

**Department of Energy**

Oak Ridge Operations  
Weldon Spring Site  
Remedial Action Project Office  
Route 2, Highway 94 South  
St. Charles, Missouri 63303

December 11, 1987



Ms. Katherine Biggs, Chief  
Environmental Review Branch  
U. S. Environmental Protection Agency  
Region VII  
726 Minnesota Avenue  
Kansas City, Kansas 66101

Dear Ms. Biggs:

**PLAN FOR THE SAMPLING AND ANALYSIS OF LAKE AND STREAM  
SEDIMENTS**

Enclosed are four copies of the Final Sampling Plan for Lake and Stream Sediments influenced by the Weldon Spring Chemical Plant drainage. All of your July 6, 1987, comments have been incorporated and the sampling effort is scheduled to begin in January 1988.

If you have any questions, please call.

Sincerely,

A handwritten signature in cursive script that reads "R. R. Nelson".

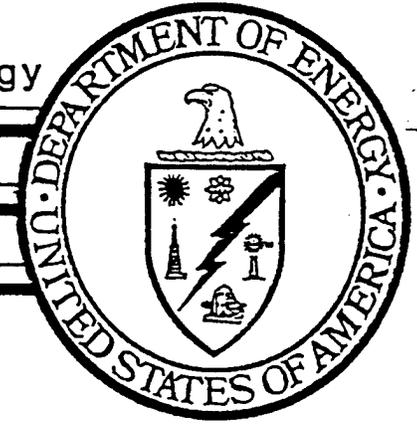
R. R. Nelson  
Project Manager  
Weldon Spring Site  
Remedial Action Project

Enclosures

cc:

Dave Bedan, MDNR, w/enclosures (4 copies)  
Jack Hammond, MK-F, w/o enclosure

United States Department Of Energy



# W.S.S.R.A.P.

## PLAN FOR THE SAMPLING AND ANALYSIS OF LAKE AND STREAM SEDIMENTS INFLUENCED BY THE WELDON SPRING CHEMICAL PLANT DRAINAGE

NOVEMBER, 1987

WELDON  
SPRING  
SITE  
REMEDIAL  
ACTION  
PROJECT

PLAN FOR THE SAMPLING & ANALYSIS OF  
LAKE & STREAM SEDIMENTS INFLUENCED BY  
THE WELDON SPRING CHEMICAL PLANT DRAINAGE

NOVEMBER, 1987

PLAN FOR THE SAMPLING & ANALYSIS OF LAKE & STREAM  
SEDIMENTS INFLUENCED BY THE  
WELDON SPRING CHEMICAL PLANT DRAINAGE

PREPARED FOR:

UNITED STATES DEPARTMENT OF ENERGY  
OAK RIDGE OPERATIONS OFFICE  
UNDER CONTRACT NO. DE-AC05-86OR21548

PREPARED BY:

MK-FERGUSON COMPANY  
AND  
JACOBS ENGINEERING GROUP, INC.  
ROUTE 2, HIGHWAY 94 SOUTH  
ST. CHARLES, MISSOURI 63303

NOVEMBER, 1987

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## 1.0 INTRODUCTION

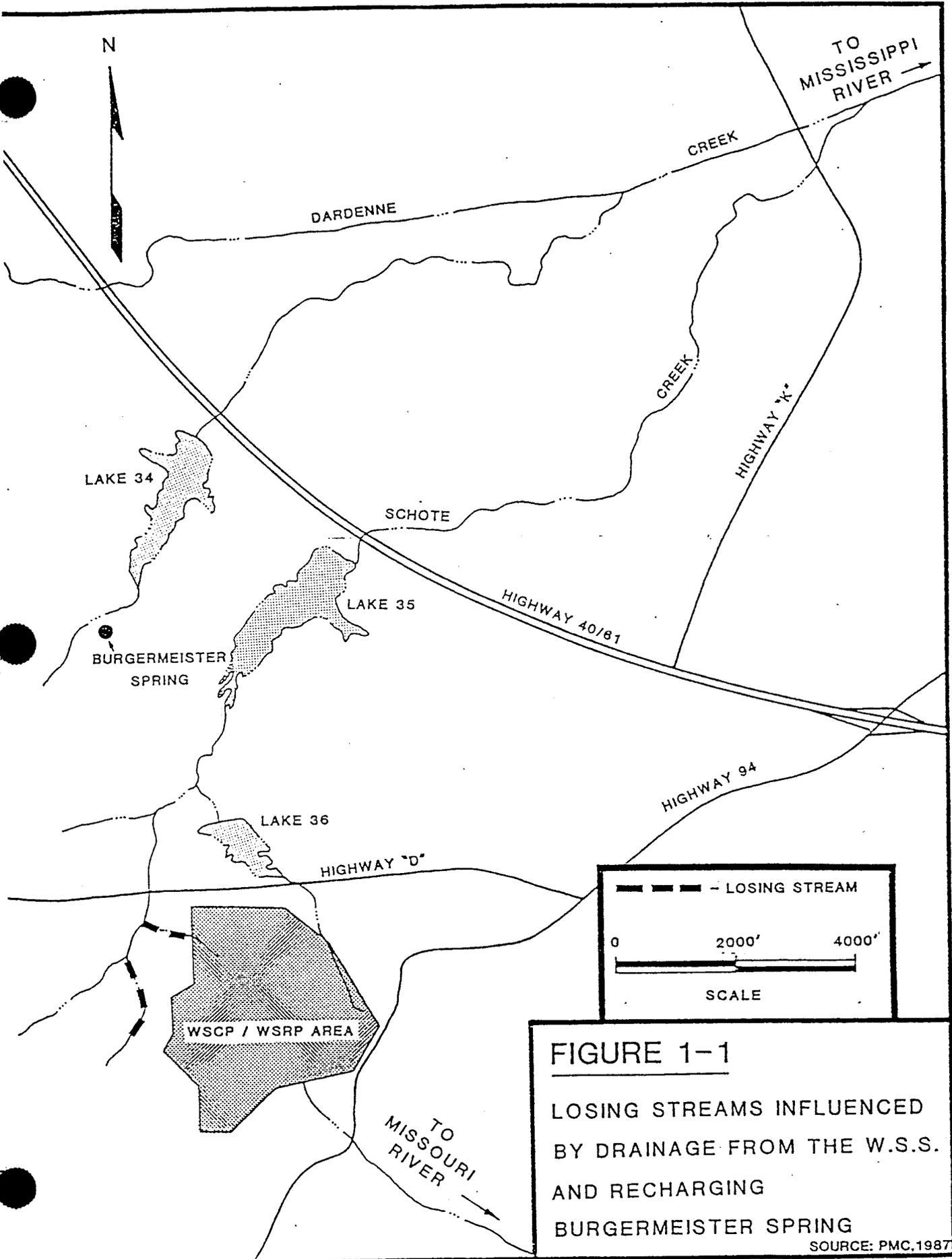
This document presents the Field Sampling and Analysis Plan for the collection of sediments from lakes and streams influenced by drainage from the Weldon Spring Site. The plan describes the scope of activities to be performed by the Project Management Contractor (PMC) and its subcontractors during sediment collection and analysis.

Results of this study and any subsequent sediment investigations will be incorporated into the Site Characterization Report. In addition, the risks associated with any discovered contaminant deposition will be assessed as part of the Environmental Impact Statement.

### 1.1 Background

A survey of sediments near the Weldon Spring Site will be performed in 1988. Surface drainage from most of the combined Weldon Spring Chemical Plant (WSCP) and Weldon Spring Raffinate Pit (WSRP) areas flows in a northerly direction, toward Lakes 35 and 36 on the August A. Busch Memorial Wildlife Area (Busch Area) (Figure 1.1). The remaining surface drainage flows southward down a drainage easement to the Missouri River, through the Weldon Spring Wildlife Area (WSWA). The drainage easement also carried process and sanitary sewer outfall to the Missouri River.

The 7,000-acre Busch Area and 7,200-acre WSWA are managed by the Missouri Department of Conservation and are open throughout the year to the general public. Several of the intermittent streams draining portions of the WSCP/WSRP areas are losing streams. A portion of this drainage resurfaces at Burgermeister Spring which is upstream from Lake 34 on the Busch Area. Radiological activity above background was detected in the waters of these three lakes at levels ranging from 11 pCi/L to 36 pCi/L (DOE, 1986 Environmental Monitoring Report).



**FIGURE 1-1**  
 LOSING STREAMS INFLUENCED  
 BY DRAINAGE FROM THE W.S.S.  
 AND RECHARGING  
 BURGERMEISTER SPRING  
 SOURCE: PMC, 1987

In addition, limited lake and stream sediment sampling conducted in 1986 (ORAU: Radiological Survey of the August A. Busch and Weldon Spring Wildlife Areas.) and in 1978 (Rykman, Edgerly, Tomlinson and Associates: Phase III Report: Assessment of Deposition Alternatives) indicated uranium activity in several lake and stream sediment samples exceeding the remedial action guidelines of 60 pCi/g for U-238 and U-234 respectively. These data suggest that the underlying sediments in these lakes may require remedial action.

In addition, five sediment samples were collected in 1983 from Dardenne Creek by a local citizens group and analyzed for radiological parameters. While analyzed results of these samples technically indicated background levels, the report concludes that samples from downstream of the WSS exhibited higher activity than background. However, insufficient quality control analyses do not allow adequate assessment of the validity of the report's conclusion. In August of 1987, eight sediment samples were collected from the proposed NPDES storm water discharge points around the perimeter of the WSS. Samples were collected from the top 6 inches of sediment from each outfall. The data indicate above background levels of uranium, nitroaromatics and several semi-volatiles related to coal burning.

Nitroaromatics are also known to be present in the soil at the WSCP/WSRP area. Tributary and receiving streams from these areas as well as the drainage easement, also may be contaminated and require investigation. Lakes 35 and 36 drain into Schote Creek which joins Dardenne Creek just east of Highway K. Lake 34 flows directly into Dardenne Creek just west of Highway K. Dardenne Creek, in turn, flows north to the Mississippi River.

## 1.2 Objectives

The purpose of this activity is to determine the extent and magnitude of potential chemically and radiologically contaminated sediment under off-site streams and surface water bodies. This determination will be performed by the collection and analysis of a significant number of samples to limit uncertainty and achieve a proper level of confidence required to evaluate the no action and various remedial action alternatives. Limited analysis for PCB's, semi-volatiles and metals will also be performed to document any presence of these compounds in sediments compared to background.

The field sampling and analysis activities will comply with all applicable WSSRAP procedures including:

- o Soil/Sediment Sampling
- o Sample Number
- o Chain of Custody
- o Sample Packaging and Shipment
- o Decontamination

## 1.3 Overview of Program

This sampling effort will determine the uranium activity and nitroaromatic, PCB's, semi-volatiles, and metals concentrations in lake and stream sediments influenced by the WSS drainage. Areas receiving direct runoff or subsurface recharge will be considered in this study. Based on data from the RETA report and knowledge of the types of materials processed during uranium refinement, radium-226, thorium-230, and thorium-232 activity levels exceeding DOE remedial action guidelines in these sediments are not expected. However, at least 30 percent of all sediment samples collected will be analyzed for these additional radiological parameters.

Stream sediments below the Busch Area Lakes (with the exception of 2 locations) will not be sampled for nitroaromatics, PCB's, semi-volatiles, or metals since contaminated sediment should have settled in the lakes. Since no documentation exists for chemical species in the lake sediments, a single composite sample from each of 3 six inch sediment intervals will be collected. These composites, coupled with results from upstream locations, should confirm the absence of these compounds.

Table 1.1 describes the area, the number of sampling stations, and estimated number of samples, and analysis to be performed on each sample. Samples will be collected from a total of 66 stations.

TABLE 1.1

SUMMARY OF PROPOSED LAKE & STREAM SEDIMENT SAMPLING PROGRAM<sup>(1)</sup>

| AREA                             | NO. OF SAMPLING STATIONS | TOTAL NUMBER OF SAMPLES (2)   | ANALYTICAL PARAMETERS  |
|----------------------------------|--------------------------|-------------------------------|--|
| Lakes 34, 35, & 36               | 10<br>(per lake)         | 90<br>30<br>9<br>9 Composites | Uranium<br>Nitroaromatics<br>Radium & Thorium<br>PCBs, Semi-volatiles,<br>Metals |
| Lake 37                          | 3                        | 9<br>3<br>3<br>1 Composite    | Uranium<br>Nitroaromatics<br>Radium & Thorium<br>PCBs, Semi-Volatiles,<br>Metals |
| Dardenne Creek & Peruque Creek   | 12                       | 36<br>12                      | Uranium<br>Radium & Thorium  |
| Schote Creek                     | 10                       | 30<br>24<br>10<br>24          | Uranium<br>Nitroaromatics<br>Radium & Thorium<br>PCBs, Semi-volatiles,<br>Metals |
| Burgermeister Spring, and Stream | 5                        | 15<br>12<br>5<br>12           | Uranium<br>Nitroaromatics<br>Radium & Thorium<br>PCBs, Semi-volatiles,<br>Metals |
| Southeast Drainage Easement      | 6                        | 18<br>18<br>6<br>18           | Uranium<br>Nitroaromatics<br>Radium & Thorium<br>PCBs, Semi-volatiles,<br>Metals |

1 - Based on 3 six-inch-interval composites per location

2 - 5% of samples will be submitted for Duplicate Analysis

Source: WSSRAP, 1987.

## 2.0 SAMPLING PROGRAM

Samples will be collected from several depth intervals at each location. Each interval will be a maximum of six inches thick, beginning with the 0 to 6 inch interval. A minimum of three depth intervals will be collected at each location, if sediments are 18 inches thick and recoverable. Samples will be collected by a subcontractor to the Project Management Contractor (PMC) using a PMC-approved method based on the criteria stated below. Sampling equipment will be thoroughly decontaminated between samples following EPA guidance documents.

After collection, the samples will be packaged and shipped to the subcontractor's laboratory for analysis. Field data shall be recorded on the Sediment Sampling Data Form (Figure 2-1) which records all relevant sample collection data, such as depth of sample, analytical parameters, location diagram, etc. Completed forms will be included in the final data report as an appendix.

The exact sampling methods and procedures will be supplied by the selected subcontractor for approval by the DOE before sampling commencement. In order to avoid limiting competition among potential subcontractors, exact methods have not been defined. However, in the Technical Instructions to potential bidders, EPA procedures, WSSRAP Standard Operating Procedures, and applicable guidance documents have been provided. Bidders have been instructed to propose sampling methods which will comply with both EPA and DOE requirements.

FIGURE 2-1

WELDON SPRING SITE REMEDIAL ACTION PROJECT (WSSRAP)  
Route 2, Highway 94 South, St. Charles, Missouri 63303  
Phone (314) 441-8086      Telecopy (314) 447-0803

Sediment Sampling Data Form

Sample Number: \_\_\_\_\_ Date: \_\_\_\_\_

Location: \_\_\_\_\_  
\_\_\_\_\_

Personnel: \_\_\_\_\_ Time: \_\_\_\_\_  
\_\_\_\_\_

Sample Collection Method:    Pipe            Post Hole Digger            Other

Decon of Sampling Equipment Performed \_\_\_\_\_

Sample Type:    Depth            Composite            Grab            Other \_\_\_\_\_

Height (Ft) of Water Above Sample

Depth of Sample:    \_\_\_\_\_ to \_\_\_\_\_ inches

Analysis to be Performed: \_\_\_\_\_

Location Diagram:

Description of Sample

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Sample Container(s) \_\_\_\_\_ # of Containers \_\_\_\_\_

Sample Preservation \_\_\_\_\_

MK-Ferguson - Project Management Contractor

## 2.1 Sampling Locations

Sampling locations have been selected in both lakes and streams as described below. The rationale for sampling each location is presented in Table 2-1.

## 2.2 Stream Sampling Locations

Stream sediments will be collected at, or as near as possible to, the marked locations for each stream. Areas of sediment deposition will be sampled preferentially. Depth interval samples will be taken at stream locations to the extent possible, depending on sediment type and depositional environment. Samples from locations near highway crossings will be taken far enough upstream of the crossing to avoid influences from casual private dumping.

### 2.2.1 Schote Creek

Sediment samples will be collected from 10 locations (SD-4001 to SD-4010) shown on Figure 2-2.

### 2.2.2 Unnamed Tributary To Dardenne Creek

Five locations (SD-4011 to SD-4015) along the Burgermeister Spring stream will be sampled. The approximate locations are shown in Figure 2-2.

### 2.2.3 Dardenne Creek

Sediment samples will be collected from 11 locations (SD-4016 to SD-4026) along Dardenne Creek. An additional background sample (SD-4027) will be collected from Peruque Creek. These locations are shown in Figure 2-3.

TABLE 2-1

## STREAM SEDIMENT REMEDIAL INVESTIGATIONS

| LOCATION NO. | LOCATION DESCRIPTION   | SAMPLING RATIONALE                        |
|--------------|--|---|
| *SD-4001     | Inflow to Lake 36 - 100' north of Highway D                                | Assess sediment prior to entering lake    |
| *SD-4002     | Ash Pond drainage 100' west of DOE fence                                   | Assess sediment in outfall stream         |
| *SD-4003     | Unnamed tributary to Schote Creek  | Establish background conditions           |
| *SD-4004     | Unnamed tributary to Schote Creek just south of Army Reserve Training Area | Assess sediment entering Busch Area       |
| *SD-4005     | Schote Creek - 200' east of Ahden Knight Memorial Lake                     | Establish background conditions           |
| *SD-4006     | Lake 36 outfall stream north of gravel road                                | Assess sediment below lake                |
| *SD-4007     | Schote Creek - 600' above Lake 35  | Assess sediment prior to entering Lake 35 |
| *SD-4008     | Schote Creek at Hwy 40-61  | Assess sediment below Lake 35             |
| SD-4009      | Schote Creek at Weldon Spring Rd. area                                     | Assess sediment in populated              |
| SD-4010      | Schote Creek at Highway K  | Assess sediment below Lake 35             |
| *SD-4011     | Stream above Burgermeister Spring  | Establish background conditions           |
| *SD-4012     | Burgermeister Spring   | Assess sediment in source area            |

TABLE 2-1

## STREAM SEDIMENT REMEDIAL INVESTIGATIONS

| LOCATION NO. | LOCATION DESCRIPTION   | SAMPLING RATIONALE                                       |
|--------------|--|--|
| *SD-4013     | Burgermeister Spring Stream<br>midway between Spring & Lake 34 | Assess sediment<br>prior to<br>entering lake             |
| *SD-4014     | Lake 34 outfall stream at Hwy 40                               | Assess sediment<br>below Lake 34                         |
| SD-4015      | Stream at Henning Road   | Assess sediment in<br>populated area                     |
| SD-4016      | Dardenne Creek at Hopewell Road                                | Establish background<br>conditions                       |
| SD-4017      | Dardenne Creek at Hwy DD                                       | Establish background<br>conditions                       |
| SD-4018      | Dardenne Creek at Lake 33                                      | Establish background<br>conditions                       |
| SD-4019      | Dardenne Creek at Hwy 40                                       | Establish background<br>conditions                       |
| SD-4020      | Dardenne Creek at Hwy K  | Assess Burgermeister<br>Spring stream<br>sediment impact |
| SD-4021      | Dardenne Creek at Schote Creek                                 | Assess combined<br>sediments                             |
| SD-4022      | Dardenne Creek at Hwy N  | Assess sediment<br>conditions                            |
| SD-4023      | Dardenne Creek at St. Peters Rd.                               | Assess sediment in<br>populated area                     |
| SD-4024      | Dardenne Creek at Mexico Road                                  | Assess sediment in<br>populated area                     |
| SD-4025      | Dardenne Creek at St. Peters                                   | Assess sediment in<br>populated area                     |
| SD-4026      | Dardenne Creek at Kampville                                    | Assess sediment in<br>populated area                     |

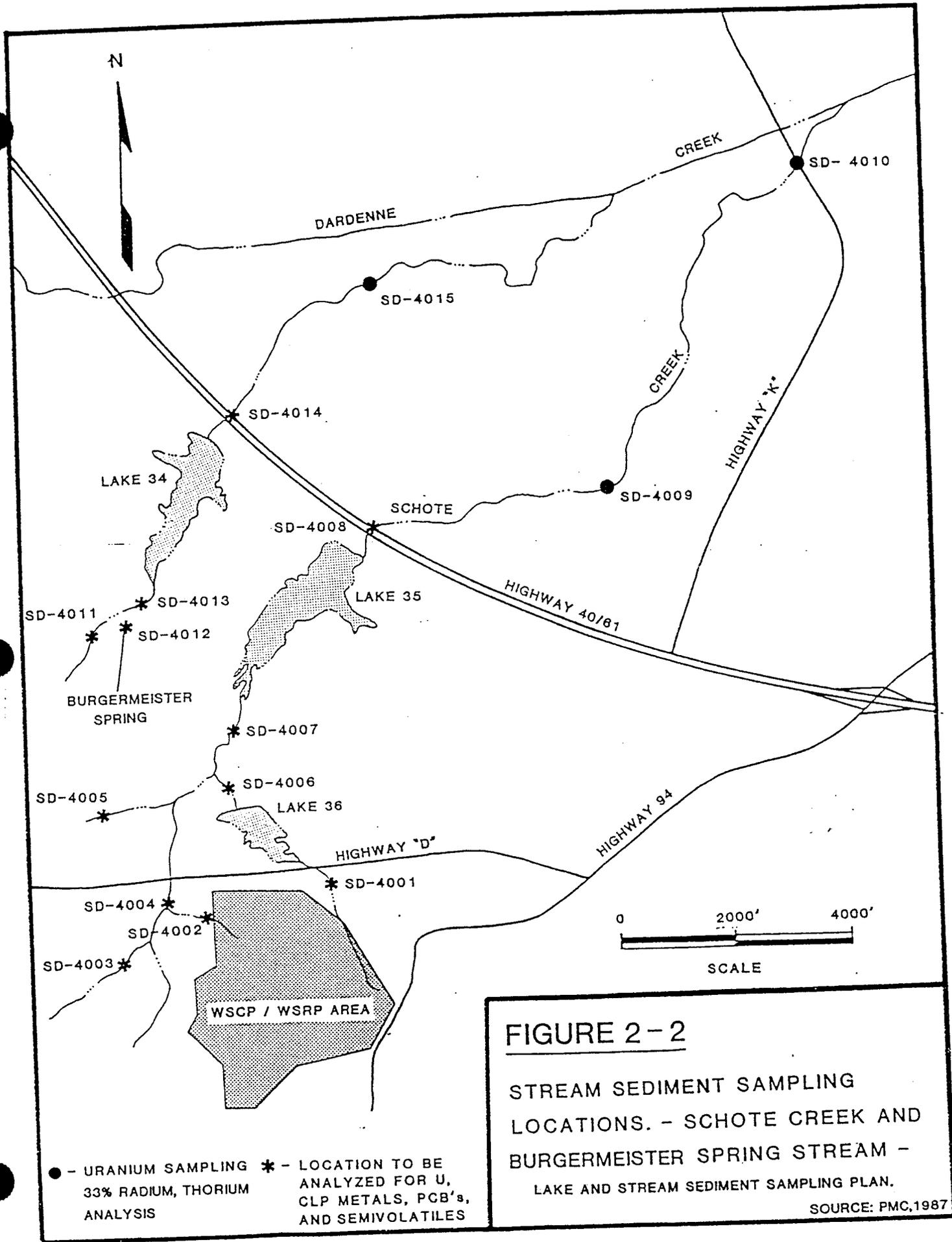
TABLE 2-1

## STREAM SEDIMENT REMEDIAL INVESTIGATIONS

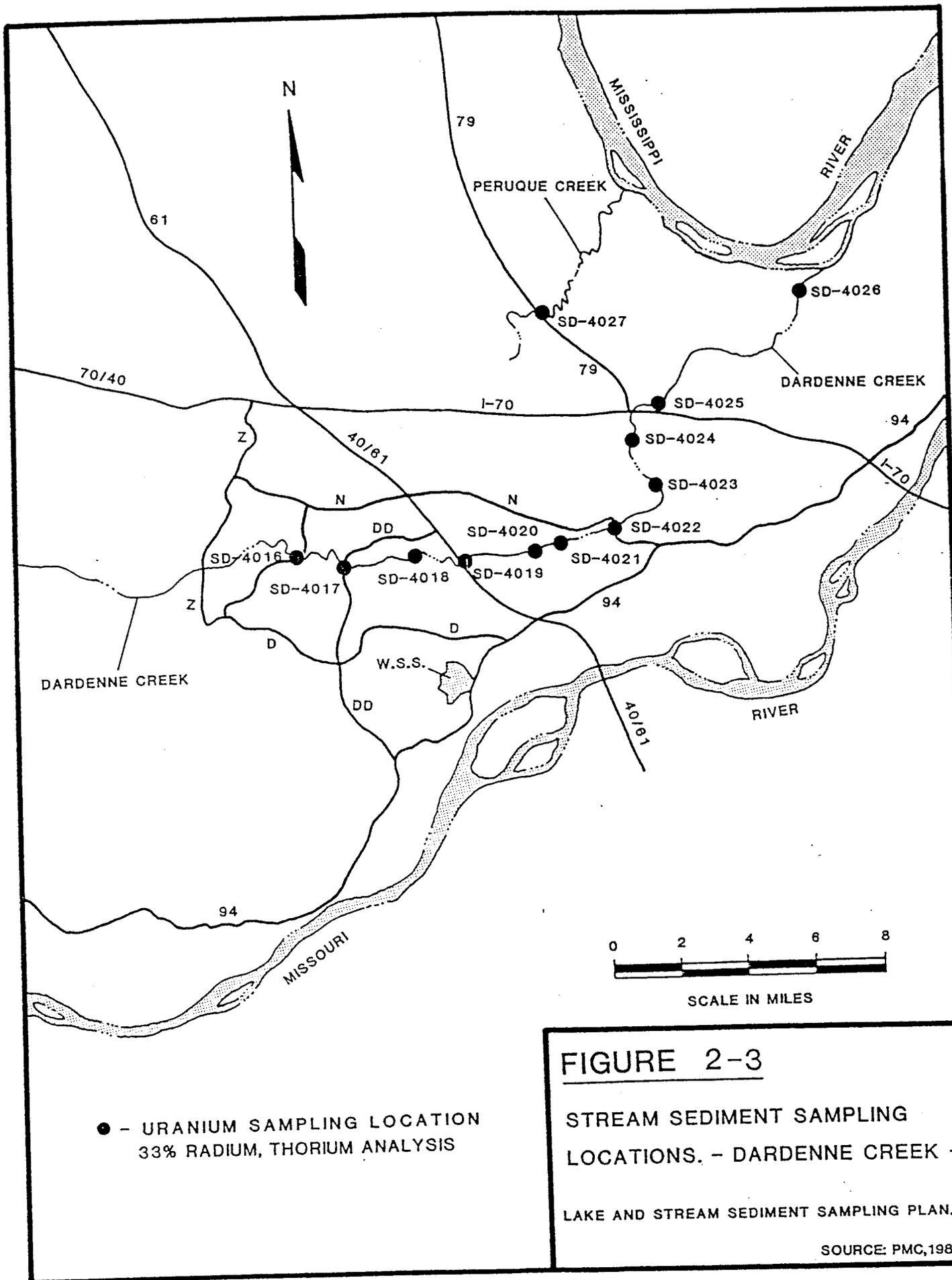
| LOCATION NO. | LOCATION DESCRIPTION    | SAMPLING RATIONALE  |
|--------------|-------------------------|---|
| SD-4027      | Peruque Creek at Hwy 79 | Establish background in Mississippi River alluvial stream |
| *SD-4061     | Drainage Easement       | Assess sediment in Wildlife Area                          |
| *SD-4062     | Drainage Easement       | Assess sediment in Wildlife Area                          |
| *SD-4063     | Drainage Easement       | Assess sediment in Wildlife Area                          |
| *SD-4064     | Drainage Easement       | Assess sediment in Wildlife Area                          |
| *SD-4065     | Drainage Easement       | Assess sediment in Wildlife Area                          |
| *SD-4066     | Drainage Easement       | Assess sediment in Wildlife Area                          |

Source: WSSRAP, 1987.

\*Location to be sampled for nitroaromatics, PCB's, Semi-volatiles, and CLP Metals



**FIGURE 2-2**  
 STREAM SEDIMENT SAMPLING  
 LOCATIONS. - SCHOTE CREEK AND  
 BURGERMEISTER SPRING STREAM -  
 LAKE AND STREAM SEDIMENT SAMPLING PLAN.  
 SOURCE: PMC, 1987

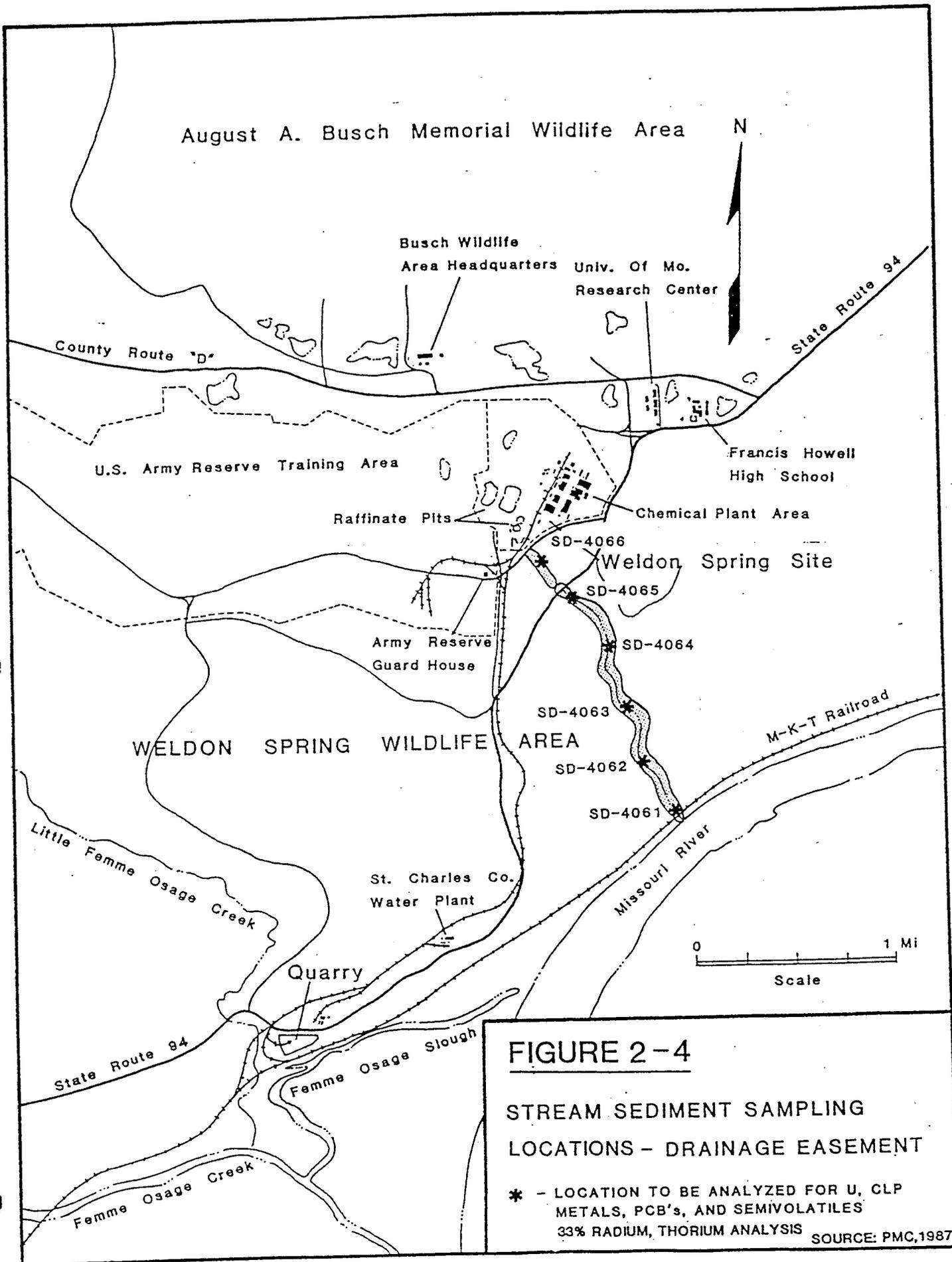


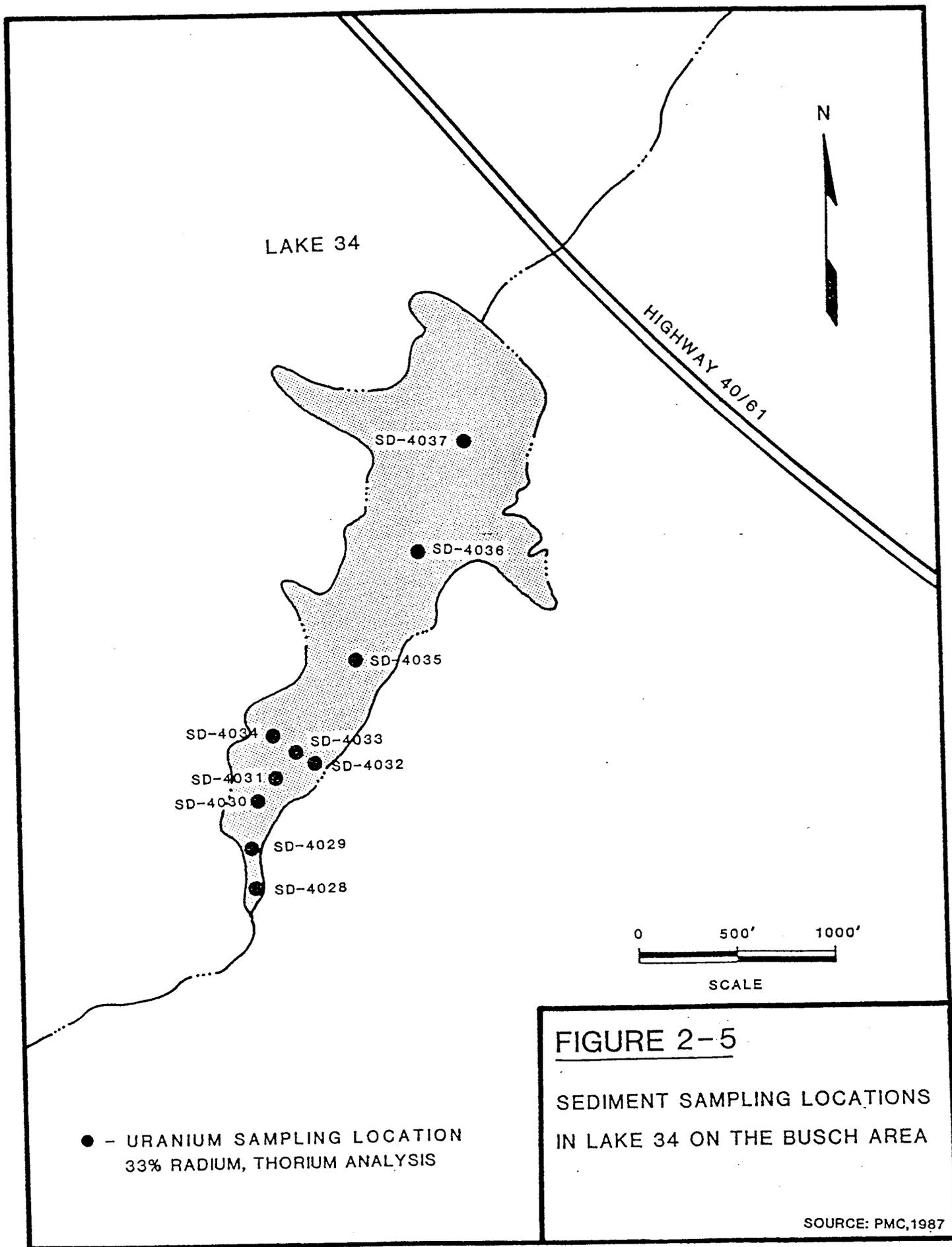
#### 2.2.4 Southeast Drainage Easement

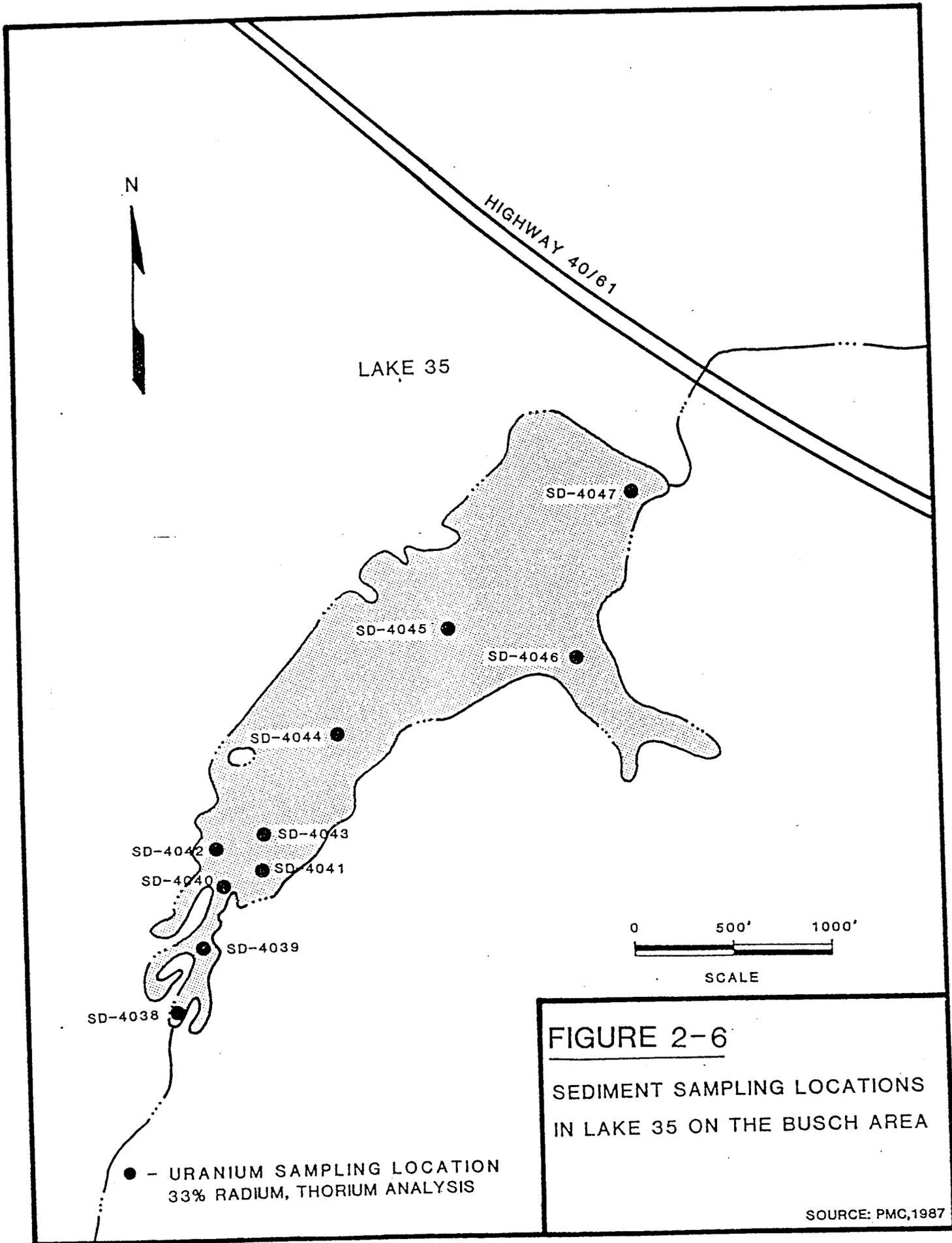
Six locations (SD-4061 to SD-4066) along the drainage easement will be sampled. The locations are shown on Figure 2-4.

#### 2.3 Lake Sampling Locations

Samples will be collected from 10 locations in each of the three affected lakes. Three background locations will be sampled in Lake 37 on the Busch Area. The approximate locations within the lakes are shown in Figures 2-5, 2-6, 2-7 and 2-8 for Lakes 34, 35, 36 and 37 respectively. At all locations, measurements of water depth and depth of sediment will be recorded on the Sediment Sampling Data Form (Figure 2-1) during sample collection. All samples will be analyzed for natural uranium. At least three samples per lake will be analyzed for radium-226 and thorium-230. One-third of all lake sediment samples will be analyzed for nitroaromatics. Three composite samples will be prepared from Lake 34, 35 and 36 respectively. One composite sample will be prepared from Lake 37. Each composite will be prepared by combining sediments from three to four sampling locations and sediments from the same sampling interval (i.e. 0-6", 6-12" etc.) Each composite will be analyzed for PCB's, semi-volatiles and metals.



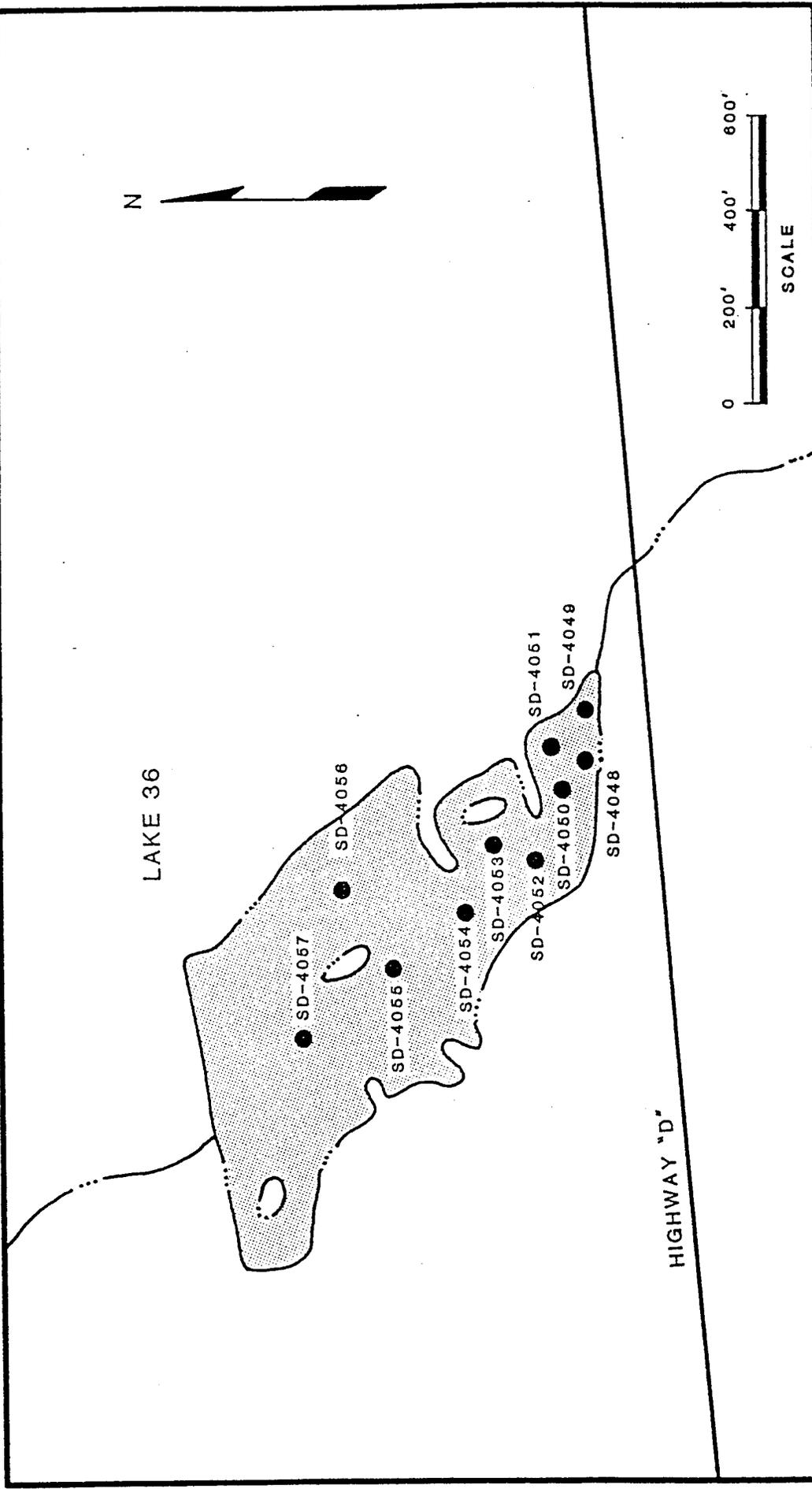




**FIGURE 2-6**

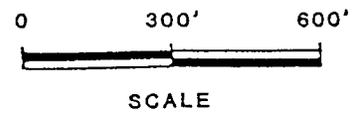
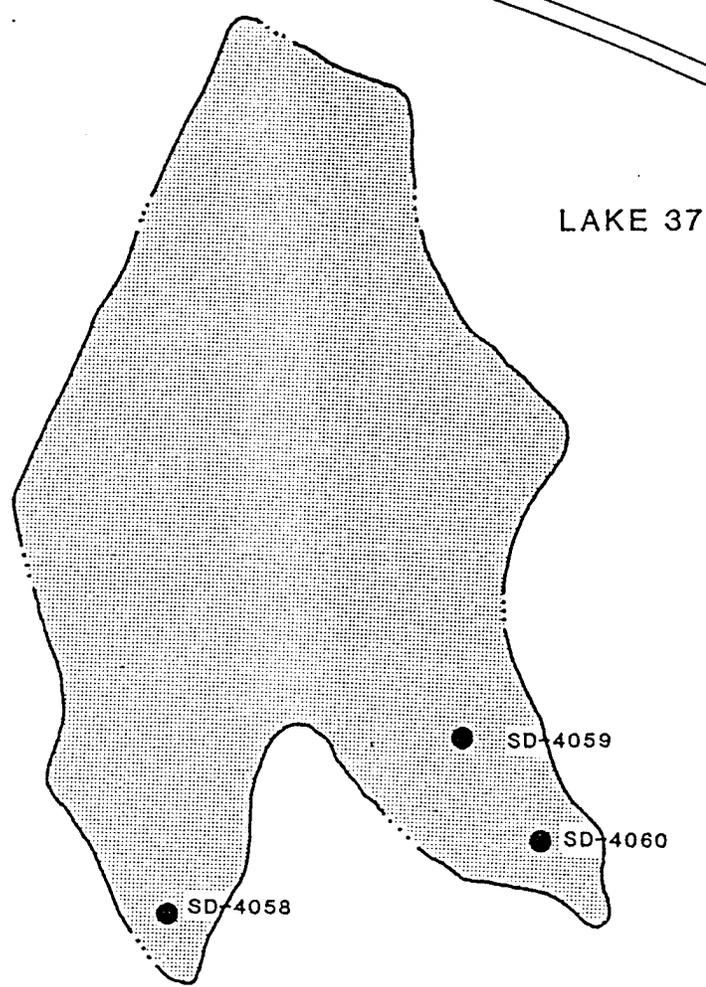
SEDIMENT SAMPLING LOCATIONS  
IN LAKE 35 ON THE BUSCH AREA

SOURCE: PMC, 1987



**FIGURE 2-7**  
**SEDIMENT SAMPLING LOCATIONS**  
**IN LAKE 36 ON THE BUSCH AREA**

● - URANIUM SAMPLING LOCATION  
 33% RADIUM, THORIUM ANALYSIS



● - URANIUM SAMPLING LOCATION  
33% RADIUM, THORIUM ANALYSIS

**FIGURE 2-8**  
SEDIMENT SAMPLING LOCATIONS  
IN LAKE 37 ON THE BUSCH AREA

SOURCE: PMC, 1987

### 3.0 ANALYTICAL PROCEDURES

Samples will be analyzed as described in Table 1.1. Metals and semi-volatiles analyses will be performed using methodology, chain of custody, and detection limits required in the USEPA Contract Laboratory Program Statement of Work. Nitroaromatic analyses will be performed according to USATHAMA methodology. Radiologic parameters will be determined following the methods and meeting the minimum detection and accuracy limits shown in Table 3-1.

TABLE 3-1

## DETECTION LIMITS FOR RADIOLOGICAL PARAMETERS

---

| SPECIES          | METHODS      | DETECTION LIMITS | ACCURACY * (95%<br>CONFIDENCE<br>LEVEL) |
|------------------|--------------|------------------|---|
| Uranium, Natural | EPA 908/ASTM | 5 pCi/g          | + 30% at 30 pCi/g                       |
| Radium-226       | EPA 904      | 1 pCi/g          | + 30% at 5 pCi/g                        |
| Thorium-230      | EERF 00/07   | 1 pCi/g          | + 30% at 5 pCi/g                        |
| Thorium-232      | EERF 00/07   | 1 pCi/g          | + 30% at 5 pCi/g                        |

---

Source: WSSRAP, 1987.

\* All activities reported on a dry weight basis.

#### 4.0 QUALITY ASSURANCE

The integrity of all sediment samples shall be maintained in accordance with WSSRAP ES&H Standard Operating Procedure No. 4.01.02 (Chain of Custody). A minimum of 5 percent of the total number of samples shall be duplicates to assess analytical precision.

## 5.0 DATA DOCUMENTATION

Proper documentation is a fundamental element for quality assurance of this program. All sampling activities including sampling location, identification, sampling techniques and methods, decontamination procedures, and shipment of samples will be extensively documented in the field on a daily basis.

### 5.1 Sample Collection

Prior to sample collection, the sample location will be checked to verify that the sampling ID code used corresponds to the sampling plan station. For each sample collected, a Sediment Sampling Data Form will be completed. The data form (Figure 2.1) includes the name(s) of the person(s) collecting the sample, the time of collection, the mechanism for sampling, depth of sample, location, and description of the sample. Sample numbering will be as defined in ES&H WSSRAP SOP 4.01.01 (Environmental Numbering System).

### 5.2 Chain of Custody

Custody of Samples will be maintained and documented from the time of collection to completion of analysis and reporting of data. Chain of Custody procedures are specified in the ES&H WSSRAP Standard Operating Procedure 4.01.02 (Chain of Custody).

### 5.3 Field Notebook

All field sampling activities will be documented through written entries into a field notebook. Field activities will be logged in on a daily and event-oriented basis.

Entries will be as detailed as possible so that, at a later date, the reader could reconstruct each event without reliance on the



of sampling (except lake locations). These photographs will document the position of each location in relation to local surroundings and prominent reference points. Photographs will be taken of groups of soil sampling locations where each location is clearly visible. The frame, roll number and compass heading (e.g., N, NE, NW, etc.) of each picture will be logged into the field sampling notebook along with the other site location information.

In addition to documenting each sampling location with photographs a photographic record also will be made of the sediment collected at each location. A reference (such as a ruler) and identification label will be used to identify the sample, depth and physical description of the interval sampled.

## 6.0 REPORTING REQUIREMENTS

After the analytical results are received from the laboratory, a data report will be prepared to present the findings from this study and to interpret the data. This report will show actual sampling locations, sampling method, field data, and analytical results. It will also be used to make recommendations regarding further sampling and/or continued monitoring. This report will provide information from which a decision can be made regarding the necessity for cleanup of sediment in these surface water bodies.