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United States Department of Energy

Savannah River Site

# Record of Decision
# Remedial Alternative Selection for the Road A Chemical Basin (904-111G) Operable Unit (U)

WSRC-RP-2002-4153

Revision 0

April 2003

Prepared by:
Westinghouse Savannah River Company LLC
Savannah River Site
Aiken, SC 29808

SRS

Prepared for U.S. Department of Energy under Contract No. DE-AC09-96SR18500

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Prepared for
U.S. Department of Energy
and
Westinghouse Savannah River Company LLC
Aiken, South Carolina

# RECORD OF DECISION
# REMEDIAL ALTERNATIVE SELECTION (U)

## ROAD A CHEMICAL BASIN (RdACB) (904-111G) (U)

## OPERABLE UNIT

**WSRC-RP-2002-4153**
**Revision 0**

**April 2003**

**Savannah River Site**
**Aiken, South Carolina**

**Prepared by:**

**Westinghouse Savannah River Company LLC**
**for the**
**U. S. Department of Energy under Contract DE-AC09-96SR18500**
**Savannah River Operations Office**
**Aiken, South Carolina**

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## DECLARATION FOR THE RECORD OF DECISION

### *Unit Name and Location*

Road A Chemical Basin (904-111G) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU-64

Savannah River Site

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Identification Number: SC1 890 008 989

Aiken, South Carolina

United States Department of Energy

The Road A Chemical Basin (RdACB) Operable Unit (OU) is listed as a Resource Conservation and Recovery Act (RCRA) 3004(u) Solid Waste Management Unit/ Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) unit in Appendix C of the Federal Facility Agreement (FFA) for the Savannah River Site (SRS).

The FFA is a legally binding agreement between regulatory agencies USEPA and SCDHEC and regulated entities (USDOE) that establishes the responsibilities and schedules for the comprehensive remediations of the SRS. The media associated with the RdACB OU are: soil, sediment, surface water and groundwater. The RdACB OU consists of four subunits (exposure groups): (1) Basin Soils (surface and subsurface soils); (2) groundwater; (3) wetland surface water; and (4) wetland sediment.

### *Statement of Basis and Purpose*

This decision document presents the selected remedy for the RdACB OU located at the SRS in Barnwell County, South Carolina. The remedy was chosen in accordance with CERCLA, as amended by Superfund Amendments Reauthorization Act (SARA), and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record File for this site.

The State of South Carolina concurs with the selected remedy.

***Description of the Selected Remedy***

The selected remedy for the RdACB OU is No Action. Although contamination was identified, the contaminant concentrations do not pose risk to human health and the environment. The RdACB OU is capable of supporting unrestricted (residential) use without any remedial actions.

The RCRA Permit will be revised to reflect selection of the final remedy using the procedures under 40 CFR Part 270 and SCHWMR R.61-79.264.101; 270.

***Statutory Determinations***

Hazardous substances have been released at the site; however, their concentrations do not pose a risk to human health and the environment based on unrestricted usage and unlimited exposure.

No remedial action is necessary to ensure protection of human health and the environment.

Since the selected remedy for the RdACB OU is No Action, a Certification Checklist is unnecessary.

8/6/03

Date

Jeffrey M. Allison
Manager
U. S. Department of Energy
Savannah River Operations Office

9/24/03

Date

Winston A. Smith
Director
Waste Management Division
U. S. Environmental Protection Agency - Region IV

10-21-03

Date

R. Lewis Shaw
Deputy Commissioner
Environmental Quality Control
South Carolina Department of Health and Environmental Control

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# DECISION SUMMARY
# REMEDIAL ALTERNATIVE SELECTION (U)

## ROAD A CHEMICAL BASIN (RdACB) (914-111G)

## OPERABLE UNIT (U)

WSRC-RP-2002-4153
Revision 0

April 2003

Savannah River Site
Aiken, South Carolina

Prepared By:

Westinghouse Savannah River Company LLC
for the
U. S. Department of Energy under Contract DE-AC09-96SR18500
Savannah River Operations Office
Aiken, South Carolina

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## LIST OF ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| ARAR | applicable or relevant and appropriate requirement |
| AWQC | Ambient Water Quality Criteria |
| bgs | below ground surface |
| BRA | baseline risk assessment |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act, 1980 |
| CERCLIS | Comprehensive Environmental Response, Compensation, and Liability Information Act |
| CMCOC | contaminant migration constituent of concern |
| CMS/FS | corrective measures study/feasibility study |
| COC | constituent of concern |
| COPC | constituent of potential concern |
| CPT | cone penetrometer technology |
| CSM | conceptual site model |
| FFA | Federal Facility Agreement |
| ft | feet |
| $ft^2$ | square feet |
| GPR | ground penetrating radar |
| HHCOC | human health constituent of concern |
| HQ | hazard quotient |
| HSWA | Hazardous and Solid Waste Amendment |
| kg | kilogram |
| km | kilometer |
| $km^2$ | square kilometer |
| L | liter |
| m | meter |
| MCL | maximum contaminant level |
| mg | milligram |
| mi | mile |
| $mi^2$ | square mile |
| msl | mean sea level |
| NCP | National Oil and Hazardous Substances Pollution Contingency Plan |
| NEPA | National Environmental Policy Act |
| NPL | National Priorities List |
| NTU | nephelometric turbidity unit |

## LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

| | |
|---|---|
| OU | operable unit |
| PCB | polychlorinated biphenyl |
| pCi | picocurie |
| PTSM | principal threat source material |
| RAO | remedial action objective |
| RBA | risk-based activity |
| RBC | risk-based concentrations |
| RCRA | Resource Conservation and Recovery Act, 1976 |
| RdACB | Road A Chemical Basin |
| RFI | RCRA Facility Investigation |
| RI | Remedial Investigation |
| ROD | Record of Decision |
| SARA | Superfund Amendments Reauthorization Act |
| SB/PP | Statement of Basis/Proposed Plan |
| SCDHEC | South Carolina Department of Health and Environmental Control |
| SCHWMR | South Carolina Hazardous Waste Management Regulation |
| SRS | Savannah River Site |
| SVOC | semi-volatile organic constituent |
| TAL | target analyte list |
| TCL | target compound list |
| TES | threatened endangered species and sensitive species |
| TOC | total organic carbon |
| USC | unit specific constituent |
| USDOE | United States Department of Energy |
| USEPA | United States Environmental Protection Agency |
| UTRA | Upper Three Runs aquifer |
| VOC | volatile organic constituent |
| WSRC | Westinghouse Savannah River Company LLC |

# I. SAVANNAH RIVER SITE AND OPERABLE UNIT NAME, LOCATION, AND DESCRIPTION

## Unit Name, Location, and Brief Description

Road A Chemical Basin (904-111G) Operable Unit

Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) Identification Number: OU-64

Savannah River Site

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Identification Number: SC1890008989

Aiken, South Carolina

United States Department of Energy

Savannah River Site (SRS) occupies approximately 800 $km^2$ (310 $mi^2$) of land adjacent to the Savannah River, principally in Aiken and Barnwell counties of South Carolina (Figure 1). SRS is located approximately 40 km (25 mi) southeast of Augusta, Georgia, and 32 km (20 mi) south of Aiken, South Carolina.

The United States Department of Energy (USDOE) owns SRS, which historically produced tritium, plutonium, and other special nuclear materials for national defense and the space program. Chemical and radioactive wastes are byproducts of nuclear material production processes. Hazardous substances, as defined by Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), are currently present in the environment at SRS.

The Federal Facility Agreement (FFA) (FFA 1993) for SRS lists the Road A Chemical Basin (RdACB) (904-111G) operable unit (OU) as a Resource Conservation and Recovery Act (RCRA)/CERCLA unit requiring further evaluation. The RdACB OU required further evaluation through an investigation process that integrates and combines the RCRA Facility Investigation (RFI) process with the CERCLA Remedial Investigation (RI) process to determine the actual or potential impact to human health and the environment resulting from releases of hazardous substances to the environment.

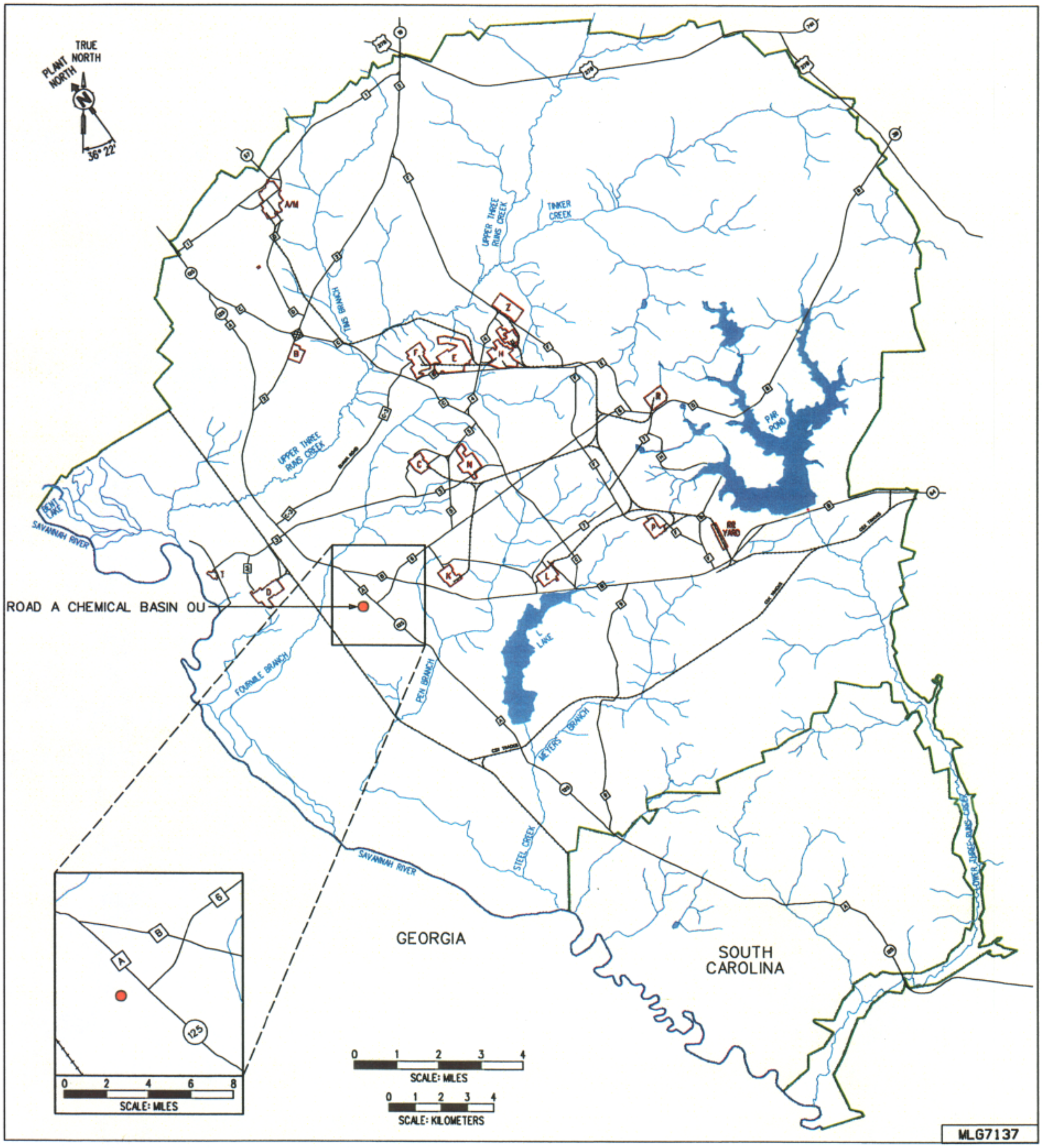


**Figure 1. Location of the Road A Chemical Basin OU at SRS**

# II. SITE AND OPERABLE UNIT COMPLIANCE HISTORY

## SRS Operational and Compliance History

The primary mission of SRS has been to produce tritium, plutonium, and other special nuclear materials for our nation's defense programs. Production of nuclear materials for the defense programs was discontinued in 1988. SRS has provided nuclear materials for the space program as well as for medical, industrial, and research efforts up to the present. Chemical and radioactive wastes are byproducts of nuclear material production processes. These wastes have been treated, stored, and in some cases, disposed of at SRS. Past disposal practices have resulted in soil and groundwater contamination.

Hazardous waste materials handled at SRS are managed under RCRA, a comprehensive law requiring responsible management of hazardous waste. Certain SRS activities require South Carolina Department of Health and Environmental Control (SCDHEC) operating or post-closure permits under RCRA. SRS received a RCRA hazardous waste permit from SCDHEC, which was most recently renewed on September 5, 1995. Module IV of the Hazardous and Solid Waste Amendments (HSWA) portion of the RCRA permit mandates corrective action requirements for non-regulated solid waste management units subject to RCRA 3004(u).

On December 21, 1989, SRS was included on the National Priorities List (NPL). The inclusion created a need to integrate the established RFI program with CERCLA requirements to provide for a focused environmental program. In accordance with Section 120 of CERCLA 42 USC Section 9620, USDOE has negotiated a FFA (FFA 1993) with the United States Environmental Protection Agency (USEPA) and SCDHEC to coordinate remedial activities at SRS as one comprehensive strategy to fulfill these dual regulatory requirements. USDOE functions as the lead agency for remedial activities at SRS, with concurrence by the USEPA - Region IV and SCDHEC.

**Operable Unit Operational and Compliance History**

The RdACB OU, approximately 15.2 m (50 ft) long and 9.1 m (30 ft) wide, is located in the southwestern section of the SRS, approximately 0.8 km (0.5 mi) west of the intersection of SRS Road A (South Carolina Route 125) and SRS Road 6 and approximately 6.4 km (4 mi) from the nearest SRS plant boundary (see Figure 1). Very little historical information about the OU is available. It is thought that the RdACB OU was a liquid waste disposal basin that received unknown quantities of hazardous and radioactive materials. The exact operational period of the unit is not known, but historical aerial photography shows the basin existed as early as 1954. In 1973, the basin was backfilled with native soil. No wastes have been deposited since that time. The area surrounding the basin was re-graded between 1973 and 1987. In 1997, a fence was placed around the area where the basin had previously existed.

A 1996 aerial photograph of the area is provided as Figure 2. As is apparent from Figure 2, a wetland area is located downgradient of the waste unit, approximately 240 to 300 m (800 to 1,000 ft) to the south-southwest. The wetland drains into Fourmile Branch, located approximately 1,667 to 1,829 m (5,500 to 6,600 ft) to the west of the RdACB OU.

The 40-Acre Hardwood Site (761-0G), a former site evaluation unit, is located approximately 366 m (1,200 ft) south of the RdACB OU (see Figure 2).

This site was used as part of a forest productivity study and received domestic sewage sludge in 1980. The site was closed in August 1989.

Regulatory concurrence for the 40-Acre Hardwood Site as a No Further Action unit was obtained from USEPA on August 31, 1992, and from SCDHEC on March 12, 1993.

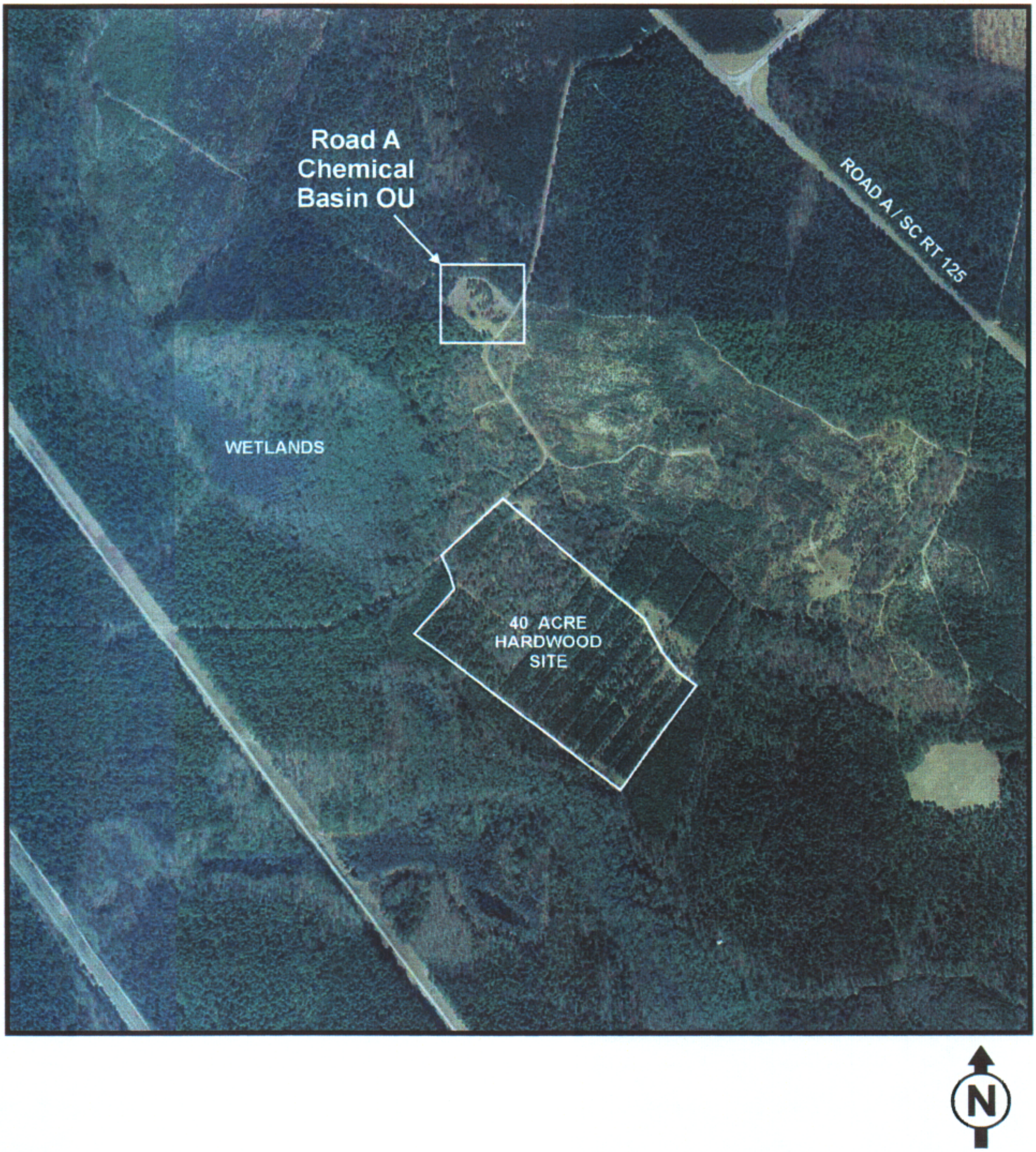


Figure 2. Aerial Photograph of the Road A Chemical Basin Operable Unit

The RdACB OU is located in the Fourmile Branch watershed (see Figure 3).

Topographically, the basin is close to an escarpment found along an elevation contour of approximately 48.8 m (160 ft) that separates the Aiken Plateau from the Ellenton Plain. The ground surface elevation at the RdACB is approximately 62.5 m (205 ft), slopes moderately from the basin at a rate of approximately 6% to the wetlands (see Figure 4) located approximately 244 m (800 ft) southwest of the RdACB OU. Fourmile Branch, a major tributary of the Savannah River, drains these wetlands between 1,676 and 1,829 m (5,500 and 6,000 ft) west of the RdACB OU. Fourmile Branch discharges into the Savannah River Swamp and Savannah River. The ground surface at the wetlands slopes moderately at a rate of approximately 5%.

The vadose zone beneath the RdACB is approximately 10.7 m (35 ft) thick. The groundwater elevations beneath the RdACB OU range from approximately 48.8 to 51.8 m (160 to 170 ft) above mean sea level (msl). The ground surface elevation in the wetlands is approximately 47.2 m (150 ft) above msl, which is approximately 4.6 m (15 ft) below the water table elevation at the RdACB OU. At certain times of the year, rising groundwater floods the wetlands. As shown in Figure 5, groundwater flow is generally to the west at a gradient of approximately 0.005 m/m (0.005 ft/ft).

The soils in the area of the RdACB OU are predominantly sandy, varying primarily by their slope and degree of drainage. The soil series include Udorthents, Blanton sands, Wagram sands, and Pickney sands.

The soils in the immediate vicinity of the RdACB OU are classified as Udorthents. Between the RdACB OU and the wetlands to the west, the soils are classified as Blanton and Wagram sands. Along the wetlands in the area of the RdACB OU, the soils are predominantly classified as Pickney sands and are frequently flooded during the winter and spring.

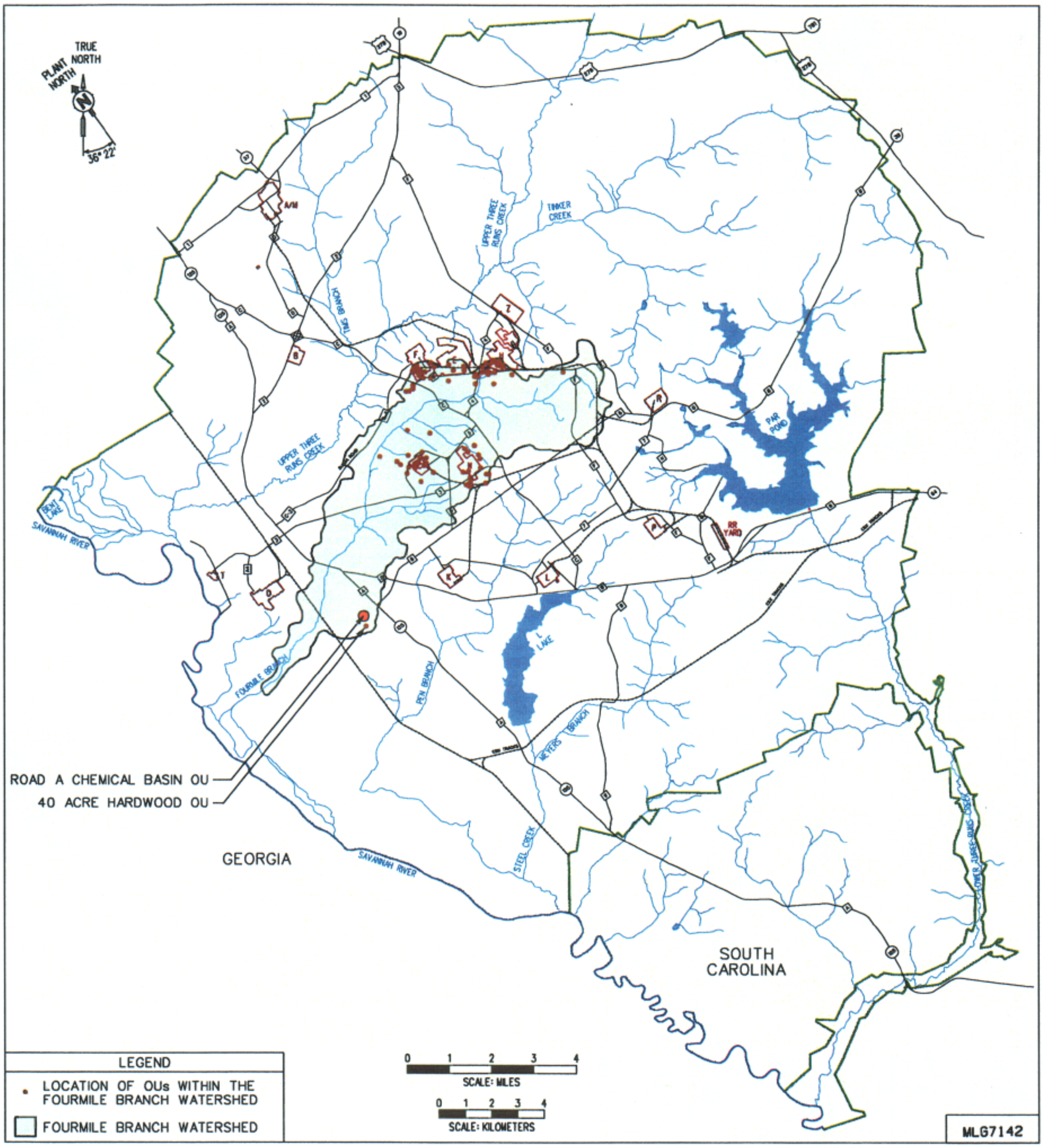


**Figure 3.** **Location of the Road A Chemical Basin Operable Unit in the Fourmile Branch Watershed**

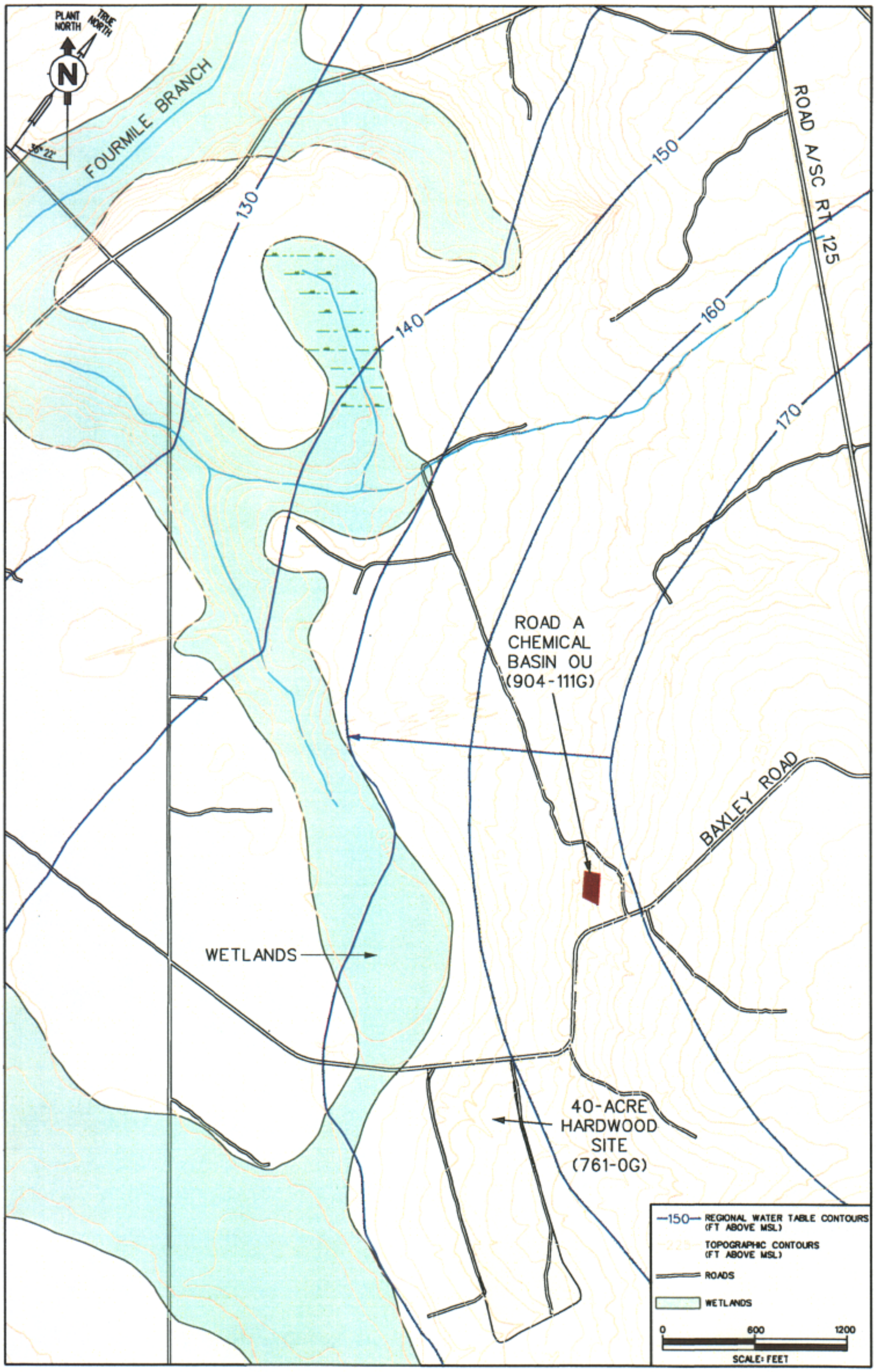


**Figure 4. Topographic Map of the Road A Chemical Basin Operable Unit with Regional Water Table Contours**

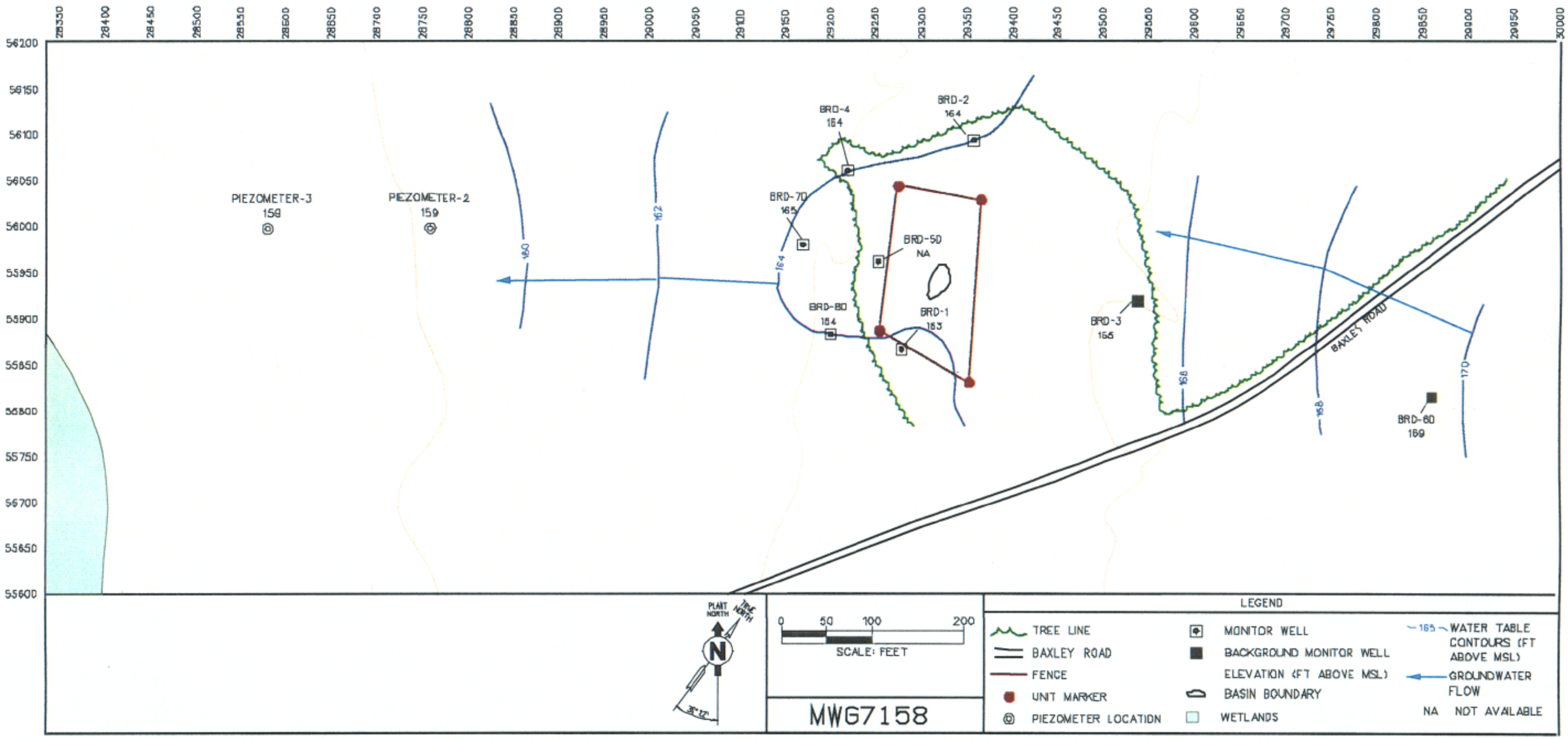


Figure 5. Potentiometric Surface Map of the Upper Aquifer Zone of the Upper Three Runs Aquifer (UTRA) at the Road A Chemical Basin OU (November 2000)

SRS Future Use Project Report (USDOE 1996) presents SRS stakeholders-preferred future land use recommendations. Figure 6 depicts the proposed future land use for SRS. As is apparent from Figure 6, the preferred future land use for the area where the RdACB OU is located is designated as residential.

No water wells that can be used as a drinking water source exist at or near the vicinity of the RdACB OU.

No threatened or endangered and sensitive species exist in the vicinity of the RdACB OU.

**Removal Action**

No removal action of any kind has taken place at the unit; however, in 1973 the basin was backfilled with soil brought from an SRS source. No waste has been deposited since that time. Between 1973 and 1987, the area surrounding the basin was re-graded. In 1997, a fence was placed around the area where the basin had previously existed. Presently, the RdACB is an inactive waste unit.

## III. HIGHLIGHTS OF COMMUNITY PARTICIPATION

Both RCRA and CERCLA require that the public be given an opportunity to review and comment on the draft permit modification and proposed remedial alternative. Public participation requirements are listed in South Carolina Hazardous Waste Management Regulation (SCHWMR) R.61-79.124 and Sections 113 and 117 of CERCLA 42 USC Sections 9613 and 9617. These requirements include establishment of an Administrative Record File that documents the investigation and selection of the remedial alternatives for addressing the RdACB OU soil and groundwater. The Administrative Record File must be established at or near the facility at issue. The SRS Public Involvement Plan (USDOE 1994) is designed to facilitate public involvement in the decision-making process for permitting, closure, and selection of remedial alternatives. The SRS Public Involvement Plan addresses requirements of RCRA, CERCLA, and the National Environmental

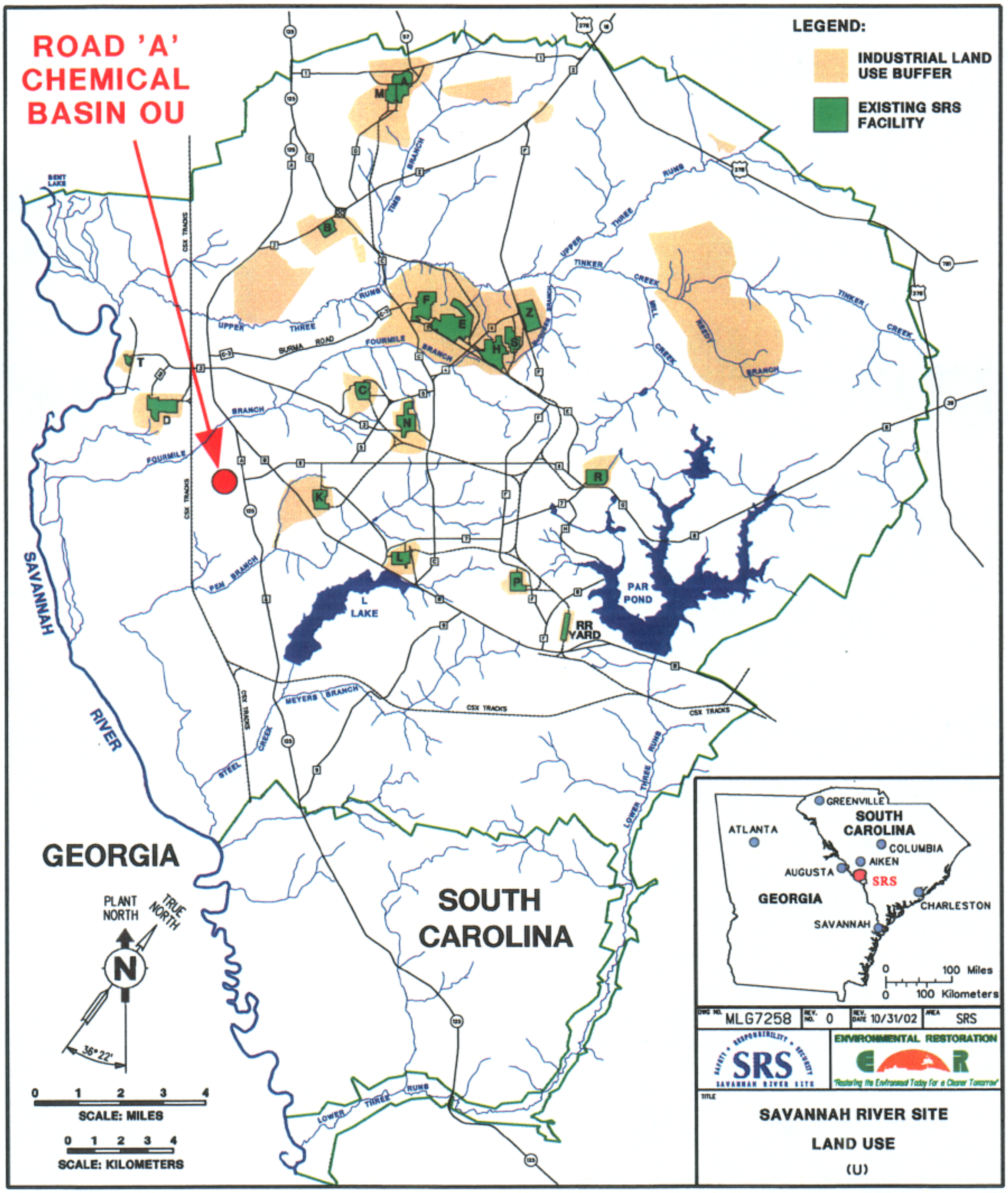


Figure 6. Proposed SRS Future Land Use

Policy Act, 1969 (NEPA). SCHWMR R.61-79.124 and Section 117(a) of CERCLA, as amended, require the advertisement of the draft permit modification and notice of any proposed remedial action and provide the public an opportunity to participate in the selection of the remedial action. The Statement of Basis/Proposed Plan (SB/PP) for the Road A Chemical Basin (RdACB) (904-111G) Operable Unit, Revision 0 (WSRC 2002a), a part of the Administrative Record File, highlights key aspects of the investigation and identifies the preferred action for addressing the RdACB OU.

The FFA Administrative Record File, which contains the information pertaining to the selection of the response action, is available at the following locations:

U.S. Department of Energy
Public Reading Room
Gregg-Graniteville Library
University of South Carolina – Aiken
171 University Parkway
Aiken, South Carolina 29801
(803) 641-3465

Thomas Cooper Library
Government Documents Department
University of South Carolina
Columbia, South Carolina 29208
(803) 777-4866

The RCRA Administrative Record File for SCDHEC is available for review by the public at the following locations:

The South Carolina Department of
Health and Environmental Control
Bureau of Land and Waste
Management
8901 Farrow Road
Columbia, South Carolina 29203
(803) 896-4000

Lower Savannah District
Environmental Quality Control Office
206 Beaufort Street, Northeast
Aiken, South Carolina 29802
(803) 641-7670

The public was notified of the public comment period through the *SRS Environmental Bulletin*, a newsletter sent to citizens in South Carolina and Georgia, and through notices in the *Aiken Standard*, the *Allendale Citizen Leader*, the *Augusta Chronicle*, the *Barnwell People-Sentinel*, and *The State* newspapers. The public comment period was also announced on local radio stations.

The SB/PP 45-day public comment began on February 10, 2003, and ended on March 25, 2003. No comments were received during the public comment period.

## IV. SCOPE AND ROLE OF THE OPERABLE UNIT WITHIN THE SITE STRATEGY

### RCRA/CERCLA Programs at SRS

RCRA/CERCLA units (including the RdACB OU) at SRS are subject to a multi-stage RI process that integrates the requirements of RCRA and CERCLA as outlined in the FFA (FFA 1993). The RCRA/CERCLA processes are summarized below:

- investigation and characterization of potentially impacted environmental media (such as soil, groundwater, and surface water) comprising the waste site and surrounding areas
- evaluation of risk to human health and the local ecological community
- screening of possible remedial actions to identify the selected technology which will protect human health and the environment
- implementation of the selected alternative
- documentation that the remediation has been performed competently
- evaluation of the effectiveness of the technology

The steps of this process are iterative in nature and include decision points that require concurrence between USDOE as owner/manager, USEPA and SCDHEC as regulatory oversight agencies, and the public (see Figure 7).

**Operable Unit Remedial Strategy**

The overall strategy for addressing the RdACB OU was to (1) characterize the waste unit, delineating the nature and extent of contamination and identifying the media of concern (perform the RFI/RI); (2) perform a Baseline Risk Assessment (BRA) to evaluate media of concern, constituents of concern (COCs), exposure pathways, and characterize potential risks; and (3) evaluate and perform a final action to remediate, as needed, the identified media of concern.

The RdACB is not a "source control" unit (i.e., the unit does not contain contaminated soil that may act as a source of future contamination to the groundwater through leaching). In addition to the RdACB unit, there are many OUs within the Fourmile Branch Watershed. All the source control and groundwater OUs located within this watershed will be evaluated to determine their impacts, if any, to the associated streams and wetlands. SRS will manage all source control units to prevent impact to the watershed. Upon disposition of all source control and groundwater OUs within the watershed, a final comprehensive ROD for the Fourmile Branch Watershed will be pursued.

The previous field investigations and soil sampling conducted in the 1980s through 2001 during the development of the RFI/RI/BRA report for the RdACB OU (WSRC 2002b) have indicated that the groundwater has not been impacted by activities associated with the RdACB OU. The results of the contaminant fate and transport analysis also did not reveal any potential for impact to the groundwater. No refined contaminant migration constituents of concern (CMCOCs) have been identified for the groundwater.

The risk assessments (human health and ecological) have also revealed that there is no unacceptable risk to human health and the environment associated with the RdACB OU. There is no principal threat source material (PTSM) present at the unit requiring cleanup activities.

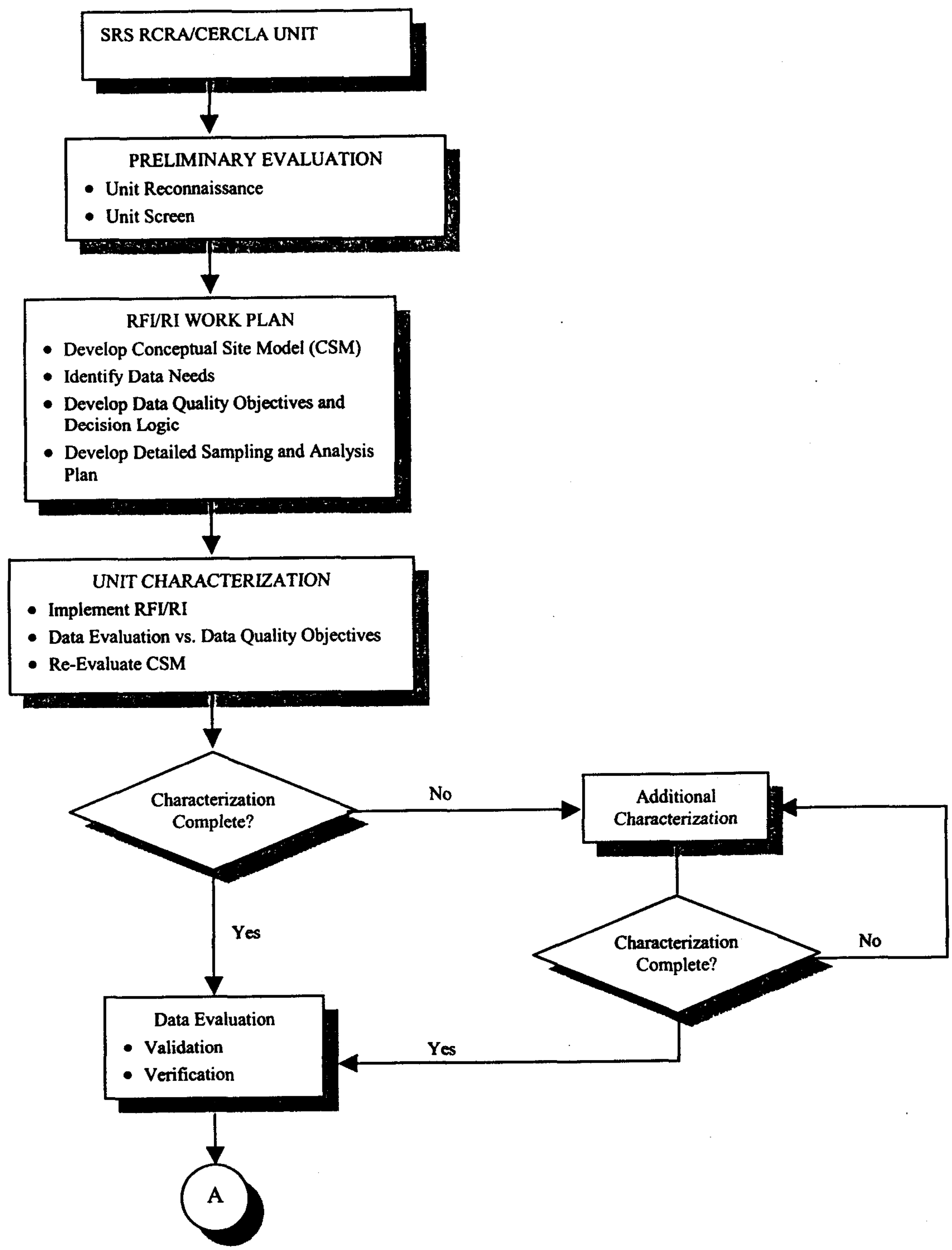


Figure 7. RCRA/CERCLA Logic and Documentation

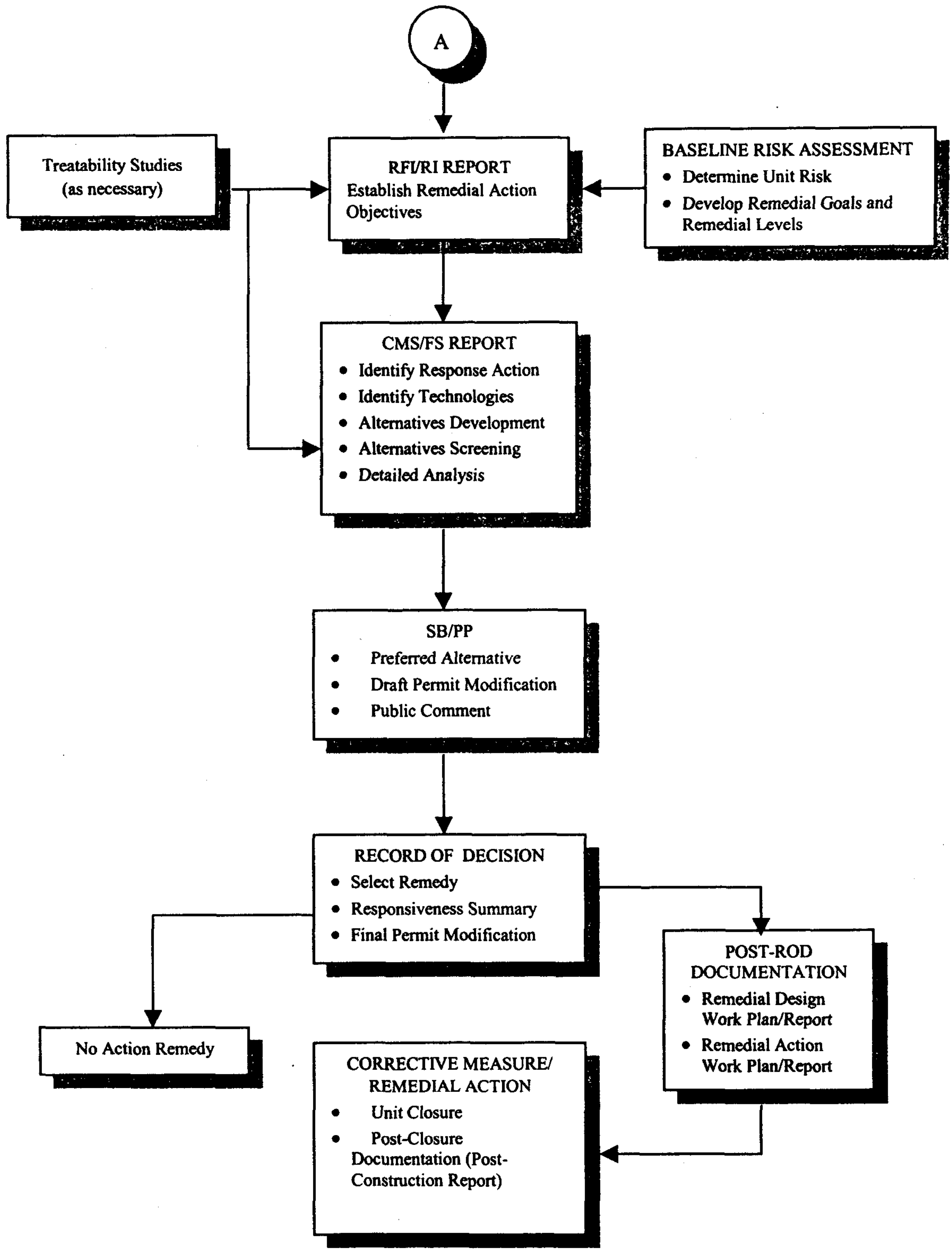


**Figure 7. RCRA/CERCLA Logic and Documentation (Continued)**

Hence, a No Action remedy is recommended for the unit. This means no further action will be taken, and the RdACB OU will remain in its present condition. Therefore, the RdACB will have no impact on the response actions of other OUs at SRS.

## V. OPERABLE UNIT CHARACTERISTICS

### Conceptual Site Model for the RdACB

The conceptual site model (CSM) for the RdACB OU is presented in Figure 8. The review of the information contained in the Preliminary Characterization Summary/Preliminary Risk Assessment Report for the Road A Chemical Basin (CH2M Hill 1990) and Environmental Information Document for the Road A Chemical Basin (Pickett et al. 1987) reveals that the primary source of potential contamination was waste water disposed of in the RdACB OU consisting of miscellaneous aqueous radioactive and chemical wastes. However, after the basin was backfilled in 1973, no primary source wastewater remained in the basin.

#### *Primary Source and Release Mechanisms*

The primary release mechanisms for the RdACB OU are presented in Figure 8. Potential contamination may have been released from the primary sources by the following mechanisms:

- spills/overflow/regrading during operation and/or closure
- infiltration/percolation of wastewater from basin into deep soil

#### *Secondary Source and Release Mechanisms*

Environmental media impacted by the release of potential contamination from the primary sources become secondary sources. Potential secondary sources of contamination at the RdACB OU included surface soil (0 to 0.3 m [0 to 1 ft]), subsurface soil (0 to 1.2 m [0 to 4 ft]), and deep soil (>1.2 m [>4 ft]).

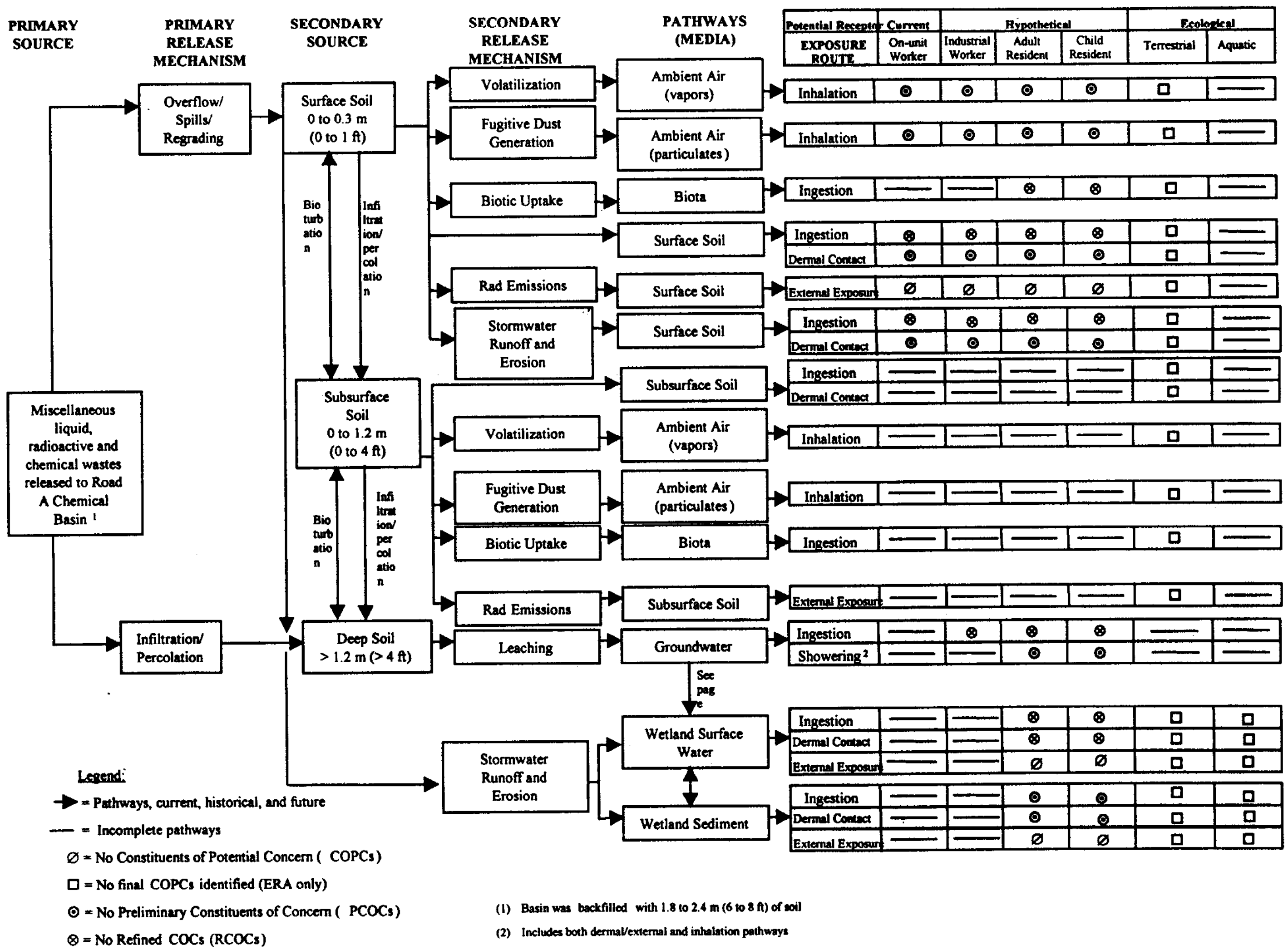


**Figure 8. Conceptual Site Model for the RdACB OU**

The potential secondary sources could have released contamination to other media through a variety of secondary release mechanisms, including the following:

- release of volatile constituents from the soil (volatilization),
- generation of contaminated fugitive dust by wind or other surface soil disturbance,
- biotic uptake,
- bioturbation/excavation between surface and subsurface soils,
- radionuclide emissions,
- transport of contaminants via stormwater runoff and erosion,
- leaching of contaminants, and
- erosion and groundwater seeps to wetland surface water and sediment.

The most significant potential secondary release mechanism affecting the RdACB OU was expected to be contaminants leaching into groundwater. Near-surface mechanisms, such as volatilization, fugitive dust generation, biotic uptake, direct contact, and stormwater runoff and erosion, were not thought to be as significant because the unit was backfilled with 1.8 to 2.4 m (6 to 8 ft) of soil. The basin bottom was below grade while in operation, but the dispersion of contaminants by surficial processes would still have been possible due to spills and overflows at the basin during operations and/or regrading during basin closure.

*Exposure Pathways, Exposure Routes, and Receptors*

Contact with contaminated environmental media creates the exposure pathways to human health and ecological receptors that are evaluated in a BRA. The following potential exposure pathways were identified at the RdACB OU:

- ambient air (vapors and particulates)
- surface, subsurface, and deep soil
- groundwater
- biota
- wetland surface water
- wetland sediment

The exposure route is the way a receptor comes into contact with a contaminant. Potential exposure routes for human and ecological receptors at the RdACB OU included the following:

- inhalation of volatile emissions and airborne dust from soil
- ingestion of contaminated media, including soil and homegrown produce
- dermal contact with soil
- ingestion of and/or showering with groundwater
- exposure to external radiation from surface soil, subsurface soil, wetland sediment, and surface water

Human and ecological receptors are identified based on physical and operational knowledge of the site, local demographics, and known and hypothetical land uses. Human receptors may include the following:

- current on-unit workers occasionally in the area
- future industrial workers
- future on-unit residents (adult and child)

Ecological receptors may include the following terrestrial and aquatic organisms:

- soil-dwelling invertebrates, herbivorous mammals, worm-eating and insectivorous birds/mammals, and large mammals inhabiting the wooded and grassy areas near the basin
- various aquatic organisms, sediment-dwelling biota, reptiles/amphibians, birds and mammals inhabiting the bottomland hardwood swamp located several hundred feet downgradient of the basin

**Media Assessment**

The RFI/RI with BRA report (WSRC 2002b) contains the detailed information and analytical data for all the investigations conducted and samples taken in the media assessment of the RdACB OU. This document is available in the Administrative Record File (see Section III of this document).

The investigations conducted to characterize RdACB OU soils and groundwater are briefly described in the following sections.

For the purpose of characterizing the RdACB OU, the unit was divided into the following four exposure groups (subunits):

- Basin Soils (surface and subsurface soils)
- Groundwater
- Wetland Surface Water
- Wetland Sediment

The investigations conducted to characterize the RdACB OU included a background investigation, a primary source investigation, a secondary source investigation including review of historical secondary source characterization activities, and RFI/RI characterization activities. Additionally, a physical characteristics investigation was conducted that included cone penetrometer technology (CPT) testing, wireline coring, geophysical logging, geotechnical analysis of Shelby tube samples, aquifer hydraulic conductivity testing, monitoring wells and piezometer installations, and a ground penetrating radar (GPR) survey.

The investigations conducted to characterize the RdACB OU are briefly described in the following sections.

***Soil Investigations***

The soil investigations of the RdACB OU were conducted in several stages. Table 1 summarizes all the environmental activities conducted at the RdACB OU. The activities included the following:

- Background Investigation

During February 2000, 26 samples (including one duplicate and one split sample) were obtained from six sample locations hydraulically upgradient (for soil sample locations see Figure 9). Sampled intervals included 0 to 0.3 m (0 to 1 ft), 0.3 to 1.2 m (1 to 4 ft), 2.1 to 3.0 m (7 to 10 ft) and 3.0 to 4.0 m (10 to 13 ft).

**Table 1. Summary of Characterization Activities**

| Investigation Dates | Media Investigated | Location | Number of Borings/Samples or Characterization Activity |
|---|---|---|---|
| 1983 through 1996 | Groundwater | BRD-1 through BRD-5 | Five wells sampled |
| 1987 | Ecological field survey | Area Surrounding RdACB OU | None |
| 3/89 to 4/89 | Surface and subsurface soil | RdACB OU and surrounding area | Nine boreholes/19 samples<br>Six outside OU<br>Three inside OU |
| 9/92 | Soil gas | RdACB OU and surrounding area | 36 locations<br>25 outside OU<br>11 inside OU |
| 8/97 | Radiological survey | RdACB OU and surrounding area | 20 samples |
| 3/00 | Ground penetrating radar survey | RdACB OU and surrounding area | None |
| 2/00 to 8/00 | Surface and subsurface soil, wetland surface water and sediment | Soils-RdACB OU and surrounding area<br>Surface water and sediment-downgradient from RdACB OU | Soil 27 boreholes/110 samples<br>Surface water-9 samples<br>Sediment-19 samples |
| 4/00 to 11/00 | Groundwater | BRD-1 through BRD-8; Piezometers 1 through 3 | Installed four monitor wells and three temporary piezometers.<br>Eight wells sampled three times<br>One well sampled two times<br>Water level measured<br>Wireline core from two wells<br>Slug tests conducted on four wells<br>CPT lithology pushes at four locations<br>Geophysical logs at six locations |
| 3/00 to 2/01 | Subsurface soil | Adjacent to RdACB OU and at background locations | Geotechnical samples:<br>One borehole (One sample Gordon confining unit)<br>Two boreholes (Four samples from each borehole in the vadose zone) |
| 3/01 | Wetland surface water and sediment | Background | Six surface water samples<br>Six sediment samples |

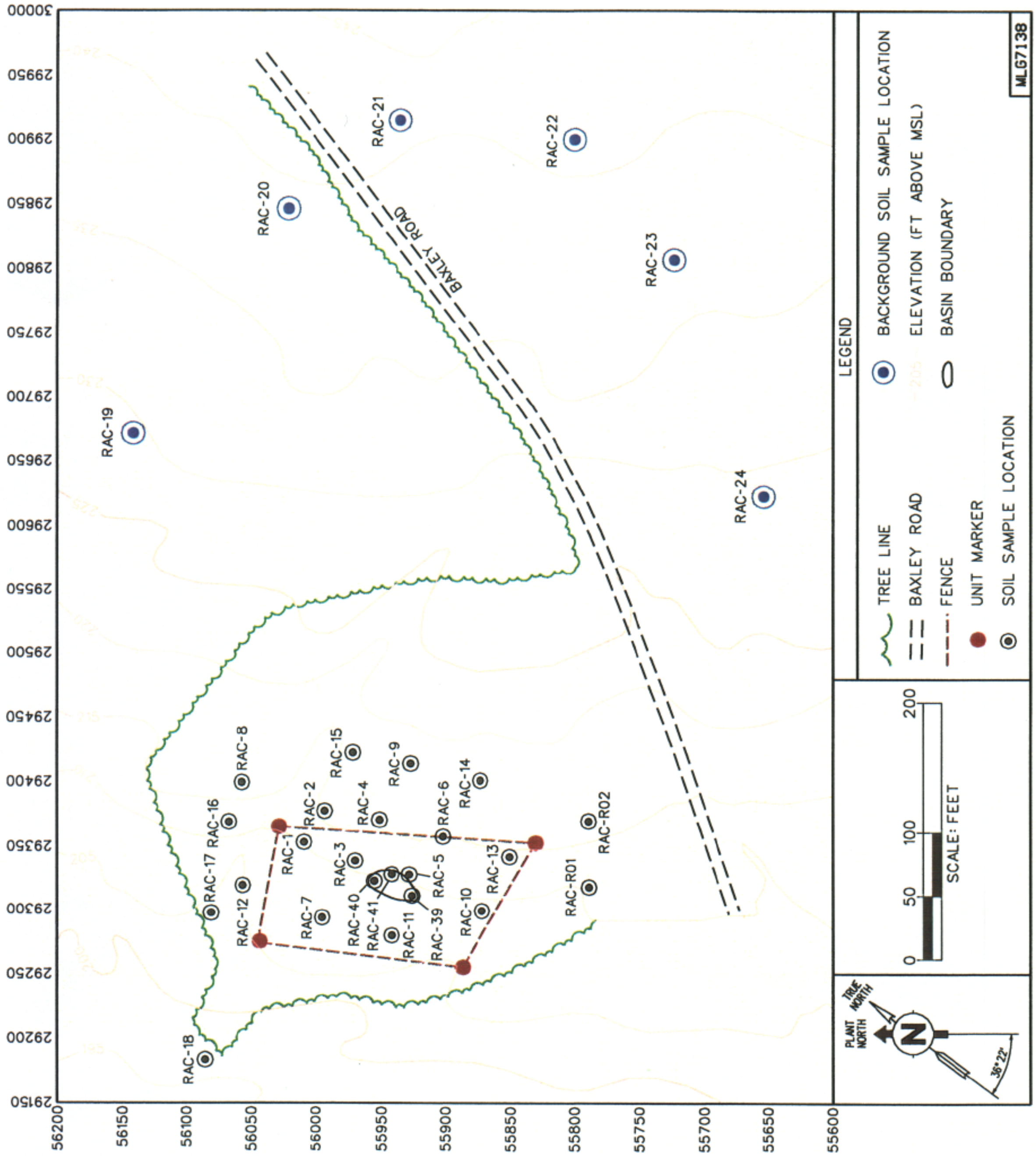


Figure 9. RFI/RI Soil Sampling Locations at the Road A Chemical Basin Operable Unit

- Primary Source Investigation

The primary source investigation included review of historical records to determine the nature of the primary source at RdACB OU (nature and quantities of materials disposed of in the basin; it is thought the basin primarily received uranium process liquids (caustics) and miscellaneous aqueous radioactive and chemical wastes from 300-M Area).

- Secondary Source Investigation

  (a) Historical Secondary Source Characterization Activities

During March and April 1989, nine boreholes (SB-1 through SB-9) were drilled to collect 19 soil samples (for borehole locations, see Figure 10). Boreholes SB-1, -3, -4, -5, and -7 were drilled to a depth of 3.0 m (10 ft), and boreholes SB-2, -6, -8, and -9 were drilled to a depth of 10.7 m (35 ft).

During September 1992, a soil-gas survey was performed with a total of 36 gas sampling locations (for gas survey locations, see Figure 11).

During August 1997, a radiological survey was performed using hand-held instruments. The results of this survey were used in the development of the Sampling and Analysis Plan for the RFI/RI Characterization.

  (b) RFI/RI Characterization Activities

Between February and August 2000, 110 samples were collected from 27 boreholes. Samples were collected from 0 to 0.3 m (0 to 1 ft), 0.3 to 1.2 m (1 to 4 ft), 2.1 to 3.0 m (7 to 10 ft), and 3.0 to 4.0 m (10 to 13 ft) below ground surface (bgs) at locations RAC-1 through RAC-18. Samples were collected from 0 to 0.3 m (0 to 1 ft) and 0.3 to 1.2 m (1 to 4 ft) bgs intervals at RAC-R01 and RAC-R02. For RAC-40 and RAC–41, the

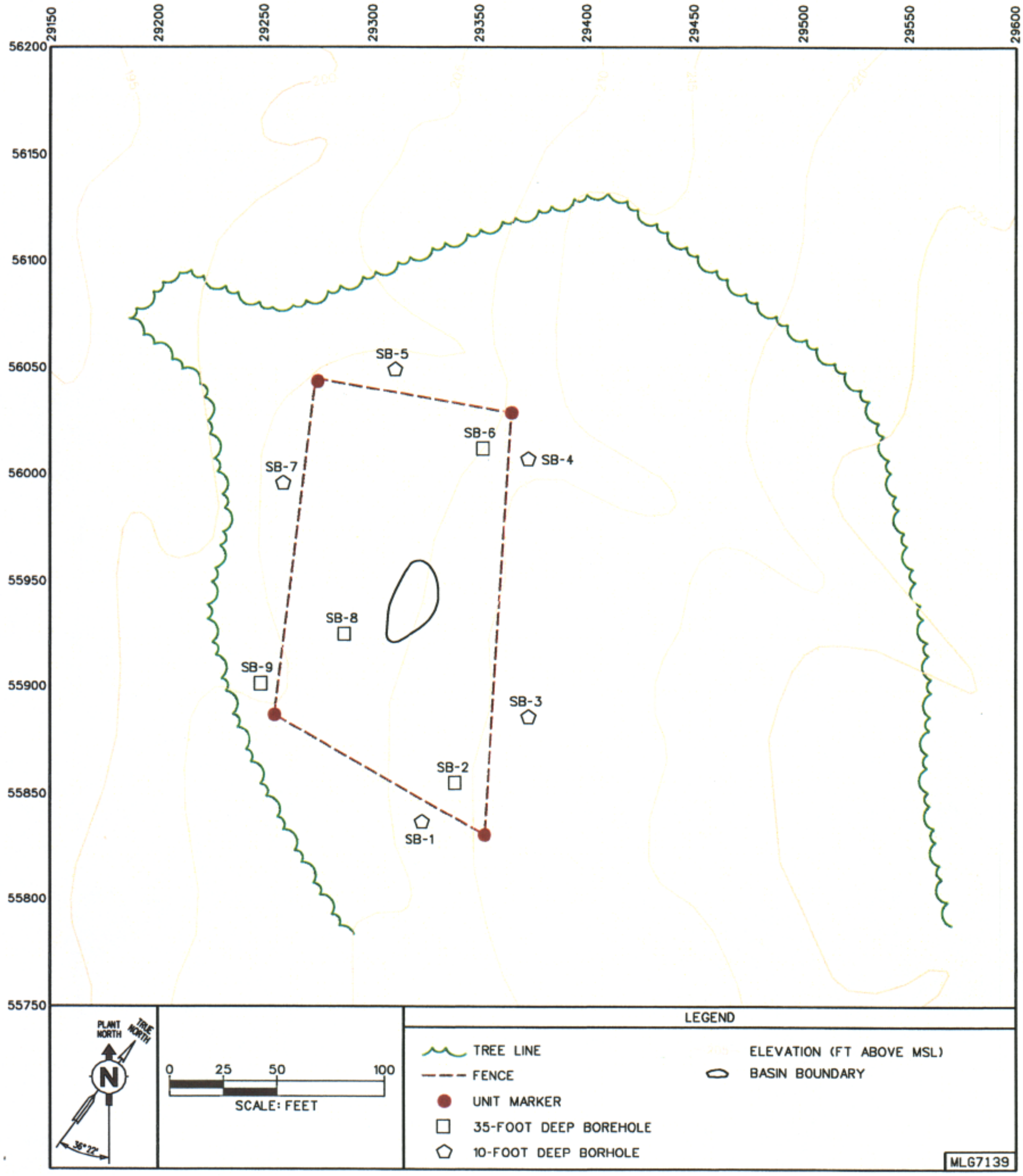


**Figure 10.** **Locations of 1989 Soil Boreholes at the Road A Chemical Basin Operable Unit**

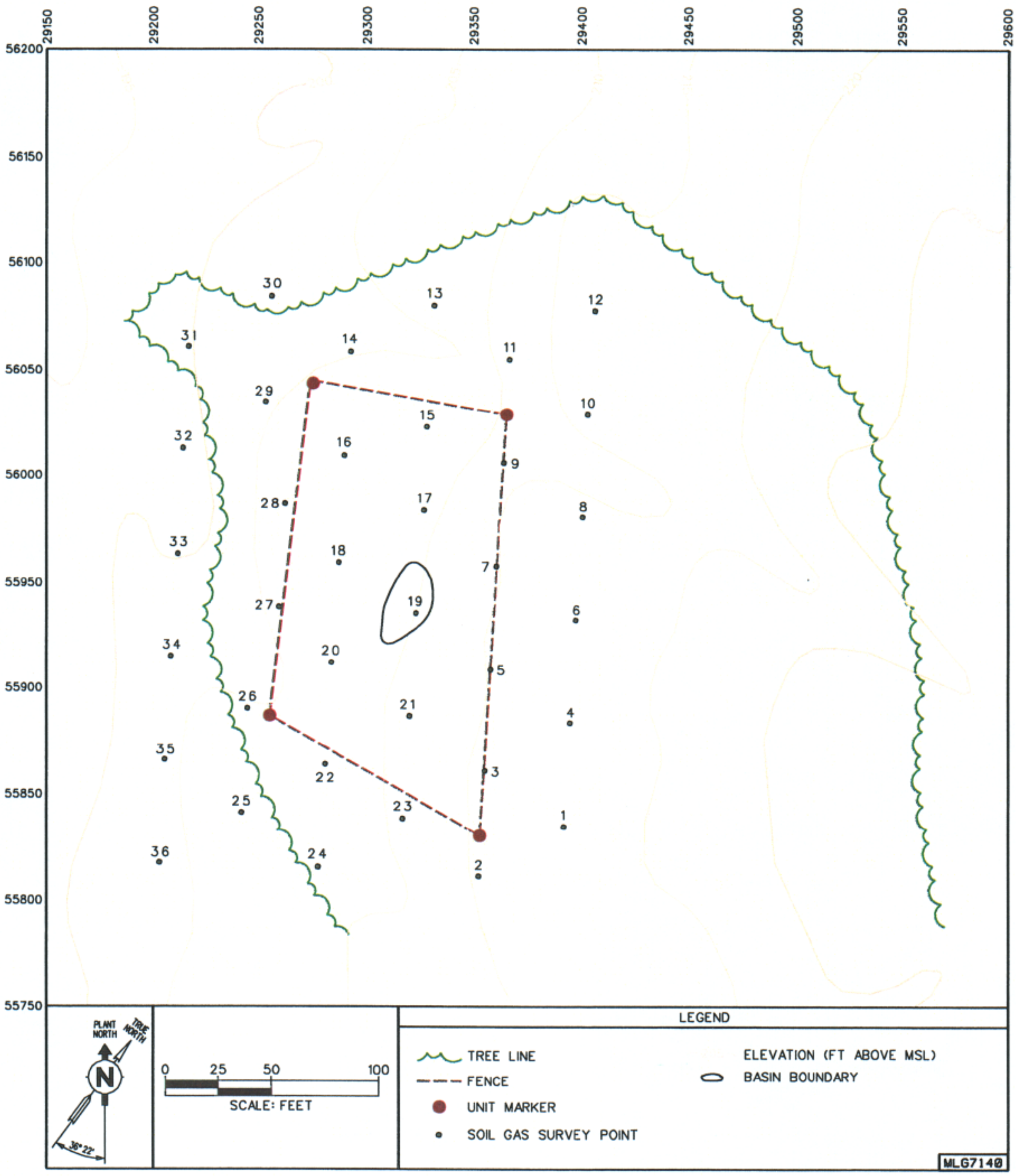


**Figure 11. Soil-Gas Survey Locations for the Road A Chemical Basin Operable Unit**

sample intervals included 0 to 0.3 m (0 to 1 ft), 0.3 to 1.2 m (1 to 4 ft), and 1.2 to 1.8 m (4 to 6 ft) bgs.

For RAC-39, the sample intervals included 0 to 0.3 m (0 to 1 ft), 0.3 to 1.2 m (1 to 4 ft), 1.2 to 1.7 m (4 to 5.5 ft), and 1.7 to 2.1 m (5.5 to 7 ft) bgs (for sample locations, see Figure 9).

All the soil samples collected in 2000 (including the background samples) were analyzed for target compound list (TCL) volatile organic compounds (VOCs), TCL semivolatile organic compounds (SVOCs), target analyte list (TAL) inorganics, TCL pesticides and polychlorinated biphenyls (PCBs), and radiological indicators (gross alpha and non-volatile beta). Samples from locations RAC-39 through RAC-41 received additional radiological analyses for americium, curium, plutonium, radium, thorium and uranium because gross alpha activities were elevated.

*Groundwater Investigations*

Groundwater monitoring has been ongoing since 1983 at the RdACB OU. All the historical groundwater analytical data for the RdACB are included in the RFI/RI Work Plan for the RdACB OU (U) (WSRC 1999). The groundwater investigation conducted at RdACB OU included installing and sampling monitoring wells and piezometers at the RdACB. Figure 12 shows the locations of nine monitoring wells and three piezometers installed at RdACB OU. The groundwater investigations conducted to characterize the groundwater associated with RdACB are briefly described below.

- Background Investigation

Unit-specific background groundwater samples were collected from three upgradient wells (wells BRD-3 and BRD-6D screened in the upper aquifer zone of the Upper Three Runs aquifer (UTRA) and well BRD-6C screened in the Gordon aquifer).

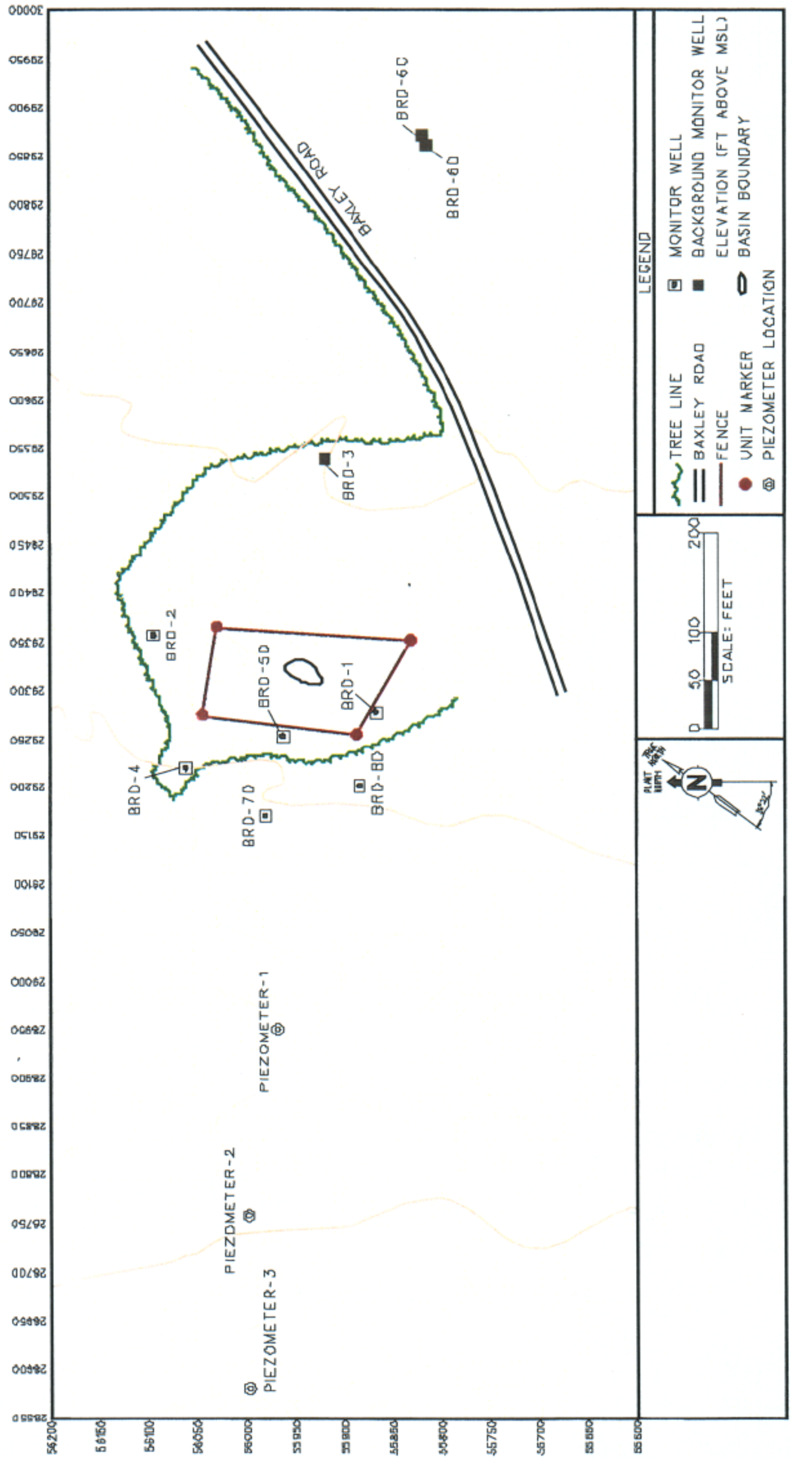


**Figure 12. Location of Monitoring Wells and Piezometers at the Road A Chemical Basin Operable Unit**

- Historical Groundwater Monitoring

Records from the SRS Groundwater Monitoring Program between 1990 and 1995 indicate that each of five wells (BRD-1, BRD-2, BRD-3, BRD-4, and BRD-5) in the vicinity of the RdACB OU have been sampled periodically. Each well was analyzed at least once during this period for VOCs, SVOCs, metals, dioxins/furans, gross alpha, nonvolatile beta, and tritium.

- RFI/RI Groundwater Sampling

From April 2000 to November 2000, three rounds of groundwater sampling were performed at nine monitoring wells.

Groundwater samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL inorganics, herbicides, radiological indicators (gross alpha and non-volatile beta), radium, and gamma spectroscopy.

***Wetland Surface Water Investigations***

- Background Investigation

During March 2001, six surface water samples were collected from locations RAC-53 through RAC-58 (for sample locations see Figure 13). All samples were analyzed for TCL VOCs, TCL SVOCs, TCL pesticides and PCBs, TAL inorganics, and cyanide. Turbidity and pH were also measured at each location.

- RFI/RI Characterization Activities

During March 2000, seven samples were collected from locations RAC-25 through RAC-27 and RAC-35 through RAC-38 (for sample locations see Figure 13). All samples were analyzed for TAL and TCL analytes (VOCs, SVOCs, inorganics and pesticides/PCBs), gross alpha, and nonvolatile beta.

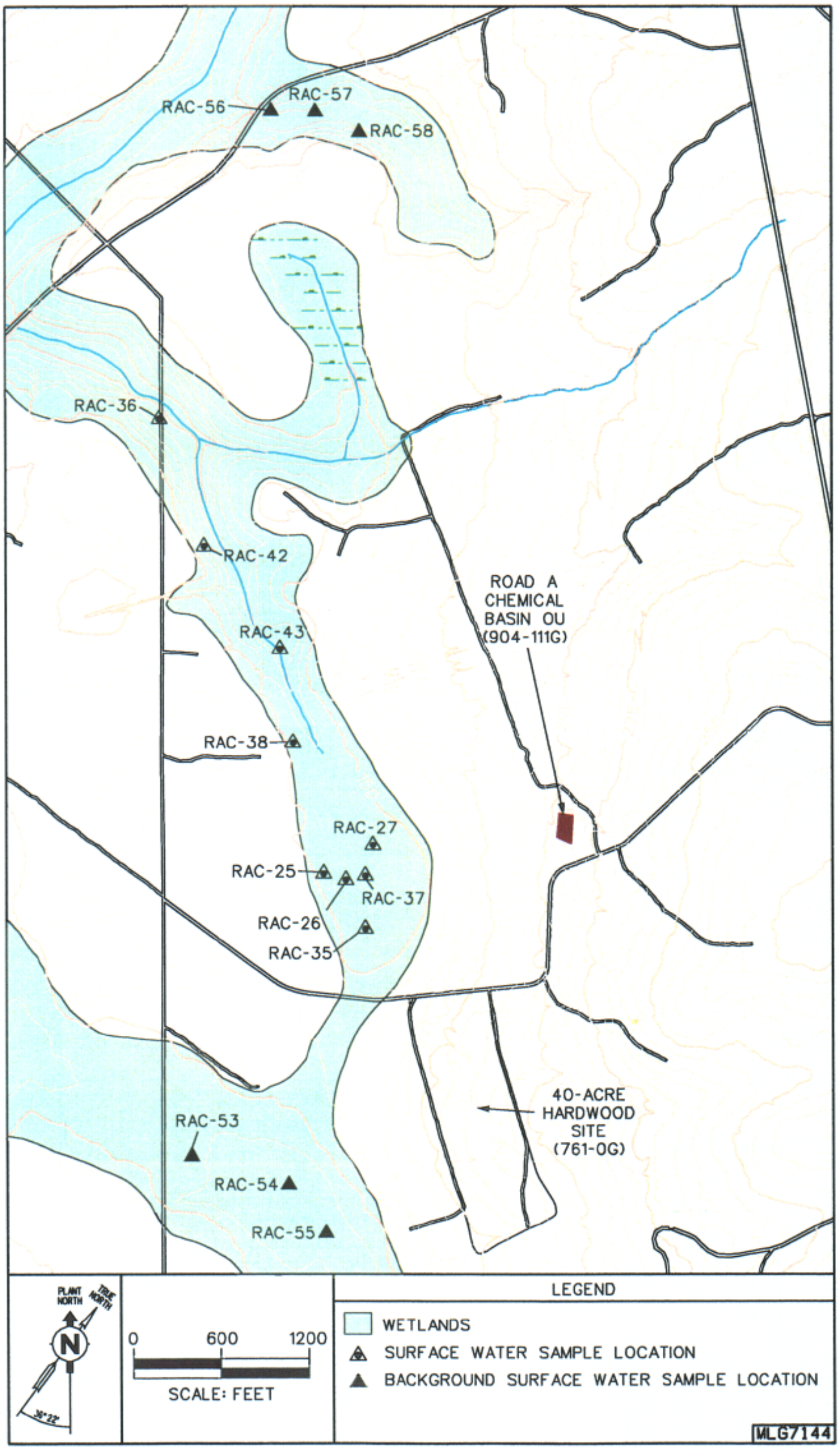


**Figure 13.** **Wetland Surface Water Sample Locations for the Road A Chemical Basin Operable Unit**

During August 2000, two samples were collected from locations RAC-42 and RAC-43 (for sample locations see Figure 13). Both samples collected were analyzed for phosphate, sulfide, sulfate, nitrate, nitrite, chloride, cyanide, total organic carbon (TOC), and TAL and TCL analytes (VOCs, SVOCs, inorganics, pesticides/PCBs).

Field measurements for turbidity and pH were obtained for all samples (for locations see Figure 14).

***Wetland Sediment Investigation***

- Background Investigation

During March 2001, six sediment samples were collected from locations RAC-47 through RAC-52 (for sample locations see Figure 15). Each sediment sample was collected at approximately the same location as the background surface water sample. All samples were analyzed for TAL inorganics, TCL VOCs, TCL SVOCs, and pH.

- RFI/RI Characterization Activities

Between March 2000 and August 2000, 19 samples were collected from 12 locations (RAC-25 through RAC-27, RAC-35 through RAC-38, and RAC-42 through RAC-46 (for sample locations see Figure 15). All samples were analyzed for TAL and TCL analytes (VOCs, SVOCs, inorganics, pesticides/PCBs), gross alpha, and nonvolatile beta. Samples collected from five locations (RAC-42, -43, -44, -45, and -46) were also analyzed for phosphate, sulfide, sulfate, nitrate, nitrite, chloride, TOCs, and soil pH. Seven samples, collected from locations RAC-25A, -26A, -27A, -35A, -36A, -37A, and -38A, were analyzed in August 2000 for total and amenable cyanide in addition to the above-mentioned parameters.

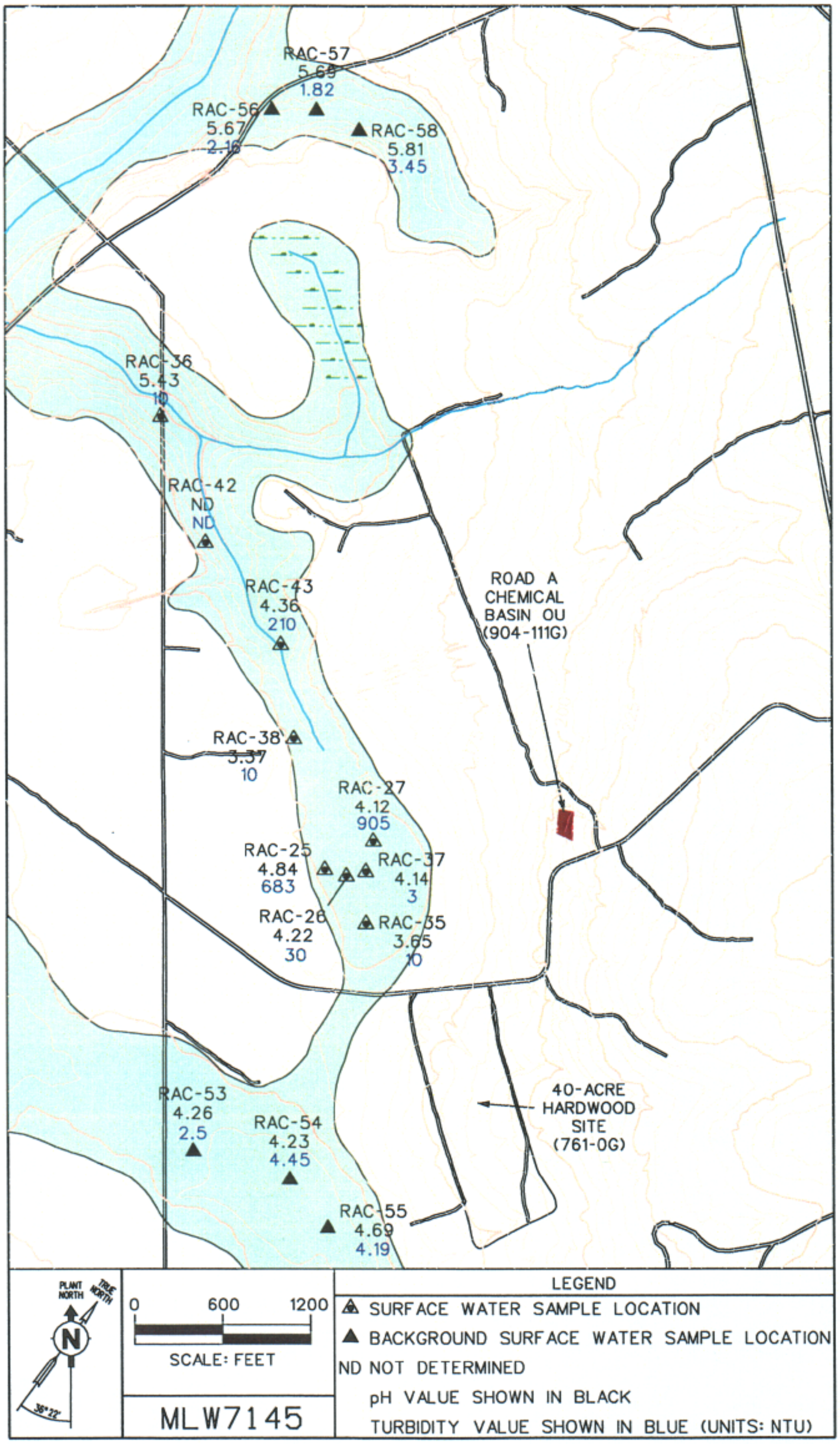


**Figure 14. Wetland Surface Water pH and Turbidity Field Measurements**

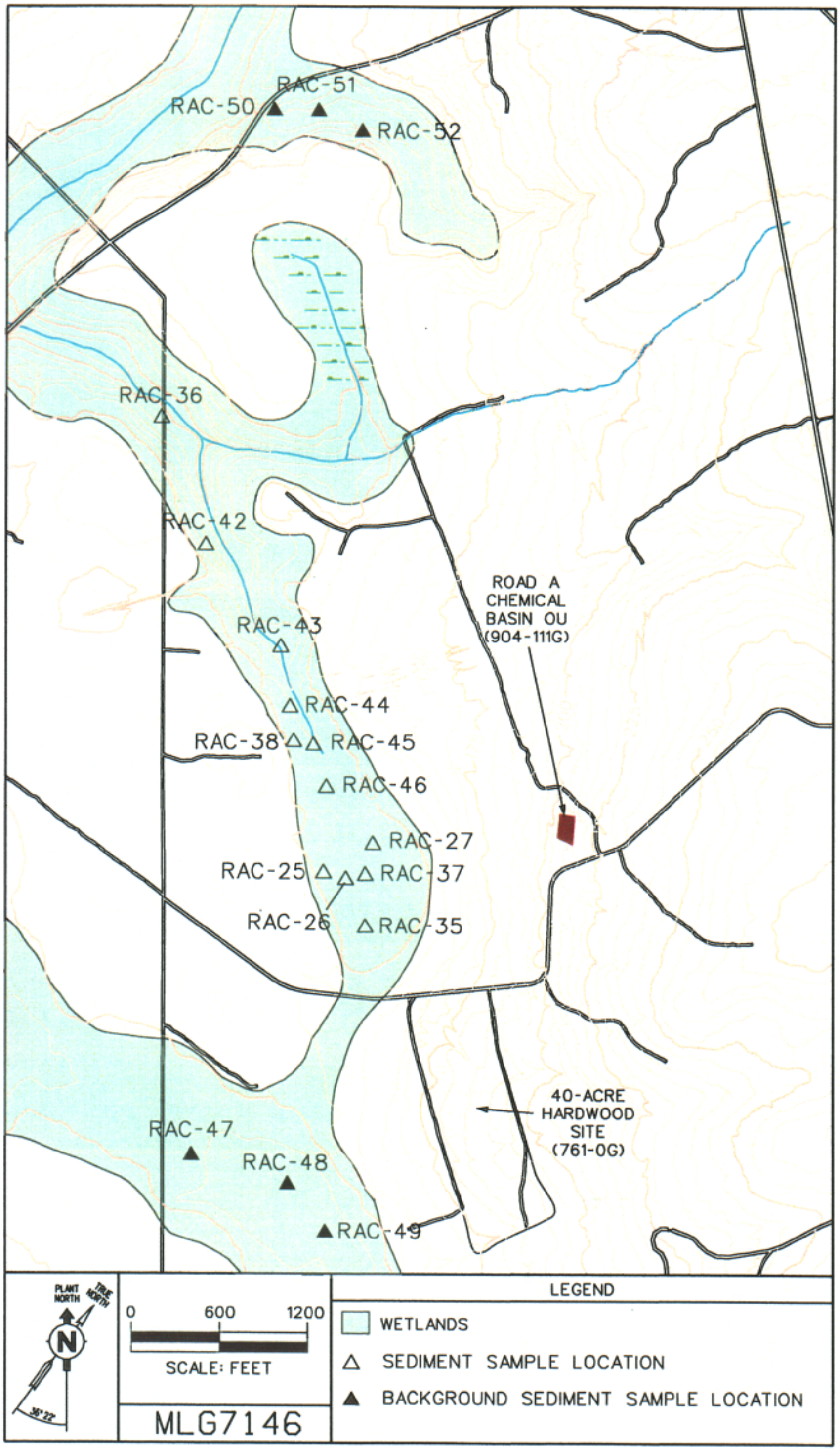


**Figure 15.** **Wetland Sediment Sample Locations for the Road A Chemical Basin Operable Unit**

***Physical Characterization Investigations***

The physical characterization performed during RFI/RI investigation of RdACB OU included CPT testing; wireline coring; geophysical logging; geotechnical analysis of Shelby tube samples; aquifer hydraulic conductivity testing, and ground penetrating radar surveys. These investigations are briefly described below.

- CPT Testing - CPT lithology pushes at six locations (CPT-01, CPT-02, CPT-03, BRD-7C, BRD-2C, and BRD-6C) (for locations see Figure 16).

- Wireline Coring and Geophysical Logging – April 2000, geophysical logging at four locations (BRD-06D, BRD-07D, BRD-08D, and BRD-06C) (for locations see Figure 12).

- Geotechnical Analysis – Shelby Tube samples from three locations (BRD-7C, RACB-ST1, and RACB-ST2) (for locations see Figure 17).

- Aquifer Hydraulic Conductivity Testing – performed slug and withdrawal tests at each of four monitoring wells (BRD-6C, -6D, -7D, and –8D) (for locations see Figure 12).

- GPR Survey - performed GPR survey in the vicinity of the waste unit to define the boundaries of the basin.

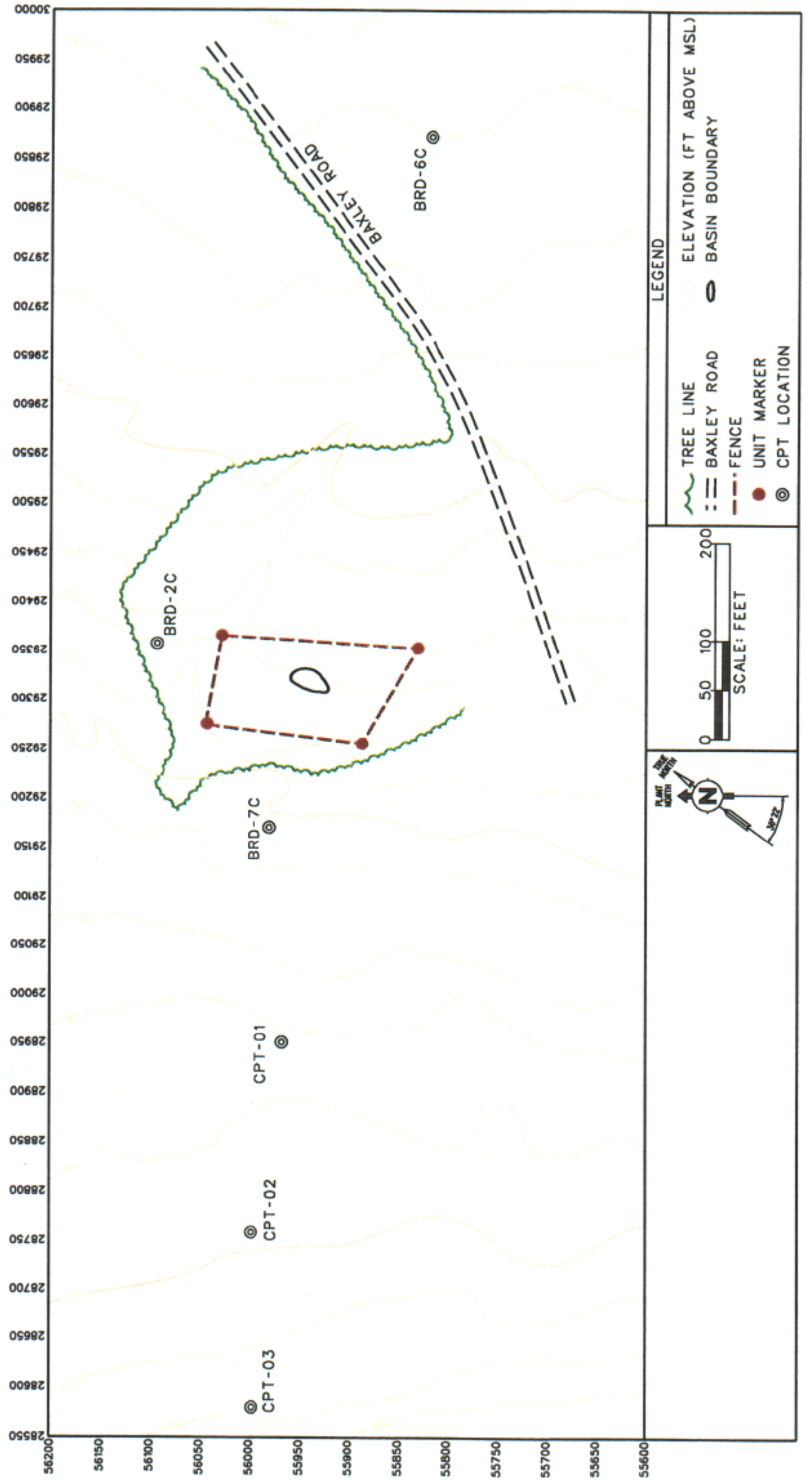


**Figure 16. CPT Sampling Locations at the Road A Chemical Basin Operable Unit**

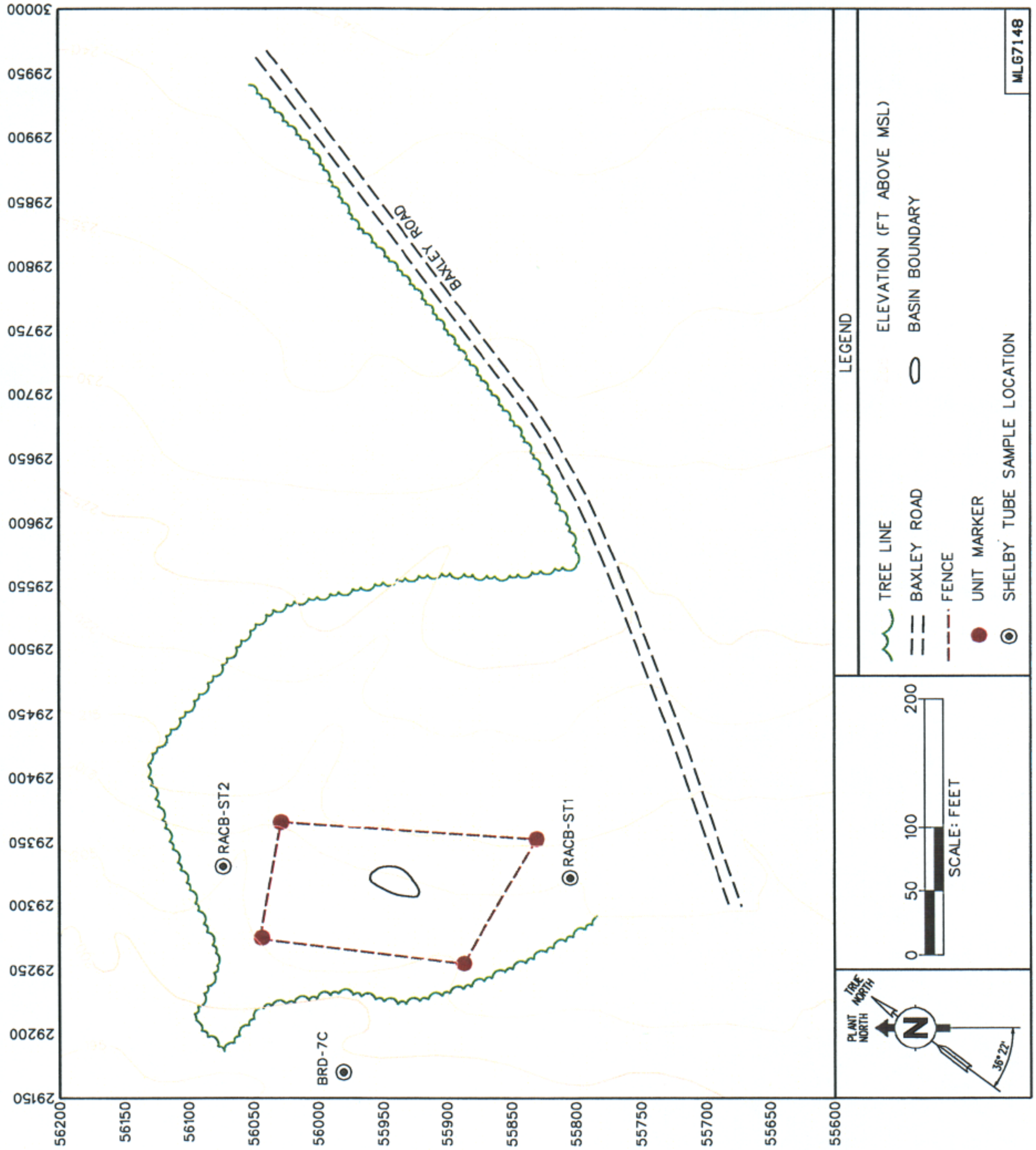


**Figure 17. Locations of Shelby Tubes Collected for Geotechnical Analysis**

**Media Assessment Result**

The COCs associated with the RdACB OU soils were determined by applying standard SRS characterization and risk assessment (human health and ecological) protocols to the unit data for surface, subsurface and deep soils and for groundwater, wetland surface water and wetland sediment data groupings. Unrestricted land use was applied in calculating the human health risks. The calculated risks were below the USEPA target range of 1 x $10^{-4}$ to 1 x $10^{-6}$. CMCOCs were identified through contaminant fate and transport analyses.

The acceptable range of 1 x $10^{-4}$ to 1 x $10^{-6}$ is for site-related exposure and represents the incremental probability of an individual's developing cancer over a lifetime as a result of exposure to a carcinogen. An excess lifetime cancer risk of 1 x $10^{-6}$ indicates that an individual experiencing the reasonable maximum exposure estimate has a 1 in 1,000,000 (one million) chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual's developing cancer from all other causes has been estimated to be as high as one in three. Likewise, the cancer risk of 1 x $10^{-4}$ indicates a chance that 1 in 10,000 (ten thousand) will develop cancer.

The potential for noncarinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., lifetime) with a reference dose (RfD) derived for a similar exposure period. An RfD represents a level that an individual may be exposed to that is not expected to cause any deleterious effect. The ratio of exposure to toxicity is called a hazard quotient (HQ). An HQ<1 indicates that a receptor's dose of a single contaminant is less than the RfD, and that toxic noncarcinogenic effects from that chemical are unlikely. The Hazard Index (HI) is generated by adding the HQs for all chemical(s) of concern that affect same target organ (e.g., liver) or that act through the same mechanism of action within a medium or across all media to which a given individual may reasonably be exposed. An HI<1 indicates that, based on the sum of all HQ's from different contaminants and exposure routes, toxic noncarcinogenic effects from all contaminants are unlikely. An HI>1 indicates that site-related exposures may present a risk to human health.

No refined COCs were identified. The results of the characterization and assessment have been summarized in the RFI/RI/BRA report (WSRC 2002b).

Tables 2 through 5 provide the results from the screening process employed in determining the refined COCs to be retained for further remedial action for the Basin Soils, Groundwater, Wetland Surface Water, and Wetland Sediment subunits, respectively. The process entailed the following steps. First, from the detected constituents, unit-specific constituents (USCs) were identified. USCs were determined by comparing each constituent concentration found in the soil against its respective twice average background concentration for all depth intervals. The USCs were used to determine the preliminary CMCOCs. Second, the risk-based preliminary COCs (human health COCs and ecological COCs) were determined in accordance with CERCLA guidance and protocols. Third, the ARAR COCs were determined using RCRA/CERCLA screening values/standards. Finally, all the preliminary COCs were carried into a formal uncertainty analysis to determine if there were any refined COCs.

**Table 2. Overview of the COC Screening Process for Basin Soils RdACB OU**

| | Nature and Extent | | | Fate & Transport | | Human Health | | Ecological | | Refinement of COCs |
|---|---|---|---|---|---|---|---|---|---|---|
| **Detected Constituent** | **USC** | **ARAR COC** | **PTSM COC** | **CM COPC** | **CM COC** | **COPC** | **COC** | **COPC[a]** | **COC** | **Refined COC** |
| **Pesticides/PCBs (mg/kg)** | | | | | | | | | | |
| Aroclor 1254 | X | | | | | | | X | | |
| Endrin | X | | | | | | | X | | |
| Heptachlor | X | | | | | | | X | | |
| Heptachlor epoxide | X | | | | | | | X | | |
| alpha-Chlordane | X | | | | | | | X | | |
| gamma-Chlordane | X | | | | | | | X | | |
| p,p'-DDD | X | | | | | | | | | |
| p,p'-DDE | X | | | | | | | | | |
| p,p'-DDT | X | | | | | | | | | |
| **Radionuclides (pCi/g)** | | | | | | | | | | |
| Cesium-137 | X | | | | | | | | | |
| Gross Alpha | X | | | | | | | | | |
| Nonvolatile Beta | X | | | | | | | | | |
| Radium-226 | X | | | X | | | | | | |
| Radium-228 | X | | | X | | | | | | |
| Thorium-228 | X | | | X | | | | | | |
| Thorium-230 | X | | | | | | | | | |
| Thorium-232 | X | | | X | | | | | | |
| Uranium-233/234 | X | | | X | | | | | | |
| Uranium-235 | X | | | X | | | | | | |
| Uranium-238 | X | | | X | | | | | | |
| **TAL Inorganics (mg/kg)** | | | | | | | | | | |
| Aluminum | X | | | | | X | X | X | | |
| Antimony | X | | | | | | | | | |
| Arsenic | X | | | | | X | X | | | |
| Barium | X | | | | | | | | | |
| Beryllium | X | | | | | | | | | |
| Cadmium | X | | | X | X | | | X | | |
| Calcium | X | | | | | | | X | | |
| Chromium | X | | | | | X | | X | | |
| Cobalt | X | | | | | | | | | |
| Copper | X | | | | | | | | | |
| Cyanide | | | | | | | | | | |
| Iron | X | | | X | | X | X | X | | |
| Lead | X | | | | | | | | | |
| Magnesium | X | | | | | | | X | | |
| Manganese | X | | | | | | | X | | |
| Mercury | X | | | | | | | X | | |
| Nickel | X | | | | | | | | | |
| Potassium | X | | | | | | | X | | |

**Table 2. Overview of the COC Screening Process for Basin Soils RdACB OU (Continued)**

| | Nature and Extent | | | Fate & Transport | | Human Health | | Ecological | | Refinement of COCs |
|---|---|---|---|---|---|---|---|---|---|---|
| **Detected Constituent** | **USC** | **ARAR COC** | **PTSM COC** | **CM COPC** | **CM COC** | **COPC** | **COC** | **COPC[a]** | **COC** | **Refined COC** |
| Silver | X | | | | | | | X | | |
| Sodium | X | | | | | | | X | | |
| Thallium | X | | | X | | X | | X | | |
| Vanadium | X | | | | | X | | X | | |
| Zinc | X | | | | | | | X | | |
| **TCL Semivolatiles (mg/kg)** | | | | | | | | | | |
| 1,2,4-Trichlorobenzene | X | | | | | | | | | |
| 1,4-Dichlorobenzene | X | | | | | | | | | |
| 2,4-Dinitrotoluene | X | | | | | | | X | | |
| 2-Chlorophenol | X | | | | | | | X | | |
| 2-Methylnaphthalene | X | | | | | | | X | | |
| 4-Chloro-3-methylphenol (p-Chloro-m-cresol) | X | | | | | | | X | | |
| Acenaphthene | X | | | | | | | | | |
| Benzoic acid | X | | | | | | | X | | |
| Bis(2-ethylhexyl) phthalate | X | | | | | | | X | | |
| Di-n-octyl phthalate | X | | | | | | | X | | |
| N-Nitroso-di-n-propylamine | X | | X | X | X | X | | X | | |
| N-Nitrosodiphenylamine | X | | | | | | | | | |
| Phenol | X | | | | | | | X | | |
| Pyrene | X | | | | | | | X | | |
| **TCL Volatiles (mg/kg)** | | | | | | | | | | |
| 1,1,2,2-Tetrachloroethane | X | | | X | | | | | | |
| 2-Butanone (MEK) | X | | | | | | | X | | |
| Acetone | X | | | | | | | X | | |
| Bromomethane (Methyl bromide) | X | | | | | | | X | | |
| Carbon disulfide | X | | | | | | | X | | |
| Chlorodibromomethane | X | | | | | | | X | | |
| Dichloromethane (Methylene chloride) | X | | | | | | | | | |
| Toluene | X | | | | | | | | | |
| Xylenes (total) | X | | | | | | | | | |

Notes:
[a] Ecological COPCs are "retained constituents" as defined in *the Ecological Constituents of Potential Concern Selection Process* Protocol
ARAR COC – Applicable or Relevant and Appropriate Requirement COC
COPC – Constituent of Potential Concern

## Table 3. Overview of the COC Screening Process for the Groundwater-RdACB OU

| Detected Constituent | Nature and Extent | | Fate & Transport | | Human Health | | Ecological | | Refinement of COCs |
|---|---|---|---|---|---|---|---|---|---|
| | USC | ARAR COC | CM COPC | CM COC | COPC | COC | COPC[a] | COC | Refined COC |
| **Radionuclides (pCi/L)** | | | | | | | | | |
| Bismuth-214 | X | | | | X | X | | | |
| Gross Alpha | X | X | | | | | | | |
| Cobalt-60 | X | | | | X | X | | | |
| Nonvolatile Beta | X | | | | | | | | |
| Radium-226 | X | | | | X | X | | | |
| **TAL Inorganics (mg/L)** | | | | | | | | | |
| Aluminum | X | | | | | | | | |
| Chromium | X | | | | X | | | | |
| Copper | X | | | | X | | | | |
| Cyanide | X | | | | X | | | | |
| Iron | X | | | | | | | | |
| Lead | X | | | | | | | | |
| Manganese | X | | | | | | | | |
| Nickel | X | | | | | | | | |
| **TCL Semivolatiles (mg/L)** | | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | X | X | | | X | | | | |
| **TCL Volatiles (mg/L)** | | | | | | | | | |
| Carbon disulfide | X | | | | | | | | |
| Dichloromethane (Methylene chloride) | X | | | | | | | | |

Notes:
[a] Ecological COPCs are "retained constituents" as defined in *the Ecological Constituents of Potential Concern Selection Process* Protocol
ARAR COC – Applicable or Relevant and Appropriate Requirement COC
COPC – Constituent of Potential Concern

**Table 4. Overview of the COC Screening Process for Wetland Surface Water RdACB OU**

| | Nature and Extent | | Fate & Transport | | Human Health | | Ecological | | Refinement of COCs |
|---|---|---|---|---|---|---|---|---|---|
| **Detected Constituent** | **USC** | **ARAR COC** | **CM COPC** | **CM COC** | **COPC** | **COC** | **COPC[a]** | **COC** | **Refined COC** |
| **Radionuclides (pCi/L)** | | | | | | | | | |
| Nonvolatile Beta | X | | | | | | | | |
| **TAL Inorganics (mg/L)** | | | | | | | | | |
| Aluminum | X | | | | X | | X | | |
| Barium | X | | | | X | | X | | |
| Calcium | X | | | | | | | | |
| Cobalt | X | | | | | | X | | |
| Iron | X | X | | | X | | X | | |
| Lead | X | X | | | X | | X | | |
| Magnesium | X | | | | | | | | |
| Manganese | X | | | | X | | X | | |
| Mercury | X | X | | | X | | X | | |
| Thallium | X | X | | | X | X | X | | |
| Vanadium | X | | | | X | | X | | |
| Zinc | X | X | | | | | X | | |
| **TCL Semivolatiles (mg/L)** | | | | | | | | | |
| Benzoic acid | X | | | | | | | | |
| Bis(2-ethylhexyl) phthalate | X | X | | | X | | X | | |
| **TCL Volatiles (mg/L)** | | | | | | | | | |
| Acetone | X | | | | | | | | |
| Chlorobenzene | X | | | | | | | | |
| Toluene | X | | | | | | | | |

Notes:
[a] Ecological COPCs are "retained constituents" as defined in *the Ecological Constituents of Potential Concern Selection Process* Protocol
ARAR COC – Applicable or Relevant and Appropriate Requirement COC
COPC – Constituent of Potential Concern

## Table 5. Overview of the COC Screening Process for Wetland Sediment RdACB OU

| Detected Constituent | Nature and Extent | | Fate & Transport | | Human Health | | Ecological | | Refinement of COCs |
|---|---|---|---|---|---|---|---|---|---|
| | USC | ARAR COC | CM COPC | CM COC | COPC | COC | COPC[a] | COC | Refined COC |
| **Pesticides/PCBs (mg/kg)** | | | | | | | | | |
| alpha-Chlordane | X | | | | | | X | | |
| gamma-Chlordane | X | | | | | | X | | |
| p,p'-DDE | X | | | | | | X | | |
| p,p'-DDT | X | | | | | | X | | |
| **Radionuclides (pCi/g)** | | | | | | | | | |
| Gross Alpha | X | | | | | | | | |
| Nonvolatile Beta | X | | | | | | | | |
| **TAL Inorganics (mg/kg)** | | | | | | | | | |
| Aluminum | X | | | | X | | X | | |
| Antimony | X | | | | X | | | | |
| Barium | X | | | | | | X | | |
| Beryllium | X | | | | | | X | | |
| Cadmium | X | | | | X | | X | | |
| Chromium | X | | | | | | | | |
| Cobalt | X | | | | | | | | |
| Copper | X | | | | | | | | |
| Iron | X | | | | X | | X | | |
| Lead | X | | | | | | X | | |
| Magnesium | X | | | | | | X | | |
| Manganese | X | | | | X | | X | | |
| Mercury | X | | | | | | X | | |
| Nickel | X | | | | | | | | |
| Potassium | X | | | | | | X | | |
| Thallium | X | | | | X | | X | | |
| Vanadium | X | | | | | | X | | |
| **TCL Semivolatiles (mg/kg)** | | | | | | | | | |
| Benzoic acid | X | | | | | | X | | |
| Bis(2-ethylhexyl) phthalate | X | | | | | | X | | |
| Butyl benzyl phthalate | X | | | | | | | | |
| **TCL Volatiles (mg/kg)** | | | | | | | | | |
| 2-Butanone (MEK) | X | | | | | | X | | |
| 2-Hexanone | X | | | | | | X | | |
| Acetone | X | | | | | | X | | |
| Carbon disulfide | X | | | | | | X | | |
| Dichloromethane (Methylene chloride) | X | | | | | | | | |
| Ethylbenzene | X | | | | | | | | |
| Toluene | X | | | | | | | | |

**Table 5. Overview of the COC Screening Process for Wetland Sediment RdACB OU (Continued)**

| | Nature and Extent | | Fate & Transport | | Human Health | | Ecological | | Refinement of COCs |
|---|---|---|---|---|---|---|---|---|---|
| **Detected Constituent** | **USC** | **ARAR COC** | **CM COPC** | **CM COC** | **COPC** | **COC** | **COPC[a]** | **COC** | **Refined COC** |
| Xylenes (total) | X | | | | | | | | |

Notes:
[a] Ecological COPCs are "retained constituents" as defined in *the Ecological Constituents of Potential Concern Selection Process* Protocol
ARAR COC – Applicable or Relevant and Appropriate Requirement COC
COPC – Constituent of Potential Concern

The key findings pertaining to the four RdACB OU subunits are described below:

***Basin Soils (Surface and Subsurface Soils)***

- Initially N-nitroso-di-n-propylamine was identified as PTSM based upon its predicted migration to the groundwater above its maximum contaminant level (MCL) in less than 10 years. However, due to its lateral and vertical distribution in soil and lack of detections in groundwater, this constituent does not qualify as PTSM. Hence, no PTSM or low-level threat wastes are present at the RdACB OU.

- The contamination nature and extent evaluation indicates that, in general, all the COCs (aluminum [human health, surface soil], arsenic [human health, surface soil], and iron [human health, surface soil]) are present in the surface soil at low concentrations within the variability of natural SRS background. In addition, there is no apparent trend in their distributions to suggest that they are related to unit disposal activities. Therefore, aluminum, arsenic, and iron are not considered refined COCs.

- Cadmium and N-nitroso-di-n-propylamine were initially considered CMCOCs; however, because of cadmium's natural occurrence, the low frequencies of cadmium detection, the potential for false positive cadmium detection due to spectral interference from high concentrations of iron, and chemical–specific properties of both cadmium and N-nitroso-di-n-propylamine, neither was identified as a refined CMCOC for the RdACB OU by the Core Team.

In summary, no refined CMCOCs, no refined human health (HH)COCs, and no refined ecological COCs are identified for the RdACB soils subunit (exposure group) that require further evaluation for remedial action (see Table 2).

**Groundwater**

- Three secondary HHCOCs (bismuth-214, cobalt-60, and radium-226) were identified in groundwater for the industrial worker and future resident. However, an assessment of activities in the background wells, their natural occurrence in groundwater due to Piedmont and Coastal Plain geology (uranium and/or radon daughters), their frequency and variability of detections (e.g., cobalt-60, 1 in 18 samples), and their relatively low risks ($1 \times 10^{-6}$ to $4 \times 10^{-6}$ for bismuth-214 and cobalt-60; and $6 \times 10^{-6}$ to $9 \times 10^{-6}$ for radium-226) precluded their consideration as refined COCs.

- Bis (2-ethylhexyl) phthalate and gross alpha activities were identified as ARAR COCs based upon their concentrations in groundwater above their respective MCLs. Because bis (2-ethylhexyl) phthalate was detected in one well and in only one out of 12 soil samples, it is not considered a contaminant migration concern. Additionally, it is a common laboratory contaminant. Average gross alpha activities in the groundwater samples are consistent with average unit background levels and are likely to occur naturally from groundwater due to Piedmont and Coastal Plain geology. Hence neither were considered refined COCs.

In summary, the results of the groundwater analyses have revealed no refined COCs for the RdACB groundwater subunit (exposure group) (see Table 3).

***Wetland Surface Water***

- Iron, lead, mercury and zinc were identified as ARAR COCs based upon exceedences of Ambient Water Quality Criteria (AWQC) for ecological receptors. However, these metals are naturally-occurring in Piedmont and Coastal Plain sediments. It is likely that the presence of these constituents in wetland surface water is the result of low pH (down to 3.37) conditions noted during sampling and high turbidity (up to 905 NTU) in the samples. Also, the concentrations of these metals in soils associated with the RdACB OU and groundwater samples collected from monitoring wells located at the

RdACB OU are significantly lower than concentrations found in the wetland surface water. Therefore, these metals were not considered refined COCs for the RdACB OU.

- Thallium and bis (2-ethylhexyl) phthalate are identified as ARAR COCs based upon exceedances of MCLs. However, thallium is a naturally occurring metal in Piedmont and Coastal Plain sediments. It is likely that the presence of thallium in wetland surface water is the result of low pH (down to 3.37) conditions noted during sampling and high turbidity (up to 905 NTU) in the samples. Also, the concentration of thallium in the soils associated with RdACB OU and groundwater samples collected from monitoring wells at this unit are significantly lower than the concentrations found in the wetland surface water. Therefore, thallium is not considered a refined COC for the RdACB OU. Bis (2-ethylhexyl) phthalate was not considered a refined COC since only one of six samples exceeded MCLs and the constituent is also a common laboratory contaminant.

- Thallium was identified as a secondary HHCOC for the future child resident (ingestion hazard 1.6; dermal hazard = 0.4). However, thallium is a naturally occurring metal in Piedmont and Coastal Plain sediments. It is also likely that the presence of this constituent in the wetland surface water is the result of low pH (down to 4.14) conditions noted during sampling and turbidity (30 NTU) in the samples. Additionally, thallium was not detected in any of the groundwater samples and in only one of the 82 samples collected from the soils associated with the RdACB OU; therefore, concentrations of thallium in the wetland surface water are not likely unit-related. The surface water is shallow and transient in nature; as such, actual exposure intakes to estimate the ingestion and dermal exposure hazards are overly conservative. Hence, thallium was not identified a refined COC for the wetland surface water.

In summary, the results of the wetland surface water analyses have revealed no refined COCs for the RdACB wetland surface water subunit (exposure group) (see Table 4).

*Wetland Sediment*

- No ARAR COCs, HHCOCs or ecological COCs were identified for the wetland sediment (see Table 5). Also there is no PTSM present in the wetland sediment.

*Conclusion*

In conclusion, no refined COCS have been determined to be associated with any of the four subunits (exposure groups) associated with the RdACB OU. This conclusion is based upon unrestricted residential land use assumptions. The HHCOCs were determined by estimating the risk levels and environmental hazards that could result from the RdACB OU-related constituents and by comparing the calculated risks to the USEPA target range of $1 \times 10^{-4}$ to $1 \times 10^{-6}$ risk for cancer constituents and hazard quotients (HQ) of less than 0.1 for non-cancer constituents. (For an explanation of carcinogenic and noncarinogenic risk values, refer to the Media Assessment Result section on page 38). The ecological COCs were determined by evaluating the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to unit-related constituents based on a weight-of-evidence approach.

**Site-Specific Factors**

There are no site-specific factors that can affect the No Action cleanup decision.

**Contaminant Transport Analysis**

Figure 18 presents the conceptual model for the contaminant migration analysis performed for the RdACB OU. The analysis of contaminant fate and transport was based on the lithological information, groundwater levels, and geotechnical data collected from investigations conducted in 2000 and in 2001 (see Table 1).

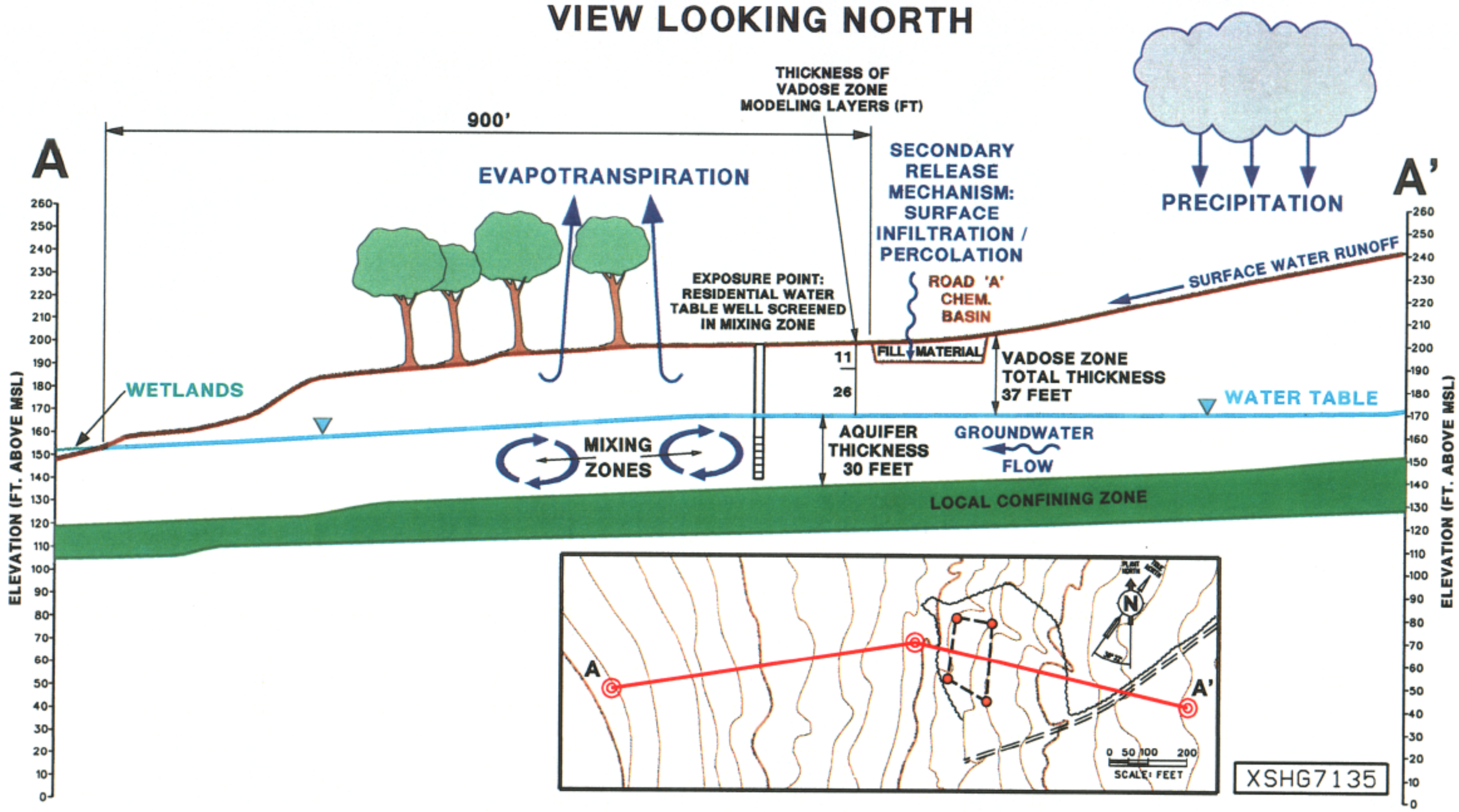


Figure 18. Groundwater Contaminant Migration Conceptual Site Model

The analysis was performed (1) to determine each USC's potential for leaching to groundwater, (2) to predict the migration of each USC, and (3) to project concentrations delivered to the receptor via vadose zone pore water and groundwater. The results of the analysis revealed that concentrations of constituents detected in the RdACB OU soils will not exceed their maximum contaminant levels (MCLs) or risk-based concentrations (RBCs) within the 1,000-year modeling period. The MCL is the maximum concentration of a substance allowed in water that is delivered to any user of a public water supply as required by the Safe Drinking Water Act. The contaminant migration analysis identified no refined CMCOCs. Therefore, the RdACB OU soils do not pose a migration threat to groundwater.

## VI. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

### Land Uses

*Current Land Use*

Currently, the RdACB is an inactive waste unit. It is located approximately 0.8 km (0.5 mi) west of the intersection of SRS Road A (South Carolina Route 125) and SRS Road 6 (see Figure 1). Access to SRS is controlled by USDOE. Access to the RdACB is not restricted within the SRS boundaries.

The RdACB OU is situated within a cleared area adjacent to wooded lands in an area of moderate relief. The cleared area is approximately 569 $m^2$ (6,125 $ft^2$) and is surrounded by pines and hardwoods with a stand of bottomland hardwood approximately 200 m (656 ft) to the southwest. Access to the RdACB OU is by a gravel road off of South Carolina State Route 125 (see Figure 2). South Carolina State Route 125 traverses through the SRS boundary and is open to the general public. Access to the unit is prevented by a 2.4 m (8 ft) locked chain-link fence that surrounds the basin. Orange Health Protection RFI/RI unit marker balls, which indicate a RCRA/CERCLA unit, are located at the corners of the RdACB OU. The unit is located outside of an industrially developed area, and the possibility of future residential land use cannot be ruled out.

The potential receptor for exposure to constituents associated with the RdACB OU is the known on-unit worker who comes to the area on an infrequent or occasional basis. Known on-unit workers are defined as SRS employees who work at or in the vicinity of the RdACB OU under current land use conditions. A known on-unit worker may be a researcher, environmental sampler, or other SRS personnel in close proximity to the unit. Although these receptors may be involved in the excavation or collection of contaminated media, they would be using SRS procedures and protocols to minimize exposure to potential contaminants.

***Future Land Use***

According to the *Savannah River Site: Future Use Project Report* (USDOE 1996), the preferred future land use for the area where the RdACB OU is located is designated as residential (see Figure 6). Therefore, the potential receptors for exposure to constituents associated with the RdACB OU include the hypothetical on-unit industrial worker and hypothetical on-unit resident (adult and child).

The hypothetical on-unit industrial worker is an adult who works in an outdoor industrial setting that is in direct proximity to the contaminated media for the majority of his or her time. The hypothetical on-unit residents include adults and children who are exposed to all the contaminated media (both indoors and outdoors).

**Groundwater Uses/Surface Water Uses**

Currently, groundwater beneath the RdACB OU is not being used for any type of human consumption. Furthermore, it is unlikely that this groundwater will be used for human consumption in the future. The groundwater that flows beneath the RdACB OU discharges into the UTRA.

There are no distinct surface water features on the unit, nor are there any drainage or surface runoff features that indicate that the surface runoff is being used for irrigation or any other beneficial uses.

## VII. SUMMARY OF OPERABLE UNIT RISKS

As a component of the RFI/RI process, a BRA was performed for the RdACB OU. The BRA included human health risk and ecological risk assessments. The results of the risk assessments are summarized in the following paragraphs.

### Summary of Human Health Risk Assessment

A review of the analytical data contained in the RFI/RI with BRA for the RdACB OU Report (WSRC 2002b) indicates that the data are of sufficient quality for use in the risk assessment evaluation.

Based on the existing analytical data, an evaluation was conducted to estimate the human health and environmental problems that could result from the current physical and waste characteristics of the RdACB OU. The results of the assessments for all of the four subunits of the RdACB OU indicated that the concentrations of all the constituents analyzed were below USEPA RBCs and the calculated risks were below the USEPA target risk range of $1.0 \times 10^{-4}$ to $1.0 \times 10^{-6}$ (or HQs less than 0.1 for non-cancer constituents); hence, no refined HHCOCs are associated with any of the four RdACB OU subunits (exposure groups). (For an explanation of carcinogenic and noncarcinogenic risk values, refer to the Media Assessment Result section on page 38). Consequently, no health risks that warrant remedial action are posed by the RdACB OU soils and groundwater to current or future industrial workers or future residents at the unit. The RdACB OU is suitable for unrestricted use.

### Summary of Ecological Risk Assessment

The purpose of the ecological risk assessment component of the BRA is to evaluate the likelihood that adverse ecological effects may occur or are occurring as a result of exposure to unit-related constituents based on a lines-of-evidence approach. The ecological risk assessment has concluded that no final constituents of potential concern (COPCs) are associated with RdACB OU. Hence, no COCs or refined COCs are associated with the RdACB OU and, therefore, the unit does not pose an unacceptable risk to the ecological receptors.

**Risk Assessment Summary**

The risk assessments and contaminant fate and transport analysis establish that the risk associated with the RdACB OU is within the acceptable range of $1 \times 10^{-4}$ to $1 \times 10^{-6}$ so that the unit can support unrestricted land use. Additionally, it is concluded that no PTSM exists at the unit. No mobile or highly toxic materials are associated with the RdACB OU.

**Conclusion**

The RdACB OU poses no current or potential threat to human health or the environment based on unlimited exposures and unrestricted land use. Therefore, No Further Action is required.

## VIII. EXPLANATION OF SIGNIFICANT CHANGES

There were no significant changes made to this ROD since no comments were received during the public comment period for the SB/PP.

## IX. RESPONSIVENESS SUMMARY

Since no comments were received during the public comment period the Responsiveness Summary to address the comments is not provided.

## X. POST-ROD DOCUMENT SCHEDULE AND DESCRIPTION

No remedial action will be performed at the RdACB OU; therefore, a schedule for post-ROD cleanup activities is not provided.

## XI. REFERENCES

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