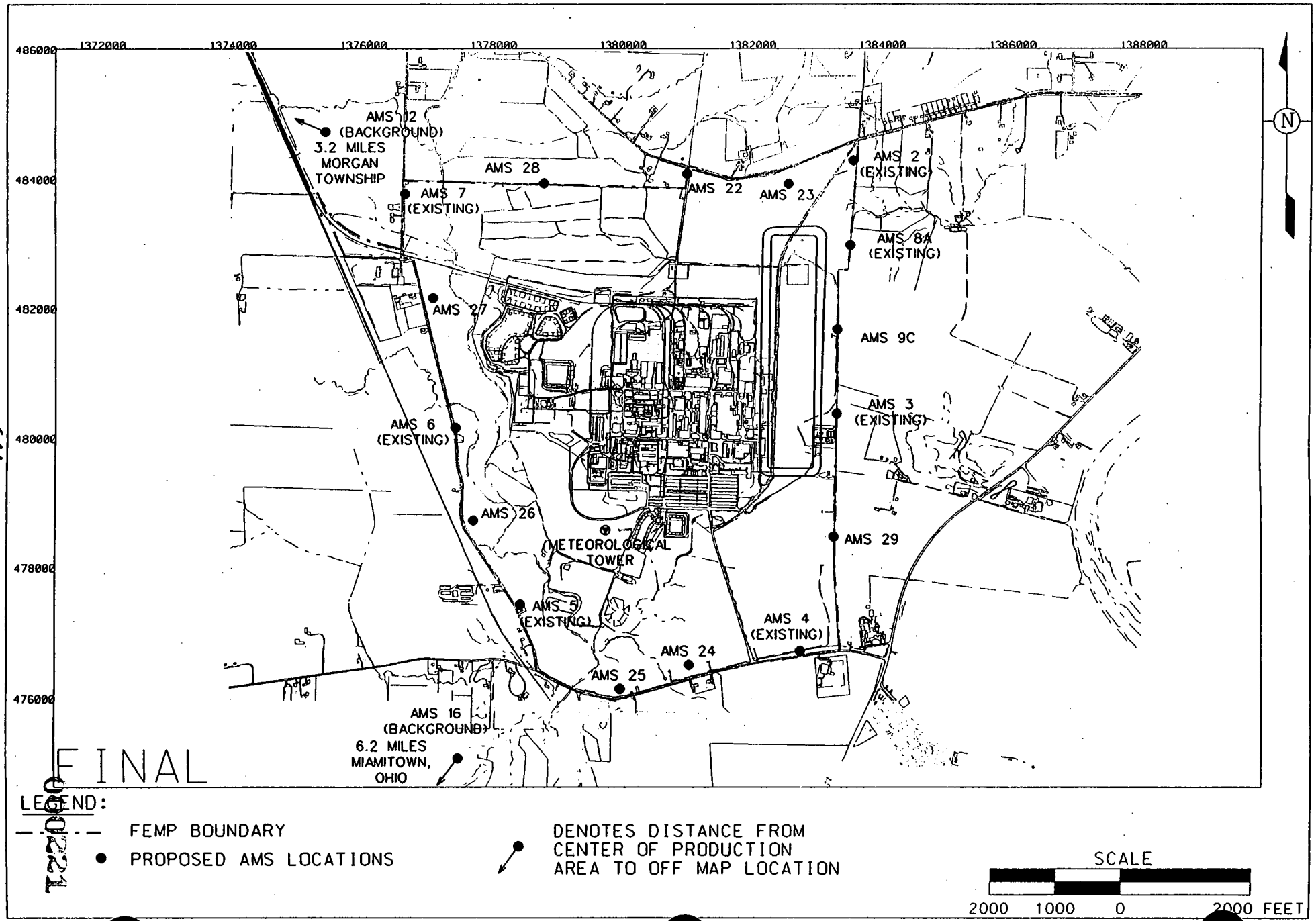

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FIGURE 6-2. LOCATION MAP FO[illegible]MP AIR MONITORING LOCATIONS

[illegible]L-1997

000221

2) Account for the major contributors to dose as defined in 40 CFR 61.93(b)(5)(ii) for the purposes of demonstrating NESHAP Subpart H compliance.

Based on these criteria, the analytical regime and sampling frequency for the radiological air particulate monitoring program for 1997 and 1998 consists of the following:

- Bi-weekly Samples

  Filters will be exchanged bi-weekly at all air monitoring stations and analyzed for total uranium and total suspended particulates (TSP). This data will provide the basis for conducting an ongoing assessment of the effectiveness of sitewide emission controls. The results of this assessment will be provided to the remediation projects on a routine basis as feedback to support timely project decision-making as necessary. The data evaluation process is presented in Section 6.6. Uranium represents the most pervasive contaminant at the site; it can be analyzed quickly, reliably, and inexpensively at the on-site laboratory and is expected to be the major contributor to dose based on the remediation activities scheduled over the next 2 years. The TSP data will be used to evaluate particulate loading on the filters and in determining corrections for background radionuclide concentrations. The particulate loading will be monitored to ensure that acceptable flow-rates are maintained through the filter. If loading becomes excessive due to increased activity at the site and in the surrounding community, then adjustments will be made to the sampling frequency.

- Quarterly Composite Sampling

  A portion of each bi-weekly sample will be used to form a quarterly composite sample for each air monitoring station. The quarterly composite samples will be analyzed at an off-site laboratory for the expected major contributors to dose over the next 2 years including U-238, U-235/236, U-234, Th-232, Th-230, Th-228, and Ra-226. The results of the quarterly composite data will be used to track compliance against the NESHAP Subpart H standard and will serve as the basis for demonstrating annual compliance. This data will also be incorporated into the on-going evaluation of emission controls.

The isotopes selected for quarterly analysis represent the major contributors to dose based on the following considerations:

1. Radionuclides which are stored in large quantities at the FEMP and which will be handled or processed during the remediation effort (uranium, Th-230, Th-232, Ra-226).

2. Radionuclides which have been the major contributors to dose based on environmental and stack filter measurements (uranium).

3. Radionuclides which, due to their concentration in waste and contaminated soil, will be the major contributors to dose if the waste or soil is released in the form of fugitive dust (uranium, Th-228, Th-230).

Additional technical information supporting the analytical regime presented here, is provided in Appendix C. Table 6-2 presents a summary of the analytical and sampling information provided above.

6.4.2.2 Radon Monitoring Design Summary

In addition to fulfilling the monitoring requirements mandated by the FFA, the radon monitoring component of the IEMP program is designed to collect measurements of environmental radon emissions resulting from radon-generating materials contained on-site. The monitoring design incorporates overlapping networks of alpha track-etch radon cups and alpha scintillation continuous radon monitors (Figure 6-3 and Table 6-3). The radon monitoring program for ensuring environmental monitoring compliance with DOE Order 5400.5 annual limits primarily utilizes alpha track-etch detectors. The use of these long-term integrating detectors produces data used for assessing compliance with the annual limits contained in DOE 5400.5. The track-etch detectors do not require electrical power; and hence, the detectors can be placed in any needed location.

Alpha scintillation detectors, which are continuous radon monitors, produce data that are used to assess compliance with the instantaneous ambient air radon concentration requirement of DOE Order 5400.5, which is 100 pCi/l at any given point over a facility. Currently there are 20 locations both on- and off-site where alpha scintillation detectors gather radon data on a routine basis. In accordance with the established requirements of the FFA, data from eight locations on the FEMP property and at off-property locations are reported on a quarterly basis to the EPA. Monitors are placed near a variety of sources and/or are used during site-specific project activities that could release radon. The continuous radon monitors require electrical power to operate; consequently, placement of these monitors is more constrained and related to the availability of electrical power. These monitors also provide feedback of environmental radon conditions on a more timely basis (e.g., daily) than the long-term track-etch detectors.

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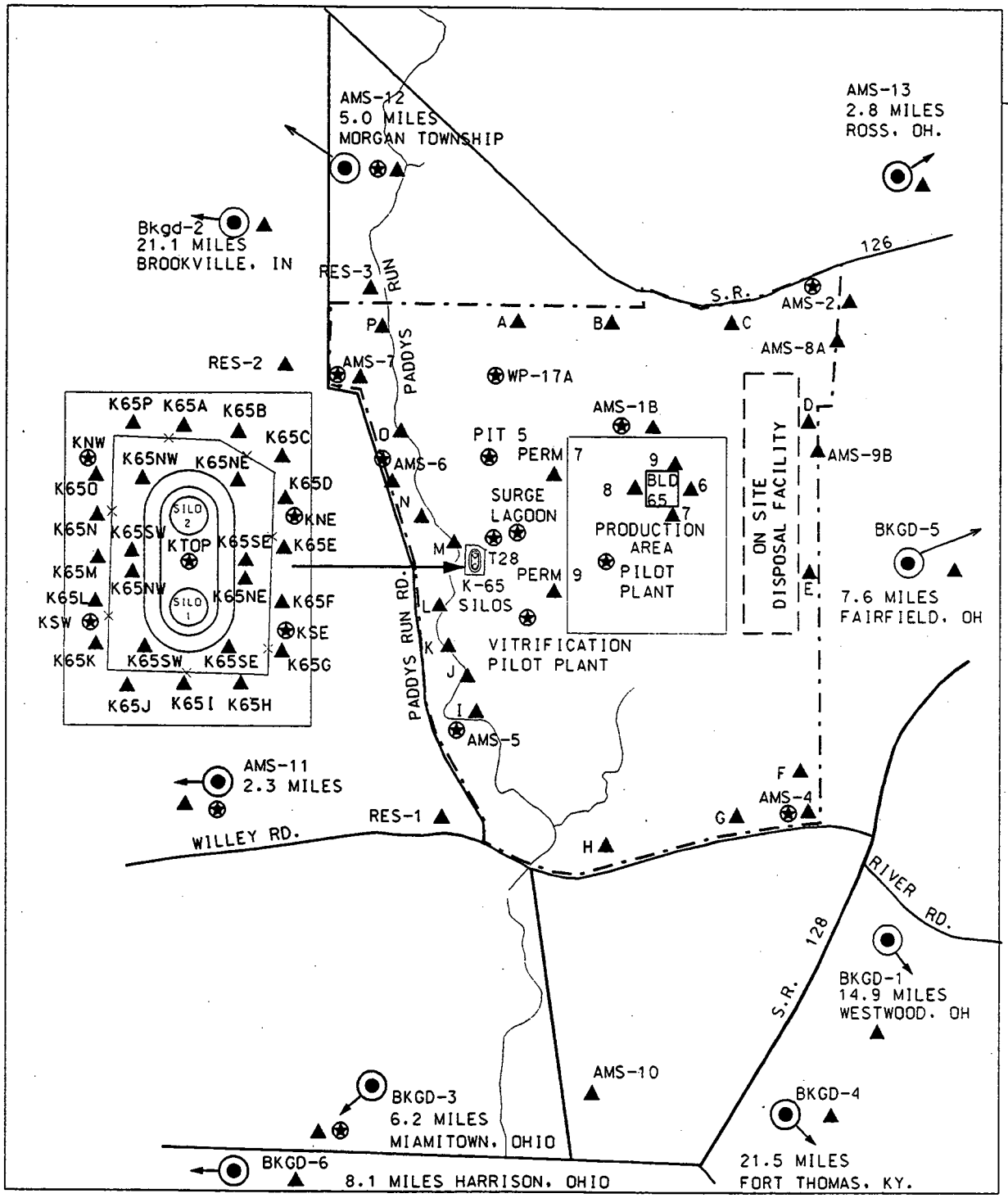

LEGEND:

- FEMP BOUNDARY
- CONTINUOUS RADON MONITORING LOCATION
- TRACK-ETCH MONITORING LOCATION
- DISTANCE FROM CENTER OF PRODUCTION AREA TO LOCATION OFF THE MAP

FINAL

NOT TO SCALE

FIGURE 6-3. RADON MONITORING LOCATIONS

TABLE 6-2

SAMPLING AND ANALYTICAL SUMMARY FOR RADIOLOGICAL AIR PARTICULATE SAMPLES

Analyte	Sample Matrix	Sample Frequency	Lab	ASL	Holding Time	Preservative	Detection Level	Container
Total Uranium	Air	Bi-weekly	On Site	B	12 months	N/A	2 μg/filter	20 cm x 25 cm polyester 0.5 μm filter
TSP (total suspended particulate)	Air	Bi-weekly	On Site	A	N/A	N/A	N/A	20 cm x 25 cm polyester 0.5 μm filter
Rad Suite:	Air	Quarterly composite	Contract	D	12 months	NA		2 liter glass
·U-234							7.0×10^{-6} pCi/m^3	
·U-235/236							7.0×10^{-6} pCi/m^3	
·U-238							7.0×10^{-6} pCi/m^3	
·Th-228							2.3×10^{-6} pCi/m^3	
·Th-230							2.3×10^{-6} pCi/m^3	
·Th-232							2.3×10^{-6} pCi/m^3	
·Ra-226							0.8×10^{-6} pCi/m^3	

000225

TABLE 6-3

SAMPLING ANALYTICAL SUMMARY FOR RADON DETECTORS

Analyte	Sample Matrix	Sample Frequency	ASL	Holding Time	Preservative	Detection Level	Detection Method
Radon-222	Air	Semi-annual	B	N/A	N/A	0.2 pCi/L	Track-etch
Radon-222	Air	Continuous/daily	A	N/A	N/A	1.0 pCi/L	Scint.

The radon monitoring locations reflect DOE guidance (DOE 1991) for locating environmental monitors. For comparison, both indicator and background monitoring locations have been selected. Radon monitoring locations may be designated by FFA monitoring requirements, or through the need to monitor near specific sources in order to maintain regulatory compliance. As remedial activities are undertaken at the site, the site radon monitoring program may change to ensure proper radon monitoring as a result of changing work activities. Table 6-3 summarizes the analytical regime for the radon monitoring program.

Alpha Track-etch Cups

Alpha track-etch radon cups provide data on the long-term average environmental radon concentration at selected monitoring locations on site, at the facility fenceline, and in the local community. Because the K-65 silos are the single largest source of radon at the FEMP, the radon cup locations radiate outward from the silo area with emphasis on the nearby and publicly accessible western boundary of the site (Figure 6-3). Radon detectors are co-located at selected air monitoring stations along the facility fenceline and in the local community, as well as at background locations considered outside the influence of the FEMP radon sources.

Sample locations at the boundary fenceline provide data that are used in assessing compliance with established limits under DOE Order 5400.5. In addition, the data collected will be used to assess radon concentrations during remediation activities both on site and at the fenceline.

Two to three detectors are located at each alpha track-etch monitoring location. The use of multiple detectors corresponds with industry recommendations and is useful in assessing the precision of

monitoring data, as well as addressing any spurious results. The alpha track-etch cups are placed at a height of one to two meters (i.e., attached to a fence) and exchanged semi-annually to provide sufficient exposure time given the low ambient radon concentrations and the analytical limits of detection. In response to public concerns, radon data from the alpha track-etch cups are used to estimate a dose at the fenceline. This radiation dose estimate for radon is not required under DOE 5400.5, however, in response to the public's interest in this information, it is reported in the annual site environmental report.

Alpha Scintillation Monitors

Alpha scintillation continuous radon monitors provide data on the short-term (typically one hour) fluctuations in radon concentration. Currently twenty (20) alpha scintillation radon detectors are located on FEMP property and at off-property locations. As with the radon cups, the monitoring locations for the alpha scintillation monitors radiate outward from the K-65 silos and include areas in close proximity to sites (i.e., waste pits, vitrification plant) where significant amounts of radon may be released during the remediation process (Figure 6-3).

These continuous monitors provide hourly readings which are used to establish compliance with the 100 pCi/l radon limit defined in DOE Order 5400.5 and to observe short-term data trends. The data are also used to aid in the quantification of radon releases from the silos. Hourly data collected from all environmental alpha scintillation detectors will be summarized on a monthly basis to provide the following information: daily average, monthly average, minimum daily average, and maximum daily average for the month. This data will be submitted to the EPA quarterly in IEMP quarterly reports.

6.4.2.3 Direct-Radiation Monitoring Design Summary

The direct-radiation monitoring component of the IEMP program is designed to collect measurements of environmental radiation levels resulting from radioactive materials on site. This is accomplished using a network of 37 environmental thermoluminescent dosimeters (TLD). DOE guidance (DOE 1991) and ANSI recommendations (ANSI 1975) were considered in selecting monitoring locations.

The K-65 silos are the single largest source of direct (gamma) radiation at the FEMP. Therefore, TLD locations radiate outward from the silo area with emphasis on the nearby and publicly accessible western boundary of the site (Figure 6-4). Additional TLDs are located at air monitoring stations at the

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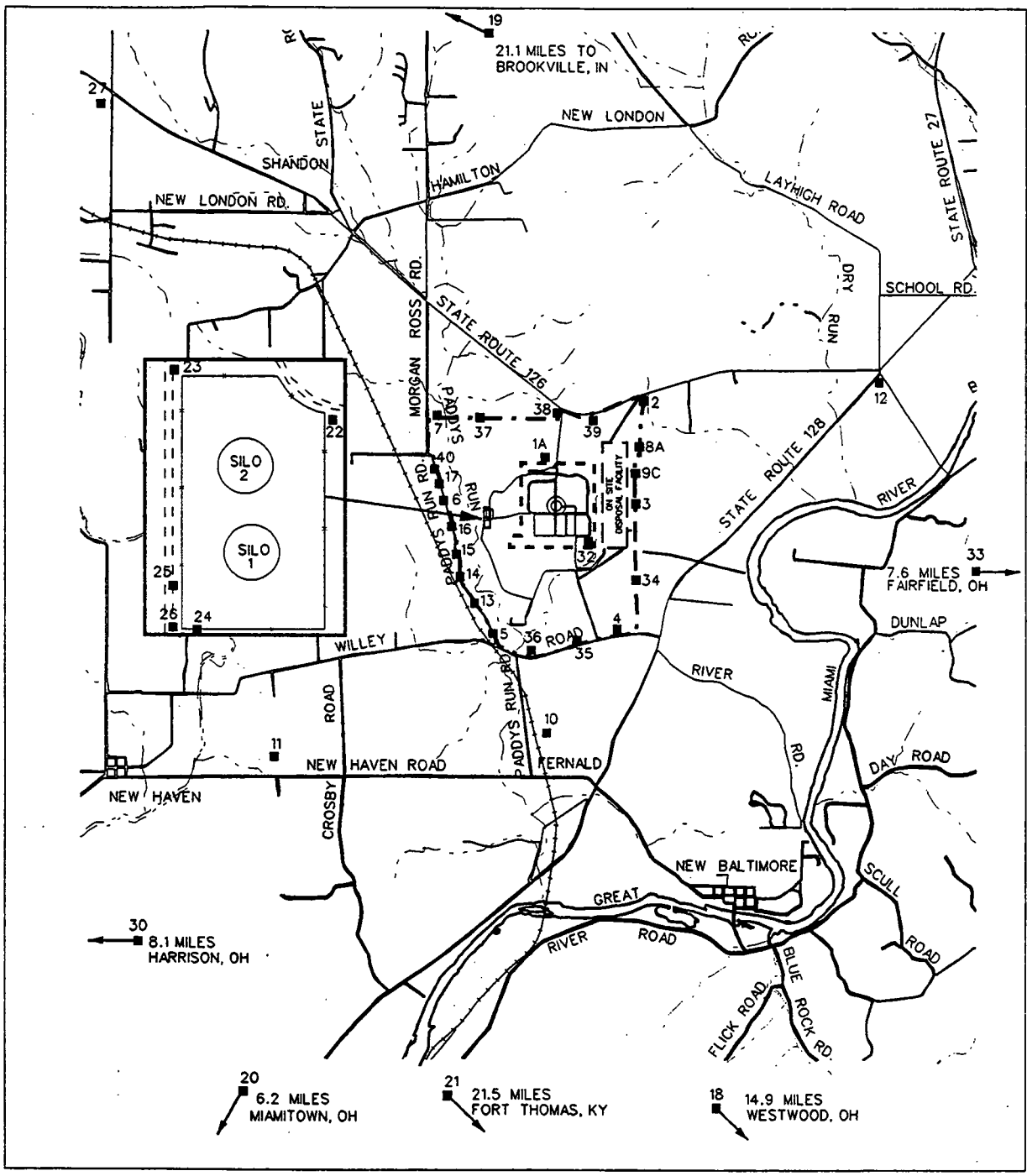

LEGEND:

- DISTANCE FROM CENTER OF PRODUCTION AREA TO SAMPLING LOCATIONS OFF MAP
- TLD MONITORING LOCATION
- FEMP BOUNDARY
- PRODUCTION AREA BOUNDARY

SCALE

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FINAL

FIGURE 6-4. TLD MONITORING LOCATIONS

facility fenceline and in the local community. Six TLD locations serve as background measurement points.

The network of TLDs provides a mechanism to measure and track ambient radiation levels at the facility fenceline, as gamma emitting radioactive materials (primarily Radium-226, Thorium-232, and their decay products) that are handled and processed during remediation.

Three individual TLDs are placed at each location in order to assess the precision of the measurement data, as well as to address any spurious results that may occur. The TLDs are placed one meter above the ground and exchanged quarterly in accordance with industry standards and DOE guidance (DOE 1991). The TLDs are processed at the DOE Laboratory Accreditation Program-approved on-site dosimetry laboratory.

Data from the TLDs are used to assess the direct radiation component of the air pathway dose calculation (see Appendix C). Table 6-4 summarizes the analytical regime for the direct radiation monitoring program.

TABLE 6-4

ANALYTICAL SUMMARY FOR DIRECT RADIATION (TLD)

Analyte	Sample Matrix	Sample Frequency	ASL	Holding Time	Preservative	Detection Level	Container
Gamma Radiation (TLD)	Air	Quarterly	B	NA*	NA	5 mrem	NA

*TLDs are read soon after collection by on-site laboratory (typically within one week).

6.4.2.4 Meteorological Monitoring Program Design Summary

Although not a distinct component of the existing sitewide air monitoring program, the meteorological monitoring program is designed to provide data on the atmospheric conditions which influence the dispersion and transport of contaminants in the air pathway. This program provides critical data for the

evaluation and interpretation of air monitoring data, and the support of the design and conduct of the IEMP air monitoring program and as such, is presented in this section.

The FEMP meteorological monitoring system consists of a single 60 meter meteorological tower located west of the Storm Water Retention Basin (Figure 6-2). Monitoring instruments record wind speed, wind direction, temperature, barometric pressure, precipitation and relative humidity and store 1-minute and 15-minute average data on the meteorological database. The system has been developed based on the requirements of DOE Order 5400.5 and DOE guidance (DOE 1991) and complies with industry standards for calibration and data recovery.

Meteorological data is used in the evaluation and interpretation of environmental data collected from the air, radon, and project-specific monitoring data. Short-term meteorological data will be used to relate air monitoring results to specific projects, when necessary. For example, if the results from a specific monitor are higher than expected, the monitoring result would be evaluated using the wind rose developed from meteorological measurements collected during the monitoring period. A remediation project upwind of the monitor during the monitoring period would then be considered a possible source of the higher-than-expected results. In addition to supplying data necessary to support monitoring and surveillance, the meteorological monitoring system serves to support the day-to-day operations for construction, emergency preparedness, and engineering design.

6.5 MEDIA-SPECIFIC PLAN FOR SITEWIDE ENVIRONMENTAL AIR MONITORING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental air monitoring program. The program expectations and design presented in Section 6.4 were used as the framework for developing the monitoring approach presented in this media-specific plan. The sampling, analytical, and data management activities described herein were designed to provide environmental data of sufficient quality to meet the intended data use as described in the program design. All sampling procedures and analytical protocols described or referenced in this media-specific plan are consistent with the requirements of the FEMP SCQ (DOE 1993).

The sitewide environmental air monitoring program is comprised of the following three distinct components:

- Radiological air particulate monitoring
- Radon monitoring
- Direct radiation monitoring.

The sampling and analytical aspects of each component are unique, therefore this media-specific plan is organized to present a separate discussion of the sampling program for each component. The subsections of this media-specific plan define the following:

- Program organization and associated responsibilities
- Sampling programs (radiological air particulate, radon, direct radiation)
- Change control
- Health and safety
- Data management
- Project quality assurance.

6.5.1 Project Organization

A multi-discipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this media-specific plan in compliance with all regulatory specifications and sitewide programmatic requirements defined by the Oversight and Program Integration Division. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support and assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards and assist in evaluating and resolving all quality related concerns.

6.5.2 Sampling Program - Radiological Air Particulates

This sampling program is designed to collect radiological air particulate data which is representative of ambient air conditions at/or near potential receptor locations (see Figure 6-2). The data collected under this program will be used to assess the collective effect of concurrent remediation activities on the air pathway and provide continual feedback to the remediation projects on the effectiveness of emission controls and provide a monitoring basis to support the implementation and track the effectiveness of corrective actions as necessary. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design incorporates a network of 17 high-volume continuous air monitoring stations. Filter media are collected on a bi-weekly basis and analyzed at the on-site laboratory for total uranium at ASL B. A portion of each bi-weekly sample is retained for a quarterly composite sample, which is analyzed at ASL D by an off-site laboratory for those radionuclides expected to be the major contributors to dose. Greater detail on the sampling design is provided in Section 6.4.2.1 and Appendix C.

6.5.2.1 Sampling Procedures

The air filters from the high-volume environmental monitors are collected and analyzed in accordance with the following:

- DOE Order 5400.5, "Radiation Protection of the Public and Environment"
- "Environmental Regulatory Guide for Radiological Effluent Monitoring" (DOE 1991)
- FEMP SCQ Section 6.0 and Appendix K
- Standard Operating Procedure SRS-REM-001, High Volume Air Monitoring
- Data Quality Objective AR-006, "Routine Air Monitoring"
- Standard Operating Procedure EW-0002, Chain of Custody/Request for Analysis Record for Sample Control
- Standard Operating Procedure EQT-18, Calibration of Graesby GMW High Volume Air Sampler.

Table 6-5 provides the technical specifications for air-particulate monitors program.

TABLE 6-5

TECHNICAL SPECIFICATIONS FOR AIR-PARTICULATE MONITORS

Monitor Type	Flow Rate	Filter Type	Gauge/Meters	Indicator
High volume continuous	45 cfm	Polyester 0.5 *um* Dynaweb© brand	Hours Flow Rate Flow Rate Set Point	Low Flow Warning Light

Sample collection is accomplished by using high-volume environmental air monitors that continuously collect samples of airborne particulates. Table 6-5 provides the technical specifications for the high volume air monitoring equipment and filter media. Any changes in flow rate are accounted for by the automatic flow controller in the monitor and are documented on a flow chart recorder which continuously records flow data. Air monitoring equipment must meet the following criteria per DOE guidance and industry practice:

- Environmental air samplers shall be mounted in locked, all-weather stations with the sampler discharge positioned to prevent the recirculation of air.
- The air sampling system shall have a flow-rate meter, and the total air flow or total running time should be indicated.
- The air sampling rate should not vary by more than +/- 10 percent of the monitor setpoint of 45 cfm for the collection of a given sample.
- Linear flow rate across air particulate filters should be maintained between 20 and 50 m/min.
- Air sampling systems shall be flow-calibrated, tested, and inspected routinely according to written procedures (DOE 1991). Flow calibration shall be at least as often as recommended by the manufacturer.

The monitors are inspected and calibrated at least once yearly in accordance with recommendations from the manufacturer. All units placed in the field are tracked via a field tracking log which provides

information pertaining to when calibrations were last completed and the date of the next scheduled calibration. All monitors will be inspected daily to ensure continuous operation.

6.5.2.2 QA Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination, sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. The following quality assurance samples will be collected under this sampling program:

Air Particulate Samples

- One blank sample will be submitted for analysis with each batch of bi-weekly filters and with each set of quarterly composite samples.
- One spike sample with a known amount of uranium will be submitted for analysis with each batch of bi-weekly filters. The spike sample results are used to monitor the laboratory performance within defined tolerance limits within the established contract and in accordance with the SCQ (typically between 0.75 and 1.25 of the known value).
- The laboratory is also required to perform analyses on method blanks, matrix spikes and laboratory control samples as required by the SCQ for the corresponding ASL and analytical method. For the quarterly composite samples, analyzed under ASL D, a method blank, duplicate, matrix spike and laboratory control sample will be analyzed for each batch of samples.

In addition to QA sampling requirements, air monitoring personnel (technicians) are required to complete the following training requirements prior to performing unsupervised collection of air samples.

- 40-hour training program for general site workers in accordance with 29 CFR 1910.120
- Sample collection and chain-of-custody training
- Procedural training on the collection of air samples, air sampler maintenance, and calibration of air sampling equipment
- 40 hours of supervised on-the-job training.

6.5.2.3 Decontamination

Decontamination of air filters collected on site is not necessary since the filters are collected from stationary cassettes identified for each monitor. Only monitoring units that have been stationed in the former production area are required to undergo cleaning and decontamination if deemed necessary by a radiological survey. Radiological surveys are performed when equipment and/or samples are required to be released from the former process area for transport and/or analysis.

6.5.2.4 Waste Dispositioning

Contact wastes generated by technicians during sample collection activities are collected, maintained, and dispositioned, as necessary, depending on the location of waste generation (i.e., former production area or off site).

Waste associated with the air monitoring program is generated and handled by the respective laboratory identified for conducting the analyses.

6.5.3 Sampling Program - Radon Monitoring

This sampling program is designed to collect measurements of environmental radon concentrations released from the radon generating materials contained on-site and in the K-65 silos. Sample locations on-site, at the boundary fence lines and off-site locations provide representative measurements in assessing compliance with established limits. In addition, data collected will be used to assess radon concentrations during remediation activities both on-site and at the fence line. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design incorporates a network of approximately 64 alpha track-etch radon cup locations. The cups are exchanged on a semi-annual basis (twice yearly) and measured at ASL B. Additionally, in accordance with established agreements, approximately 20 alpha scintillation radon detectors are located on site and off site. Data from selected continuous monitors provide hourly readings which are compiled into 24-hour averages and included in the quarterly FFA report to the EPA, as required. The data collected from the monitors are collected at ASL A. Greater detail on sampling design is provided in Section 6.4.2.2.

6.5.3.1 Sampling Procedures

The alpha track-etch radon cups and continuous radon monitors are collected and analyzed in accordance with the following:

- DOE Order 5400.5 "Radiation Protection of the Public and Environment"
- Environmental Regulatory Guide for Radiological Effluent Monitoring (DOE 1991)
- FEMP SCQ, Appendix K
- Standard Operating Procedures:

  EP-REM-011, Environmental Radon Monitoring
  EM-RM-014, Real-Time Environmental Radon Monitoring
  SMPL-06, Radon Sampling from Headspace of K-65 Silos
  EM-RM-002, Logkeeping Procedure

- Standard Operating Procedure EW-0002, Chain of Custody/Request for Analysis Record for Sample Control.

Table 6-3 provides a sample and analytical summary for the radon monitoring program. Sample collection is accomplished by two different modes: one is the radon cup which utilizes an alpha track-etch detector and the second is continuous radon monitoring via a Continuous Passive Radon Detector (CPRD) and a Pylon AB-5 radon monitor. Radon alpha track-etch allows for radon to penetrate a membrane filter within a plastic cup. Once the radon decays, an alpha particle is emitted that interacts with the plastic chip within the cup (hence the measurement is based on the "etch" left in the plastic). The continuous environmental radon monitors operate in a passive mode, allowing radon to diffuse through the foam barrier of the CPRD into the detector. The units are set to collect measurements of a one-hour duration, with a 24-hour period averaged into a monthly summation of minimum, maximum, and average radon concentrations.

Continuous monitors are calibrated as a contiguous unit at least once per year with National Institute of Standards and Technology traceable sources. The radon cups are received new from the vendor and therefore do not require periodic calibration. Both types of units are tracked upon deployment in the field via an equipment tracking log and field logbooks. Additionally, an equipment maintenance/ calibration logbook is used to track and schedule units requiring any necessary maintenance and/or calibrations.

6.5.3.2 QA Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed to evaluate the possibility that some controllable practice, such as decontamination, sampling, or analytical practice, may be responsible for introducing bias in the project's analytical results. The following quality assurance samples will be collected under this sampling program, as applicable:

- Approximately 5-10 percent of the alpha track-etch detectors will be reserved for spike samples. The spike sample results are used to monitor laboratory performance within defined tolerance limits.
- QA practices for the electronic monitoring will be maintained as per established maintenance and calibration schedules. In addition, routine source checks (i.e. monthly) are performed on continuous radon detectors. Data will be recorded on process control charts and only instruments demonstrating acceptable performance will be used to collect data in the field. Source check data that falls within +/- two standard deviations of the mean identifies an instrument as acceptable for use. If the source check data from an instrument lies outside of +/- two standard deviations from the mean, that instrument will not be used until it is examined and repaired, and recalibrated if necessary.
- The vendor is also required to perform analyses on their internal control blanks, spikes and laboratory control samples as required by the SCQ for the corresponding ASL and analytical method.

The following process will be used to evaluate replicate data usability by identifying outliers and suspect data points.

1) IF $\frac{|\text{Maximum Value} - \text{Average Value}|}{\text{Average Value}} \leq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

AND

IF $\frac{|\text{Minimum Value} - \text{Average Value}|}{\text{Average Value}} \leq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

THEN average all data from location

2) IF $\frac{|\text{Maximum Value} - \text{Average Value}|}{\text{Average Value}} \leq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

AND

IF $\frac{|\text{Minimum Value} - \text{Average Value}|}{\text{Average Value}} \geq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

THEN average data from two higher data points

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3) IF $\frac{|\text{Maximum Value} - \text{Average Value}|}{\text{Average Value}} \geq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

AND

IF $\frac{|\text{Minimum Value} - \text{Average Value}|}{\text{Average Value}} \leq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

THEN average data from two lower data points

4) IF $\frac{|\text{Maximum Value} - \text{Average Value}|}{\text{Average Value}} \geq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

AND

IF $\frac{|\text{Minimum Value} - \text{Average Value}|}{\text{Average Value}} \geq \frac{\text{Standard Deviation (at 95\%)}}{\text{Mean}}$

THEN record highest value if within historical range and not an obvious nonrealistic outlier

6.5.3.3 Decontamination

The decontamination of the radon monitoring equipment is necessary only for those detectors deployed in the former process area. Decontamination for these detectors is conducted under the radiological controls program for releasing equipment off-site. Radiological surveys are performed when equipment and/or samples are required to be released from the former process area for transport and/or analysis. These surveys are conducted in accordance with established procedures.

6.5.3.4 Waste Dispositioning

Contact wastes that are generated by the field technicians during field sampling activities are collected, maintained, and dispositioned, as necessary, depending upon the location of waste generation (i.e., former production area or off site). Any other waste generated is covered by the established contract(s) with the vendor(s).

6.5.4 Sampling Program - Direct Radiation (TLDs)

This sampling program is designed to measure the direct radiation at the FEMP from locations which are representative of radiological environmental conditions at select locations on-site, at the facility fence line and in the local community (see Figure 6-4). The data collected under this program will be used to assess the collective effect of current remediation activities on the air pathway. As such, field procedures and analytical methods are designed to support the necessary level of data quality.

The monitoring design incorporates a network of 37 TLD locations. Three TLD are deployed quarterly

at each location and submitted to the on-site dosimetry laboratory for analysis. External gamma radiation measurements are recorded from each TLD read. All TLDs are analyzed to ASL B. Greater detail on the sampling design is provided in Section 6.4.2.3.

6.5.4.1 Sampling Procedures

The TLDs are collected from environment monitoring locations and analyzed in accordance with the following:

- DOE Order 5400.5 Radiation Protection of the Public and Environment
- Environmental Regulatory Guide for Radiological Effluent Monitoring (DOE 1991)
- FEMP SCQ Section 6.0 and Appendix K, Section 6.5
- Standard Operating Procedure EP-REM-002, Environmental Direct Radiation
- Data Quality Objective MS-004 REM Direct Radiation Measurements
- Standard Operating Procedure EW-0002, Chain of Custody/Request for Analysis Record for Sample Control.

Table 6-4 provides a sample and analytical summary for the direct radiation monitoring program.

Sample collection is accomplished using Panasonic UD-814 dosimeters. Environmental TLDs must meet the following criteria as per DOE guidance:

- Environmental TLDs shall be mounted at 1 meter above ground.
- The frequency of exchange should be based on predicted exposure rates from site operations.
- The exposure rate should be long enough (typically 1 calendar quarter) to produce a readily detectable dose (DOE 1991).
- Annealing, calibration, readout, storage and exposure periods used should be consistent with the ANSI standard recommendations (ANSI 1975).

All TLDs placed in the field are tracked via a field tracking log which provides information pertaining to when and where dosimeters were deployed as well as scheduled collection date.

6.5.4.2 QA Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination, sampling or analytical practice, may be responsible for introducing bias in the project's analytical results. Quarterly data from the three TLDs at each location will agree within ± 20 percent or will be considered suspect and invalid data. A TLD which repeatedly differs by more than ± 15 percent from the other two co-located TLDs will be removed from service. The following quality assurance practices will be conducted under this sampling program:

- TLD reader is calibrated semi-annually and quality control checks are performed prior to reading each batch of TLDs.
- Spiked dosimeters with a known amount of gamma radiation will be submitted for analysis (must agree within 10 percent of known dose).
- Interlaboratory comparisons will be conducted with the DOE Environmental Measurements Laboratory. The comparison studies require the FEMP to submit a set of TLDs which are then exposed (along with TLDS from other study participants) to a known amount of environmental radiation. The TLDs are then returned to the FEMP for processing. The results from all participants are then compared to known value of radiation and the ± 30% performance specification from ANSI-N545.

6.5.4.3 Decontamination

Decontamination of environmental TLD is not necessary since the units are self contained, unless collected from known areas of high radiation. Only the units which hold the TLD and have been stationed in the former process area are required to undergo cleaning and decontamination if deemed necessary upon a radiological survey. Radiological surveys are performed when equipment and/or samples are required to be released from the former process area for transport and/or analysis. These surveys are conducted in accordance with established procedures.

6.5.4.4 Waste Dispositioning

Contact wastes generated by the field technicians during sample collection activities are collected, maintained and dispositioned as necessary, depending upon the location of waste generation (i.e., former production area or off site).

6.5.5 Change Control

Changes to the media-specific plan will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the media-specific plan must have approval by the designee and QA prior to implementation. The completed Variance/Field Change Notice must be approved by QA. The Variance/Field Change Notice form shall be controlled and included in the field data package and become part of the project record. Permanent media-specific plan changes will incorporate applicable Variance/Field Change Notices in annual media-specific plan revisions. Scope changes to the media-specific plan will require respective document changes.

6.5.6 Health and Safety Considerations

The FDF Health and Safety Department is responsible for the development and implementation of health and safety requirements for this media-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this media-specific plan. Daily safety meetings will be conducted prior to beginning field work to address specific health and safety issues.

All FDF employees and subcontractor personnel who will be performing field work required by this media-specific plan are required to complete all site applicable training.

For areas which are subject to more restrictive radiological controls where the potential for exposure is greater, Radiation Work Permits (RWPs) are necessary and will be obtained prior to the field work being performed in those areas. A radiological control technician will be assigned to each field crew performing any activities in an area requiring an RWP.

6.5.7 Data Management

Field and analytical data will be managed to meet the IEMP data reporting and quality objectives. The field documentation and analytical data results shall be verified to ensure conformance to the appropriate SCQ sections and appendices. The process for management of the field and analytical data is described

in the EDMP (FERMCO 1996).

Field documentation will be verified for accuracy and completeness by the sampling team followed by an independent field data validation in accordance with SCQ requirements for the corresponding ASL. The project team leader must have processes in place to verify that chemical and radiological data results meet all applicable quality requirements specified in the SCQ for the respective ASL (SCQ Section 11.0 and Appendix F). The quality of analytical data shall be evaluated by independent project personnel qualified to determine accuracy, completeness and applicable statistical data necessary to evaluate data useability and data quality required for environmental monitoring reporting.

Both the field and analytical data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project files in accordance with FEMP recordkeeping procedures and DOE Orders.

6.5.8 Quality Assurance

Independent assessments of work processes shall be conducted to verify quality of performance. Such assessments may include audits, surveillances, inspections, tests, data verification and field validation, and peer reviews. Assessments shall include performance based evaluation of compliance to technical and procedural requirements and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance to the IEMP, the SCQ, applicable DQOs, and FEMP Quality Assurance Program (FERMCO 1994c) requirements.

Independent assessment is the responsibility of designated project QA personnel. The project team leader and QA will coordinate independent assessment oversight activities and comply with SCQ Section 12.0. Recommended quarterly QA surveillances shall be performed on some task specified in the media-specific plan. The QA representative shall have "stop work" authority if significant adverse quality conditions are identified or work conditions are unsafe. In accordance with SCQ Section 3.0, QA shall review and have approval signature of plans, procedures, and final documents supporting IEMP programs.

Only laboratories on the Approved Laboratory List will be used for FEMP sample analyses in accordance with SCQ Section 12.0 and Appendix E.

6.6 IEMP Air Monitoring Data Evaluation and Reporting

This section provides the methods that will be used in evaluating and reporting the data generated through the IEMP air monitoring program. It summarizes the data evaluation and decision making associated with the air particulate, radon, and direct radiation monitoring results. In addition, the planned reporting structure for the IEMP air monitoring program including the specific information to be reported in the quarterly and annual reports is provided.

6.6.1 Air Particulate Data Evaluation

Data resulting from the air particulate program will be evaluated with respect to the program expectations identified in Section 6.4. Based on these expectations, the following questions will be answered through the air data evaluation processes indicated by the text following each of the questions:

- Are the emission control measures executed by the remediation projects effective in maintaining exposures to the public below the annual 10 mrem NESHAP Subpart H standard?

Bi-weekly uranium and quarterly composite data from air monitoring locations will be compared to historical air measurements and trend analysis will be performed to assess the collective effectiveness of emission control measures. Basic statistics (i.e., minimum, maximum, and mean) will be generated per sampling location on a routine basis (as the data is received from the laboratory). The data generated from individual sampling events will be trended by sample location over time via graphical and statistical (when sufficient data has been generated) methods. Monitoring results will be evaluated in light of project operations active during the period and the associated meteorological conditions (wind roses, precipitation levels, etc) in order to correlate monitoring results with (upwind) project activities. In addition, any project-specific monitoring and operations data will be used to support this data evaluation. If monitoring data indicate an increasing trend which, if sustained, could result in an exceedance of the 10 mrem NESHAP standard, then immediate notification will be targeted to the project(s) suspected of contributing to the increased emissions (based on the monitoring location(s) exhibiting the elevated results, the prevailing meteorological conditions and project activities conducted during the sampling period) and action will be taken at the project level to further control fugitive emissions. If increasing trends are identified, but indicate the NESHAP standard is not in jeopardy of being exceeded (based on

current trend analysis and the anticipated schedule of project activities), projects will be asked to review remediation activities and the application of the sitewide BAT determination for fugitive dust control to ensure all project activities are compliant. Additional fugitive dust controls may be implemented as provided for in the BAT determination based on the project review. Figure 6-5 provides a schematic of the specific decision process for the radiological air particulate monitoring program. Additionally, this information will support the collective decision making process outlined in Section 1.

- Do the results of quarterly composite radionuclide concentrations indicate that the dose limit of NESHAP, Subpart H may be exceeded?

Data evaluation will consist of direct comparison of the quarterly composite data to the NESHAP Subpart H Appendix E, Table 2 values. If, after considering the planned remediation activities for the rest of the calendar year, the sum of the fractions (measured concentrations divided by the corresponding NESHAP limit) indicates that exceeding the 10 mrem/year limit is likely, then increased emission control measures (modification and/or curtailment of remediation activities) will be initiated.

- Are modifications or adjustments in program focus necessary?

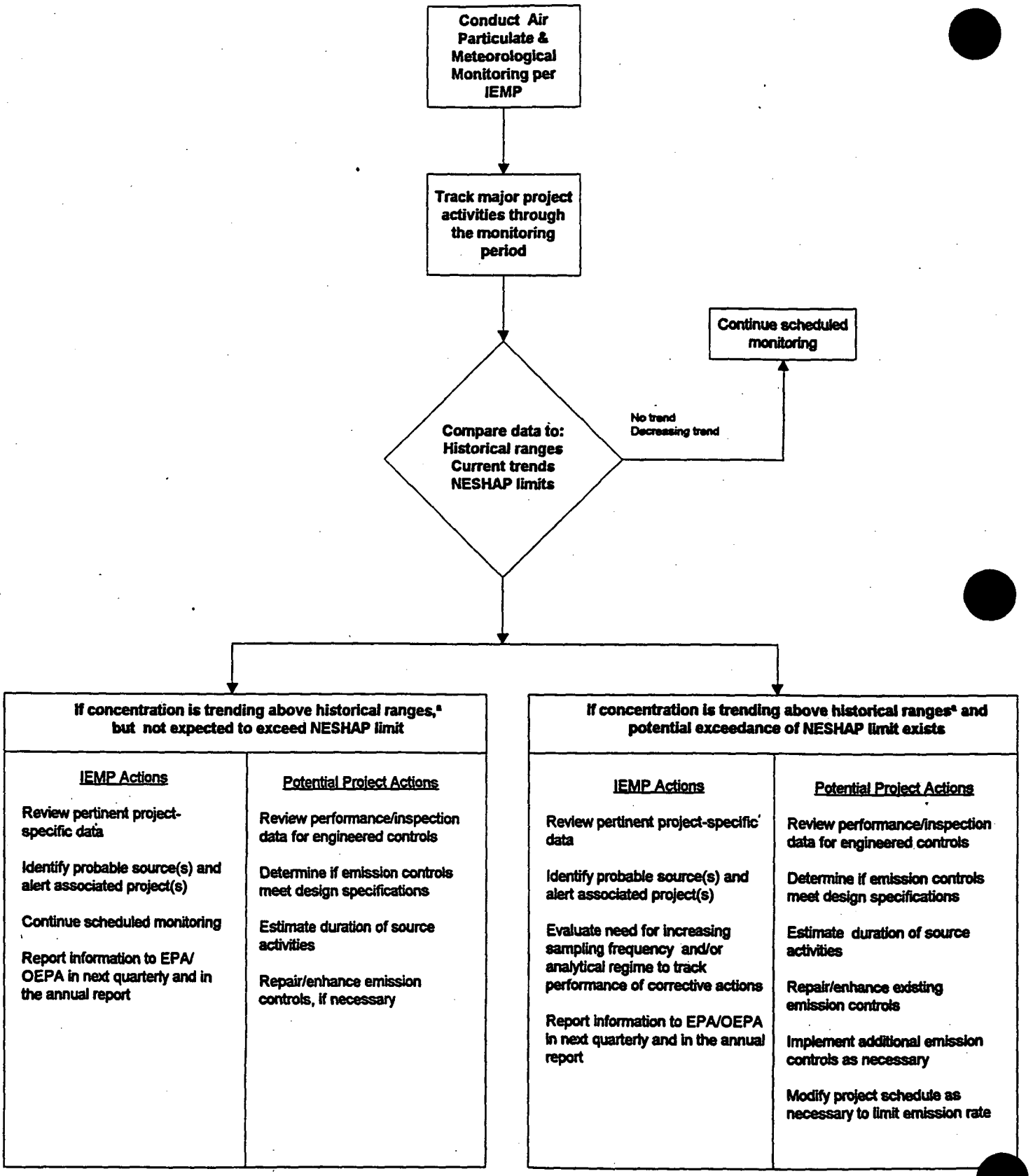
The quarterly composite results will be compared to the NESHAP Appendix E, Table 2 values. If the comparison indicates a contaminant other than uranium is contributing the largest percentage of dose, then modifications to the IEMP air monitoring and analytical schedule will be proposed in order to better monitor the major contributors to inhalation dose. The bi-weekly TSP measurements will be used to evaluate the filter loading and may result in changes to the sampling frequency if excessive loading is observed based on TSP concentrations in conjunction with diminishing flow-rates through the filter.

6.6.2 Radon Data Evaluation

Data resulting from the radon monitoring program will be evaluated with respect to the program expectations identified in Section 6.4 and radon monitoring design summary in Section 6.4.2.2. Based on these expectations, the following questions will be answered through the radon data evaluation processes indicated by the text following each of the questions:

- Are radon concentrations below the limits set in DOE Order 5400.5?

FIGURE 6-5
IEMP AIR PARTICULATE DATA EVALUATION AND ASSOCIATED ACTIONS



[a] These determinations will be based on the significance of the trend and the projected scope and duration of the source activity.

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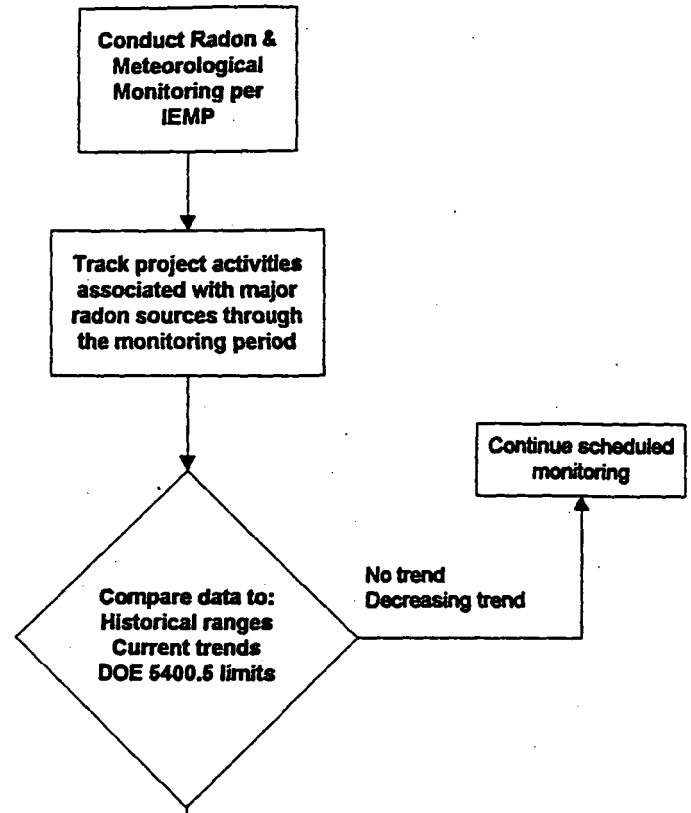
Data from the alpha track-etch monitoring locations will be compared to the annual limits (3 pCi/l fence line and 30 pCi/l site-wide) of DOE Order 5400.5. Data from the alpha scintillation continuous radon monitoring locations will be compared to the short-term (100 pCi/l) limits of DOE Order 5400.5. Basic statistics (i.e., minimum, maximum, and mean) will be generated on a semi-annual basis and monthly basis for the track-etch and alpha scintillation monitors, respectively. The data generated from individual sampling events will be trended by sample location over time via graphical tabular, and statistical (when sufficient data has been generated) methods. If historic data is available for or near a particular IEMP sampling location, then the IEMP-generated trends will be evaluated with respect to the historic trends in order to assess whether current conditions are similar to the past, increasing or decreasing. Meteorological data (wind roses, temperature inversions, etc.) from the sampling period will be used to determine which radon source is likely to have contributed to the observed data. In addition, any project-specific monitoring and operational data from radon source areas will be used to support this data evaluation. If trends indicate that radon concentrations will exceed the DOE Order 5400.5, then actions shown in Figure 6-6 will be implemented. Integration of radon air monitoring information generated by project-specific monitoring (i.e., the vitrification stack when operational) will occur as necessary in interpreting the sitewide radon data via the IEMP data evaluation process. The findings of data evaluations will be shared with project personnel. Those personnel responsible for the K-65 silos, waste pit excavation, and other radon emission sources will be informed of the findings as indicated on Figure 6-6.

- Do current radon monitoring and reporting activities comply with FFA/FFCA requirements?

Data collection and radon monitor performance at the FFA/FFCA monitoring locations will be evaluated to ensure the continuous monitoring requirements are met. Removal Action No. 4 requires that monitoring of the radon concentration in the headspace of each K-65 silo be performed on a continuous basis until the radium-bearing materials inside are removed. In addition to reporting this data quarterly in the FFCA report, data from the following locations are also reported: K65-NE, K65-SE, K65-NW, K65-SW, AMS-5, AMS-6, Pilot Plant, and background. Since two background locations record data, data from the additional background monitoring are also reported.

- Are modifications or adjustments in the radon program focus necessary?

FIGURE 6-6
IEMP RADON DATA EVALUATION AND ASSOCIATED ACTIONS



If concentration is trending above historical ranges,[a] but not expected to exceed DOE 5400.5 limits	
IEMP Actions	**Potential Project Actions**
Review pertinent project-specific data	Review performance/inspection data for engineered controls
Identify probable source(s) and alert associated project(s)	Determine if emission controls meet design specifications
Continue scheduled monitoring	Estimate duration of source activities
Report information to EPA/ OEPA in next quarterly and in the annual report	Repair/enhance emission controls, if necessary

If concentration is trending above historical ranges[a] and potential exceedance of DOE 5400.5 limits exists	
IEMP Actions	**Potential Project Actions**
Review pertinent project-specific data	Review performance/inspection data for engineered controls
Identify probable source(s) and alert associated project(s)	Determine if emission controls meet design specifications
Evaluate need for increasing sampling frequency and/or analytical regime to track performance of corrective actions	Estimate duration of source activities
Report information to EPA/OEPA in next quarterly and in the annual report	Repair/enhance existing emission controls
	Implement additional emission controls as necessary
	Modify project schedule as necessary to limit emission rate

[a] These determinations will be based on the significance of the trend and the projected scope and duration of the source activity

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Changes to the monitoring program will be evaluated based on the expected changing configuration of the primary radon source materials at the site (most importantly the K-65 silo material), prior to remediation of these materials. Revisions to the program will be proposed through the annual review and biennial revision process outlined in Section 1.

6.6.3 Direct Radiation Monitoring Data Evaluation

Data resulting from the direct radiation monitoring program will be evaluated with respect to the program expectations identified in Section 6.4 and direct radiation monitoring design summary in Section 6.4.2.3. Based on these expectations, the following questions will be answered through the direct radiation data evaluation processes indicated by the text following each of the questions:

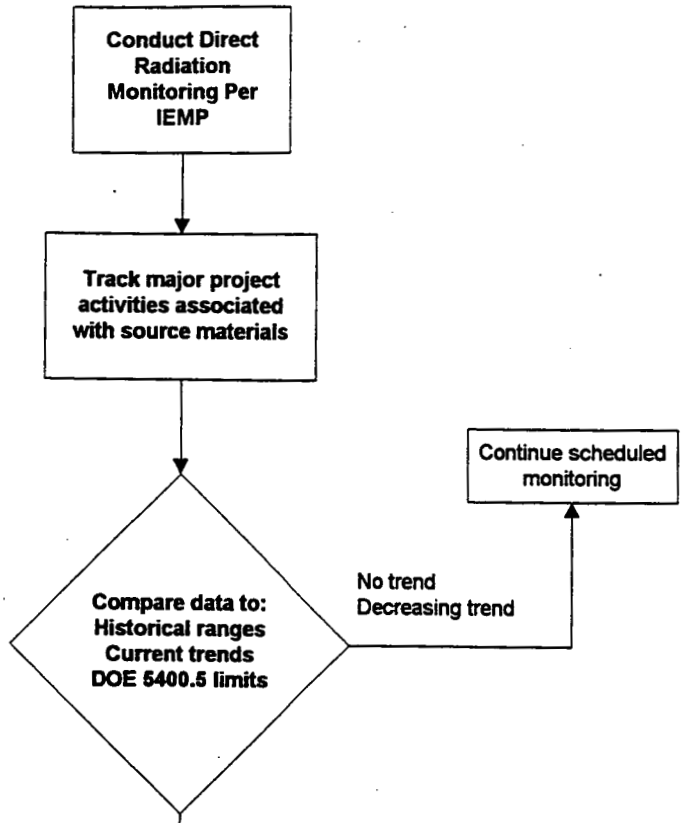
- Do direct radiation levels indicate a significant increase which could contribute to an exceedance of the 100 mrem/year all-pathway dose limit from DOE Order 5400.5?

The data generated from individual TLD locations will be trended over time via graphical and statistical (when sufficient data has been generated) methods. Basic statistics (i.e., minimum, maximum, and mean) will be generated on a quarterly basis. Historic TLD monitoring data will be used to assess whether current trends are similar to the past, increasing or decreasing. In addition, any project-specific and operational data from areas with large sources of direct radiation will be used to support the evaluation and interpretation of TLD results. Data from the TLD locations will be used to assess the direct radiation component of the all-pathway dose (see Appendix C). If trends indicate a significant increase above historical ranges which could contribute to an exceedance of the 100 mrem/year all-pathway dose limit, then actions shown in Figure 6-7 will be implemented. Direct radiation monitoring information generated by project-specific occupational monitoring will be used as necessary in interpreting the sitewide direct radiation data via the IEMP data evaluation process. The findings of the ongoing data evaluations will be shared with project personnel. Those personnel responsible for the K-65 silos and other direct radiation sources will be informed of the findings as indicated on Figure 6-7.

- Are modifications or adjustments in program focus necessary?

Changes to the air monitoring program will be evaluated based on the changing configuration of source materials (primarily K-65 waste materials) at the site, prior to remediation of these materials. Revisions to the program will be proposed through the annual review and biannual revision process outlined in Section 1.

FIGURE 6-7
IEMP TLD DATA EVALUATION AND ASSOCIATED ACTIONS



If concentration is trending above historical ranges,[a] but not expected to exceed DOE 5400.5 limits

IEMP Actions	Potential Project Actions
Review pertinent project-specific data	Review performance/inspection data for engineered controls
Identify probable source(s) and alert associated project(s)	Determine if emission controls meet design specifications
Continue scheduled monitoring	Estimate duration of source activities
Report information to EPA/ OEPA in next quarterly and in the annual report	Repair/enhance emission controls, if necessary

If concentration is trending above historical ranges[a] and potential exceedance of DOE 5400.5 limits exist

IEMP Actions	Potential Project Actions
Review pertinent project-specific data	Review performance/inspection data for engineered controls
Identify probable source(s) and alert associated project(s)	Determine if emission controls meet design specifications
Evaluate need for increasing sampling frequency and/or analytical regime to track performance of corrective actions	Estimate duration of source activities
Report information to EPA/OEPA in next quarterly and in the annual report	Repair/enhance existing emission controls
	Implement additional emission controls as necessary
	Modify project schedule as necessary to limit emission rate

[a] These determinations will be based on the significance of the trend and the projected scope and duration of the source activity

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I:\IEMP\NEW\FIGURES\TBL6-7.VSD

Data evaluation to address any remaining expectations identified in Section 6.4.1 is encompassed in the data evaluation techniques described above.

6.6.4 Reporting

Data from the air monitoring program have been provided in three types of reports. Figure 6-8 identifies the reporting schedule for these documents and when IEMP reporting will assume responsibility for air monitoring reporting. Air monitoring activities have been reported in the following documents:

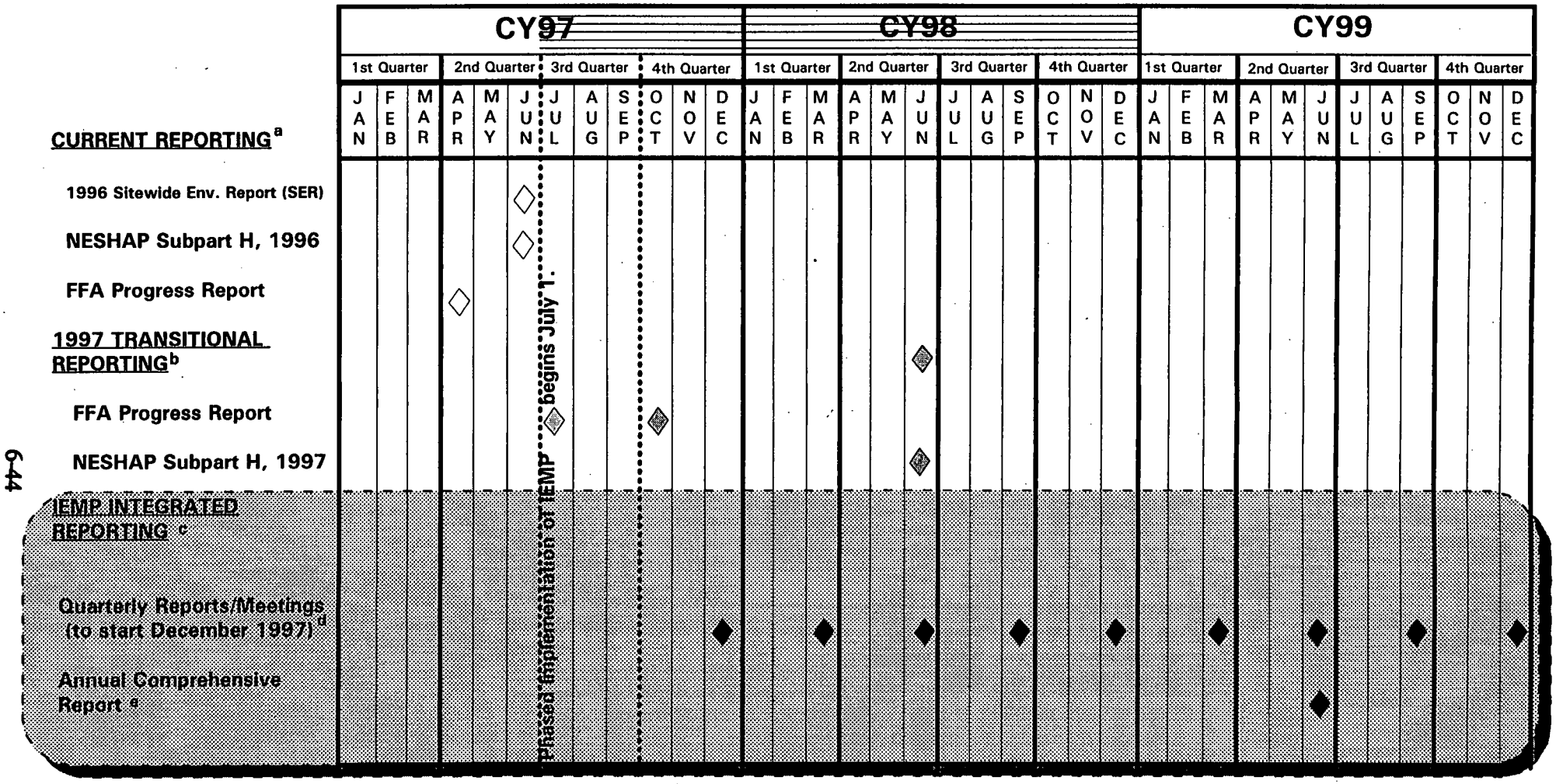
- Site Environmental Report, which provides monitoring data annually
- NESHAP Subpart H Report - required to be submitted annually by June 30 to demonstrate compliance with the NESHAP Subpart H annual off-site dose limit, and
- FFA reports for radon data at K-65 silos.

All three of the above reporting requirements will be streamlined into the IEMP reporting strategy. Air monitoring data reporting will be as follows:

- Air monitoring data for calendar year 1996 will be reported in the 1996 SER to be published in June 1997. Air monitoring, TLD and radon data for calendar year 1997 will be published in June 1998 in a transitional environmental monitoring report. Data collected in calendar year 1998, will be reported under the quarterly IEMP reports, as well as the new IEMP annual comprehensive report to be published in June 1999.
- The NESHAP Subpart H report for calendar year 1996 will be published in June 1997. Approval will be requested from EPA to submit the report, beginning with the 1997 report, as part of the transitional environmental monitoring report to be published in June 1998.
- Additionally, quarterly reporting for the FFA radon monitoring data will continue on its April, July, and October schedule. The FFA radon monitoring data will be incorporated into the IEMP quarterly reports/meetings beginning in December 1997, pending EPA approval.

Due to the amount of time necessary for sample analysis, data review, evaluation and reporting, the content of the quarterly submittal will not contain all the data collected in the previous quarter. Quarterly composite air particulate data and radon track-etch data reporting will lag other air data reporting by one month. Quarterly meetings will be held to coincide with the quarterly report submittal. Data and information pertaining to the air program will be presented in the quarterly meetings and reports and will consist of the following:

FIGURE 6-8
IEMP AIR REPORTING SCHEDULE



a = Reporting of all CY96 EMP data by June 1997.

b = Reporting CY97 EMP data and IEMP program data as implemented.

c = Includes the first complete year of reporting IEMP data, CY98 (Assuming IEMP fully implemented by January 1, 1998).

d = Includes the radon data collected per the FFA monitoring requirements.

e = Includes radon data formatted monthly from the preceding quarter.

CY97-98, the timeframe covered in this version of the IEMP

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- Graphical presentation of data trends for air particulate, radon, and TLD results at each sample location for the most recent quarter and target radionuclide results from analyses of quarterly composite filter samples from the previous quarter,

- Summary-level information on the effectiveness of the project-specific emission controls, as necessary for interpretation of IEMP results, and

- Status of regulatory compliance with NESHAP Subpart H.

The air portion of the IEMP annual report will consist of the following:

- Constituent concentrations for each sample location,

- Statistical analysis summary for each constituent,

- Status of regulatory compliance with NESHAP Subpart H, and

- Summary-level information on the effectiveness of the project-specific emission controls, if necessary for interpretation of IEMP results.

7.0 BIOTA MONITORING PROGRAM

Section 7.0 provides the monitoring strategy for assessing the sitewide impact of the FEMP's remediation activities on biota (primarily produce) in the vicinity of the FEMP; identifies the integrated objectives for biota monitoring; analyzes program drivers; describes the programmatic boundary for the IEMP biota monitoring program; presents the program expectations and design considerations, a produce sampling and analysis media-specific plan, and a discussion of data evaluation. This section concludes with a plan to integrate the FEMP's existing biota reporting into a single IEMP-sponsored reporting structure. The IEMP program for monitoring produce during remediation is much more limited than the other monitoring programs presented. The distinctions are discussed in detail in this section.

7.1 INTEGRATION OBJECTIVES FOR THE BIOTA MONITORING PROGRAM

At 3-year intervals beginning in 1997 during remediation, the IEMP will be used to determine concentrations of uranium (the principal site contaminant) in samples of area produce for comparison to current and historic concentrations; this will assess impacts to produce that may be related to site remediation. This assessment will be integrated with the assessments of the other media sampled under the IEMP in an annual IEMP-sponsored site environmental report, according to the reporting schedule established in Section 7.6 and summarized for all media in Section 8.0. Ultimately, the IEMP will provide the approach for determining when biota monitoring related to remediation can be discontinued.

7.2 SUMMARY OF REGULATORY DRIVERS, DOE ORDERS, AND OTHER FEMP-SPECIFIC AGREEMENTS

7.2.1 Approach

This section presents an evaluation of the regulatory drivers governing biota monitoring during site remediation. The intent of this section is to identify any pertinent regulatory requirements, including CERCLA-driven ARAR- and TBC-based requirements, for the scope and design of the biota monitoring program.

The analysis of the regulatory drivers and policies was conducted by examining the FEMP's approved CERCLA Records of Decision to identify any biota-specific monitoring requirements. An evaluation of the FEMP's regulatory drivers for biota monitoring was conducted to confirm that the existing environmental monitoring program scope, which historically has satisfied public concerns and DOE Order 5400.1 and 5400.5 requirements, also meets any additional requirements for biota monitoring that may have been activated by the FEMP's CERCLA Records of Decision.

7.2.2 Results

The results of the evaluation indicate the drivers of the IEMP biota monitoring program are the following DOE Orders (no CERCLA-driven requirements were identified):

- DOE Order 5400.1, General Environmental Protection Program, which requires DOE facilities that use, generate, release, or manage significant pollutants or hazardous materials to develop and implement an environmental monitoring plan. Each DOE site's environmental monitoring plan must contain the design criteria and rationale for the routine effluent monitoring and environmental surveillance activities of the facility. The FEMP's EMP provides the initial basis for the development of the IEMP strategy that is responsive to the changing site mission and associated remedial needs while still DOE-Order compliant.

- DOE Order 5400.5, Radiation Protection of the Public and the Environment, which establishes radiological dose limits and guidelines for the protection of the public and environment. Under this requirement, the exposure to members of the public associated with activities at DOE facilities from all pathways must not exceed, in one year, an effective dose equivalent of 100 mrem. Compliance with this limit is determined by calculating the radiological dose using monitoring data. Supporting Guidance (DOE 1991) to DOE Order 5400.5 indicates that if combined doses from secondary pathways (such as produce, fish, meat, milk, sediment, and grass) are less than 1 mrem per year, then media-specific surveillance monitoring is not required. As noted in the annual site environmental reports, the total dose from all evaluated FEMP pathways to the hypothetical, maximally exposed individual near the FEMP site has been 1 mrem or less for each of the last four years. Therefore, fish in the Great Miami River, produce, grass, meat, and milk obtained from the area surrounding the FEMP do not specifically require monitoring according to this 1 mrem threshold criterion.

The above regulatory drivers and the associated monitoring for biota are included in Table 7-1. As discussed in Section 7.4.2, the IEMP proposes to discontinue monitoring of secondary and tertiary exposure pathways, with the exception of produce. Produce sampling will be continued to accommodate specific public interest in this medium. The FEMP's current and long-range plan for complying with the produce sampling reporting requirements involved by the IEMP regulatory drivers is provided in Sections 7.6 and 8.0.

TABLE 7-1
FEMP BIOTA MONITORING
REGULATORY DRIVERS AND RESPONSIBILITIES

	DRIVER	ACTION
IEMP	DOE Order 5400.1	The IEMP described surveillance produce monitoring as required by the order
	DOE Order 5400.5	The IEMP describes off-site produce monitoring for radionuclides to assess compliance with dose limits to the public

7.3 PROGRAMMATIC BOUNDARY FOR THE IEMP BIOTA MONITORING PROGRAM

This section identifies the programmatic boundary that has been established between the IEMP and activities conducted by other projects. The intent of establishing a boundary definition is to clearly delineate the scope and geographic extent of the IEMP's monitoring responsibility. For 1997 and every third year thereafter, the IEMP biota monitoring program will include only produce sampling. A second boundary important to discussion of the biota monitoring program is the physical boundary. The FEMP property boundary represents the beginning point from which produce samples will be collected.

7.4 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

7.4.1 Biota Monitoring Program Expectations

The IEMP biota sampling program is essentially a continuation of the current EMP produce surveillance monitoring program for 1997 and every third year thereafter. The expectations for the program are to collect data sufficient to:

- Determine if substantive changes occur in uranium concentrations observed in area produce (as defined by the scope equivalent of the current surveillance produce sampling program)
- Determine if the program should continue as is, be refined in scope, or be discontinued in the future, based on accumulated results
- Continue to address the concerns of the community associated with future remedial construction activity at the FEMP.

7.4.2 Biota Monitoring Program Design Considerations

The IEMP will include only produce sampling to accommodate public concerns. As discussed in Section 7.2.2, there are no specific regulatory drivers requiring the continuation of the fish, meat, milk, grass, and soil sampling. Regardless of the lack of regulatory drivers requiring monitoring of this media, there is sufficient justification to cease monitoring, as discussed below.

Sampling of soil co-located with produce has been discontinued. To date, no strong correlation between uranium concentrations in soil and produce has been made because uranium concentrations in field and garden soil samples are within the range of background. Based on approximately 60 farm/garden soil samples collected from 1993 through 1995, the maximum soil concentration detected in FEMP area farm/garden soil was 5.9 μg/g. The average uranium level in local farm and garden soil

sampled over the past three years has been 2.8 μg/g which is below the 95% upper confidence level background soil concentration of 3.7 μg/g (Operable Unit 5 Remedial Investigation, DOE 1995f). A correlation would be expected if the sampled soils had high (i.e., significantly greater than background) uranium concentrations.

Milk sampling previously has been phased out of the existing environmental monitoring program as a result of the discontinuance of nearby dairy operations. Additionally, the historical sampling results indicate no definitive site impact to meat, milk, and grass in the vicinity of the FEMP.

The following factors were considered in the discontinuation of the Great Miami River fish-monitoring program:

- The program has evaluated fish populations in the river for the past 10 years and has not identified a significant difference in the health or diversity of the fish population in the river when comparing upstream populations (isolated from the site by a dam) to populations in the vicinity of the FEMP-treated effluent discharge point and in the vicinity of the river confluence with Paddys Run.

- IEMP monitoring will provide comprehensive monitoring for contaminants in surface water and treated effluent leaving the site. Data collected from this monitoring will be compared to BTVs from the Sitewide Ecological Risk Assessment to assess any potential site impacts to ecological receptors in both the river and in Paddys Run.

- Annual average uranium concentrations in the Great Miami River, downstream from the treated effluent discharge and Paddys Run, have been less than 2 μg/l for each of the last five years. This is less than 0.5 μg/l above background and two orders of magnitude below the ecologically protective BTV of 890 μg/l that was established in the Operable Unit 5 Ecological Risk Assessment.

- Operable Unit 5 Record of Decision (DOE 1996b) requirements mandate that, effective January 1, 1998, the monthly average concentration of uranium in the FEMP treated effluent to the river must be 20 μg/l or less.

- Ohio EPA periodically studies Great Miami River water quality and aquatic life (including game fish) to assess any impacts from industry discharges. These studies are completed along portions of the river and include monitoring in the vicinity of the FEMP. The OEPA's ongoing studies will provide a surveillance function beyond the comprehensive discharge monitoring planned as part of this IEMP.

Based on the above considerations, this IEMP proposes to discontinue the fish monitoring program after the 1996 sampling and analysis are completed.

The IEMP is focusing on those primary pathways (air, surface water, and groundwater) to various receptors to provide indications about the impacts of site remediation on the surrounding environment. If, in the future, monitoring of the primary pathways suggests a potential for increased levels of exposure through the secondary or tertiary pathways, then further evaluation may be warranted. The evaluation to determine additional monitoring needs in secondary and tertiary pathways will be completed annually as part of IEMP review and reporting, and is consistent with the "living document" role of the IEMP.

The implementing guidance for DOE Orders 5400.1 and 5400.5 also specifies that surveillance monitoring of various media may be necessary for other reasons, including addressing public concerns. During meetings, members of the public have expressed an interest in the continuation of produce sampling near the FEMP as an assurance measure; therefore, the produce sampling program will continue through 1997.

The design considerations to address the expectations listed in Section 7.4.1 are as follows:

- Sample locations should, in general, be consistent with current environmental monitoring locations so that comparable areas are evaluated.
- Sampling frequency, parameters analyzed, and ASL should be consistent with the EMP so that appropriate comparison findings can be made.
- Sampling should provide uranium data to continue to confirm that dose received from eating produce grown near the site is below the threshold established by DOE Order 5400.5.

The produce sampling program was initiated in the late 1980s in response to stakeholder concerns about the impacts of historical and then current emissions from the site. Through the 1990s, the program has been scaled back gradually as the data repeatedly confirmed that site emissions had no measurable impact on produce.

7.4.3 Biota Monitoring Program Design

Produce sampling locations are selected using the following guides:

- Locations that are next to or near the site are preferred.
- Locations that are downwind of the site (based on the predominant wind direction) are preferred.
- Locations that have commonly grown vegetables (tomatoes, beans, corn) are preferred.
- Background locations that are at least five miles from the site and in the least predominant wind direction are preferred.

Sampling locations vary from year to year, depending on the willingness of the property owner to participate in the program and on local weather fluctuations that can influence the success and desirability of domestic gardening.

Typically, 20 to 40 samples from about 20 locations are collected and analyzed annually for total uranium.

7.5 MEDIA-SPECIFIC PLAN FOR PRODUCE SAMPLING

This section serves as the media-specific plan for implementation of the sampling, analytical, and data management activities associated with the sitewide environmental produce sampling program. The sampling, analytical, and data management activities described in this media-specific plan were designed to provide produce sampling data of sufficient quality to meet the program expectations as stated in Section 7.4.1. The program expectations in conjunction with the design considerations presented in Section 7.4.2 were used as the framework for developing the monitoring approach presented in this media-specific plan. All sampling procedures and analytical protocols described or referenced herein are consistent with the requirements of the SCQ.

Subsequent sections of this media-specific plan define the following:

- Project organization and associated responsibilities
- Sampling program
- Change control
- Health and safety
- Data management
- Project quality assurance.

7.5.1 Project Organization

A multidiscipline project organization has been established and assigned responsibility to effectively implement and manage the project planning, sample collection and analysis, and data management activities directed in this media-specific plan. The key positions and associated responsibilities required for successful implementation are described below.

The project team leader will have full responsibility and authority for the implementation of this PSP in compliance with all regulatory specifications and sitewide programmatic requirements defined by the Oversight and Program Integration Division. Integration and coordination of all media-specific plan activities defined herein with other project organizations is also a key responsibility. All changes to project activities must be approved by the project team leader or designee.

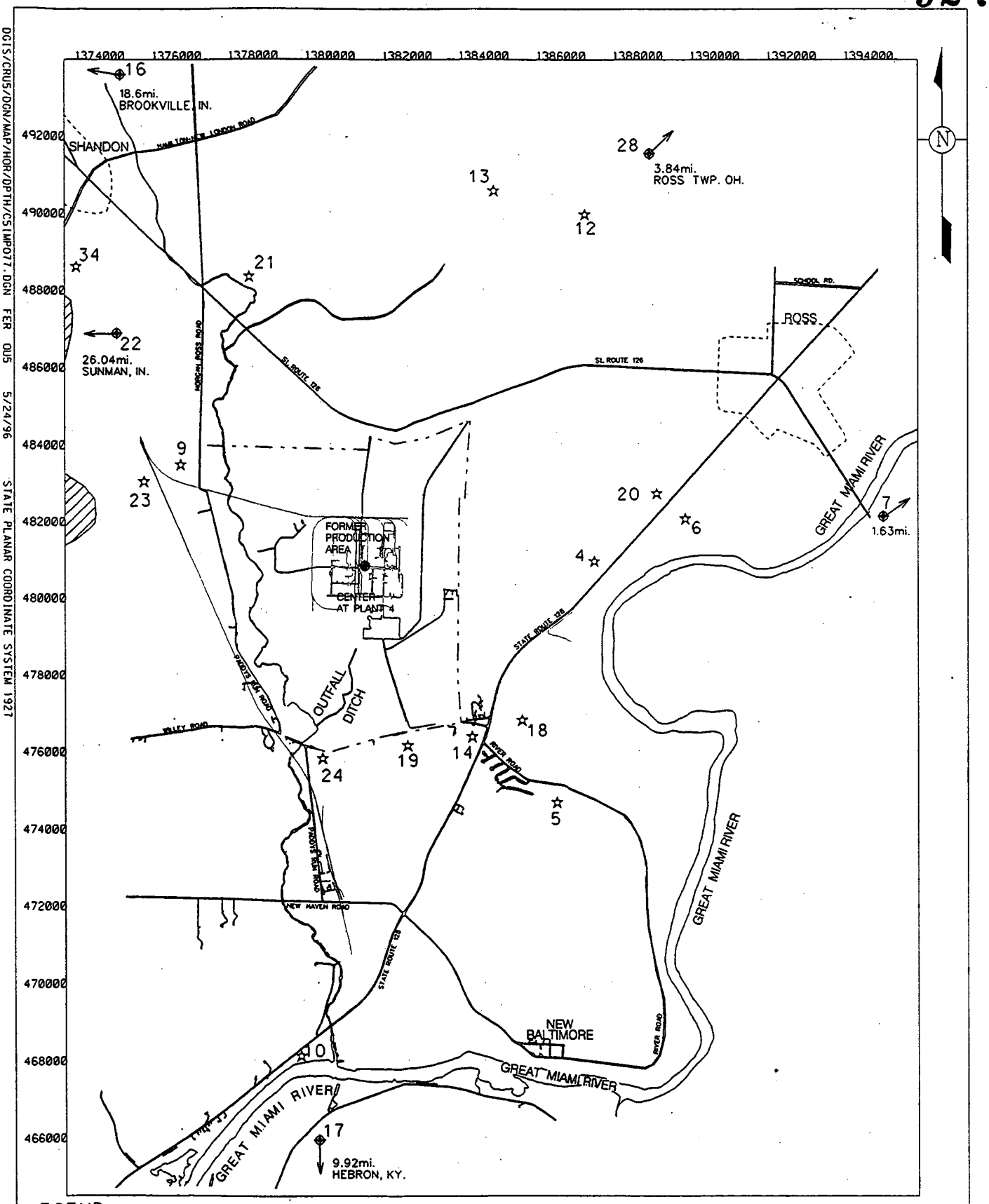
Health and safety is the responsibility of all individuals working on this project scope. Qualified health and safety specialists shall participate on the project team to provide radiation protection and industrial hygiene support, and to assist in preparing and obtaining all applicable permits. In addition, safety specialists shall periodically review and update the project-specific health and safety documents and operating procedures, conduct pertinent safety briefings, and assist in evaluation and resolution of all safety concerns.

Quality assurance specialists will participate on the project team, as necessary, to review project procedures and activities ensuring consistency with the requirements of the SCQ or other referenced standards and to assist in evaluating and resolving all quality-related concerns.

7.5.2 Produce Sampling Program

Figure 7-1 illustrates the locations for produce sample collection. The locations shown in Figure 7-1 are approximate and change yearly based on the availability of samples from farms and gardens and the willingness of local residents to participate in the program. An estimated minimum of 15 produce samples are required annually to meet the program expectations.

Produce samples are collected once per year and analyzed according to Table 7-2.



LEGEND:

- FEMP BOUNDARY
- ☆ SINGLE SAMPLING LOCATION
- DISTANCE FROM FORMER PRODUCTION AREA TO SAMPLING LOCATIONS OFF MAP

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SCALE

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FIGURE 7-1. PRODUCE MONITORING LOCATIONS

TABLE 7-2

ANNUAL PRODUCE SAMPLE ANALYTICAL REQUIREMENTS

Location	Sample Size (grams)	Type	Number of Samples[a]	Analyte	ASL	Container	Hold Time	Preservative
See Figure 7-1	500 Min.	Grab	Min. of 15	Total Uranium	B	Plastic Bag	6 Months	Freezing

[a]The number of individual produce samples will vary depending upon private participation and availability. Approximately 20 produce or crop locations exist for which samples may be collected.

7.5.2.1 Sampling Procedures

Sample collection is performed according to EP-REM-006, Produce Sampling. Sample handling and transfer is governed by Chain of Custody/Request for Analysis Record for Sample Control, EW-0002, and Logkeeping, EM-RM-002. Sampling conditions to be considered are as follows:

- Produce should be in good (edible) condition.
- Commonly grown fruits and vegetables (e.g., tomatoes, beans, and corn) should be selected for sampling.
- When possible, collect a portion of the total sample from several plants within the garden. The produce should not be rinsed.
- Collect a minimum of 500 grams of produce per sample.

The sampling location shall be described and/or sketched in the field log for the sampling event. Calibration of the field balance before field activities is required by the SCQ.

7.5.2.2 QA Sampling Requirements

Quality control samples will be taken according to the frequency recommended in the SCQ. These samples will be collected and analyzed in order to evaluate the possibility that some controllable practice, such as decontamination or sampling technique, may be responsible for introducing bias in the project's analytical results. The radiological data will be sampled and analyzed at ASL B. ASL B provides qualitative, semi-qualitative, and quantitative data with some QA/QC checks. Field duplicates will be collected for every 20 samples. Quality control samples shall be collected in accordance with Section 6.0 and Appendix K of the SCQ.

7.5.2.3 Decontamination

Sampling equipment shall be decontaminated prior to transport to the sample field site, between sampling locations, and after all sampling is completed. The decontamination of equipment is covered in procedure EP-REM-006.

7.5.3 Change Control

Changes to the PSP will be at the discretion of the project team leader. Prior to implementation of field changes, the project team leader or designee shall be informed of the proposed changes and circumstances substantiating the changes. Any changes to the project-specific plan must have approval by the designated project authority and QA prior to implementation. The completed Variance/Field Change Notice must be approved by QA. The Variance/Field Change Notice form shall be controlled and included in the field data package and become part of the project record. Permanent project-specific plan changes will incorporate applicable Variance/Field Change Notices in annual project-specific plan revisions. Scope changes to the project-specific plan will require respective document changes.

7.5.4 Health and Safety Considerations

The Fluor Daniel Fernald (FDF) Health and Safety Department is responsible for the development and implementation of health and safety requirements for this project-specific plan. Hazards (physical, radiological, chemical, and biological) typically encountered by personnel when performing the specified field work will be addressed.

All involved personnel will receive adequate training to the health and safety requirements prior to implementation of the field work required by this project-specific plan. Daily safety meetings will be conducted prior to beginning field work to address specific health and safety issues.

All FDF employees and subcontractor personnel who will be performing field work required by this project-specific plan are required to have completed all site required training.

7.5.5 Data Management

Field and analytical data will be managed to meet the IEMP data reporting and quality objectives. The field documentation and analytical data results shall be verified to ensure conformance to the

appropriate SCQ sections and appendices. The process for management of the field and analytical data is described in the EDMP (FERMCO 1996).

Field documentation will be verified for accuracy and completeness by the sampling team, followed by an independent field data validation in accordance with SCQ requirements for the corresponding ASL. The project team leader must have processes in place to verify that chemical and radiological data results meet all applicable quality requirements specified in the SCQ for the respective ASL (SCQ Section 11.0 and Appendix F). The quality of analytical data shall be evaluated by independent project personnel qualified to determine accuracy, completeness, and applicable statistical data necessary to evaluate data useability and data quality required for environmental monitoring reporting.
Both the field and analytical data will be entered into a controlled database using a double key or equivalent method to ensure accuracy. The hard copy data will be managed in the project files in accordance with FEMP record keeping procedures and DOE Orders.

7.5.6 Quality Assurance

Independent assessments of work processes shall be conducted to verify quality of performance. Such assessments may include audits, surveillances, inspections, tests, data verification and field validation, and peer reviews. Assessments shall include performance-based evaluations of compliance to technical and procedural requirements, and corrective action effectiveness necessary to prevent defects in data quality. Assessments may be conducted at any point in the life of the project. Assessment documentation shall verify that work was conducted in accordance with the IEMP, SCQ, applicable DQOs, and FEMP Quality Assurance Program (RM-0012) requirements.

Independent assessment is the responsibility of designated project quality assurance personnel. The project team leader and QA will coordinate independent assessment oversight activities and comply with SCQ Section 12. Recommended quarterly QA surveillances shall be performed on some task specified in the project-specific plan. The QA representative shall have "stop work" authority if significant adverse quality conditions are identified or work conditions are unsafe. In accordance with SCQ Section 3, QA shall review and have approval signature of plans, procedures, and final documents supporting IEMP programs.

Only laboratories on the Approved Laboratory List will be used for FEMP sample analyses in accordance with SCQ Section 12 and Appendix E.

7.6 IEMP BIOTA MONITORING DATA EVALUATION AND REPORTING

This section provides the currently envisioned methods to be utilized in analyzing the data generated during the first two years of the IEMP biota monitoring program. It summarizes the data evaluation process and actions associated with various monitoring results. The planned reporting structure for IEMP-generated biota data is presented. The reporting subsection also provides the information to be reported in the third quarterly report in December 1997 and in the comprehensive annual report.

7.6.1 Data Evaluation

Data resulting from the IEMP biota program will be evaluated with respect to the program expectations identified in Section 7.4.1. Based on these expectations, the following question will be answered through the biota data evaluation processes:

- Have substantive changes occured in uranium concentrations observed in area produce?

Data evaluation will consist of basic statistical analysis (i.e., mean, minimum, and maximum) and comparison to historical data and background to determine if substantive changes occur in uranium concentrations in area produce. Additionally, should air emissions exceed historical ranges for a sustained period, refinement of the IEMP biota monitoring program will be considered.

Data evaluation to address any remaining expectations identified in Section 7 is encompassed in the data evaluation techniques described above.

7.6.2 Reporting

Quarterly meetings will be held to coincide with the quarterly submittals. The quarterly status reports/meetings will be scheduled approximately 60 days after the close of the quarter. A quarterly results summary of the biota sampling, conducted between August and October 1997 will be presented in the third quarterly meeting of the year, i.e., December 1997. Data pertaining to the IEMP biota sampling program to be presented in the annual report will consist of a summary of the analytical results and a comparison to background.

Data from the biota monitoring program were published annually in the Site Environmental Report. Figure 8-1 identifies the reporting schedule for biota and identifies when IEMP reporting will assume responsibility for biota monitoring reporting. Biota data for calendar year 1996 will be reported in the 1996 Site Environmental Report to be published in June 1997. Assuming an IEMP start date of July 1, 1997, calendar year 1997 biota data will be published in the June 1998 report that transitions from the Site Environmental Report to the new IEMP annual comprehensive report that will be issued in June 1999.

8.0 PROGRAM SUMMARY

8.1 INTRODUCTION

This section summarizes the IEMP, highlighting two key program areas: program design and integrated reporting strategy. The program design section explains the technical approach taken in developing the IEMP and outlines the strategy for reviewing and revising the IEMP. The reporting section integrates the reporting discussion in Sections 3.0 through 7.0 and provides an overview of the entire IEMP reporting strategy.

8.2 PROGRAM DESIGN

As discussed throughout this plan, the IEMP combines pertinent elements of the FEMP's existing long-term EMP with the additional sitewide remediation-based environmental monitoring requirements that have been activated by the ARARs and TBCs contained in the FEMP's CERCLA remedy decision documents. Additionally, other ongoing monitoring programs required by other regulatory requirements have been integrated with the IEMP. In combining these elements, the IEMP establishes a sitewide environmental monitoring program that is aligned with the broad range of remedial activities scheduled for implementation at the FEMP, and continues to meet the effluent and surveillance monitoring requirements of DOE Orders 5400.1 and 5400.5. Furthermore, by acknowledging the global remediation strategy and focusing the monitoring program design on a discrete two-year window of remediation activities, the IEMP will forecast and be responsive to emerging monitoring needs.

IEMP media-specific monitoring programs were developed through a systematic evaluation of existing monitoring scope, technical considerations, pertinent regulatory drivers, and critical stakeholder concerns. Programmatic boundaries between the IEMP and project-specific monitoring were identified during this evaluation to clearly delineate the scope and geographic extent of the IEMP monitoring and reporting responsibilities.

8.2.1 Programmatic Boundaries

Programmatic boundaries between the sitewide environmental monitoring program and the projects have been identified as part of the IEMP. These boundaries are defined for monitoring and reporting activities. The IEMP presents a sitewide monitoring approach focused on assessing the collective impacts of site remediation activities. As such, a fundamental programatic boundary exists between the

global monitoring approach of the IEMP and the primarily emissions-control monitoring focus of the individual remediation projects.

The IEMP is designed to provide accurate, accessible, and manageable environmental monitoring information during remediation to support the following:

- Continued compliance with the monitoring and reporting requirements contained in DOE Orders 5400.1 and 5400.5
- Monitoring the performance of the Great Miami Aquifer groundwater remedy, including determination of when restoration activities are complete
- Providing a consolidated reporting mechanism for environmental data.

The following list summarizes the activities that fall outside the scope of the IEMP:

- Project-specific emission-control monitoring for both point and area sources.
- The soil remediation precertification and certification sampling program which will be conducted as part of the work scope of the Soil Characterization and Excavation Project
- The ambient air sampling and direct radiation measurements conducted for worker health and safety purposes as part of the FEMP's occupational monitoring program
- The FEMP's spill and chemical release reporting required under SARA Title III.

8.2.2 IEMP Monitoring Summary for Fiscal Years 1997 and 1998

The IEMP 1997-1998 monitoring scope for groundwater, surface water, sediment, air, and biota has been described in detail in Sections 3.0 through 7.0. The summary that follows is intended to provide a synopsis of and basis for each media monitoring program. Evaluation of each program will form the basis for any IEMP program modifications in the future.

Groundwater: The groundwater monitoring program for the Great Miami Aquifer provides for monitoring of 144 existing monitoring wells distributed over the aquifer restoration area, along the FEMP's downgradient property boundary, and at a few private well locations. These wells provide a monitoring network to track the progress of the

aquifer restoration, monitor groundwater quality in the area of the on-site disposal facility and provide assurance that contaminants are not migrating beyond the groundwater restoration area that is defined in the FEMP's sitewide hydraulic capture zone. The analytical regime for this monitoring program is based on the FRLs documented in the Operable Unit 5 ROD.

Surface Water: The surface water monitoring program is designed to assess the impacts of site remedial activities on surface water. The non-radiological discharge monitoring and reporting related to the NPDES permit have been incorporated into the IEMP. The radiological discharge monitoring related to the FFCA has been incorporated into the IEMP with minor modifications. All constituents that exceeded FRLs and/or BTVs will be monitored. There are 14 monitoring locations.

Sediment: The sediment sampling program consists of 21 monitoring locations for key site-specific radiological constituents. It is designed to determine whether substantial changes to current residual contaminant conditions occur in the sediment along the storm sewer outfall ditch, Paddys Run, and the Great Miami River, as a result of runoff and treated effluent from the site.

Air: The air monitoring program consists of three distinct sampling elements: airborne particulate monitoring, radon monitoring, and direct radiation monitoring, with each element supported by the meteorological monitoring program. Each element has a network of monitoring locations on site, at the FEMP boundary, and off site that are used to measure the collective sitewide effects of remediation activities. Data from the airborne particulate monitoring element will be used to develop and refine an emissions model for future remediation activity. The analytical regime for the air monitoring program focuses on the principle contaminants of each monitoring element.

Biota: The biota monitoring program consists of the analysis of produce samples from approximately 15 local farms and gardens in order to address stakeholder concerns regarding this secondary pathway. Frequency of sampling is once every three years. All samples are analyzed for uranium, the principle contaminant of concern.

8.2.3 Program Review and Revision

As stated in Section 1.0, the IEMP is a "living document" and, as such, is anticipated to change over the life of the FEMP's remediation program. This approach to developing the IEMP acknowledges the dynamic nature of the remediation effort, allowing the plan to focus on the current and evolving mix of site remediation activities from year to year that accompany the FEMP's accelerated site remediation schedule.

To facilitate timely changes to the IEMP program, a structured schedule of annual reviews and two-year mandatory revisions has been incorporated into the IEMP. This schedule meets the requirements of DOE Order 5400.1 for review and revision of environmental monitoring plans. Annual reviews will

evaluate the current IEMP program against the anticipated mix of remediation activities scheduled to occur in the subsequent two years. The annual review cycle provides the mechanism for identifying and initiating any program modifications that are necessary to align the IEMP with the mix of near-term remediation activities. For example, parameter selection and sampling locations, frequency, and media will be reviewed and evaluated annually. Any resultant modifications to the IEMP will be communicated to the regulatory agencies.

The two-year revision will incorporate all changes initiated as a result of the annual review process. The revision also will identify any program modifications necessary as a result of progressive findings of the IEMP and any changes to existing regulatory agreements or requirements applicable to sitewide monitoring. The specific schedule dates for review and revision of the IEMP will be based on the approval date of the IEMP.

In addition to the IEMP-sponsored review and revision obligations identified above, an independent review and assessment mechanism exists through the agreement in principle reached between the OEPA and the DOE. The AIP (approved in October 1993) provides an avenue for the OEPA to conduct an independent review of DOE environmental monitoring programs. The OEPA's role, as defined in the AIP, is to independently verify the adequacy and effectiveness of DOE's environmental monitoring programs through program review and independent data collection. Results of the OEPA review are summarized in an annual report that will be considered during the IEMP annual review process. Modifications to the scope or focus of the IEMP as a result of the OEPA's activities will be incorporated as necessary via the annual IEMP review process.

8.3 REPORTING

As stated in Section 1, a primary objective of the IEMP is to successfully integrate the numerous routine environmental reporting requirements under a single comprehensive framework. The IEMP provides the vehicle to centralize, streamline, and focus sitewide environmental monitoring and associated reporting under a single controlling document. Centralization will occur by consolidating environmental data reporting, that currently exists under various programs, under the IEMP umbrella. Streamlining will be achieved as reporting frequencies are transitioned to the new IEMP reporting schedule in fiscal years 1997 and 1998. Greater focus will occur as the DOE meets quarterly with EPA and OEPA to review IEMP and project-specific monitoring data. This consolidation is intended to

facilitate timely technical review and discussion of the monitoring data generated during remediation. The IEMP seeks to accomplish this integration objective for reporting through a phased transition which is presented on a media-specific basis in Sections 3.0 through 7.0 and is summarized below.

8.3.1 Regulatory Drivers for Reporting Monitoring Data

An analysis of regulatory drivers and policies was conducted by examining ARARs within operable unit RODs, FEMP compliance agreements, and DOE Orders applicable to monitoring each media. These regulatory drivers are identified in Sections 3.0 through 7.0 of the IEMP and were evaluated for reporting requirements. The following reporting drivers will be phased into the IEMP reporting strategy:

- DOE Order 5400.1, General Environmental Protection Program Requirements, which requires DOE facilities to submit annual site environmental reports that summarize the environmental monitoring data results
- The September 10, 1993, Ohio EPA Director's Findings and Orders (OEPA 1993), which requires submittal, by March 1 of each year, of groundwater monitoring data collected over the previous year in the RCRA Annual Report, to fulfill RCRA/Ohio hazardous waste regulations for groundwater monitoring. Groundwater monitoring data provided in the annual report is compiled from quarterly sampling of 33 property boundary wells.
- The Abandonment and Plugging of the KC-2 Warehouse/Well No. 67 Groundwater Sampling Work Plan Addendum, which includes a provision to submit, in an annual letter report, the groundwater monitoring data from sampling Well No. 67
- The South Plume Design Monitoring Evaluation Program Plan, which requires semi-annual reporting of performance monitoring data from the South Plume Removal Action pumping system
- The current NPDES permit for the FEMP, which requires monthly reports to demonstrate compliance with provisions in the NPDES permit
- The 1986 FFCA, which, per an agreement made with EPA and OEPA in January 1996, requires submittal of quarterly progress reports
- NESHAP 40 CFR 61, Subpart H, which requires submittal of an annual NESHAP report to demonstrate compliance with emission standards for radionuclides other than radon
- The FFA, Control and Abatement of Radon-222 Emissions, signed November 19, 1991, which requires, per an agreement made with EPA and OEPA in January 1996, submittal of the continuous air monitoring data in selected on-site areas in a quarterly progress report.

8.3.2 Reporting Responsibilities

Under the IEMP consolidated reporting concept, each project will be responsible for maintaining records of its project-specific monitoring program and reporting the data as defined in the appropriate project-specific controlling document. Concurrently, the data generated by sitewide environmental monitoring will be maintained and managed by the IEMP program. Project-specific data and interpretation thereof would be transmitted to the IEMP program to support quarterly meetings with and status reports to the regulators, to support the annual review and bi-annual revision of the IEMP, and to support an IEMP-sponsored annual site environmental report. IEMP data will be communicated to the projects as warranted by evaluation of the IEMP data.

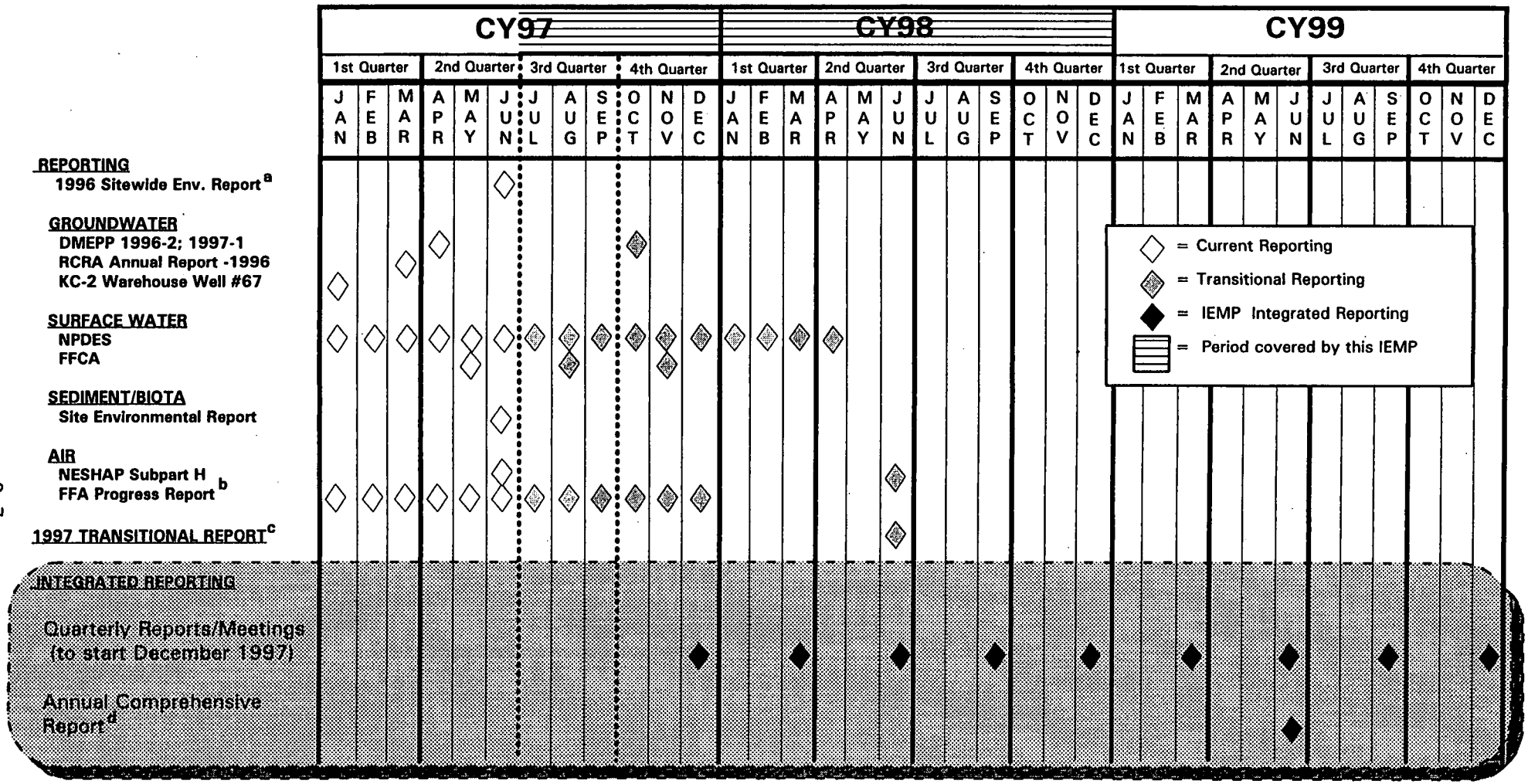
8.3.3 Transition to IEMP Reporting

As discussed in Sections 3.0 through 7.0, a number of reports are currently being prepared to fulfill regulatory requirements and other site commitments for each of the media monitoring programs. Figure 8-1 details the range of current environmental reporting to be consolidated under the IEMP umbrella. In addition, key transition dates are called out for each report to be phased in under the IEMP reporting strategy. Complete transition from the current reporting schedule to IEMP reporting will be phased in, as most appropriate for each media.

The following presents a summary of reports that will be integrated under the IEMP and the associated schedule.

Groundwater Monitoring Reporting: Four groundwater monitoring reports will transition into the new IEMP reporting format starting in January 1997. Affected reports include the Site Environmental Report, the DMEPP semi-annual reports, the KC-2 warehouse well monitoring report, and the RCRA Annual Report. Groundwater monitoring data currently presented in the annual Site Environmental Report will be published in an expanded IEMP-sponsored Site Environmental Report beginning in 1998 (report covering calendar year 1997).

FIGURE 1
IEMP REPORTING SCHEDULE



a = Includes all CY96 EMP data for all media.

b = The FFA reporting of radon data will become quarterly in CY98, and will be included in the quarterly Integrated Reports.

c = The Groundwater section includes RCRA, DMEPP, and KC-2 Warehouse No. 67 data, as well as any additional groundwater data available. The Surface Water section includes FFCA quarterly reports beginning December 1997 and includes NPDES quarterly reports beginning June 1998, pending OEPA approval. This report includes all CY97 EMP data and IEMP program data as implemented.

d = This report contains all available CY98 IEMP program data.

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Surface Water Monitoring Reporting:	Three surface water monitoring reports are currently prepared to document surface water monitoring results. The NPDES monthly report will transition into a Quarterly reporting schedule beginning in March 1998 under the IEMP. Surface water monitoring data currently presented in the annual Site Environmental Report will be published in a new IEMP annual Site Environmental Report beginning in 1998 (report covering calendar year 1997).
Sediment Monitoring Reporting:	Sediment monitoring data currently presented in the annual Site Environmental Report will be published in a new IEMP annual Site Environmental Report beginning in 1998 (report covering calendar year 1997).
Air Monitoring Reporting:	Air monitoring data currently presented in the annual Site Environmental Report will be published in a new IEMP annual Site Environmental Report beginning in 1998 (report covering calendar year 1997). The NESHAP subpart H report will also be incorporated into the Site Environmental Report beginning in 1998.
Biota Monitoring Reporting:	Biota monitoring data currently presented in the annual Site Environmental Report will be published in a new IEMP annual Site Environmental Report beginning in 1998 (report covering calendar year 1997).

The Site Environmental Report, published annually in June, currently documents the technical approach and data reported for the groundwater, surface water, sediment, air, and biota monitoring programs, and summarizes CERCLA, RCRA, and waste management activities. Under the IEMP umbrella, the current Site Environmental Report format would be presented through June 1997 (report covering calendar year 1996). Data for the 1997 Site Environmental Report would be gathered from the backup for the quarterly status updates that DOE will present to both EPAs during quarterly meetings. This quarterly input will be used to develop an expanded Site Environmental Report to be submitted in the spring/summer of 1998. Since this report must serve a wide audience, the format and content will be developed through a collective effort incorporating input from the EPA, OEPA, and involved stakeholders.

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APPENDIX A

DETAILED EXPLANATION OF PARAMETER SELECTION FOR THE GROUNDWATER MONITORING PROGRAM

APPENDIX A

DETAILED EXPLANATION OF PARAMETER SELECTION FOR GROUNDWATER MONITORING

A.1 INTRODUCTION

As discussed in Section 3.0 of the Integrated Environmental Monitoring Plan (IEMP), the groundwater monitoring program for the Great Miami Aquifer consists of 128 monitoring wells distributed over five restoration modules, along the Fernald Environmental Management's Project's (FEMP) downgradient property boundary, and at several private well locations. These wells provide an extensive monitoring network that will allow module-specific performance measures to be tracked and provide assurance that contaminants are not migrating beyond the groundwater restoration area that is defined by the sitewide hydraulic capture zone of the FEMP. Because of the extensive nature of this system, it is important to recognize that if all 128 of these wells were monitored quarterly for the full suite of the FEMP's groundwater final remediation level (FRL) constituents (50 constituents, total), the analytical costs alone would exceed 16 million dollars over the life of the FEMP's groundwater restoration program. Clearly, these costs are prohibitive, and it is not cost-effective to monitor the full suite of parameters at each successive monitoring interval at all available wells during the active restoration process.

The intent of this appendix is to develop a cost-effective, representative list of analytical parameters that can be used to successfully track the progress of the remedy, satisfy regulatory requirements, and ultimately determine when restoration activities are complete for each module. The FEMP recognizes its obligation to verify that all 50 FRL constituents are below their corresponding FRL values in order to deem the restoration activities as complete. During the active restoration process, the FEMP is proposing to track the progressive success of the remedy using a logical "short-list" of zone-specific indicator parameters (developed through the methodology described in this appendix), and then verify the completion for the remedy (step-wise for each module, as appropriate) using the full suite of 50 FRL constituents identified in the Operable Unit 5 Record of Decision (ROD) (DOE 1996c). In accordance with the current scope and revision cycles for the IEMP, this appendix focuses primarily on the development of analytical parameters that can support the next two years of monitoring efforts for the aquifer (years 1997 and 1998). Subsequent versions of the IEMP are expected to focus on the monitoring activities and the parameters needed to support a collective decision on the part of U.S. Department of Energy (DOE), U.S. Environmental Protection Agency (EPA), and Ohio Environmental

Protection Agency (OEPA) that restoration activities are complete for each module. Later versions will also define the FEMP's long-term groundwater monitoring activities (on-site disposal facility) that may extend beyond completion of the restoration program.

The remainder of the appendix is organized into the following sections:

- Objectives: defines the overall parameter selection strategy for groundwater monitoring over the life of the remedy, along with the specific intentions and needs to support the next two years of activity
- Approach: defines the parameter selection criteria and describes the historical information reviewed to develop zone-specific parameter lists that are responsive to regulatory requirements and the remedy performance tracking needs
- Results: presents the zone-specific parameter and sampling frequencies that will support the next two years of monitoring activities
- Future Activities: defines the process for modifying and revising the lists as needed to support future versions of the IEMP and ultimate completion of the Operable Unit 5 groundwater remedy.

A.2 OBJECTIVES

The objective of the parameter selection process is to develop a cost-effective, representative list of parameters that can be used to successfully track the progress of the remedy, satisfy regulatory commitments, and ultimately determine when restoration activities are complete for each module. This section presents the strategy used to meet this objective.

Restoration of the aquifer will be measured by the achievement of the FEMP's 50 groundwater FRL. FRLs for the aquifer are presented in the Operable Unit 5 Record of Decision (ROD) for 50 constituents of concern. Developed during the remedial investigation/feasibility study (RI/FS) process, these 50 FRL constituents either 1) have concentrations that have been detected in the aquifer, or 2) have the potential to reach the aquifer within 1,000 years (assuming no source control actions are in place) and pose an unacceptable risk to human health and/or the environment. A detailed discussion of how FRLs were developed can be found in Section 2.0 of the Operable Unit 5 Feasibility Study (FS) Report (DOE 1995).

The 50 FRL constituents have been organized into four categories for the purpose of establishing a parameter hierarchy and identifying a "short-list" of indicator parameters which will be targeted for more frequent monitoring than the other FRL constituents. The objective will be to track all 50 FRL constituents at various intervals throughout the restoration, but to track the short-list of indicator parameters more frequently. This approach provides a more cost-effective and realistic method to track remedy performance.

Constituents from each of the four different categories were organized into specific monitoring parameter lists based upon specific monitoring objectives and the geographic locations of the monitoring module/activities. The specific monitoring objectives considered in subdividing the parameters into specific groups are:

- Is the success of the groundwater remedy proceeding satisfactorily at the pace that is desired?
- Are physical adjustments to the restoration system (flow rates, well locations, etc.) needed?
- Are FRL constituents migrating beyond the hydraulic zone of capture created by the restoration system?
- Are new FRL constituents arriving in the aquifer as a result of migration through the glacial overburden or as a result of surface water infiltration?
- Is sufficient information being gathered to ultimately demonstrate that remedial objectives contained in the Operable Unit 5 ROD have been obtained?
- Have all specific regulatory-based monitoring requirements for specific parameters been satisfied in the selection process?

Figure A-1 illustrates the parameter selection process. The selection process results in a parameter categorization hierarchy that identifies a short-list of 10 indicator constituents that will be sampled more frequently to track the progress of the restoration and assess the need for changes in operating conditions as necessary. The remaining constituents will be sampled less frequently to determine whether new FRL exceedances are occurring in the aquifer due to migration through the glacial overburden or surface water and to ultimately demonstrate that remedial objectives are being achieved. Figure A-1 also shows how the categories are organized into the different aquifer zones. The aquifer was divided into five geographic zones to determine zone-specific monitoring lists. Four of these five zones correspond to the restoration modules. The fifth zone (Zone 0) consists of the areas outside

Zones 1 through 4. The five aquifer zones are illustrated in Figure A-2.

A.3 APPROACH

This section on approach defines the parameter selection criteria, and describes the historical information reviewed to develop zone-specific parameter lists that are responsive to regulatory requirements and the remedy performance tracking needs. These criteria are used to divide the 50 FRL constituents into four categories for monitoring the aquifer restoration as follows:

- FRL constituents with at least one validated FRL exceedance in the aquifer (using data collected between 1988 through 1995) will be grouped together and identified using a > symbol. FRL constituents that have not had a validated FRL exceedance in the aquifer will be grouped together and identified using a < symbol.

- FRL constituents predicted to have the ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and the environment will be grouped together. These constituents are considered "mobile and persistent", and will be identified using the letters MP. FRL constituents that are predicted not to have the ability to migrate to the aquifer and create an unacceptable risk will be grouped together. These constituents are considered not mobile and persistent, and will be identified using the letter N.

- FRL constituents that have not been sampled for in the aquifer, but are predicted to be unable to migrate to the aquifer and create an unacceptable risk will be categorized as not having a validated FRL exceedance (<).

- FRL constituents that have not been sampled for in the aquifer, but do have the ability to migrate to the aquifer and create an unacceptable risk will be categorized as having a validated FRL exceedance (>).

- FRL constituents that are common laboratory contaminants and do not have a confirmed FRL exceedance will be categorized as not having a validated FRL exceedance (<).

- FRL constituents analyzed using a method detection limit above the FRL value and predicted to be unable to migrate to the aquifer and create an unacceptable risk will be categorized as not having a validated FRL exceedance (<).

- FRL constituents analyzed using a method detection limit above the FRL value and predicted to have the ability to migrate to the aquifer and create an unacceptable risk will be categorized as having a validated FRL exceedance (>).

After the 50 FRL constituents are identified as being ["<" or ">"] and ["MP" or "N"], they are grouped into the four categories, ">MP", ">N", "<MP", and "<N". The ">MP" constituents are considered to be the short-list of indicator parameters and will be targeted for more frequent

monitoring. The remaining constituents [">N", "<MP", and "<N"] will be targeted for less frequent monitoring.

In addition to monitoring restoration performance, there are regulatory commitments that specify the need to monitor select constituents at specific locations:

- The Paddys Run Road Site constituents are monitored at key locations in the South Plume Module.
- An established short-list of specific constituents are monitored for the KC-2 warehouse well monitoring program.
- Total uranium is monitored in the FEMP's private well monitoring program.
- Constituents that have caused FRL exceedances in Zones 0 through 3 are proposed for monitoring at the FEMP's downgradient property boundary (RCRA Property Boundary Monitoring Program).

The 1995 RCRA Annual Report (DOE 1996b) provided recommendations to update and align the monitoring parameters evaluated for the RCRA Property Boundary Program with the FRLs for groundwater contained in the February 1996 Operable Unit 5 ROD. The parameter selection process outlined in this appendix serves to implement this proposal.

A.4 RESULTS

A.4.1 FRL Constituents that Have Been Detected in the Great Miami Aquifer at a Concentration above their Established FRLs

The Operable Unit 5 RI/FS data set, supplemented with groundwater data collected in 1994 and 1995, were reviewed to identify constituents that have been detected in the Great Miami Aquifer at concentrations above the established FRLs, and where they occur. The majority of the groundwater data collected in 1994 and 1995 are obtained from the RCRA Property Boundary Monitoring Program and the DMEPP monitoring program for the South Plume. All filtered and unfiltered samples from Type 2 and Type 3 monitoring wells were evaluated. Data from Type 4 monitoring wells were not reviewed because, other than uranium at one location, there are no FRL exceedances related to the FEMP at the Type 4 well depth. Only one uranium FRL exceedance was recorded in a Type 4 well during the RI. This exceedance was at monitoring well 4013, as shown on Operable Unit 5 RI Plate E-82.

Table A-1 summarizes the results of the data evaluation. Columns 1 through 4 list the FRL constituents, the assigned groundwater FRL value, units for the FRL value, and the basis for the FRL value, respectively. As discussed in Section 2.0 of the Operable Unit 5 FS Report, the FRLs were developed based on ARARs, detection limits, background concentrations, and/or risk assessment results. As identified in the Restoration Area Verification Sampling Program PSP, the selection for the FRLs for fluoride and lead was not consistent with the approved process detailed in the Operable Unit 5 FS Report. The FRL for fluoride as stated in the Operable Unit 5 ROD is 0.89 milligrams per liter (mg/L) and is based on the background value. The Safe Drinking Water Act (SDWA) maximum contaminant level (MCL) for fluoride is 4 mg/L. The MCL should have been used as the FRL because, in accordance with the FRL development process, if an MCL exists and is higher than background the MCL takes precedence over the background value and becomes the FRL. Similarly, the FRL for lead as stated in the Operable Unit 5 ROD is 0.002 mg/L and is also based on the background value. The SDWA action level for lead is 0.015 mg/L. The plan proposed that the decision to monitor and remediate for lead be based on the SDWA action level. The proposed FRLs for these two constituents are identified in Table A-1 and the data was assessed against these proposed FRLs.

Column 5 of Table A-1 lists the number of validated samples included in the data sets. Column 6 lists the number of validated results (either "-" or "J") that were detected for each constituent above their established FRLs. Using validated data rather than using non-validated data provides results which should be more accurate at determining where actual exceedances occur. Constituents that were not detected in the aquifer at a concentration above their FRL will still be monitored, but not as frequently as those that have been detected.

Column 7 lists, by aquifer zone, the number of wells with FRL exceedances. Using total uranium as an example, 14 wells have shown exceedances of the uranium FRL in Aquifer Zone 4. The last column of the table lists the range of validated results above the FRL and also provides the validation aquifer (either "-" or "J").

The data evaluation indicates that:

- Twenty-nine of the 50 FRL constituents have had exceedances of their FRLs in the Great Miami Aquifer at least one time, using data collected from 1988 through 1995 .

- Four of the 50 FRL constituents (boron, chromium VI, 2,3,7,8-tetrachlorodibenzo-p-dioxin, and octochorodibenzo-p-dioxin) have not been analyzed in every zone. Of these four constituents, only boron has not been analyzed in any zone. Nonetheless, these four constituents were categorized as either having an exceedance or not having an exceedance based upon the criteria presented in the previous section.

- One of the 50 FRL constituents (bis(2-ethylhexyl)phthalate) had three reported historical FRL exceedances (.015 mg/L, .013 mg/L, and .007 mg/L) at three different wells. Confirmatory sampling of each exceedance indicated that the result was most likely due to laboratory contamination. This constituent was, therefore, categorized as not having a FRL exceedance.

- Four of the 50 FRL constituents (aroclor-1254, bis(2-chloroisopropryl)ether, chloroethane, and octochlorodibenzo-p-dioxin) have been analyzed using a method detection limit above the FRL value. These four constituents were categorized as either having an exceedance or not having an exceedance based upon criteria presented in the previous section.

Figures A-3 through A-31 illustrate, by constituent, where FRL exceedances have occurred. The figures also show the modeled hydraulic capture zone associated with the accelerated aquifer remediation scenario.

A.4.2 Constituents that Could Migrate to the Great Miami Aquifer Through the Glacial Overburden

A constituent's ability to migrate to the Great Miami Aquifer vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and the environment was also used to categorize the 50 FRL constituents. While at present, the data evaluation of historical results (1988 through 1995) indicates that FRL exceedances in the aquifer have only been detected for 29 of the 50 FRL constituents, it was recognized during the FRL development process that a constituent could potentially migrate through the glacial overburden to the aquifer in the future and cause a FRL exceedance.

During the RI/FS process, the mobility and persistence characteristics of 93 constituents were assessed and modeled to predict which constituents had the ability to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk to human health and the environment. Table F.2-2 of the Operable Unit 5 FS Report presents the results of the model screening process. In order to be conservative, the modeling assumed that no sources of contamination were removed (i.e., the "no-action alternative" was selected for the FEMP).

For the purpose of parameter selection, the terms "mobile and persistent" are used to describe those constituents that are predicted to be able to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk in the absence of the source-control actions (i.e., identified as failing the Operable Unit 5 FS model screening in Table F.2-2). These FRL constituents are identified in Column 4 of Table A-2 with the letters "MP". Those FRL constituents that do not have the ability to migrate to the aquifer and create an unacceptable risk (not "mobile and persistent"), are identified in Column 4 of Table A-2 with the letter "N" (identified as passing the Operable Unit 5 FS model screening in Table F.2-2).

The first three columns of Table A-2 summarize the information included in Table A-1. The information in Column 4 originated from Table F.2-2 of the Operable Unit 5 FS Report. (Note: Table A-2 is identical to Table 3-2 of the IEMP).

Three of the 50 FRL constituents were not specifically modeled during the Operable Unit 5 FS process: chloroethane, 4-nitrophenol, and 2,3,7,8-tetrachlorodibenzo-p-dioxin. The upper range of half-lives found in literature for chloroethane and 4-nitrophenol in groundwater are eight weeks and 9.8 days, respectively (Howard 1991). Due to these relatively short half lives, chloroethane and 4-nitrophenol are not expected to reach the aquifer. Although 2,3,7,8-tetrachlorodibenzo-p-dioxin has a half-life of about 3.23 years, dioxin-like compounds are primarily associated with particulate and organic material due to their high lipophilicity and low water solubility, and therefore are not considered mobile. Dioxins exhibit little potential for significant leaching and are not mobile into the aquifer. Therefore, dioxin-like compounds in Table F.2-2 passed the model screening and are not predicted to be able to migrate to the aquifer and create an unacceptable risk. For these reasons, the above three constituents were considered to be not mobile and persistent and assigned "N" in Table A-2 as they either have high degradation rates or low water solubility.

The Operable Unit 5 FS modeling predicted that bis(2-chloroisopropyl)ether and carbazole had the ability to migrate vertically through the glacial overburden, reach the aquifer and create an unacceptable risk in the absence of source control measures. It has since been determined that the decay rate used for these two constituents was overly conservative. This conservative assumption was used because no literature decay half-life was found, at the time, for these two constituents. A recent study (Grosser 1995) concluded that the degradation rate of carbazole is similar to phenanthrene and

anthracene. The upper range of half-lives found in literature for bis-(2-chloroisopropyl)ether in groundwater is one year (Howard 1991). Additional model screening simulations were conducted using the half-life of anthracene (i.e., five years) for carbazole and one year for bis(2-chloroisopropyl)ether. Based on the last modeling results, both constituents passed the model screening and are, therefore, not considered to be mobile and persistent. For this reason, these constituents were assigned "N" in Table A-2.

In summary, none of these five constituents (chloroethane, 4-nitrophenol, 2,3,7,8-tetrachlorodibenzo-p-dioxin, bis(2chloroisopropyl)ether, and carbazole) are considered sufficiently mobile and persistent to impact the aquifer. As mentioned, they have been assigned the "N" characteristic in Table A-2. It is also important to point out that none of these five constituents have been detected in the aquifer at concentrations above the groundwater FRLs.

From review of Table A-2, Column 4, it can be determined that:

- Thirteen of the 50 constituents (26 percent) are considered mobile and persistent ("MP"). These constituents are: fluoride, nitrate, boron, chromium VI, mercury, neptunium-237, strontium-90, technetium-99, total uranium, alpha-chlordane, bromodichloromethane, 1,2-dichloroethane, and vinyl chloride.

- Thirty-seven of the 50 constituents (74 percent) are considered not mobile and persistent ("N"). The constituents are identified in Table A-2.

A.4.3 Zone-Specific Parameter Lists and Sampling Frequencies

Information from Column 3 of Table A-2 was combined with information from Column 4 to produce four categories (">MP", "<MP", ">N", "<N"). Columns 5 through 9 of Table A-2 provide a zone-specific sort of how each FRL constituent is categorized. The four terms to describe the combined constituent information by zone are:

- **>MP** The constituent has been detected in the aquifer at concentrations "greater than its established FRL" and is considered "Mobile and Persistent." It has been predicted to be able to migrate from the glacial overburden to the aquifer and has already caused a FRL exceedance in the aquifer.

- **>N** The constituent has been detected in the aquifer at concentrations "greater than its established FRL" but is "Not considered mobile and persistent." This constituent is not predicted to be able to migrate vertically through the glacial overburden, reach the aquifer, and create an unacceptable risk. Background conditions and/or surface

water infiltrations may be the cause of the isolated FRL exceedances noted in the historical record.

- <MP The constituent has "not been detected is the aquifer at concentrations greater than its established FRL," but is considered both "Mobile and Persistent." This constituent is predicted to be able to migrate through the glacial overburden to the aquifer (if no source removal/control actions are taken), but as yet has not caused exceedances of its established FRL.

- <N The constituent has "not been detected is the aquifer at concentrations greater than its established FRL" and is "Not considered mobile and persistent."

A zone-specific breakdown of the number of constituents in each of the four categories is presented below.

BREAKDOWN OF FRL CATEGORY CONSTITUENTS BY AQUIFER ZONE

Constituent Characteristic	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
>MP	8	6	5	6	7
>N	13	16	12	14	18
<MP	5	7	8	7	6
<N	24	21	25	23	19

The constituents that are in the >MP category in at least one zone are:

- Fluoride
- Nitrate
- Boron
- Chromium VI
- Mercury
- Neptunium-237
- Strontium-90
- Technetium-99
- Total Uranium
- 1,2-Dichloroethane.

These constituents are considered to be the master short-list of indicator parameters from which zone-specific short-lists will be developed. These short-list parameters will be monitored more frequently than the other constituents in order to track the progress of the remedy. These parameters have been detected in the aquifer at concentrations above their established FRLs and they are both mobile and persistent.

Each of the four categories of constituents will be targeted for monitoring at the following frequency:

- >MP Are to be monitored quarterly in source areas and at the property boundaries because they have been detected in the Great Miami Aquifer above their established FRL and are considered mobile and persistent.

- >N Are to be monitored quarterly at the property boundaries so that sufficient data will be available to evaluate water quality trends. Are to be monitored annually in source areas because they have been detected in the Great Miami Aquifer above their established FRL and because they are not considered mobile and persistent.

- <MP Are to be monitored annually because they have not been detected in the Great Miami Aquifer above their established FRL and because they are considered mobile and persistent.

- <N Will be monitored every five years to verify that these lowest-priority FRL constituents remain below their established FRL.

Exception:

- The constituents with the >MP characteristic in the two areas where groundwater cleanup is not expected to begin in the next five years (Plant 6 and Waste Storage Area modules) the groundwater will be monitored semi-annually instead of quarterly. The frequency will be increased to quarterly one year before the groundwater remediation begins in these areas.

Parameter lists for the monitoring modules/activities were developed using Columns 5 through 9 of Table A-2. These module-/activity-specific parameter lists can be found in Section 3.5.1 and 3.5.2 of the IEMP. Columns 5 through 9 indicate how constituents have been categorized for each aquifer zone. Specific monitoring modules and activities fall in one or more of these zones as follows:

- South Plume Module is located in Zones 2 and 4
- South Field/Injection Demonstration Modules are located in Zone 2
- Waste Storage Area Module is located in Zone 1
- Plant 6 Area Module is located in Zone 3
- RCRA Boundary Monitoring monitors downgradient of Zones 0 through 3.

Exceptions:

- KC-2 warehouse well, private well monitoring and Paddys Run Road Site Activity of the South Plume Module have established parameter lists that were put together to meet specific objectives. These will be maintained as discussed in Section 3.5 of the IEMP.

Although the FRLs listed in Table 9-3 of the Operable Unit 5 ROD were developed for nitrate and chromium VI, future monitoring modules/programs will be analyzed for nitrate/nitrite and total chromium, respectively. This was done to facilitate laboratory procedures and minimize cost. In both cases, the constituent for which the FRL was developed is a portion of what will be analyzed. For example, the quantity of chromium VI is reflected in total chromium analysis. Consequently, if a total chromium analysis does not indicate an FRL exceedance, then the chromium VI will also be below the FRL since there is less chromium VI than total chromium. This is also the case for nitrate/nitrite.

In addition to the analytical constituents, several field parameters will be monitored during each groundwater sample collection event. These field parameters include dissolved oxygen, pH, specific conductance, temperature and turbidity and serve as indicators of aquifer conditions and are used to verify that groundwater samples are representative.

A.5 FUTURE ACTIVITIES

A.5.1 Modifying Parameter Lists

After a year of data are collected and reviewed, the parameter list for each module/activity will be reevaluated using the same logic outlined previously in this appendix. The new data collected may indicate that it is necessary to increase or decrease the monitoring frequency for some of the constituents. The following are possible changes that would indicate a necessity to modify parameter frequencies. In general, if in any zone, a constituent is categorized as:

- <MP becomes >MP - indicating a FRL exceedance - increase sampling frequency to quarterly
- <N becomes >N - indicating a FRL exceedance - increase sampling frequency to annual
- >MP becomes <MP - indicating no longer a FRL exceedance - decrease sampling frequency to annual
- >N becomes <N - indicating no longer a FRL exceedance - decrease sampling frequency to every five years.

Note: As identified earlier, the Plant 6 and Waste Storage Area Modules along with the RCRA Property Boundary Activity have some exceptions to the above monitoring frequencies.

Modifying and revising parameter lists and sampling locations will be an ongoing process for the groundwater monitoring program, as more data are obtained and trends become apparent. Formal revisions to the IEMP will occur every two years and annual modifications will be identified in the IEMP annual reports. No parameter will be removed from a sampling list until the EPA and OEPA have concurred with the decision.

In order to clearly identify the necessary modifications to parameter lists, tables like Table A-1 and Table A-2 will be created. These tables will be included in the IEMP annual reports.

A.5.2 Ongoing Background Issues

The reassessment of background concentrations for select constituents was identified as part of a formal Operable Unit 5 activity (Restoration Area Verification Sampling Program) in the Operable Unit 5 Remedial Design Work Plan (DOE 1996c). The suitableness of the background groundwater database was revisited during the preparation of the draft and draft final Restoration Area Verification Sampling Program PSP submitted in October 1996 and January 1997 (DOE 1996c and DOE 1997, respectively), which concluded that the remediation could proceed, at this time, without further refinement of background values.

A.5.3 Documenting that Aquifer Restoration Objectives have been Met and FRLs have been Obtained

Ultimately, the IEMP will be used to document the approach for determining when the various modules can be removed from service, once remedial action objectives for the Great Miami Aquifer (provided in the Operable Unit 5 ROD) are achieved.

In future revisions to the IEMP (beyond this first two-year increment), the following decision-making criteria will need to be established:

- The amount and type of data needed to establish that an extraction or injection well can be turned off
- The number of confirmatory sampling events which will be required to document that FRLs have been achieved.

A.5.4 Addressing Sporadic and Isolated Detections Outside the Uranium Based Aquifer Restoration Footprint

During the groundwater parameter selection process, a review of the Operable Unit 5 RI/FS data set, supplemented with groundwater data collected in 1994 and 1995, identified a number of constituents that occasionally and sporadically exceeded their established FRL outside of the uranium based aquifer restoration footprint. These sporadic and isolated exceedances were acknowledged in the RI/FS and targeted for future investigation.

This investigation was conducted under the Restoration Area Verification Sampling Program PSP and concluded that in addition to monitoring the RCRA Property Boundary wells that are outside the restoration footprint that three additional wells, 3423, 2436, and 3091, would be sampled for antimony, manganese and zinc, respectively, for a year and a report would be issued on the findings. The summary report would include recommendations regarding the need for modifications of the footprint beyond that dictated by uranium.

TABLE A-1

GROUNDWATER FRL EXCEEDANCES BASED ON SAMPLES AND LOCATIONS

Constituents	Groundwater FRL[a]	Units	Basis for FRL[b]	No. of Validated Samples[c]	No. of Validated Samples > FRL[c,d]	Zones with FRL Exceedances (No. of Wells with exceedances in each Zone)[c,d]	Range Above FRL[c,d]
Total Uranium	20	µg/L	A	1385	239	0(2) 1(19) 2(29) 3(4) 4(14)	20.6-/2070-
Zinc	0.021	mg/L	B	614	114	0(20) 1(24) 2(14) 3(14) 4(10)	.0223-/2.3J
Arsenic	0.05	mg/L	A	1324	56	0(12) 1(2) 2(4) 3(2) 4(8)	.0516J/.55-
Manganese	0.9	mg/L	B	1200	40	0(5) 1(7) 2(2) 3(7) 4(4)	.931-/139-
Lead	0.015	mg/L	A	1209	39	0(8) 1(5) 2(7) 3(4) 4(7)	.0152-/.295-
Nitrate[e]	11	mg/L	B	713	35	0(8) 1(10) 2(1) 4(2)	11.1J/158J
Thorium-228	4	pCi/L	R*	1186	35	0(9) 1(1) 2(10) 3(2) 4(5)	4.01-/14.2J
Antimony	0.006	mg/L	A	600	25	0(5) 1(6) 2(3) 3(3) 4(3)	.0245-/41.2J
Nickel	0.1	mg/L	A	1253	18	0(2) 1(5) 2(3) 3(2) 4(4)	.131J/3.93-
Technetium-99	94	pCi/L	R*	1186	18	0(1) 1(5)	100-/5510-
Cadmium	0.014	mg/L	B	1214	17	0(3) 1(5) 2(1) 3(6) 4(2)	.0154-/3-
Vanadium	0.038	mg/L	R	877	17	0(1) 1(5) 3(3) 4(5)	.0382-/.361J
Mercury	0.002	mg/L	A	1208	14	0(5) 1(4) 2(1) 3(1) 4(3)	.0023J/.0139J
Strontium-90	8	pCi/L	A	893	9	0(2) 1(1) 3(2) 4(1)	8.14J/38.5-
Thorium-232	1.2	pCi/L	R*	1265	9	0(4) 2(4) 4(1)	1.3-/2.73-
Carbon disulfide	0.00555	mg/L	A	579	6	1(4) 2(1) 3(1)	.008-/.026J
Trichloroethene	0.005	mg/L	A	610	6	0(1) 1(1) 2(1) 4(1)	.007-/.15-
Selenium	0.05	mg/L	A	1196	5	1(1) 2(2) 3(1) 4(1)	.0563J/.246-
Neptunium-237	1	pCi/L	R*	739	4	0(2) 2(1) 4(1)	1.46J/2.5J
Silver	0.05	mg/L	A	1236	4	0(1) 1(1) 4(2)	.0598-/.12-
Beryllium	0.004	mg/L	A	623	3	1(1) 3(1) 4(1)	.0116-/.178-
Cobalt	0.17	mg/L	R	626	3	1(1) 3(1) 4(1)	.305-/.528-
Molybdenum	0.1	mg/L	A	784	3	1(1) 3(1)	.2-/.618-
Barium	2	mg/L	A	1222	2	4(1)	3.11-/8.69-
Fluoride	4	mg/L	A	1177	1	3(1)	23J
Benzene	0.005	mg/L	A	622	1	0(1)	.16J
1,1-Dichloroethene	0.007	mg/L	A	581	1	4(1)	.11-
1,2-Dichloroethane	0.005	mg/L	A	581	1	4(1)	.31-
Radium-226	20	pCi/L	A	1204	1	4(1)	39.8-
1,1-Dichloroethane	0.28	mg/L	A	609	0	N/A	N/A
2,3,7,8-Tetrachlorodibenzo-p-dioxin	0.00001	mg/L	D	19	0	N/A[f]	N/A
4-Methylphenol	0.028	mg/L	R	181	0	N/A	N/A
4-Nitrophenol	0.32	mg/L	R	180	0	N/A	N/A

TABLE A-1
(Continued)

Constituents	Groundwater FRL[a]	Units	Basis for FRL[b]	No. of Validated Samples[c]	No. of Validated Samples > FRL[c,d]	Zones with FRL Exceedances (No. of Wells with exceedances in each Zone)[c,d]	Range Above FRL[c,d]
Alpha-chlordane	0.002	mg/L	A	130	0	N/A	N/A
Aroclor-1254	0.0002	mg/L	D	130	0[g]	N/A	N/A
Bis(2-chloroisopropyl)ether	0.005	mg/L	D	117	0[g]	N/A	N/A
Bis(2-ethylhexyl)phthalate	0.006	mg/L	A	182	0[h]	N/A	N/A
Boron	0.33	mg/L	R	0	0	N/A[i]	N/A
Bromodichloromethane	0.1	mg/L	A	579	0	N/A	N/A
Bromomethane	0.0021	mg/L	R	579	0	N/A	N/A
Carbazole	0.011	mg/L	R	137	0	N/A	N/A
Chloroethane	0.001	mg/L	D	580	0[g]	N/A	N/A
Chloroform	0.1	mg/L	A	581	0	N/A	N/A
Chromium VI[j]	0.022	mg/L	R	5	0	N/A[k]	N/A
Copper	1.3	mg/L	A	1231	0	N/A	N/A
Methylene chloride	0.005	mg/L	A	609	0	N/A	N/A
Octachlorodibenzo-p-dioxin	0.0000001	mg/L	D	15	0[g]	N/A[f]	N/A
Radium-228	20	pCi/L	A	1218	0	N/A	N/A
Thorium-230	15	pCi/L	R*	1330	0	N/A	N/A
Vinyl Chloride	0.002	mg/L	A	581	0	N/A	N/A

[a]From OU5 Record of Decision Table 9-3. Fluoride and lead FRLs are proposed in the Restoration Area Verification Sampling Program PSP.
[b]From OU5 feasibility study Table 2-16:
A - ARAR based
B - Based on 95th percentile background concentrations.
D - Based on lowest achievable detection limit.
R - Risk based Preliminary Remediation Goal (PRG)
R*- Risk based Preliminary Remediation Level includes the radionuclide risk-based PRG plus its 95th percentile background concentration.
[c]Based on filtered and unfiltered samples from the OU5 remedial investigation/feasibility study data set and supplemented with 1994 and 1995 groundwater data.
[d]Validation qualifiers - or J were used:
- (dash) = result is confident as reported
J = result is quantitatively estimated
[e]Nitrate/nitrite will be analyzed in future modules/programs.
[f]Constituent not analyzed in samples from Zones 2 and 4
[g]Analyses of constituent had method detection limit above FRL value
[h]This constituent showed FRL exceedances in three samples (.015- mg/L, Well 3043 in Zone 1; .013- mg/L, Well 3016 in Zone 2; .007J mg/L, Well 2037 in Zone 3). Confirmatory sampling indicated that each exceedance was due to laboratory contamination.
[i]Constituent not analyzed in samples from Zones 0, 1, 2, 3 and 4.
[j]Total chromium will be analyzed in future modules/programs.
[k]Constituent not analyzed in samples from Zones 0 and 3.

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TABLE A-2

CATEGORIZATION OF GROUNDWATER FRL CONSTITUENTS BASED ON EXCEEDANCES, MOBILITY, AND PERSISTENCE

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Characterization by Zone[d]				
				Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
General Chemistry	**mg/L**							
Fluoride	4	3	MP	<MP	<MP	<MP	>MP	<MP
Nitrate[e]	11	0,1,2,4	MP	>MP	>MP	>MP	<MP	>MP
Inorganics	**mg/L**							
Antimony	.0060	0,1,2,3,4	N	>N	>N	>N	>N	>N
Arsenic	.050	0,1,2,3,4	N	>N	>N	>N	>N	>N
Barium	2.0	4	N	<N	<N	<N	<N	>N
Beryllium	.0040	1,3,4	N	<N	>N	<N	>N	>N
Boron	.33	-[f]	MP	>MP[f]	>MP[f]	>MP[f]	>MP[f]	>MP[f]
Cadmium	.014	0,1,2,3,4	N	>N	>N	>N	>N	>N
Chromium VI[g]	.022	-[h]	MP	>MP[h]	<MP	<MP	>MP[h]	<MP
Cobalt	.17	1,3,4	N	<N	>N	<N	>N	>N
Copper	1.3	-	N	<N	<N	<N	<N	<N
Lead	0.015	0,1,2,3,4	N	>N	>N	>N	>N	>N
Manganese	.90	0,1,2,3,4	N	>N	>N	>N	>N	>N
Mercury	.0020	0,1,2,3,4	MP	>MP	>MP	>MP	>MP	>MP
Molybdenum	.10	1,3	N	<N	>N	<N	>N	<N
Nickel	.10	0,1,2,3,4	N	>N	>N	>N	>N	>N
Selenium	.050	1,2,3,4	N	<N	>N	>N	>N	>N
Silver	.050	0,1,4	N	>N	>N	<N	<N	>N
Vanadium	.038	0,1,3,4	N	>N	>N	<N	>N	>N
Zinc	.021	0,1,2,3,4	N	>N	>N	>N	>N	>N
Radionuclides	**pCi/L**							
Neptunium-237	1.0	0,2,4	MP	>MP	<MP	>MP	<MP	>MP
Radium-226	20	4	N	<N	<N	<N	<N	>N
Radium-228	20	-	N	<N	<N	<N	<N	<N
Strontium-90	8.0	0,1,3,4	MP	>MP	>MP	<MP	>MP	>MP
Technetium-99	94.0	0,1	MP	>MP	>MP	<MP	<MP	<MP
Thorium-228	4.0	0,1,2,3,4	N	>N	>N	>N	>N	>N
Thorium-230	15	-	N	<N	<N	<N	<N	<N
Thorium-232	1.2	0,2,4	N	>N	<N	>N	<N	>N
	µg/L							
Total Uranium	20	0,1,2,3,4	MP	>MP	>MP	>MP	>MP	>MP

TABLE A-2
(Continued)

Constituents	Groundwater FRL[a]	Zones with Groundwater Concentrations > FRL[b]	Mobility/Persistence Characteristic[c]	Characterization by Zone[d]				
				Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Organics	**mg/L**							
Alpha-chlordane	.0020	-	MP	<MP	<MP	<MP	<MP	<MP
Aroclor-1254	.00020	-[i]	N	<N	<N	<N	<N	<N
Benzene	.0050	0	N	>N	<N	<N	<N	<N
Bis(2-chloroisopropyl)ether	.0050	-[i]	N[j]	<N	<N	<N	<N	<N
Bis(2-ethylhexyl)phthalate[k]	.0060	-	N	<N	<N	<N	<N	<N
Organics (Contd.)	**mg/L**							
Bromodichloromethane	.1	-	MP	<MP	<MP	<MP	<MP	<MP
Bromomethane	.0021	-	N	<N	<N	<N	<N	<N
Carbazole	.011	-	N[j]	<N	<N	<N	<N	<N
Carbon disulfide	.0055	1,2,3	N	<N	>N	>N	>N	<N
Chloroethane	.0010	-[i]	N[l]	<N	<N	<N	<N	<N
Chloroform	.10	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethane	.28	-	N	<N	<N	<N	<N	<N
1,1-Dichloroethene	.0070	4	N	<N	<N	<N	<N	>N
1,2-Dichloroethane	.0050	4	MP	<MP	<MP	<MP	<MP	>MP
Methylene chloride	.0050	-	N	<N	<N	<N	<N	<N
4-Methylphenol	.029	-	N	<N	<N	<N	<N	<N
4-Nitrophenol	.32	-	N[l]	<N	<N	<N	<N	<N
Octachlorodibenzo-p-dioxin	.0000001	-[l,m]	N	<N	<N	<N[m]	<N	<N[m]
2,3,7,8-Tetrachlorodibenzo-p-dioxin	.000010	-[m]	N[l]	<N	<N	<N[m]	<N	<N[m]
Trichloroethene	.0050	0,1,2,4	N	>N	>N	>N	<N	>N
Vinyl Chloride	.0020	-	MP	<MP	<MP	<MP	<MP	<MP

Shading indicates short list of indicator parameters.
[a]From Table 9-3 in OU5 ROD. Fluoride and lead FRLs are proposed in the Restoration Area Verification Sampling Program PSP.
[b]0,1,2,3,4 indicate the zone(s) where constituent was detected in the aquifer above the FRL. From OU5 RI/FS data set and supplemented by 1994 and 1995 groundwater data.
- indicates that the constituent was not detected in the aquifer above the FRL.
[c]From OU5 FS Report Table F.2-2. A constituent that failed modeling (model screening predicted that it has the ability to migrate to the aquifer) is considered mobile and persistent, and is listed as MP. A constituent that passed modeling (model screening indicated that it could not reach the aquifer) is considered not mobile and persistent, and is listed as N.
[d]>MP = Has been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate to the aquifer.
>N = Has been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate to the aquifer.
<MP = Has not been detected in the aquifer at concentrations greater than the FRL, and has the ability to migrate to the aquifer.
<N = Has not been detected in the aquifer at concentrations greater than the FRL, and does not have the ability to migrate to the aquifer.
[e]Nitrate/Nitrite will be analyzed in future modules/programs.
[f]Not analyzed in Zones 0, 1, 2, 3 or 4, but categorized as having a valid FRL exceedance in these zones since it has been predicted to have the ability to migrate to the aquifer and create an unacceptable risk.

TABLE A-2
(Continued)

[g]Total chromium will be analyzed in future modules/programs.
[h]Not analyzed in Zones 0 or 3, but categorized as having a valid FRL exceedance in these zones since it has been predicted to have the ability to migrate to the aquifer and create an unacceptable risk.
[i]Analyses of constituent had method detection limit above FRL, but categorized as not having a valid FRL exceedance since model predictions indicate that it does not have the ability to migrate to the aquifer and create an unacceptable risk.
[j]Failed modeling in F.2-2. Constituent was since remodeled with updated information and passed modeling. It was therefore assigned an N.
[k]This constituent showed FRL exceedances in three samples (.015- mg/L, Well 3043 in Zone 1; .013- mg/L, Well 3016 in Zone 2, .007J mg/L, Well 2037 in Zone 3). Confirmatory sampling indicated that each exceedance was due to laboratory contamination.
[l]Not in Table F.2-2. Constituent assigned an N based on literature review which shows high degradation rates for chloroethane and 4-nitrophenol and low water solubility for 2,3,7,8 tetrachlorodibenzo-p-dioxin.
[m]Not analyzed in Zones 2 or 4, but categorized as not having a valid FRL exceedance in these zones since it does not have the ability to migrate to the aquifer and create an unacceptable risk.

REFERENCES

Grosser, R.J., D. Warshawsky, and J.R. Vestal, 1995, "Mineralization of Polycyclic and N-Heterocyclic Aromatic Compounds in Hydrocarbon-Contaminated Soils," Environmental Toxicology and Chemistry, Vol. 14, No. 3, pp. 375-382.

Howard, P.H., R.S. Boethling, W.F. Jarvis, W.M. Meylan, E.M. Michalenko, 1991, "Handbook of Environmental Degradation Rates," Lewis Publishers, Chelsea, MI.

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U.S. Dept. of Energy, 1996c, "Restoration Area Verification Sampling Program, Project Specific Plan," Fernald Environmental Management Project, Fernald Area Office, Cincinnati, OH.

U.S. Dept. of Energy, 1997 "Restoration Area Verification Sampling Program, Project Specific Plan," Fernald Environmental Management Project, Fernald Area Office, Cincinnati, OH. 2222

50 FRL Constituents based on Operable Unit 5 ROD

50 FRL constituents are categorized using the criteria below.

Constituent is categorized as >, <, MP, or N if it has:

>
- At least one validated FRL exceedance in the aquifer
- Not been sampled in the aquifer but has been predicted to have the ability to migrate to the aquifer and cause an unacceptable risk
- Been analyzed using a method detection above the FRL value and predicted to have the ability to migrate to the aquifer and cause an unacceptable risk

<
- No validated FRL exceedance in the aquifer
- Not been sampled in the aquifer but has been predicted to not have the ability to migrate to aquifer and cause an unacceptable risk
- Been analyzed using a method detection unit above FRL value and predicted to not have the ability to migrate to the aquifer and cause an unacceptable risk
- Been identified as a common laboratory contaminant with unconfirmed FRL exceedance

MP
- Been predicted to be able to migrate to the aquifer and cause an unacceptable risk; constituent is considered to be "mobile and persistent"

N
- Been predicted to be unable to migrate to the aquifer and cause an unacceptable risk; constituent is not considered to be "mobile and persistent"

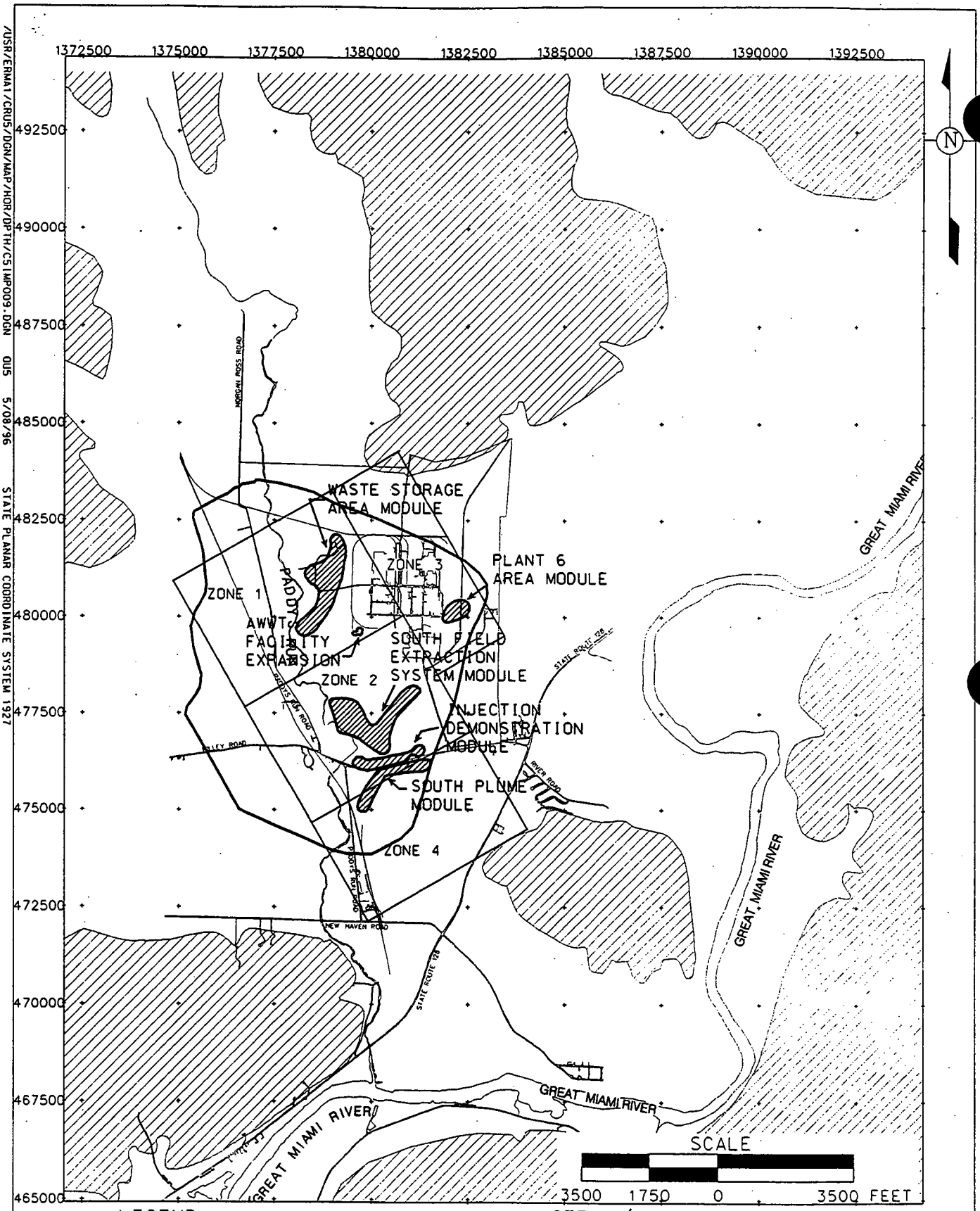
Zone	> MP	> N	< MP	< N	Total
0	8	13	5	24	50
1	6	16	7	21	50
2	5	12	8	25	50
3	6	14	7	23	50
4	7	18	6	19	50

(> MP) represents a 'short list' of 10 indicator parameters that will be monitored more frequently because they have FRL exceedances and are mobile and persistent.

FINAL

FIGURE A-1. PARAMETER SELECTION PROCESS USED FOR FRL CONSTITUENTS

/USR/ERMA1/CRU5/DGN/MAP/HOR/DPTH/C5IMF009.DGN OU5 5/08/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:

SHADED AREAS REPRESENT GEOGRAPHIC LOCATIONS WITHIN WHICH EXTRACTION AND/OR INJECTION WELLS ARE PLANNED

ZONE 0 CONSISTS OF ALL AREAS OUTSIDE ZONES 1, 2, 3, AND 4.

FINAL

FIGURE A-2. GROUNDWATER MONITORING ZONES

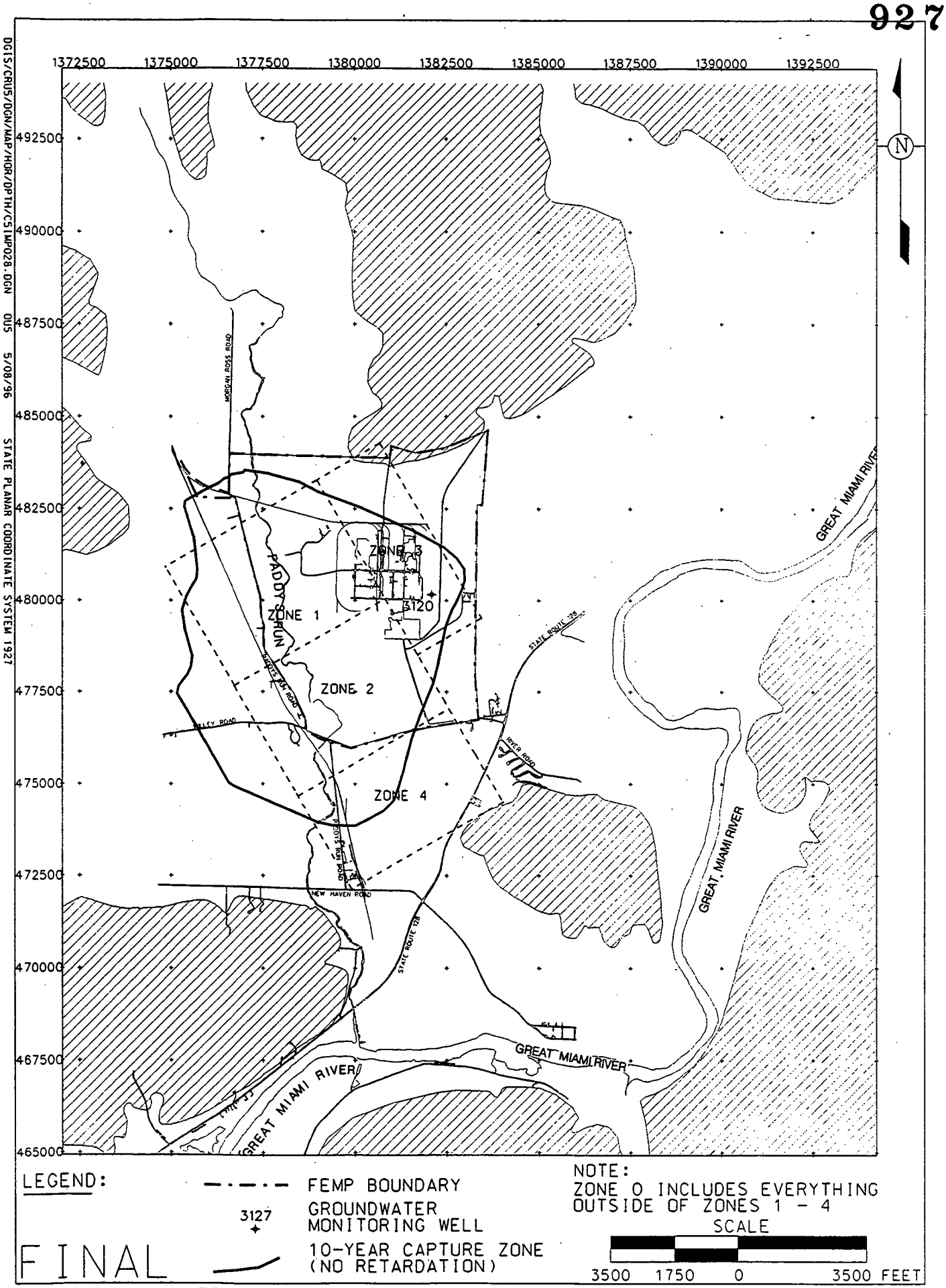


FIGURE A-3. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR FLUORIDE

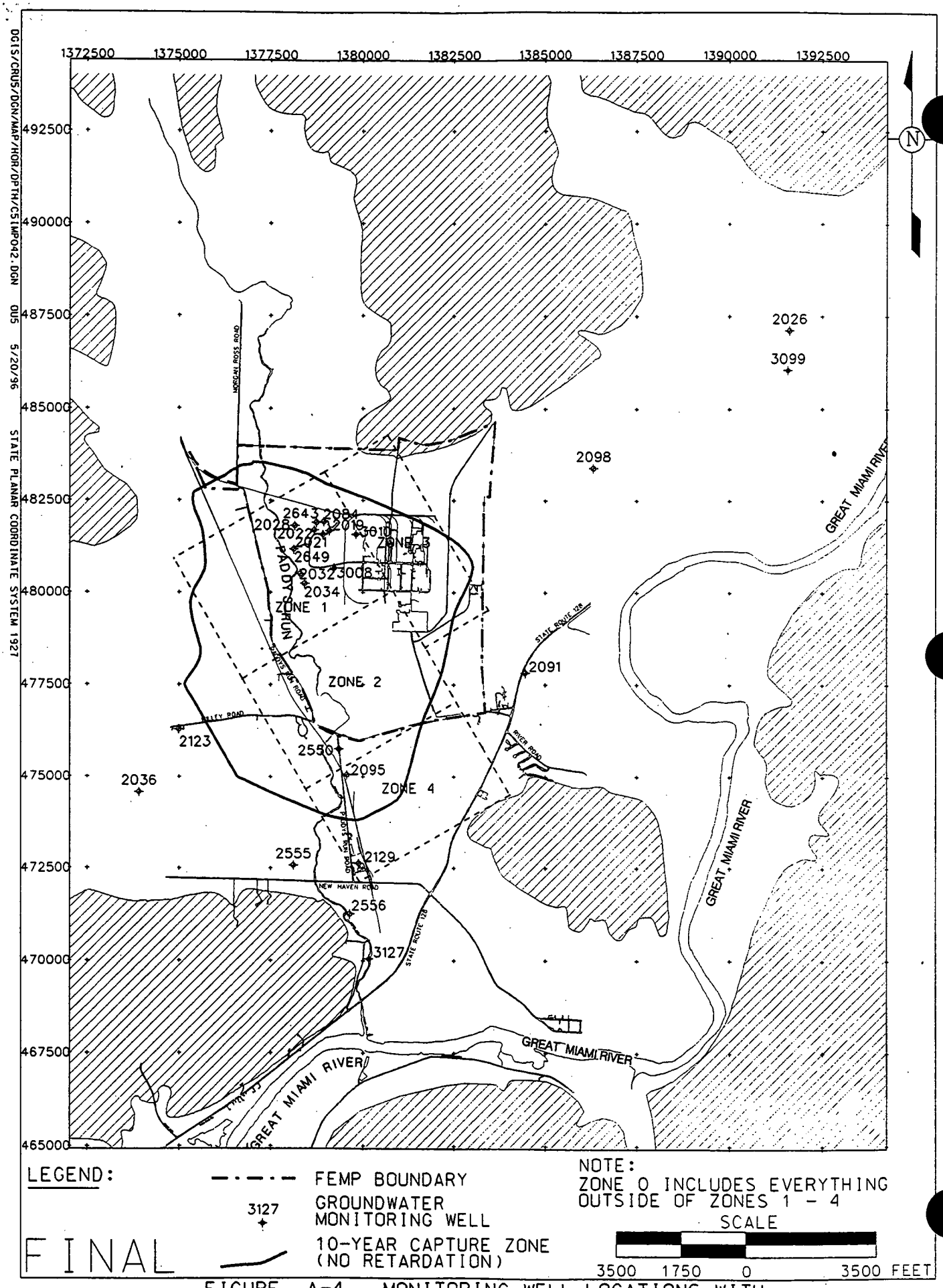


FIGURE A-4. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NITRATE

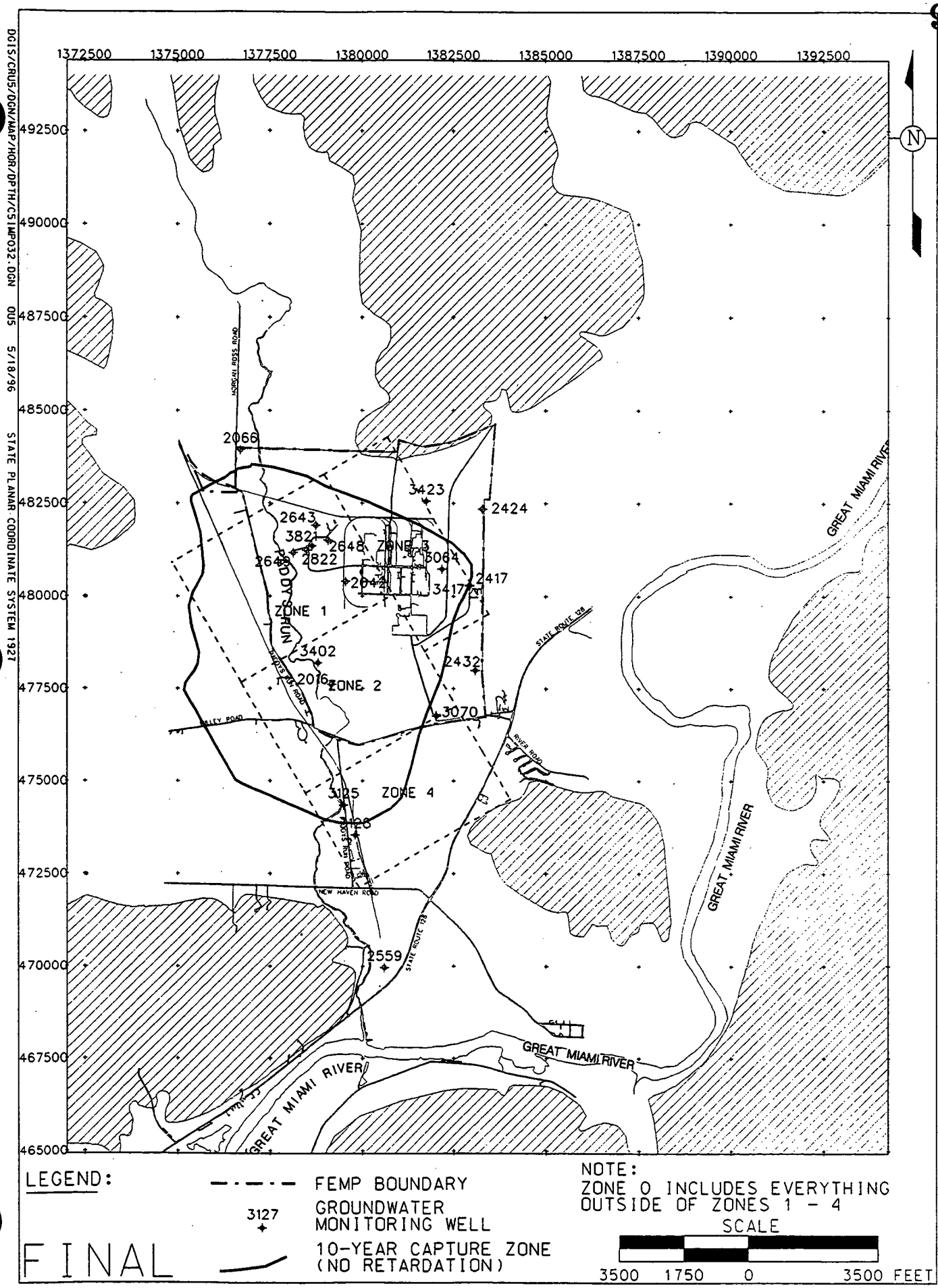
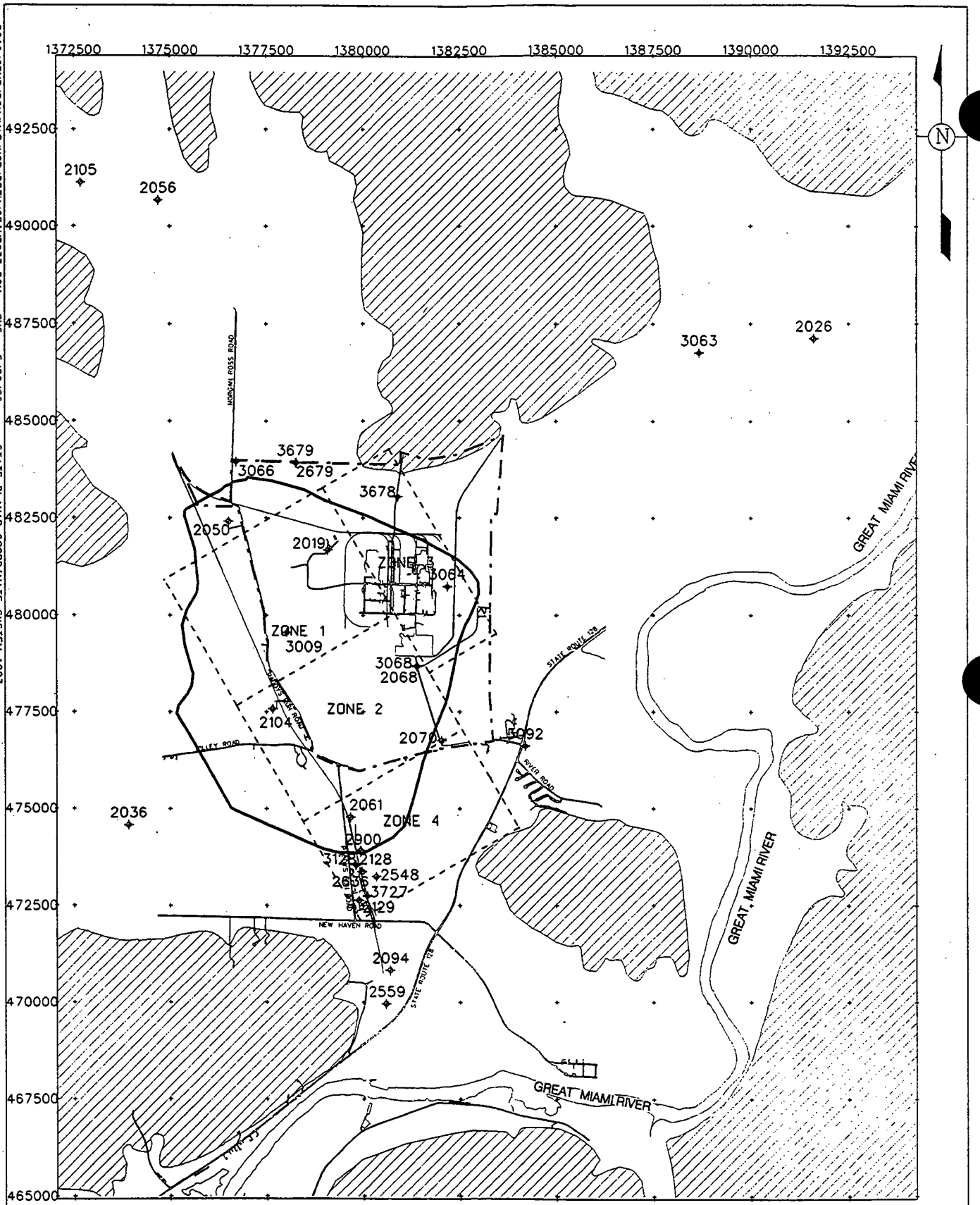


FIGURE A-5. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ANTIMONY



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE
3500 1750 0 3500 FEET

FINAL

FIGURE A-6. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ARSENIC

DGIS/CRU5/DGN/MAP/HOR/DPTH/C51MP033.DGN OU5 5/20/96 STATE PLANAR COORDINATE SYSTEM 1927

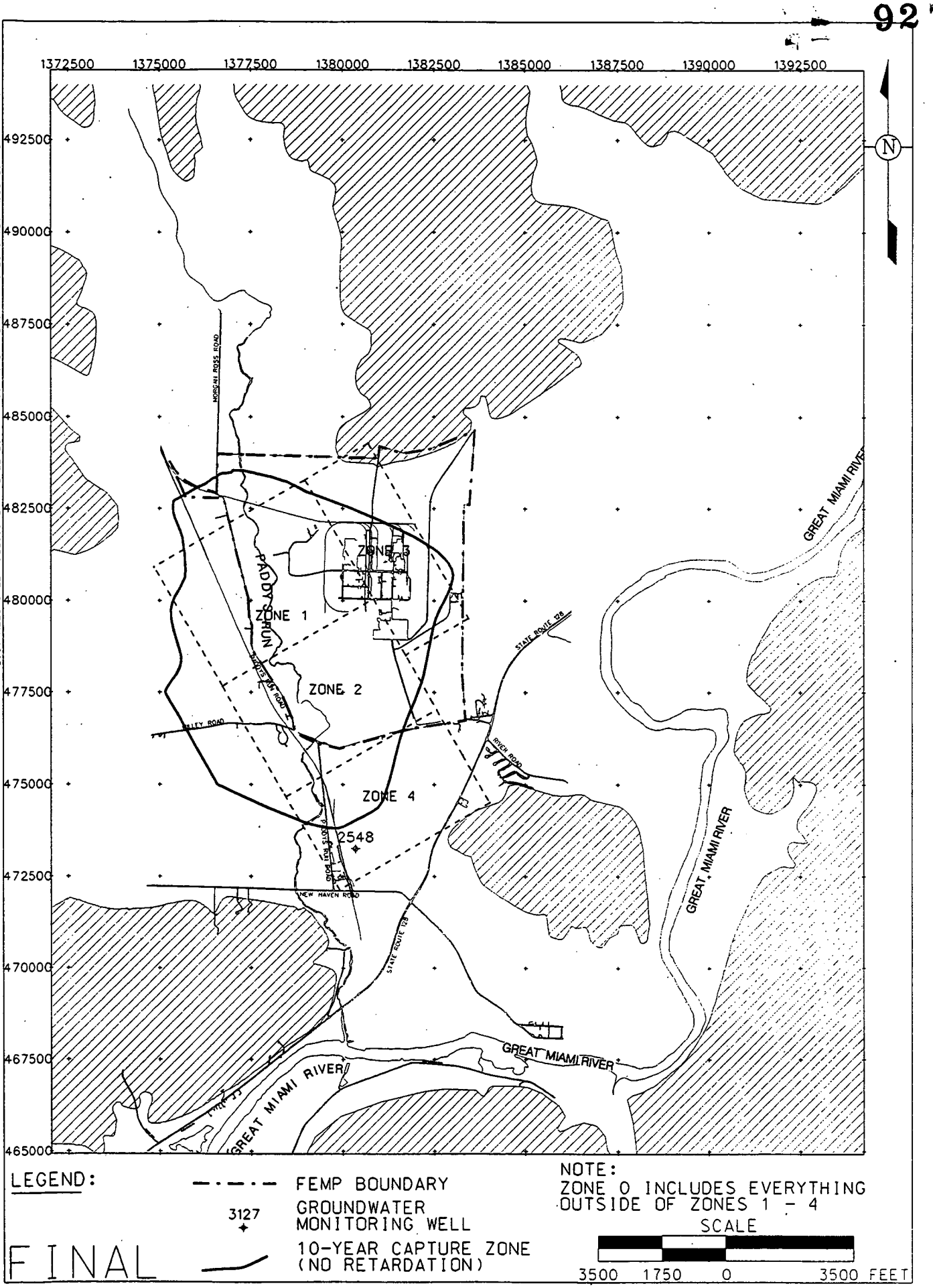


FIGURE A-7. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BARIUM

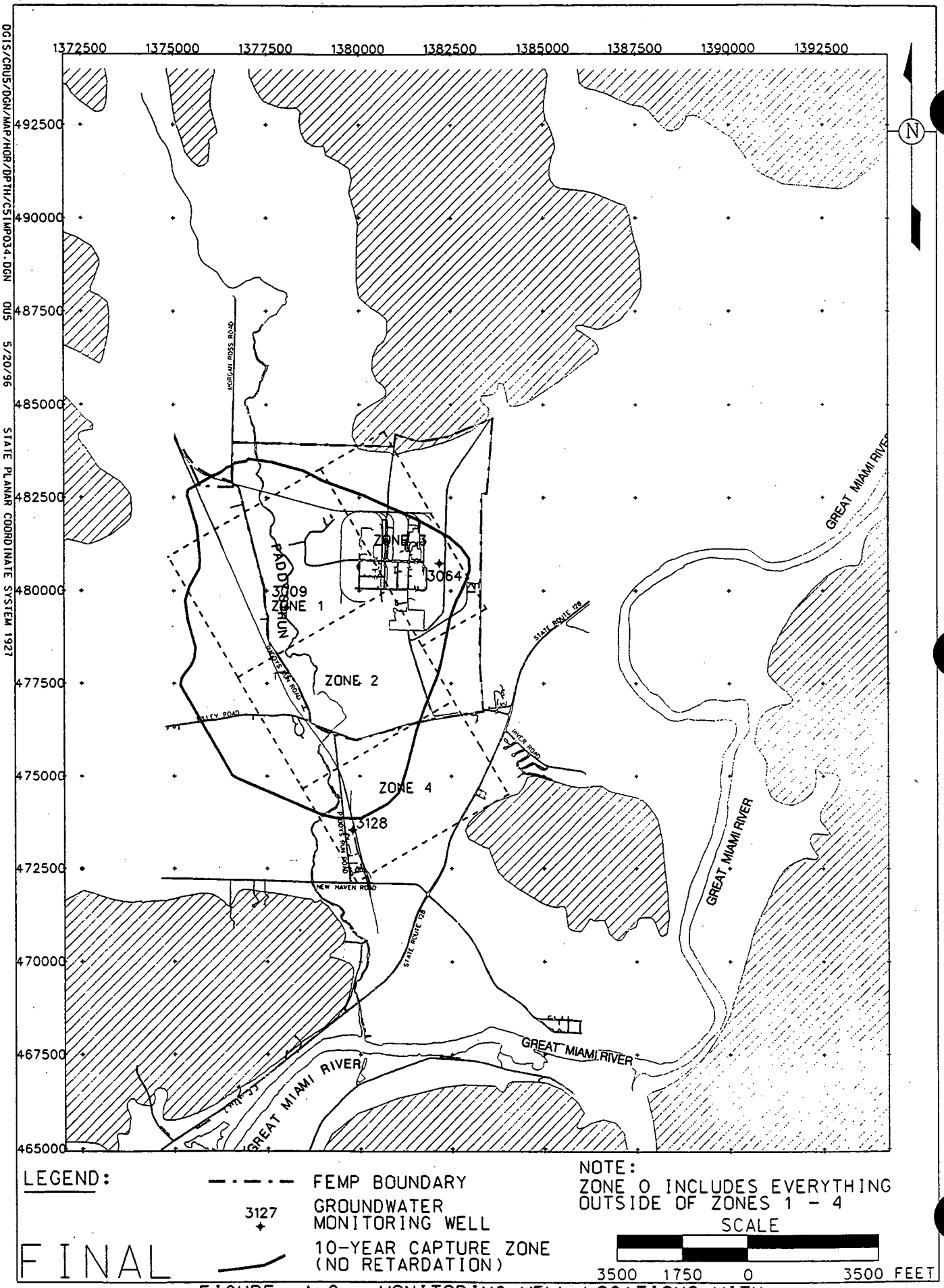


FIGURE A-8. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BERYLLIUM

DGIS/CRU5/DGN/MAP/HOR/DPTH/C51MP034.DGN OU5 5/20/96 STATE PLANAR COORDINATE SYSTEM 1927

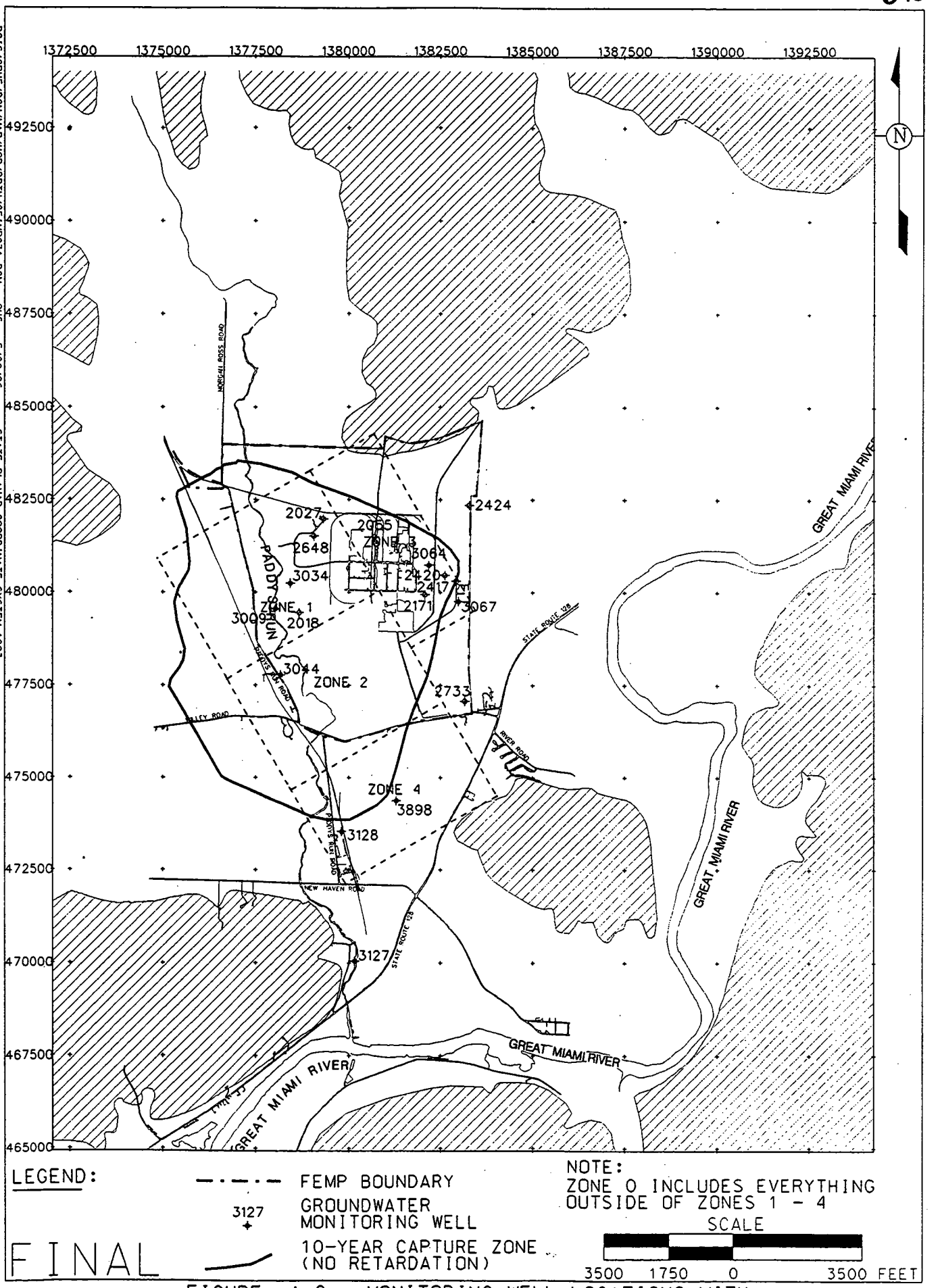


FIGURE A-9. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CADMIUM

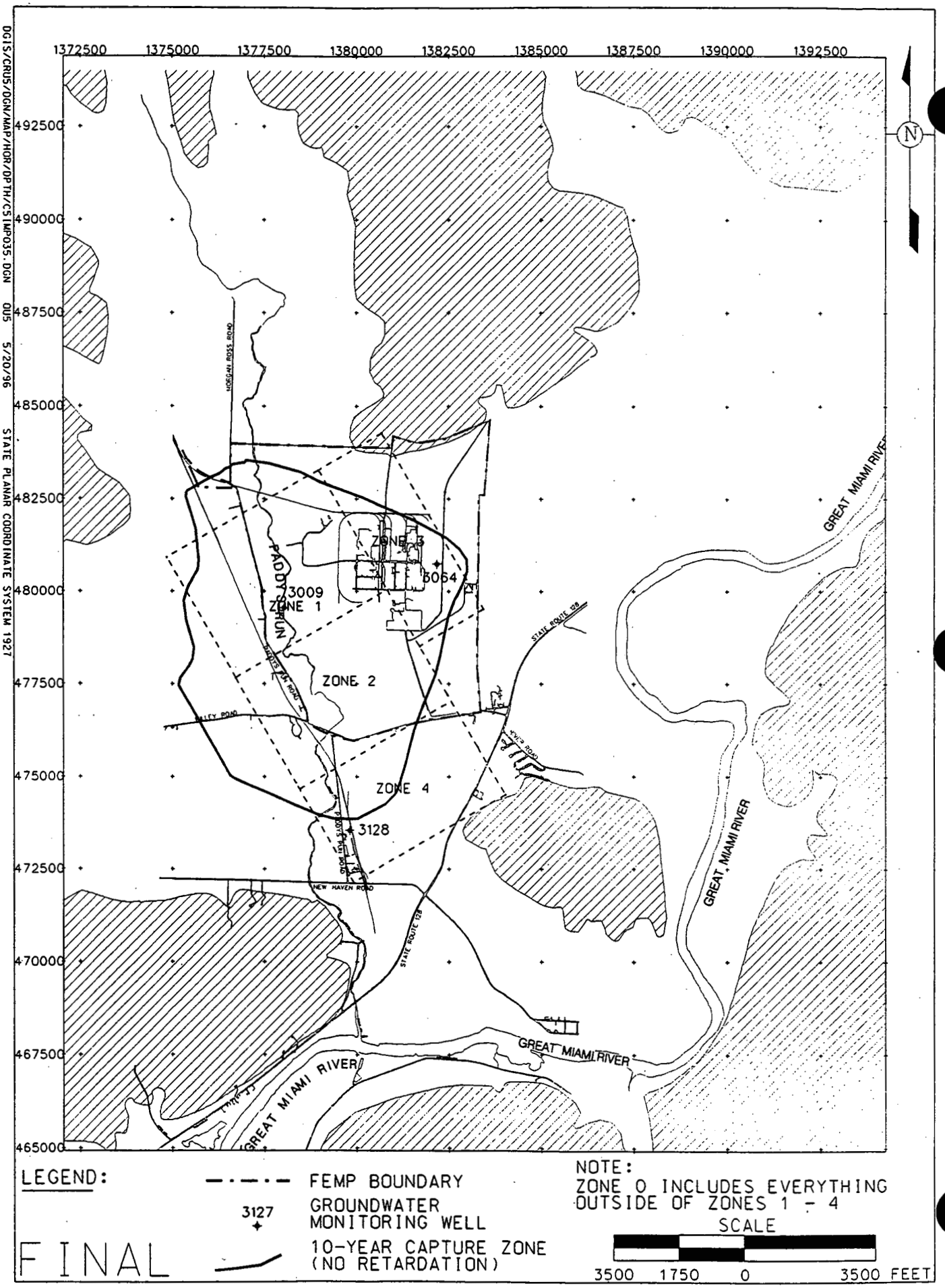
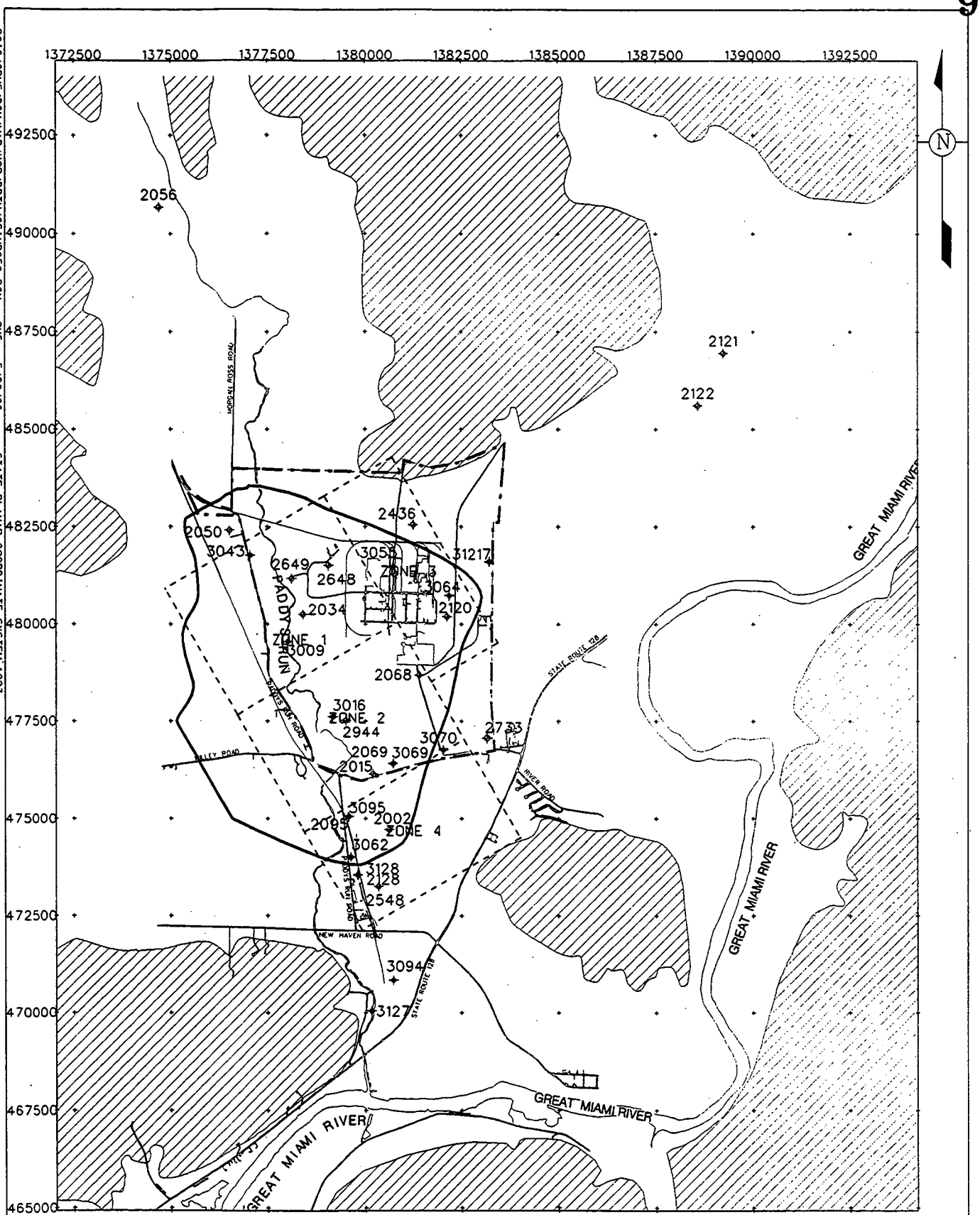


FIGURE A-10. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR COBALT



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

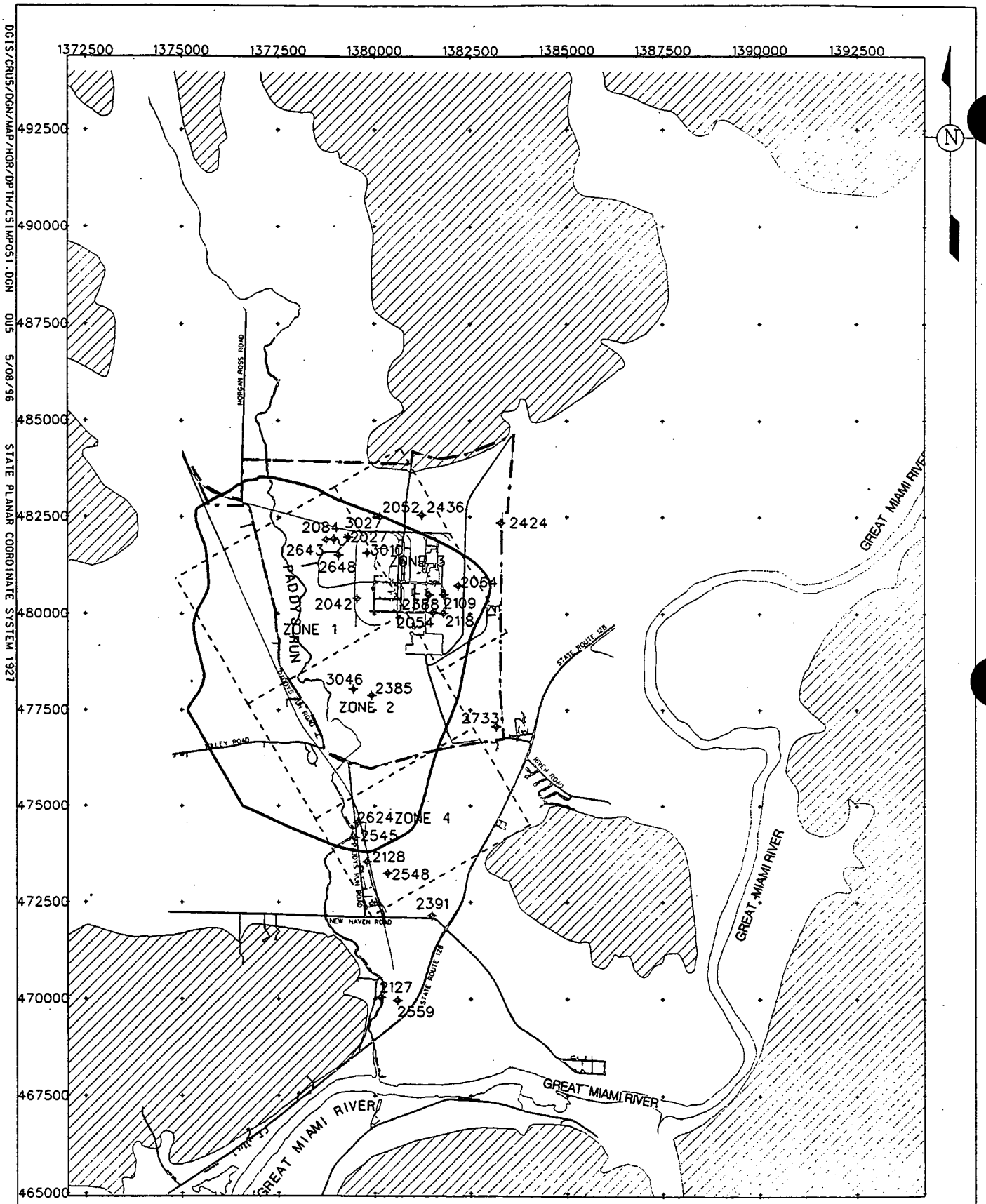
NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-11. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR LEAD



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

FINAL

DGIS/CRUS/DGN/MAP/HOR/DPTH/C51MP051.DGN OU5 5/08/96 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE A-12. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MANGANESE

000310

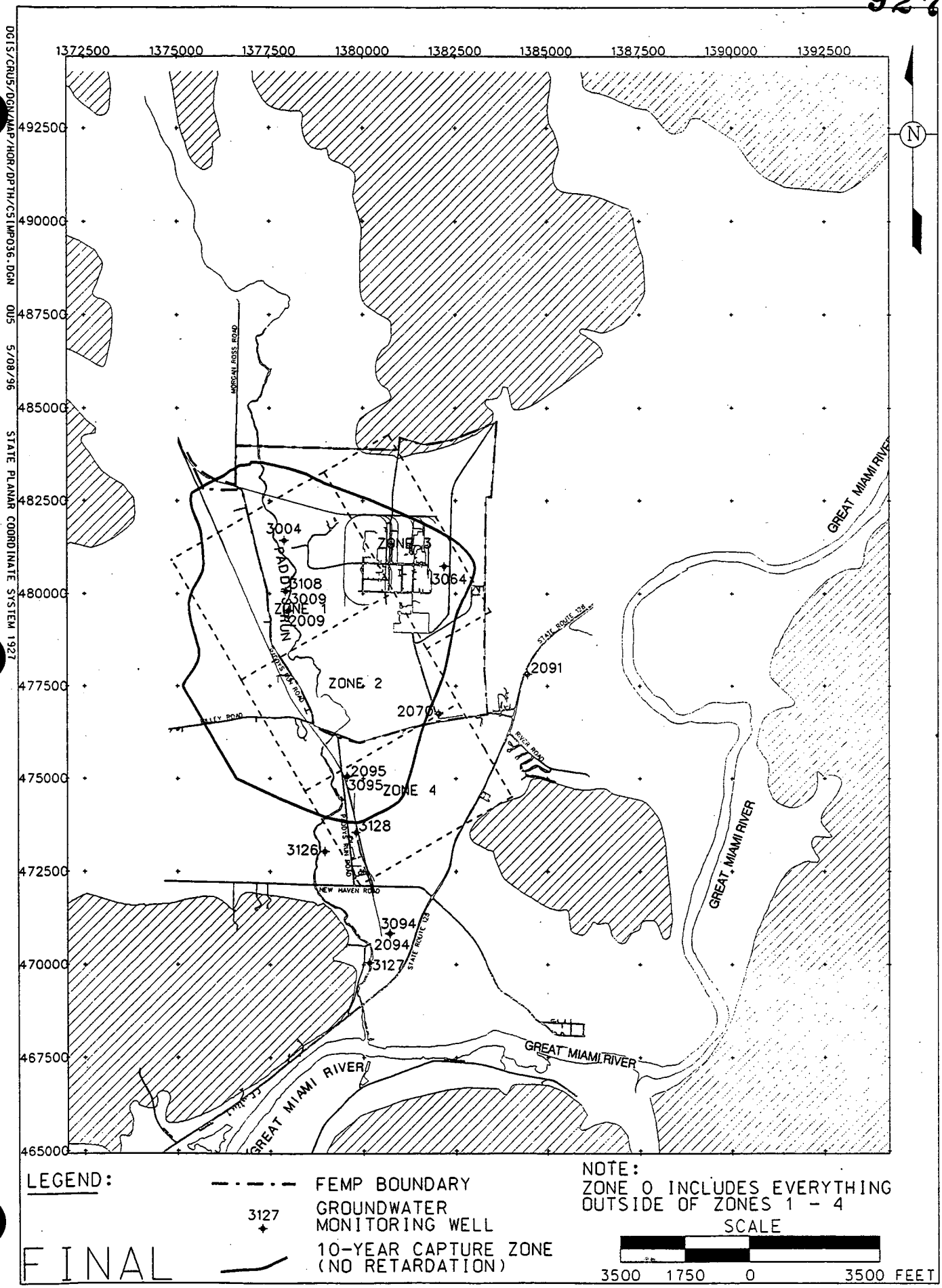


FIGURE A-13. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MERCURY

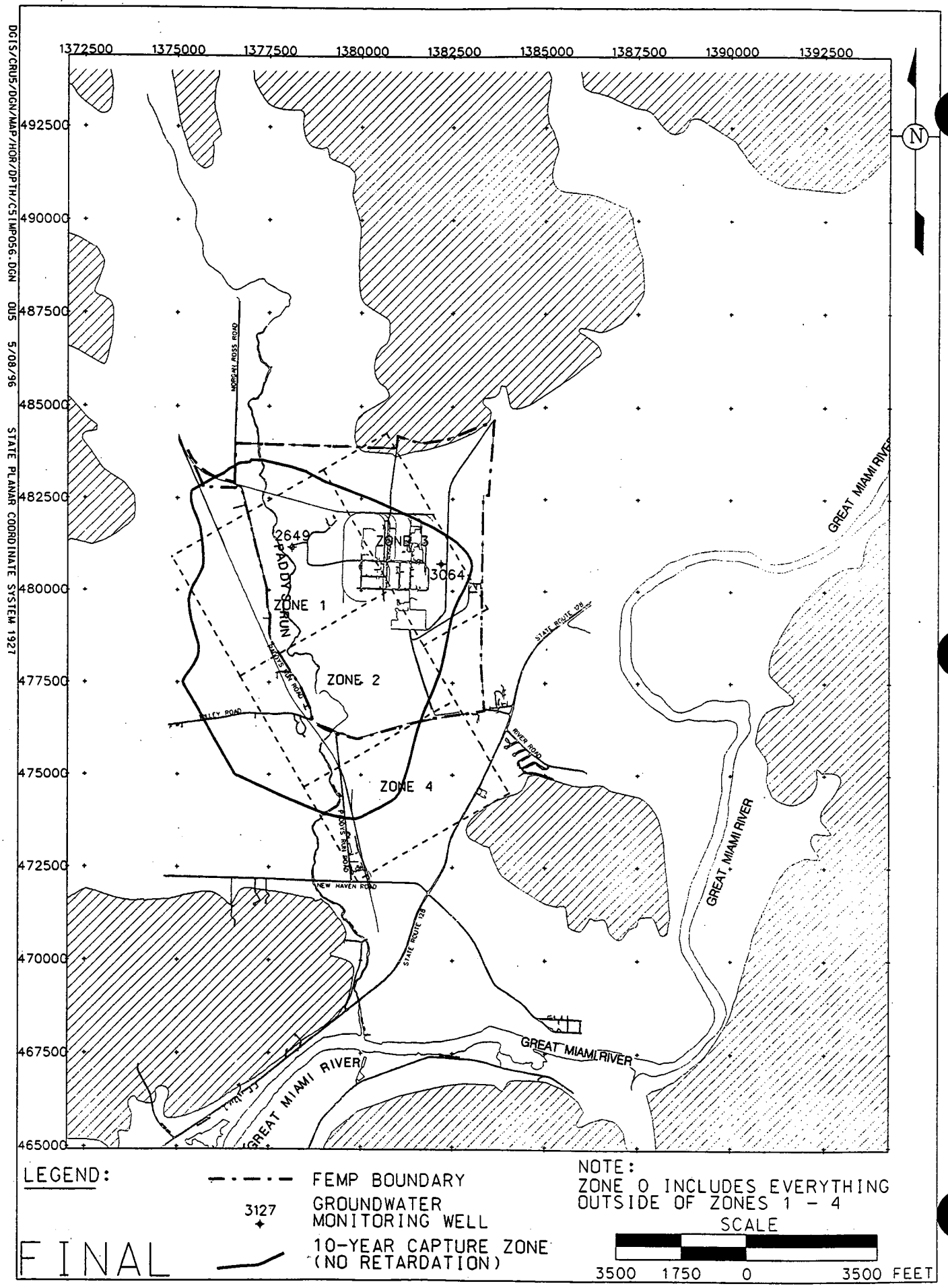
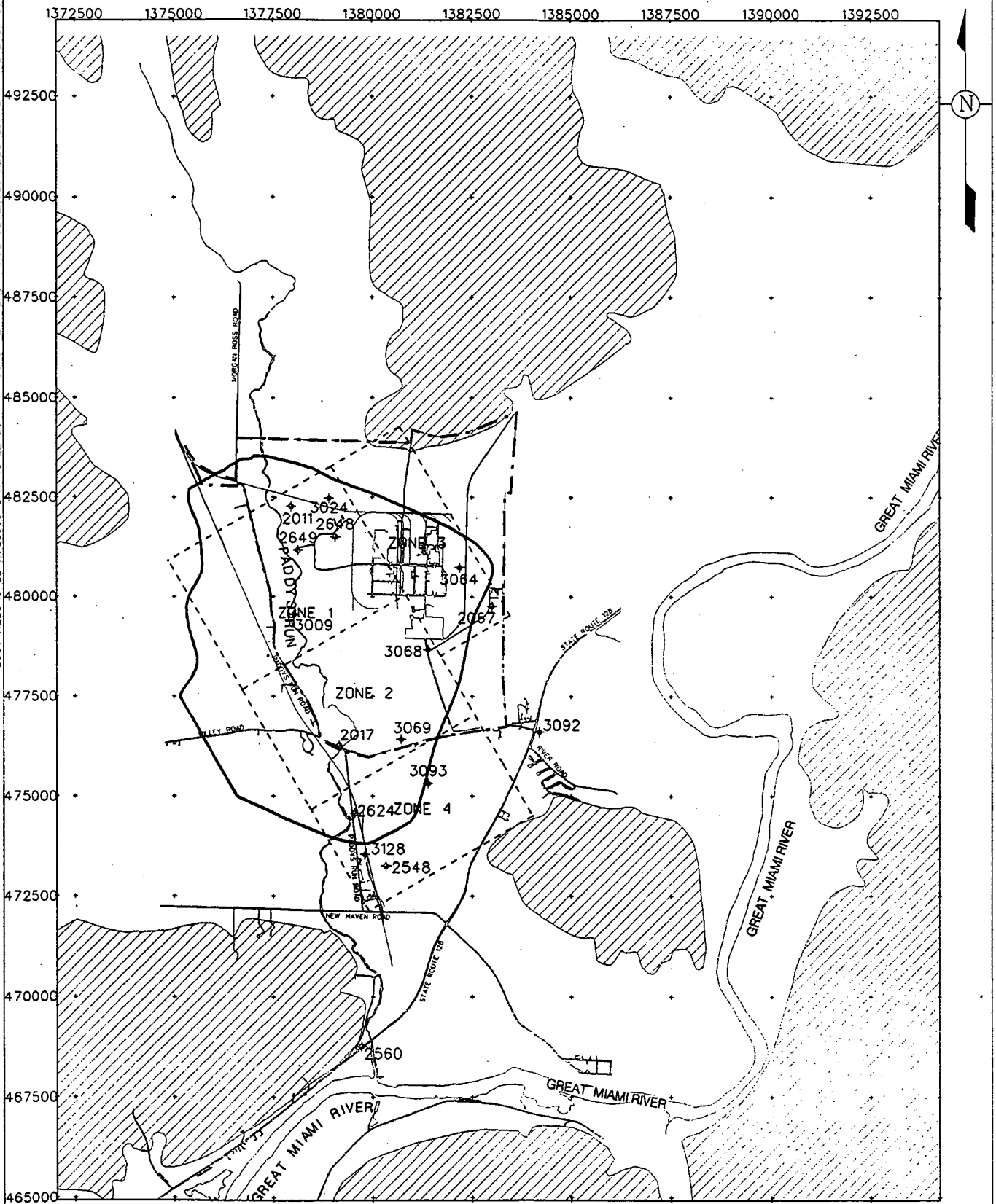


FIGURE A-14. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MOLYBDENUM

DGIS/CRU5/DGN/MAP/HOR/DPTH/C5IMP052.DGN OU5 5/08/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-15. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NICKEL

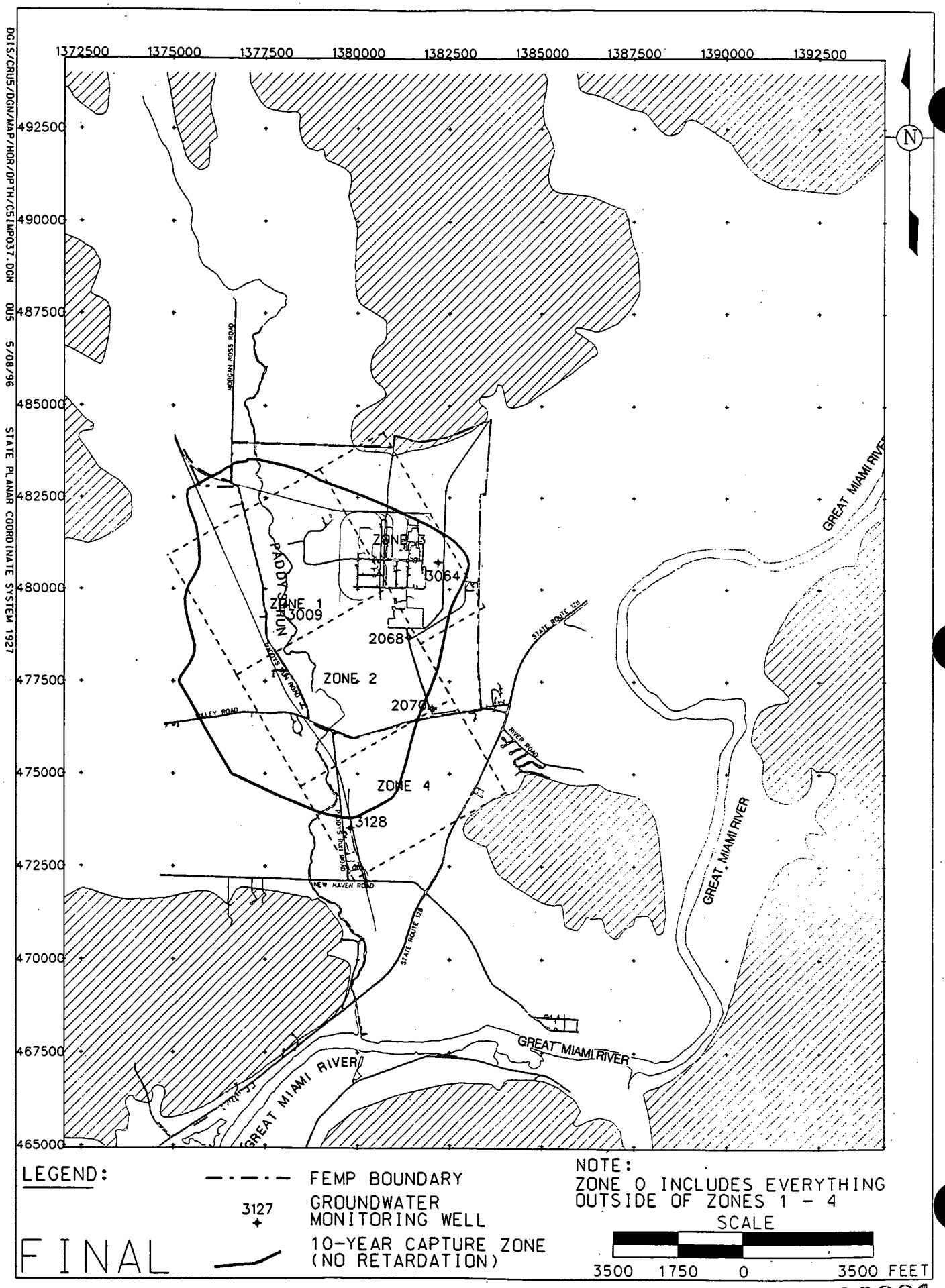


FIGURE A-16. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR SELENIUM

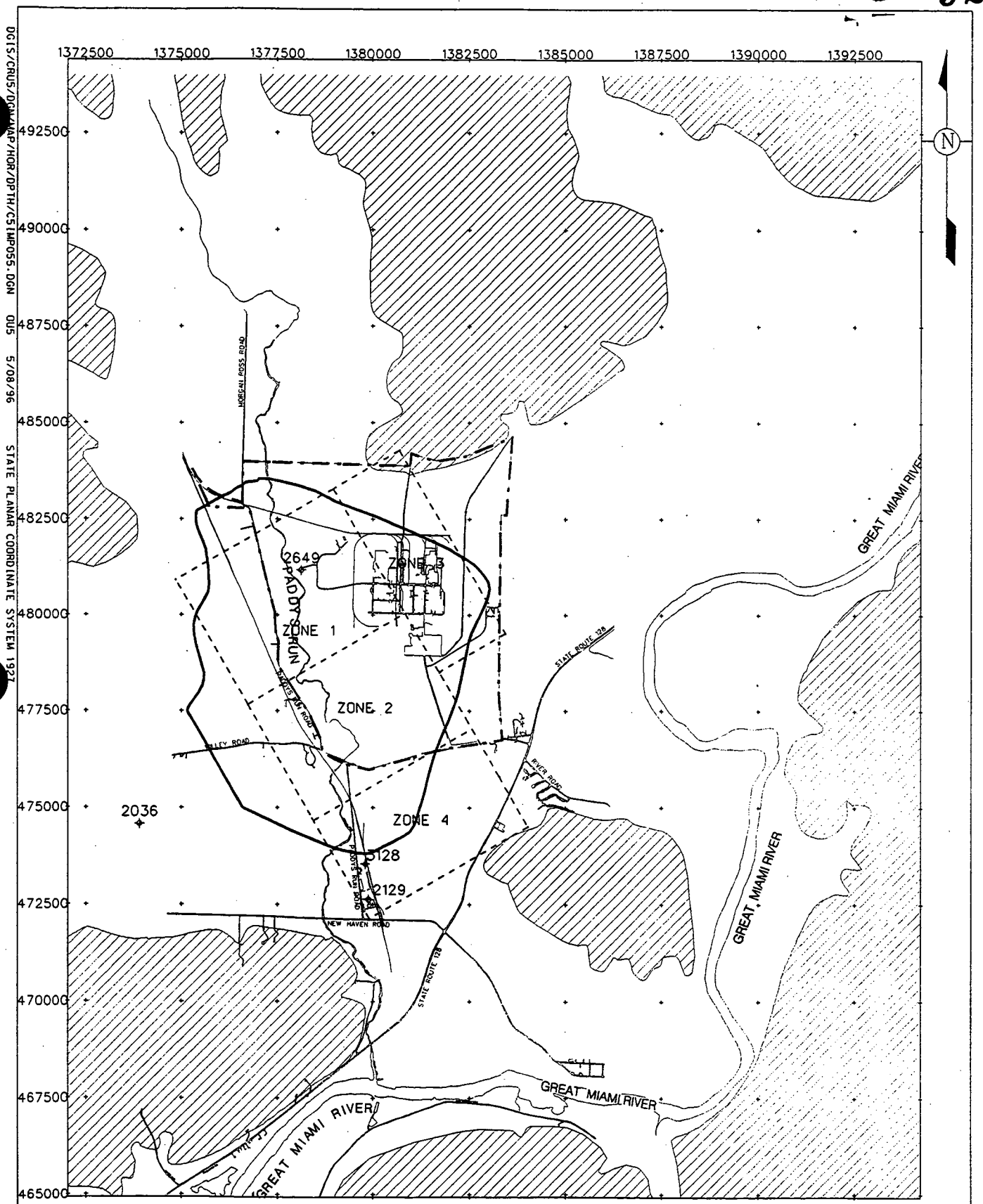


FIGURE A-17. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR SILVER

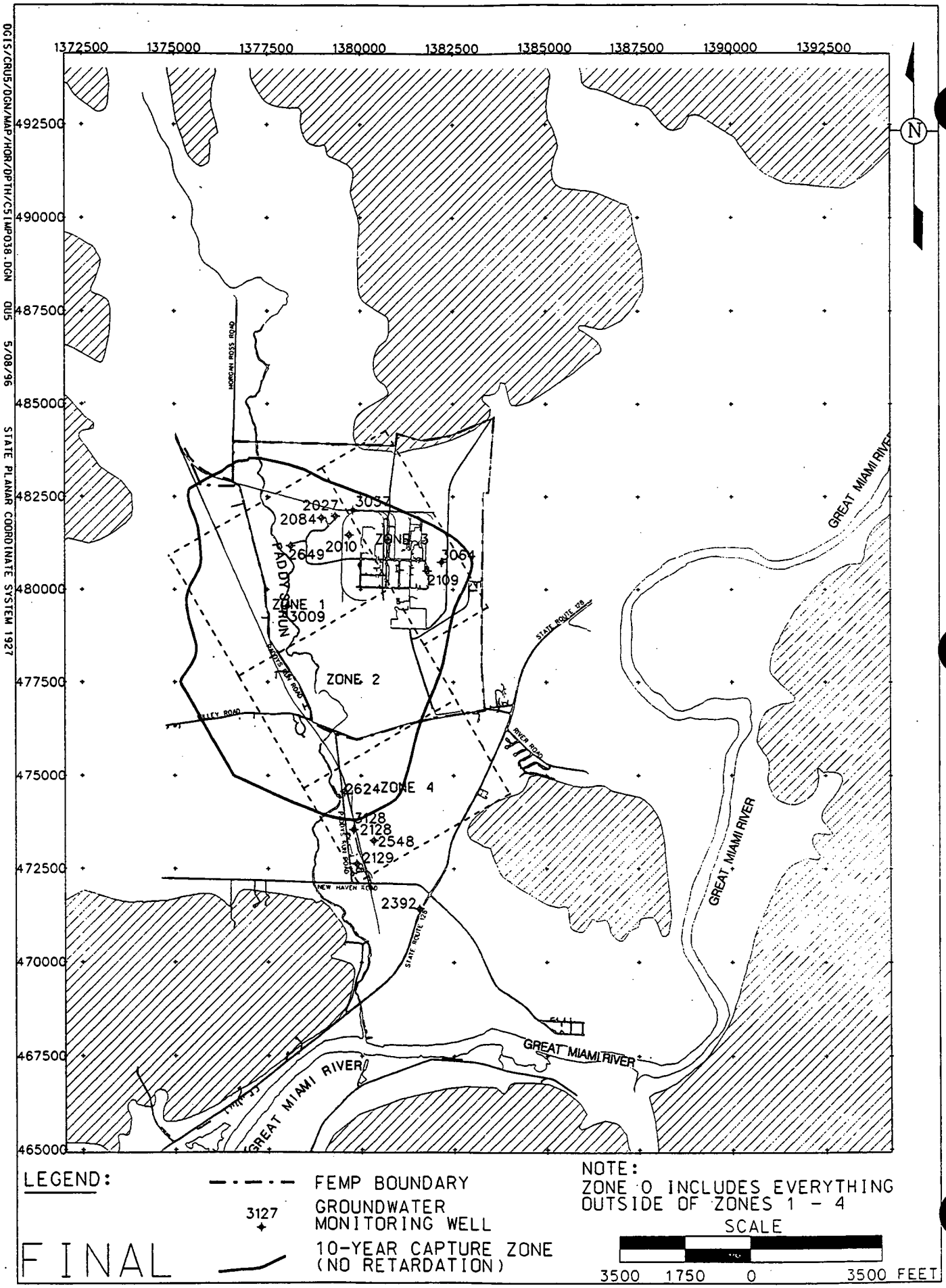


FIGURE A-18. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR VANADIUM

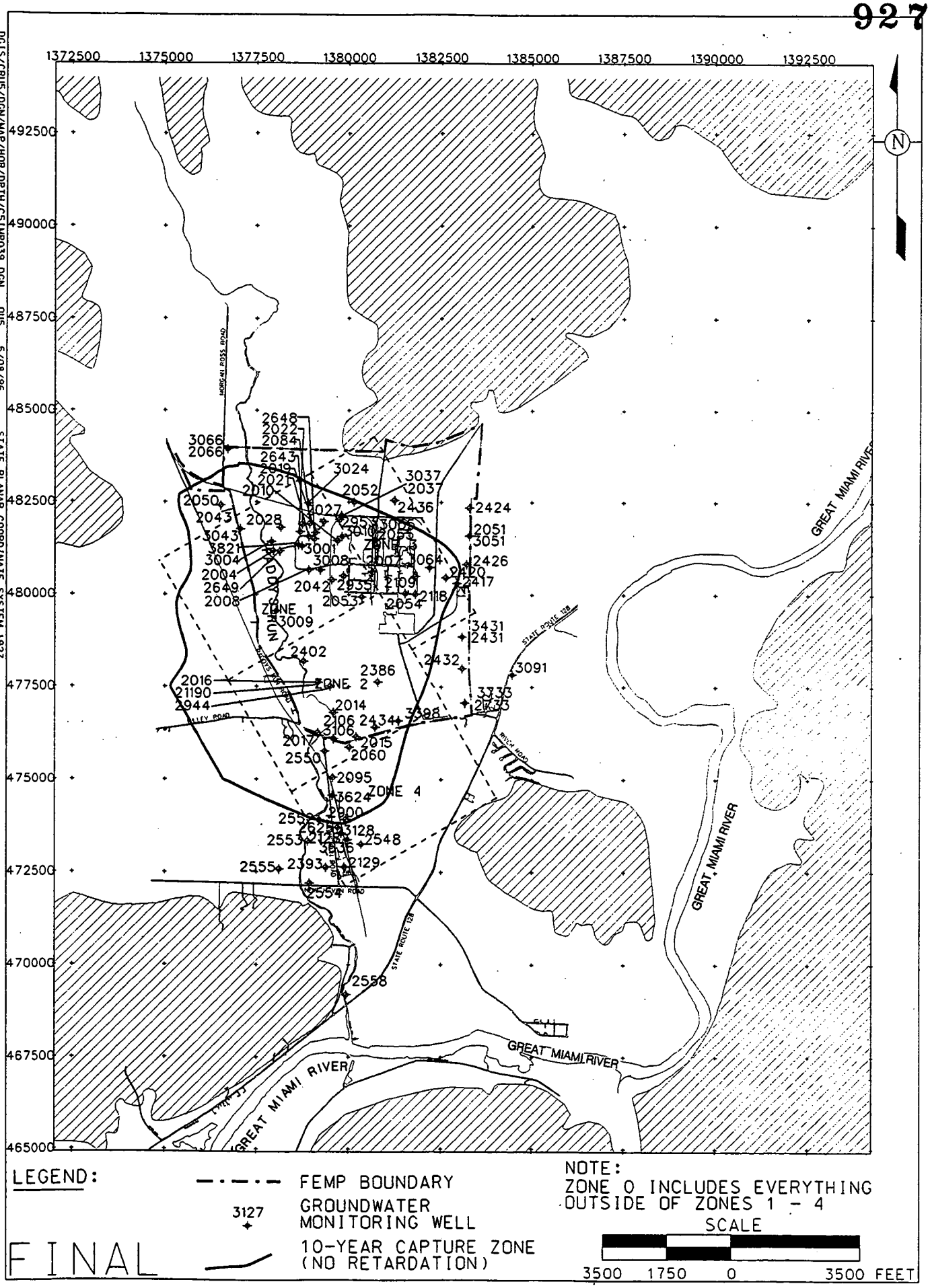


FIGURE A-19. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR ZINC

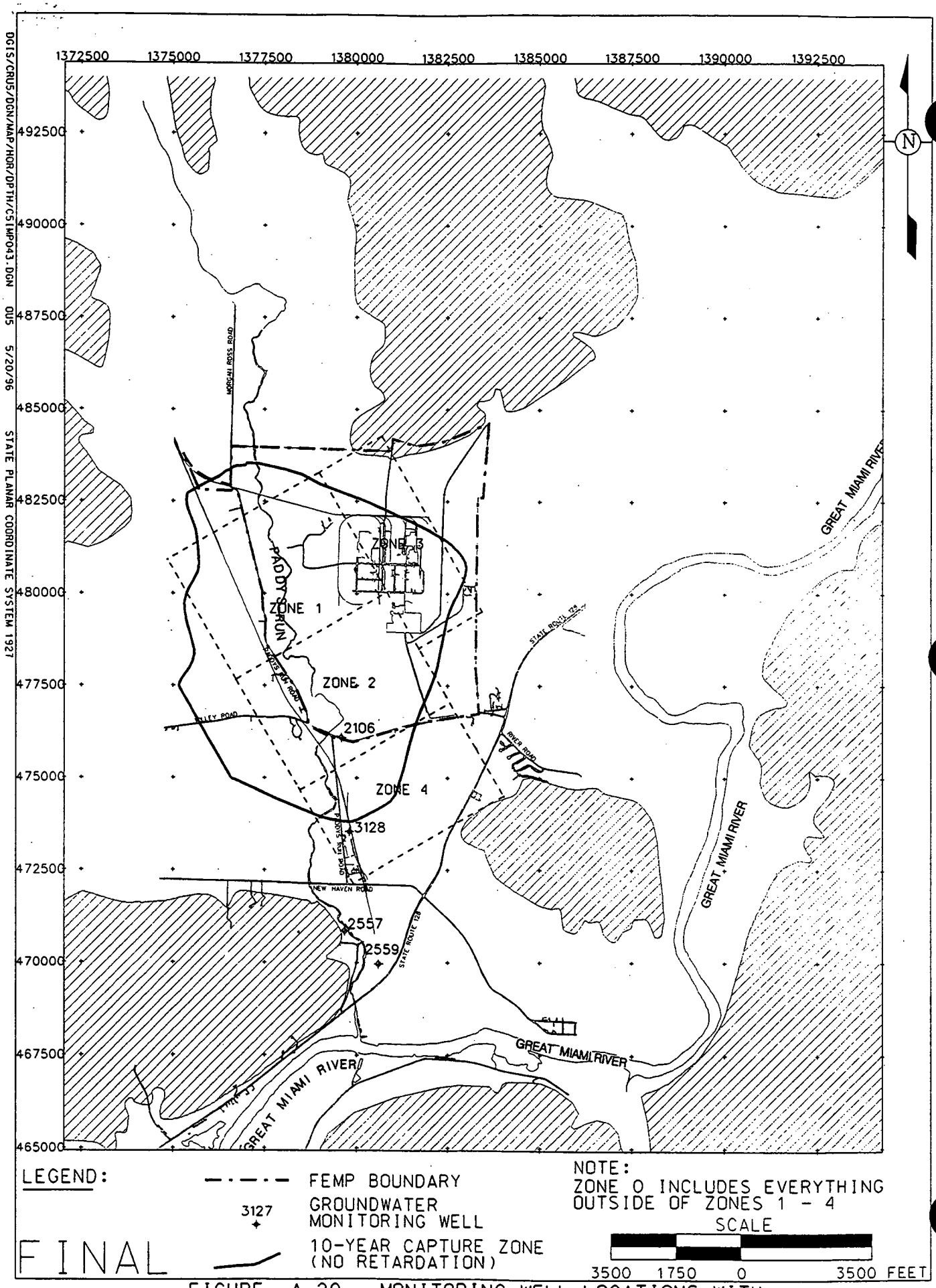


FIGURE A-20. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR NEPTUNIUM-237

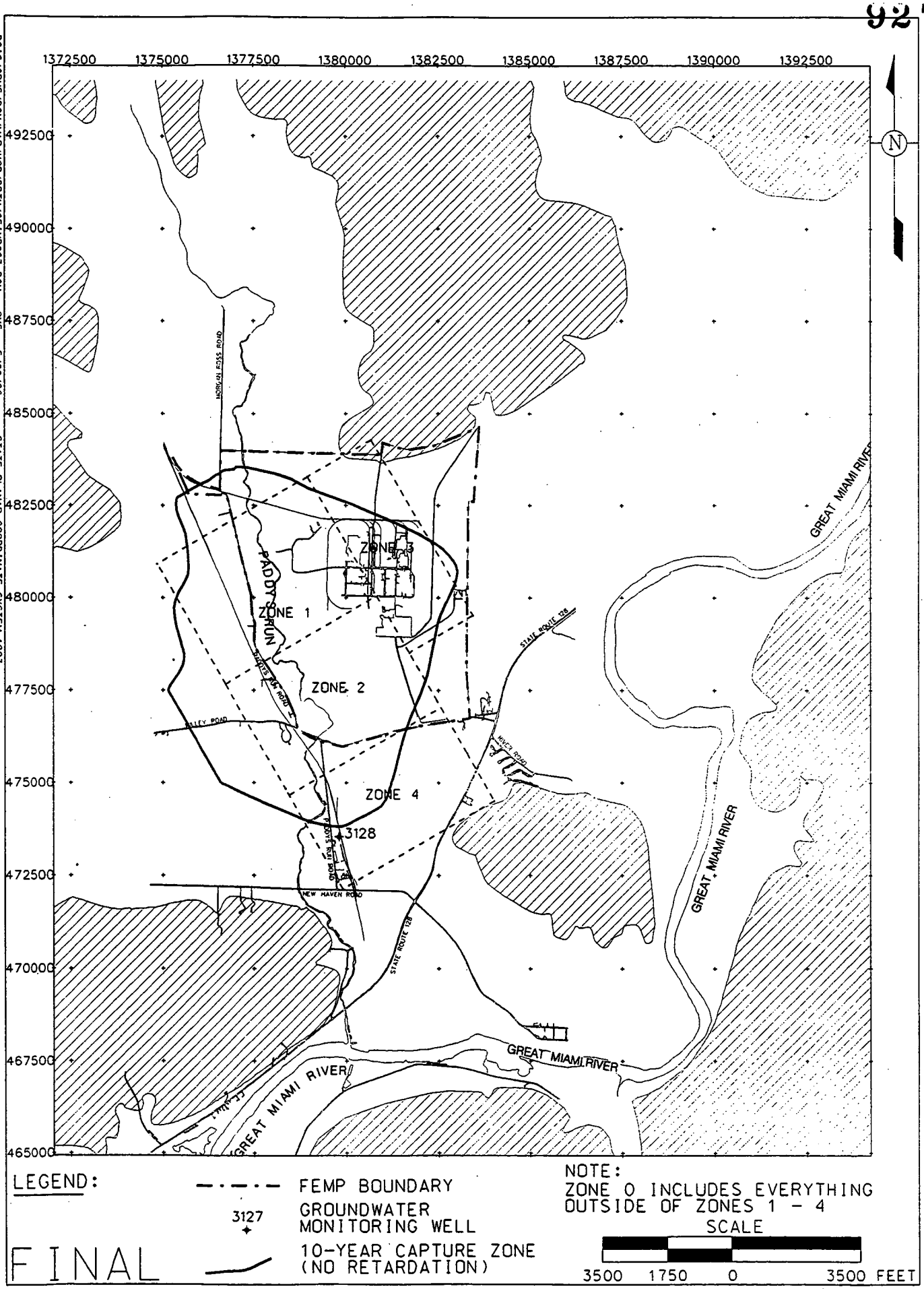


FIGURE A-21. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR RADIUM-226

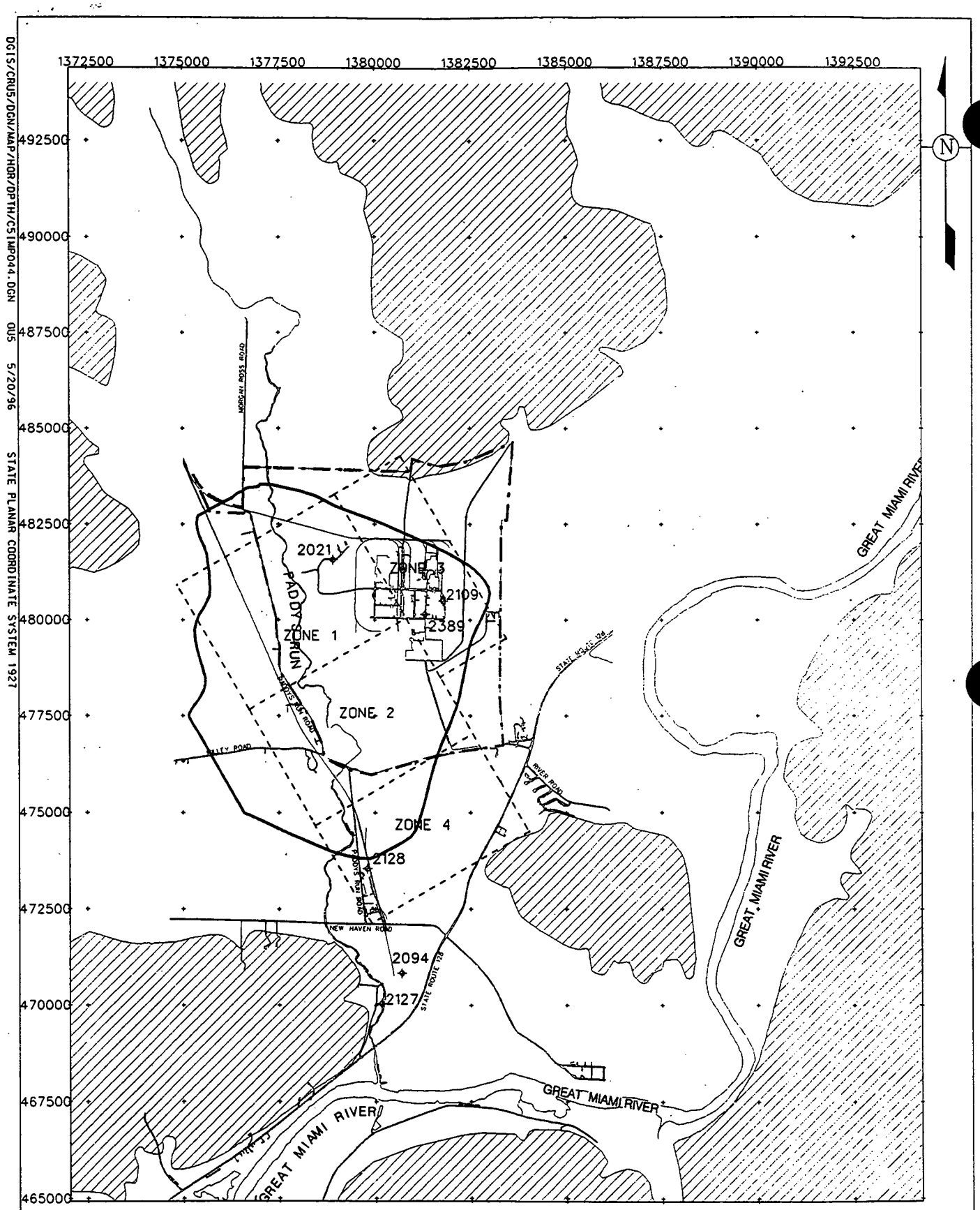
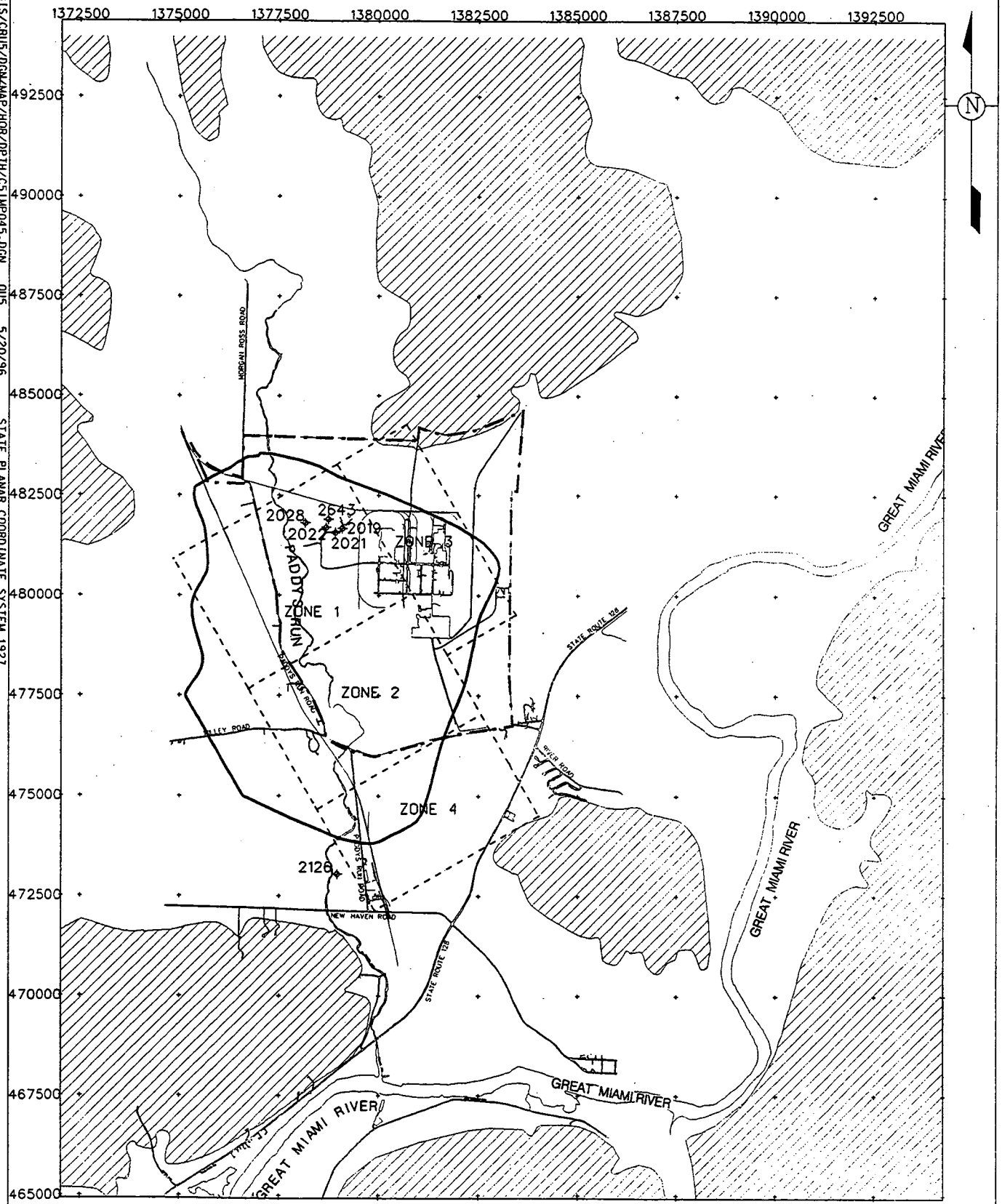


FIGURE A-22. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR STRONTIUM-90

DGIS/CRU5/DGN/MAP/HOR/DPTH/C51MP045.DGN OU5 5/20/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE
3500 1750 0 3500 FEET

FINAL

FIGURE A-23. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TECHNETIUM-99

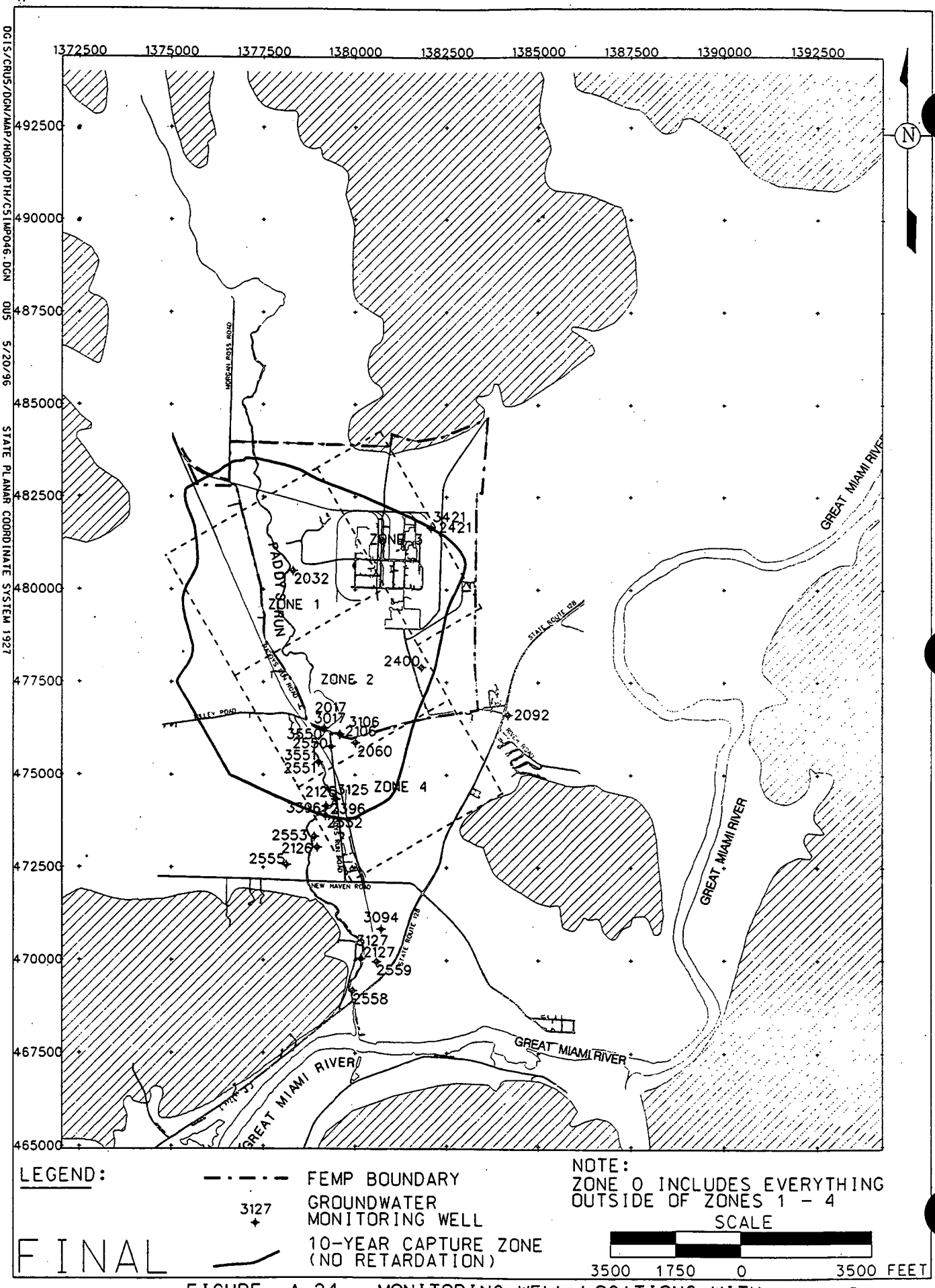
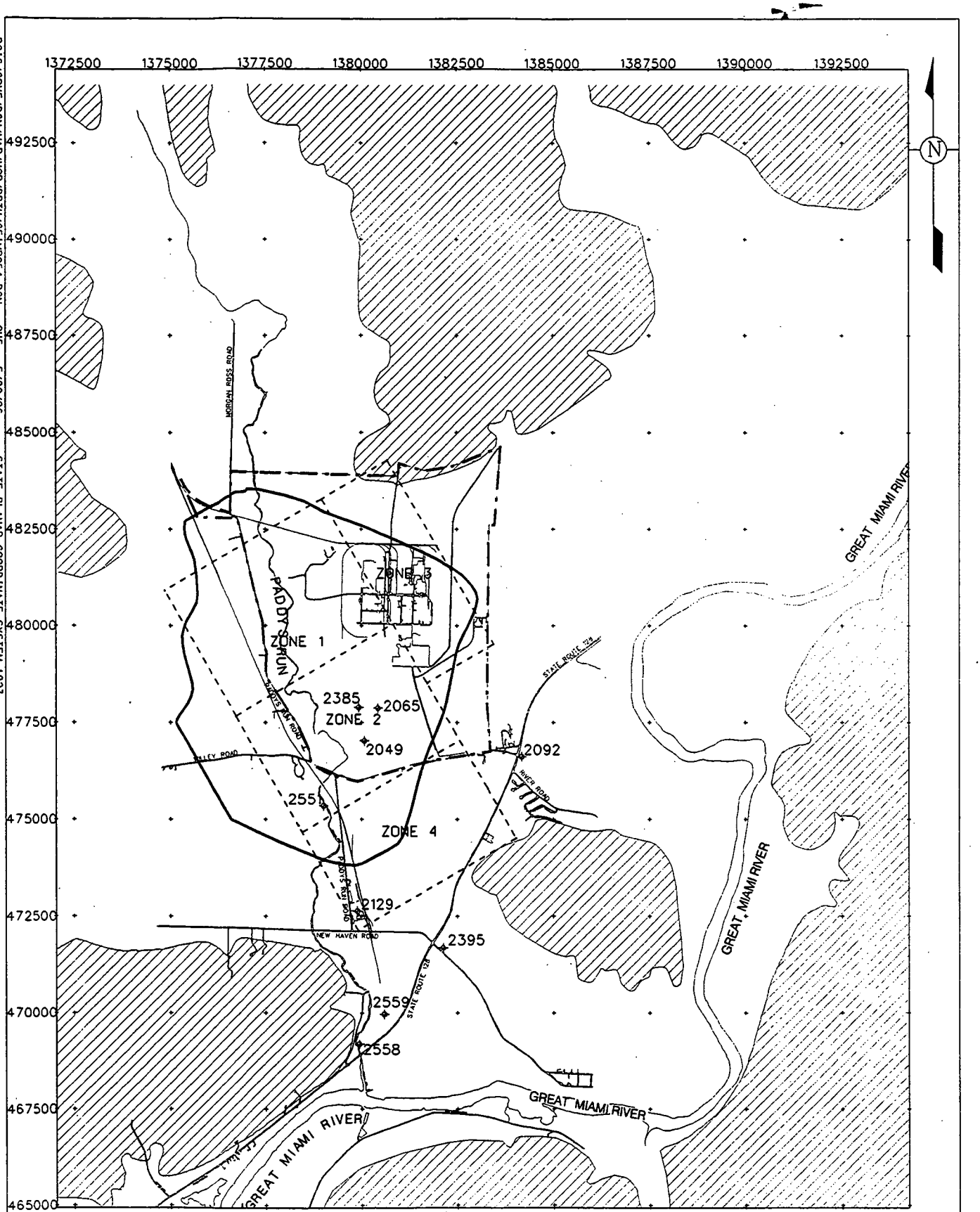


FIGURE A-24. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR THORIUM-228



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

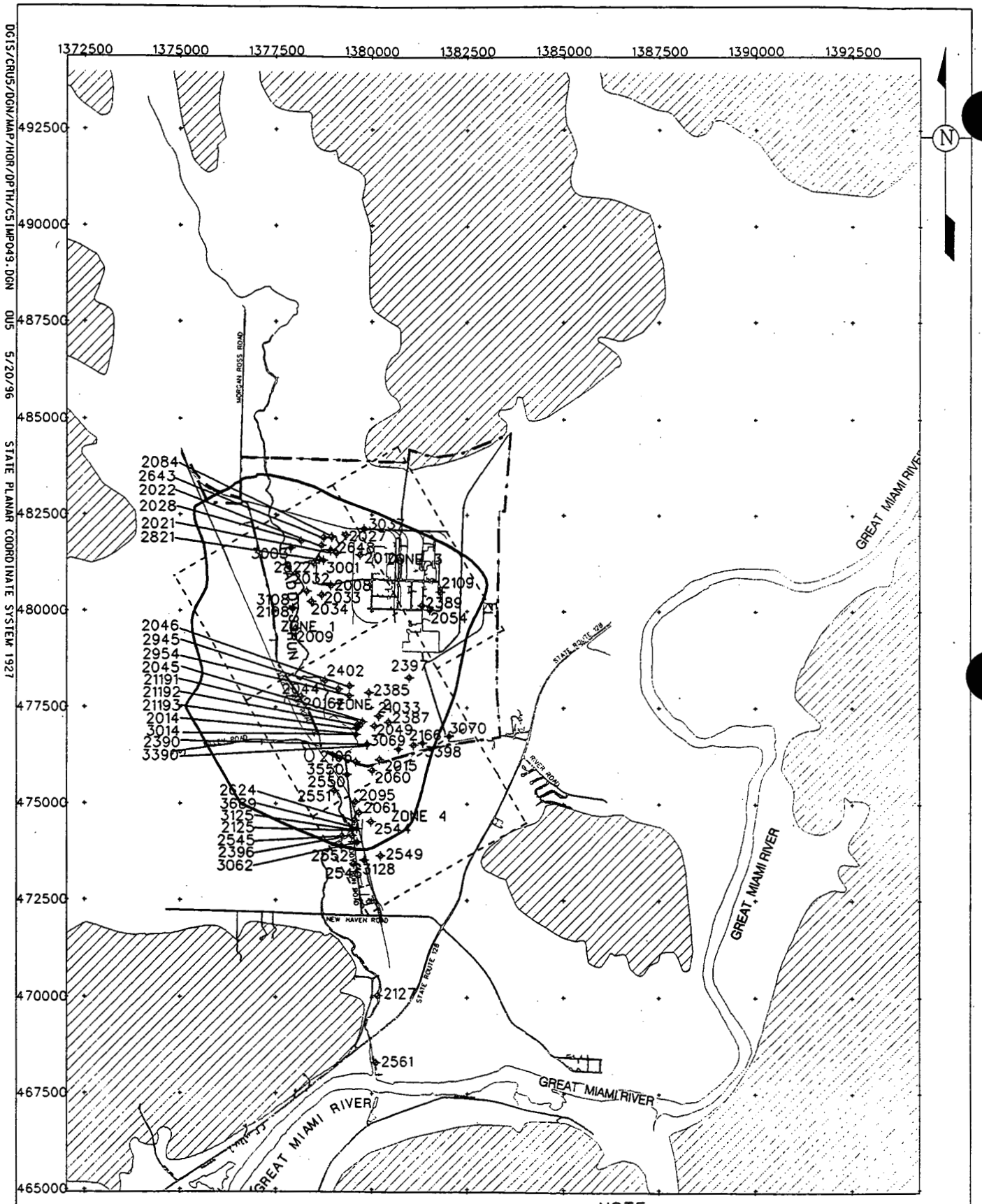
10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE
3500 1750 0 3500 FEET

FINAL

FIGURE A-25. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR THORIUM-232



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

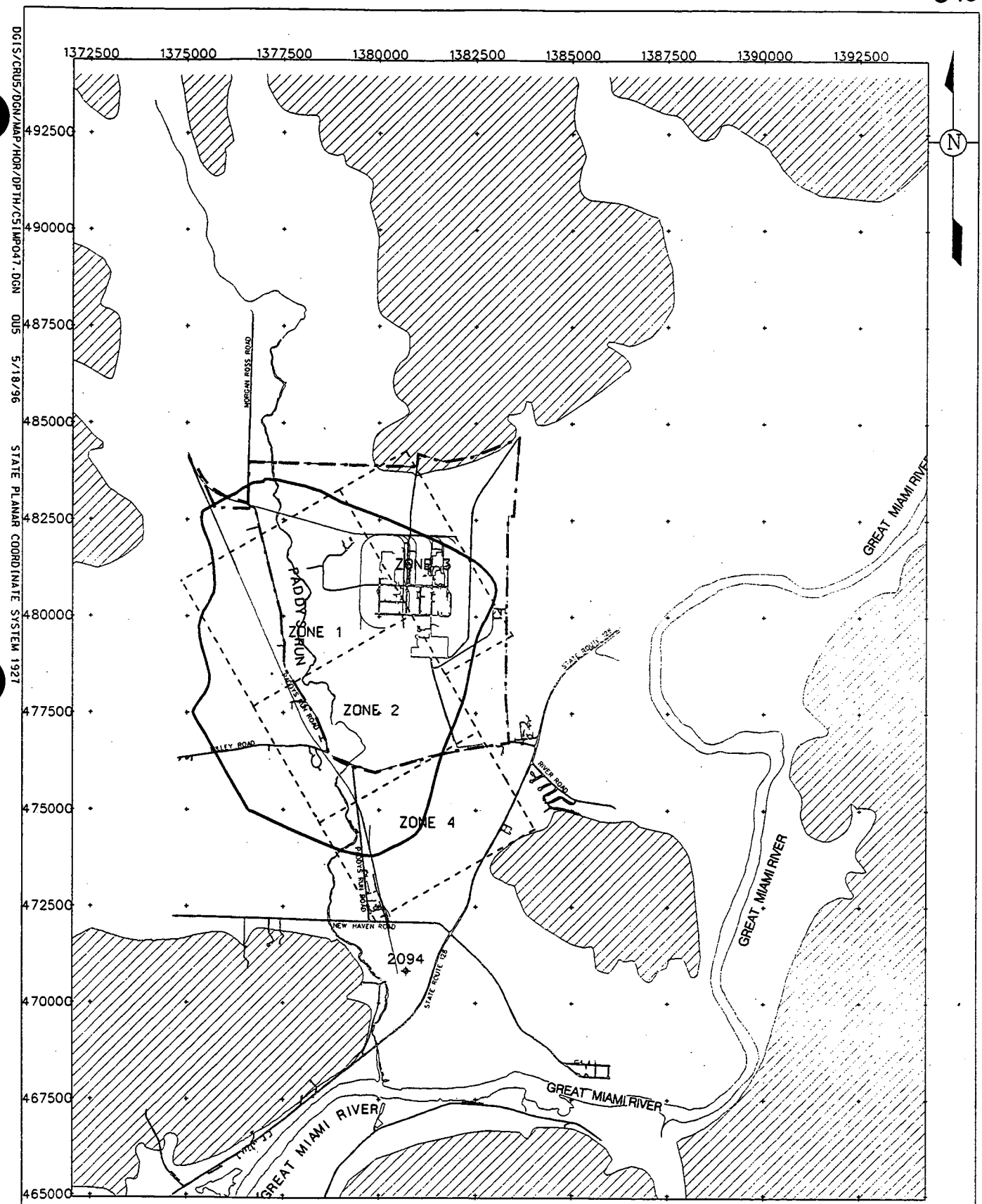
SCALE

3500 1750 0 3500 FEET

FINAL

FIGURE A-26. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TOTAL URANIUM

DGIS/CRUS/DGN/MAP/HOR/DPTH/CSIMP049.DGN OU5 5/20/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE
3500 1750 0 3500 FEET

FINAL

FIGURE A-27. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BENZENE

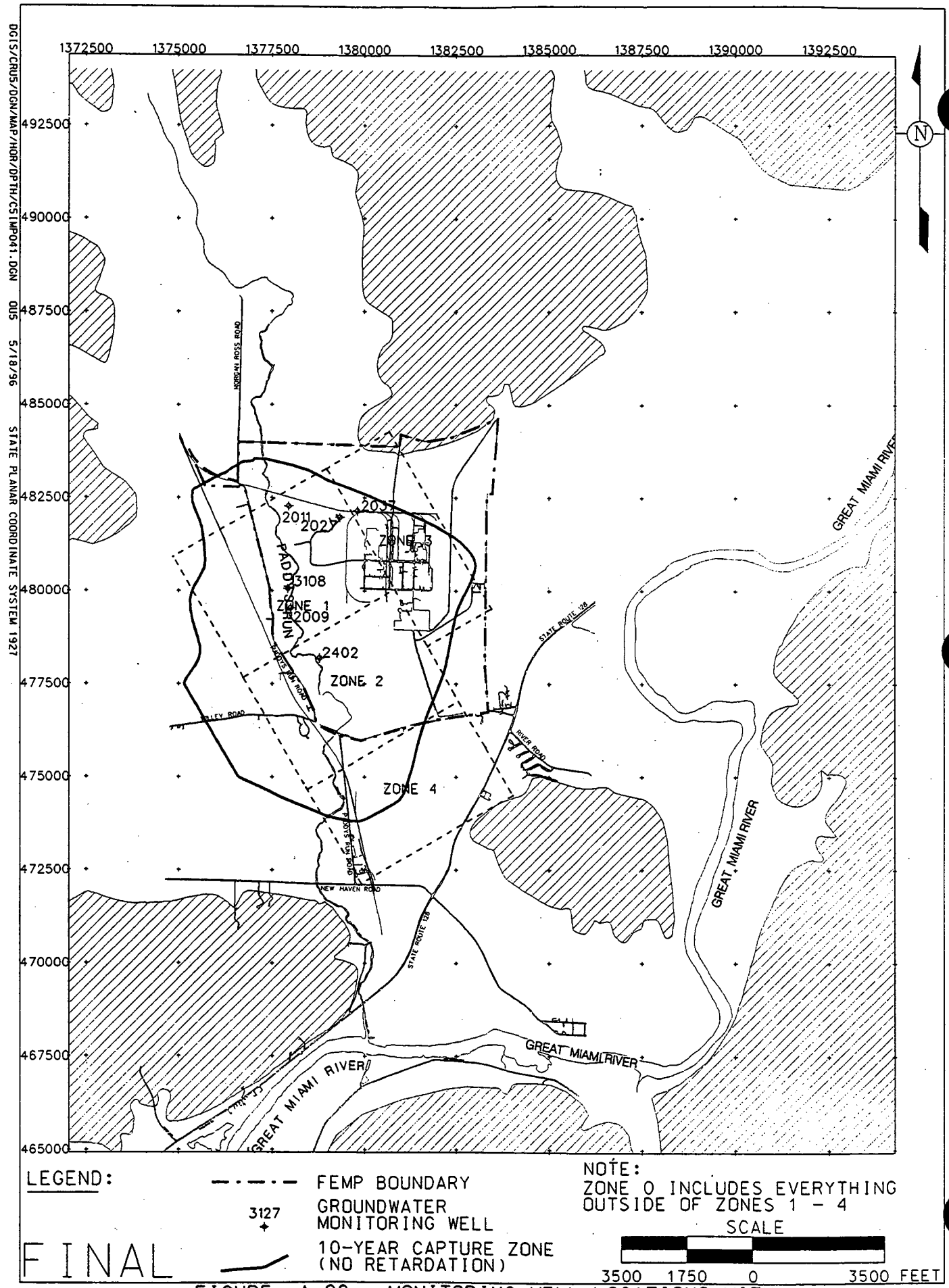


FIGURE A-28. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CARBON DISULFIDE

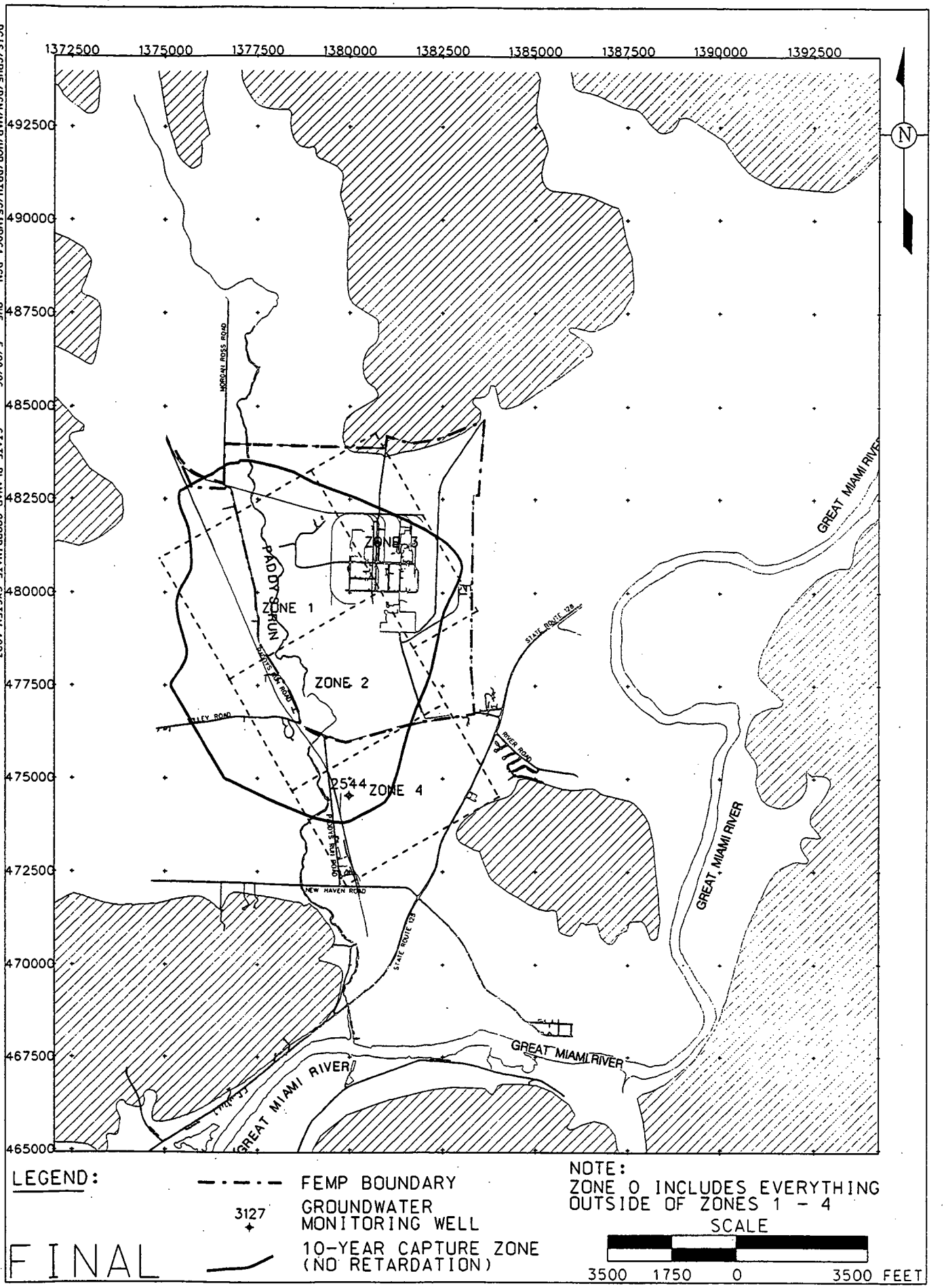


FIGURE A-29. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR 1,1-DICHLOROETHENE

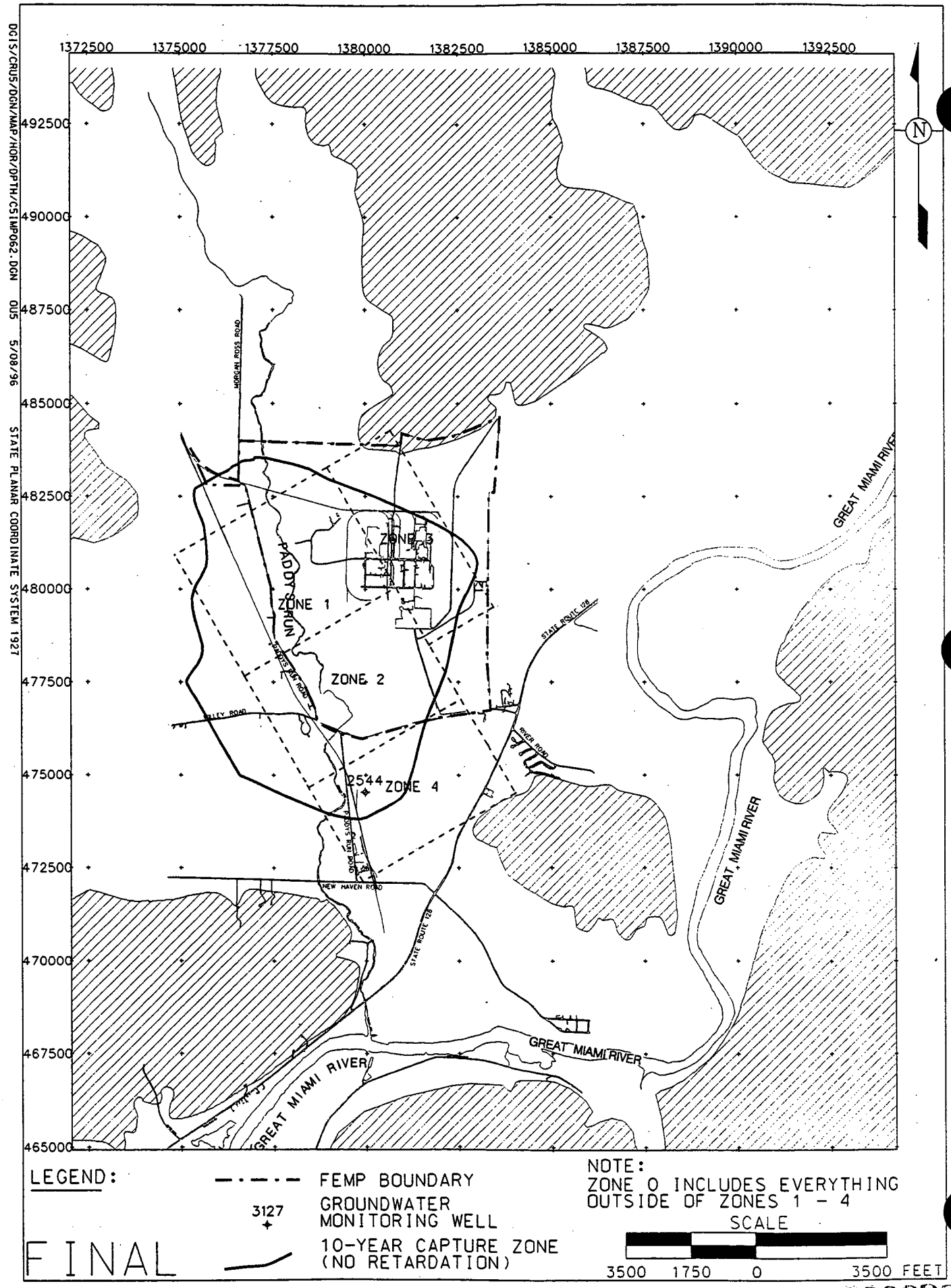
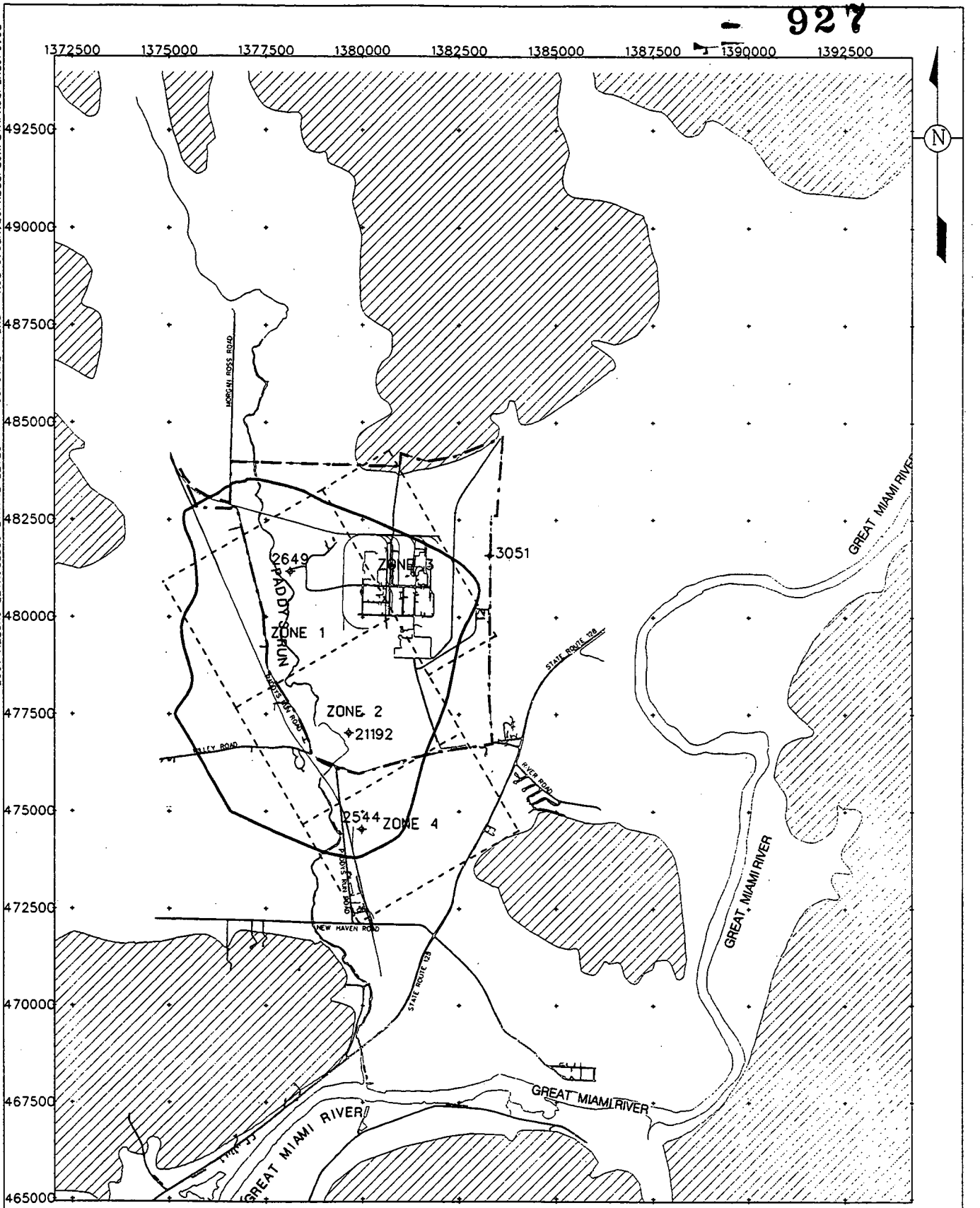


FIGURE A-30. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR 1,2-DICHLOROETHANE



LEGEND:

FEMP BOUNDARY

3127 GROUNDWATER MONITORING WELL

10-YEAR CAPTURE ZONE (NO RETARDATION)

NOTE:
ZONE 0 INCLUDES EVERYTHING OUTSIDE OF ZONES 1 - 4

SCALE
3500 1750 0 3500 FEET

FINAL

DGIS/CRU5/DGN/MAP/HOR/DPTH/C51MP048.DGN OU5 5/18/96 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE A-31. MONITORING WELL LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TRICHLOROETHENE

APPENDIX B

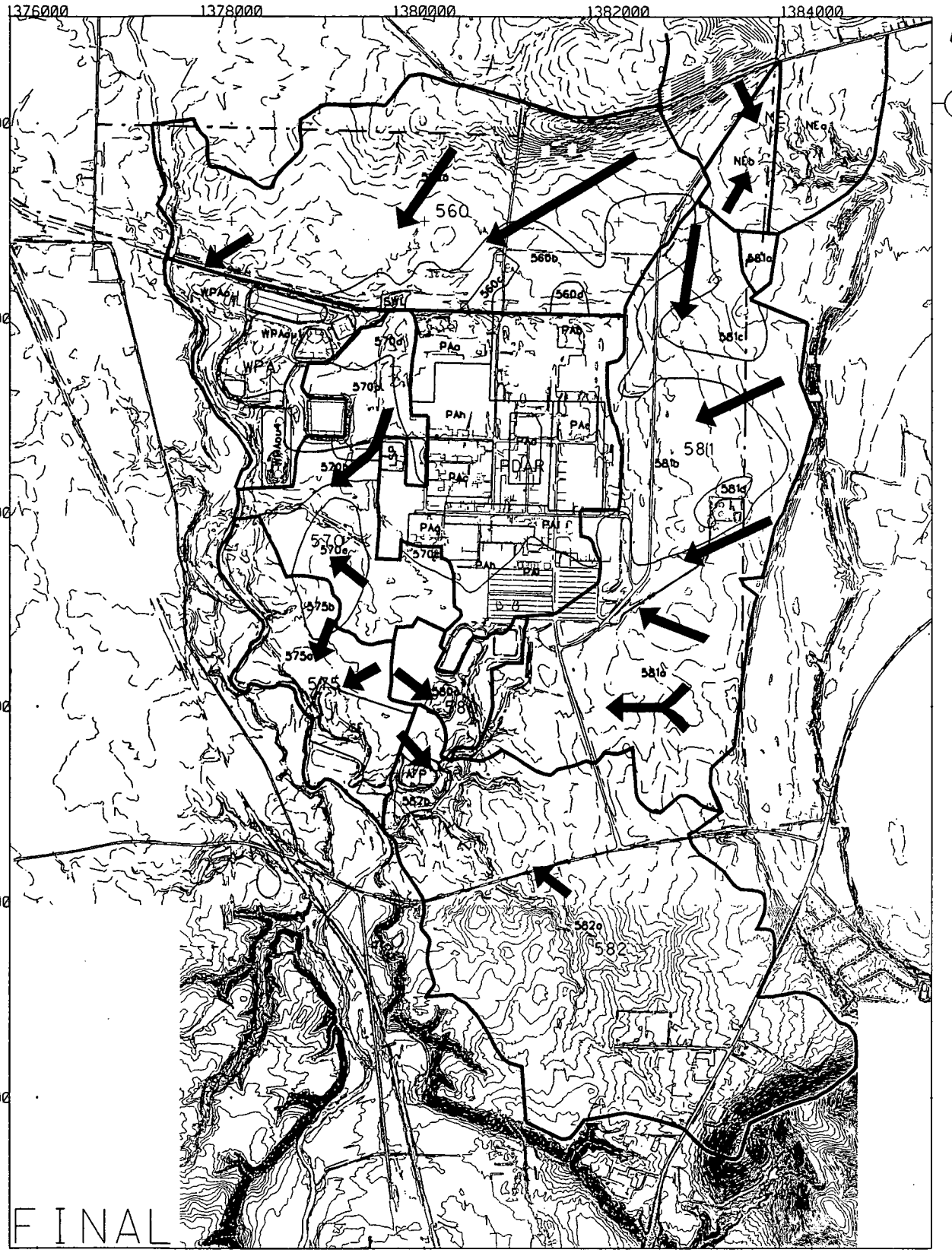
SURFACE WATER FRL AND BTV EXCEEDENCES

APPENDIX B

SURFACE WATER FRL AND BTV EXCEEDENCES

This appendix provides backup information regarding the FRL/BTV exceedances which were summarized in Table 4-2 as part of the parameter selection criteria for the IEMP surface water sampling program. As discussed in Section 4.4.2.3, a limited number of constituents have been detected above the respective FRL and/or BTV at sporadic surface water monitoring locations. To better quantify the actual number and location of exceedances, historical surface water data were compiled and compared to FRLs and BTVs to determine the number and locations of the exceedances.

This appendix provides figures which document, by constituent, the particular sampling locations where FRLs and BTVs have been exceeded. The figures also depict the number of exceedances for a particular constituent at each location. Drainage basin flow patterns (see Figure B-1) were also evaluated to determine appropriate downstream sampling locations. Figures B-2 to B-12 depict, by constituent, those locations where FRLs have been exceeded. BTV exceedances are summarized in Figures B-13 to B-22. On all these figures the number of exceedances is shown in parentheses for each location when the number of exceedences was greater than one.



LEGEND:

- FEMP BOUNDARY
- SUBBASIN BOUNDARY
- 582a CONTAMINATION ZONE DESIGNATION
- GENERAL DIRECTIONAL UNCONTROLLED RUNOFF FLOW

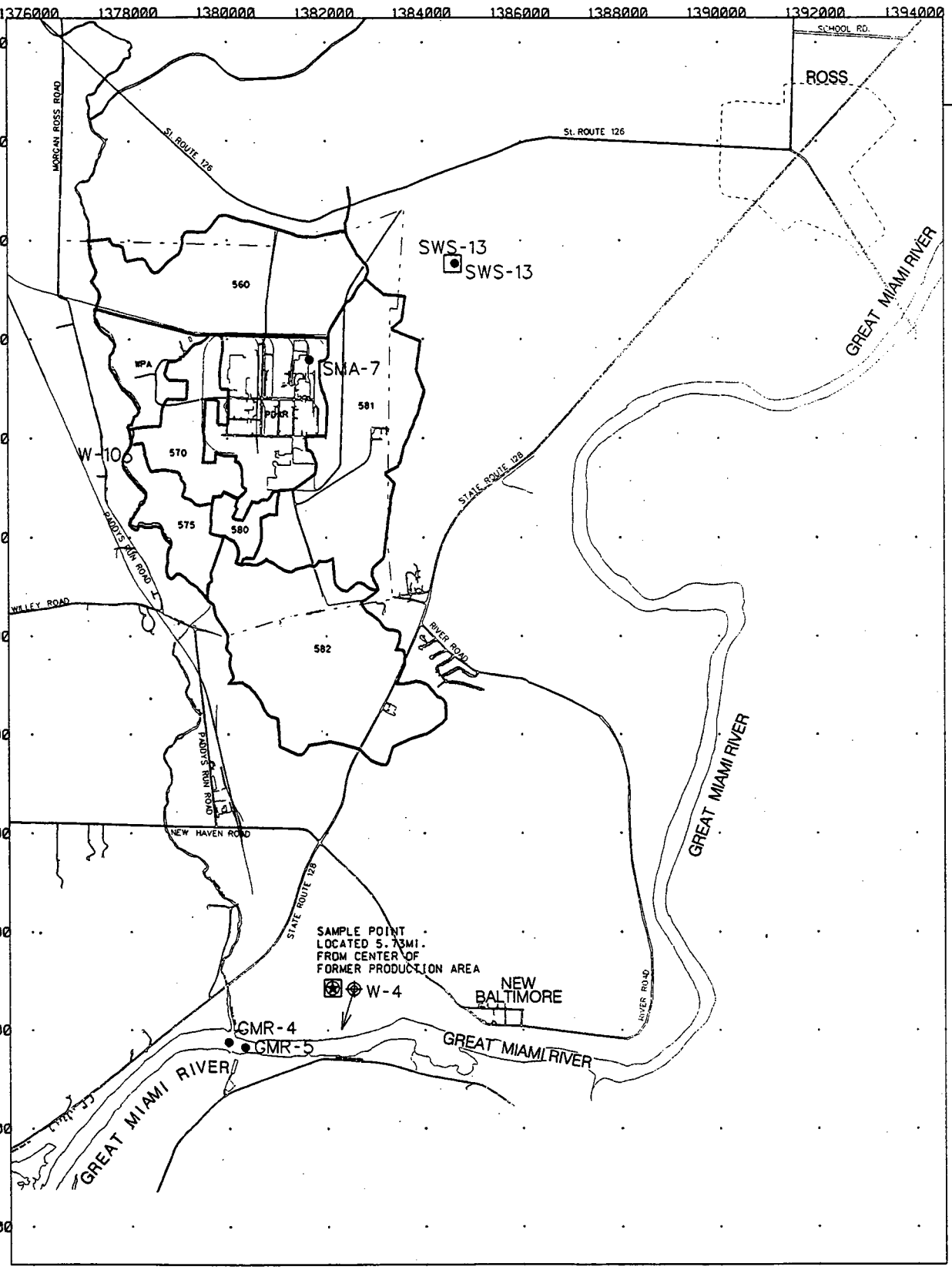
SCALE

1500 750 0 1500 FEET

FIGURE B-1. UNCONTROLLED SURFACE WATER RUNOFF FLOW DIRECTION

DGIS/CRUS/DGN/MAP/HOR/DPTH/C51MP119.DGN FER OU5 7/26/96 STATE PLANAR COORDINATE SYSTEM 1927

DGIS/CRU5/DGN/MAP/HOR/DPTH/CS1MP088.DGN FER OU5 7/18/96 STATE PLANAR COORDINATE SYSTEM 1927



LEGEND:

- FEMP BOUNDARY
- CADMIUM
- SELENIUM
- ZINC
- CYANIDE

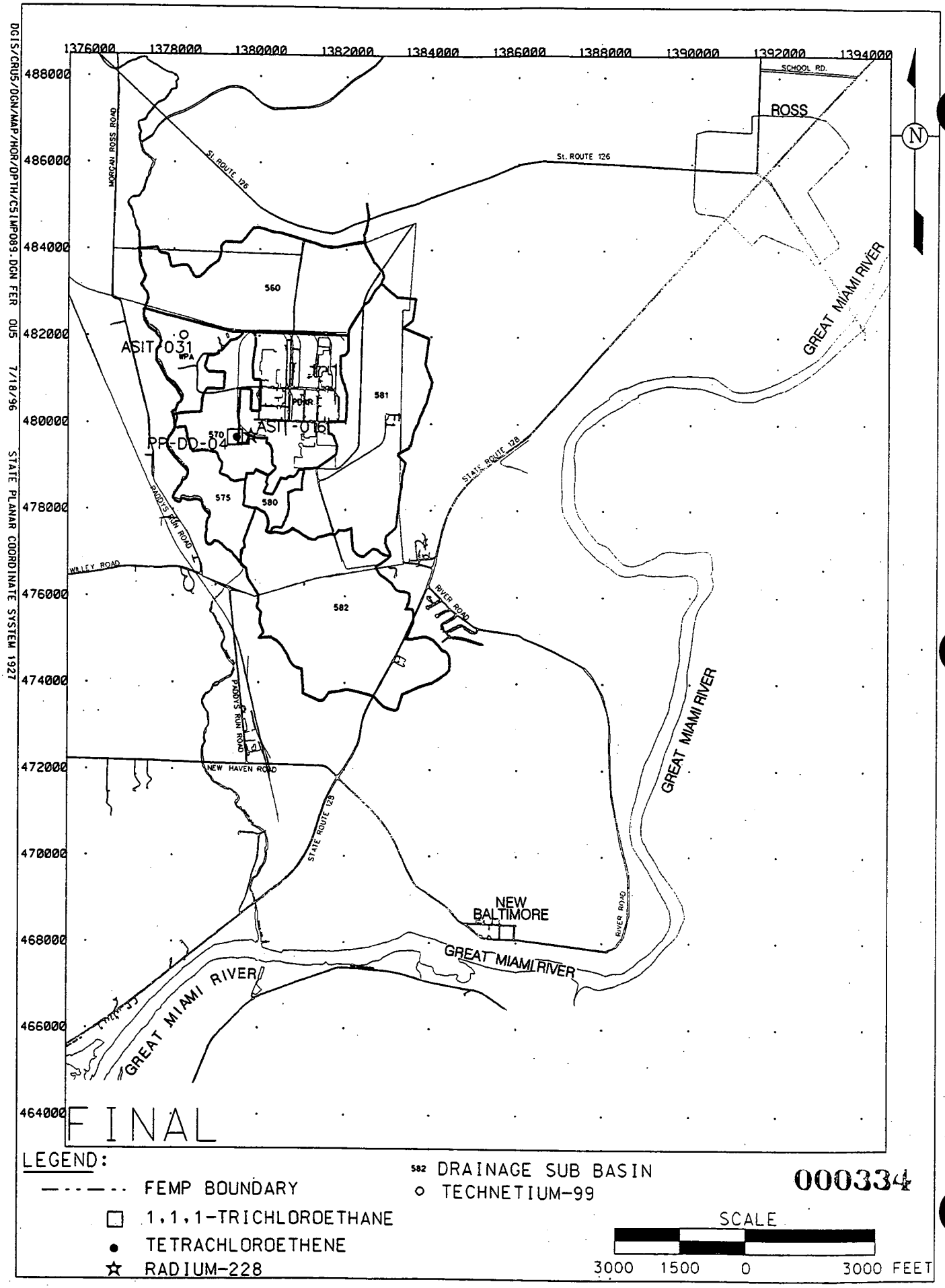
582 DRAINAGE SUB BASIN

SCALE

3000 1500 0. 3000 FEET

FINAL

FIGURE B-2. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CADMIUM, SELENIUM, ZINC AND CYANIDE



000334

FIGURE B-3. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR 1,1,1-TRICHLOROETHANE, TETRACHLOROETHENE, TECHNETIUM-99 AND RADIUM-228

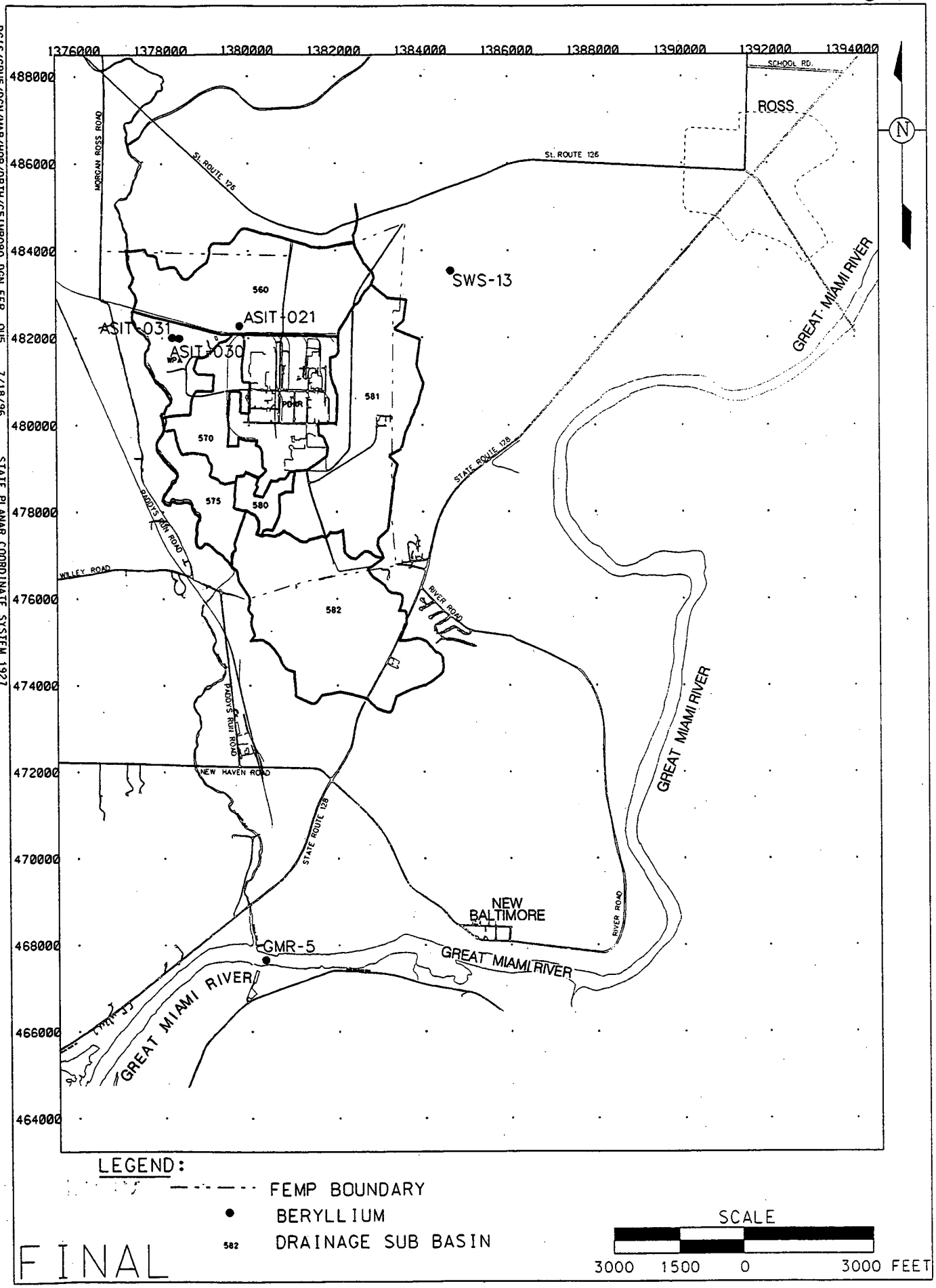
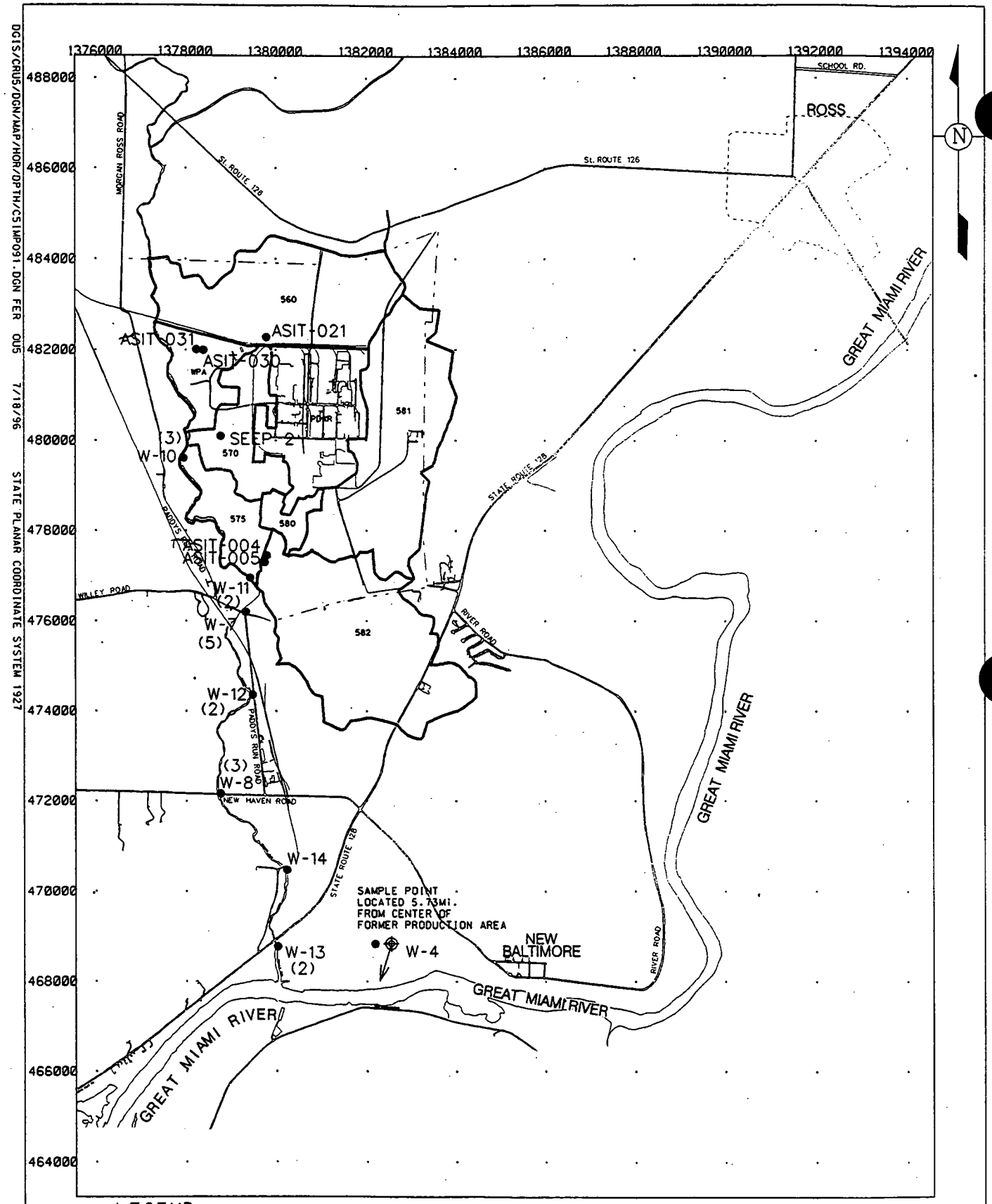


FIGURE B-4. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BERYLLIUM



LEGEND:

- FEMP BOUNDARY
- CHROMIUM
- 582 DRAINAGE SUB BASIN
- (2) NUMBER OF EXCEEDANCES

000336

SCALE

3000 1500 0 3000 FEET

FINAL

FIGURE B-5. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR CHROMIUM

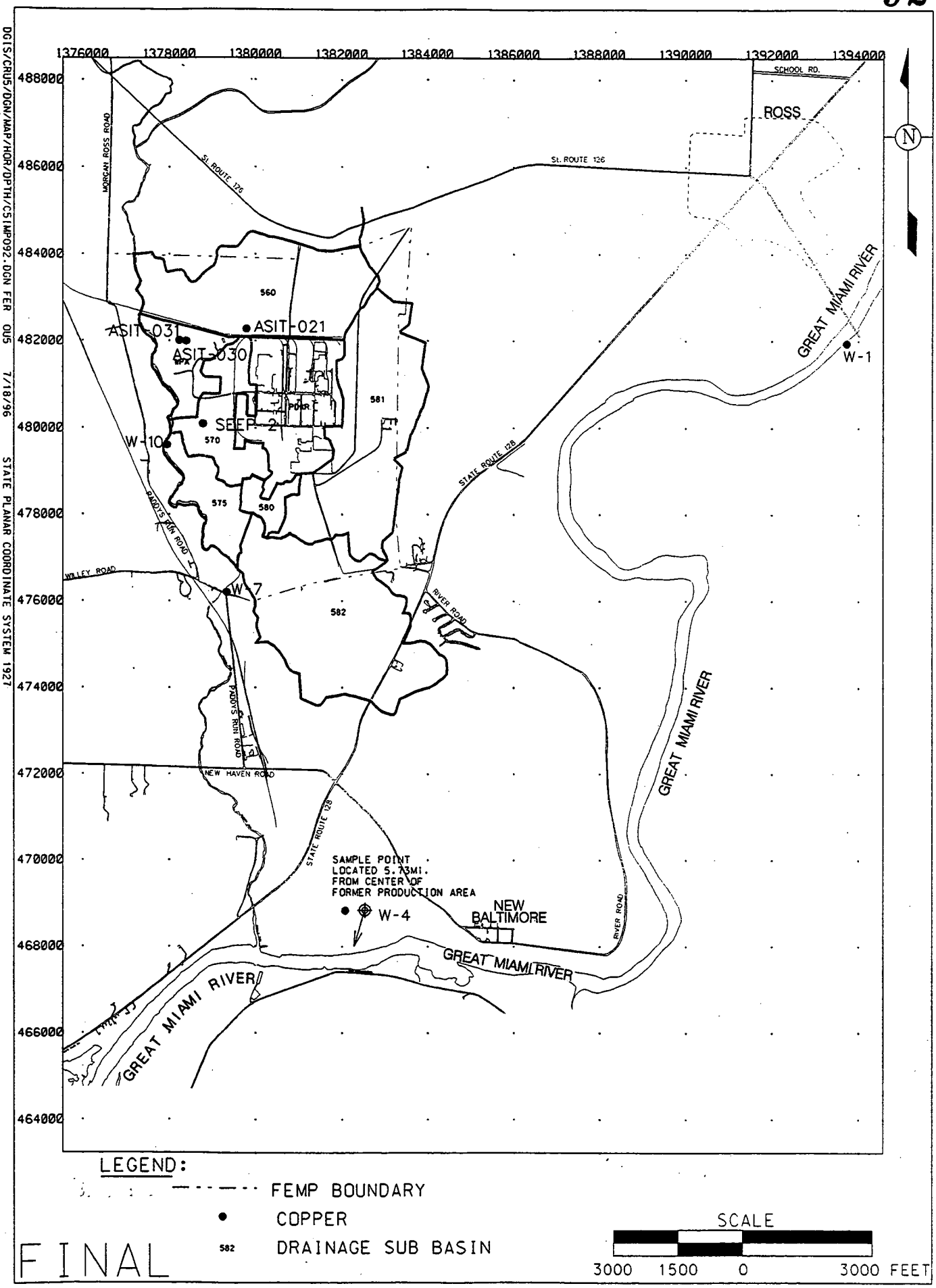
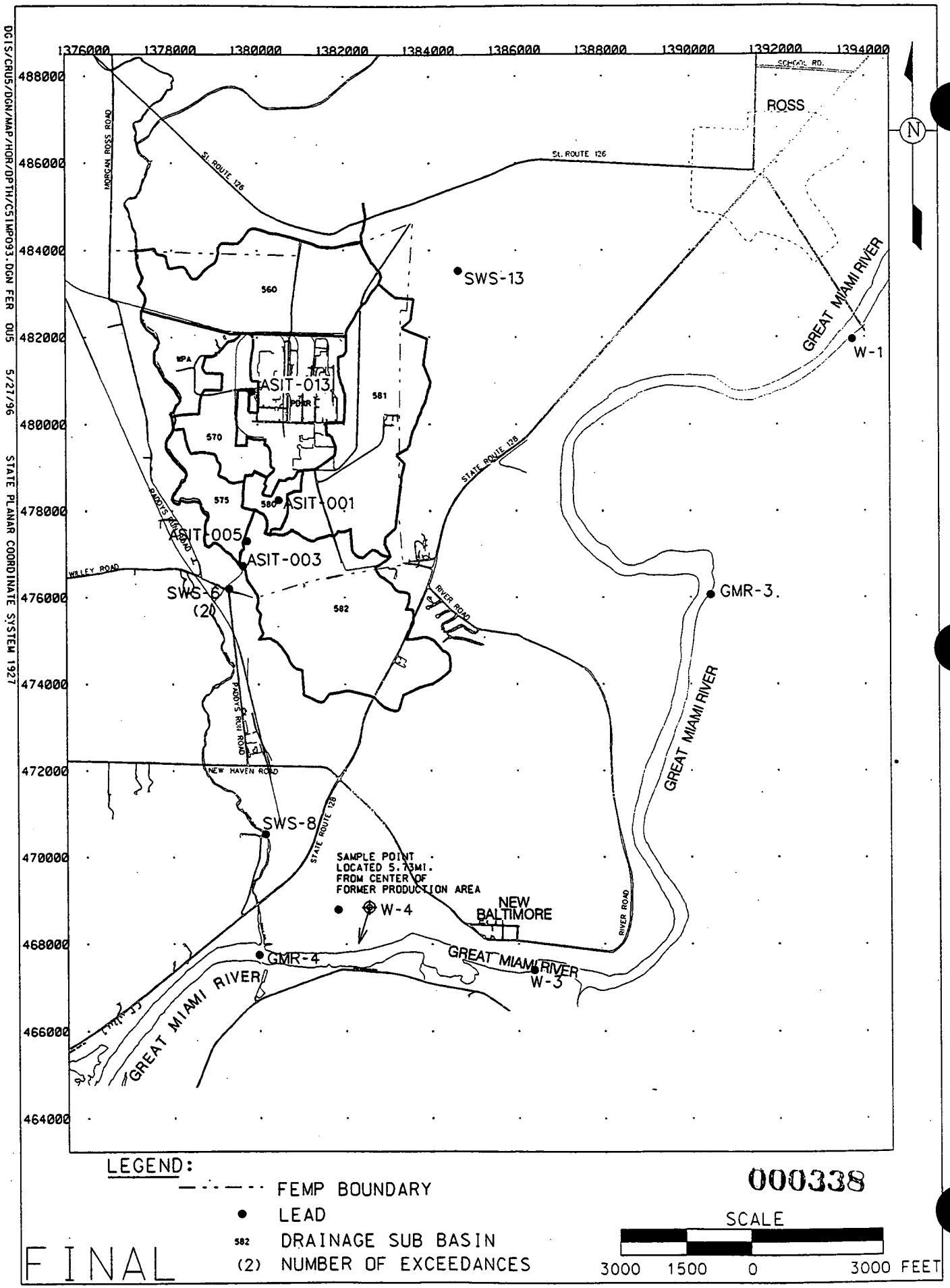
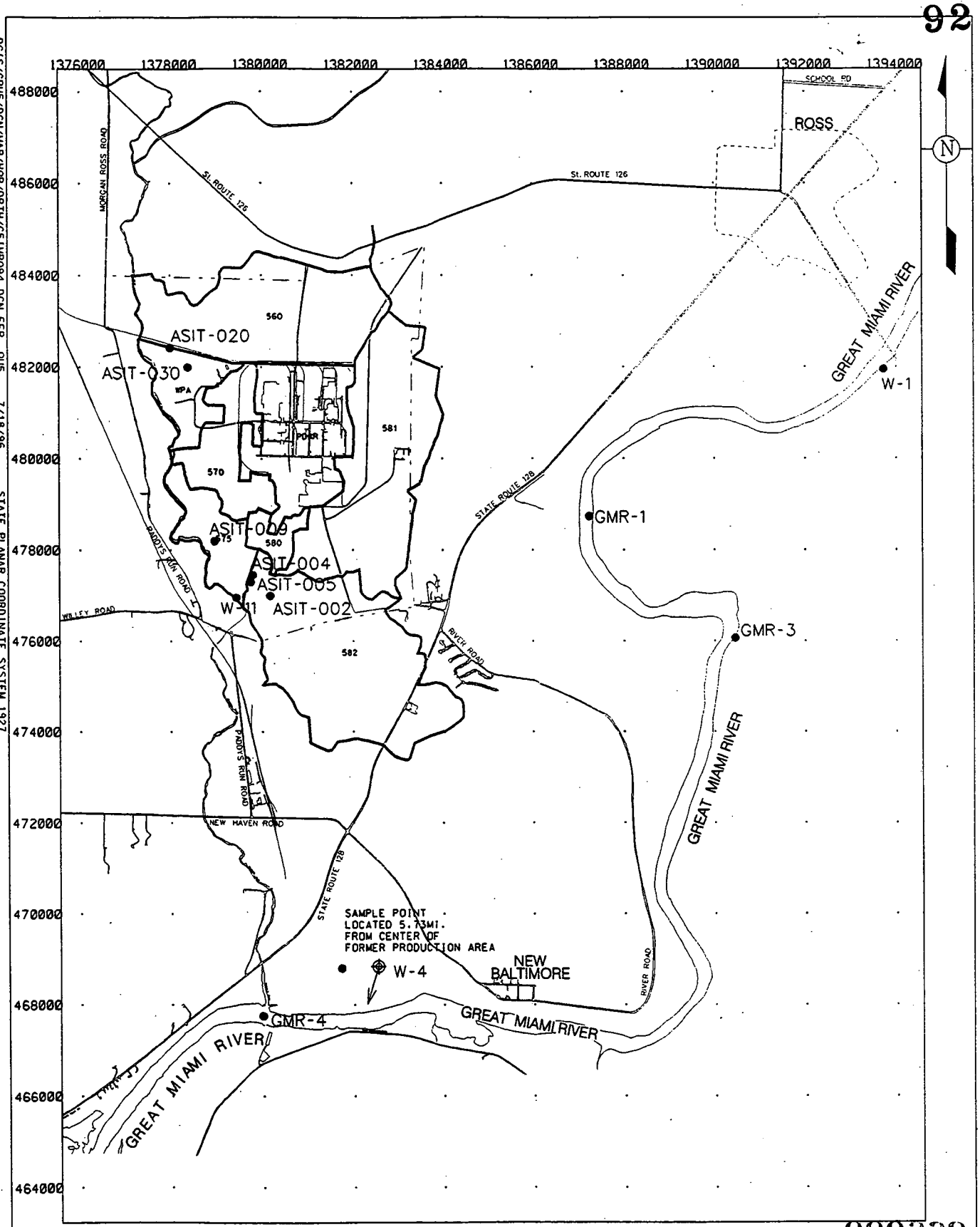


FIGURE B-6. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR COPPER



000338

FIGURE B-7. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR LEAD



DGIS/CRU5/DGN/MAP/HOR/DPTH/CS1MP094.DGN FER OU5 7/18/96 STATE PLANAR COORDINATE SYSTEM 1927

LEGEND:

- - - - FEMP BOUNDARY

● MERCURY

582 DRAINAGE SUB BASIN

SCALE

3000 1500 0 3000 FEET

FINAL

FIGURE B-8. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR MERCURY

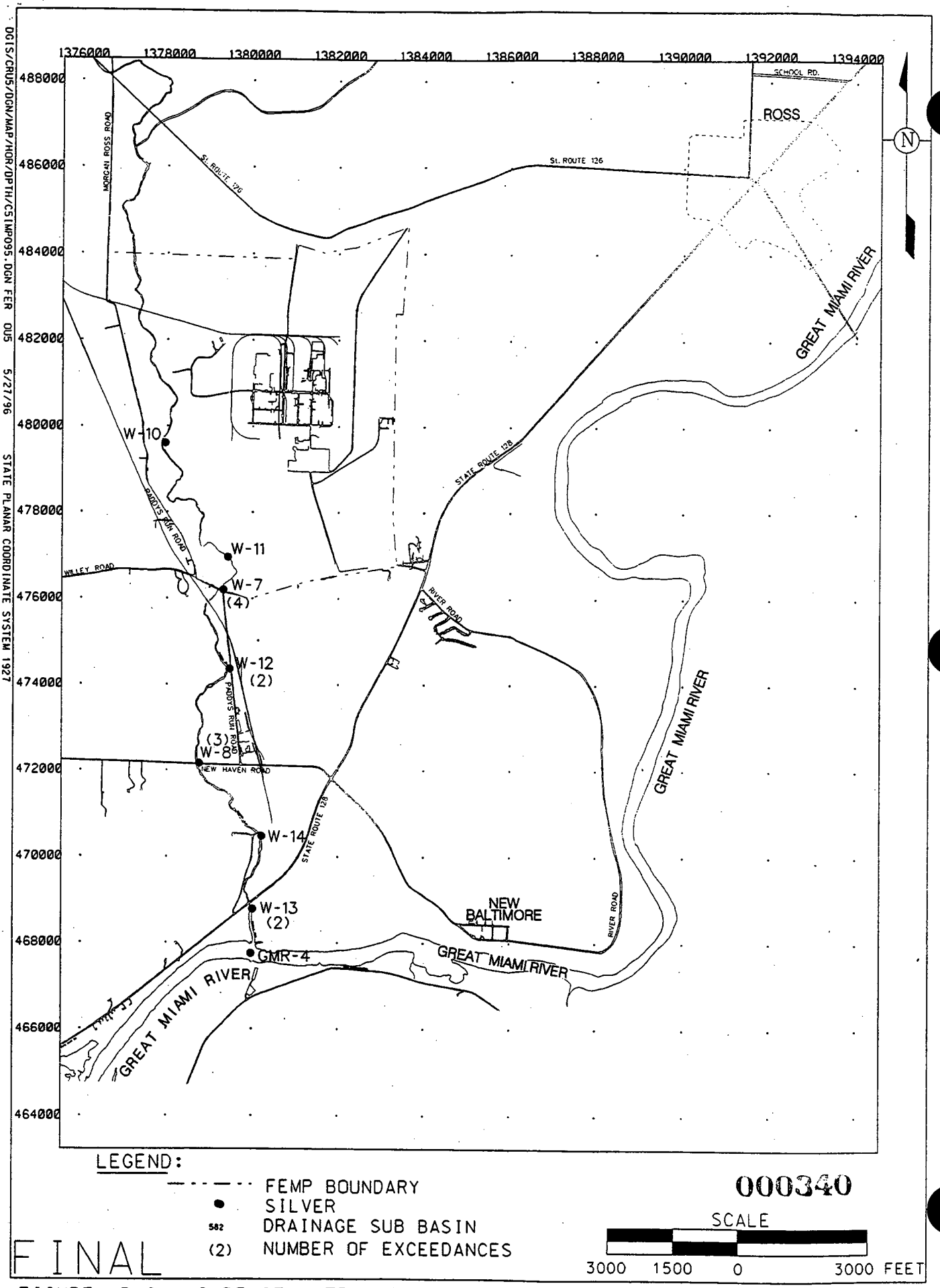
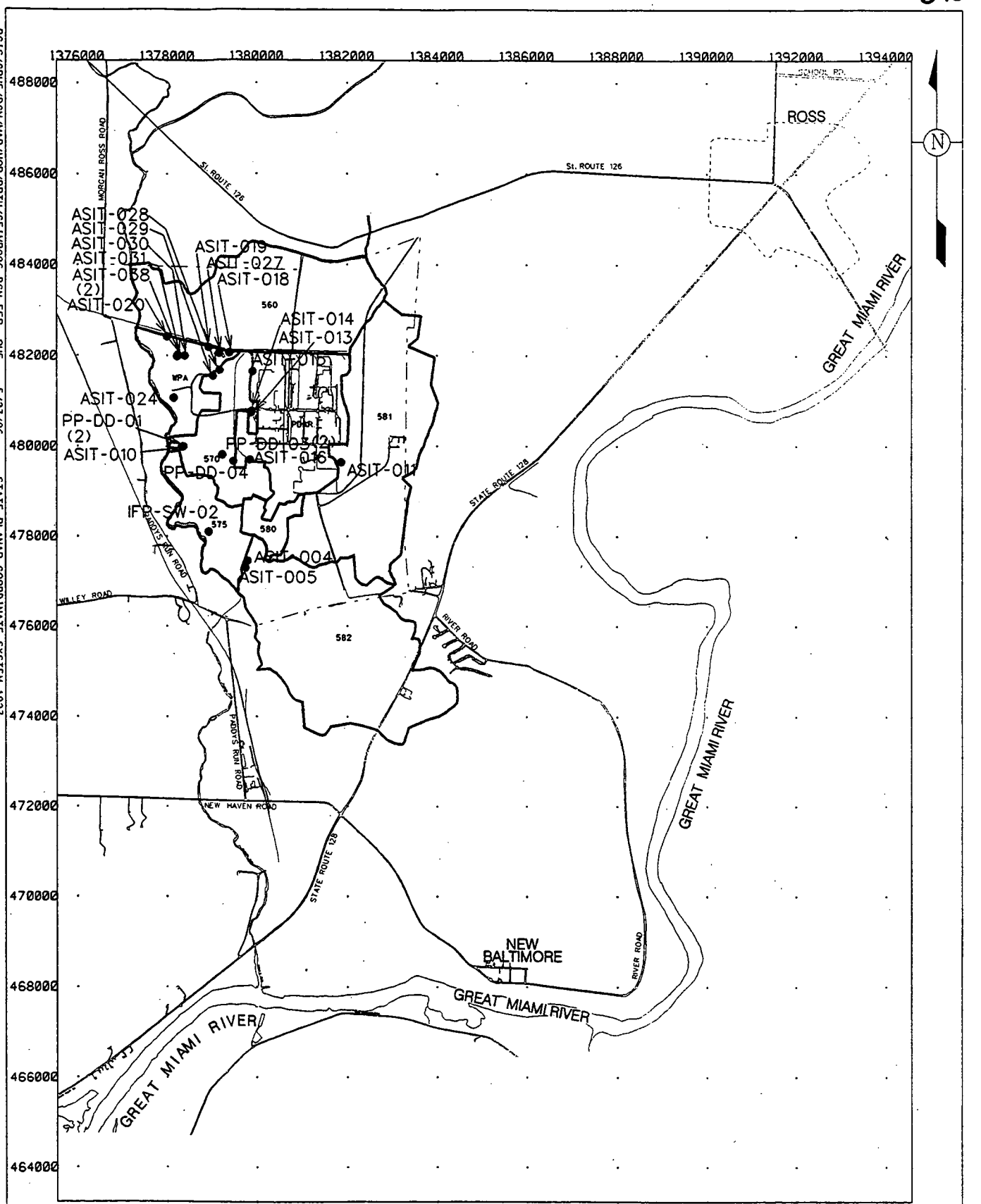


FIGURE B-9. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR SILVER



LEGEND:

- FEMP BOUNDARY
- • TOTAL URANIUM
- 582 DRAINAGE SUB BASIN
- (2) NUMBER OF EXCEEDANCES

SCALE

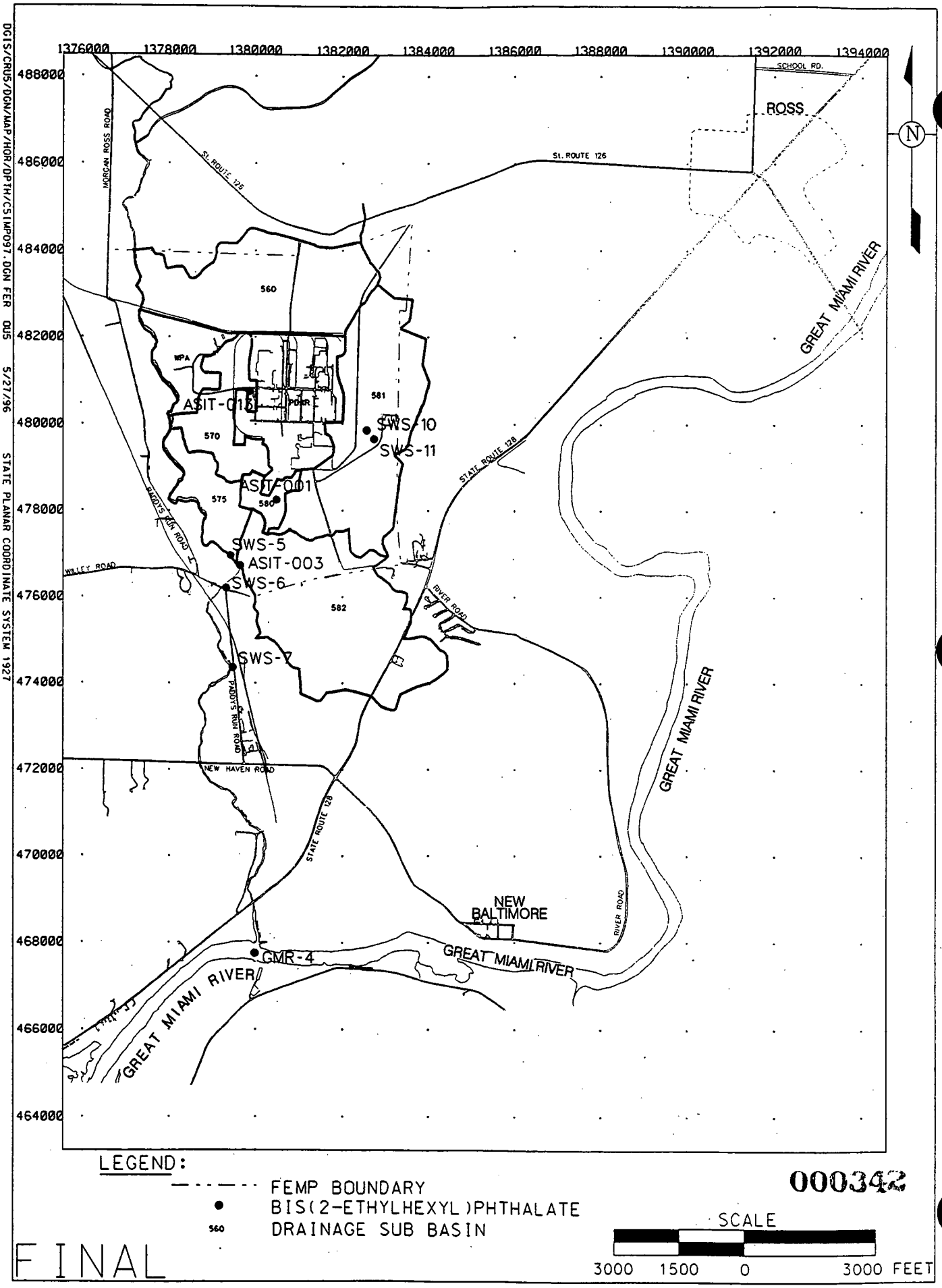
3000 1500 0 3000 FEET

FINAL

000341

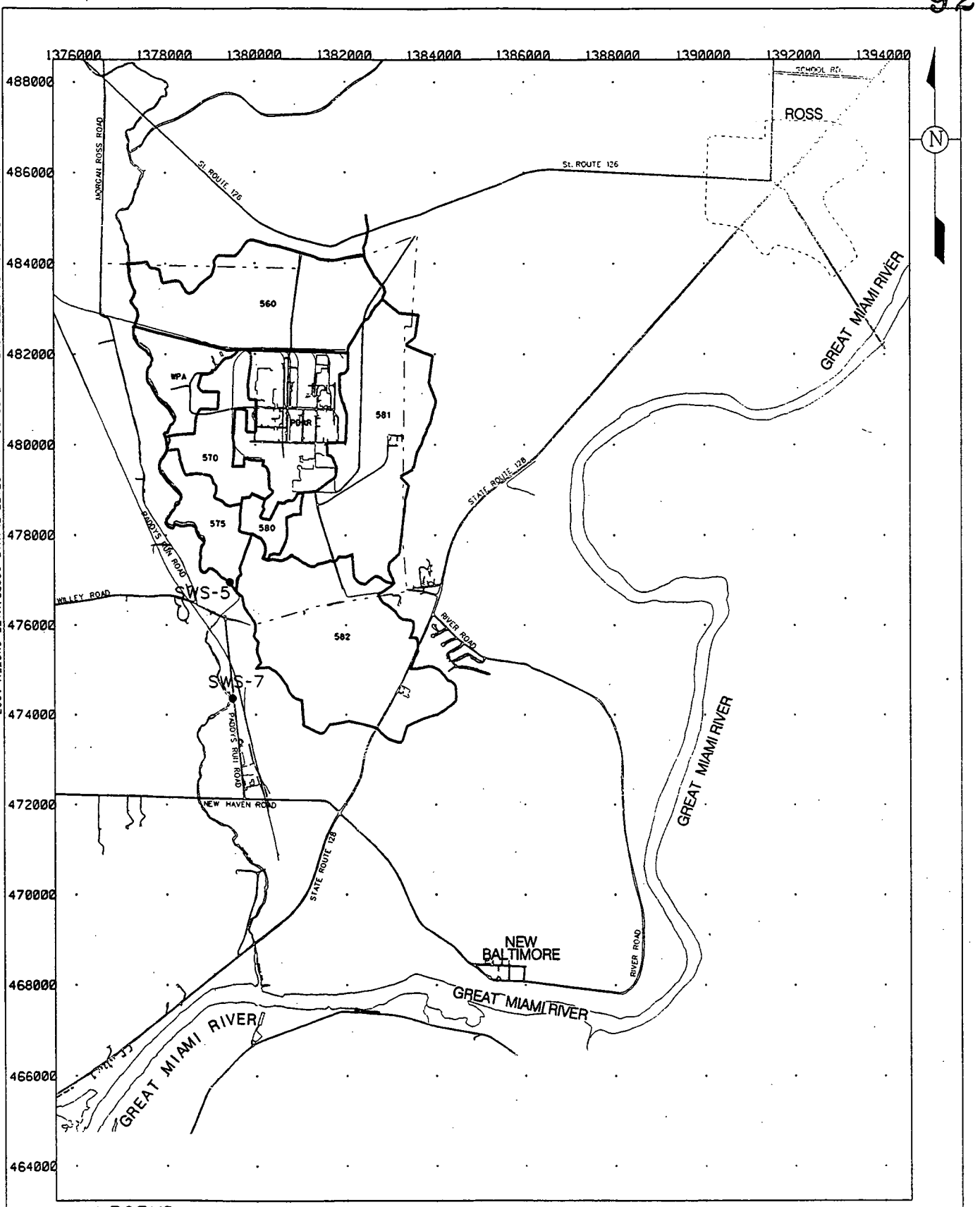
DGIS/CRU5/DGN/MAP/HOR/DPTH/C51MP096.DGN FER 0U5 5/27/96 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE B-10. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR TOTAL URANIUM



000342

FIGURE B-11. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR BIS(2-ETHYLHEXYL)PHTHALATE



LEGEND:

FEMP BOUNDARY

DI-N-OCTYLPHTHALATE

560 DRAINAGE SUB BASIN

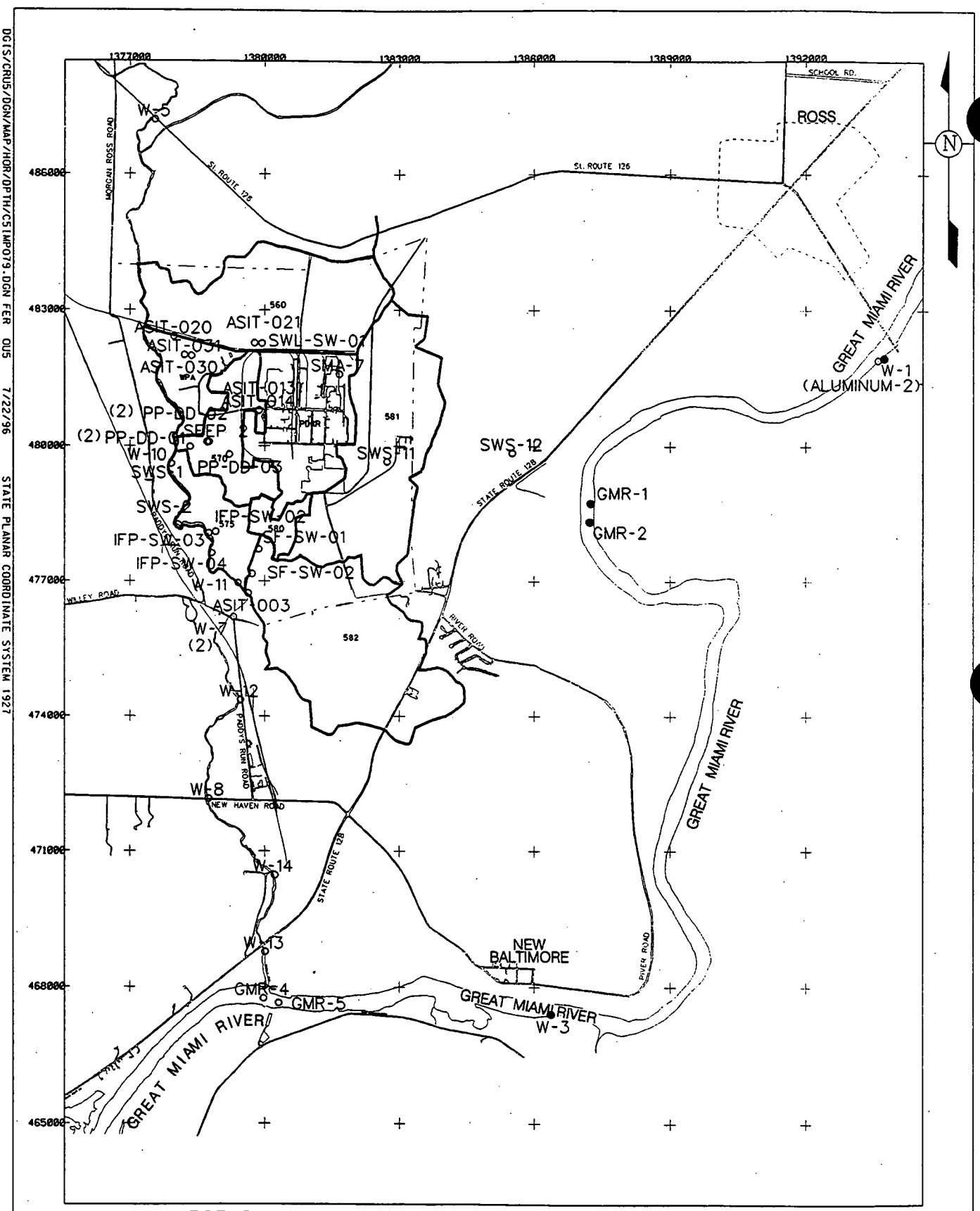
SCALE

3000 1500 0 3000 FEET

FINAL

DGIS/CRU5/DGN/MAP/HOR/DPTH/C5IMP121.DGN FER OU5 5/29/96 STATE PLANAR COORDINATE SYSTEM 1927

FIGURE B-12. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE FRL FOR DI-N-OCTYLPHTHALATE



LEGEND:

- FEMP BOUNDARY
- 560 DRAINAGE SUB BASIN
- ● AMMONIA
- ○ ALUMINIUM
- (2) NUMBER OF EXCEEDANCES

000344

SCALE

3000 1500 0 3000 FEET

FINAL

FIGURE B-13. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR ALUMINIUM AND AMMONIA

DGIS/CRU5/DGN/MAP/HOR/DPTH/C5IMP079.DGN FER OU5 7/22/96 STATE PLANAR COORDINATE SYSTEM 1927

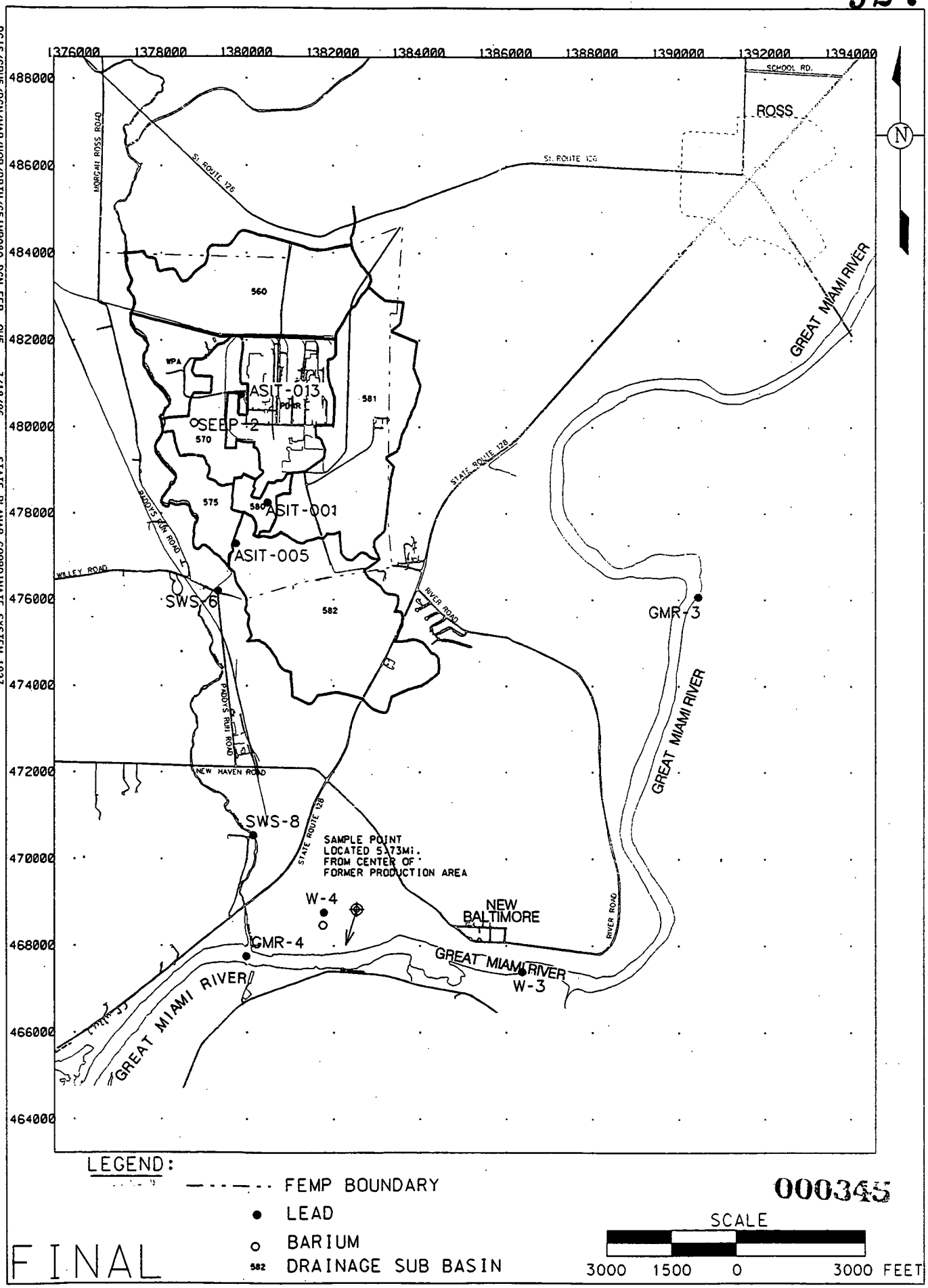
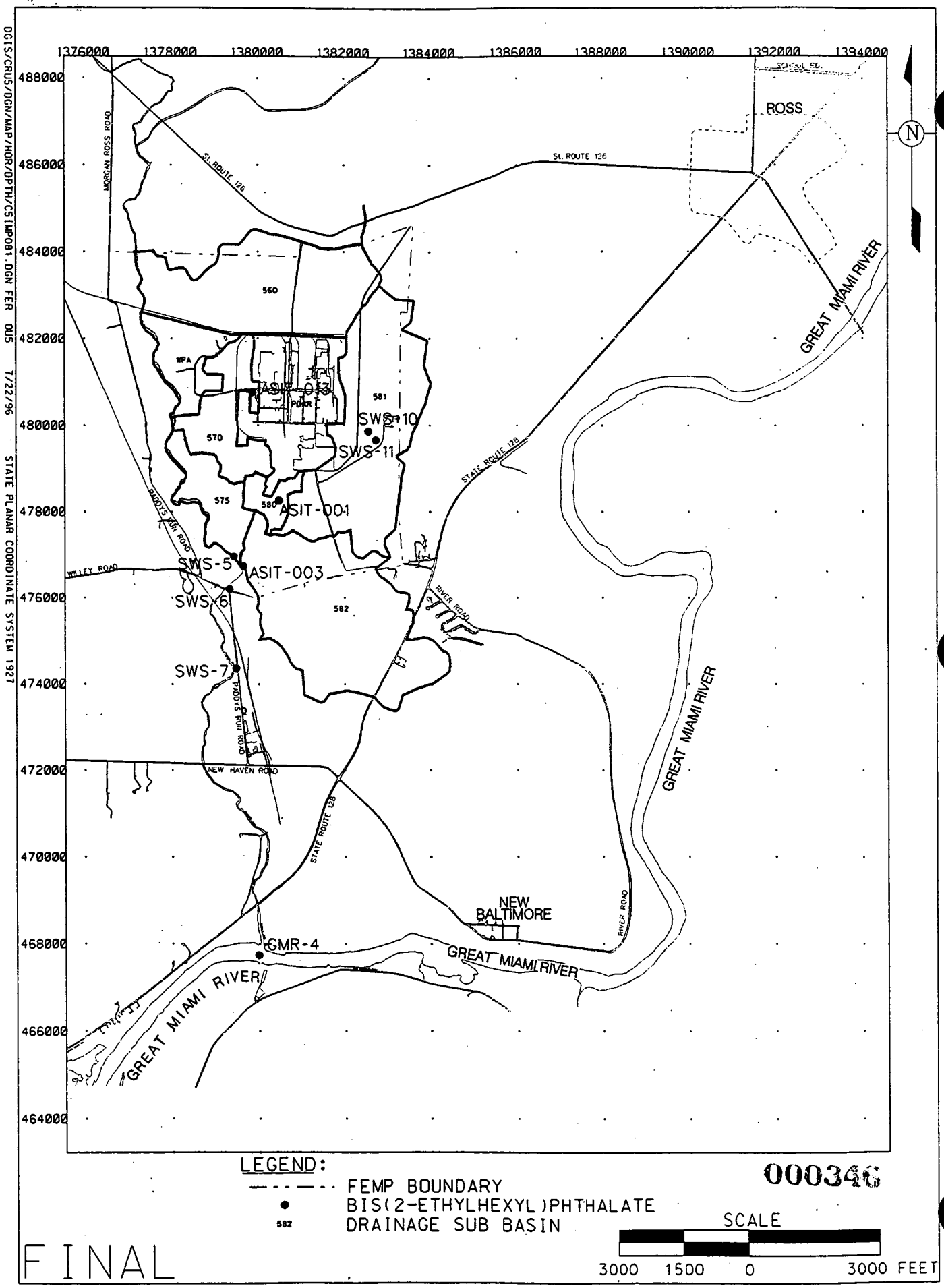


FIGURE B-14. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR LEAD AND BARIUM



LEGEND:

FEMP BOUNDARY

BIS(2-ETHYLHEXYL)PHTHALATE

582 DRAINAGE SUB BASIN

SCALE

3000 1500 0 3000 FEET

000346

FINAL

FIGURE B-15. SURFACE WATER LOCATION WITH CONCENTRATIONS ABOVE THE BTV FOR BIS (2-ETHYLHEXYL)PHTHALATE

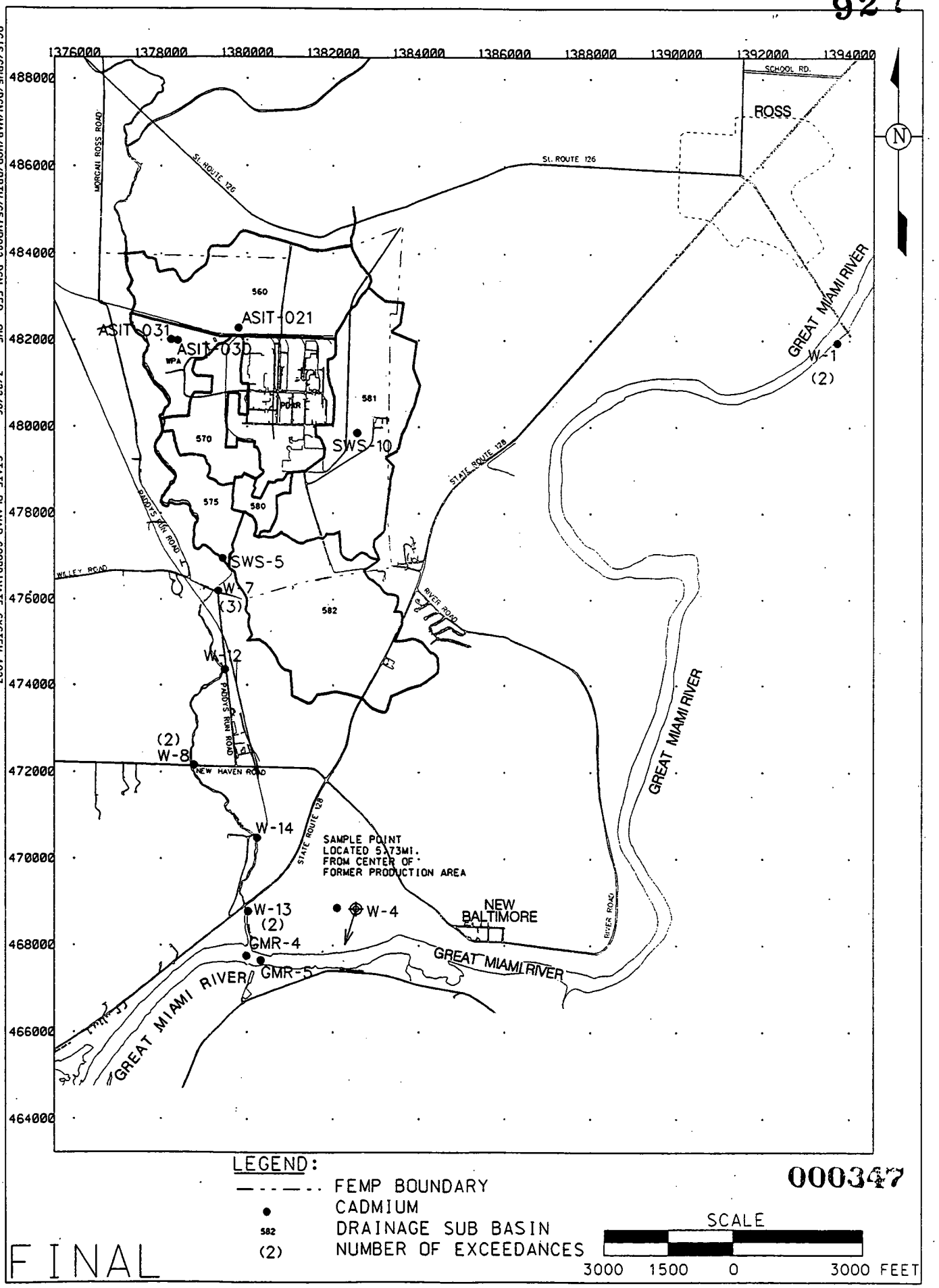
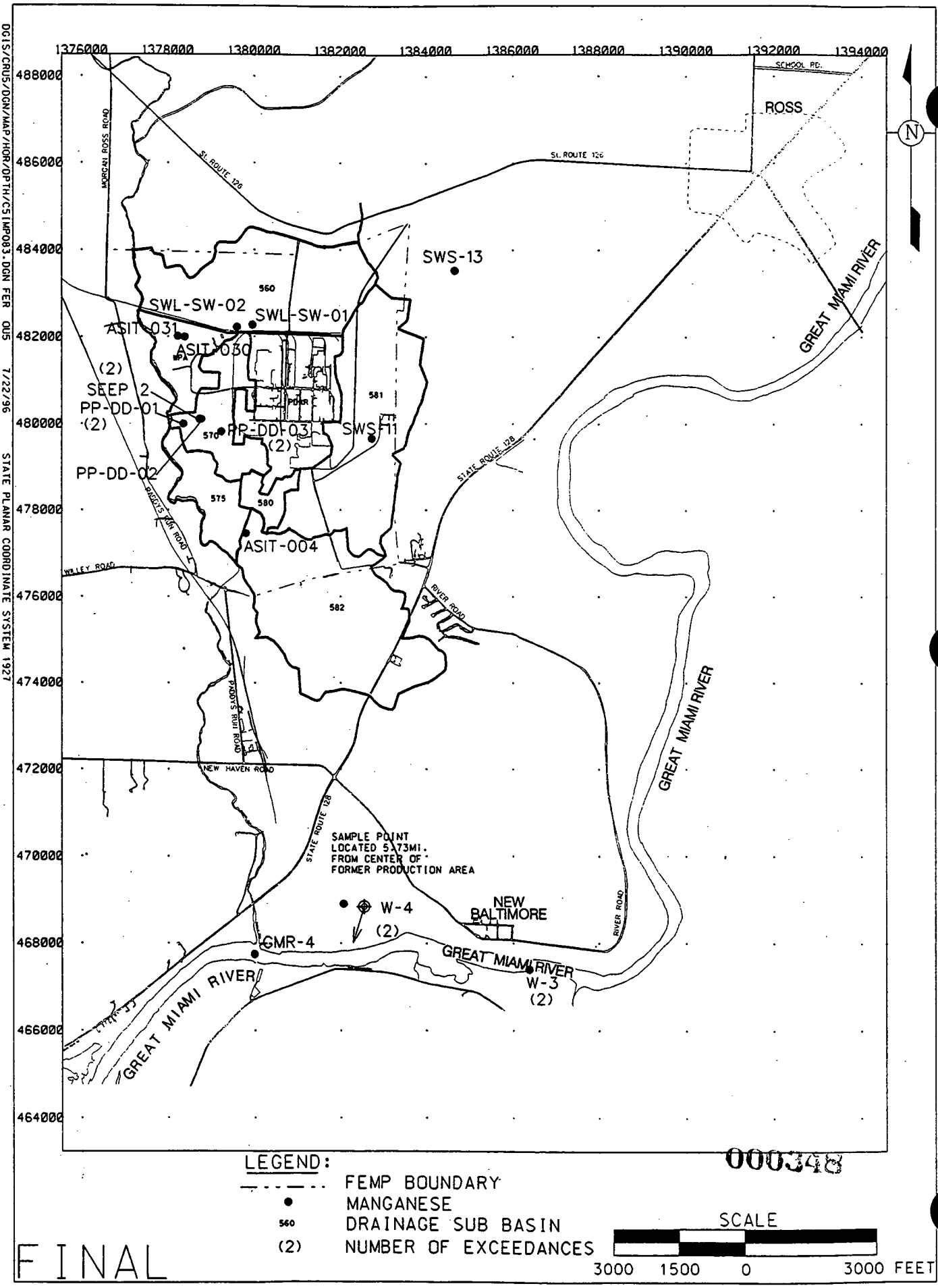
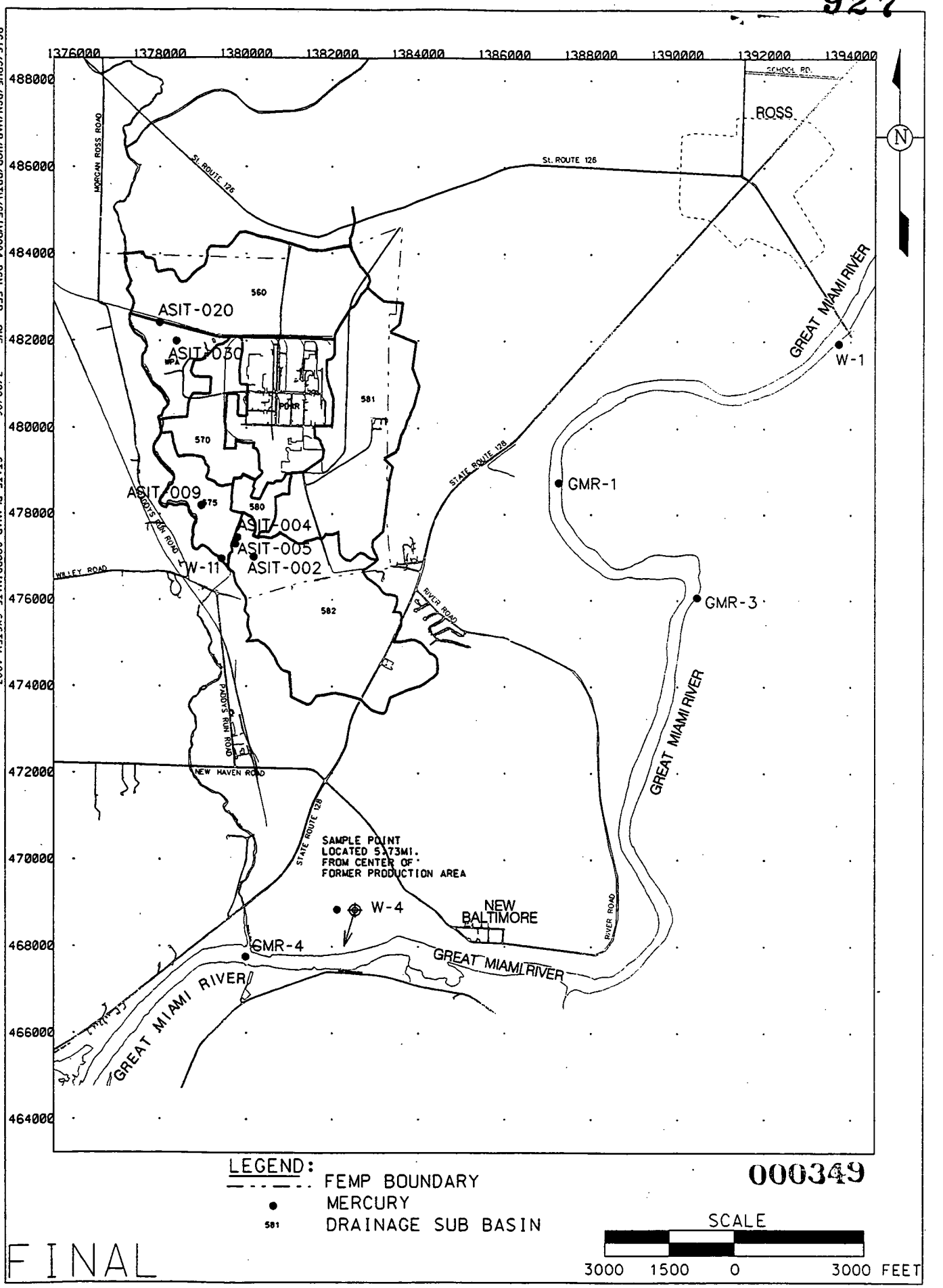


FIGURE B-16. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR CADMIUM



000348

FIGURE B-17. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR MANGANESE



LEGEND:

FEMP BOUNDARY

MERCURY

581 DRAINAGE SUB BASIN

SCALE

3000 1500 0 3000 FEET

000349

FINAL

FIGURE B-18. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR MERCURY

DGIS/CRU5/DGN/MAP/HOR/DPTH/C51MP084.DGN FER OU5 7/22/96 STATE PLANAR COORDINATE SYSTEM 1927

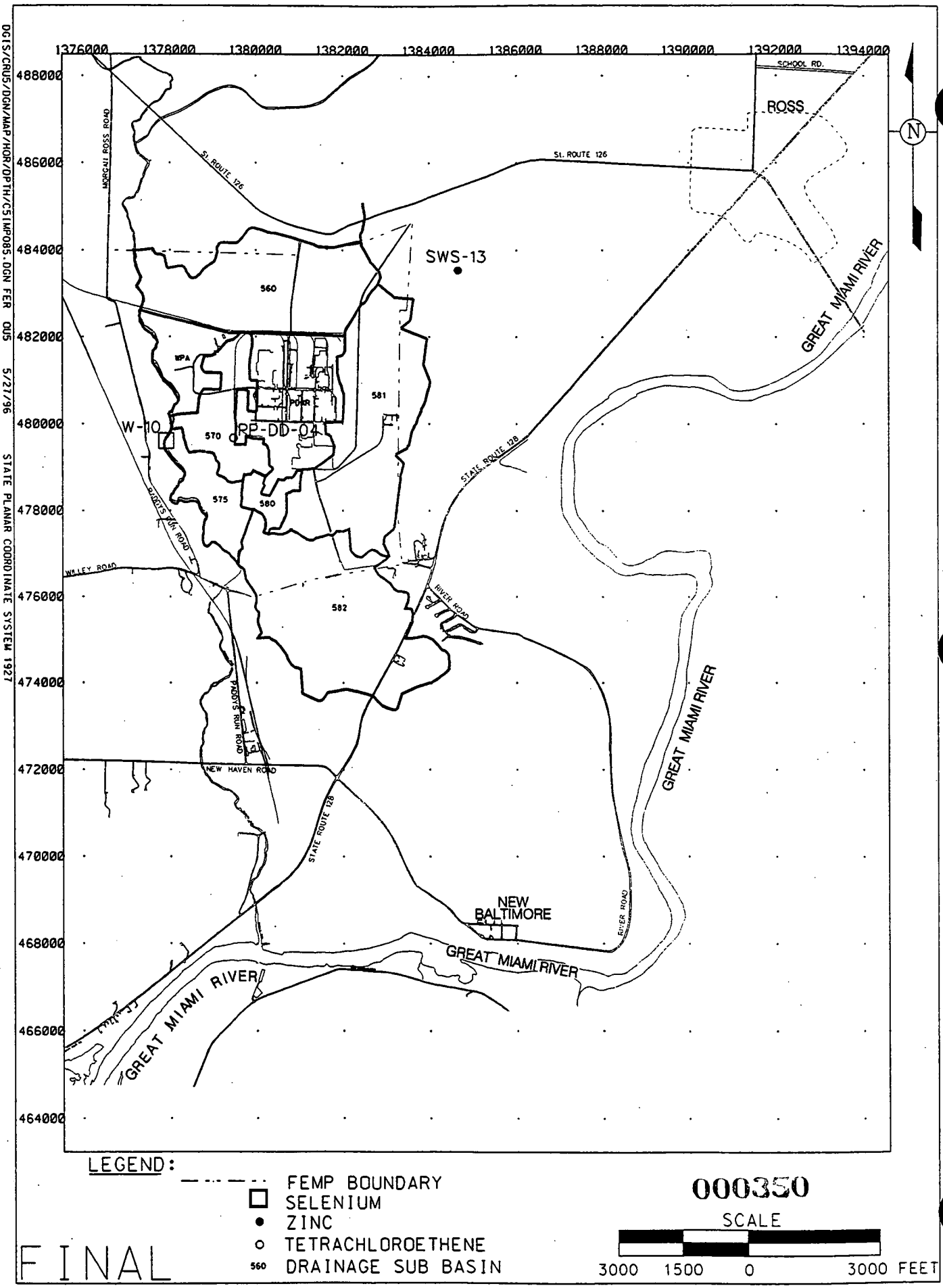
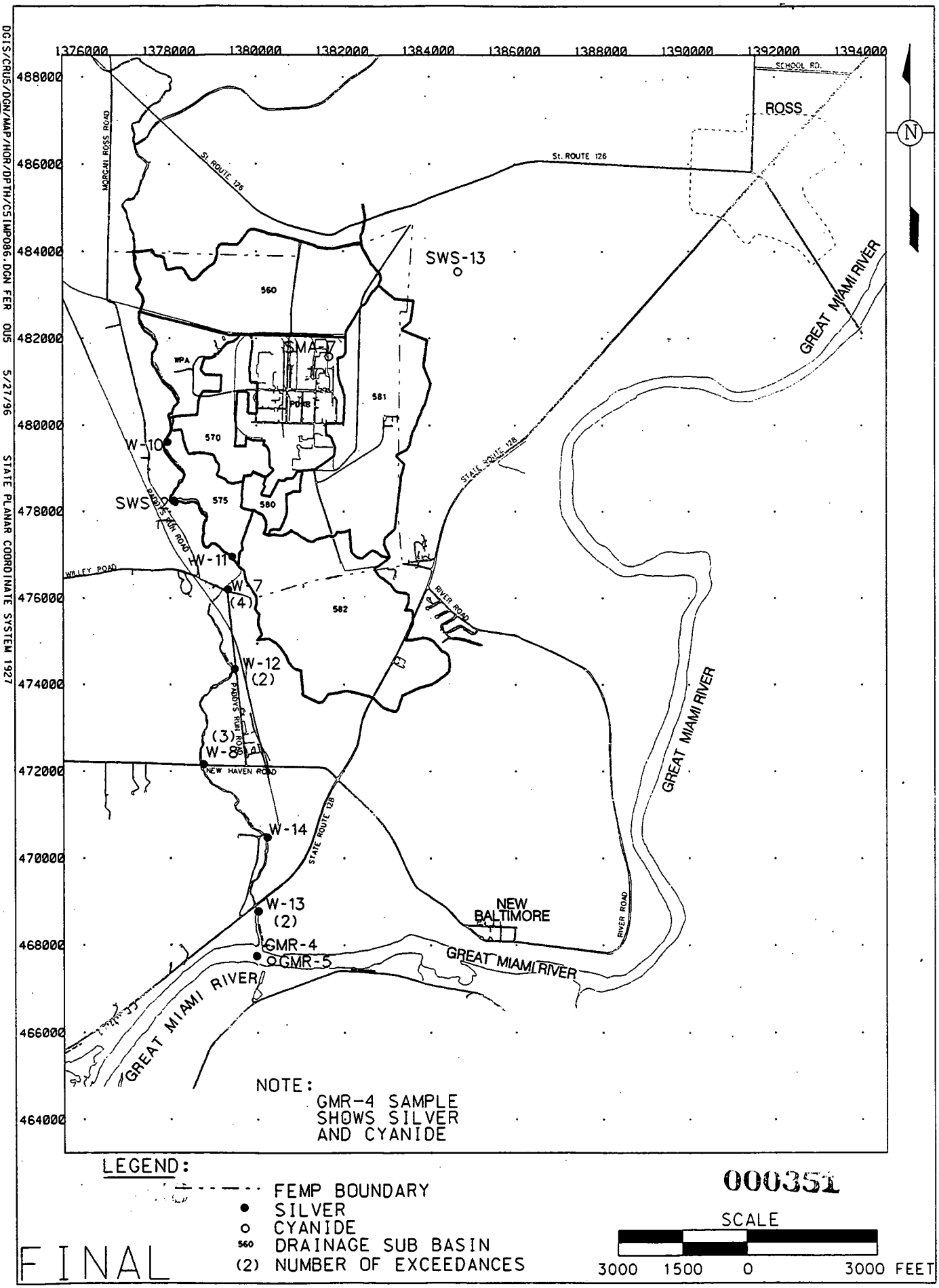
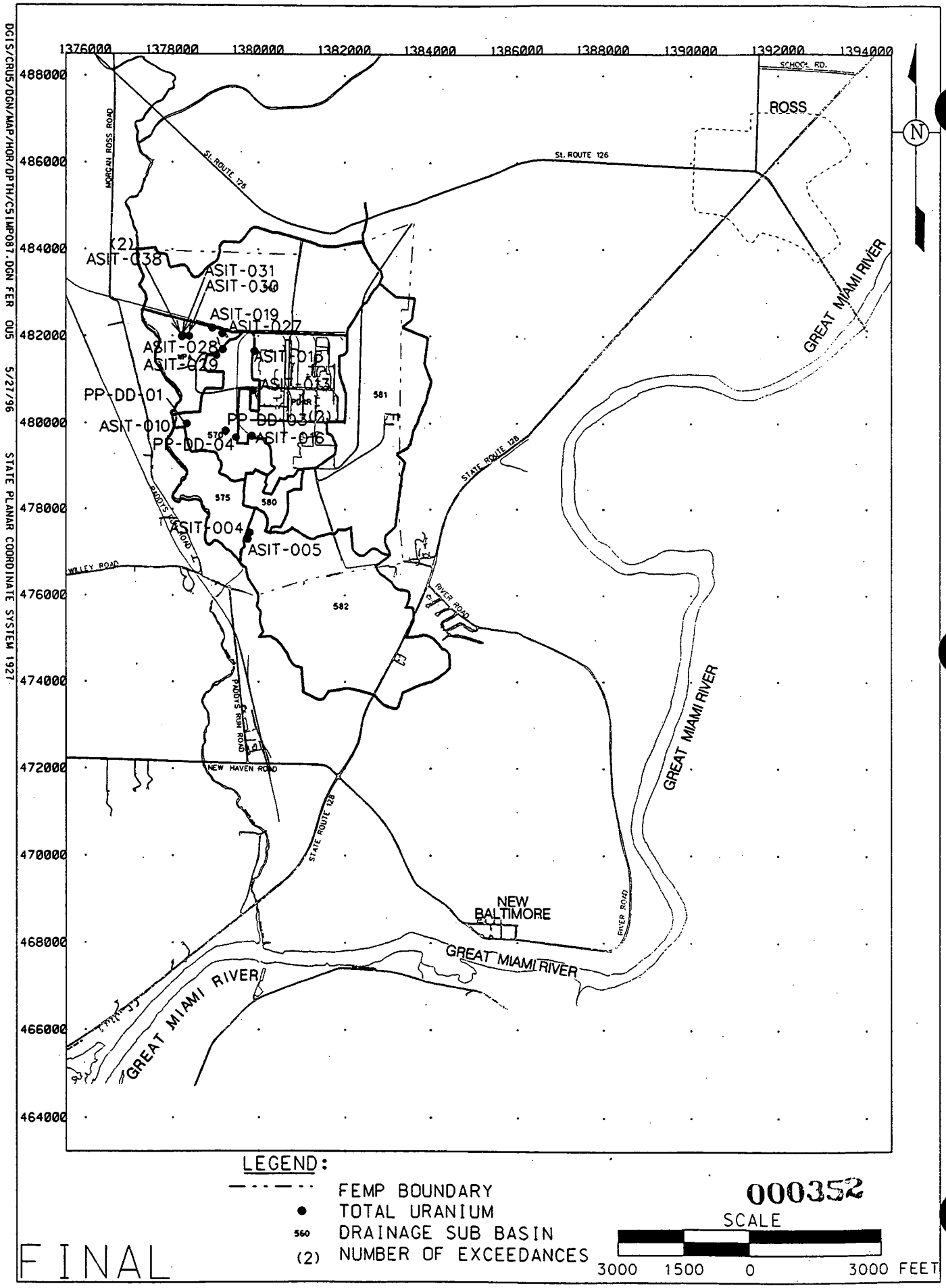


FIGURE B-19. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR SELENIUM, ZINC, AND TETRACHLOROETHENE



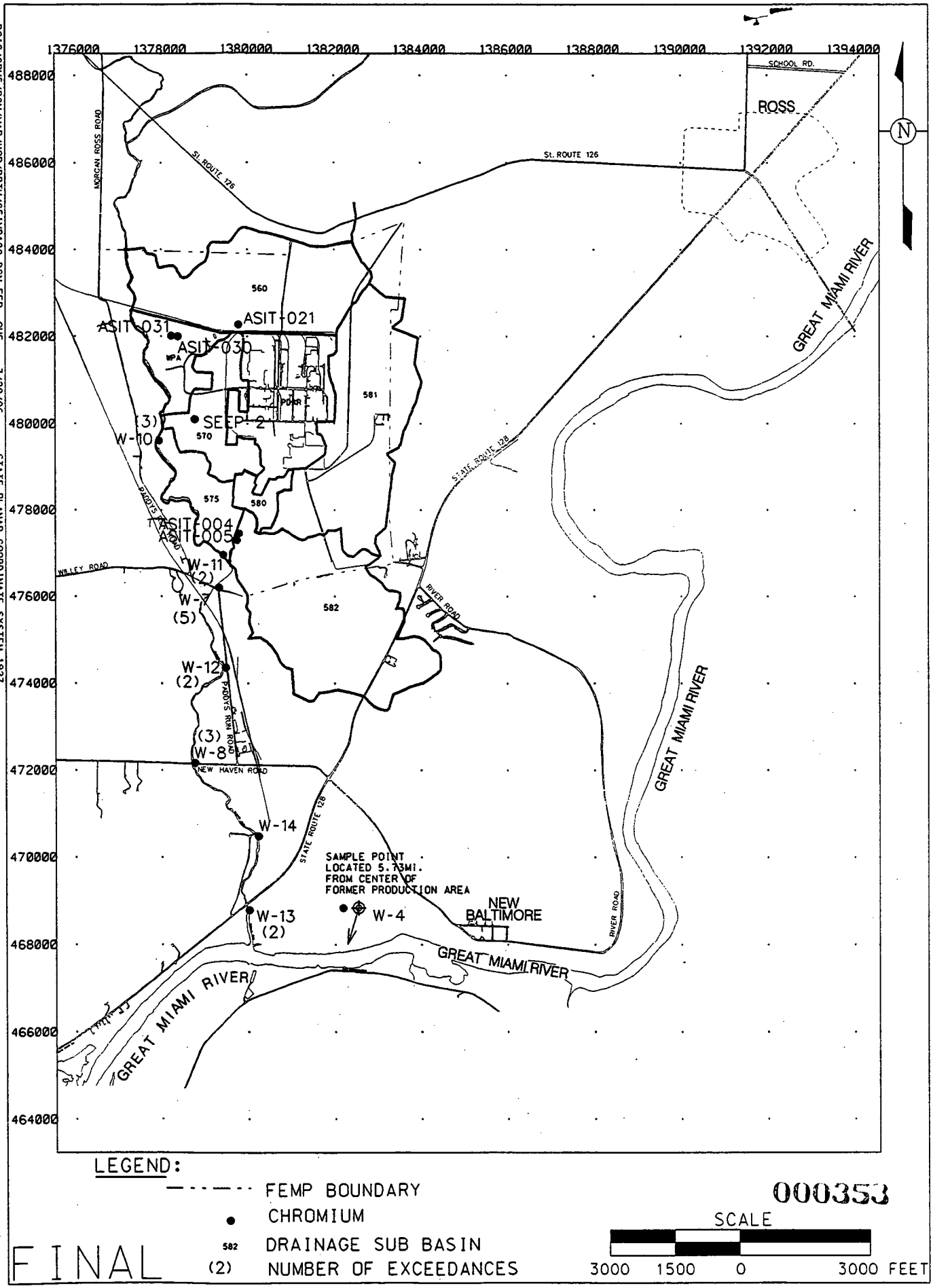
000351

FIGURE B-20. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR SILVER AND CYANIDE



000352

FIGURE B-21. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR TOTAL URANIUM



LEGEND:

- FEMP BOUNDARY
- CHROMIUM
- 582 DRAINAGE SUB BASIN
- (2) NUMBER OF EXCEEDANCES

000353

SCALE

3000 1500 0 3000 FEET

FINAL

FIGURE B-22. SURFACE WATER LOCATIONS WITH CONCENTRATIONS ABOVE THE BTV FOR CHROMIUM

APPENDIX C

DOSE ASSESSMENT

APPENDIX C

This appendix describes the technical approach for conducting the annual radiological dose assessment (to meet the intentions of DOE Order 5400.5) and the air pathway compliance determination (for 40 CFR 61 NESHAP Subpart H) during the active remediation of the Fernald Environmental Management Project (FEMP). The Integrated Environmental Monitoring Plan (IEMP) will be the vehicle for conducting and reporting the annual sitewide radiological dose assessments.

The application of effective source and emission control-measures, coupled with appropriate initial planning and on-going preventive tracking, will form the cornerstone of the FEMP's environmental safeguards during remediation. The objective of the dose assessment under the IEMP is to support these safeguards during remediation and to provide appropriate feedback, when necessary. The FEMP's current compliance-based method for conducting the site's annual dose assessment (which, by definition, is performed at the end of the calendar year to report the results of past activities) will be supplemented with tracking and evaluating actual monitoring data collected at or near potential receptor locations during the year to identify any need for improving source emission control measures to ensure that the annual NESHAP dose limit is never reached.

C.1 REGULATORY DRIVERS AND REQUIREMENTS

Radiological dose assessments are prepared annually at the FEMP to establish that doses to the public from routine operations and emissions are in compliance with the dose limits set by the U.S. Environmental Protection Agency (EPA) and U.S. the Department of Energy (DOE) regulations and orders. In the past, radiological dose assessments conducted at the end of the year were based on modeling results that used measured and estimated releases of airborne radioactive materials from significant sources. The various radiological dose limits and guidelines defined in the Applicable or Relevant and Appropriate Requirements (ARARs) and other regulatory requirements accompanying the FEMP's remediation activities are described in this section.

In addition to the regulatory-based drivers for the FEMP's annual dose assessment, the need for a dose tracking procedure that can be utilized as a preventive tool has been identified. Dose tracking is needed to help prevent exceedence of the annual radiological dose limits and to identify the expected significant contributors for each year's combination of remedial activities. Based on the dose tracking

results, any additional source control measures or adjustment in project-specific activities can be made as necessary to ensure that the FEMP's contributions to annual dose remain within prescribed limits.

C.1.1 ARARs and Other Regulatory Drivers

This subsection summarizes the ARARs and other regulatory drivers for the dose assessment and associated dose limits. A sitewide radiological dose assessment is needed to demonstrate compliance with the following limits and guidelines from DOE Order 5400.5, which incorporates dose assessment standards in 40 CFR 61 NESHAP, Subpart H.

- *The exposure of members of the public to radiation sources as a consequence of all routine activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 100 millirem (mrem).* This annual effective dose equivalent is defined as the sum of external penetrating exposure for the year, plus the committed effective dose equivalent for intakes experienced during the year.

  The guideline includes doses from remedial actions and naturally occurring radionuclides released by DOE processes, but not radon and its decay products. All pathways that could significantly contribute to the exposure are to be included in the calculations. Significant exposures are considered to be one percent of the 100 mrem (1 mrem) dose limit or greater.

- *The exposure of members of the public to radioactive materials released to the atmosphere as a consequence of all activities at a DOE site shall not cause, in a year, an effective dose equivalent greater than 10 mrem.* Because this guideline implements the dose limits of 40 CFR 61 Subpart H, doses caused by Radon-222 and its decay products are not included. The same annual effective dose equivalent definition applies as above.

  Note: The radon effluent guidelines of DOE Order 5400.5 also implement the EPA flux regulations of 40 CFR 61, Subpart Q, which apply to radon-producing wastes during storage or disposal. These guidelines are expressed in terms of radon concentrations in air and radon flux at the surface of radon-producing wastes, not in terms of dose to humans or other organisms.

- *The liquid effluents from DOE activities shall not cause private or public drinking water systems to exceed the drinking water radiological limits in 40 CFR 141.* That is, effluents must not cause the drinking water to exceed any of the following independent limits: man-made beta/gamma-emitting radionuclides at an annual average concentration that would cause an annual dose equivalent of 4 mrem to the total body or any internal organ, combined radium-226 and radium-228 at any time totaling 5 picoCurie/liter (pCi/L), or gross alpha activity (including radium but excluding radon and uranium) of 15 pCi/L at any time.

- *The absorbed dose to native aquatic organisms shall not exceed one rad per day from exposure to the radioactive material in liquid wastes discharged to natural waterways.* For the purposes of satisfying this requirement, the term "native aquatic organisms" (which is not otherwise defined by DOE) is interpreted to mean insects, macroinvertebrates (crayfish, shellfish, etc.), fin fish, or mammals.

C.1.2 Remediation Support Requirements

During the FEMP remediation, routine dose assessments using actual monitoring data will also be conducted more frequently to verify the effectiveness of the source control measures implemented by individual remediation projects and to prevent exceedence of the annual dose limits.

During the year, actual monitoring data at potential receptor locations as defined in Section 6 will be evaluated at least quarterly. When determined necessary, the source emission control measures for selected remediation projects will be revised to reduce the chance of exceeding the annual dose limit. At the end of the year, the actual air monitoring data will also be directly used to determine the annual dose for the 40 CFR 61 NESHAP Subpart H compliance demonstration.

C.2 GENERAL TECHNICAL APPROACH

This section presents a discussion of the general technical approach to be followed for performing the dose tracking and actual annual dose assessment. The discussion includes an explanation of exposure pathways and media important to the dose assessment, surveillance and characterization of these pathways, and the dose calculation procedure. In general, the technical approach for the future dose assessment will be similar to the approach conducted under the FEMP's EMP, except that the monitoring activities will follow the scope described in the media-specific section of this IEMP. Other additions (i.e., routine dose tracking and confirmation of source control measures) will also be incorporated to support the remediation. The major change for dose assessment is that monitoring data instead of results of CAP88-PC calculations will be directly used for the NESHAP Subpart H compliance demonstration.

C.2.1 Exposure Pathways During Remediation

Establishment of representative exposure pathways is important for performing the dose assessment. A typical exposure pathway consists of a specific source, medium of transport, and defined receptor. During the course of remediation, conditions at the FEMP's contaminant sources may be altered both temporarily (during the action) and permanently (as a result of the action). Therefore, representative definitions of remediation-specific exposure pathways are needed to support accurate projections of radiological dose. Because contaminant source conditions can vary each year due to the mix of remedial activities in a given year, representative definitions of remediation-specific exposure pathways will be reevaluated each year during the initial annual sitewide planning and dose projection.

C.2.1.1 Remedial Project-Specific Sources

Specific remedial operations will be conducted at the FEMP to achieve the final cleanup goals. These remedial operations will present new potential emissions sources in addition to the traditional sources evaluated for NESHAP compliance. Following is a list of the major types of remedial operations which may have significant emissions:

- Building decontamination and demolition (D&D)
- Soil and waste material excavation
- Waste treatment
- Construction of the disposal facility
- Waste transportation.

It is important to emphasize that the scope of the IEMP does not include the project-specific emission control monitoring (as specified in the Sitewide BAT determination) that will be performed by the individual projects. The individual projects will also be responsible for applying the appropriate emission controls within a remediation activity to achieve compliance with project-specific regulatory requirements for workers' protection and environmental emissions. As a feedback mechanism for the projects, in the event that the routine IEMP dose tracking results indicate a pending unacceptable annual cumulative impact, follow-up project-specific analyses will be conducted to determine the possible causes. Then, the results of the analysis will be provided to the specific remedial projects and they will be responsible for further adjusting their control measures or activities to bring cumulative projections within acceptable limits.

C.2.1.2 Media-Specific Pathways

Effective source control measures for each remedial action will be implemented and maintained during the FEMP remediation. (The IEMP monitoring and dose projection activities are designed to appraise the cumulative effectiveness of these control measures.) As a result of the FEMP's obligation to apply such measures, the potential impacts resulting from remedial activities are not expected to appreciably increase in any of the media-specific pathways from historical levels. Therefore, the historical monitoring results summarized in the FEMP's annual Site Environmental Reports (SER) can be used to select the FEMP's significant exposure pathways (i.e., those pathways with the potential to contribute one percent or more of regulatory-based dose limits, as prescribed by DOE guidelines) to be routinely monitored and included in the annual dose projection procedure under the scope of the IEMP.

According to the previous annual dose assessments and remedial investigation/feasibility studies (RI/FS) performed at the FEMP, the potential exposure pathways to human receptors are through the air (inhalation and ingestion), surface water, groundwater, and by direct radiation. These potential media-specific pathways are summarized below:

Air Pathway

Potentially significant exposure (i.e., above one percent of the all-pathway combined dose limit of 100 mrem) to humans through the air pathway during remediation may result from:

- Inhalation of contaminated fugitive dust from soil excavation, building D&D, temporary storage piles, disposal facility construction and waste pits
- Inhalation of stack and vent releases
- Ingestion of foodstuff contaminated by direct deposition onto crops
- Ingestion of foodstuff contaminated indirectly by deposition onto soil where crops are grown.

Note: Exposure through consumption of meats and milk from animals that consumed contaminated feed (assuming all contaminated by air deposition instead of irrigation using contaminated water) has been shown to be consistently insignificant (i.e., less than half of the 0.2 mrem total 1995 dose in the foodstuffs ingestion pathway), according to existing monitoring data.

Surface Water Pathway

Potentially significant exposures (i.e., above one percent of the all-pathway combined dose limit of 100 mrem) via surface water during remediation may include:

- Consumption of foodstuff contaminated through irrigation with contaminated surface water
- Contamination of groundwater due to infiltration through the storm sewer outfall ditch and Paddys Run into the Great Miami Aquifer.

Note: Direct consumption of surface water and/or fish from the Great Miami River are not considered significant pathways since surface water is not used as a source of drinking water and there is no commercial fishing in the Great Miami River in the FEMP vicinity. Furthermore, the estimated dose due to an assumed 4.5 kilograms (kg) per year consumption of fish in the Great Miami River is only 0.04 mrem in 1995. Exposure through consumption of meats and milk contaminated through animal consumption of foodstuffs irrigated with contaminated surface water (i.e., Great Miami River) has been shown to be consistently insignificant (i.e., less than 0.2 mrem, which was the total 1995 dose in the foodstuffs ingestion pathway), according to existing monitoring data.

Groundwater Pathway

Potentially significant exposure (i.e., above one percent of the drinking water dose limit of 4 mrem and the all-pathway combined dose limit of 100 mrem) via groundwater during remediation may result from:

- Consumption of foodstuff contaminated through irrigation with contaminated groundwater
- Consumption of drinking water from off-site wells.

Note: Consumption of meats and milk contaminated though animal consumption of foodstuff irrigated with groundwater has been shown to be consistently insignificant (e.g., less than half of the 0.2 mrem total 1995 dose in the foodstuffs ingestion pathway), according to existing monitoring data.

Direct Radiation Pathway

Exposure from direct radiation may result from:

- Direct radiation from materials stored at the FEMP, especially materials in the K-65 silos
- Direct radiation from contaminated soil and sediment.

C.2.1.3 Potential Receptors

Potential receptors to be considered in the radiological dose assessment during the FEMP remediation will include actual and hypothetical off-property residents. The hypothetical receptors are usually selected to demonstrate the worst possible dose at locations of the measured or calculated maximum groundwater and/or air concentrations even when there is no actual receptor at those locations. However, the NESHAP compliance demonstration will be based on actual off-property residents. The IEMP air monitoring network will focus on monitoring at representative potential off-property receptor locations. These receptor monitoring locations will be at the FEMP fenceline or close to actual off-property residents as described in the main text (Section 6). The exposure scenarios and parameters (i.e., duration of exposure and potential food sources) will be generally conservative as used in the previous dose assessments.

C.2.2 Routine Surveillance of Pathways

The environmental media that have the potential to lead to a significant annual dose (greater than one percent of the all-pathway combined dose limit of 100 mrem) at the site boundary and representative potential receptor locations will be routinely sampled and analyzed for the analytes contributing to the

dose. Sections 3 through 7 of the main text describe the media-specific monitoring programs under the IEMP. All the significant pathways listed in Section C.2.1.2 will be monitored under the IEMP.

In general, the routine surveillance under the IEMP will include both environmental sampling/analysis and preventive tracking/feedback. The frequency of monitoring and evaluation will be selected to satisfy the regulatory drivers, as well as, remediation support requirements.

Most of the data for the dose assessment will be based on measurements of radionuclide concentrations in environmental media at on-property and boundary/receptor monitoring locations (as presented in Sections 3.0 through 7.0), rather than in effluent samples obtained at specific sources (e.g. stacks), for the following reasons:

- *Dose assessments based on measured radionuclide concentrations in environmental media are less uncertain than those based on effluent measurements.* Assessments based on environmental monitoring avoid the use of the transport and bioaccumulation models required by effluent-based calculations, thereby reducing the overall uncertainty in the results.

- *The potential exists for unmonitored releases from the FEMP, and the impact of all releases must be accounted for.* Examples of potential unmonitored releases are: releases from open waste pits, fugitive releases from remediation activities, and any releases from demolition projects in the former production area. In an effluent-based method, releases from such pathways must be conservatively estimated, which again contributes to the uncertainty of the results and over-estimates the impact.

- *Calculations based on environmental measurements directly account for impact from multiple sources.* Using environmental monitoring results as input for the dose assessment accounts for all sources of environmental contaminants, without the need for assumptions regarding the impacts of multiple facilities.

- *Despite the lower concentrations in environmental media compared to effluent samples, adequate dose sensitivity can be achieved.* Environmental sampling frequencies, sample sizes, and analytical methods have been selected to obtain sufficient sensitivity in order to support the required dose calculations.

Per EPA's request, the air pathway dose calculation, which is required to demonstrate compliance with EPA's NESHAP Subpart H standards, will also be based on monitoring data instead of effluent activities and subsequent air dispersion modeling.

As part of its integration responsibilities, the IEMP will serve to consolidate the FEMP's environmental monitoring, preventive tracking/feedback, and reporting requirements required to assess the air exposure pathway.

C.2.3 Dose Calculation Procedure

C.2.3.1 Air Monitoring for NESHAP Subpart H Compliance

This section describes the technical approach for demonstrating compliance with NESHAP Subpart H using environmental measurements of radionuclide air concentrations at receptor locations. The section addresses each of the criteria for environmental measurement compliance programs as described in 40 CFR 61.93 (b)(5) and the basic requirements issued by the EPA for NESHAP Subpart H environmental measurements at the FEMP.

Criterion (I): *The air at the point of measurement shall be continuously sampled for collection of radionuclides.*

A network of 17 (15 receptor and 2 background) continuously operating high volume air monitors will be used for the collection of radionuclides. The monitors sample air at approximately 1 m^3/minute using a 0.5 micron filter. The monitors contain a flow rate chart recorder and an hour-meter which provide a record of the monitors operation over the sampling period. Monitoring stations are routinely checked to ensure normal operation. Figure 6-2 is a map of monitoring locations.

Monitoring locations have been selected based on wind rose sectors and potential receptor locations. In sectors where potential receptors are located near the facility fence line, monitors have been sited at the fence line on the FEMP property. In sectors where potential receptor locations are distant from the facility, every effort will be made to place monitors at or near selected receptor locations off-property. Monitors will not be sited at every potential receptor location. Rather, to the greatest extent possible, monitors were sited to provide coverage to groupings of receptors off-property (see map provided). Since the point of compliance under NESHAP Subpart H is at the receptor locations, if agreement can not be reached with private property owners for placement of off-property monitors, further discussions between EPA, OEPA and DOE will be necessary to determine an alternate approach or locations for demonstrating compliance.

Criterion (ii): Those radionuclides released from the facility, which are the major contributors to the effective dose equivalent, must be collected and measured as part of the environmental measurement program.

The IEMP air monitoring program consists of the following sampling and analytical regime.

- Biweekly samples will be collected from each air monitoring station and analyzed at ASL B by the on-site laboratory for the following parameters.

TABLE C-1 BI-WEEKLY ANALYSIS REGIME

ANALYTE	METHOD	HAMDC (pCi/m^3)
Total Uranium	Laser Phosphorescence	3E-05
TSP	Gravimetric	.001g/Filter

- Quarterly composite samples will be prepared from the biweekly samples for each monitor. The composite samples will be analyzed at ASL D by an off-site laboratory for the following radionuclides of concern. The basis for the frequency of analysis and selection of radionuclides is provided below:

TABLE C-2 QUARTERLY ANALYSIS REGIME

ANALYTE	METHOD	HAMDC (pCi/m^3)	HAMDC AS PERCENT OF APPENDIX E, TABLE 2 VALUES
U^{238}	Alpha Spec.	9E-05	1.1
U^{234}	Alpha Spec.	9E-05	1.3
$U^{235/6}$	Alpha Spec.	9E-05	1.2
Th^{228}	Alpha Spec.	7E-06	0.2
Th^{230}	Alpha Spec.	7E-06	0.2
Th^{232}	Alpha Spec.	7E-06	1.1
Ra^{226}	Gamma Spec.	2E-04	6.1

HAMDC = Highest Allowable Minimum Detectable Concentration as specified in the CERCLA Quality Assurance Project Plan (SCQ) or as specified in analytical contracts with off-site laboratories. The HAMDCs required by the FEMP provide adequate sensitivity to detect below 10% of the corresponding NESHAP standard for each radionuclide of interest.

Frequency of Analysis

Quarterly analysis of composite samples is performed in order to meet the following needs of the IEMP air monitoring program:

- Sufficient air sample volumes to detect the (very) low concentrations of contaminants in the air
- Periodic confirmation that contaminant concentrations are below the levels which would cause a dose of 10 mrem/year.

At low concentrations, large volumes of air must be sampled in order to readily detect and distinguish the presence of a contaminant from both the background and blank concentrations. Since filter loading limits the volume of air that can be sampled with a single filter, composite sampling is used to create a sample which represents a large volume of air.

Periodic (quarterly) measurements provide a means to check the concentrations of contaminants several times during the year. Activities or work practices will be adjusted if quarterly measurements indicate that the 10 mrem/year limit might be exceeded.

Quarterly Composite Analytical Suite

The isotopes selected for quarterly analysis represent the major contributors to dose based on the following considerations:

1. Radionuclides which are stored in large quantities at the FEMP and which will be handled or processed during the remediation effort (uranium, Th-232, Th-230, Ra-226)
2. Radionuclides which have been the major contributors to dose based on environmental and stack filter measurements (uranium)
3. Radionuclides, which due to their concentration in waste and contaminated soil, will be the major contributors to dose if the waste or soil is released in the form of fugitive dust (uranium, Th-228, Th-230).

The large quantities of uranium and thorium compounds stored at the FEMP combined with the potential for release during the remediation effort are the basis for including them as major contributors to dose. The waste products from the chemical processes used to produce uranium metal at the FEMP, contain comparatively high levels of Th-230 and Ra-226. These wastes were either stored in the K-65

silos (with the intent of recovering the Ra-226) or disposed of in the waste pits. The high concentrations of Th-230 in the waste pit material is documented in the Operable Unit 1 RI. The K-65 silos contents and the high levels of Ra-226 and Th-230 are characterized in the Operable Unit 4 RI. The inclusion of Ra-226 and Th-230 as major contributors is based, in part, on the quantity of wastes which contain high levels of these radionuclides.

Stack filter measurements during production and environmental measurements during both production and the pre-remediation period at the FEMP confirm that uranium is the major contributor to air inhalation dose. Thus, these measurements provide additional justification for its inclusion as a major contributor as well as the target analyte for bi-weekly sampling.

Based on planned activities and the radiological characteristics of materials (soil and waste) to be processed, uranium is expected to be the major contributor to the air pathway dose during the near term (1997 and 1998). However, DOE recognizes that as the remediation progresses, new sources of emissions may change the mix of major contributors. The potential to change the list of major contributors exists through the excavation of the waste pits and, to a lesser extent, the removal and handling of the silo's contents. The major contributors from these sources were estimated by calculating the radionuclides relative contributions to dose assuming resuspension of the pit material in the form of fugitive dusts. Average concentrations of pit materials (Operable Unit 1 RI) were used to represent the radiological characteristics of the fugitive dusts. The radiological characteristics of the K-65 silos were not used since the process to remove the silo contents is not expected to generate emissions in the form of fugitive dusts. The expected major contributors to dose during pit excavation are shown in the following table.

TABLE C-3 PERCENTAGE CONTRIBUTION TO INHALATION DOSE ASSUMING RESUSPENSION OF WASTE PIT MATERIAL

RADIONUCLIDE	Pit 1	Pit 2	Pit 3	Pit 4	Pit 5	Pit 6
Cs-137	0	0	0	0	0.2	0
Np-237	0	0	0	0	3.4	0
Pu-238	0	0	0	0	0.1	0
Pu-239/240	0	0	0	0	0.3	0.1
Ra-226	1.1	4.8	2.9	0.3	3.4	0
Ra-228	0.2	1.1	1.2	0.4	0.5	0.2
Ru-106	0	0	0	0	0	0
Sr-90	0	2.0	0	0.1	0	0
Tc-99	0	0	0.1	0	1.2	0
Th-228	5.2	6.1	2.8	7.4	0.7	0
Th-230	47.1	40.0	77.3	9.8	66.6	0.2
Th-232	16.2	9.1	8.4	9.5	2.5	0
U-234	5.1	14.3	2.6	9.1	10	8.8
U-235/6	0.7	6.6	.2	1.6	0.4	1.7
U-238	24.4	16.1	4.6	61.7	10.7	88.9

Th-228 was added to the list of major contributors based on its greater than 5 percentage contribution from Pits 1, 2, and 4. Based on process knowledge, small quantities of transuranics (e.g. Np-237 and Pu-239/240) and fission products (Sr-90, Tc-99, Ru-106, and Cs-137) shown in Table C-3 were introduced into the waste pits from recycled material and not from irradiated fuel. These radionuclides have been well characterized in the FEMP wastes and will not be major contributors to air inhalation dose.

DOE proposes to monitor the changing mix of contributors by comparing the quarterly composite results to the NESHAP Appendix E, Table 2 values. If the fractions of the measured concentration to the corresponding NESHAP limit indicates a contaminant other than uranium is contributing the largest percentage of dose, then DOE will propose changes to the IEMP air monitoring and analytical schedule in order to better monitor the mix of major contributors.

Consideration of Decay Chain Daughter Products

Uranium-238, thorium-232 and uranium-235 are initial radionuclides in the uranium, thorium and actinide decay chains, respectively. The decay chains and the half-lives of the daughter products are provided in the following table.

Note: Doses caused by radon-222 and its respective decay products formed after the radon is released from the facility are not included in the NESHAP dose limit of 10 mrem/year and will not be measured as part of the NESHAP Subpart H compliance demonstration. A description of the FEMP radon monitoring program is included in Section 6.

TABLE C-4 URANIUM, THORIUM AND ACTINIDE DECAY CHAINS

ISOTOPE	HALF-LIFE	ISOTOPE	HALF-LIFE	ISOTOPE	HALF-LIFE
U-238	4.5×10^9 years	Th-232	1.4×10^{10} years	U-235	7.1×10^8 years
Th-234	24 days	Ra-228	5.7 years	Th-231	25.64 hrs
Pa-234m	1.2 min.	Ac-228	6.13 hrs	Pa-231	3.25×10^4 years
U-234	2.5×10^5 years	Th-228	1.9 years	Ac-227	21.6 years
Th-230	8.0×10^4 years	Ra-224	3.64 days	Th-227	18.2 days
Ra-226	1622 years	Rn-220	55 sec.	Fr-223	22 min.
Rn-222	3.8 days	Po-216	0.16 sec	Ra-223	11.4 days
Po-218	3.05 min.	Pb-212	10.6 hr	Rn-219	4.0 sec.
Pb-214	26.8 min.	Bi-212	60.5 min	Po-215	1.77×10^{-3} sec.
Bi-214	19.7 min.	Po-212	3.04×10^{-7} sec.	Pb-211	36.1 min.
Po-214	1.6×10^{-4} sec.	Pb-208	Stable	Bi-211	2.16 min.
Tl-210	1.3 min.			Tl-207	4.79 min.
Pb-210	22 years			Pb-207	Stable
Bi-210	5 days				
Po-210	138 days				
Pb-206	Stable				

The majority of uranium and thorium received and processed during the production era of the FEMP had been separated from its decay chain daughters prior to shipment to the FEMP. As a result, decay chain daughter products were not in equilibrium (the condition where the daughter concentration (in Ci/g) is equal to the parents concentration (in Ci/g)) with the parent concentrations in the bulk of the materials received on site for processing.

Radioactive decay laws govern the ingrowth of the daughters from the purified parent. Daughter product ingrowth is based on the length of time the parent bearing material has been stored on site. As a general rule, the daughter of a long-lived parent (e.g. U-238, Th-232, or U-235) grows into equilibrium with the parent in about 10 daughter half-lives. For example, using data from the above table, Th-234 would reach equilibrium with U-238 in about 240 days (10 x 24 days).

Considering the half-lives in the table above and the 40 year production history of the FEMP, a number of daughters can conservatively be considered to be present in equilibrium concentrations with their parents. These radionuclides (Th-234, Ra-228, Ac-228, Ra-224, and Th-231) will be considered to be in equilibrium with their parent concentrations measured in the quarterly composite. The equilibrium based concentration for these radionuclides will be compared to the corresponding 40 CFR 61 subpart H, Appendix E Table 2 value as described in *Criterion iv* (below). Other radionuclides (Protactinium-231 [Pa-231], Actinium-227 [Ac-227], and their decay products) have not had sufficient time to reach equilibrium with their parent. In fact, due to the 32,500 year half-life of Pa-231, none of the decay chain daughters have had time for significant ingrowth. Therefore, concentrations of decay chain daughters in the U-235 chain below Th-231 will be considered to be zero in the quarterly composite samples.

Criterion (iii): *Radionuclide concentrations which would cause an effective dose equivalent of 10% of the standard shall be readily detectable and distinguishable from background.*

As indicated in Table C-2 above, the detection limits for the major contributors to dose are less than 10% of NESHAP Appendix E, Table 2 values and will therefore be readily detectable, if present. The analysis of samples from the two background monitors will provide the data to distinguish fenceline and potential receptor monitoring results from background.

Criterion (iv): *Net measured radionuclide concentrations shall be compared to the concentration levels in Table 2 of Appendix E to determine compliance with the standard. In the case of multiple radionuclides being released from the facility, compliance shall be demonstrated if the value for all radionuclides is less than the concentration level in Table 2, and the sum of the fractions that result when each measured concentration value is divided by the value in Table 2 for each radionuclide is less than 1.*

Average annual radionuclide concentrations at each monitoring location will be determined for each radionuclide by dividing the sum of the radionuclide mass values, obtained via quarterly laboratory

analysis, by the total volume of air drawn through the filter. As described above, decay chain daughter products will be assumed to be in equilibrium with the measured parent concentration. Concentrations will be corrected for background to obtain the net measured concentration. The resulting net annual average concentrations will be divided by the corresponding 40 CFR 61 subpart H, Appendix E Table 2 values. The resulting fractions will be summed per monitoring location to demonstrate compliance. Compliance with the Subpart H standard will be documented in an annual compliance summary that will be submitted as part of the IEMP sponsored annual environmental report.

Managing Analytical Results

The analysis of environmental air samples may result in contaminant concentrations being reported at levels which are at or below the minimum detectable concentration (MDC). Contaminant concentrations which are at or below MDC are statistically indistinguishable from concentrations found in a blank sample. Air sample results from fenceline or receptor locations which are reported at or below the MDC will therefore be considered non-detects (zero) for the purposes of demonstrating compliance with the NESHAP dose limit.

Detectable contaminant concentrations will be corrected to net detectable concentrations using the average background concentration. Average background concentrations will be determined using the average detected concentrations at the two background air monitors.

Detectable contaminant concentrations will be corrected to net detectable concentrations using the average background concentration measured during the same sampling period. Average background concentrations will be determined using the average detected concentrations at the two background air monitors. Background air monitoring results which are MDCs will not be averaged, only measured concentrations will be used.

Criterion (v): A quality assurance program shall be conducted that meets the performance requirements described in Appendix B, Method 114.

All environmental sample collection and analysis conducted in support of the remediation effort at the FEMP are subject to the quality assurance requirements of the Sitewide CERCLA Quality Assurance Program Plan (SCQ). This EPA approved plan and its incorporation into the IEMP sampling plan meets the quality assurance program requirements of Appendix B, Method 114.

Criterion (vi): *Use of environmental measurements to demonstrate compliance with the standard is subject to prior approval by EPA. Applications for approval shall include a detailed description of the sampling and analytical methodology and show how the above criteria will be met.*

The submittal of the IEMP to the EPA for review and approval serves as the application. The IEMP and its appendices provide a description of the sampling and analytical methodology and explains how the criteria will be met.

C.2.3.2 All Pathway Dose Calculations

This section describes the technical approach for demonstrating compliance with the 100 mrem/year all-pathway dose limit in DOE Order 5400.5. Estimates of annual dose are based on the measured, background-corrected concentration of a contaminant in each environmental media (e.g., groundwater, and foodstuff). Ingestion rates for standard man are used for the consumption of water. A modified reference diet (NRC Reg. Guide 1.109) is used for the consumption of food. Dose conversion factors (DCF) [which are radionuclide specific factors used to convert a unit of ingested radioactivity (pCi) to dose (mrem)] are taken from DOE publications (Internal/External Dose Conversion Factors for Calculation of Dose to the Public DOE/EH-0070 and DOE/EH-0071).

The general form of the dose assessment equation is

$$D = C_{i,m} * I_m * DCF_i$$

where,

D = Dose (mrem/yr)

$\mathbf{C_{i,m}}$ = Background-corrected concentration of radionuclide **I** in media **m** (pCi/kg or pCi/l)

$\mathbf{I_m}$ = Intake (ingestion) rate for media (kg/yr, or L/yr)

$\mathbf{DCF_i}$= Dose conversion factor for radionuclide **I** (mrem/yr*pCi)

The detailed calculation of doses from the various environmental media was governed by FEMP procedure EP-REM-008, Estimating Radiological Pathway Dose except for the air inhalation dose, which is calculated as described in the previous section. Doses from all the media monitored under the IEMP also will be calculated according to relevant sections in this procedure. In general, drinking

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water ingestion dose, foodstuff ingestion dose, and direct radiation dose will be calculated separately and then combined into the DOE all-pathway annual dose.

C.3 REPORTING

The types, frequency, and procedure of dose assessment reporting during FEMP remediation are summarized in this section. Based on the expanded objective of the dose assessment described in Section C.1, there will be three interfacing and reporting mechanisms in which the dose assessment results will need to be presented. Each of these three reporting processes is described in the following subsections.

C.3.1 Project-Specific Interfaces

Remedial project-specific emission monitoring results collected by remediation projects for remedial workers health and safety concerns will be used to determine significant contributors among the on-going remedial actions. Therefore, an interface between the IEMP and ongoing remediation projects will be maintained in order to gather project-specific data and to provide feedback for adjusting/implementing source control measures. Frequency of data collection of evaluation will generally follow a quarterly reporting schedule unless project-specific considerations warrant special modifications.

C.3.2 Regulatory Interfaces

The IEMP air monitoring data will be submitted quarterly. When the preventive tracking, based on quarterly monitoring data, indicates a need for adjusting/implementing project-specific source control measures, the regulatory agencies will be notified by the specific remediation projects. The modifications and the effectiveness of the improved source control measures will also be documented.

C.3.3 Annual Reporting

The NESHAP Subpart H Annual Report and the SER will be issued annually, according to reporting schedule in Section 8.0 of the IEMP. Annual summaries of the monitoring results, calculated doses from airborne emissions, calculated dose from eating foodstuffs produced near the site, calculated direct radiation dose, and estimated dose from drinking well water will be included in these reports. Comparisons of the pathway-specific and the combined annual radiological doses to the regulatory dose limits will be also be presented.

C.4 SUMMARY

Figure C-1 shows the major tasks in the sitewide dose tracking and annual dose assessment processes during the FEMP remediation described in this Appendix. Table C-1 further summarizes the responsibilities of the IEMP and specific remediation projects to fully implement the sitewide air-pathway sitewide dose tracking and annual dose assessment processes.

TABLE C-1 SITEWIDE DOSE TRACKING AND ANNUAL ASSESSMENT TASKS

TASKS	PROJECT RESPONSIBILITIES
IEMP	
• Annual Sitewide planning	Evaluate planned remedial activities and source conditions at beginning of the year.
• Routine Fenceline/Receptor Monitoring	Conduct routine air monitoring at background, fenceline and/or representative potential receptor locations.
• Preventive Tracking/Feedback	Directly compare routine monitoring results to annual dose benchmarks quarterly; report and evaluate any exceedences.
• NESHAP Compliance Demonstration	Based on actual monitoring data, calculate annual doses at monitoring locations, and determine the receptor locations at end of the year.
• Reporting	Prepare quarterly monitoring data reports and the annual NESHAP report.
Remediation Project	
• Annual Planning	Specify project-specific remedial schedule and activities at beginning of the year.
• Maintain Fugitive Dust and/or Emission Source Control	Maintain/improve effective fugitive dust and emission source control measures within the project boundary.
• Health and Safety Monitoring	Conduct routine remedial worker health and safety monitoring.

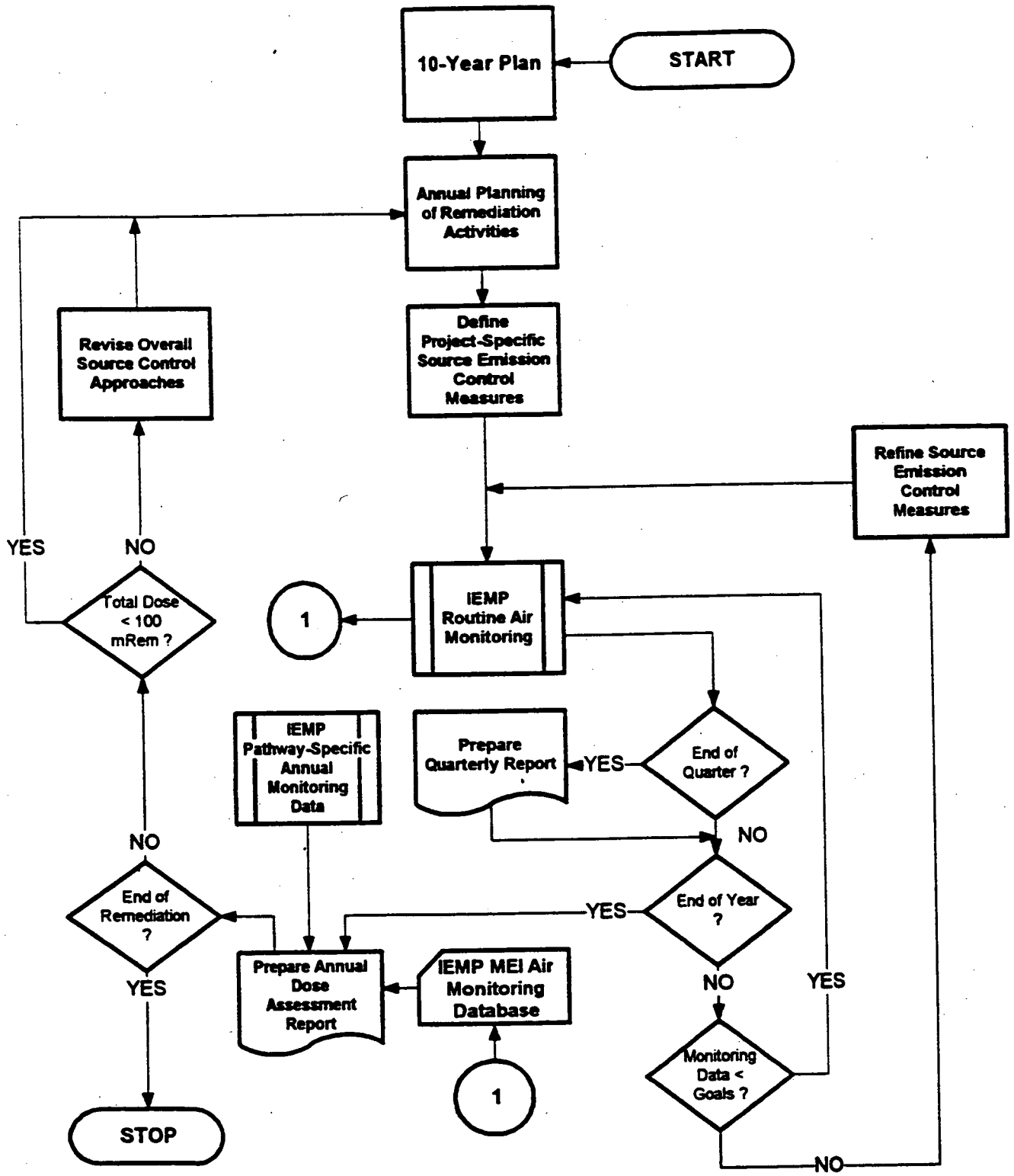

FIGURE C-1 SITEWIDE IEMP/DOSE TRACKING AND ASSESSMENT ROAD MAP

APPENDIX D

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NATURAL RESOURCE IMPACT MONITORING PLAN

D.1 INTRODUCTION AND OBJECTIVES

The purpose of the Natural Resource Impact Monitoring Plan (NRIMP) is to monitor the status of impacts to natural resources on the Fernald Site during remediation. In addition, the plan will outline an approach to monitor the status of several priority natural resource areas in order to remain in compliance with the appropriate regulations. Reporting of the monitoring results will be fully integrated with the Integrated Environmental Monitoring Plan (IEMP) reporting.

The results of this monitoring will be used to inform the Agencies (i.e., U.S. EPA and Ohio EPA) and the Fernald Natural Resource Trustees (NRTs) as to the status of Fernald's natural resources and the status of impacts to those resources through integrated reporting with the IEMP. The NRTs have chosen to focus on a restoration-based approach to resolve DOE's liability for natural resource impacts.

The NRTs are collectively developing a natural resource restoration plan (NRRP) which is based on a set number of acres of past and anticipated future natural resource impacts as defined in the Natural Resource Impact Assessment (NRIA). One primary function of the NRIMP will be to monitor the status of impacts at the Fernald Site so that any needed adjustments to the NRRP can be made if the actual amount of acreage impacted varys significantly from that anticipated in the NRIA. Changes to the baseline impacts outlined in the NRIA will be noted in the NRRP section that summarizes the NRIA. The NRIA itself will not be revised if changes to baseline impacts occur.

The NRIMP will also provide an integrated, systematic approach for monitoring the status of the site's natural resources and reporting the results of that monitoring to the appropriate Agencies and NRTs. Implementation of this plan will facilitate the site's ongoing responsibility for maintaining compliance with a number of natural resource regulations as outlined below.

D.2 ANALYSIS OF REGULATORY DRIVERS

Regulatory drivers for the management of natural resources and associated impact monitoring include five areas; endangered species protection, wetlands/floodplain regulations, cultural resource management, the Comprehensive Environmental Response, Compensation, and Liability Act

(CERCLA) natural resource trusteeship process, and National Environmental Policy Act (see Table D-1).

D.2.1 THREATENED AND ENDANGERED SPECIES

The federal laws and regulations listed below mandate that any action authorized, funded, or carried out by DOE cannot jeopardize the continued existence of any listed species or result in the destruction or adverse modification of the constituent elements essential to the conservation of a listed species within a defined critical habitat. Additional requirements may apply if it is determined that a proposed activity could adversely affect these species or their habitat. These laws and regulations include the Endangered Species Act (16 U.S.C. §1531, et seq.) and its associated regulations (50 CFR 17 and 50 CFR 402).

State law also protects endangered species by prohibiting the taking or destruction of any state-listed endangered species. These laws are found at ORC §1518 and §1531, as well as OAC §1501.

D.2.2 WETLANDS/FLOODPLAINS

Executive Order 11990 (Protection of Wetlands) and Executive Order 11988 (Protection of Floodplains), which are implemented by DOE Regulation 10 CFR 1022, "Compliance with Floodplain/Wetlands Environmental Review Requirements," specify the requirement for a Floodplain/Wetland Assessment in cases where DOE is responsible for providing federally undertaken, financed, or assisted construction and improvements that may impact floodplains or wetlands. This regulation further requires that DOE exercise leadership to minimize the destruction, loss, or degradation of wetlands and preserve and enhance the natural and beneficial values of wetlands.

Pursuant to Section 404 of the Clean Water Act (CWA) and 33 CFR § 323.3, any activity that results in the discharge of dredged or fill material into a wetland or water of the United States requires permit authorization by the Army Corps of Engineers. These permits can be in the form of either nationwide permits (33 CFR Part 330) or individual permits (33 CFR Part 323) depending on the nature of the activity.

TABLE D-1

FEMP ECOLOGICAL MONITORING

REGULATORY DRIVERS AND RESPONSIBILITIES

DRIVER	ACTION
Endangered Species Act Ohio Endangered Species Regulations	The IEMP describes management of existing habitat and future follow-up surveys
Clean Water Act - Section 404	The IEMP describes the monitoring of mitigated wetlands.
National Historic Preservation Act Native American Graves Protection and Repatriation Act Archaeological Resources Protection Act	The IEMP describes the monitoring of cultural resources.
CERCLA Executive Order 12580 National Contingency Plan	The IEMP describes the CERCLA Natural Resource Trusteeship Process.
National Environmental Policy Act	The IEMP discusses the substantive requirements of NEPA for protecting sensitive environmental resources.

Section 401 of the CWA and 33 CFR §325.2(b)(1)(ii), also require that a Section 401 State Water Quality Certification be obtained to authorize discharges of dredged and fill material under a Section 401 permit. In Ohio, the Section 401 State Water Quality Certification program is administered by OEPA pursuant to Chapter 3745-32 of the Ohio Administrative Code (OAC).

D.2.3 CULTURAL RESOURCE MANAGEMENT

Management of cultural resources, particularly archeological sites, is mandated by the National Historic Preservation Act (NHPA, 16 U.S.C. §470), the Native American Graves Protection and Repatriation Act (NAGPRA, 25 U.S.C. §3001, et seq.), and the Archeological Resources Protection Act (ARPA, 16 U.S.C. §470aa-470ll). The associated regulations for the above laws are found at 36 CFR 800, 43 CFR 10, and 43 CFR 7, respectively. These laws and associated regulations ensure that archeological resources on Federal Land are managed appropriately. Section 106 of NHPA ensures that DOE takes into consideration the effect of its undertakings on properties eligible for listing on the National Register of Historic Places, and that the Advisory Council on Historic Preservation has an opportunity to comment on those effects. NAGPRA and 43 CFR 10 requires that the rightful control of Native American cultural items that are discovered on "Federal Land" be relinquished to the appropriate, culturally affiliated tribe(s). "Federal Land" is defined as land that is owned or controlled by a federal agency (e.g., the Fernald Site). Cultural items are defined as human remains, associated funerary objects, unassociated funerary objects, sacred objects, and objects of cultural patrimony. ARPA and 43 CFR 7 ensure that archeological excavations are carried out by competent individuals in a scientific manner.

DOE has finalized a Programmatic Agreement with the Advisory Council on Historic Preservation and the Ohio Historic Preservation Office that will streamline the NHPA Section 106 consultation process. Monitoring provisions will be included as part of this agreement to ensure that appropriate management is implemented for any eligible properties on the Fernald Site.

D.2.4 THE CERCLA NATURAL RESOURCE TRUSTEESHIP PROCESS

The CERCLA, Executive Order 12580, and the National Contingency Plan collectively require certain federal and state officials to act on behalf of the public as trustees for natural resources. Trustees for the Fernald site are the Secretary of DOE; the Secretary of the U.S. Department of the Interior (DOI); and officials of the Ohio Environmental Protection Agency (Ohio EPA), appointed by the Governor of Ohio.

The trustees' role is to act as guardians for public natural resources at or near the Fernald Site. The trustees are responsible for determining if natural resources have been injured as a result of a release of a hazardous substance or oil spill from the site and if so, how to restore, replace, or acquire the equivalent natural resources to compensate for the injury. DOE, as the responsible party, is responsible for costs related to natural resource injury, in addition to costs associated with remediation of the site.

The Fernald Site Natural Resource Trustees have been meeting since June of 1994 to evaluate and determine the feasibility of integrating the trustees' concerns with future remedial activities. The trustees have identified their desire to resolve DOE's liability by integrating restoration activities with remediation.

D.2.5 NATIONAL ENVIRONMENTAL POLICY ACT

In addition to the specific regulatory drivers summarized above, aspects of natural resource management and monitoring are mandated through the incorporation of substantive NEPA requirements into remedial action planning. In June, 1994, a revised secretarial policy on NEPA compliance was issued by DOE. This policy called for the integration of NEPA requirements into the CERCLA decision making process. Therefore, requirements for the protection of sensitive environmental resources including threatened and endangered species and cultural resources, are to be considered throughout remedial activities.

D.3 PROGRAM EXPECTATIONS AND DESIGN CONSIDERATIONS

The expectations of the monitoring and reporting as outlined in the NRIMP are as follows:

- Provide a systematic approach for monitoring and reporting habitat impacts during the implementation of remediation activities
- Identify natural resource impacts (if any), that were not documented in the Natural Resource Impact Assessment (NRIA) for the Fernald Site
- Provide a mechanism to monitor the status of Fernald's natural resources to remain in compliance with applicable laws and regulations.

The results of the monitoring outlined in this plan may have an impact on design issues associated with the NRRP. If the amount of impact to natural resources during remedial activities is substantially more

or less than anticipated in the NRIA, adjustments to the amount of natural resource restoration activities as outlined in the NRRP may be warranted. In addition, if impacts to a sensitive area were to occur during remediation that were not anticipated (e.g., the northern forested wetland), additional activities (e.g., wetland mitigation) may be required. It is not anticipated that results of the NRIMP will impact any other aspect of remedial design.

D.4 NATURAL RESOURCE MONITORING PLAN

Monitoring will be implemented during remediation activities to identify impacts to natural resources at the Fernald Site with particular emphasis placed on meeting regulatory requirements for NEPA, threatened and endangered species, wetlands/floodplains, and cultural resources. To accommodate natural resource monitoring, priority natural resource areas have been established across the Fernald Site (Figure D-1). All natural resource monitoring will be carried out by Fluor Daniel Fernald with oversight from DOE-Fernald. Outside expertise may be used in limited circumstances depending on the type of monitoring to be conducted. A description of the monitoring strategies to be implemented at the Fernald Site is provided below.

D.4.1 THREATENED AND ENDANGERED SPECIES

The State-listed threatened Sloan's crayfish (*Orconectes sloanii*) is the only threatened or endangered species to have a known population on the Fernald Site. However, there is the potential for other State and Federal-listed threatened and endangered species to have habitat ranges that encompass the Fernald Site and/or occupy the Fernald Site. Therefore, monitoring is being proposed to track the status of the Sloan's crayfish population and their habitat and also monitor the habitat of several other listed species that could potentially use the Fernald Site.

D.4.1.1 Sloan's Crayfish

The state-listed threatened Sloan's crayfish (*Orconectes sloanii*) prefers streams with rocky riffle habitat and medium water flow. A large, well established population of Sloan's are found at the Fernald Site in the northern reaches of Paddys Run. In dry periods, the crayfish retreat to deeper pools which remain both downstream and upstream of the train trestle.

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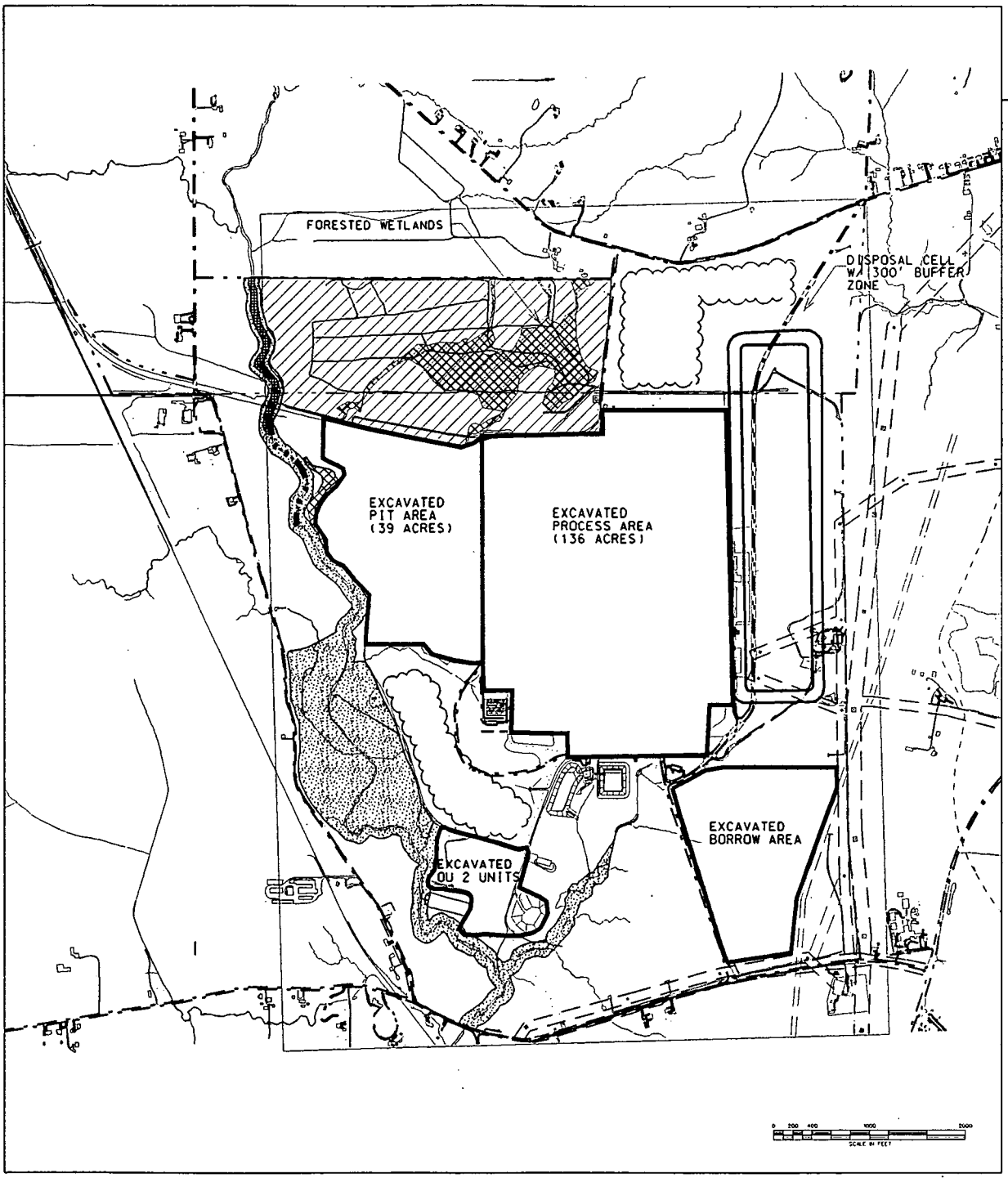


LEGEND:

	ACREAGE:
RIPARIAN CORRIDOR	78
SLOAN'S CRAYFISH AREA	2
INDIANA BROWN BAT HABITAT	3
WETLANDS	36
NORTHERN WOODLOT AREA	100
PINES	125

FINAL

000381

FIGURE D-1. PRIORITY NATURAL RESOURCE AREAS

This species resides with one other competing species of crayfish (*Orconectes rusticus*) that is generally considered more aggressive. In addition, the Sloan's crayfish is sensitive to siltation in streams. A significant population of Sloan's crayfish also resides in an off-property section of Paddys Run at New Haven Road.

Impacts to the Sloan's crayfish are similar to impacts to other aquatic organisms in Paddys Run. Impacts of concern would include excavation and alteration of the stream bed along with increased siltation and runoff into Paddys Run. Visual field observations after every storm event were conducted from August of 1996 through January of 1997 to identify any impact of sediment loading on the Sloan's crayfish population in Paddys Run from site activities. As a result of those visual field observations, no impact was observed due to sediment loading to Paddys Run. These observations support the finding that existing stormwater controls are adequate for addressing potential impacts to Sloan's crayfish habitat due to sediment loading.

As a condition of the Fernald NPDES permit, visual observations of sediment controls must be carried out pursuant to the site's Stormwater Pollution Prevention Plan on a weekly basis and after any "storm event." A "storm event" is defined as being any event in which more than 0.5 inches of rainfall occurs in a 24-hour period. An inspection form is completed after each visual observation to ensure that sediment controls are functioning properly. Therefore, monitoring of the Sloan's crayfish population will be implemented as outlined in the Sloan's Crayfish Monitoring Plan which was included as Appendix D to Area 1 Phase I RA Work Plan (Attachment A). Fernald natural resource personnel will interface with the personnel conducting the visual observations of sediment controls on a regular basis to ensure controls remain in place.

The Sloan's crayfish population in Paddys Run will be surveyed every three years to monitor trends in the long-term status of the population. Surveys will involve the use of nets to capture and identify species in Paddys Run. The most recent survey was conducted in the Fall of 1996 with the next survey to be conducted in 1999.

D.4.1.2 Indiana Bat

Good to excellent habitat for the federally-endangered Indiana bat has been identified north of the train trestle in Paddys Run. The habitat provides an extensive mature canopy from older trees and the presence of water throughout the year. Potential impacts to Indiana bat habitat include soil excavation

and tree removal associated with soil and/or stream remediation and alteration along riparian areas in the northern on-property sections of Paddys Run. Because the bats use loose-bark trees for their maternal colonies, removal of trees would impact this species by eliminating its summer habitat.

Remedial activities are not currently planned within the area of concern for the Indiana bat. The habitat of the Indiana bat will be monitored during remedial activities as part of the program outlined in Section 4.4 to identify any unanticipated impacts during remediation. However, if remedial activities are proposed as a result of certification sampling identifying unanticipated hot spots of contamination in the Paddys Run Area north of the train trestle, then a follow-up survey for the Indiana bat will be initiated prior to initiation of remedial activities. Follow-up surveys may also be proposed as part of success monitoring in the NRRP if that area is considered for enhancement of the Indiana bat population.

If monitoring is determined appropriate, monitoring methods for the bat would consist of mistnetting in areas suitable as bat flyways and where canopy occurs. Mistnetting would occur between May 15 and August 15, since some bats begin to disperse for winter shelter in late August. Data recorded at each sampling site would include type of habitat, water depth and permanence, type bottom, tree species and size, and presence of hollow trees or trees with loose bark in the vicinity.

In addition to mistnets, bat detectors would be used during all sampling to detect echolocation calls near the net, which determines bat activity. The number of calls on the detector would be recorded to indicate the effectiveness of the nets in relation to bat activity. Bat detectors can also be used to sample areas of marginal habitat to determine if netting should be attempted.

D.4.1.3 Running Buffalo Clover

The federally endangered running buffalo clover surveys conducted in 1994 found no individuals of this species on Fernald property. However, since running buffalo clover is found nearby in the Miami Whitewater Forest, the potential exists for this species to establish on the Fernald Site. The running buffalo clover prefers habitat with well-drained soil, filtered sunlight, limited competition from other plants, and periodic disturbance. Therefore, surveys will be conducted in future years, as needed, prior to remedial activities within areas of concern for running buffalo clover. Areas of concern would include partially shaded areas along Paddys Run and the Storm Sewer Outfall Ditch.

Follow-up surveys would be conducted between May and June, which is the time frame for blooms.

An appropriate number of transects would be walked in suspect areas to identify the running buffalo clover. This plant is a perennial that forms long stolons, rooting at the nodes. The plant is also characterized by erect flowering stems, typically 3-6 inches tall, with two leaves near the summit topped by a round flower head. If populations are discovered, Best Management Practices would be utilized to minimize impacts and the NRRP would be adjusted accordingly.

D.1.4 Spring Coral-Root

This state-threatened orchid blooms in April and May and grows in semi-shade in a variety of mesic deciduous woods, such as forested wetlands and wooded ravines. Although surveys conducted in 1994 and 1995 indicated no individuals were present, suitable habitat exists in the Northern Forested Wetland.

Follow-up surveys will be conducted if practicable between April and May, prior to any wetland mitigation or remedial activities in the Northern Woodlot. Wetland mitigation activities in the Northern Woodlot are tentatively being considered for Summer of 1999. An appropriate number of transects would be walked in suspect areas. Flowering of the Spring Coral-root is triggered by a combination of natural factors such as air, temperature, soil moisture, and photoperiod. Because these conditions must be optimal for flowering, this species may not bloom every year. Since this species may not bloom every year, impacts would be noted to the habitat, even if no individuals are found.

D.4.2 FLOODPLAINS/WETLANDS

Approximately 10 acres of on-property wetlands adjacent to the production area will be impacted as a result of contaminated soil excavation. The 26 acre northern forested wetland area and associated drainage characteristics will be avoided and protected during remedial activities. A mitigation ratio of 1.5:1 (1.5 acres of wetlands will be replaced for every 1 acre of wetland disturbance) was negotiated between DOE and the appropriate Agencies (U.S. EPA, OEPA, USFWS, and ODNR). As a result of this agreement, 15 acres of wetlands must be established to compensate for the impacts during remediation. The technical feasibility of on-property wetland mitigation is currently being evaluated. Assuming that all Agencies and Stakeholders agree to pursue on-property mitigation, the construction of additional wetlands is being tentatively considered for the summer of 1999. It is anticipated that specific monitoring will be required as a component of Wetland mitigation to ensure success and to maintain the status of unimpacted wetlands on the Fernald Site. The details of success monitoring for wetland mitigation will be established in the NRRP.

D.4.3 CULTURAL RESOURCE MANAGEMENT

All field personnel must comply with EP-0003, "Unexpected Discovery of Cultural Resources" if cultural resources are uncovered during ground disturbing activities. Monitoring will occur on a limited basis in all areas that have been surveyed to identify any unexpected discoveries of human remains (Figure D-2). More intensive field monitoring will only take place in areas known to have a high potential for archaeological sites as determined by previously conducted investigations. In most instances, discovery of human remains will require data recovery work in previously surveyed areas. Any disturbance of previously unsurveyed areas will require at least Phase I investigations.

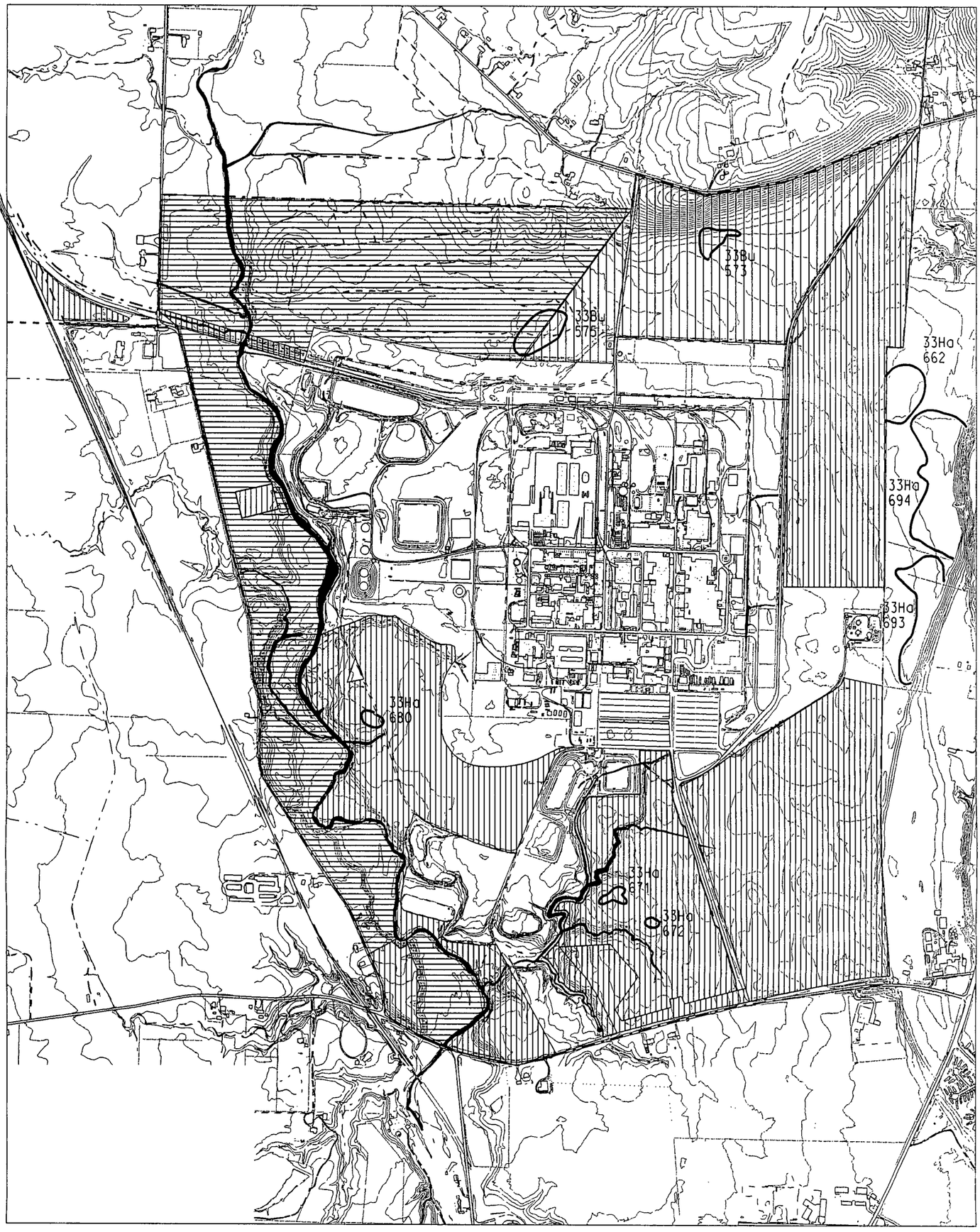
D.4.4 HABITAT MONITORING:

Visual observations of designated habitat areas (as defined in the NRIA) will be implemented on a quarterly basis for the entire Fernald Site. The extent of each impacted habitat area will be surveyed using a Global Positioning System (GPS). This mapping system consists of a Trimble Pathfinder ProXL and an Omnistar 6300A. The Trimble Pathfinder ProXL system is a mapping grade receiver with powerful GIS capabilities when used with Trimble's Asset software. The Omnistar 6300A receiver is used to provide differential correction to the Trimble Pathfinder ProXL. The interfacing of the two units provides real-time differential correction, thus increasing position accuracy. A map will be scaled to depict the extent of impacts in each specific habitat type (see Figure D.3).

In addition, changes to habitats will be tracked using an electronic database with specific fields to indicate the scope of the activity being conducted, the impacts to the habitat based on field observations and any other relevant information pertaining to the impact. If necessary, photographs will also be taken. The GPS map and electronic database will be presented on a quarterly basis. Results of monitoring will be compared with results of the NRIA to determine unanticipated impacts during remediation. The determination of unanticipated impacts will allow the NRTs to collectively determine if adjustment to the levels of natural resource restoration is needed.

D.5.0 NATURAL RESOURCE DATA EVALUATION AND REPORTING

The results of natural resource monitoring will be fully integrated with the quarterly and annual reporting committed to in the IEMP. A summary of the monitoring activities to be carried out until the end of FY 1998 (i.e., the life of this version of the IEMP) is provided in Table D-2. The quarterly monitoring will provide appropriate updates on unexpected impacts to natural resources and the results of specific natural resource monitoring that has been implemented in that quarter (i.e., crayfish,



LEGEND:

AREA TO BE SURVEYED

AREA PREVIOUSLY SURVEYED

AREA WITH SURFACE CONTAMINATION ¢ 1000 dpm/100 cm^2
OR
AREA PREVIOUSLY DISTURBED BEYOND THE STERILE SOIL LAYER

IDENTIFIED ARCHAEOLOGICAL SITE

WATERS OF THE U.S.

FEMP BOUNDARY

5' CONTOUR INTERVAL

NOTE: AREA DEPICTION IS CURRENT AS OF 7/27/97

SCALE

1000 500 0 1000 FEET

DRAFT

FIGURE D-2. CULTURAL RESOURCE SURVEY AREAS

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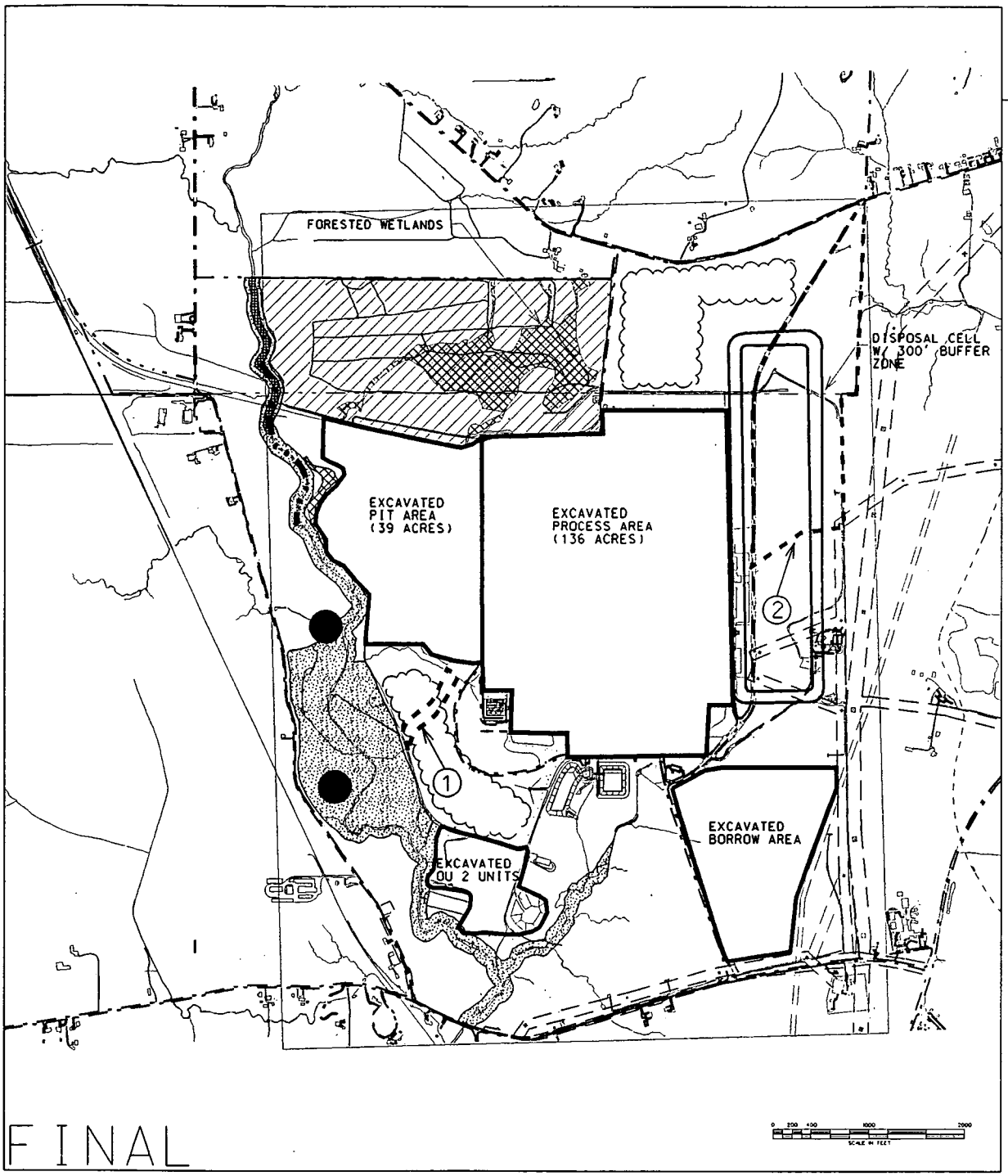

LEGEND:

	ACREAGE:
RIPARIAN CORRIDOR	78
SLOAN'S CRAYFISH AREA	2
INDIANA BROWN BAT HABITAT	3
WETLANDS	36
NORTHERN WOODLOT AREA	100
PINES	125

SUSPECT RUNNING BUFFALO CLOVER AREAS

IMPACTED HABITAT:	ACREAGE:
1 WOODLAND	2
2 GRASSLAND	55

FIGURE D-3. HABITAT MONITORING MAP

cultural resources). Annual reporting will provide a complete status of site impacts including a comparison of actual impacts with those predicted in the NRIA and the status of each of the specific natural resources discussed above (e.g., wetlands, cultural resources). It is anticipated that some quarterly reporting will not reveal any new information with regard to natural resource monitoring, depending on the level of site activity.

TABLE D-2

SUMMARY OF MONITORING ACTIVITIES IN FY 1997 AND 1998

Monitoring Activity	Implementation
Sloan's crayfish	FY 1997 & 1998
Cultural resources	FY 1997 & 1998
Habitat of priority natural resources	Ongoing Quarterly
Delineation of additional wetlands	Spring/Summer 1997
Follow-up Threatened and Endangered Species Surveys	Dependent upon extent of remedial activities

ATTACHMENT D.1

SLOAN'S CRAYFISH MANAGEMENT PLAN

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D.1.0 SLOAN'S CRAYFISH MANAGEMENT PLAN

D.1.1 Introduction

The purpose of this plan is to provide a management strategy for the state-threatened Sloan's crayfish *(Orconectes sloanii)* and its associated habitat at the Fernald Environmental Management Project (FEMP). The potential exists for impacts to the habitat and population to occur during the Area 1, Phase I soil excavation work within Operable Unit 5. Remedial work at the FEMP has the potential to result in increased sediment loading to Paddys Run in the area inhabited by the Sloan's crayfish. Therefore, the Department of Energy (DOE) has prepared a management plan to meet the intent of state and federal regulations governing the management of threatened and endangered species and to fulfill the DOE's role as a Natural Resource Trustee.

D.1.2 Background

The Sloan's crayfish has been listed as threatened in the state of Ohio. Populations of the Sloan's crayfish are known to reside only in southeastern Indiana and southwestern Ohio (St. John, 1993). The Sloan's crayfish resides in streams with constant flow and flat, rocky bottoms covered with broken or rounded stones. A decline in the species has been noted in streams that have been affected by urbanization, construction, and other forms of human stress. Crayfish breathe through gills; therefore, increases in sediment loading in streams they inhabit will decrease their chances for survival.

The species was discovered in the northern portion of Paddys Run at the FEMP (Figure D.1-1) during surveys conducted by Dr. F. Lee St. John in September 1993 and May 1994. The surveys for the crayfish were amongst several conducted at the site during that time frame. Remediation of the FEMP is being undertaken pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and will involve the excavation of large portions of the site and the construction of new treatment and disposal facilities. The Sloan's crayfish has been identified as a species that requires special consideration during the planning and implementation of remedial activities at the FEMP.

D.1.3 Management Objectives

The primary objective in managing the Sloan's crayfish population at the FEMP is to ensure that adequate habitat is available within Paddys Run for the continued existence of the population upon completion of site remediation. This will be accomplished through preservation and/or postremedial restoration. In addition, efforts to protect the current population from degradation during remedial activities will also be employed to the extent practicable. As discussed in greater detail below, the combination of adequate controls to minimize sediment loading from the Area 1, Phase I work (as well as other remedial activities) coupled with the availability of a "refuge area" for the crayfish population upstream will minimize short-term degradation to the crayfish population. In addition, field monitoring will be initiated to identify potential impacts to the portions of Paddys Run containing the population. If it is determined that impacts to the stream may result in the long-term degradation of the population, then DOE will notify the appropriate agencies and relocate individual crayfish.

The objectives of this management plan are to undertake all measures practicable to protect the species within Paddys Run and to minimize stress to the species by relocating only if necessary. The DOE feels the most important aspect of the management plan is to ensure that an optimal habitat exists for the crayfish in the long-term (i.e., postremediation). This would be accomplished either through preserving and/or enhancing existing habitat or restoring habitat if the existing habitat is impacted during remediation. Future FEMP remedial activities may also involve excavation activities that will potentially impact the population. Therefore, this plan of action may be incorporated by reference into future work plans. The monitoring aspect of this management plan will be outlined in a support plan to the Integrated Environmental Monitoring Plan (IEMP) and will include the reporting of monitoring results to the appropriate agencies on a quarterly basis.

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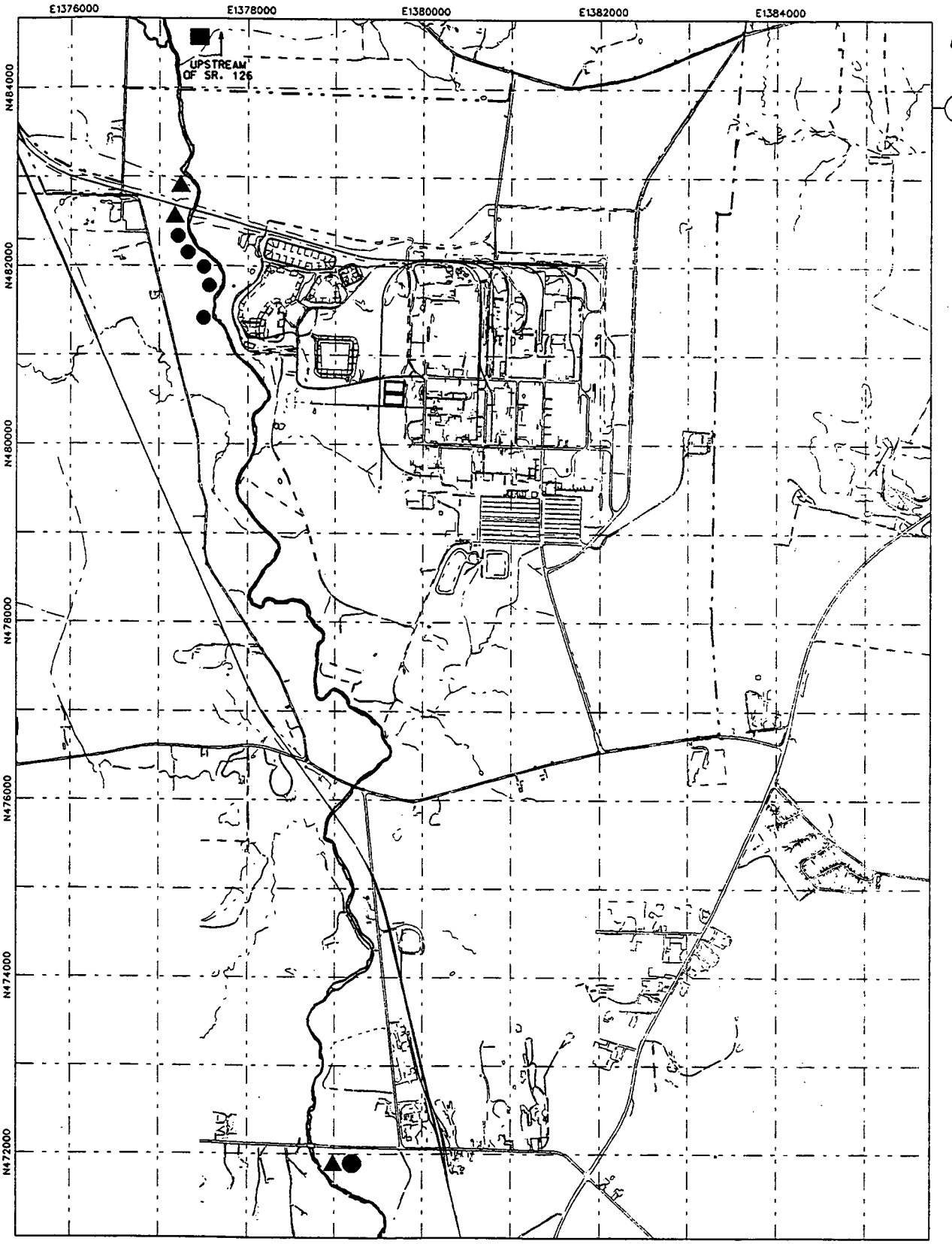

LEGEND:

FEMP BOUNDARY

▲ SLOAN'S CRAYFISH POPULATIONS IN 1993

● SLOAN'S CRAYFISH POPULATIONS IN 1994

■ SLOAN'S CRAYFISH POPULATIONS IN 1995

SCALE

1500 750 0 1500 FEET

DRAFT

FIGURE D.1-1. RECENT SURVEY RESULTS FOR SLOAN'S CRAYFISH

D.2.0 MANAGEMENT PLAN

There are three phases to the protection of the Sloan's crayfish and its associated habitat within Paddys Run. The first two phases are avoidance measures while the last phase is a mitigation effort. First, several controls will be installed to prevent excessive sedimentation into Paddys Run. Second, the area of Paddys Run upstream of the train trestle and the confluence of the northern drainage ditch will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (shown in Figure D.2-1). The third aspect of protection is the mitigation of appropriate habitat, if required, after remedial activities have been completed. All three phases of Sloan's crayfish protection are discussed in more detail below.

D.2.1 Sedimentation Controls

The primary source of surface water runoff from the FEMP to the Sloan's crayfish habitat in Paddys Run is from the westerly flowing drainage area located directly north of the railroad tracks on the northern side of the former production area. The confluence of this drainage area and Paddys Run is a National Pollutant Discharge Elimination System (NPDES) permitted storm water outfall (*4006) and is subject to semiannual monitoring under the terms and conditions of the current site NPDES permit (Ohio EPA Permit No. 1IO00004*ED). This ditch was also identified as a jurisdictional wetland during the 1993 delineation of the site.

Large scale earthmoving activities associated with the Operable Unit 1, Operable Unit 2, and Operable Unit 5 Remedial Actions are planned within several watershed basins in the northern and eastern portions of the site that ultimately drain to Paddys Run through the northern drainage ditch described above. Erosion control devices will conform to the requirements of the site NPDES permit, the FEMP Storm Water Pollution Prevention Plan (SWPPP, RM-0039), and various Applicable or Relevant And Appropriate Requirements (ARARs) identified in the Operable Unit 1, Operable Unit 2, and Operable Unit 5 Records of Decision (RODs). Specifications for sedimentation and erosion control devices are being incorporated into the remedial design packages for these activities in an effort to avoid and/or minimize erosion and sedimentation to the northern drainage ditch and Paddys Run. As part of CERCLA Remedial Design packages for Operable Unit 1, Operable Unit 2, and Operable Unit 5, these erosion and sedimentation designs are subject to review and approval by the U.S. Environmental Protection Agency (EPA) and the Ohio Environmental Protection Agency (OEPA). Once established in the field, DOE will inspect these controls, at a minimum, on a weekly basis to ensure their

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effectiveness in accordance with the requirements of the SWPPP. Given that the extensive erosion and sedimentation controls described above will be established, adverse impacts to Sloan's crayfish habitat in Paddys Run will be avoided and minimized to the maximum extent practicable.

D.2.2 Refuge Preservation

The area of Paddys Run immediately north of the train trestle and the confluence of the northern drainage ditch to the FEMP property line will be preserved as a refuge for Sloan's crayfish to the maximum extent practicable (Figure D.2-1). Appropriate habitat exists in this area, as evidenced by several studies that have identified Sloan's crayfish upstream of the northern drainage ditch (St. John, 1993; Schneider, 1996). St. John, in his 1994 addendum report at the FEMP, concluded that Sloan's crayfish repopulation within Paddys Run is governed by downstream migration rather than upstream migration or repopulation in situ.

The preservation of the upstream portion of Paddys Run is also the primary protection effort for the Indiana bat (*Myotis sodalis*), a federally-endangered species for which suitable habitat exists within the riparian areas north of the train trestle. This area will be considered a priority natural resource area, and a maximum effort will be made to preserve the stream and its associated habitat in its present state.

D.2.3 Restoration Commitment

Once remedial activities have been completed within the area of influence for Paddys Run, the stream will be restored to suitable Sloan's crayfish habitat, if necessary (Figure D.2-2). This stream restoration will take place in accordance with the sitewide natural resource restoration plan, as agreed to by the FEMP Natural Resource Trustees. It is expected the upstream refuge will act as the catalyst for the repopulation of impacted sections of Paddys Run, where pools and riffles will be reestablished.

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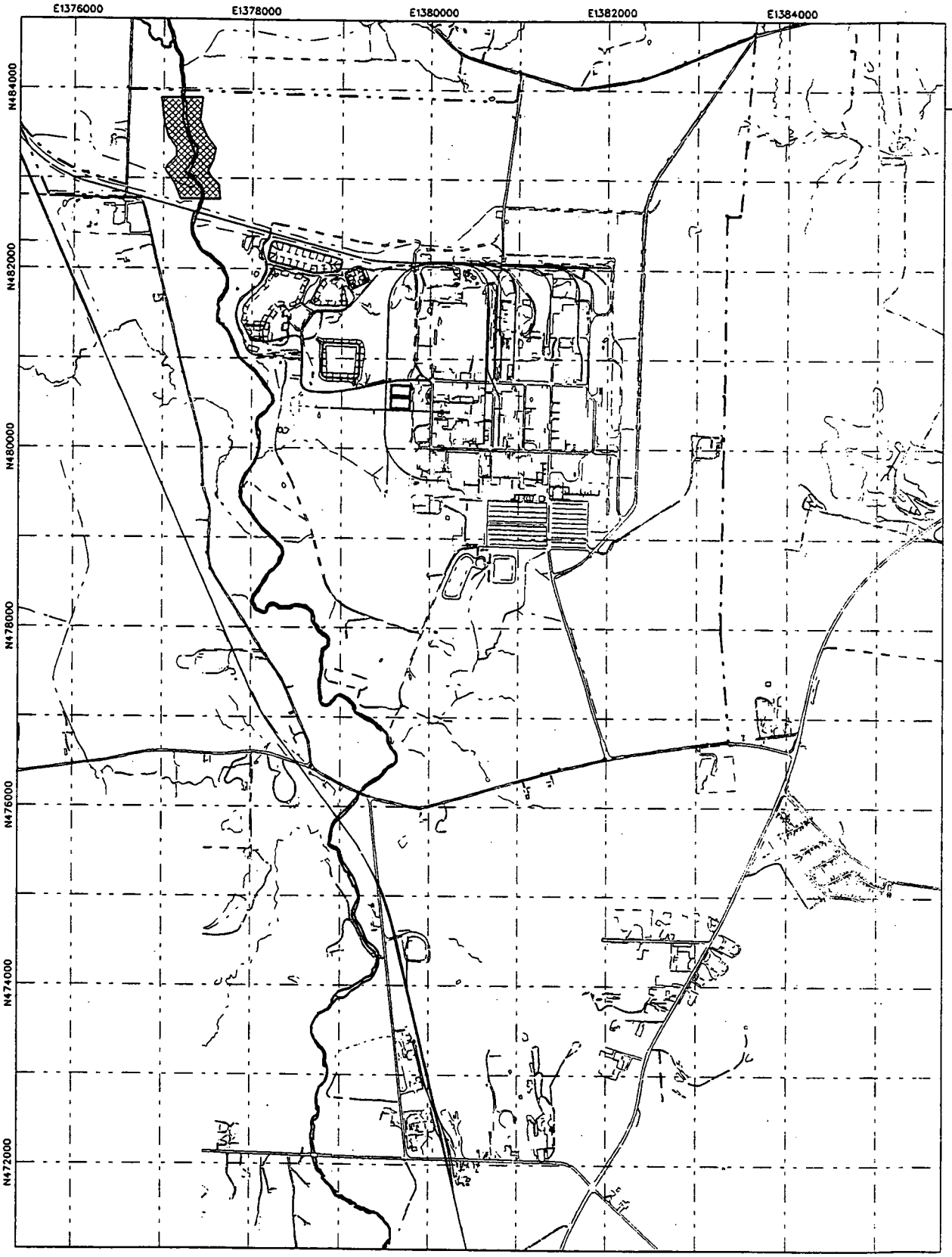

LEGEND:

FEMP BOUNDARY

REFUGE AREA FOR SLOAN'S CRAYFISH

SCALE

1500 750 0 1500 FEET

DRAFT

FIGURE D.2-1. REFUGE AREA FOR SLOAN'S CRAYFISH

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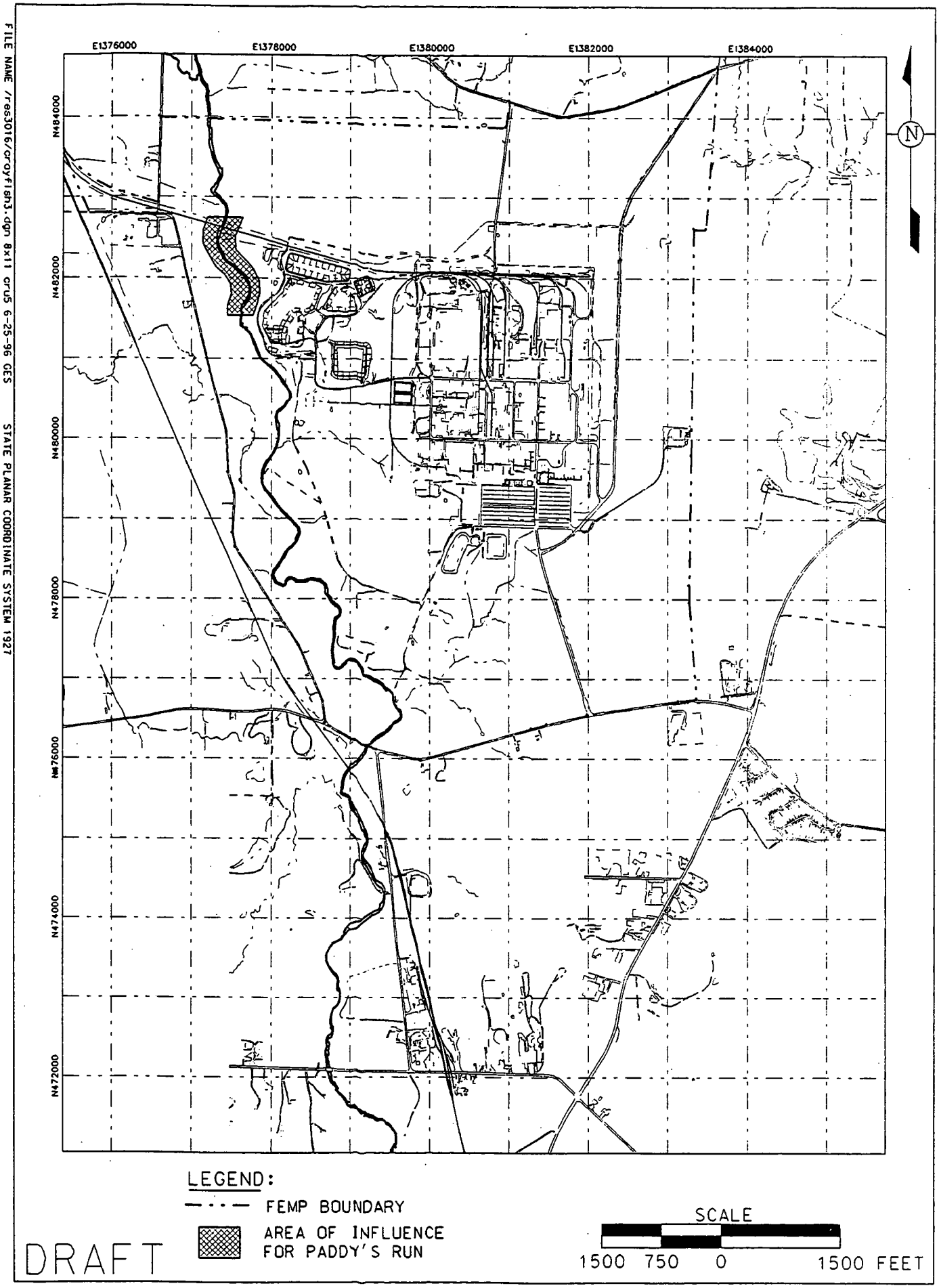

FIGURE D.2-2. AREA OF INFLUENCE FOR PADDY'S RUN

D.3.0 FIELD MONITORING

Field monitoring will be conducted to determine the effectiveness of the sedimentation controls discussed above. Sedimentation controls will be inspected at least weekly in accordance with the FEMP SWPPP. In addition, visual observations will be used to monitor sediment loading in Paddys Run. DOE will conduct field observations within 24 hours of a storm event. If increased sediment loading is observed, daily monitoring will be initiated. If the increased loading continues for several days, DOE will implement the contingency plan to relocate individuals of Sloan's crayfish as described below.

The Sloan's crayfish population of Paddys Run will be surveyed every three years in order to monitor trends in the long-term status of the population. This information will not be used as an indicator of remedial impacts, but rather as an assistance in restoration planning.

D.4.0 CONTINGENCY PLAN

This contingency plan includes provisions for relocating individual Sloan's crayfish. Relocation will be dependant upon field observations of Paddys Run as discussed above. These relocation provisions include the establishment of locations within Paddys Run, along with the frequency and methodology for relocation.

Relocation is an unproven technique that may result in harm to individuals. Problems associated with relocation include alteration of stream habitat from netting and species removal activity and loss of individuals from the stress of relocation. In addition, an otherwise healthy community could be impacted by the introduction of relocated species.

D.4.1 Relocation

The crayfish will be relocated further upstream within Paddys Run. Optimal habitat for the crayfish is a stream with constant current flowing over a rocky bottom, which occurs upstream of the train trestle in Paddys Run and within the refuge area illustrated in Figure D.2-1.

D.4.2 Frequency

Crayfish will be relocated as appropriate, up to a frequency of every two months, depending on stream conditions. If visual observations of the Paddys Run tributary indicates increased turbidity into Paddys Run for several consecutive days, then the crayfish will be relocated. If turbid tributary conditions persist two months after the initial relocation, the crayfish will be relocated again.

D.4.3 Methods

Crayfish will be obtained by seining Paddys Run with a minnow seine (1.2 x 1.8 meters; 0.64 centimeters mesh). Pools and riffles will be seined several times in an effort to capture as many individuals as possible. Upon capture, crayfish will be placed in a plastic container containing existing stream water and transported upstream for free release. The location selected for release will be predetermined based on the suitability of habitat.

D.5.0 REPORTING

The results of the monitoring activities described above will be reported to the EPA, OEPA and the Department of Interior (including the U.S. Fish and Wildlife Service) on a quarterly basis. Reporting will include observations of the sediment controls in place for the Area 1, Phase I work, observed impacts to the crayfish population resulting from site activities, and information available on the status of the population. The report will include a copy of all field surveillance forms and a letter summarizing any findings for that reporting period. The first submittal of the report will occur on September 1, 1996 and will be submitted quarterly thereafter. Any issues requiring immediate attention (e.g., impacts that may require relocation of the species) will be conveyed to the agencies listed above as necessary. The reporting will be integrated with the quarterly reporting of other natural resource impacts which will be outlined in an independent plan supporting the IEMP.

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St. John, F. L. Report on the Sloan's Crayfish (*Orconectes sloanii* Bundy) at the Fernald Environmental Management Project, 1993.

St. John, F.L., Addendum to the Report on the Status of the Sloan's Crayfish, *Orconectes sloanii* (Bundy, 1876) at the Fernald Environmental Management Project, 1994.