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IMPLEMENTATION PLAN FOR AREA 2, PHASE I NON-WASTE UNITS CAROLINA AREA

FERNALD ENVIRONMENTAL MANAGEMENT PROJECT
FERNALD, OHIO

INFORMATION ONLY

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U.S. DEPARTMENT OF ENERGY
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LIST OF ACRONYMS AND ABBREVIATIONS

A1PI	Area 1, Phase I
A1PII	Area 1, Phase II
A2PI	Area 2, Phase I
A2PII	Area 2, Phase II
A2PIII	Area 2, Phase III
ACA	Amended Consent Agreement
ACHP	Advisory Council on Historic Preservation
AFP	Active Flyash Pile
ALARA	as low as reasonably achievable
ARAR	applicable or relevant and appropriate requirement
ASCOC	area-specific constituent of concern
CDL	Certification Design Letter
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
COC	constituent of concern
COE	U.S. Army Corps of Engineers
CRDL	contract required detection limits
DCN	Design Change Notice
DOE	U.S. Department of Energy
EM	electromagnetic
EPA	U.S. Environmental Protection Agency
FEMP	Fernald Environmental Management Project
FRL	final remediation level
GPR	ground penetrating radar
HPGe	high-purity germanium detector
IEMP	Integrated Environmental Monitoring Plan
IRDP	Integrated Remedial Design Package
mg/kg	milligrams per kilogram
NPDES	National Pollutant Discharge Elimination System
NRRP	National Resource Restoration Plan
NRT	Natural Resource Trustee
NWU	Non-Waste Unit
OEPA	Ohio Environmental Protection Agency
OHPO	Ohio Historical Preservation Office
OSDF	On-Site Disposal Facility
OU	operable unit
pCi/g	picoCuries per gram
ppm	parts per million
PSP	Project Specific Plan
QA/QC	quality assurance/quality control
RCRA	Resource Conservation and Recovery Act
RD/RA	remedial design/remedial action
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
RSS	Radiation Scanning System
RTRAK	Radiation Tracking System

LIST OF ACRONYMS AND ABBREVIATIONS
(Continued)

SED	Sitewide Environmental Database
SEP	Sitewide Excavation Plan
SP	soil stockpile
SSOD	Storm Sewer Outfall Ditch
SWPPP	Stormwater Pollution Prevention Plan
SWU	Southern Waste Unit
TBC	to be considered criteria
WAC	waste acceptance criteria
WAO	Waste Acceptance Organization
yd^3	cubic yards

EXECUTIVE SUMMARY

This Implementation Plan describes the remediation of soil and at- and below-grade debris in a portion of the Area 2, Phase I (A2PI) Non-Waste Units (referred to as the Carolina Area) at the Fernald Environmental Management Project. The Carolina Area is located in the southern portion of the FEMP site, between the A2PI Southern Waste Units (SWUs), Paddys Run and the Storm Sewer Outfall Ditch.

Predesign investigations have shown that the surface and subsurface of the Carolina Area do not exceed the final remediation levels for A2PI constituents of concern; however, there is visible debris at the surface and evidence of buried debris and flyash. The Carolina Area is scheduled for remediation in Summer 2000, followed by precertification and certification.

This Implementation Plan addresses the remedial design/remedial action steps discussed in the Sitewide Excavation Plan (DOE 1998a) (i.e., predesign investigations, remedial design, remedial action, precertification and interim grading activities) as they pertain to the remediation of at- and below-grade debris and soil in the Carolina Area. Post-remediation precertification and certification will be addressed in future documents (e.g., the Certification Design Letter).

Remedial action in the Carolina Area involves removing at- and below-grade debris and soil containing flyash, both of which have been identified through predesign. Approximately 1,500 cubic yards (yd^3) of flyash and soil will be excavated and transported to the On-Site Disposal Facility (OSDF) for disposal. An estimated 100 yd^3 of debris will be removed, sized to meet the physical waste acceptance criteria (WAC), and transported to the OSDF for disposal. Control mechanisms and monitoring/inspection requirements will be established to minimize impacts to natural resources and the air, surface water, and groundwater pathways.

The remedial action requirements shown on the Design Change Notice, utilizing established plans and specifications for the SWU excavation, were developed in accordance with the concepts described in this Implementation Plan, as guided by the OSDF WAC Attainment Plan (DOE 1998b) and the Sitewide Excavation Plan. As the integrating document for the Integrated Remedial Design Package, the Implementation Plan provides a comprehensive description of planned remediation activities.

1.0 INTRODUCTION

This Implementation Plan describes the remediation of soil and at- and below-grade debris in the Area 2, Phase I (A2PI) Non-Waste Unit (NWU) area (referred to as the Carolina Area) at the Fernald Environmental Management Project (FEMP) in southwestern Ohio. The Carolina Area covers approximately 2.8 acres in the southern portion of the FEMP site, between the former Southern Waste Units (SWUs), Storm Sewer Outfall Ditch (SSOD) and Paddys Run (see Figure 1-1). This region was previously used as a staging area for construction supplies, equipment, and debris. The surface and subsurface of the Carolina Area contain visible debris at the surface and evidence of buried debris and flyash.

The FEMP site has been divided into ten areas for remediation of soil and at- and below-grade structures and debris. As shown on Figure 1-1, the southwestern corner of the FEMP east of Paddys Run has been identified as Remediation Area 2. The remediation of this area has been separated into three phases (i.e., Phase I, Phase II and Phase III) to prioritize removal of material presenting the greatest risk to human health and the environment. A2PI was further subdivided into the SWU and the NWU subareas. The SWUs consisted of the former Inactive Flyash Pile, the former South Field, and the former Active Flyash Pile (AFP). The NWU area is comprised of perimeters around the SWU, but within A2PI, including the Carolina Area.

Specific methods to accomplish the scope of work presented in this plan will be provided in the technical specifications and construction drawings. The construction contractor will be under the direction of Fluor Fernald, and all methods employed will be approved and supervised by Fluor Fernald.

Remedial activities in the Carolina Area are in accordance with the Operable Unit (OU) 5 Record of Decision (ROD; DOE 1996a). This Implementation Plan and the Sitewide Excavation Plan (SEP; DOE 1998a) satisfy the Amended Consent Agreement (ACA; EPA 1991) requirement for a remedial action (RA) work plan. In addition, this Implementation Plan and the remedial design (RD) constitute the Integrated Remedial Design Package (IRDP), as outlined in the OU5 Remedial Design Work Plan (DOE 1996b). In the case of the Carolina Area, the RD is illustrated by a Design Change Notice (DCN) to the existing SWU excavation plans and specifications. The Implementation Plan is the

integrating document for the IRDP, and it describes the planned remediation activities. Its purpose is to facilitate regulatory agency review of the RD and to summarize the scope of work. Activities described in this plan are being conducted in accordance with the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and corrective action requirements of the Resource Conservation and Recovery Act (RCRA). The Implementation Plan conforms to the general model outline for IRDPs provided in Section 7 of the SEP.

1.1 SCOPE AND GENERAL APPROACH OF THE IMPLEMENTATION PLAN

This Implementation Plan consists of the following sections:

- Section 1.0 - Introduction, which summarizes the purpose and scope of this Implementation Plan and describes programmatic strategies and requirements for implementation of this remedial action project.
- Section 2.0 - Predesign Investigations, which describes the constituents of concern (COCs) for the Carolina Area, the surface and subsurface conditions, the nature and extent of contamination, and the anticipated excavation boundaries.
- Section 3.0 - Remedial Action Approach, which presents the work associated with site preparation, removal of at- and below-grade debris, general excavation to remove contaminated soil, real-time monitoring of the excavation surface, precertification and restoration.
- Appendix A – Data Summary, which presents the data collected through the predesign investigations.

The suggested outline for an Implementation Plan would include the following sections as well:

- Section 4.0 - Project-Specific Environmental Controls and Monitoring, which discusses environmental controls and associated monitoring established with respect to natural resources and air, surface water and groundwater pathways.
- Section 5.0 - Project-Specific Health and Safety, which summarizes project-specific health and safety requirements and procedures.
- Section 6.0 - Remedial Action Management Strategy, which discusses the strategy for managing remediation activities, project organization and responsibilities, waste management activities, data and records management, quality assurance/quality control (QA/QC), and integration of A2PI remediation with other FEMP projects.

The A2PI SWUs Implementation Plan (DOE 1998c) contains all of these sections. Since remediation of the Carolina Area is being performed as a DCN to the existing SWU excavation plans and specifications, and the Carolina Area is in close proximity to the SWUs, the discussion in the A2PI Implementation Plan adequately addresses the subject matter of the latter three sections for the Carolina Area and are not repeated in this Implementation Plan.

The area-specific RD/RA process at the FEMP is illustrated on Figure 1-1 of the SEP and involves the following steps:

- Predesign investigations
- Remedial design
- Remedial action
- Precertification of excavated areas
- Certification of excavated areas
- Post-remedial action.

This Implementation Plan covers all of the steps except certification and post-remedial action. As stated in the SEP, a Certification Design Letter (CDL) will be prepared and submitted to the regulatory agencies following completion of the precertification process. This will provide a summary of the area-specific remediation completed, results of the precertification activities, and design of the certification sampling and analysis program. Following completion of certification activities and agency approval, restoration activities will be completed. Any post-remedial action will follow restoration and be guided on a sitewide basis by the final version of the Natural Resource Restoration Plan (NRRP; DOE 1998d).

Predesign activities began in the Carolina Area in Fall 1999, as described in the Project Specific Plan (PSP) and resulting variances (DOE 1999a). The sampling activities have been focused on identifying material that must be excavated due to its nature (i.e., debris and/or flyash content). The Carolina Area footprint has been surveyed with real-time instruments to assess the presence of radiological contamination associated with uranium, radium-226, and thorium-232 that is above the final remediation levels (FRLs) established in the OU5 ROD. Physical sampling, electromagnetic (EM) conductivity profiling survey, and ground penetrating radar (GPR) survey were conducted as part of predesign.

The excavation boundaries depicted on the DCN are based on:

- Remedial Investigation/Feasibility Study (RI/FS; DOE 1995a and 1995b) data on the nature of COC concentrations in soil and perched groundwater
- Data collected during predesign investigations to identify the presence of flyash, surface and buried debris.

The final extent of excavation will be based on actual field conditions, radiological field survey measurements (i.e., real-time surveys), and physical sampling results.

Remediation of the Carolina Area will involve excavating and disposing of impacted material, including any soil containing flyash and debris. Impacted material is defined as soil with above-FRL contamination or man-made materials (e.g., flyash). Impacted material that meets the chemical, radiological, and physical waste acceptance criteria (WAC) established for the On-Site Disposal Facility (OSDF) will be hauled to the OSDF for disposal. Impacted material that meets the chemical/ radiological WAC, but not the physical WAC, will be size-reduced to achieve the WAC and delivered to the OSDF. Items that are prohibited from disposal in the OSDF will be containerized and shipped off-site to a permitted commercial disposal facility.

1.2 REMEDIATION AREA BACKGROUND AND DESCRIPTION

The Carolina Area covers approximately 2.8 acres of the southern portion of the FEMP site. It is generally bounded by Paddys Run and the SSOD to the south, the east-west construction road to the north, the access road to Area 2, Phase III (A2PIII) to the east, and extends just past Well House 14 to the west.

At- and below-grade debris (e.g., concrete, cable, rebar, etc.) is present throughout the Carolina Area footprint. The primary scope of remediation activities within the Carolina Area is removal of this debris and the soil containing flyash.

Predesign investigations have also shown that radiological contamination is not the driver for remediation of the Carolina Area. Real-time scans and data from soil sampling and analysis do not indicate the presence of any above-FRL material. Section 2.0 presents a complete discussion of the Carolina Area's predesign investigations and findings.

1.3 SUMMARY OF THE REGULATORY DRIVERS

Regulatory requirements, criteria and legal obligations are the drivers for FEMP remediation activities, and Section 1.3.1 of the SEP provides the overall discussion on FEMP regulatory drivers. A summary of regulatory drivers applicable to the remediation of the Carolina Area is presented in the following paragraphs.

1.3.1 ARARs and TBCs

The subset of applicable or relevant and appropriate requirements (ARARs) and to be considered criteria (TBCs) that will guide remedial actions in the Carolina Area are included in the Design Criteria Package for the A2PI SWUs Implementation Plan.

1.3.2 Permits

The National Pollutant Discharge Elimination System (NPDES) permit (Permit No.1IO00004*FD), for storm water and wastewater discharges to Paddys Run and the Great Miami River, covers the discharge of stormwater from the Carolina Area during excavation through the implementation of the permit-required sitewide Storm Water Pollution Prevention Plan (SWPPP; RM-0039). Thus, no modifications to the permit are required as a result of the Carolina Area remedial action.

1.3.3 Natural Resource Trusteeship and Related Natural and Cultural Resource Regulations

Two mechanisms drive protection of natural resources during remediation: the Natural Resource Trusteeship process and compliance with pertinent federal and state regulations. Both of these mechanisms have been incorporated into the Carolina Area remedial design.

Regulatory drivers for the management of natural and cultural resources and associated surveys are grouped into three areas: threatened and endangered species protection, wetlands/floodplain protection, and the resolution of DOE's liability for injuries to natural resources.

1.3.3.1 Threatened and Endangered Species

Based on updated FEMP property surveys conducted in 1993-1994, DOE does not expect to encounter any federal- or state-listed threatened or endangered species or critical habitat in the areas to be addressed by the Carolina Area remediation project. Therefore, no additional threatened or endangered species surveys are planned for the area.

1.3.3.2 Wetlands/Floodplains

Jurisdictional wetlands and waters of the United States that are identified on the FEMP property are delineated in the 1993 FEMP Wetland Delineation Report (COE 1993), officially approved by the U.S. Army Corps of Engineers on August 19, 1993. Based on the overlay of the Carolina Area boundary on the 1993 FEMP Jurisdictional Wetland Delineation, no jurisdictional wetlands are located within the Carolina Area.

The Carolina Area is located within the 100-year floodplain of Paddys Run. Potential impacts will be minimized through the implementation of appropriate erosion and sedimentation controls. No changes in the elevation of the 100-year floodplain in Paddys Run are anticipated as a result of the Carolina Area remediation activities. The remediation activities are authorized by Nationwide Permit 38 (Cleanup of Hazardous and Toxic Waste) under 33 Code of Federal Regulations (CFR) 330.1(c).

1.3.3.3 Resolution of DOE's Liability for Injuries to Natural Resources

The Natural Resource Trustees (NRTs) are working to resolve liability that DOE faces for injuries to natural resources under CERCLA. In 1986, the State of Ohio filed a claim against the DOE for injuries to natural resources. The claim has been in stay while negotiations are proceeding toward resolution. The State of Ohio has designated the Ohio Environmental Protection Agency (OEPA) as their trustee representative in matters involving natural resource injuries. The Fernald NRTs have jointly developed the NRRP and have tentatively agreed that DOE, through implementation of the plan, will resolve natural resource liability at the Fernald site, including the 1986 State of Ohio claim.

1.3.4 Cultural Resource Management

DOE, the Ohio Historic Preservation Office (OHPO), and the Advisory Council on Historic Preservation (ACHP) have entered into a "Programmatic Agreement Regarding Archaeological Investigations at the Fernald Environmental Management Project" (March 6, 1997), pursuant to 36 CFR Part 800.13. The Carolina Area has been surveyed in accordance with this agreement and all potential historic properties discovered have undergone data recovery after consultation with the OHPO and the ACHP. No additional archaeological surveys are planned for the area; however, a contingency plan is in place to ensure that any additional cultural resources discovered during remediation activities are recognized and protected.

1.4 COMPONENTS OF THE REMEDY

The Carolina Area remediation activities address specific components of the selected remedies set forth in the OU5 ROD for debris and environmental media, including soil. These activities are coordinated closely with OSDF construction [an OU2 ROD (DOE 1995c) remedy component], which is being conducted under another FEMP RA plan. The following is a summary of OU5 remedy components (in italics) that are particularly relevant to this plan and an indication of specific actions that will be taken in the Carolina Area:

- *Perform verification sampling to establish horizontal and vertical boundaries of excavation required to attain soil and sediment FRLs.* Predesign investigations were performed to augment historical data and refine excavation limits, as discussed in Section 2.0.

- *Excavate contaminated soil and sediment as necessary to meet FRLs; use mitigation measures as necessary to minimize potential short-term impacts to human health and the environment.* Based on predesign investigations (Section 2.0), the material will be excavated as described in Section 3.0. Mitigation measures to minimize short-term impacts will be taken with respect to natural and cultural resources, air pathway, water pathways, and health and safety.

- *Perform certification sampling following excavation of contaminated soil and sediment to demonstrate that FRLs have been attained.* Predesign real-time scanning has shown that the material is below the FRLs for the COCs. After the excavation of identified debris and flyash, a CDL will detail the proposed certification activities. If results of the certification sampling and analysis indicate the presence of above-FRL contamination, additional excavation and certification sampling and analysis will be performed. The certification program is discussed in Section 3.4 of the SEP.

- *Apply DOE's As Low As Reasonably Achievable (ALARA) principles by using hand-held instruments to support verification sampling and excavation processes and, to the extent economically practical and by using detection limits achievable with hand-held instruments, reduce the remediation level for on-property soil containing relatively nonleachable uranium from 80 parts per million (ppm) to 50 ppm.* The Carolina Area has been shown to be below the total uranium FRL of 82 milligrams per kilogram (mg/kg). Excavation boundaries are based on the known presence of debris or flyash. Precertification and certification activities will be conducted to ensure that FRLs are achieved.

- *Dispose of contaminated soil and sediment that meets the on-site WAC in the OSDF. Where possible, treat soil and sediment that exceeds the OSDF WAC to meet the WAC or treat, if necessary, and dispose of such soil at an off-site facility.* All of the material in the Carolina Area has been shown to meet FRLs; debris will be handled as necessary (size reduction) to meet the OSDF WAC for subsequent placement in the OSDF.

Pieces of concrete with elevated surface contamination were found and removed from the existing riprap at the SSOD during predesign investigations.

- *Continue to employ institutional controls, including access controls and monitoring, to ensure continued protectiveness.* Access to the Carolina Area will be restricted using barriers, warning signs, and procedural controls for the duration of remedial activities. Similarly, monitoring will continue to be conducted in accordance with the Integrated Environmental Monitoring Plan (IEMP; DOE 1999b). Long-term institutional controls necessary to implement restoration goals under the site's selected remedy are presented in the NRRP.

- *Restore the site.* Restoration of the Carolina Area will be conducted in a manner consistent with the NRRP, and will grade areas disturbed by excavation as necessary to restore positive drainage and establish interim vegetation cover to prevent erosion.

1.5 LESSONS LEARNED

A lessons learned program has been implemented to apply knowledge accumulated during successive remedial efforts conducted under the SEP. Lessons learned from past remedial activities in Area 1, Phase I (A1PI), Area 1, Phase II (A1PII), A2PI, and A2PIII Part Two have been incorporated into the Carolina Area IRDP to ensure that remedial activities carried out under this plan meet all applicable requirements and achieve the highest quality level possible. Some of the most important lessons include:

- Establish a single project director that is responsible for the entire remedial effort in an area
- Obtain regulatory approval on PSPs prior to beginning work
- Complete sampling and analysis activities before submitting IRDP (if possible), and include all data in the Implementation Plan
- Identify excavation depth and sample control points on figures
- Perform continuous visual observation of the excavation to identify and segregate special material.

Because the general complexity of remedial activities varies from area to area, soil remediation approaches at the FEMP will continue to evolve with each successive remedial effort.

1.6 SCHEDULE

The remediation of the Carolina Area is scheduled for Summer 2000. Precertification and certification activities will follow upon completion of the excavation and removal of debris. This schedule is dependent upon weather, funding, and regulatory approval.

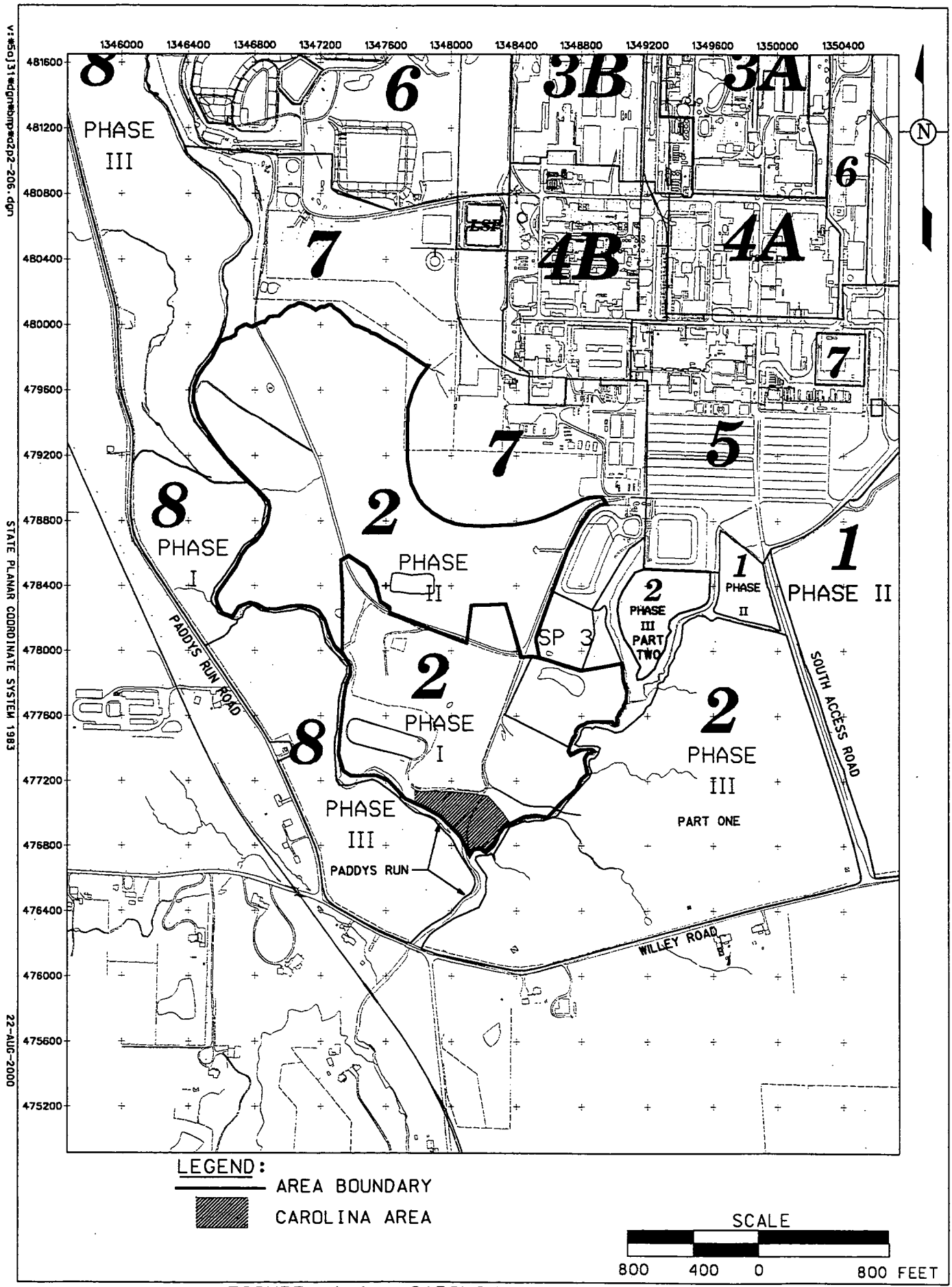

FIGURE 1-1. CAROLINA AREA LOCATION MAP

2.0 PREDESIGN INVESTIGATIONS AND CHARACTERIZATION DATA

This section summarizes the investigations used in developing the remedial design for the Carolina Area. These investigations include:

- Characterization Investigation Study conducted by Roy F. Weston Co.
- OU5 RI/FS activities
- A2PI NWU/Area 2, Phase II (A2PII) Part One Predesign Investigation, which consisted of the following:
  - Physical sampling and analyses to delineate the extent of above-FRL contamination.
  - Real-Time Gamma Spectroscopy measurements
  - Lithological examination of soil borings
  - EM Terrain Conductivity Profiling and GPR measurements (conducted by Grumman Exploration, Inc.)
  - Generation and examination of cut-fill maps.

These investigations have been used to identify the COCs for the A2PI NWUs, including the Carolina Area, to describe the surface and subsurface conditions expected, as well as to present the anticipated excavation boundaries.

2.1 SUMMARY OF RI/FS AND PREDESIGN INVESTIGATIONS

Predesign investigations used to characterize the Carolina Area include studies conducted as part of the OU5 RI/FS as well as additional sampling and real-time gamma spectroscopy measurements that were completed pursuant to RI/FS activities.

The nature and extent of soil contamination at the FEMP site places considerable demands on the coordination of characterization and excavation activities carried out during the remediation process. In many remediation areas, data generated from RI activities are not comprehensive for the purpose of preparing detailed engineering designs and excavation drawings, and additional radiological surveys and sampling programs must be implemented to collect the needed data.

Real-time, field-deployable instruments such as the Radiation Tracking System (RTRAK), the Radiation Scanning System (RSS), and the high-purity germanium detector (HPGe), as well as supplemental field

investigative techniques using GPR and EM terrain conductivity profiling surveys, can satisfy a major portion of these additional data needs. These field-deployable instruments are integrated with discrete sampling and subsequent laboratory analysis to maintain an efficient remediation process.

2.1.1 RI/FS Data Review

The nature and extent of radiological constituents within the Carolina Area are based on data collected during RI/FS field investigation activities. More detailed information regarding the extent and nature of contamination within the Carolina Area is available in Section 4.0 of the OU5 RI Report. The development and list of FRLs pertinent to OU5 are presented in the OU5 ROD.

Data queries were retrieved from the Sitewide Environmental Database (SED) to identify sample locations that exhibited contamination levels greater than the FRLs. The locations of these above-FRL samples identified in the data query, along with the results, are shown in Figure 2-1. Only four samples indicated above-FRL concentrations. Note there were no sample locations with above-FRL technetium-99 concentrations.

A review of the mapped data shows two samples with above-FRL estimated concentrations for n-nitroso-di-n-propylamine. These results are not conclusive about the presence of this organic compound because the validated above-FRL n-nitroso-di-n-propylamine estimated values are the result of contract required detection limits (CRDLs) which are greater than the FRL. Review of the data packages shows that these samples were diluted per method by the subcontractor laboratory, effectively raising the CRDL above the FRL concentrations. It should be noted that the soil FRLs were established after receipt of the analytical report with the high CRDLs, and the samples taken in 1989 and 1993 were no longer available for re-analysis. While these data are inconclusive with respect to exceeding FRLs, process knowledge and disposal practices indicate these organic compounds are not likely to be found in this predesign study area. Based on this information, OU5 inorganic and organic compounds were not retained as area-specific constituents of concern (ASCOCs).

Two sample locations within the Carolina Area had above-FRL thorium-228 concentrations: samples 055446 and 055476, from borings 21192 and 21193 respectively, located south of SWU Basin 2. Contamination was seen at a depth of 16.5 to 17 feet (boring 21192) and 11 to 11.5 feet (boring 21193); the data are summarized in the OU5 RI/FS. Over 15 other RI/FS samples were

collected from each of these borings to a depth of over 19.5 feet. All these samples exhibited below-FRL concentrations for isotopic thorium as well as other COCs. The possible sources of the elevated thorium concentrations at these locations are vertical migration of contaminated perched water, cross contamination of the sample, laboratory error, or mislabeling of samples (DOE 1995a). Due to this uncertainty, only the highest isotopic thorium sample location (21193) was further investigated in predesign.

2.1.2 A2PI NWU/A2PII Part One Predesign Investigation

Pursuant to the RI/FS, five investigative techniques were utilized in the Carolina Area:

- Physical sampling and analysis, including lithological examination of soil borings
- Real-Time Gamma Spectroscopy measurements
- EM Terrain Conductivity Profiling
- GPR measurements
- Generation and examination of cut-fill maps.

The purpose of these investigations is discussed in the following paragraphs; the real-time and analytical results of the investigations are presented in Appendix A of this Implementation Plan.

2.1.2.1 Predesign Real-time Scanning

Real-time instrumentation was used to scan the Carolina Area for potential above-FRL contamination for total uranium, radium-226, or thorium-232. This instrumentation included HPGe, RTRAK, and RSS. Maps showing the highest total uranium, thorium-232, radium-226, and total counts per second values, and HPGe data tables of the scanning results, are depicted in Appendix A. As noted in these tables and figures, the results of the real-time monitoring indicate that all material is at or below the FRLs for these COCs.

2.1.2.2 Predesign Soil Sampling

Nineteen soil samples were collected in and around the Carolina Area under the PSP for Predesign Sampling in the A2PI NWUs and A2PII Part One, 18 within the Carolina Area and one immediately north of the area. Of the 19, five samples were collected to investigate the above-FRL RI/FS sample (boring 21193). The remaining 14 samples were located to investigate and characterize suspicious surface features. Figure 2-2 shows these sample locations.

The five physical borings located around RI/FS boring 21193 were collected to confirm and bound any contamination, both laterally and vertically. Boring A2P1-NWU-21 was placed at the coordinates for boring 21193 and collected to a depth of 16 feet in an attempt to vertically bound the above-FRL RI/FS sample interval. Four additional borings (A2P1-NWU-21A, -21B, -21C, and -21D) were placed at the cardinal compass points 5 feet from the original boring to define laterally any contamination. These four borings were collected to a depth of 12 feet. The analytical data from these samples were below FRL for all five primary radionuclides. Based on these data, the previous above-FRL thorium has been determined to be insupportable and does not require remediation.

In addition to analysis for radiological contamination, these five borings and RI/FS boring 21193 were examined lithologically to determine the extent (if any) of fill material and/or impacted material (i.e., flyash). The lithological examination of these borings indicated that neither fill nor impacted material was present. All material from the borings were scanned in the field with alpha and beta-gamma field friskers, and all the field frisker measurements were below or at background concentrations.

The Carolina Area's surface features include several ridges and mounds scattered throughout. Based on these suspicious surface features and partially exposed debris at the surface, which could indicate potential fill material locations, the remaining 14 borings were placed in discrete locations throughout the area. These borings were examined lithologically to determine the extent (if any) of fill material and/or impacted material (i.e., flyash) present. These borings were divided into 1-foot increments. Samples were submitted for laboratory analysis from the surface interval as well as from any interval that was directly beneath an impacted interval (i.e., flyash). The analytical data from these samples were below FRL for all the five primary radionuclides.

The lithological examinations of the remaining 14 borings indicated two of the borings, A2P1-NWU-24 and 38, show fill material to a depth of 5.5 and 6.0 feet respectively. Boring A2P1-NWU-24 also has flyash present in the 3.5 to 5.5 feet intervals, thus requiring remediation. Boring A2P1-NWU-38 is in close proximity to surface debris scattered west of the south construction road embankment leading to the crossing of the box culvert in the SSOD. The lithological examinations of the other 12 borings indicated native soil at the surface. All borings were scanned in the field with alpha and beta-gamma field friskers, and all the field frisker measurements were at or below background concentrations.

2.1.2.3 Geophysical Survey Methods

To supplement the real-time gamma spectroscopy measurements and the physical sampling and analysis, two additional environmental investigative techniques were used to explore potential subsurface anomalies. These two approaches are non-destructive, geophysical survey methods using EM Terrain Conductivity Profiling and GPR.

EM Terrain Conductivity Profiling

EM Terrain Conductivity Profiling was used as a reconnaissance-level screening tool for exploration and mapping of buried objects and subsurface conditions. The exploration depth of the EM in this area extended up to approximately 15 to 25 feet. The entire Carolina footprint was scanned with EM equipment. An interpretive summary of the results, taken from the geophysical summary report, is shown with the physical sampling locations in Figure 2-3.

Based on the interpretation data, nine potential subsurface anomalies are identified. One of the largest anomalies is supported with sampling and GPR data. This anomaly is located in a mound in the south-central portion of the Carolina Area (near sample A2P1-NWU-24). While sample data from this mound are below FRL, lithological information and GPR scanning indicate the presence of fill and flyash to a depth of at least 5.5 feet at the A2P1-NWU-24 sample location.

Soil borings surrounding the other eight EM survey anomalies do not support the presence of buried or fill materials. The EM data provided by Grumman Exploration identified the potential for buried material at relatively shallow depths (within the first 10 feet of the surface). The borings in proximity to these eight anomalies were found to be native soil at the surface, with all sample data below FRL. In addition, the real-time surface scans exhibited below-FRL concentrations. Excavation of these eight anomalies will be useful for validation of the absence or presence of impacted material.

For specific details regarding the EM equipment and findings, refer to the EM and GPR summary report (Grumman 2000).

Ground Penetrating Radar

GPR measures contrasts in the electrical properties of the underlying surface and subsurface. Interfaces between electrically distinctive materials such as sand and clay, backfill and steel, and concrete and soil

can be detected using GPR. Based on the EM screening data, the mound in the south-central portion of the Carolina area (near sample A2P1-NWU-24) was scanned with the GPR. In addition, three transect lines were scanned using the GPR; one across the small mounds or mogul-like features ("moguls") along Paddys Run and two other lines parallel to the section of gravel road just south of Basin 2. The GPR scan over the mound validated the presence of an anomaly as indicated with the soil sampling and EM screening data. A large anomaly was detected towards the northern end of the mound. The precise subsurface depth of the anomaly is unknown, but has been determined to be within the first 10 feet of the surface. This possibly confirms the physical sample showing flyash at the 3.5 to 5.5-foot depth interval below the current surface of the mound.

The GPR scan along the "moguls" near Paddys Run did not indicate the presence of subsurface anomalies. In addition, the GPR transect lines parallel to the gravel road near Basin also did not indicate the presence of subsurface anomalies. These parallel transect lines are in close proximity to several of the EM screening anomalies discussed previously.

For specific details regarding the GPR equipment and findings, refer to the EM and GPR summary report (Grumman 2000).

2.1.2.4 Cut-Fill Maps

In an effort to discover the locations of previous activity and potential fill areas, a map was generated to compare the 1952 topography to the current topography of the Carolina Area. Areas indicating a change in elevation (i.e., fill areas) greater than 2 feet warranted further investigation, such as physical sampling or geophysical surveying discussed above. These fill areas are shown on Figure 2-3, along with the physical sample locations and the anomalies identified through the use of geophysical surveying.

2.2 IDENTIFICATION OF EXCAVATION COCs

The selection process for retaining COCs for a remediation area is driven by applying a set of decision criteria. A soil contaminant will be retained as a COC for the Carolina Area if the following are true:

- It is listed as a soil COC in the OU5 ROD
- It can be traced to site use, either through process knowledge or known release of the constituent to the environment
- Analytical results indicate the contaminant is present at a concentration above its FRL, and the above-FRL concentrations are not attributable to false positives or elevated CRDLs
- Physical characteristics of the contaminant, such as half-life, indicate it is likely to persist in the soil between time of release and remediation
- The contaminant is one of the sitewide primary COCs.

The selected remedy for OU5 discusses the full suite of on-site COCs as well as their corresponding FRLs. The SEP divides these sitewide COCs into two groups, primary and secondary. Total uranium, radium-226, radium-228, thorium-228, and thorium-232 are sitewide primary COCs and will be retained as ASCOCs for this reason. No above-FRL concentrations of any of the secondary COCs were detected in the Carolina Area, except for n-nitroso-di-n-propylamine. The n-nitroso-di-n-propylamine estimated values are the result of elevated CRDLs; as a result, this compound is not retained as an ASCOC for the Carolina Area. Since no mechanism for other secondary COCs within the Carolina Area can be identified, only the sitewide primary COCs will be retained as ASCOCs.

2.3 SUMMARY OF SURFACE AND SUBSURFACE CONDITIONS

Surface and subsurface conditions in the Carolina Area are described in the following paragraphs in terms of surface coverage, drainage patterns, and at- and below-grade debris.

2.3.1 Surface Coverage and Drainage Pattern

The Carolina Area covers approximately 2.8 acres, and slopes generally towards the south and southeast, being bounded on the southeast and south sides by the SSOD and Paddys Run. Existing drainage consists of sheet flow, which is uncontrolled before reaching the SSOD or Paddys Run.

2.3.2 At- and Below-Grade Debris

Debris has been located at the surface and is partially exposed within the Carolina Area. An area of concrete debris is present along the eastern boundary of the Carolina Area, adjacent to the road leading

to A2PIII. Below-grade debris is anticipated based on the EM and GPR investigations and the partially exposed debris that has been identified.

2.4 ANTICIPATED EXCAVATION BOUNDARIES

OU5 RI/FS data, predesign investigations, and visual identification were used to delineate the presence of impacted material and establish the extent of excavation within the Carolina Area. Approximately 1,500 cubic yards (yd^3) of soil containing flyash will be excavated, as shown on the DCN, and transported to the OSDF for placement. Additional excavation will be conducted to excavate buried debris identified during predesign; this soil will either be transported to the OSDF with the impacted material or remain in the area to be placed back within the excavation if no impacted material is discovered. The excavation procedures to be used are discussed in Section 3.3.

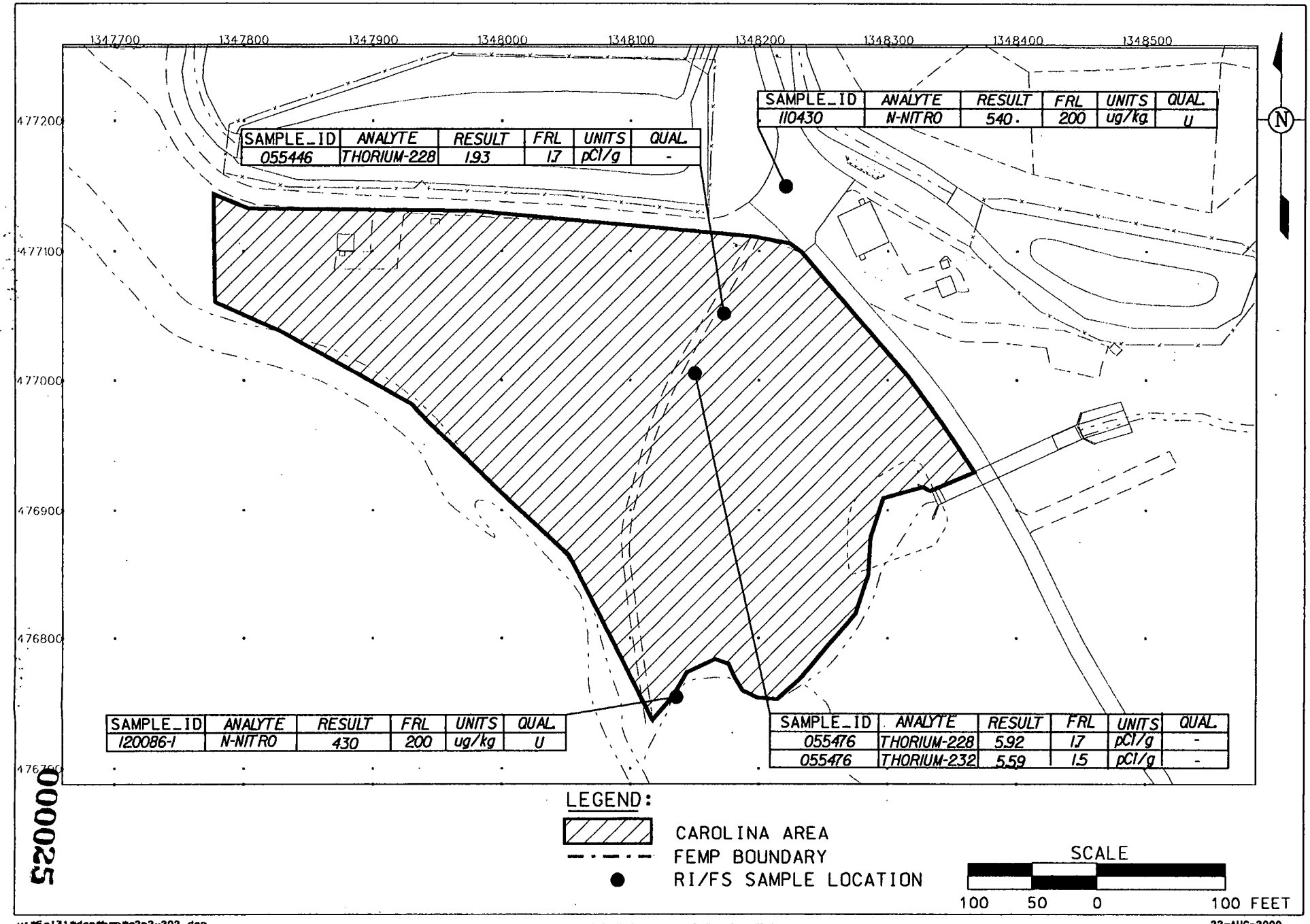

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FIGURE 2-1. HISTORICAL ABOVE-FRL SAMPLE LOCATIONS

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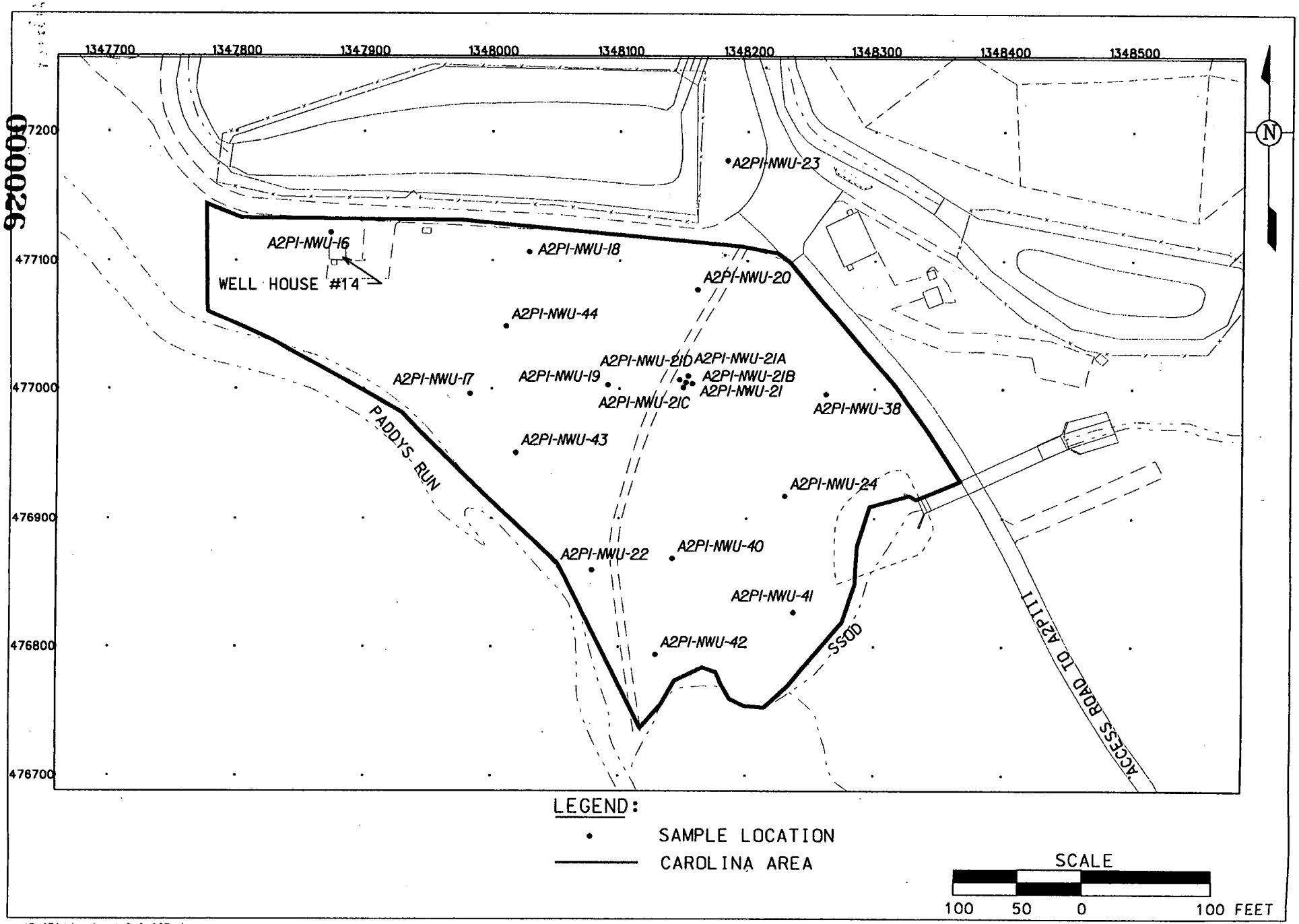

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FIGURE 2-2. PREDESIGN SAMPLE LOCATIONS

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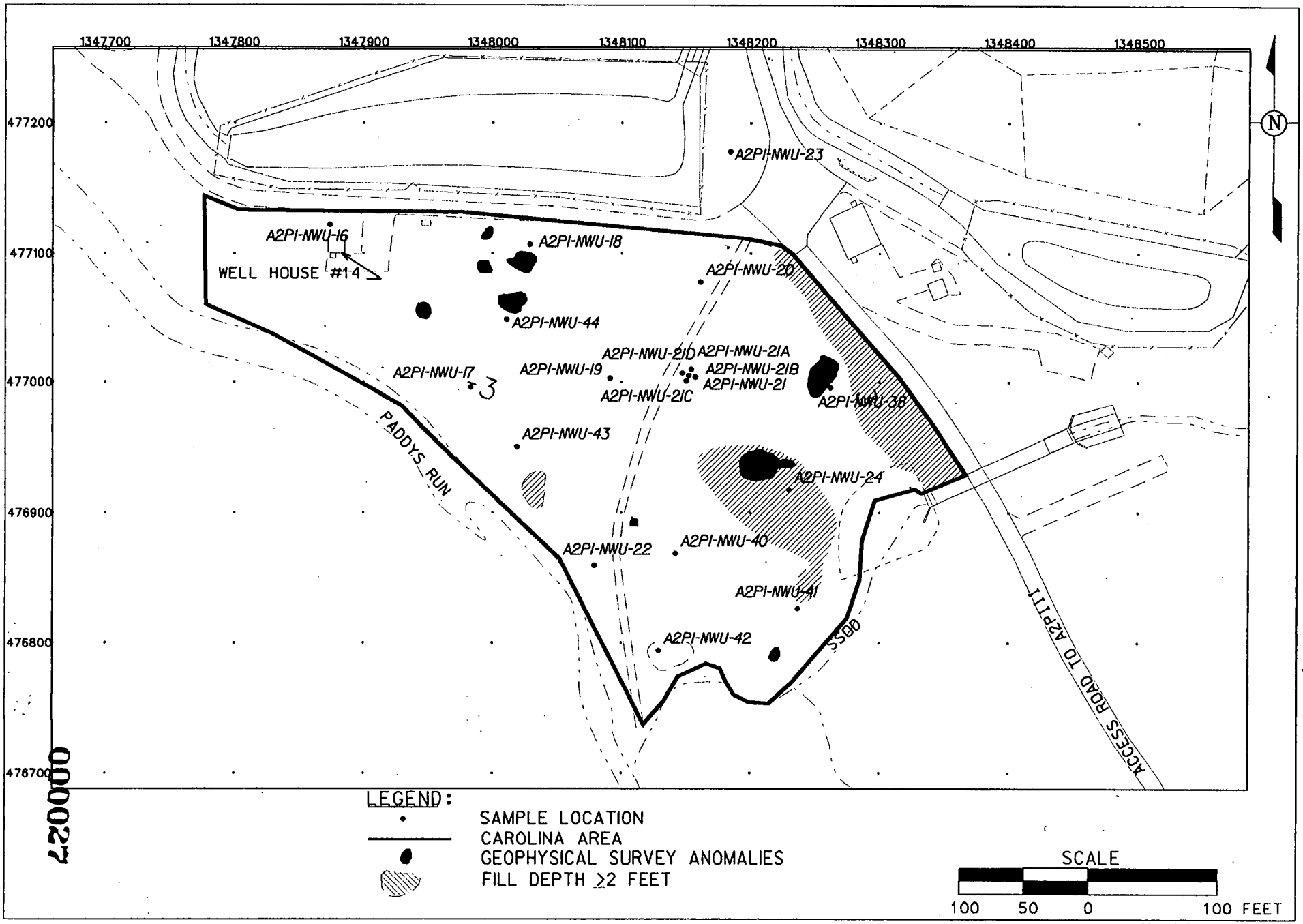

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FIGURE 2-3. SUMMARY OF PREDESIGN INVESTIGATIONS

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3.0 REMEDIAL ACTION APPROACH

The general approach is in accordance with "Excavation Approach A – Shallow Excavation of Impacted On-Property Area Outside the Former Production Area and other Waste Storage/Management Areas," described in Section 4.1 of the SEP. The performance requirements for implementing this approach are presented on the DCN to the A2PI SWUs construction drawings and technical specifications for excavation activities, which is included as part of this IRDP. The contractor performing the remediation will provide specific work methods in a Safe Work Plan, to be reviewed and approved by Fluor Fernald before applicable remedial activities are implemented.

The remedial actions in the Carolina Area will be comprised of the removal of identified impacted material, comprised of surface debris, buried debris, and soil with flyash. The remediation activities are scheduled for Summer 2000. In an effort to prevent two contractors from working in the same area, the impacted material generated through the remediation of the Carolina Area will be staged in the vicinity for subsequent transfer to the OSDF. There are two possible staging area locations, depending on where the SWU contractor is working at the time of the Carolina Area remediation:

- SWU contractor working in the former AFP area – the Carolina Area material will be staged near Well House 14 (located on the west end of the Carolina Area) for later transfer to the OSDF by the Carolina Area contractor; or
- SWU contractor not working in former AFP area – the Carolina Area material will be staged at the southern end of the AFP for subsequent transfer to the OSDF by the SWU contractor during the remediation of the AFP.

3.1 ESTABLISHING SITE BOUNDARIES AND CONTROLS

The project boundary will be posted as a construction area; a radiological boundary is not needed due to the absence of above-FRL material. Vehicle entry points will be defined and controlled by the contractor, and all exiting vehicles will travel north on the clean construction road before entering the Impacted Material Haul Road via the SWUs.

3.2 SURVEYING AND SITE LAYOUT

Surveys will be used to identify the areas to be excavated and scraped. Surveys will also be used to verify the remediation of areas identified through predesign investigations as having surface or buried

debris. Upon the completion of excavation, the depth of each excavation location will be surveyed and recorded. Surveys will also be performed for the location and configuration of the exploratory trenches.

3.3 EXCAVATION, MONITORING AND SEGREGATION

General excavation covers the following: removal of approximately 1,500 yd^3 from the soil mound where predesign investigations have identified flyash, excavation at six locations where the geophysical survey indicated the presence of anomalies indicating possibly buried impacted material, excavation of three trenches along the bank of Paddys Run, a 12-inch scrape in an area where a high concentration of surface debris has been visually observed, and the removal of miscellaneous debris located throughout the Carolina Area. Figure 3-1 shows the limits of excavation and scraping, along with the physical sample locations and the Geophysical Survey Summary information.

The Waste Acceptance Organization (WAO) and radiological technicians will provide continuous visual observation for special materials, prohibited items or elevated contamination levels. If radiological monitoring or visually discolored materials are found during the excavation, indicating the presence of elevated contamination, then the affected soil will be transported to the OSDF [or Soil Stockpile (SP) 7 for above-WAC materials] for placement.

Approximately 100 yd^3 of debris is anticipated during the remediation of the Carolina Area, resulting from the removal of debris that has been identified through visual observation at the surface and predesign investigations below the surface. This debris will be excavated, size reduced if necessary, and transported to the OSDF for placement. Any debris not passing the visual inspection will be managed at SP-7.

3.3.1 Mound Excavation

As shown on Figure 3-1, a mound area has been designated for excavation and transporting the material to the OSDF. As discussed in Section 2.1.2.2, predesign sampling indicated the presence of flyash within this area. The footprint of this area (the mound) will be excavated to elevation 533 to ensure the removal of all soil containing flyash. Approximately 1,500 yd^3 is anticipated to be excavated and transported to the OSDF.

3.3.2 Excavation for Buried Debris

As discussed in Section 2.1.2.3, geophysical surveying has indicated the presence of unidentified buried debris (the anomalies) at several distinct locations. These anomalies have been grouped and designated as Excavations 1 through 6. The excavations shall be remediated as shown on Figure 3-2 and as described in this section.

Excavations 1, 2, 3, 5, and 6 shall be performed in a similar manner. The soil will be excavated, with sideslopes no steeper than 1½ horizontal:1 vertical, to a depth of 3 feet ± 1 foot, and staged in the immediate area. If no impacted material is encountered, a real-time monitoring scan shall be performed before continuing the excavation, followed by additional excavation up to a depth of 10 feet. If impacted material is encountered at any depth, the excavation shall go to at least 10 feet; the impacted material and the excavated soils will be removed and transported to the OSDF. If the depth of impacted material is greater than 10 feet, excavation will continue until it has been removed and additional real-time gamma spectroscopy measurements will be performed. Physical samples will also be taken at the bottom of the excavations prior to backfilling or re-grading. The contractor will be responsible for ensuring that real-time monitoring personnel can safely enter the excavation.

If no impacted material is encountered at a depth of 10 feet, the excavation will be backfilled using material from the excavation following the real-time monitoring and physical samples. If impacted materials are excavated, the resulting 10-foot excavation will be graded into the surrounding area with maximum sideslopes of 4 horizontal:1 vertical.

Real-time excavation monitoring and collection of physical samples following the excavation described above will be documented in a Variance/Field Change Notice to the existing, approved the PSP for Predesign Sampling in the A2PI Non-Waste Units and A2PII Part One.

Excavation 4 is located within the boundaries of the mound excavation. If debris has not been encountered during the excavation of the mound, the excavation will proceed as described above within the boundary of Excavation 4. Any soil removed beyond elevation 533 will be staged within the immediate area and possibly used as backfill for Excavation 4 if no impacted materials are encountered.

3.3.3 Exploratory Trenching

Three trenches with minimum dimensions of 40 feet long, 2 feet wide, and 6 feet deep will be excavated in the Carolina Area, extending inward from Paddys Run, as shown on Figure 3-3 and the DCN. The length of the trenches will be adjusted as necessary in the field to ensure that the trench extends through the berm along the stream bank of Paddys Run. The trenches are intended to verify that no debris or fill material exists on the banks of Paddys Run. Prior to excavation of the trenches, the agencies will be invited to participate in a field walk down to ensure concurrence on trench location and length.

If impacted materials are discovered during excavation, there are three possible paths forward:

- Expand the trench both laterally and vertically to removal all impacted material;
- Excavate additional trenches in vicinity of trench where impacted material discovered in an attempt to bound the impacted materials; or
- Remove a portion of the streambank of Paddys Run if extensive impacted material is encountered (after notification to the Agencies that such action is necessary).

Any impacted material discovered during the excavation of the trench will be removed and transported to the OSDF. The trenches will be backfilled with the material that was excavated and graded into the surrounding area.

3.3.4 Twelve-Inch Scraping Area

There is an area, as shown on the sketch attached to the DCN, designated for a 12-inch scrape. Visual observation and predesign investigations have identified a concentration of surface and partially buried debris within the boundary of this scraping area, including a large amount of debris along the road that creates the eastern boundary of the Carolina Area. Upon completion of the 12-inch scrape over the footprint of the area, a real-time radiological scan will be performed. The soil from the scrape will remain within the immediate area and be graded back into the area once the debris has been removed. If the quantity or nature of the debris in the scraping area is such that segregation of the debris from the soil is not practical, the contractor will then be directed to transport the soil and debris to the OSDF. The debris within the embankment of the road will be chased to a minimum depth of 12 inches, and the maximum will be a field call directed by the Construction Manager to prevent undercutting of the road.

3.3.5 Miscellaneous Debris

As shown on the sketches attached to the DCN, there are 32 locations of miscellaneous debris which have been identified based on visual observation. This debris consists of pieces of concrete, rebar, thick wire cable, and scraps of metal. It is also acknowledged, as noted on the DCN, that additional debris, not already identified, may be encountered during the excavation of the Carolina Area. For these 32 points and any additional debris locations, after the debris has been removed, a 6-inch scrape will be performed over an approximately 5-foot radius around the debris location. This scrape will verify that there is no debris remaining in the soil at that location or in its immediate vicinity. The soil that is moved during the 6-inch scrape will remain in that area unless field radiological monitoring indicates elevated contamination, in which case the affected soil will be removed and transported to either the OSDF or SP-7.

3.4 IMPACTED MATERIAL MANAGEMENT

Impacted material from the Carolina Area will consist of soil containing flyash and debris and will be placed in the OSDF in accordance with the Impacted Materials Placement Plan (DOE 2000). The contractor will be directed to manage the impacted material in a manner that ensures material placement objectives at the OSDF are met. For example, soil/debris placement ratios for the OSDF must be maintained; therefore, the removal and placement of debris from the Carolina Area will be coordinated with the OSDF project.

3.4.1 Other Materials

Section 3.3.2.2 of the SEP identifies special materials that, when encountered, require WAO input before the contractor can determine their disposition. While these special materials are not anticipated, the unknown nature of the buried debris requires that a contingency plan be in place if they are encountered. Special materials include:

- Asbestos
- Drums and tanks
- Piping and pumps
- Process residues
- Uranium metal
- Miscellaneous debris
- Acid brick.

Some of these materials (asbestos, piping, and debris) may be placed in the OSDF if they meet the WAC and if a visual inspection of pipe interiors is passed. Materials that do not meet the OSDF WAC will be placed at SP-7 or packaged into containers and staged within the project area until transferred to Fluor Fernald Waste Generator Services, with the exception of process residues, friable asbestos and uranium metal; these will be containerized and staged at the Carolina Area project. Fluor Fernald Waste Generator Services will pick up the containers from the area for characterization of the material and eventual shipment to an off-site disposal facility. Information on the identification, management, and tracking of these materials is provided in the SEP (Section 3.6 and Appendix F).

3.5 PRECERTIFICATION AND CERTIFICATION

Precertification activities will commence after the identified impacted materials have been removed and the excavation locations have been either backfilled or graded into the surrounding area. Real-time monitoring of each excavation location will be performed to precertify the area following either backfilling or re-grading. Some interim grading of the area may be required to facilitate access by the real-time monitoring crew; final grading will be dependent upon the final condition of the excavation areas. After precertification activities are completed, certification samples will be collected in addition to the samples collected from the bottom of each excavation location. The approach for certification will be presented under a separate CDL. Final grading and vegetation requirements for the slopes will be addressed in the NRRP.

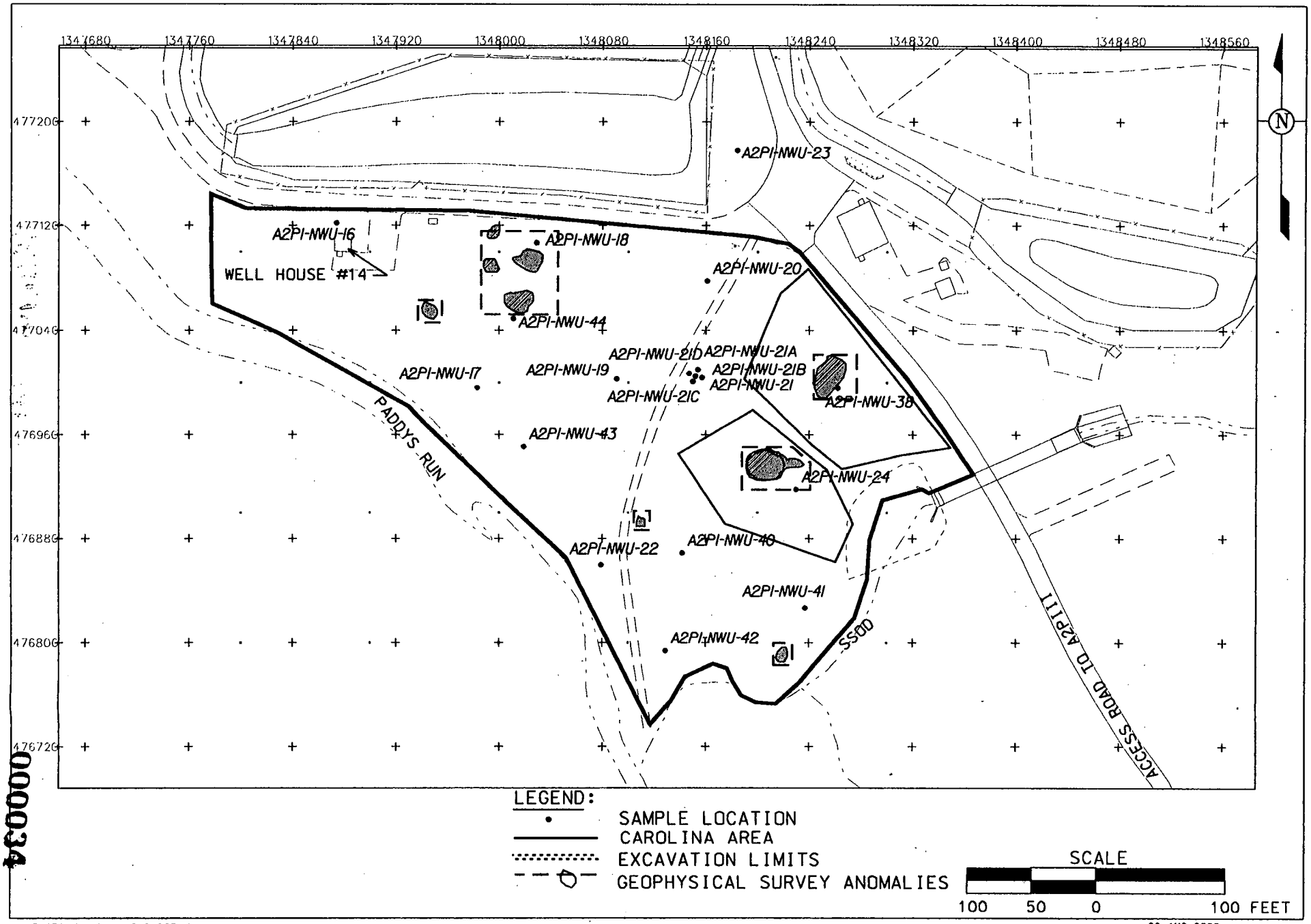

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FIGURE 3-1. LIMITS OF EXCAVATION

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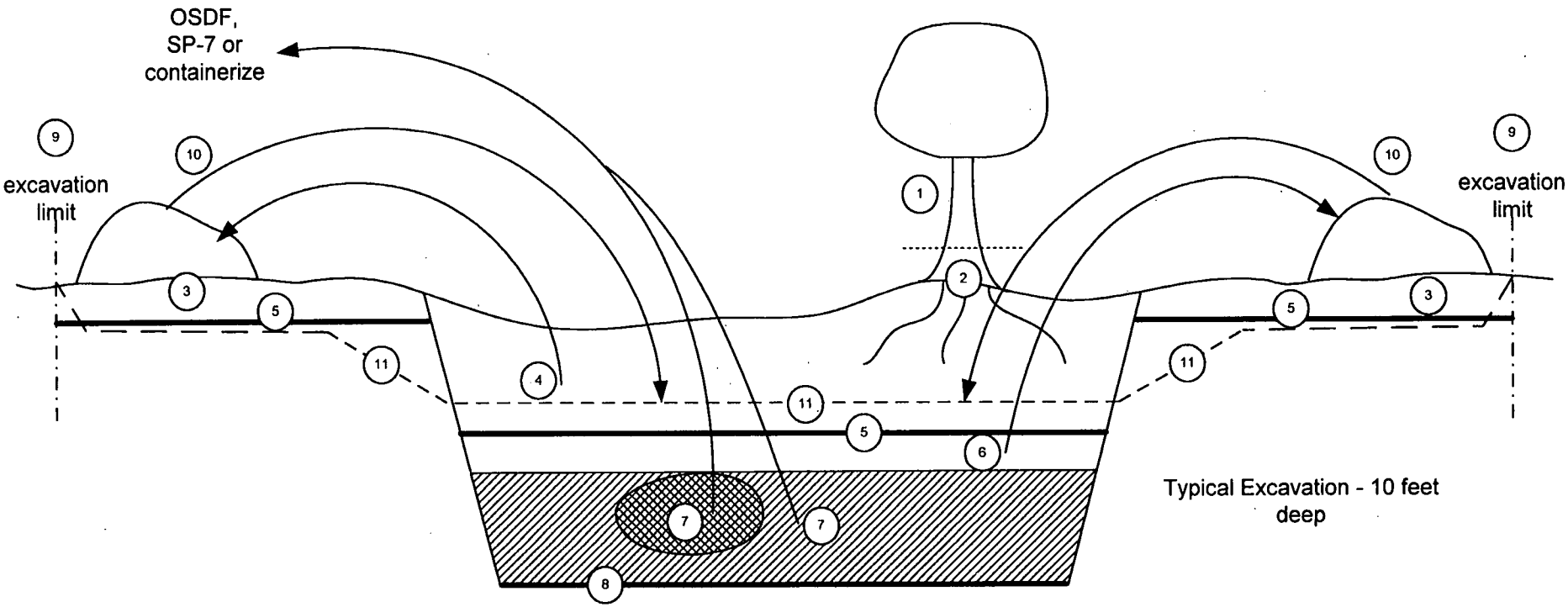
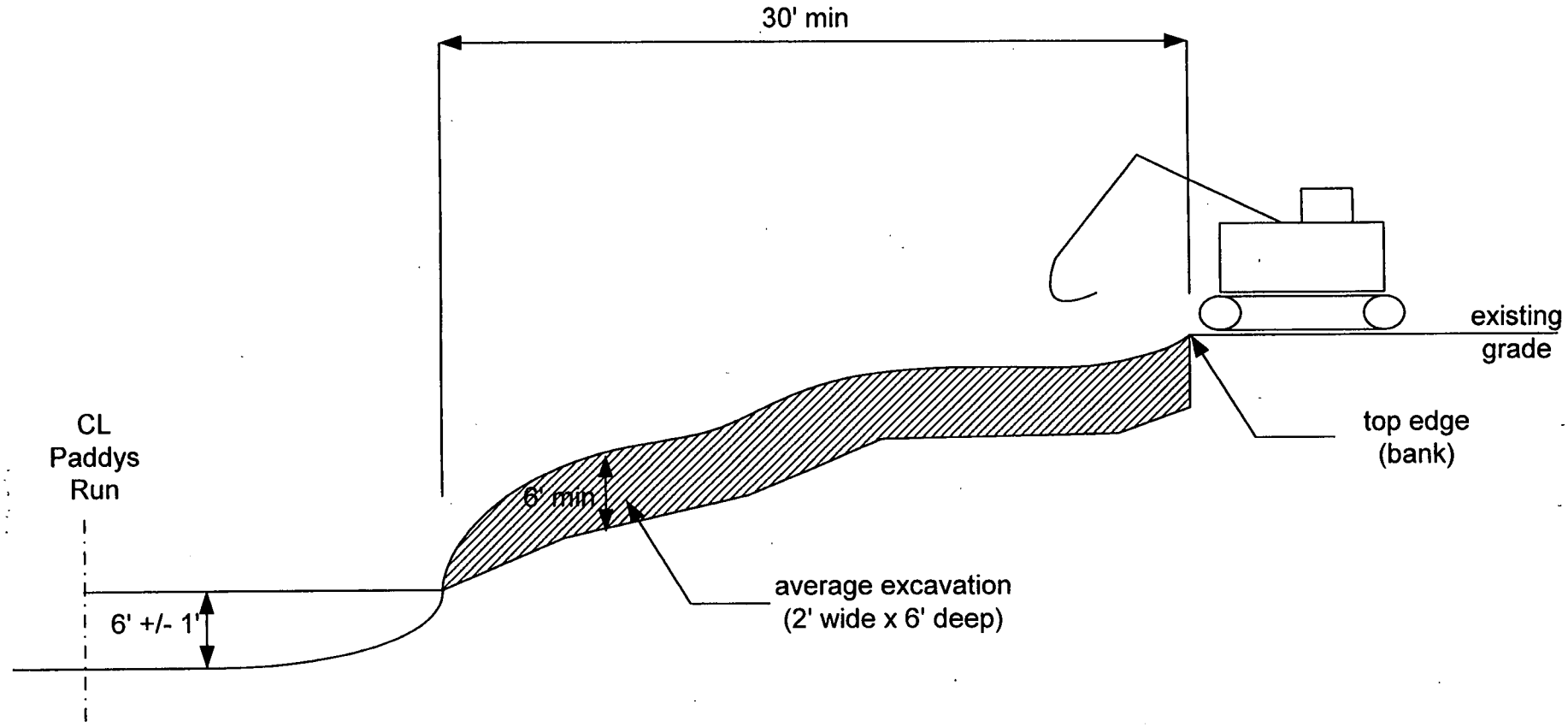


1. Cut or push over trees and stockpile in the unexcavated vicinity as a brush pile.
2. Remove stumps and roots while excavating during steps (3) or (4).
3. Remove 12 inches of soil/vegetation to visually monitor for debris. Remove and size reduce any debris and transport it to the OSDF, SP-7, or containerize it. Stockpile soil/vegetation in working piles within the area.
4. Excavate 3' +/- 1' lift and stockpile soil in a distinct working pile within the area. If impacted material is encountered, go to (7).
5. Perform real-time monitoring.
6. Excavate soil to a depth of 10 feet and stockpile it in a separate working pile within the area. If no impacted material encountered, go to (8)
7. Remove, and size reduce if necessary, any impacted material (debris, flyash, etc.) and the surrounding soil to a depth of 10 feet and transport to OSDF, SP-7, or containerize it.
8. Perform real-time monitoring and physical sampling at bottom of excavation. Take one sample at the bottom of excavation locations 1, 3 & 5. Take two samples at the bottom of excavation locations 2, 4 & 6.
9. Survey final excavation limits and depth.
10. If no impacted material removed, backfill with excavated material and compact in 24" loose lifts using appropriate equipment. If impacted material and surrounding soils removed, go to (11)
11. Reshape final grade, 4:1 final slope. Perform real-time monitoring over final grade for precertification and sample for certification.

Figure 3-2: Typical Excavation Approach



1. Field locate trench as directed by Construction Manager to minimize damage to existing trees. Survey final trench location.
2. Excavate trenches to shown minimum dimensions (2' wide x 6' deep x 30' long). Stockpile excavated material adjacent to trench and outside of Paddys Run stream.
3. Remove any impacted material (debris, flyash, etc.) and transport to OSDF, SP-7, or containerize it.
4. Assess extent of any impacted material found. There are three possible scenarios if impacted material is found:
   1) Widen the trench to pursue the impacted material.
   2) Dig additional trenches to bound and excavate the impacted material.
   3) Excavate a portion of streambank to remove the impacted material.
5. Backfill trench with excavated material and compact in 24" loose lifts using appropriate equipment.

Figure 3-3: Typical Trench Excavation

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APPENDIX A

DATA SUMMARY

APPENDIX A-1
A2P1-NWU CAROLINA AREA PHYSICAL SAMPLING RESULTS

Boring ID	Sample No.	Northing	Easting	Elevation	Depth of Fill*	Depth of Flyash*	Radium-226 (pCi/g)	Radium-228 (pCi/g)	Thorium-228 (pCi/g)	Thorium-232 (pCi/g)	Uranium (ppm)
A2P1-NWU-16	A2P1-NWU-16-1	477122	1347873	538	0	0	0.76 NV	0.52 NV	0.51 NV	0.52 NV	4.5 NV
A2P1-NWU-17	A2P1-NWU-17-1	476996	1347982	538	0	0	0.78 NV	0.5 NV	0.49 NV	0.5 NV	3.2 NV
A2P1-NWU-18	A2P1-NWU-18-1	477107	1348028	538	0	0	0.91 NV	0.64 NV	0.62 NV	0.64 NV	6.1 NV
A2P1-NWU-19	A2P1-NWU-19-1	477003	1348090	539	0	0	1.1 NV	0.85 NV	0.84 NV	0.85 NV	2.9 UNV
A2P1-NWU-20	A2P1-NWU-20-1	477078	1348160	538	0	0	1.1 NV	0.65 NV	0.65 NV	0.65 NV	6.7 NV
A2P1-NWU-21	A2P1-NWU-21-1	477005	1348151	537	0	0	0.78 NV	0.51 NV	0.51 NV	0.51 NV	2.9 UNV
A2P1-NWU-21	A2P1-NWU-21-11	477005	1348151	527	0	0	0.5 NV	0.21 NV	0.2 NV	0.04 UNV	2 UNV
A2P1-NWU-21A	A2P1-NWU-21A-1	477010	1348153	537	0	0	1 NV	0.76 NV	0.73 NV	0.76 NV	2.9 UNV
A2P1-NWU-21A	A2P1-NWU-21A-11	477010	1348153	527	0	0	0.57 NV	0.2 NV	0.19 NV	0.2 NV	2.5 UNV
A2P1-NWU-21B	A2P1-NWU-21B-1	477004	1348156	537	0	0	0.96 NV	0.71 NV	0.7 NV	0.71 NV	3.2 NV
A2P1-NWU-21B	A2P1-NWU-21B-11	477004	1348156	527	0	0	0.52 NV	0.21 NV	0.2 NV	0.21 NV	2.1 UNV
A2P1-NWU-21C	A2P1-NWU-21C-1	477001	1348149	537	0	0	0.72 NV	0.43 NV	0.43 NV	0.43 NV	2.9 NV
A2P1-NWU-21C	A2P1-NWU-21C-11	477001	1348149	527	0	0	0.5 NV	0.24 NV	0.23 NV	0.24 NV	2.1 UNV
A2P1-NWU-21D	A2P1-NWU-21D-1	477007	1348146	537	0	0	0.8 NV	0.49 NV	0.49 NV	0.49 NV	3.1 NV
A2P1-NWU-21D	A2P1-NWU-21D-11	477007	1348146	527	0	0	0.54 NV	0.21 NV	0.2 NV	0.21 NV	2.4 UNV
A2P1-NWU-22	A2P1-NWU-22-1	476860	1348078	539	0	0	1.1 NV	0.73 NV	0.72 NV	0.73 NV	4.3 NV
A2P1-NWU-23	A2P1-NWU-23-1	477178	1348183	545	0	0	1.1 NV	0.61 NV	0.6 NV	0.61 NV	4.2 NV
A2P1-NWU-24	A2P1-NWU-24-1	476918	1348229	540	0 - 5.5	3.5 - 5.5	0.96 NV	0.54 NV	0.54 NV	0.54 NV	4.9 NV
A2P1-NWU-24	A2P1-NWU-24-6	476918	1348229	535	0 - 5.5	3.5 - 5.5	0.86 NV	0.52 NV	0.49 NV	0.52 NV	2.9 NV
A2P1-NWU-38	A2P1-NWU-38-1	476996	1348261	537	0 - 6.0	0	0.94 NV	0.59 NV	0.57 NV	0.59 NV	2.9 UNV
A2P1-NWU-38	A2P1-NWU-38-7	476996	1348261	531	0 - 6.0	0	0.88 NV	0.49 NV	0.46 NV	0.49 NV	2.4 UNV
A2P1-NWU-40	A2P1-NWU-40-1	476869	1348141	535	0	0	1.3 NV	0.77 NV	0.76 NV	0.77 NV	3.1 NV
A2P1-NWU-41	A2P1-NWU-41-1	476827	1348236	537	0	0	1.4 NV	0.67 NV	0.65 NV	0.67 NV	6 NV
A2P1-NWU-42	A2P1-NWU-42-1	476794	1348128	539	0	0	1.1 NV	0.76 NV	0.75 NV	0.76 NV	2.3 NV
A2P1-NWU-43	A2P1-NWU-43-1	476951	1348018	539	0	0	0.99 NV	0.54 NV	0.52 NV	0.54 NV	5.8 NV
A2P1-NWU-44	A2P1-NWU-44-1	477049	1348010	535	0	0	1.2 NV	0.93 NV	0.92 NV	0.93 NV	9.3 NV

NV - Not validated
UNV - Estimated not validated

* Units of depth for fill and flyash are in feet

Note: All field frisking results (alpha and beta/gamma) were below background

APPENDIX A-2
HPGe RESULTS FOR CAROLINA AREA

Location ID	Northing	Easting	Detector Height	Total Uranium (ppm)	Thorium 232 (pCi/g)	Radium 226 (pCi/g)
A2P1-NWU-24-G	477095.73	1347958.00	100cm	8.41	0.492	0.981
A2P1-NWU-25-G	477092.54	1347991.06	100cm	17.5	0.646	1.115
A2P1-NWU-26-G	477092.32	1348025.09	100cm	11.2	0.78	1.059
A2P1-NWU-27-G	477089.46	1348043.90	100cm	10.2	0.71	1.045
A2P1-NWU-29-G	477066.62	1347974.49	100cm	13.6	0.581	1.102
A2P1-NWU-30-G	477068.98	1347945.56	100cm	6.62	0.499	1.07
A2P1-NWU-31-G	477064.26	1348007.77	100cm	13.9	0.775	1.1
A2P1-NWU-32-G	477068.37	1348044.22	100cm	12.3	0.796	0.885
A2P1-NWU-33-G	477034.00	1348025.26	100cm	14.6	0.849	1.074
A2P1-NWU-33-G-D	477034.00	1348025.26	100cm	14.1	0.805	1.022
A2P1-NWU-34-G	477029.47	1348058.56	100cm	9.82	0.725	0.979
A2P1-NWU-34-G	477029.47	1348058.56	100cm	9.07	0.698	0.86
A2P1-NWU-35-G	477033.37	1347993.51	100cm	12.9	0.764	1.095
A2P1-NWU-36-G	477034.52	1347957.16	100cm	10.6	0.639	0.871
A2P1-NWU-37-G	477041.43	1347921.94	100cm	9.94	0.635	0.828
A2P1-NWU-38-G	477039.85	1347891.85	100cm	9.74	0.597	0.793
A2P1-NWU-39-G	477011.22	1347937.54	100cm	0.0594	0.589	0.894
A2P1-NWU-40-G	477007.66	1347966.24	100cm	9.1	0.528	0.857
A2P1-NWU-41-G	477000.66	1348003.57	100cm	8.37	0.567	0.894
A2P1-NWU-42-G	476996.72	1348038.70	100cm	11.6	0.597	1
A2P1-NWU-43-G	476970.19	1347980.42	100cm	8.16	0.672	1.351
A2P1-NWU-44-G	476971.47	1348018.04	100cm	7.73	0.44	1.151
A2P1-NWU-45-G	476966.06	1348055.95	100cm	6.77	0.646	1.145
A2P1-NWU-46-G	476936.42	1348031.57	100cm	6.8	0.561	1.441
A2P1-NWU-47-G	476953.45	1348003.87	100cm	6.56	0.557	1.355
A2P1-NWU-50-G	476936.14	1348070.47	100cm	11.7	0.673	0.969
A2P1-NWU-51-G	476905.23	1348052.32	100cm	8.81	0.694	0.804
A2P1-NWU-52-G	476908.54	1348080.71	100cm	8.5	0.713	1.03
A2P1-NWU-53-G	476873.33	1348077.95	100cm	10.3	0.602	0.807
A2P1-NWU-54-G	476804.25	1348087.90	100cm	7.23	0.612	1.539
A2P1-NWU-55-G	476778.10	1348107.77	100cm	9.65	0.778	1.026
A2P1-NWU-57-G	476922.67	1348133.23	100cm	8.64	0.642	0.656
A2P1-NWU-58-G	476899.21	1348158.97	100cm	9.61	0.728	0.756

APPENDIX A-2
HPGe RESULTS FOR CAROLINA AREA

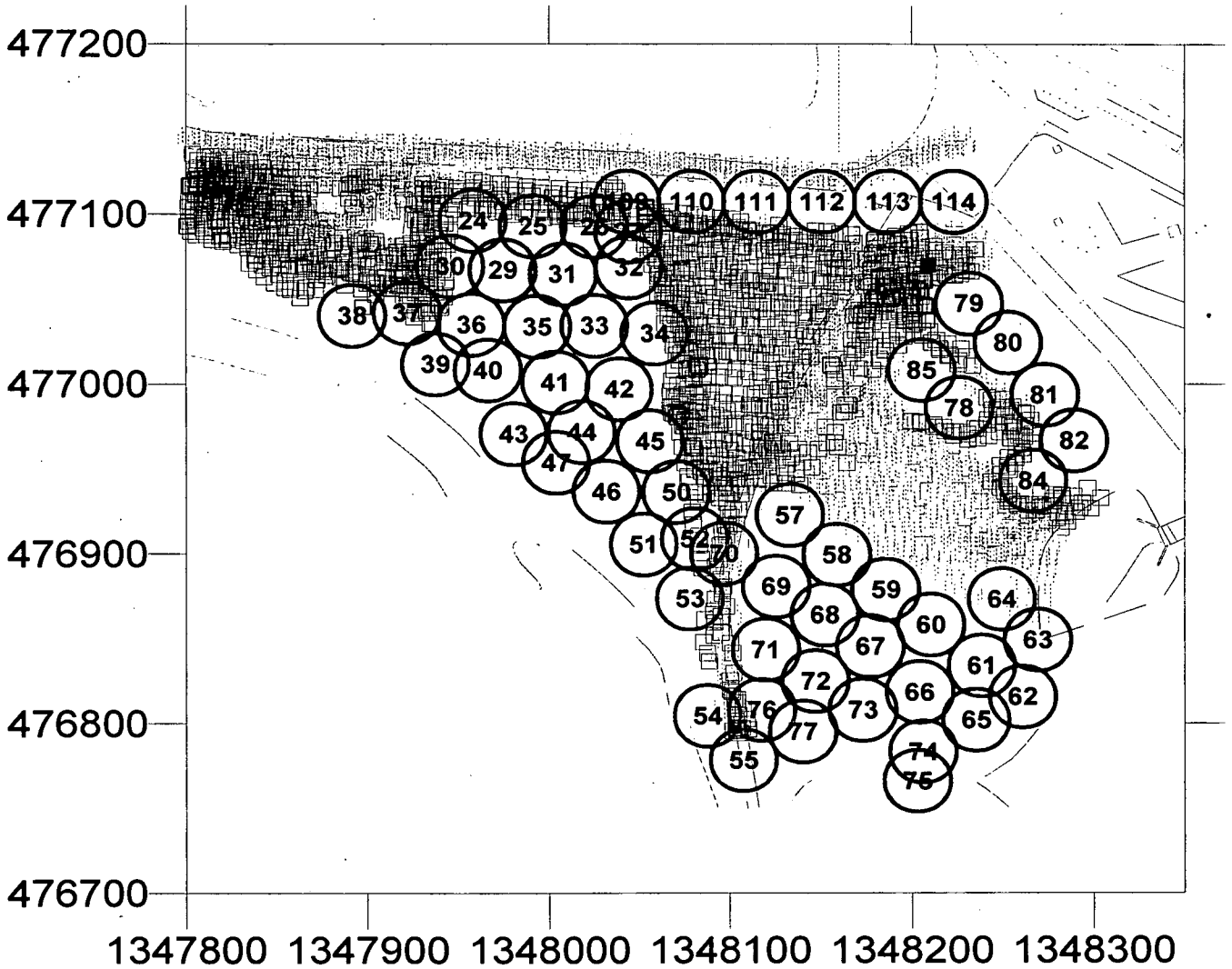
Location ID	Northing	Easting	Detector Height	Total Uranium (ppm)	Thorium 232 (pCi/g)	Radium 226 (pCi/g)
A2P1-NWU-59-G	476878.64	1348185.73	100cm	14.1	0.762	0.716
A2P1-NWU-60-G	476857.95	1348210.48	100cm	20.2	0.917	0.866
A2P1-NWU-61-G	476833.75	1348238.55	100cm	12.8	0.688	0.749
A2P1-NWU-61-G-D	476833.75	1348238.55	100cm	12.6	0.646	0.674
A2P1-NWU-62-G	476815.49	1348261.04	100cm	15.3	0.917	1.096
A2P1-NWU-63-G	476849.02	1348269.33	100cm	8.92	0.53	0.887
A2P1-NWU-64-G	476873.06	1348249.50	100cm	9.3	0.469	0.913
A2P1-NWU-65-G	476801.85	1348235.41	100cm	23.9	1.14	1.507
A2P1-NWU-66-G	476818.23	1348204.39	100cm	14.1	0.823	0.725
A2P1-NWU-67-G	476845.16	1348177.39	100cm	11.2	0.741	0.668
A2P1-NWU-68-G	476863.77	1348152.56	100cm	14.8	0.714	0.682
A2P1-NWU-69-G	476880.45	1348125.69	100cm	0.0469	0.601	0.903
A2P1-NWU-70-G	476899.99	1348097.03	100cm	5.67	0.511	0.727
A2P1-NWU-71-G	476843.15	1348120.15	100cm	0.0166	0.604	0.715
A2P1-NWU-72-G	476824.67	1348147.37	100cm	0.0125	0.693	0.669
A2P1-NWU-73-G	476807.68	1348173.20	100cm	7.4	0.696	0.771
A2P1-NWU-74-G	476783.09	1348206.20	100cm	14.7	0.922	1.31
A2P1-NWU-75-G	476765.87	1348203.17	100cm	10.9	0.787	1.021
A2P1-NWU-78-G	476985.72	1348226.02	100cm	15.6	0.633	0.839
A2P1-NWU-79-G	477047.10	1348231.41	100cm	18.9	0.554	0.909
A2P1-NWU-80-G	477024.15	1348252.93	100cm	13.2	0.713	1.028
A2P1-NWU-81-G	476993.35	1348273.27	100cm	14.7	0.797	0.955
A2P1-NWU-82-G	476966.48	1348289.24	100cm	11.7	0.739	1.393
A2P1-NWU-84-G	476942.80	1348266.68	100cm	13.2	0.668	0.972
A2P1-NWU-85-G	477007.97	1348205.41	100cm	13.7	0.515	0.757
A2P1-NWU-109-G	477107.00	1348043.00	100cm	7.33	0.548	1.012
A2P1-NWU-110-G	477107.00	1348079.00	100cm	0.0693	0.55	1.024
A2P1-NWU-111-G	477107.00	1348115.00	100cm	0.0632	0.44	0.882
A2P1-NWU-112-G	477107.00	1348151.00	100cm	5.41	0.372	0.911
A2P1-NWU-112-G-D	477107.00	1348151.00	100cm	6.77	0.403	0.808
A2P1-NWU-113-G	477107.00	1348187.00	100cm	8.04	0.48	1.018
A2P1-NWU-114-G	477107.00	1348223.00	100cm	0.0221	0.404	1.028

APPENDIX A
A2P1 NWU CAROLINA AREA
Total Counts per Second

3190

RTRK batch#: 766,767
RSS batch#: 486,487,496,501,512
Measurement dates from 10/14/99 to 3/01/00
Field of View to scale

N



RMS
Counts per Second (cps)

	0.00 to 2000.00
	2000.00 to 2500.00
	2500.00 to 3000.00
	3000.00 to 3500.00
	3500.00 to 10000.00

HPGe locations shown for coverage only

RTIMP DWG Title: A2P1-NWU-CAROLINA-AREA-TC-1PT-M
Project #: 20400-PSP-0002
Project Name: A2P1 NWU & A2P2 PT1 PreDesign Sampling
Prepared By: Dale Seiller
File: A2P1_NWU_CAROLINA_AREA_TC_1PT_MC.srf
Date Prepared: 5/24/00

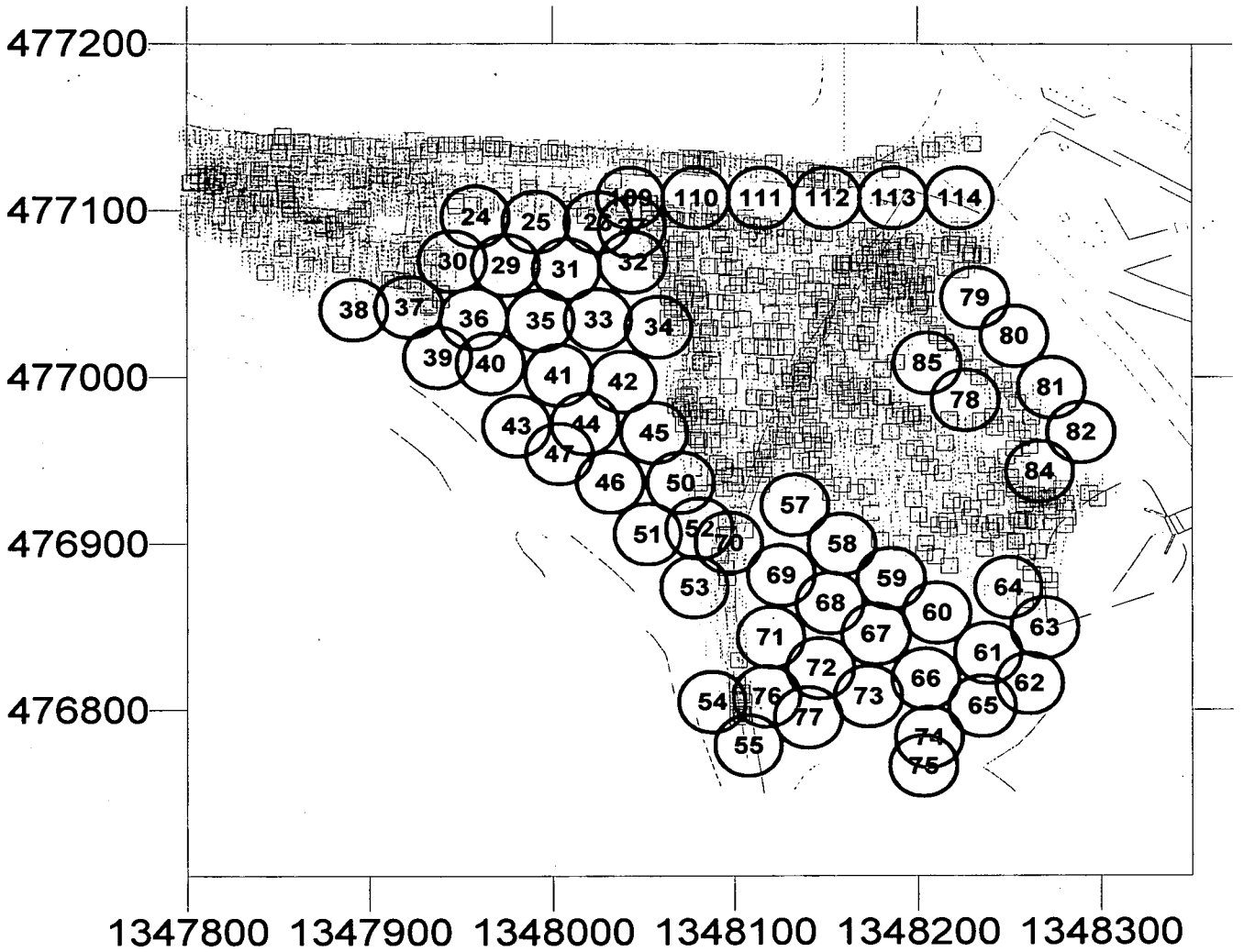
APPENDIX A
A2P1 NWU CAROLINA AREA

8190

Moisture Corrected Total Uranium

RTRK batch#: 766,767
RSS batch#: 486,487,496,501,512
Measurement dates from 10/14/99 to 3/01/00
Field of View to scale

N



RMS Total Uranium in ppm	
	-54.00 to 41.00
	41.00 to 82.00
	82.00 to 164.00
	164.00 to 246.00
	246.00 to 10000.00

HPGe Total Uranium in ppm	
○	0.00 to 41.00
○	41.00 to 82.00
○	82.00 to 164.00
○	164.00 to 246.00
●	246.00 to 10000.00

RTIMP DWG Title: A2P1-NWU-CAROLINA_AREA-TU-2PT-M
Project #: 20400-PSP-0002
Project Name: A2P1 NWU & A2P2 PT1 PreDesign Sampling
Prepared By: Dale Seiller
File: A2P1_NWU_CAROLINA_AREA_TU_2PT_MC.srf
Date Prepared: 5/24/00

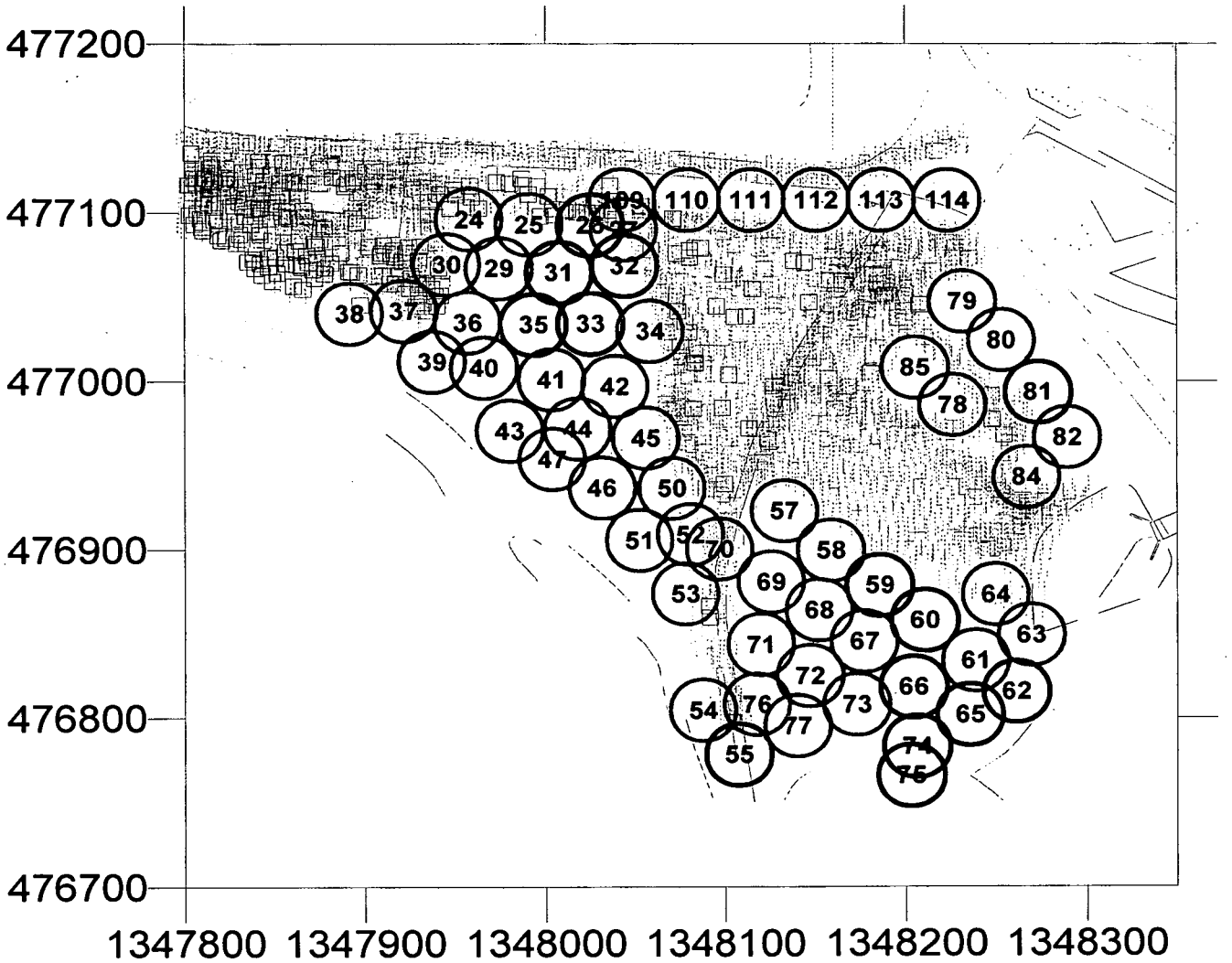
APPENDIX A
A2P1 NWU CAROLINA AREA

3190

Moisture Corrected Thorium 232

RTRK batch#: 766,767
RSS batch#: 486,487,496,501,512
Measurement dates from 10/14/99 to 3/01/00
Field of View to scale

N



RMS Th-232 pCi/gm	
	-0.26 to 0.75
	0.75 to 1.50
	1.50 to 3.00
	3.00 to 4.50
	4.50 to 10000.00

HPGe Th-232 pCi/gm	
	0.00 to 0.75
	0.75 to 1.50
	1.50 to 3.00
	3.00 to 4.50
	4.50 to 10000.00

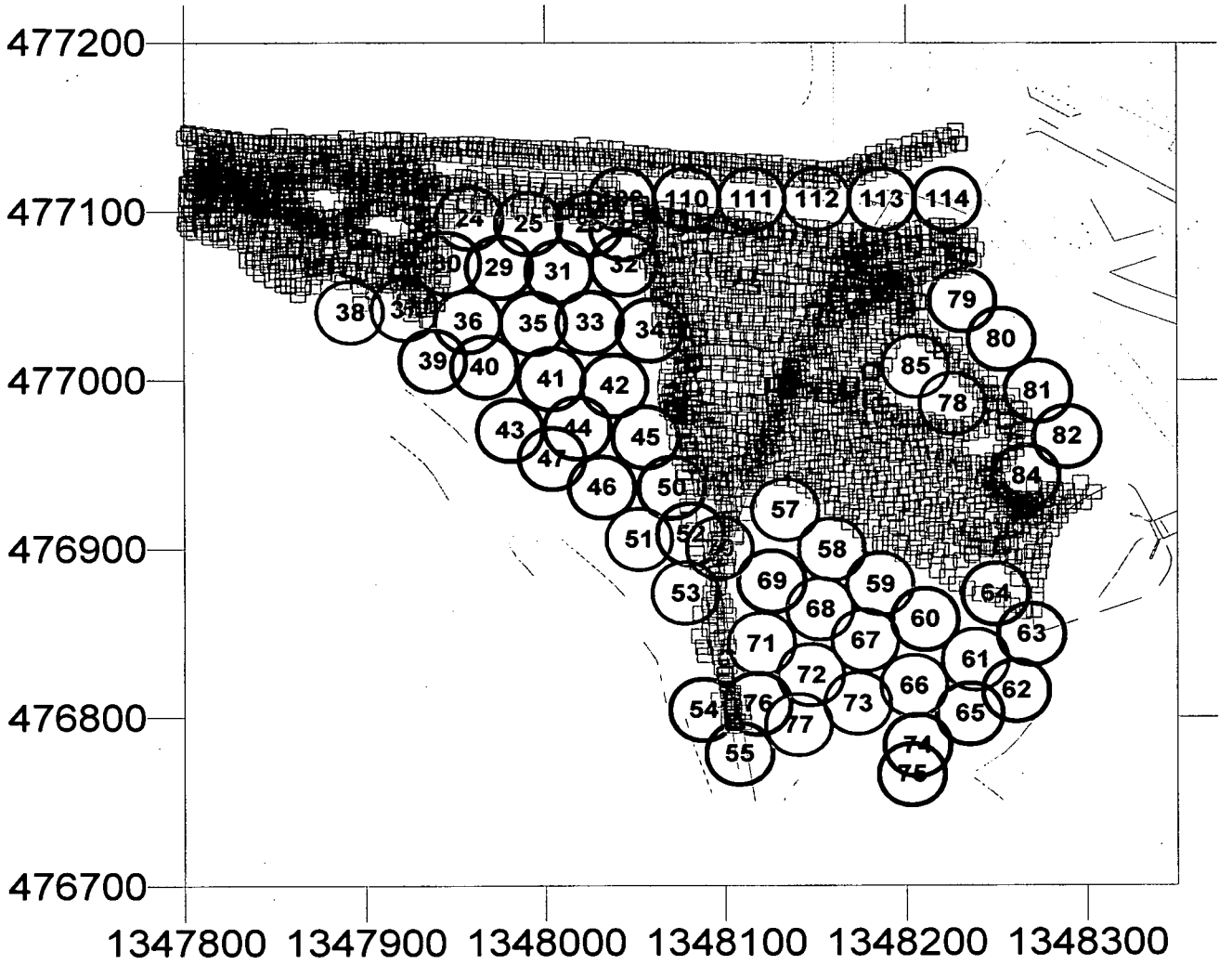
RTIMP DWG Title: A2P1-NWU-CAROLINA-AREA-TH-2PT-M
Project #: 20400-PSP-0002
Project Name: A2P1 NWU & A2P2 PT1 PreDesign Sampling
Prepared By: Dale Seiller
File: A2P1_NWU_CAROLINA_AREA_TH_2PT_MC.srf
Date Prepared: 5/24/00

APPENDIX A
A2P1 NWU CAROLINA AREA
Moisture and Radon Corrected Radium 226

3190

RTRK batch#: 766,767
RSS batch#: 486,487,496,501,512
Measurement dates from 10/14/99 to 3/01/00
Field of View to scale

N



RMS Ra-226 pCi/gm	
	-0.19 to 0.85
	0.85 to 1.70
	1.70 to 3.40
	3.40 to 5.10
	5.10 to 10000.00

HPGe Ra-226 pCi/gm	
	0.00 to 0.85
	0.85 to 1.70
	1.70 to 3.40
	3.40 to 5.10
	5.10 to 10000.00

RTIMP DWG Title: A2P1-NWU-CAROLINA-AREA-RA-2PT-M
Project #: 20400-PSP-0002
Project Name: A2P1 NWU & A2P2 PT1 PreDesign Sampling
Prepared By: Dale Seiller
File: A2P1_NWU_CAROLINA_AREA_RA_2PT_MC.srf
Date Prepared: 3/20/00