UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

4WD-FFB

DATE: September 8, 2003

SUBJECT: **2001 Remediation Effectiveness Report/CERCLA Five-Year Review** for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge Tennessee (DOE/OR/01-1941&D2/R1)

FROM: Jon D. Johnston, Chief, Federal Facilities Branch
Jay Bassett, Chief, KY/TN Federal Oversight Section, FFB

TO: Winston Smith, Director, Waste Management Division, R4

The Federal Facilities Branch requests your approval of the Five-Year Review of CERCLA actions taken at the Department Of Energy Oak Ridge Reservation NPL Site. As you know, the U.S. Department of Energy is given the authority, as the lead agency, for conducting Five-Year Reviews and EPA has a review and concurrence role. The 2001 **Remediation Effectiveness Report/CERCLA Five-Year Review**, issued March 2002, is the first Oak Ridge Reservation (ORR)-wide Five-Year Review. The Review includes all remedial actions where hazardous substances remain at levels that do not allow for unrestricted use. Attached to this memorandum is a list of the completed CERCLA actions and a map showing the locations of the completed and ongoing CERCLA actions.

Using EPA guidance in conjunction with statutory requirements, ORR evaluated 35 CERCLA actions using the following questions:

- Is the remedy functioning as intended by the decision documents?
- Are the assumptions used at the time of the remedy selection valid?
- Is there new information that would call into question the protectiveness of the remedy?

This evaluation included site visits for observing performance and reviewing monitoring data for compliance with performance requirements outlined in the decision documents. Based on this evaluation, the only CERCLA action that may need additional attention is the Lower East Fork Poplar Creek Remedial Action. Further evaluation of this remedy may be needed in the future due to changes in land use from agricultural to residential; however currently, the remedy remains protective.

10097783

As determined by the RER/Five-Year Review, the 35 completed or ongoing CERCLA action remain protective of human health and the environment. The FFB requests your signature on the attached letter of concurrence to DOE. If you have any questions, please contact me.

Attachment

(1) 5 Year Review Summary [List/Map]

(2) Letter of concurrence to DOE

Oak Ridge Reservation NPL Site
Oak Ridge, Tennessee
Five Year Review Sites

East Tennessee Technology Park (K-25)

1. K-1417 A/B Drum Storage Yard - Dewatering, containerization, transport and storage of treated waste
2. K-1070 C/D Operable Unit SW-31 Ponds - Collection and treatment of discharge from SW-31
3. K-1407 B/C Ponds - Soil cover, access controls, monitoring
4. K-1070 C/D - Mitchell Branch - Collection of groundwater and treatment at CNF
5. K-901-A Pond - Dewater pond, harvest of fish, removal of cylinders and treatment of contents
6. K-1401, K-1420 Sumps - Collection of contaminated groundwater and send to CNF
7. KAFAD Group 1 Buildings - D&D of 5 buildings down to slab, asphalt cover over 3 slabs
8. K-1007-P Pond - Dewater pond and harvest of fish

Bethel Valley (X-10)

1. Waste Area Grouping (WAG) 1 Corehole 8 - Removal of sludges from tanks
2&3. Liquid Low Level Waste Tank WC-14 (2 separate actions) - Removal of supernatant liquid and the removal of sludges, grout tanks
4. Waste Evaporator Facility - Dismantling of above ground facilities and removal of contaminated secondary sources
5. 3001 Canal - Grout canal to provide shielding and hydraulic control

Melton Valley (X-10)

1. White Oak Creek Embayment - Construction of a sediment retention structure to keep sediment from escaping into Clinch River
2. WAG 5 Seep C - Seep collection and treatment system
3. WAG 5 Seep D - Seep collection and treatment system
4. WAG 4 Seeps - Grout two primary sources
5. WAG 13 Cesium Plots - Removal of contaminated soils and monitoring
6. Old Hydrofracture Tanks - Sluice tanks with pressurized water and pump mixture to Melton Valley storage tanks

Bear Creek Valley (Y-12)

1. White Wing Scrapyard Debris - Removal of surface debris and monitoring
2. Spoil Area 1, SY-200 Yard - Physical barriers, deed restrictions, monitoring

Upper East Fork Poplar Creek (Y-12)

1. United Nuclear Corporation Disposal Site - Capping and monitoring
2. Mercury Tanks - Removal of mercury-containing sediments and water from 3 tanks
3. Plating Shop - No further action
4. Abandoned Nitric Acid Pipeline - No further action
5. Kerr Hollow Quarry - No further action (closed under RCRA)
6. Filled Coal Ash Pond - Improvements to existing dam, passive treatment of surface water, institutional controls
7. Building 9201-4 (Alpha 4) External Piping - Removal of contaminated piping
8. Union Valley - Institutional controls on groundwater
9. YS-860 Firing Range - Excavation, treatment and disposal of lead-contaminated soil
10. Building 81-10 and 9822 Sediment Basin - Removal of contaminated liquid and sediment, demolition and filling of basin and sump

Off-Site

1. Lower Watts Bar Reservoir - Institutional controls, fish consumption advisories, monitoring
2. ORAU South Campus Facility - No further action
3. Clinch River/Poplar Creek - Institutional controls, fish consumption advisories, monitoring
4. Lower East Fork Poplar Creek - Excavation of identified floodplain soils containing mercury, backfilling and revegatation, monitoring

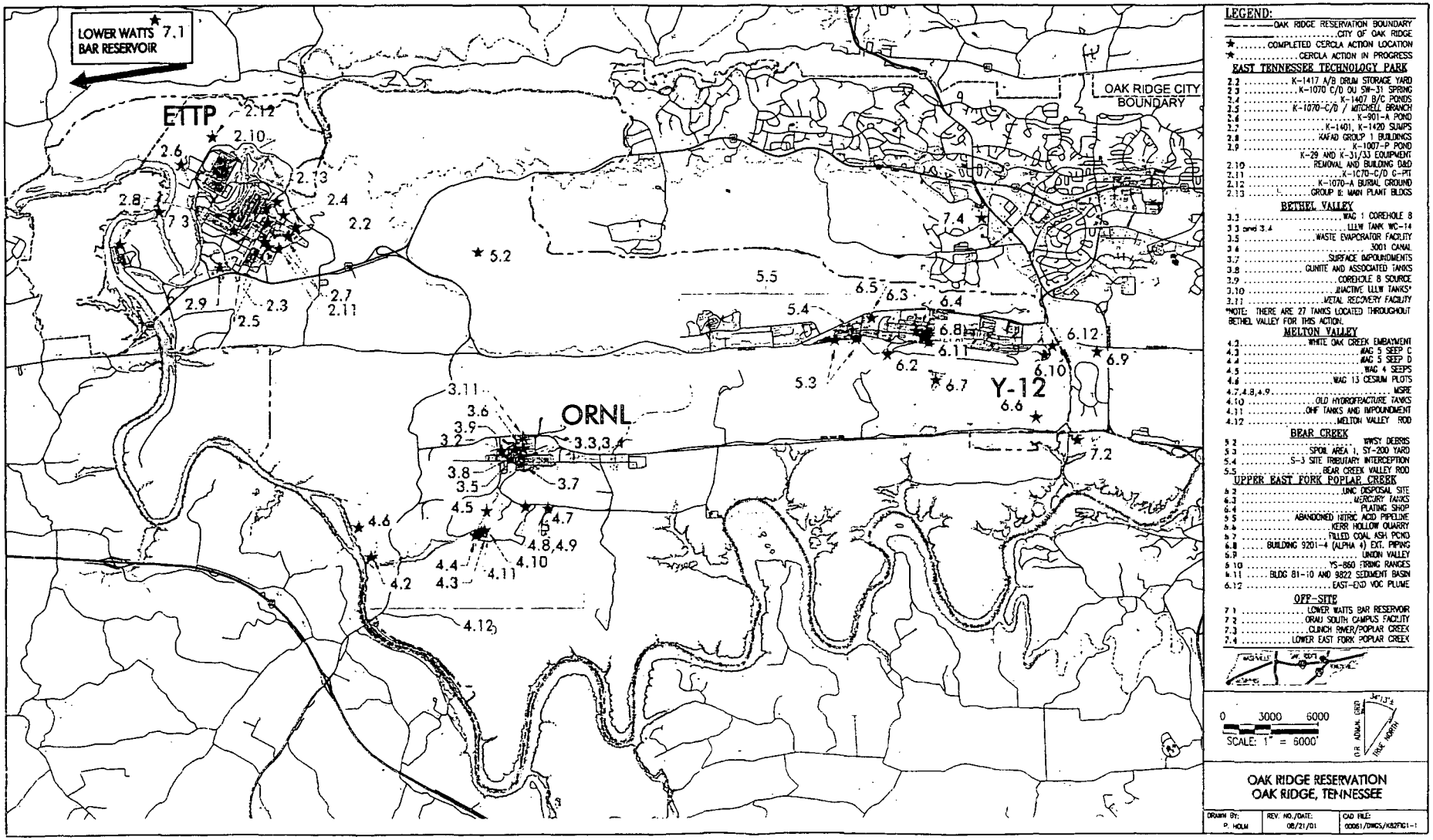

Fig. 1.1. Location of completed and in-progress CERCLA actions on the ORR.

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61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

SEP 2 5 2003

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

4WD-FFB

Mr. Steve McCraken
Assistant Manager
Environmental Management
U.S. Department of Energy
Oak Ridge Operations Office
P.O. Box 2001
Oak Ridge, Tennessee 37831

SUBJ: Five Year Review for U.S. Department of Energy Oak Ridge Reservation
Oak Ridge, Tennessee (DOE/OR/01-1941&D2/R1)

Dear Mr. McCraken:

The U.S. Environmental Protection Agency (EPA) has reviewed the Five Year Review document and concurs that the remedies selected for the thirty-five sites remain protective of human health and the environment. The remedies are supported by the previously completed CERCLA decision documents and by the review of the applicable or relevant and appropriate requirements (ARARs). If you have any questions concerning this letter, please contact Jay Bassett of my staff at 404.562.8559.

Sincerely,

Winston A. Smith
Director
Waste Management Division

cc: John Owsley, TDEC
Doug McCoy, TDEC
Dave Adler, DOE
Pat Halsey, DOE
SSAB
LOC

bcc: Lawrence Neville, 4EAD
Jeff Crane, ORR FFA Manager

DOE/OR/01-1941&D2/R1

2001 Remediation Effectiveness Report/CERCLA Five-Year Review for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge, Tennessee

Date Issued—March 2002

Prepared by
Science Applications International Corporation
Oak Ridge, Tennessee
under subcontract 23900-SC-YT014

Prepared for the
U S Department of Energy
Office of Environmental Management

BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
East Tennessee Technology Park
Y-12 National Security Complex Oak Ridge National Laboratory
Paducah Gaseous Diffusion Plant Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-98OR22700
for the
U S DEPARTMENT OF ENERGY

PROTECTIVENESS STATEMENT

The 2001 Remediation Effectiveness Report (RER) is the first Oak Ridge Reservation (ORR)-wide Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Five-Year Review. CERCLA requires a Five-Year Review of all remedial actions where hazardous substances, pollutants, or contaminants remain at the site at levels that do not allow for unlimited use and unrestricted exposure. Subsequent Five-Year Reviews are required as long as these conditions remain unabated.

This RER is based on CERCLA decisions made by the U.S. Department of Energy (DOE) and concurred with by the U.S. Environmental Protection Agency (EPA) and the Tennessee Department of Environment and Conservation and information resulting from those decisions. DOE evaluated 35 CERCLA actions at ORR for compliance with statutory requirements and EPA guidance. The following paragraphs describe how information was gathered to produce the RER.

DOE and contractors under its direction have completed environmental monitoring, data management, data interpretation, and reporting activities to support completion of a CERCLA Five-Year Review by DOE for 35 remedial actions completed on and in the immediate vicinity of ORR. Sample collection and analysis was completed in accordance with the *Integrated Water Quality Program Sampling and Analysis Plan for Fiscal Year 2000, Oak Ridge Reservation, Oak Ridge, Tennessee* (BJC/OR-363). Analytical data for samples were verified, validated, and managed in accordance with protocols documented in the *Data Management Implementation Plan for the Water Resources Restoration Program, Oak Ridge, Tennessee* (Draft BJC/OR-754). Interpretation and reporting of the monitoring data was completed following standard scientific principals and techniques and in accordance with EPA's *Comprehensive Five-Year Review Guidance* (EPA 540R-98-050, OSWER Directive 9355.7-03B-P, draft guidance dated 1999).

In reviewing the 35 CERCLA actions, DOE evaluated certain questions presented in EPA's Draft Five-Year Review Guidance. These questions focus on three areas:

- Is the remedy functioning as intended by the decision documents?
- Are the assumptions used at the time of the remedy selection valid?
- Is there new information that would call into question the protectiveness of the remedy?

In reviewing these issues, DOE evaluated whether the performance standards, as stated in the decision documents, had been met for each action. This evaluation included site visits for observing performance and reviewing monitoring data for compliance with performance requirements. DOE also reviewed the assumptions on which the CERCLA decision had been based as well as new information regarding land use that could call into question the protectiveness of the CERCLA action. These CERCLA actions were evaluated on a site-by-site basis and presented in the Five-Year Review. These evaluations indicate that either by active treatment and/or removal or by maintenance of land use controls, these CERCLA actions have contributed to increased protectiveness for human and ecological receptors. Based on this evaluation, the only CERCLA action that may need additional evaluation is the Lower East Fork Poplar Creek Remedial Action. Further evaluation may be warranted due to changes in land use from agricultural to residential along Lower East Fork Poplar Creek and new guidance issued by EPA.

G. Leah Dever
Manager

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ACRONYMS AND ABBREVIATIONS

AM	action memorandum
AOC	area of concern
ARAR	applicable or relevant and appropriate requirement
AWQC	Ambient Water Quality Criteria
BCBG	Bear Creek Burial Grounds
BCK	Bear Creek kilometer
BCV	Bear Creek Valley
bgs	below ground surface
BHC	benzene hexachloride
BJC	Bechtel Jacobs Company LLC
BMAP	Biological Monitoring and Abatement Program
BYBY	Boneyard/Burnyard
CA	cost analysis
CBC	charcoal bed cell
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLSM	controlled, low-strength material
CNF	Central Neutralization Facility
COC	contaminant of concern
C-Q	flow-versus-concentration
CR/PC	Clinch River/Poplar Creek
CRM	Clinch River mile
CY	calendar year
D&D	decontamination and decommissioning
DARA	disposal area remedial action
DCA	dichloroethane
DCE	dichloroethene
DCG	Derived Concentration Guide
DNAPL	dense, nonaqueous-phase liquid
DOE	U.S Department of Energy
ECU	excavation confirmation unit
EE	engineering evaluation
EFK	East Fork kilometer
EMD	Environmental Management Division
EPA	U S Environmental Protection Agency
EPT	Ephimeroptera, Plecoptera, and Trichoptera
ETTP	East Tennessee Technology Park
FCAP	Filled Coal Ash Pond
FFA	Federal Facility Agreement
FMSIT	Facilities Maintenance, Surveillance, Inspection, and Testing Services
FS	feasibility study
FY	fiscal year
GAAT	Gunite and Associated Tanks
gpd	gallons per day
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HFIR	High Flux Isotope Reactor
HQ	hazard quotient

HRE	Homogeneous Reactor Experiment
IP	integration point
IRIS	Integrated Risk Information System
IROD	interim record of decision
IWQP	Integrated Water Quality Program
LEFPC	Lower East Fork Poplar Creek
LLLW	liquid low-level (radioactive) waste
LWBR	Lower Watts Bar Reservoir
MCK	McCoy kilometer
MCL	maximum contaminant level
MDA	minimum detectable activity
MIK	Mitchell Branch kilometer
MRF	Metal Recovery Facility
msl	mean sea level
MSRE	Molten Salt Reactor Experiment
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
OEP	Office of Environmental Protection
OHF	Old Hydrofracture Facility
ORAU	Oak Ridge Associated Universities
ORNL	Oak Ridge National Laboratory
ORO	Oak Ridge Operations
ORR	Oak Ridge Reservation
OU	Operable Unit
PA	preliminary assessment
PAH	polyaromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PCM	Poplar Creek mile
PCR	postconstruction Report
PRG	preliminary remediation goal
PWSB	Process Waste Sludge Basin
RAO	remedial action objective
RAR	remedial action report
RAWP	remedial action work plan
RCRA	Resource Conservation and Recovery Act of 1976
RDWP	remedial design work plan
RER	Remediation Effectiveness Report
RfC	reference concentration
RfD	reference dose
RGO	remedial goal option
RI	remedial investigation
RMA	radiological management area
RmAR	removal action report
RmAWP	removal action work plan
RMPE	Reduction of Mercury in Plant Effluents
ROD	record of decision
SCF	South Campus Facility
SD	storm drain
SI	site investigation
S&M	surveillance and maintenance

SRS	sediment retention structure
SSAB	Site Specific Advisory Board
SVOC	semivolatile organic compound
SWSA	solid waste storage area
TC AM	time-critical action memorandum
TC RmA	time-critical removal action
TCA	trichloroethane
TCE	trichloroethene
TDEC	Tennessee Department of Environment and Conservation
TRM	Tennessee River mile
TRU	transuranic
TSCA	Toxic Substances Control Act of 1976
TVA	Tennessee Valley Authority
TWRA	Tennessee Wildlife Resources Agency
UEFPC	Upper East Fork Poplar Creek
UNC	United Nuclear Corporation
USACE	U S Army Corps of Engineers
VOC	volatile organic compound
WAC	waste acceptance criteria
WAG	Waste Area Grouping
WBIWG	Watts Bar Interagency Working Group
WMFS	Waste Management Federal Services
WOCE	White Oak Creek Embayment
WQP	Water Quality Program
WRRP	Water Resources Restoration Program
WWSY	White Wing Scrap Yard

EXECUTIVE SUMMARY

Under the requirements of the Oak Ridge Reservation (ORR) Federal Facility Agreement established between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency, and the Tennessee Department of Environment and Conservation in 1992, all environmental restoration activities will be performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Over the years, the environmental restoration program has experienced a gradual shift from characterization to remediation. As this occurred, it was determined that all CERCLA actions, as well as the associated assessment of each action's performance, are best understood and tracked within a single document. The Remediation Effectiveness Report (RER) is a Federal Facility Agreement document intended to collate all ORR CERCLA decision requirements, compare pre- and post-remediation conditions at CERCLA sites, and present the results of any required post-decision monitoring First issued in 1996, the RER is reissued annually to update the performance histories of completed actions and to add descriptions of new decisions.

This year, the RER is serving a very important second role. It is serving as the official Reservation-wide CERCLA Five-Year Review. The 35 completed actions on the ORR are evaluated according to the CERCLA Five-Year Review process. The 17 actions still "in progress" are not evaluated using the Five-Year Review criteria; rather, an update on the progress of each action is provided.

A variety of mechanisms has been used to document CERCLA decisions on the ORR. Typically, either a record of decision for remedial action or an action memorandum for removal action defines the selected remedy for a site. These instruments serve as the statutory decision document guiding the performance of site-remediation activities, and they may also specify long-term monitoring requirements. However, many decision documents lack post-action monitoring and stewardship requirements These details are usually found in Remedial Action Work Plans, Post-construction Reports, Remedial Action Reports, or Removal Action Reports prepared before or after field activities are completed

CERCLA decisions are grouped within this report according to the ORR administrative watersheds· East Tennessee Technology Park (ETTP), Bear Creek Valley and Upper East Fork Poplar Creek [the Y-12 National Security Complex (Y-12)]; Bethel Valley and Melton Valley [the Oak Ridge National Laboratory (ORNL)]; and Off-site Locations

This 2001 RER addresses a total of 52 CERCLA decisions Six new sites entered the RER this year:

- East Tennessee Technology Park K-1070-A Burial Ground Record of Decision,
- East Tennessee Technology Park Group II Main Plant Buildings Action Memorandum,
- Bethel Valley Metal Recovery Facility Action Memorandum,
- Melton Valley Old Hydrofracture Tanks and Impoundment Action Memorandum,
- Melton Valley Record of Decision for Interim Actions, and
- Bear Creek Valley Record of Decision for Phase 1 Activities.

This Five-Year Review is taking place 10 years after a time-critical removal action was initiated on the ORR to address releases of contaminated sediments from the White Oak Creek Embayment to the Clinch River Since then, the DOE has completed a total of 35 CERCLA actions, with 16 additional actions in progress. Of the 35 competed actions, 16 were initiated by Records of Decision and 19 were initiated as smaller-scale removal actions

The effectiveness of each of these actions has been evaluated on a site-by-site basis and presented in this Reservation-wide Five-Year Review. These evaluations indicate that, either by active treatment and/or removal, or by maintenance of land use controls, all have resulted in increased protectiveness to human and ecological receptors. In cases where the Five-Year Review has identified those changes that should be made on an action, recommendations are presented at the end of the individual site review.

In all, CERCLA actions on the ORR have been initiated to address the highest priority risk sites first. Most of the contamination on the ORR lies within DOE-controlled property to which the general public has no access. However, over time, contaminants migrated from the DOE areas to adjacent public areas Figure ES.1 shows the migration pathways for waterborne contaminants that originate at the three DOE facilities. CERCLA decisions have been implemented in all portions of the hydrologic regime depicted in Fig ES.1 that lie outside of the DOE-controlled area. Lower Watts Bar Reservoir, Clinch River/Poplar Creek, and Lower East Fork Poplar Creek. In addition, major actions occurred to reduce the most prominent releases to off-property areas· erection of a sediment retention structure at the White Oak Creek Embayment to stop releases of sediment-bound ^{137}Cs to the Clinch River, and various actions to reduce risk from releases to Lower East Fork Poplar Creek of mercury from past operations at Y-12

Next, actions occurred within the DOE property to address the major sources contributing to ongoing off-property releases. Examples of this include the two major source areas for releases of ^{90}Sr to the Clinch River: the Corehole 8 Plume action in Bethel Valley and the Seeps C and D treatment actions in Melton Valley. At the same time, DOE addressed sites near the DOE property boundary, even if these sites were found to have low risk potential, these include the K-1007 and K-901 Ponds at ETTP, the ^{137}Cs Burial Plots at ORNL, and volatile organic groundwater plumes in Union Valley.

In addition, over time, several source areas within the DOE-controlled area have been implemented to address (1) on-site worker protection (e.g., several building Decontamination and Decommissioning efforts), (2) operations logistics (e.g , the Abandoned Nitric Acid Pipeline in Upper East Fork Poplar Creek), (3) major sources with high potential for future risk (e.g., the Gunite Tanks in Bethel Valley), or (4) coincidence with Resource Conservation and Recovery Act efforts (e.g., Kerr Hollow Quarry in the Upper East Fork Poplar Creek administrative watershed)

New decisions on the ORR have been developed to address remediation by identifying watershed level goals and implementing an optimal combination of actions at various source areas within the watershed to achieve these goals These decisions have been deemed "Records of Decision for Interim Actions," primarily because of the uncertainties associated with implementing such large-scale decisions The first two watershed Records of Decision were signed in Fiscal Year 2000, for Bear Creek Valley and Melton Valley, and appear in the RER as actions in progress

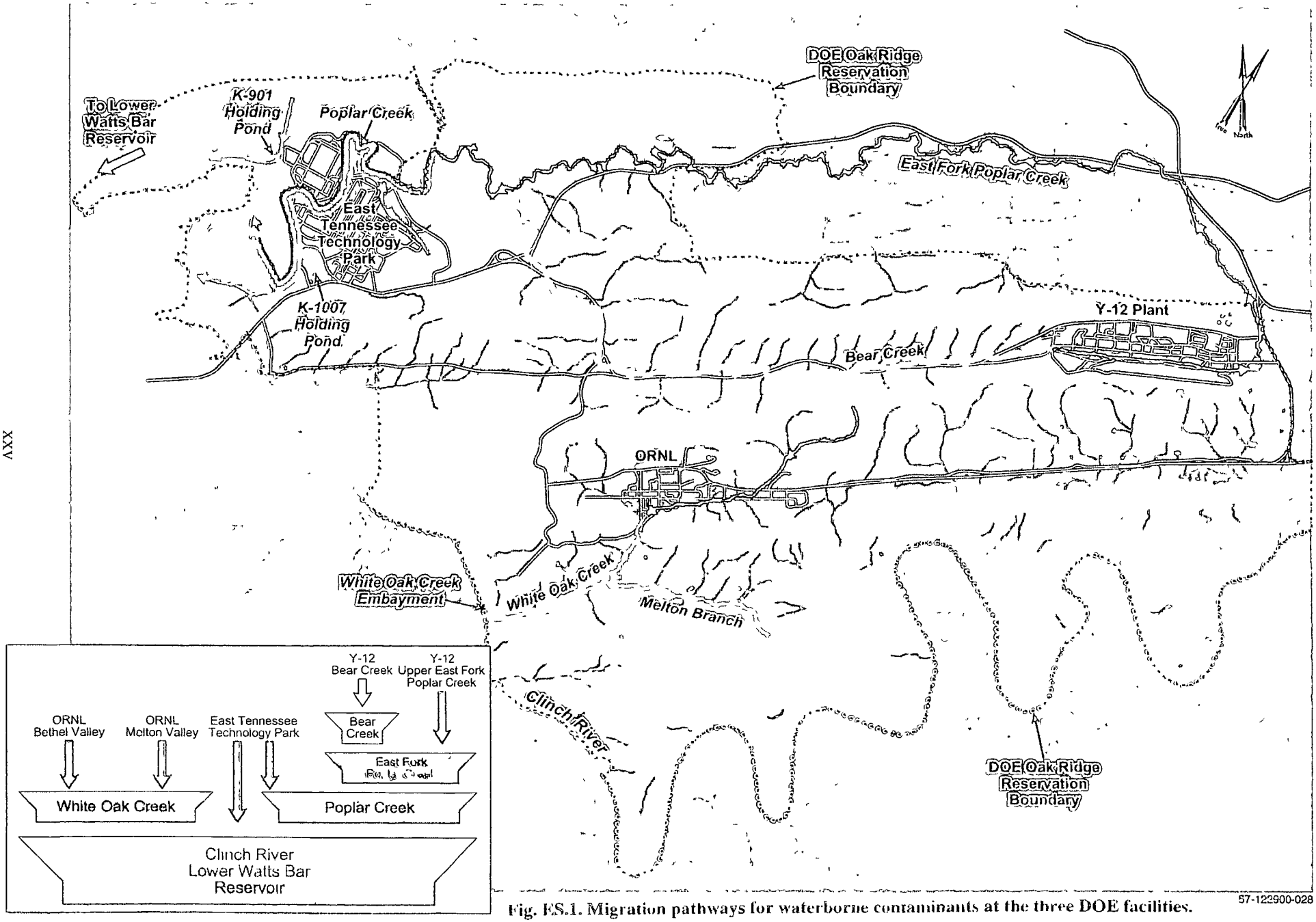

Fig. ES.1. Migration pathways for waterborne contaminants at the three DOE facilities.

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1. INTRODUCTION

1.1 OBJECTIVES OF THE REMEDIATION EFFECTIVENESS REPORT

Under the requirements of the Oak Ridge Reservation (ORR) Federal Facility Agreement (FFA) established between the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and the Tennessee Department of Environment and Conservation (TDEC) in 1992, all environmental restoration activities will be performed in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The Remediation Effectiveness Report (RER) is an FFA document intended to track post-decision monitoring requirements and compare pre- and post-remediation conditions at CERCLA sites. First issued in 1996, the RER is reissued annually to update the performance histories of completed actions and to add descriptions of new decisions and field activities.

This year, the RER is serving an additional role. The 2001 RER is also the first Reservation-wide CERCLA Five-Year Review. This report marks the first attempt to consolidate the five-year reviews of multiple CERCLA-decision sites at a large DOE facility. This effort has been conceptualized and designed with the aid of all FFA stakeholders, including the DOE, EPA, TDEC, and citizen groups overseeing the remediation efforts on the ORR.

This first consolidated Five-Year Review falls 10 years after the first CERCLA decisions were made on the ORR. a time-critical removal action at the White Oak Creek Embayment (see Sect 4 2) in November 1990, closely followed by the first CERCLA record of decision (ROD) at the United Nuclear Corporation Disposal Site on June 28, 1991 (see Sect. 6.2). Individual five-year reviews were performed for these sites in 1996 and 1997, respectively, and presented in the annual RERs In 1998-1999, planning began for moving toward a consolidated Five-Year Review instead of individual site reviews

Some CERCLA decision sites have actions that are still in progress; therefore, these sites are not included in the 2001 Five-Year Review. In addition, it is acknowledged that not all sites were scheduled for a review at this time. However, in order to move all sites into the same five-year cycle, all sites with completed actions are included in this Five-Year Review—even if those actions were completed within the last 1 or 2 years. A completed action is defined as an action having an approved Remedial (or Removal) Action Report (or similar report documenting completion of the action)

As in past RERs, there are several ongoing CERCLA actions on the ORR. These sites are addressed in this report with updates on the status of the action; however, they are not evaluated under the Five-Year Review requirements.

A variety of mechanisms has been used to document CERCLA decisions on the ORR. Typically, either a ROD for remedial action or an Action Memorandum (AM) for removal action defines the selected remedy for a site These instruments serve as the statutory decision documents guiding the performance of site remediation activities and may also specify long-term monitoring requirements; however, since most decision documents generally lack monitoring specifics, additional details are usually found in remedial action work plans (RAWPs), post-construction reports (PCRs), remedial action reports (RARs), or removal action reports (RmARs) prepared before or after field activities are completed For the purpose of the Five-Year Review, interim RODs (IRODs), RODs, and AMs are treated in the same manner, even though a Five-Year Review is not typically required of an AM.

Monitoring information used in this report in assessing the performance of completed CERCLA actions was collected and compiled under DOE's Water Resources Restoration Program (WRRP) The WRRP was established by DOE to implement a comprehensive and integrated environmental monitoring and assessment program for the DOE ORR and to minimize duplication of field, analytical, and reporting efforts The WRRP and associated site-specific Water Quality Program (WQPs) are successors to the Integrated Water Quality Program that was established in 1996 The DOE is under a regulatory requirement from the FFA to conduct post remedial action monitoring The FFA requires the evaluation and reporting annually on the effectiveness of completed remedial actions Specific monitoring requirements are typically included in the documents supporting RODs, AM, RARs, or RmARs Additional monitoring includes baseline water quality, pre-ROD monitoring to support watershed management decisions, and monitoring conducted to satisfy Post Closure Permit requirements for sites closed under the Resource Conservation and Recovery Act (RCRA)

There are WQPs for each of the three sites on the ORR the XWQP is responsible for monitoring activities within the Bethel Valley and Melton Valley administrative watersheds at the Oak Ridge National Laboratory (ORNL), the EWQP is responsible for monitoring at the East Tennessee Technology Park (ETTP), and the YWQP is responsible for monitoring within the Bear Creek Valley (BCV), and Upper East Fork Poplar Creek (UEFPC) administrative watersheds at the Y-12 National Security Complex (Y-12), and at selected non-ORR localities The WRRP provides a central administrative coordination and integration between the respective WQPs for the development and implementation of long-term monitoring strategies and plans to support future groundwater remediation decisions The WRRP reports monitoring results and interpretations on an integrated ORR-wide basis, manages environmental data collected by the three WQPs and data collected by other closely related ORR projects, and provides technical support and integration to promote consistency of level of detail and technical approach among the respective WQPs

In Fiscal Year (FY) 2000, the WRRP assumed responsibility for identifying, collecting, and compiling the performance assessment data required to determine if the stated remedial action goals for CERCLA actions on the ORR are being met Program objectives and details related to WRRP monitoring activities are presented in the annual WRRP Sampling and Analysis Plan The plan is issued near the beginning of each fiscal year and provides specific monitoring details (e g , specific sampling location, frequency of sampling, analytical parameters) that expand on the requirements issued in the decision documents, RAWPs, PCRs RARs, and RmARs WRRP monitoring information is used extensively in deriving the conclusions and formulating the recommendations presented in this report

The end of the past fiscal year (September 30, 2000) is the ending date for including data in the 2001 RER/Five-Year Review

1.2 STATUS OF CERCLA PROJECTS ON THE ORR

Updated information for ongoing CERCLA actions is presented in this report, and new information is also addressed for several additional CERCLA actions

- East Tennessee Technology Park—K-1070-A Burial Ground ROD,
- Group II Main Plant Buildings AM,
- Bethel Valley Metal Recovery Facility AM,
- Melton Valley Old Hydrofracture Tanks and Impoundment AM,
- Melton Valley ROD for Interim Actions, and
- Bear Creek Valley ROD for Phase 1 Activities

The CERCLA actions are mapped in Fig. 1.1, and a brief overview of selected remedies and performance or monitoring requirements for the sites is provided in Tables 1.1 and 1.2. The site numbers on Fig. 1.1 correspond to each site's section number within this report.

The CERCLA decision documents governing sites on the ORR are listed in the bibliography in Chap. 9. These include RODs, Time-Critical or nontime-critical Action Memoranda (TC AMs or AMs), IRODs, and notes from one governors' conference. Nomenclature has changed in some instances. For example, during 1997, the Oak Ridge K-25 Plant was renamed ETTP. The wording of the original CERCLA documents has been preserved as a guide to the remediation history of the ORR.

1.3 GOALS OF THE FIVE-YEAR REVIEW

Under the authority of CERCLA, the EPA is required to review remedial actions "that result in any hazardous substances, pollutants, or contaminants remaining at the site...to assure that human health and the environment are being protected by the remedial action being implemented" [CERCLA §121(c)]. Upon its review, the EPA may determine that additional action is appropriate Also under § 301(h)(1)(E), the EPA must report annually to Congress its progress in reducing the number of facilities subject to a Five-Year Review.

Five-year reviews are required at post-Superfund Amendments and Reauthorization Act (post-1986) sites which, upon attainment of the cleanup levels, still have hazardous substances remaining above levels that allow for unlimited use and unrestricted exposures.

Although not a requirement, it is EPA policy also to conduct five-year reviews under the following conditions

- Sites where remedial action allows unrestricted use upon completion, but attainment of cleanup goals will take longer than five years (including natural attenuation sites and sites requiring institutional controls to address risk).

- Removal sites where contaminants are left in place above levels that allow for unrestricted use, and where no further action will take place.

Five-year reviews are required at the ORR sites with final RODs allowing waste to remain in place above levels that allow for unrestricted use. Examples are the Y-12 National Security Complex (Y-12) Abandoned Nitric Acid Pipeline site (Sect. 6.5) and the Lower Watts Bar Reservoir and Clinch River/Poplar Creek Operable Units (Sects 7.1 and 7.3, respectively). However, many of the five-year reviews presented herein fall into a category of discretionary policy reviews, not required reviews.

As indicated in the guidance, the lead agency for a site has the primary responsibility for coordinating the Five-Year Review. In the case of the ORR, the DOE is the lead agency and the EPA has a review and concurrence role.

1.4 THE OAK RIDGE RESERVATION FIVE-YEAR REVIEW PROCESS

Planning for the 2001 Five-Year Review began in late 1999 during meetings that occurred between DOE, EPA Region IV, and TDEC. The initial meeting identified the desire to proceed with a single Five-Year Review for the entire ORR. This meeting was followed by individual meetings for each

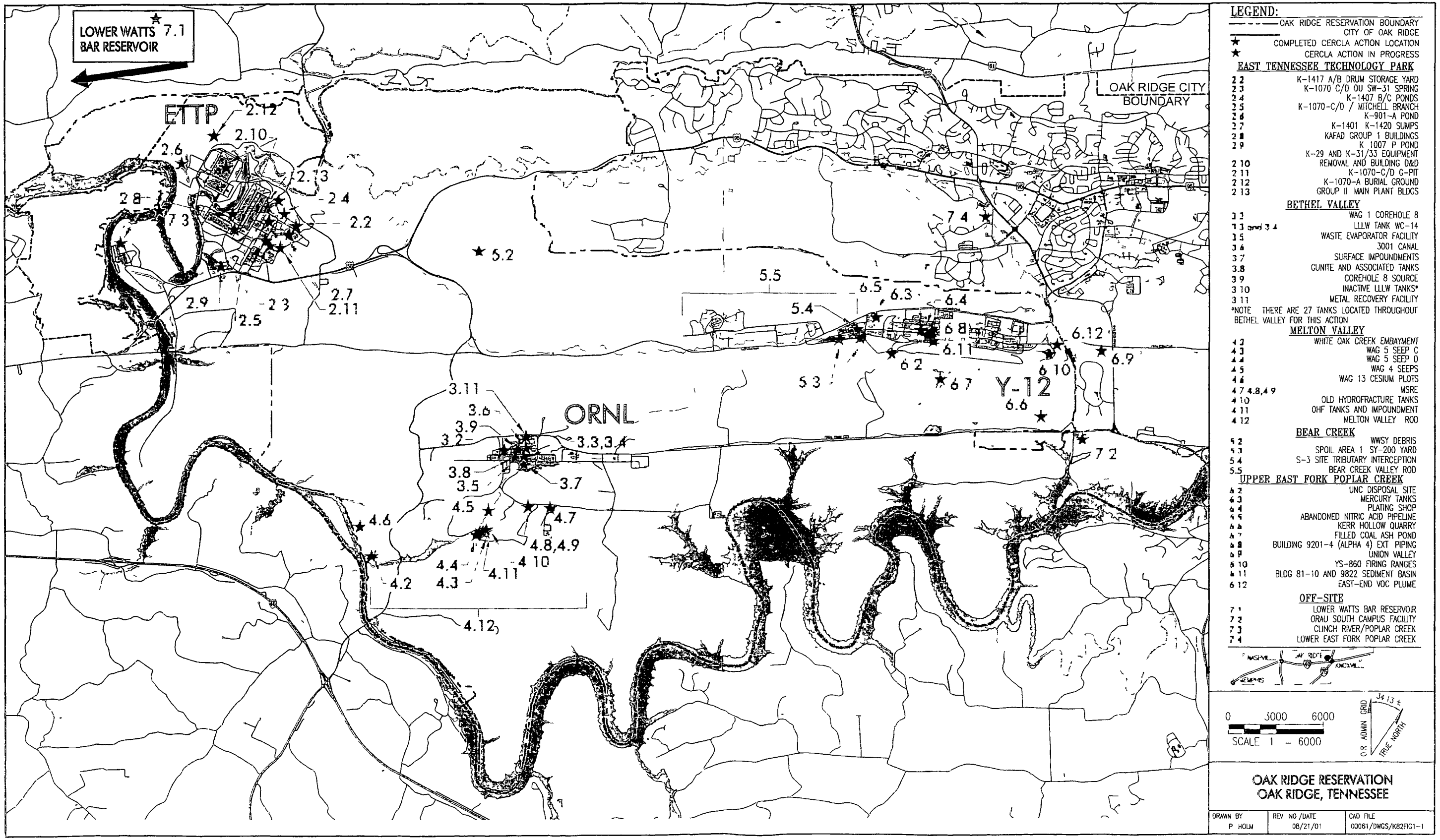

Fig. 1.1. Location of completed and in-progress CERCLA actions on the ORR.

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
			EAST TENNESSEE TECHNOLOGY PARK		
			Completed CERCLA Actions		
2 2	K-1417-A and K-1417-B Drum Storage Yards Interim Removal Action	Dewatering, containerization transport and storage of treated sludge	• Prevent release of contaminated sludge • Assure sludges are managed via IAW RCRA	None	Interim Record of Decision for the K-1417-A and K-1417-B Drum Storage Yards, DOE/OR/01-991
2 3	K-1070 Operable Unit SW-31 Spring Interim Remedial Action	• Collection and treatment of discharge from SW-31 • Treatment at the ETTP CNF and discharge under an existing NPDES permit	Eliminate pathway for potential exposure to contaminated SW-31 discharge	• Spring to be sampled several times per year to evaluate contaminant levels (VOCs and SVOCs) versus an established baseline • Physical inspection of SW-31 to verify seepage containment	Remedial Action/Effectiveness Report for the K-1070 Operable Unit SW-31 Spring, Phase 2 Remedial Action, DOE/OR/01-1520 & D1/R1
2 4	K-1407-B/C Ponds Remedial Action	• Placement of soil cover • Access controls • Surveillance and maintenance • Monitoring	Eliminate potential for exposure to residual contaminants in pond soils	See Table 1 2 • Periodic inspections • Radiological and Industrial Hygiene surveillance • Maintain access and activity controls	Remedial Action Report for the K-1407-B Holding Pond and the K-1407-C Retention Basin DOE/OR/01-1371&D1 Amended by EPA letter to DOE dated 08/03/95, and TDEC-DOE/O letter of 08/16/95
2 5	K-1070-C/D and Mitchell Branch Removal Action	• Collection of contaminated groundwater • Pipe to CNF for treatment and discharge	• Reduce VOC concentrations and other contaminants before discharge • Mitigate contaminant plume growth • Reduce contaminant flux from shallow groundwater into surface water	See Table 1 2 O&M of system by CNF	Removal Action Report on the Mitchell Branch and K-1070-C/D Removal Action DOE/OR/01-1728&D3

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Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR *(continued)*

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
2 6	K-901-A Pond Removal Action	• Dewater Pond • Harvest and disposal of fish • Removal of cylinders and debris • Treatment of cylinder contents • Disposal of cylinders and debris	• Eliminate potential for exposure to PCB-contaminated fish • Eliminate potential for exposure to hazards associated with cylinders containing hazardous chemicals	See Table 1 2	Removal Action Report for the K-901-A Holding Pond and the K-1007-P1 Pond Removal Action, DOE/OR/01-1767&D2
2 7	K-1401 and K-1420 Sumps Removal Action	• Collection of contaminated groundwater • Pipe to CNF for treatment and discharge	Prevent contaminated groundwater collected in the sumps from entering surface water	None	Action Memorandum for Rerouting of Sump Discharge from Bldgs K-1401 and K-1420, DOE/OR/02-1610&D1
2 8	K-25 Auxiliary Facilities Group I Building Demolition Removal Action	• Decontamination and demolition of five buildings to grade • Asphalt cover over three building slabs	• Reduce potential for exposure to radioactively contaminated dust, equipment, and building surfaces • Reduce potential for exposure to hazardous material	None	Removal Action Report for the K-25 Auxiliary Facilities Decommissioning Group I Building Demolition Project, DOE/OR/01-1829&D1
2 9	K-1007-P Ponds Removal Action	• Dewater Pond • Harvest and disposal of fish (pond was drained prior to remedy selection and remediation of sediments deferred to Site-wide ROD)	• Eliminate potential for exposure to PCB-contaminated fish	See Table 1 2	Removal Action Report for the K-901-A Holding Pond and the K-1007-P1 Pond Removal Action, DOE/OR/01-1767&D2
			CERCLA Actions in progress		
2 10	Equipment Removal and Building Decontamination K-29 K-31 and K-33	Equipment removal and building decontamination in K-29, K-31, and K-33	• Reduce potential for exposure to radioactively contaminated dust, equipment, and building surfaces • Reduce potential for exposure to hazardous material	To be established in RmAR	Action Memorandum for Equipment Removal and Building Decontamination for Bldgs K-29, K-31, and K-33, DOE/OR/02-1646&D1

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
2.11	K-1070-C/D G-Pit and Concrete Pad Remedial Action	• Excavation of waste materials • Treatment and disposal of wastes • Soil cover on concrete pad • Institutional controls • Surveillance and maintenance	• Prevent continued migration of contaminants from G-Pit • Provide shielding from contaminants at the Concrete Pad Area	To be established in RAR	Record of Decision for the K-1070-C/D Operable Unit, DOE/OR/01-1486&D4
2 12	K-1070-A Burial Ground	• Excavation of buried waste and associated soil • Segregation of unbreached containers and cylinders for special processing • Disposal of most or all excavated material in the ORR on-site disposal facility • Possible disposal of a small volume of waste at an off-site disposal facility • Characterization of subsurface soil subsequent to excavation to support future CERCLA decisions • Backfilling excavated areas with fill	Eliminate threat of future contaminant releases or contact with the waste through excavation of the wastes	To be established in RAR	Record of Decision for the K-1070-A Burial Ground, DOE/OR/01-1734&D3

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
2.13	EITP Auxiliary Facilities Demolition Project Group II Main Plant Buildings	• Characterization as needed to meet waste acceptance criteria and health and safety requirements • Decontamination in accordance with project specifications • Removal of equipment and piping • Demolition of structural and architectural components to slab • Appropriate deposition of all resultant materials	• Reduce the risk to human health and the environment from exposure to radiation and hazardous substances present in the buildings • Eliminate the potential for future contaminant releases from the buildings	None	Action Memorandum for the K-25 Auxiliary Facilities Demolition Project Main Plant Buildings, DOE/OR/01-1868&D2

Table 1 1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
			BETHEL VALLEY WATERSHED		
			Completed CERCLA Actions		
3 2	WAG 1 Corehole 8 Plume Removal Action	• Installation of french drain for interception of groundwater • Pumping to ORNL plant treatment system	20 to 50% reduction in ^{90}Sr discharge, as measured at First Creek weir	Corehole 8 sump, First Creek	Action Memorandum for the Waste Area Grouping 1 Corehole 8 Removal Action, DOE/OR/02-1317&D2
3 3	WAG 1 Tank WC-14 Time-Critical Removal Action–Liquid Removal	Removal of supernatant liquid	Lower the total volume of waste in the tank to a level that reduces the risk of exceeding the operational safety requirement limit	None, monitoring no longer required since tank has been grouted	Remedial Action Report for the Waste Area Grouping 1 Tank WC-14 Removal Action, DOE/OR/01-1397&D1
3 4	WAG 1 Tank WC-14 Time-Critical Removal Action–Sludge Removal	• Removal of sludge and liquids • Grouting of tank	Reduce the risk of contaminant release from tank sludge	None	Removal Action Report on Tank WC-14 at Waste Area Grouping 1, DOE/OR/01-1738&D2
3 5	Waste Evaporator Facility Removal Action	• Dismantle above-ground facilities • Removal of contaminated secondary sources	Eliminate potential contaminant releases from the deteriorating structure	None	Removal Action Report on the Waste Evaporator Facility, Bldg 3506, DOE/OR/01-1460&D1
3 6	Building 3001 Canal Removal Action	Grout canal to provide shielding and hydraulic control	• Seal leaks • Provide stable shielding for residual contamination	None	Action Memorandum for Building 3001 Canal, DOE/OR/02-1533&D2
			CERCLA Actions in progress		
3 7	Surface Impoundments Remedial Action	Removal, treatment and transport of contaminated sediments to an appropriate waste disposal facility	• Remove the source sediment contaminants • Prevent the continued migration of contaminants	• None (3539 and 3540) • To be established in the RAR (3524 and 3513)	Record of Decision for the Surface Impoundments Operable Unit DOE/OR/02-1630&D2

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
3 8	GAAT Sludge Removal Remedial Action	Removal of waste sludge from tanks	Remove and safely store contaminated sludge to prevent exposure before final treatment and disposal	To be established in RAR	Record of Decision for Interim Action Sludge Removal from the Gunite and Associated Tanks Operable Unit, DOE/OR/02-1591&D3
3 9	Corehole 8 Plume Source (Tank W-1A) Removal Action	Excavation and removal of Tank W-1A and surrounding contaminated soils	• Reduce contaminants entering First and White Oak creeks • Lower health and environmental risks associated with release of contaminants	To be established in RmAR	Action Memorandum for the Corehole 8 Plume Source (Tank W-1A) Removal Action, DOE/OR/01-1749&D1
3 10	Bethel Valley Inactive LLLW Tanks	• Removal of liquids and solids from tanks • Remove tanks or grout in place • Soil cover	Achieve and maintain risks at acceptable levels from release of, or exposure to, residual contamination associated with the tanks	To be established in RmAR	Action Memorandum for the Bethel Valley Main Plant Inactive LLLW Tanks, DOE/OR/01-1813&D1
3 11	Metal Recovery Facility (Bldg 3505) Demolition	• Decontamination and demolition of building	Reduce release of hazardous substances and hazards from deteriorating above-slab structure and residual contamination from slab and below-slab structure	To be established in RmAR	Action Memorandum for the Demolition of the Metal Recovery Facility, Bldg 3505 DOE/OR/01-1843&D1
			MELTON VALLEY WATERSHED		
			Completed CERCLA Actions		
4 2	White Oak Creek Embayment (White Oak Creek)	Construction of an SRS on the White Oak Creek	Minimize transport of sediment-bound contaminants to the Clinch River system	• Continuous water level monitoring at SRS • Sediment core sampling every 5 years • Inspection and maintenance of SRS	CERCLA Five-Year Review White Oak Creek Embayment Removal Action (included in 1997 RER, DOE/OR/01-1584&D2)
4 3	WAG 5 Seep C Collection and Treatment	Seep collection and treatment system	90% removal of ^{90}Sr from recovered seep water	See Table 1 2	Post-construction Report for Waste Area Grouping 5 Seeps Removal Action, DOE/OR/01-1334&D2

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
4 4	WAG 5 Seep D Collection and Treatment	Seep collection and treatment system	90% removal of ^{90}Sr from recovered seep water	See Table 1 2	Post-construction Report for Waste Area Grouping 5 Seeps Removal Action, DOE/OR/01-1334&D2
4 5	WAG 4 Seeps Removal Action	Grout two primary source trenches	Reduce ^{90}Sr by 35% within first 3 years, by 75% within 10 years	See Table 1 2	Removal Action Report on Waste Area Grouping 4 Seeps 4 and 6, DOE/OR/01-1544&D2
4 6	WAG 13 Cesium Plots Interim Remedial Action	• Removal and containerization of contaminated soil • Surveillance and maintenance	Reduce human health and environmental risk resulting from elevated levels of gamma radiation	None	Interim Remedial Action Postconstruction Report for Waste Area Grouping 13, Cesium Plots, DOE/OR/01-1218&D2
4 7	MSRE D&D (Reactive Gas) Time-Critical Removal Action	Removal of reactive gases from off-gas system	Prevent the accidental release of radioactive and toxic materials	None	Removal Action Report on the MSRE Time-Critical Removal Action, DOE/OR/01-1623&D2
4 10	Old Hydrofracture Facility Tank Contents Removal Action	Sluice tanks with pressurized water and pump mixture to Melton Valley Storage Tanks	Reduce risk to human health or the environment that could result from a leak or spill of tank contents	None	Removal Action Report for the Contents Removal of the Old Hydrofracture Facility Tanks, DOE/OR/01-1759&D1
			CERCLA Actions in progress		
4 8	MSRE D&D (Fuel Salt) Interim Action	Removal of fuel and flush salts from MSRE drain tanks	• Eliminate the risk of a criticality incident • Eliminate hazards associated with UF_6 and F_2 gas release	To be established in RAR	Record of Decision for Interim Action to Remove Fuel and Flush Salts from the MSRE Facility, DOE/OR/02-1671&D2

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
4.9	MSRE D&D (Uranium Deposit) Removal Action	Removal of uranium deposits and carbon-fluorine compounds from the auxiliary charcoal bed	• Reduce the amount of fissile uranium to less than critical mass • Reduce risk from uranium release to a level within the EPA target risk range	To be established in RmAR	Action Memorandum for Uranium Deposit Removal at the MSRE, DOE/OR/02-1488&D2
4.11	Old Hydrofracture Tanks and Impoundment Removal Action	Grout tanks and impoundment, Process Waste Sludge Basin and T-4 Waste Cells	Enhance the mitigation of contaminant release to the environment	To be established in RmAR	Action Memorandum for Old Hydrofracture Tanks and Impoundment DOE/OR/01-1751&D3; Addendum DOE/OR/01-1866&D22
4 12	Melton Valley ROD for Interim Actions	See selected remedy by subproject (below)	See goals by subproject (below)	Specific monitoring/stewardship goals will be established during remedial design	Record of Decision for Interim Actions for the Melton Valley Watershed DOE/OR/01-1826&D3
4.12 1	Waste Management Area (includes SWSAs 4, 5, 6, and Seepage Pits and Trenches)	Removal, hydraulic isolation, grouting, in situ vitrification, capping	• Manage waste disposal sites as restricted waste management area • Project maintenance workers • Meet AWQC in surface water in reasonable amount of time • Mitigate further impact to groundwater	Specific monitoring/stewardship goals will be established during remedial design	Record of Decision for Interim Actions for the Melton Valley Watershed DOE/OR/01-1826&D3
4 12 2	Industrial Use Area (generally area east of SWSA 5)	D&D, removals	• Manage areas generally east of SWSA 5 as an industrial area • Protect industrial workers • Meet AWQC in surface water in reasonable amount of time • Mitigate further impact to groundwater	Specific monitoring/stewardship goals will be established during remedial design	Record of Decision for Interim Actions for the Melton Valley Watershed DOE/OR/01-1826&D3

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
4 12 3	Surface Water and Floodplain Area	Removal of contaminated floodplain soils	• Achieve numeric and narrative AWQC for water of state in reasonable amount of time • Remediate contaminated floodplain soils to 2500 μR/h • Protect off-site resident user of surface water at confluence of White Oak Creek and Clinch River from contaminant sources in Melton Valley to 10^{-4} to 10^{-6} excess lifetime cancer risk and HI of 1 • Make progress toward meeting Clinch River's stream use classification as drinking water source at confluence of White Oak Creek and Clinch River	Specific monitoring/stewardship goals will be established during remedial design	Record of Decision for Interim Actions for the Melton Valley Watershed DOE/OR/01-1826&D3
			BEAR CREEK WATERSHED		
			Completed CERCLA Actions		
5 2	White Wing Scrap Yard (WAG 11) Surface Debris Remedial Action	• Removal of surface debris • Surveillance and maintenance	• Eliminate source of further environmental contamination • Reduce difficulty and expense of S&M activities and future characterization	None, S&M of access controls and surface cover	Interim Record of Decision for Waste Area Grouping 11, Surface Debris, DOE/OR-1055&D4

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
5 3	Spoil Area 1 and SY-200 Yard (Bear Creek Valley OU 2) Remedial Action	• Physical barriers (fences, gates, and signs) • Deed restrictions • Surveillance and maintenance	• Restrict access and use • Maintain integrity of surface cover and site features	None; S&M of access controls and surface cover	Record of Decision for Bear Creek Valley Operable Unit 2 (Spoil Area 1 and SY-200 Yard), DOE/OR/02-1435&D2
			CERCLA Actions in Progress		
5 4	S-3 Site Tributary Interception	Install a reactive barrier to collect and in situ treat uranium-contaminated groundwater	Reduce flux of uranium in Bear Creek that is associated with discharge from shallow groundwater	See Table 1.2; S&M requirements TBD	Removal Action Report for the Bear Creek Valley Interception Trenches for the S-3 Uranium Plume, Pathways 1 and 2, DOE/OR/01-1836&D1
5 5	Bear Creek Valley Phase I ROD	See selected remedy by subproject (below)	See performance goals by subproject (below)	See Table 1 2	Record of Decision for Phase I Activities in Bear Creek Valley, DOE/OR/01-1750&D4
5 5 1	S-3 Site	Install trench at NT-1 for passive in situ treatment of shallow groundwater	Achieve surface water standards: Uranium flux: 27.2 kg/year Cadmium: 3.9 µg/L Nitrates: 40% seasonal reduction	See Table 1.2	Record of Decision for Phase I Activities in Bear Creek Valley, DOE/OR/01-1750&D4
5 5 2	Oil Landfarm Area	Excavation, removals, capping, and hydraulic isolation	Achieve surface water standards: Uranium flux 4 3 kg/year Mercury: 51 ng/L	See Table 1 2	Record of Decision for Phase I Activities in Bear Creek Valley, DOE/OR/01-1750&D4

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
5.5 3	Other Sites	Remove waste from DARA facility, dismantle structure	Achieve surface water standards: Cadmium. 3.9 µg/L Mercury: 51 ng/L Uranium flux: 34 kg/year Nitrates: 40% seasonal reduction	See Table 1.2	Record of Decision for Phase I Activities in Bear Creek Valley, DOE/OR/01-1750&D4
			UEFPC WATERSHED		
			Completed CERCLA Actions		
6 2	United Nuclear Corporation Disposal Site Remedial Action	• Capping of UNC Disposal Site • Surveillance and maintenance of the cap	• Eliminate direct exposure to waste • Minimize leaching of contaminants to groundwater • Ensure concentrations of contaminants of concern do not exceed safe drinking water standards	See Table 1.2, semi-annual inspection of cap; routine maintenance	Post-construction Report for the United Nuclear Corporation Disposal Site, DOE/OR/01-1128&D1
6 3	Mercury Tanks Interim Action	Removal of mercury-containing sediments and water from three tanks	Reduce the amount of mercury-contaminated sediment entering the storm sewer system	None, monitoring no longer required following tank removal	Post-construction Report for the Mercury Tanks Interim Action, DOE/OR/01-1169&D1
6 4	Plating Shop Container Areas Remedial Action	No Further Action	Protect human health and the environment from risks associated with exposure to contaminated subsurface soils	None	Record of Decision for the Y-12 Plating Shop Container Areas, DOE/OR-1049&D3

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
6.5	Abandoned Nitric Acid Pipeline (UEFPC OU 2) Remedial Action	No Further Action	Ensure no excess risk to human health or ecological receptors from exposure to contaminated soils surrounding the ANAP	None	Record of Decision for the UEFPC Operable Unit 2 (Abandoned Nitric Acid Pipeline), DOE/OR/02-1265&D2
6.6	Kerr Hollow Quarry Remedial Action	No Further Action (site closed under RCRA)	• Prevent physical exposure to contaminants • Mitigate further migration of contaminants from Kerr Hollow Quarry to groundwater or surface water	See Table 1.2	Record of Decision for Kerr Hollow Quarry, DOE/OR/02-1398&D2
6 7	Filled Coal Ash Pond Remedial Action	• Improvements to existing dam • Passive treatment of surface water • Institutional controls	Prevent future release of coal ash slurry to the Upper McCoy Branch Watershed	Defers determination of monitoring requirements to IWQP; see Table 1 2; quarterly inspection and regulated maintenance	IWQP Sampling and Analysis Plan for FY 1999 and FY 2000, Oak Ridge Reservation, Oak Ridge Tennessee, BJC/OR-147 and BJC/OR-363
6.8	Building 9201-4 (Alpha 4) Exterior Process Piping Removal Action	Removal of contaminated piping	Reduce potential for mercury release	None	Action Memorandum for Bldg. 9201-4, Exterior Process Piping Removal, DOE/OR/02-1571&D2
6 9	UEFPC Union Valley Interim Action	Institutional controls related to groundwater use	Prevent activities with the potential to increase rate of contaminant migration or extent of contaminant plume; prevent exposure	Annual property owner notification and title searches	Record of Decision for an Interim Action for Union Valley, UEFPC CA, DOE/OR/02-1545&D2

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
6 10	Lead Source Removal at Former YS-860 Firing Ranges Removal Action	Excavation, treatment and disposal of lead-contaminated soil	Achieve a risk-based cleanup standard for lead in soil for protection of children under recreational scenario	None (deferred to UEFPC Watershed ROD)	Action Memorandum for Lead Source Removal at the Former YS-860 Firing Ranges, DOE/OR/02-1622&D2
6 11	Y-12 Plant 9822 Sediment Basin and Bldg 81-10 Sump Removal Action	• Removal of contaminated liquid and sediment • Demolition and filling of basin and sump	• Prevent recontamination of basin and building sump • Prevent future release of contaminants to UEFPC	None (deferred to UEFPC Watershed ROD)	Removal Action Report for the 9822 Sediment Basin and Building 81-10 Sump at the Oak Ridge Y-12 Plant, Oak Ridge, Tennessee, DOE/OR/01-1763&D1
			CERCLA Actions in progress		
6 12	Y-12 Plant East End VOC Plume Removal Action	• Extract contaminated groundwater from GW-845 • Treat water to reduce VOC concentrations • Discharge treated groundwater into UEFPC upstream of Station 17	Mitigate future releases at the Y-12 Plant boundary by containing the VOC plume that is migrating off-site	See Table 1 2	Action Memorandum for the Oak Ridge Y-12 Plant East End Volatile Organic Compound Plume, DOE/OR/01-1819&D2
			Off-site		
			Completed CERCLA Actions		
7 1	Lower Watts Bar Reservoir Remedial Action	• Institutional controls • Fish consumption advisories • Annual monitoring	Ensure that potential risk continues below that calculated in the LWBR RI/FS baseline risk assessment	See Table 1 2, participation in Interagency Working Group	Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River/Poplar Creek Operable Units, DOE/OR/01-1820&D2
7 2	ORAU South Campus Facility Remedial Action	No Further Action	Monitor for continued degradation of TCL	See Table 1 2	Remedial Action Report for Post-Record of Decision for Oak Ridge Associated Universities South Campus Facility, DOE/OR/02-1474&D1

Table 1.1. Summary of selected remedies and monitoring and stewardship requirements on the ORR (continued)

RER sect.	Site/project	Summary of selected remedy	Summary of performance goals	Monitoring/stewardship requirements[a]	Reference for monitoring/stewardship requirements
7 3	Clinch River/Poplar Creek Remedial Action	• Institutional controls • Fish consumption advisories • Annual monitoring	• Monitor physical and chemical characteristics that impact potential health risks • Monitor effectiveness of fish advisories • Track irrigation practices	See Table 1 2, participation in Interagency Working Group, survey of effectiveness of advisories	Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River/Poplar Creek Operable Units, DOE/OR/01-1820&D2
7 4	Lower East Fork Poplar Creek Remedial Action	• Excavation of identified floodplain soils containing mercury • Confirmatory sampling • Backfilling and revegetating • Monitoring	• Annual survey to track changes in depositional patterns • Continue collection and evaluation of mercury data	• Surface water sampling (continuous flow-proportional sampling of total mercury at Station 17) • Land use survey • Stream channel survey • Wetlands survey • Bioaccumulation monitoring	Remedial Action Report on the Lower East Fork Poplar Creek Project, DOE/OR/01-1680&D3

[a]While all units with residual contamination require documentation information retention and occasional surveillance at least until a more thorough stabilization is complete this column lists additional monitoring/stewardship requirements that have been explicitly stated in the decision documents

ANAP = Abandoned Nitric Acid Pipeline
CA = characterization area
CERCLA = Comprehensive Environmental Response Compensation and Liability Act of 1980
CNF = Central Neutralization Facility
D&D = decontamination and decommissioning
DARA = disposal area remedial action
DOE = U S Department of Energy
EPA = U S Environmental Protection Agency
ETTP = East Tennessee Technology Park
FS = feasibility study
FY = fiscal year
GAAT = Gunite and Associated Tanks
IAW = in accordance with
IWQP = Integrated Water Quality Program
LLLW = liquid low-level (radioactive) waste
LWBR = Lower Watts Bar Reservoir
MSRE = Molten Salt Reactor Experiment
NPDES = National Pollutant Discharge Elimination System
O&M = operation and maintenance
ORAU = Oak Ridge Associated Universities
ORNL = Oak Ridge National Laboratory
ORR = Oak Ridge Reservation
OU = operable unit
PCB = polychlorinated biphenyl
RAR = remedial action report
RCRA = Resource Conservation and Recovery Act of 1976
RER = Remediation Effectiveness Report
RI = remedial investigation
RmAR = removal action report
ROD = record of decision
S&M = surveillance and maintenance
SRS = sediment retention structure
SVOC = semivolatile organic compound
SWSA = solid waste storage area
TBD = to be determined
TCE = trichloroethene
TDEC DOE/O = Tennessee Department of Conservation Department of Energy Oversight Division
UEFPC = Upper East Fork Poplar Creek
UNC = United Nuclear Corporation
VOC = volatile organic compound
WAG = waste area grouping

Table 1.2. Summary of monitoring stations and analyses on the ORR

RER sect.	Site/project	Monitoring stations	Analyses
2 4	K-1407-B/C Ponds Remedial Action	UNW-3, UNW-9, MIK 0.39, semi-annual monitoring	Nitrate, field parameters, metals (arsenic, barium, cadmium, iron, lead, manganese, mercury, selenium, and sodium) and radiochemical parameters (gross alpha, gross beta, ^{137}Cs, ^{90}Sr, ^{99}Tc, ^{230}Th, ^{232}Th, ^{234}U, and ^{238}U)
2.5	K-1070-C/D and Mitchell Branch Removal Action	K-1070-C/D: BRW-086, TMW-008, TMW-011, UNW-110, UNW-111, UNW-114, DP-8, DP-18, DP-19 UNP-002, TMW-007, TMW-009, TMW-012, TS-004, TS-005, K-1070 trench piezometers, semi-annual sampling and water level measurements	Water level, VOCs
		K-1070 trench effluent, semi-annual sampling	VOCs, PCBs, metals, mercury, gross alpha, gross beta, ^{99}Tc, isotopic uranium
		Mitchell Branch: K-1700 weir, SD-160, SD-170, UNP-004, UNP-005, UNW-068, SD-180, SD-190, DPZA-003, DPZA-006, DPZA-010, DPZA-012, DPZA-014, DPZA-057, UNW-004, UNW-008, UNW-095, DPZA-008, DPZA-026, semi-annual sampling and water level measurements	Water level, VOCs
		Mitchell Branch trench effluent, semi-annual sampling	Water flow, alkalinity, VOCs, PCBs, metals, mercury, gross alpha, gross beta, ^{99}Tc, isotopic uranium
		Mitchell Branch RI #210, Mitchell Branch west of liner, Mitchell Branch east of railroad, Mitchell Branch at SD-210	VOCs

Table 1.2. Summary of monitoring stations and analyses on the ORR (continued)

RER sect.	Site/project	Monitoring stations	Analyses
2 6	K-901 Pond Removal Action	Required: annual sampling of fish and caged clams	Biological monitoring (PCB bioaccumulation in bass, shad, and clams)
		Additional: (not required under RmAR) SD-700, SD-710, K-901 weir annual sampling	TSS, TDS, turbidity, water quality, flow, PCBs and metals
		BRW-35, BRW-68, UNW-66, UNW-67, semiannual sampling	VOCs, isotopic uranium, ^{99}Tc, water quality, water levels
2 9	K-1007-P Ponds Removal Action	Required: annual sampling of fish and caged clams	Biological monitoring
		Additional· (not required under RmAR) SD-100, SD-480/490, K-1007-B weir, semiannual, and annual sampling	VOCs, PCBs, metals, gross beta, TSS, TDS, turbidity, water quality
		UNW-070, UNW-071, UNW-072, UNW-125–annual and semiannual sampling	VOCs, metals, water quality, water levels
4.3	WAG 5 Seep C Collection and Treatment	Monthly flow composite sampling of influent and effluent (SPC1, SPC0)	^{90}Sr
		Monthly grab sampling at MB weir and MB-5	^{90}Sr
4 4	WAG 5 Seep D Collection and Treatment	Monthly flow composite sampling of influent and effluent (SPD1, SPD0)	^{90}Sr
		Monthly grab sampling at MB weir and MB-1	^{90}Sr
4 5	WAG 4 Seeps Removal Action	Monthly grab sampling of W4T4, SCS4, W4T6, SCS6	^{90}Sr and tritium
		Monthly flow composite sampling at WAG 4-MS1	^{90}Sr and tritium

Table 1.2. Summary of monitoring stations and analyses on the ORR (continued)

RER sect.	Site/project	Monitoring stations	Analyses
5.4	S-3 Site Tributary Interception	Pathway 1–wells: TPB32, EU4, EU4, WU2, WD2, quarterly • iron monitoring at sampling point within or immediately downgradient of iron filings (location to be determined after completion of system alterations in FY 2001)	ICP metals, nitrate, total uranium, uranium isotopes, VOCs, Fe^{+2}, water quality, sulfate, chloride, fluoride, bicarbonate, water levels
		Pathway 2–wells: GW-835, EW01, TMW02, Siphon well, TPB08, quarterly • iron monitoring at North Box, South Box	ICP metals, nitrate, total uranium, uranium isotopes, VOCs, Fe^{+2}, water quality, sulfate, chloride, fluoride, bicarbonate, water levels
		• Surface water· Bear Creek Valley 12.47 and Bear Creek Valley 12.34, weekly composite and monthly grab	Continuous flow monitoring with flow-paced sampling to produce a weekly composite sample to be analyzed for ICP metals, nitrate, total uranium, uranium isotopes. Monthly grab samples to be analyzed for sulfate, chloride, fluoride, bicarbonate, nitrate, gross alpha, gross beta, ^{99}Tc, VOCs, and water quality
5.5	Bear Creek Valley Phase I ROD		
	S-3 Site Pathway 3	Refer to Table 5.11	
	S-3 Site Pathway 3	Surface water at NT-1 and BCK 12.34 Biota monitoring at BCK 12.4	Semi-annual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc. Fish community and benthic macroinvertebrate community species diversity and density
	S-3 Site Pathway 3	Surface water at NT-1 and BCK 12.34.	Semi-annual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc.
	S-3 Site Pathway 3	Refer to Table 5.11	

Table 1.2. Summary of monitoring stations and analyses on the ORR (continued)

RER sect.	Site/project	Monitoring stations	Analyses
	Boneyard/ Burnyard	Refer to Table 5.11	
	Boneyard/ Burnyard	Surface water at NT-3	Semi-annual grab samples for metals, anions, VOCs, isotopic uranium, and ^{99}Tc.
	Groundwater	Groundwater at Picket B wells (GW-704 and GW-706) and surface water at SS-4	Semi-annual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc.
6.2	United Nuclear Corporation Disposal Site Remedial Action	Although not specified in the PCR, the following wells are currently monitored semiannually: 1090, GW-339, GW-302, GW-221, GW-203, GW-205	Nitrate, $^{89/90}Sr$, gross alpha, gross beta, metals, mercury, alkalinity, chloride, fluoride, sulfate, nitrate, water quality
6.6	Kerr Hollow Quarry Remedial Action	Outfall 301, semi-annual monitoring	NPDES surface water criteria in accordance with best management practice
		Groundwater monitoring (wells and analyses not specified in ROD) at GW-142, GW-143, GW-144, GW-145, GW-231, semi-annual monitoring	Parameters per RCRA post-closure permit TNHW-88: cadmium, chromium, lead, mercury, nickel, total uranium, gross alpha, gross beta, carbon tetrachloride, PCE, chloroform
6.7	Filled Coal Ash Pond Remedial Action	Surface water: MCK 2.05, MCK 2.0, Rogers Quarry, semiannual monitoring	Metals, anions, radiological constituents, water quality
		Biota: MCK 1.4, MCK 1.9, Rogers Quarry	Biological monitoring
6.12	Y-12 National Security Complex East End VOC Plume Removal Action	Groundwater wells GW-845, GW-722, GW-170, GW-169, GW-232, effluent from treatment system, quarterly sampling	VOCs, metals, nitrates, uranium
		Emissions from the air stripper, quarterly monitoring (more frequently if organics are detected in influent water from GW-845)	Total organics and radionuclides

Table 1.2. Summary of monitoring stations and analyses on the ORR (continued)

RER sect.	Site/project	Monitoring stations	Analyses
7.1	Lower Watts Bar Reservoir	Surface water: TRM 570–572, TRM 551–556, TRM 530–532, annually, alternate fall and spring	Surface water–isotopic uranium, total mercury, TAL metals, hydrolab profile · Surface water particulate–PCB/pesticide, radionuclides, total metals
		Sediment : TRM 570–572, TRM 551–556, TRM 543–548, TRM 530–532, annually	Total metals, total mercury, ^{137}Cs
		Fish: TRM 570–572, TRM 551–556, TRM 530–532 (catfish and large mouth bass), annually, alternate fall and spring	PCB/pesticide, total mercury, ^{137}Cs, total lipid
		TRM 530–532 (striped bass), winter only	PCB/pesticide, total mercury, ^{137}Cs, total lipid
7.2	ORAU South Campus Facility	Groundwater wells MW-19, MW-43a, MW-43b, MW-43c, sampled every 2 years	TCE
		Surface water sample from ditch ~ 55 m downgradient from MW-43 well cluster	TCE

Table 1.2. Summary of monitoring stations and analyses on the ORR (continued)

RER sect.	Site/project	Monitoring stations	Analyses
7.3	Clinch River/Poplar Creek Remedial Action	Surface water: CRM 23.4–24.7, White Oak Lake, White Oak Creek, CRM 19.7–20.7, CRM 18–18.7, CRM 14–15, K-1007-P1 Pond, PCM 1, PCM 3, K-901 Pond, CRM 10.5–12, CRM 6–7, CRM 0.5–1.5, annually, alternate fall and spring	Surface water–isotopic uranium, total mercury, TAL metals, hydrolab profile Surface water particulate–PCB/pesticide, radionuclides, total metals
		Sediment: CRM 44.5–45.5, CRM 35.8, CRM 23.4–24.7, White Oak Lake, White Oak Creek, CRM 19.7–20.7, CRM 18–18.7, CRM 14–15, K-1007-P1 Pond, PCM 1, PCM 3, PCM 5.5, K-901 Pond, CRM 10.5–12, CRM 6–7, CRM 0.5–1.5, annually	Total metals, total mercury, ^{137}Cs
		Fish: CRM 23.4–24.7, White Oak Lake, White Oak Creek, CRM 19.7–20.7, CRM 18–18.7, CRM 14–15, K-1007-P1 Pond, PCM 1, PCM 3, K-901 Pond, CRM 10.5–12, CRM 6–7, CRM 0.5–1.5 (catfish and large mouth bass), annually, alternate fall and spring	PCB/pesticide, total mercury, ^{137}Cs, total lipid
		Bull Run Steam Plant effluent, Kingston Steam Plant effluent (striped bass), winter only	PCB/pesticide, total mercury, ^{137}Cs, total lipid
		Turtles: CRM 23.4–24.7, CRM 19.7–20.7, CRM 18–18.7, CRM 6–7, CRM 0.5–1.5, every 5 years in August	PCB/pesticide, total mercury, ^{137}Cs, total lipid

BCK = Bear Creek kilometer
CRM = Clinch River mile
ICP = inductively coupled plasmic
MB = Melton Branch
MCK = McCoy kilometer
NPDES = National Pollutant Discharge Elimination System
NT = North Tributary
ORAU = Oak Ridge Associated Universities
ORR = Oak Ridge Reservation
PCB = polychlorinated biphenyl
PCE = tetrachloroethene
PCM = Poplar Creek mile
PCR = postconstruction report
RCRA = Resource Conservation and Recovery Act of 1976
RER = Remediation Effectiveness Report
RmAR = removal action report
ROD = record of decision
TAL = Target Analyte List
TCE = trichloroethene
TDS = total dissolved solids
TRM = Tennessee River mile
TSS = total suspended solids
VOC = volatile organic compound
WAG = waste area grouping

watershed to identify the monitoring requirements for FY 2000, the time period for collecting data for the 2001 Five-Year Review. In general, regulators identified that, prior to watershed-scale RODs being completed, CERCLA monitoring should be limited to those monitoring activities identified in the CERCLA documents or those monitoring activities that all FFA parties agree support CERCLA decision making on the ORR. An exception was minimal watershed-scale monitoring to be able to evaluate the cumulative impact of implemented actions. These watershed-scale monitoring locations were identified primarily as surface water and groundwater integration points and exit points in each watershed

In the summer of 2000, more detailed planning began to take place to design the first Five-Year Review, including identifying Five-Year Review statutory requirements and regulatory guidance, participating in dialogue with the regulators and stakeholders to obtain input on the process, and developing for regulatory review a draft outline and draft example text and methods.

The outcome of these planning efforts is summarized here:

1. A Five-Year Review will take place at any individual CERCLA action site where the remedial action has been completed or, for sites with ongoing treatment units, where the installation of the treatment unit has been completed. "Completion" is defined by having a Remedial Action Report or similar documentation completed prior to September 30, 2000. One exception to this is the first of three related actions at the Molten Salt Reactor Experiment site. One action has been completed and the remaining two are ongoing; identifying monitoring requirements for the completed action has been postponed until the completion of the related actions. The Five-Year Review for this site will take place upon completion of all three actions. Sites such as the Upper East Fork Poplar Creek (UEFPC) East End VOC Plume pump-and-treat action are not included as full Five-Year Review sites since the action was being finished up at the end of FY 2000 and no documentation has been developed describing completion of the action.

2. Each Five-Year review site will undergo review using two primary tools: (a) a quantitative evaluation of post-action monitoring data at sites where monitoring was required, to identify the effectiveness of the action, and (b) a site visit and site inspection to document land use controls, system operations, and stewardship activities.

3. The requirements of the EPA Five-Year review guidance will be addressed as systematically as possible using a table developed that addresses each of the Five-Year Review questions identified by EPA. This table is presented as Table 1.3.. It has been filled out for each individual Five-Year Review site and is presented within the appropriate section.

4. Site visits and inspections were performed for each site and have been documented on forms developed specifically for this activity. These forms are provided in Appendix A. The forms were completed by the WRRP project team members performing the site visits, and they were reviewed and signed by the WRRP watershed lead and the Bechtel Jacobs Company LLC (BJC) Facility Manager (or designated personnel).

Where possible, quantitative monitoring data have been used to determine if the CERCLA action has been effective. Many decisions did not specify monitoring and, thus, there are no data to perform a quantitative evaluation. Of the 35 sites that are undergoing a Five-Year Review, only 19 have monitoring data that can be used to determine effectiveness.

Some of the questions on Table 1.3 required the WRRP staff to develop a consistent "general approach" to addressing the question. This pertains primarily to issues of land use. Many of the decisions

Table 1.3. Five-Year Review summary[a]

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)		
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?		
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?		
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?		
Are operating procedures, as implemented, maintaining the effectiveness of response actions?		
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?		
Have there been any changes in land use or expected land use on or near the site?		
Have new human health or ecological exposure pathways or receptors been identified?		
Have new contaminants or contaminant sources been identified?		
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?		
Have there been any changes in the physical site conditions?		
Have there been any changes in the toxicity factors for contaminants of concern?		
Were there significant changes in the standardized risk assessment methodologies?		
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?		
Is the site located in an area subject to natural disasters?		

[a]Questions designed by DOE/EPA/TDEC based on EPA 2000 draft Five-Year Review guidance
ARAR = applicable or relevant and appropriate requirement
DOE = U S Department of Energy
EPA = U S Environmental Protection Agency
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation

did not include clear stewardship requirements, even though it is assumed that continued DOE control of lands was implied in the decision In this case, the WRRP staff have documented that, although there were no specific land use controls in the decision, the land remains in the DOE control areas

Theoretically, sites that were addressed as removal actions, as opposed to ROD-driven remedial actions, would not undergo a Five-Year Review Of the 35 decisions addressed in this Five-Year Review, 20 were removal actions. Given the nature of many of these removal actions, it is important that protectiveness be addressed in the Five-Year Review until such time as a remedial decision is made to address the remaining risk. Limitations of including these sites in the Five-Year Review include the following

- No action-specific quantitative risk assessment was performed for many of these sites, so a specific risk driver was not identified, thus, the action cannot be reviewed against a specific risk driver [e g , Waste Area Grouping (WAG) 5 Seep C in Melton Valley]

- The decision document did not always identify the applicable or relevant and appropriate requirements (ARARs) (e g., White Oak Creek Embayment in Melton Valley)

- Stewardship requirements were not identified (e g , K-1417-A/B at ETTP), plus many others

- The removal action often was performed as a temporary action, with the realization that additional action(s) would address the long-term risk issues (e g , WAG 5 Seeps)

DOE is including these sites in the Five-Year Review in order to take a comprehensive accounting of all efforts to date and evaluate to the extent possible the cumulative impact of those efforts until such time as a remedial decision is made to address the remaining risk

1.5 NOTES ABOUT THE FIVE-YEAR REVIEW

The Five-Year Review evaluations have been performed individually for each decision made on the ORR using relatively new guidance developed by EPA (EPA 1999a) Each site was systematically evaluated using the requirements of the guidance and following the precise goals and requirements written into the decision The Five-Year Review guidance has been developed 10 years after the first ORR decision Over that 10 years there has been much refinement in how CERCLA is applied across the country, and particularly in how it has been applied to the ORR Many of the early decision documents do not contain all of the aspects of more recent CERCLA decision documents (e g , clear stewardship requirements) and many of the removal actions do not clearly identify a precise chemical-specific risk driver for the action Thus, some Five-Year Review questions cannot be answered for some sites A good example of this is the Y-12 9822 Sediment Basin Action, for which no risk assessment was performed, or the ETTP 1401 and 1420 Sumps Removal Action, for which no quantitative performance goals were identified

1.6 ORGANIZATION OF THE REPORT

CERCLA actions are grouped within this report according to the ORR administrative watersheds (Fig 1 2) The ETTP is treated as a single watershed The Oak Ridge National Laboratory (ORNL) is administratively divided into the Bethel Valley watershed and the Melton Valley watershed, both of which are drained by White Oak Creek Y-12 is divided into two administrative watersheds, Bear Creek Valley and UEFPC, including Chestnut Ridge Completed CERCLA actions at off-site locations are

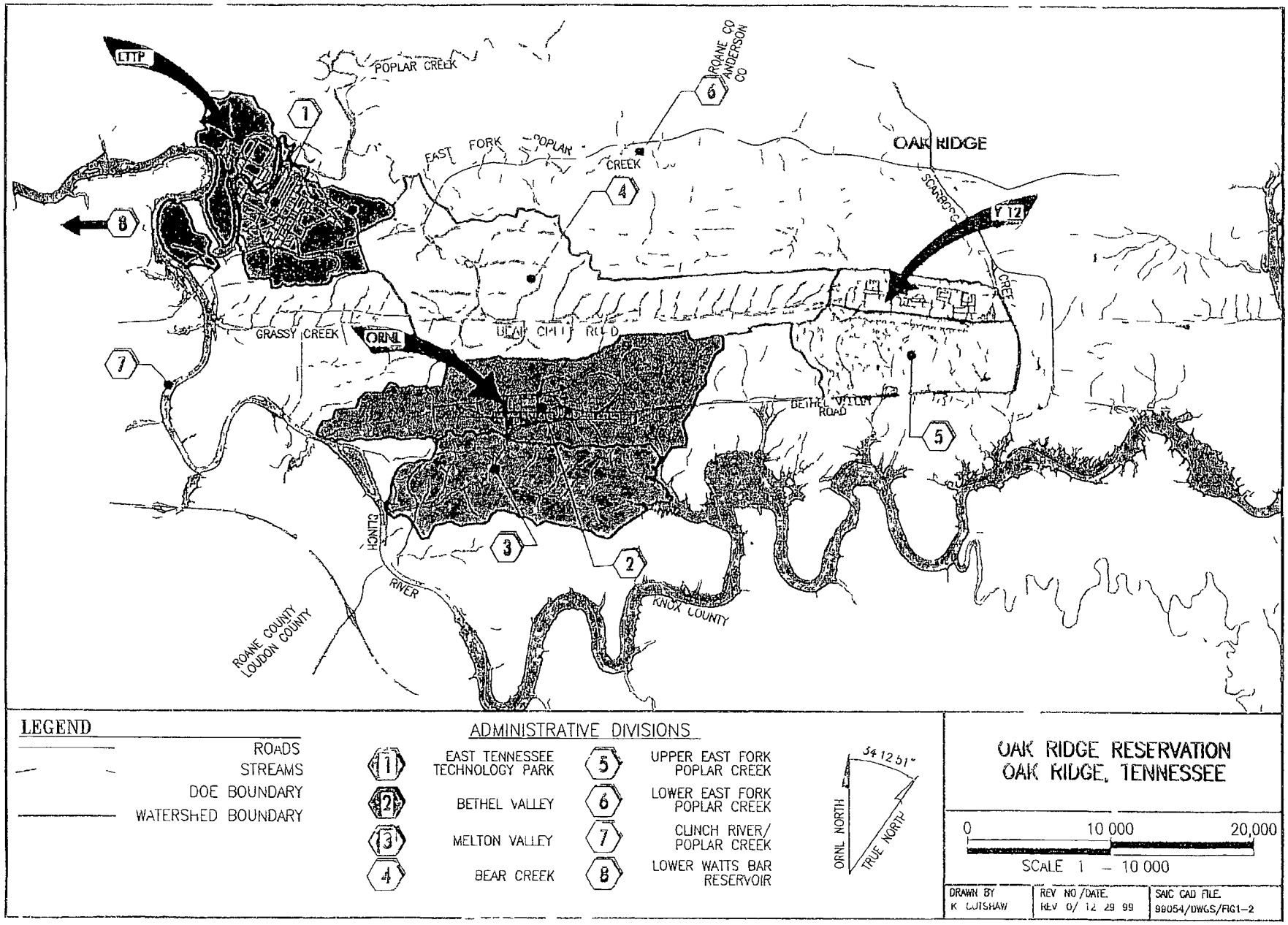


Fig 1 2 Administrative divisions in the ORR

addressed as a separate group The administrative divisions will not change within this report from year to year, even as the report grows to include new items, allowing easier tracking from year to year

At the beginning of each watershed section, a table provides a summary of each CERCLA decision to date and identifies which sites are evaluated under the Five-Year Review requirements As indicated in each table, actions that are still in progress are not evaluated as Five-Year Review sites

New watershed summary sections were added last year to the 2000 RER in preparation for this 2001 Five-Year Review These sections also provide the backdrop to review the effectiveness of individual actions on a watershed scale, and over time, on an ORR scale It will become more and more important to measure the cumulative impact of many actions taken within a single watershed both to determine the ultimate uses of the land and resources in each watershed and to determine when and if watershed-scale remediation goals have been achieved at agreed-to points of compliance The watershed sections track the ongoing conditions at critical watershed integration points and exit pathway locations (locations where contamination could leave the watershed), and will serve as the historical record of conditions prior to upcoming and future actions This will allow the impact of those actions to be more effectively measured in the next Reservation-wide Five-Year Review in 2006

2. CERCLA ACTIONS AT ETTP

This chapter presents the history of ETTP CERCLA actions. The actions are summarized in Table 2 1, and the location of each action is shown in Fig 2 1 The table indicates which actions are completed and are undergoing a Five-Year Review, and which actions are ongoing Of the completed actions, no monitoring is required at the Drum Storage Yards, the K-1401 and K-1420 Sumps, or the

Table 2.1. CERCLA actions at ETTP

CERCLA action	CERCLA areas	Decision document date signed	Action status	Monitoring required
		Five-Year Review sites		
K-1417-A/B Drum Storage Yards	K-1417 Drum Storage Yard	ROD September 19 1991	Remedial action complete	No
K 1070-C/D SW-31 Spring	SW-31 Spring	ROD September 30 1992	Remedial action complete, seep collection and treatment in progress	Yes
K-1407-B/C Ponds	K 1407-B/C Holding Pond	ROD September 30 1993	Remedial action complete post-remedial action groundwater monitoring in progress, also closed under RCRA	Yes
K-1070 C/D and Mitchell Branch Removal Action	K 1070-C/D Classified Burial Ground, K-1414 Garage, K 1070-B Old Classified Burial Ground, K-1700 Stream (Mitchell Branch), K-1413	AM August 25, 1997	Removal action complete, D2 Removal Action Report submitted December 1998	Yes
K 901-A Pond Removal Action	K 901 A Holding Pond, K 895 Cylinder Destruct Facility	AM September 15 1997	Removal action complete	Yes
K 1401 and K-1420 Sumps Removal Action	Building K-1401 Sumps, Building K-1420 Sumps	AM August 18 1997	Removal action complete	No
K 25 Auxiliary Facilities Group I Building Demolition (KAFaD)	Buildings K 1031 K-1131, K-1410, K-724, and K 725	AM January 17 1997	Removal action complete	No
K-1007 P Ponds Removal Action	K-1007-P Ponds	AM September 15, 1997	Removal action complete	Yes
		Actions in progress		
K-29, K-31, and K-33 Equipment Removal and Building Decontamination	Buildings K 29, K-31, and K-33	AM September 30, 1997	Removal action in progress	To be determined
K-1070-C/D G-Pit and Concrete Pad Removal Action	K-1070 C/D	ROD January 1998	Removal action in progress	To be determined
K-1070-A Burial Ground	K-1070-A	ROD January 2000	Removal action in progress	To be determined
K-25 Auxiliary Facilities Group II Building Demolition Main Plant Building	Buildings K-1300, K-1301, K-1302, K-1303, K-1405, K-11407, and K-1413	AM August 2000	Removal action in progress	To be determined

AM = action memorandum
RCRA = Resource Conservation and Recovery Act of 1976
ROD = record of decision

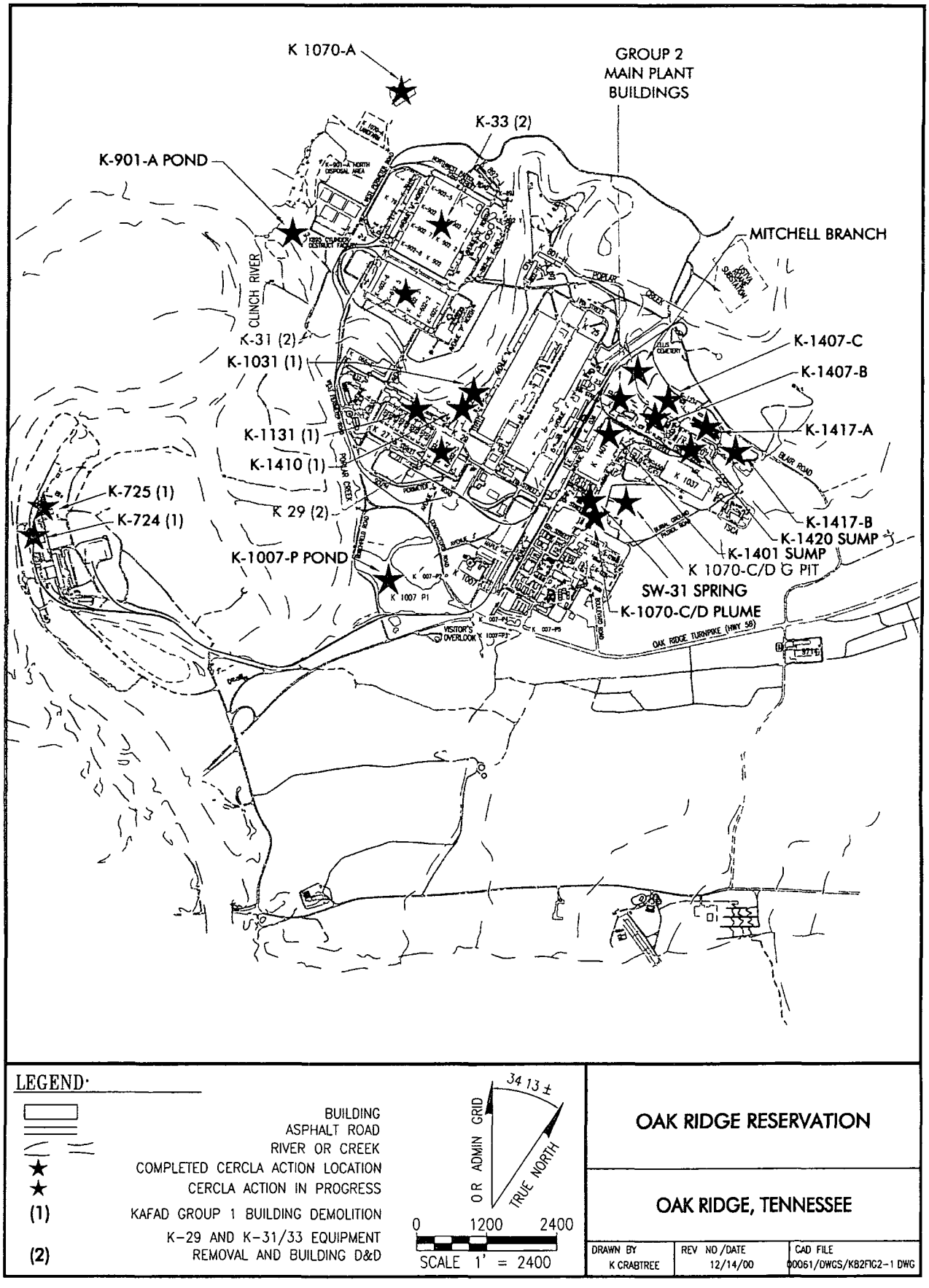


Fig. 2.1. ETTP RER site map.

K-25 Group I Buildings. [Although monitoring of the SW-31 spring discharge is specified in the Remedial Action Report, this monitoring is conducted as part of normal operations for the ETTP Central Neutralization Facility (CNF) and is not conducted under CERCLA.] Four years of monitoring results for the K-1407-B/C Ponds are available for analysis. Monitoring for the K-1070-C/D and Mitchell Branch Removal Action and the K-901-A and K-1007-P Ponds was initiated in 1999. History highlights, a project description, a local-scale map, evaluation of the decision document requirements for performance, and evaluation of additional available data judged pertinent are provided for each completed action. Also described briefly are ongoing actions at K-29, K-31, and K-33 Equipment Removal and Building Decontamination; K-1070-C/D G-Pit Remedial Action, K-1070-A Remedial Action; and the Group II Main Plant Buildings Demolition

DOE has determined that the remedies already implemented within the ETTP Watershed remain protective of public health and the environment in the context of the scope and objectives of each action

2.1 WATERSHED OVERVIEW

Although composed of several individual subwatersheds, ETTP is administratively considered a single watershed for the purposes of this report. However, the diversity of the hydrogeology and physical features across the ETTP, and the ubiquitous nature of potential exit pathways, influence the strategy for monitoring water quality and documenting remedial effectiveness from one subwatershed to another

2.1.1 ETTP Watershed Conceptual Model

The ETTP watershed encompasses approximately 1700 acres in the northwestern corner of the ORR The developed portions of the site lie in East Fork Valley between Blackoak Ridge to the north, Pine Ridge to the southeast, and the smaller McKinney Ridge to the northeast The Clinch River bounds the ETTP on the southwest, and Poplar Creek bisects the main plant area.

The rate and direction of water flow in both surface water and groundwater are transient and vary based on rainfall, upstream and downstream dam operations, and seasonal conditions Groundwater flow and occurrence at ETTP are influenced by the complex geology, past cut-and-fill, transient interactions with bounding surface water bodies, and numerous anthropogenic features including building sumps, leaking subsurface drains and utilities, and extensive areas of impermeable pavement or buildings (Fig 2.2) The water table usually occurs in the unconsolidated zone, where flowpaths to surface water bodies are typically short, mimicking local topography The Clinch River likely serves as the ultimate discharge point for groundwater because it generally truncates the unconsolidated zone flowpaths, intersects strike-parallel bedrock flowpaths, and represents the lowest hydraulic head in the valley

Groundwater may discharge into the river system through diffuse discharge via the unconsolidated zone, via discrete springs, and via seep and spring discharge to surface water bodies that flow into the Clinch River, including K-901 Pond, K-1007 Ponds, and Mitchell Branch/Poplar Creek However, there has been little success at ETTP in identifying a complete water flow path between the major water areas and the surface water bodies that flow to the Clinch River.

Based on the FFA, 112 areas of concern (AOCs) were evaluated in the sitewide Remedial Investigation (RI) for the ETTP Detailed discussions of the contaminants and their distribution at each AOC can be found in the RI report (DOE 1999k) Waste/contaminant sources at the ETTP can generally be placed in the following categories

- surface structures, including buildings and aboveground process piping,
- subsurface structures, including underground tanks, pits, vaults, and below-grade building structures,

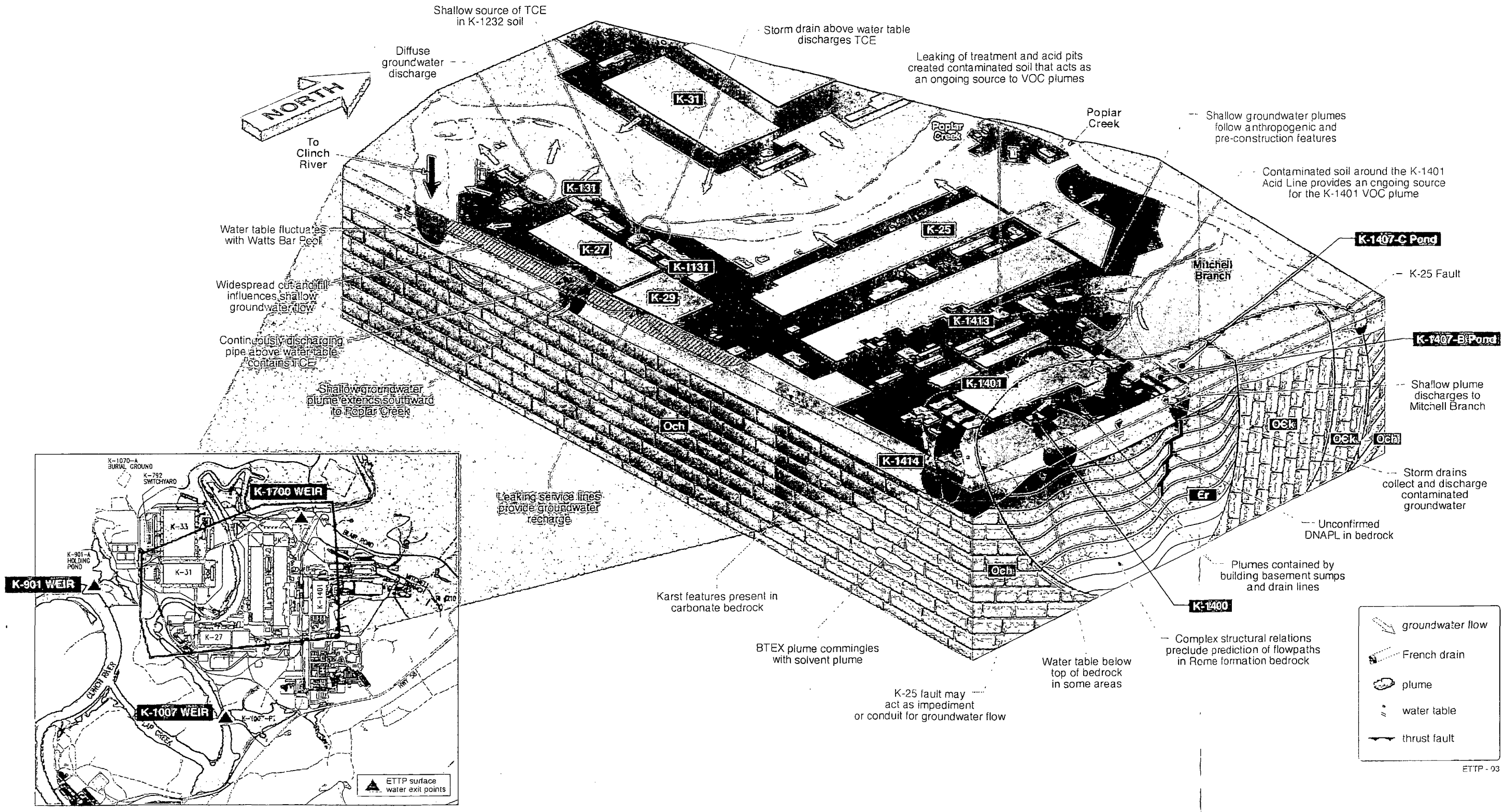


Fig. 2.2. Conceptual model of groundwater flow and contaminant transport at ETTP.

- subsurface infrastructure, including storm drain networks, buried process pipelines, and utility lines,
- scrap metal piles;
- buried waste,
- contaminated soils,
- surface water, including seeps and springs and submerged sediment, and
- groundwater

With few exceptions, primary contaminant sources originate in the vadose (unsaturated) zone in the unconsolidated materials at the ETTP. Thus, water in the unconsolidated zone is typically the first to be impacted Soluble constituents dissolve into groundwater in the unconsolidated zone, creating a groundwater plume. Commingling of these groundwater contaminant plumes has occurred in some parts of the ETTP, particularly in the Mitchell Branch area where the stream serves as a discharge zone for shallow groundwater flowing beneath numerous potential source areas in the northeastern portion of the site The primary contaminants of concern in groundwater are volatile organic compounds (VOCs). The VOC trichloroethene (TCE) is generally the most prevalent compound and serves as a fairly reliable indicator of the extent of groundwater contamination Free-phase, dense, nonaqueous-phase liquids (DNAPLs) have not been observed at the ETTP; however, some wells exhibit VOC concentrations that exceed 1% of their effective solubility limits, suggesting the possibility of DNAPL occurrence at the site. Light, nonaqueous-phase liquids, associated with past releases of fuels, have been detected in one well in the K-1070-C/D area

The primary contaminants found in sediments at ETTP are inorganic elements, radionuclides, and polychlorinated biphenyls (PCBs). The K-1007-P1 Pond probably contains the highest concentrations of PCBs at the site, with PCBs also present in sediment in the K-901 Pond and in storm drain outfalls at the K-792 Switchyard, Mitchell Branch, and the Powerhouse area (Fig 2.3). The analytical results for sediment samples collected during FY 2000 from Mitchell Branch are discussed in Sect. 2 5.3.

The major contaminants in soils at ETTP include the inorganic elements, radionuclides, semivolatile organic compounds (SVOCs), particularly the polyaromatic hydrocarbons (PAHs), and VOCs These constituents are all relatively immobile in water and are not easily leached from and transported through soils. In general, the majority of contaminants in soil lie in the top 2 ft because of their propensity to adhere to soil particles, which tends to prevent their downward migration through the soil column. Some subsurface contamination (defined as being between 2 and 10 ft below the surface) is known, but limited investigation of these deeper soils has been conducted at ETTP Areas with soils impacted by inorganic elements include the K-770 area, the K-1064 area, the K-27/29 area, the K-1420 area, and the K-1070-C/D area (Fig 2 3) The areas of radionuclides in soils (primarily the uranium isotopes) are the K-770 area, the K-1064 Peninsula area, the K-27/29 area, and the Mitchell Branch area The areas of soils impacted by PAHs include the K-901 area, the Mitchell Branch area, and the K-1070-C/D area Soils impacted by VOCs are located in the vicinity of K-1414, K-1035, K-1401, and the K-1070-A Burial Ground.

2.1.2 FY 2000 Summary

2.1.2.1 Surface water

As mentioned previously, the surface water bodies at ETTP include the Clinch River, Poplar Creek, the K-901 Pond, the K-1007-P Ponds, and Mitchell Branch The K-901 Pond discharges directly to the Clinch River, while the K-1007-P Ponds and Mitchell Branch discharge to Poplar Creek Weirs constructed at these surface water discharge points provide monitoring locations for the ETTP exit points (see Fig 2 2), however, numerous storm drains throughout the ETTP also discharge directly to Poplar Creek and the Clinch River Monitoring of these storm drains is conducted under the National Pollutant Discharge Elimination System (NPDES) Program

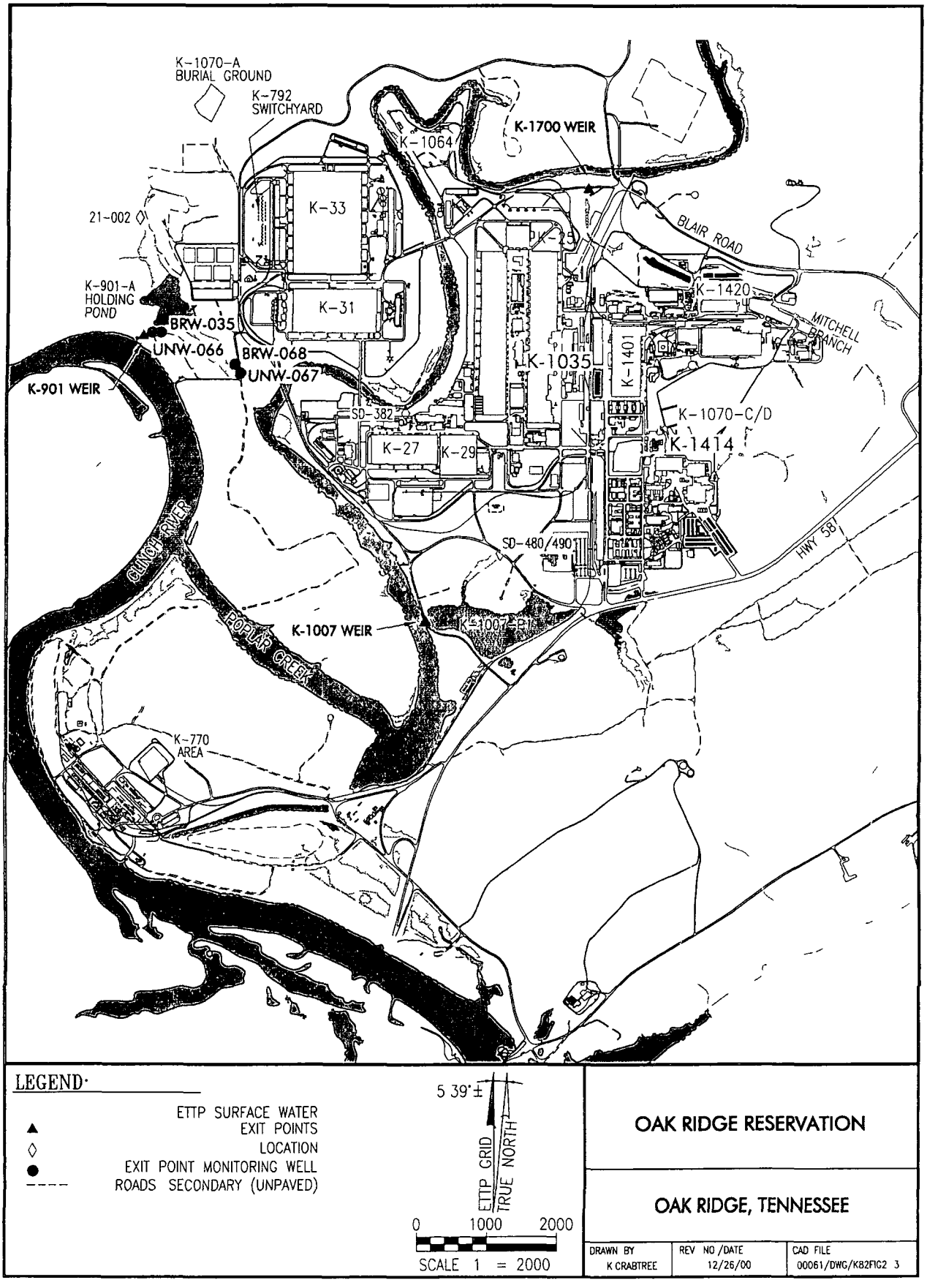


Fig. 2.3. Principal areas at ETTP.

During FY 2000, monitoring at the K-901, K-1700 (Mitchell Branch), and K-1007-B weirs, conducted by the ETTP Environmental Compliance Program, included the semi-annual collection of samples for the analysis of radiological parameters.

The sum of the fractions of the DOE Derived Concentration Guides (DCGs) for radionuclides for all three monitoring locations was well below the annual limit, as required by DOE Order 5400 5. The highest sum of the fractions (1 7% of the allowable sum of the fractions of the DCGs) was reported at the K-1700 weir The surface water monitoring data for the weirs do not indicate any significant radiological effects from ETTP operations on perimeter surface waters. Surface water data collected by the WRRP in Mitchell Branch is discussed in Sect 2.5 4 2

Spring 21-002, which discharges to the K-901-A Pond (Fig. 2.3), has historically contained detectable concentrations of TCE. However, monitoring conducted by the WRRP during FY 2000 did not detect the presence of TCE (Fig 2 4) However, the discharge point for this spring in the bed of the stream is transient, which may impact the monitoring results Figure 2.4 includes the regression line (trend) and confidence intervals on the indicated trend.

VOCs were detected at two storm drain (SD) outfalls; one discharges to Poplar Creek and the other to the K-1007-P1 Pond TCE was detected at SD outfalls SD-382 and SD-480/490 (Fig 2 3) during FY 2000. TCE was detected at a concentration of 33 μg/L at SD-382 and 8 μg/L at SD-480/490 Both of these storm drain networks drain areas of known groundwater plumes, and it is suspected that groundwater infiltrating the storm drains is the source of the TCE observed at these outfalls

2.1.2.2 Groundwater

The designated exit point monitoring wells at the ETTP include the monitoring wells BRW-035, BRW-068, UNW-066, and UNW-067 located at the west and south ends of the K-901 Pond (see Fig. 2.3). Diffuse groundwater discharge to Poplar Creek and Clinch River likely occurs throughout the ETTP. Although discrete exit points are provided by some springs discharging to Poplar Creek and the Clinch River in the ETTP area, these springs and seeps are numerous and appear to be somewhat transient in nature due to the complex river stage variations and associated water table fluctuations In addition, the usefulness of these springs as monitoring points is contingent upon their hydraulic connection to disposal or release sites at ETTP Only limited dye tracing, which is necessary to identify the usefulness of these springs as monitoring points, has been completed. To date, tracing at ETTP from dye injection sites to springs and monitoring wells has been limited to the K-1070-A/B Burial Ground Diffuse groundwater discharge to surface water via the unconsolidated zone materials occurs throughout significant portions of the ETTP.

Despite several springs at the northern end of the K-901 Pond discharging VOCs directly to the pond, VOCs are generally not detected at the four exit point wells. Historically, TCE and 1,2-dichloroethene (DCE) have been reported at two of these wells (BRW-035 and BRW-068), however, no VOCs were detected at the exit point wells during the FY 2000 sampling events

2.1.3 Recommendations

While not required under CERCLA, exit point monitoring collected for NPDES and DOE Order 5400 that is relevant to the understanding of overall environmental conditions will be reported in the watershed summary sections of future RERs

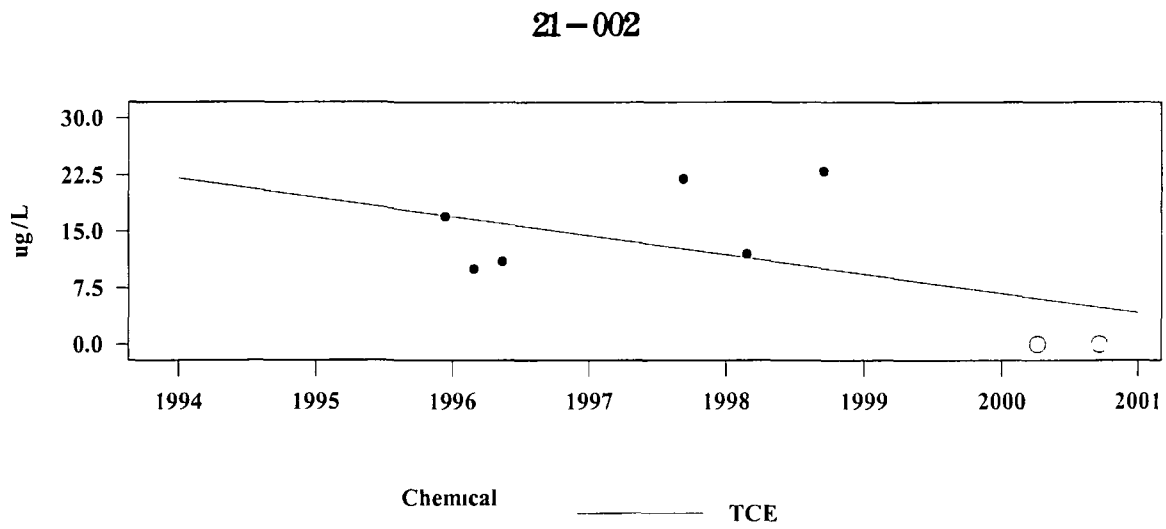


Fig. 2.4 TCE concentrations at Spring 21-002.

Based on the likelihood that groundwater contamination discharges to surface water in areas of the ETTP that have not been monitored in recent years, additional monitoring locations will be included in the FY 2001 monitoring program Additional monitoring to be conducted in the ETTP watershed includes the K-27/29 area, the K-1064 area, the K-770 area, the K-31 area, and in the vicinity of the K-25 building The results of this monitoring will be reported in the 2002 RER

2.2 K-1417-A AND K-1417-B DRUM STORAGE YARDS INTERIM REMEDIAL ACTION

- TDEC Commissioner's Orders — September 1991 and June 1994
- IROD — September 1991
- Field Activities Complete — December 1994
- RAR — February 1995

2.2.1 Project Description

The K-1417-A and K-1417-B Drum Storage Yards and the K-1419 Storage Treatment Facility (Fig 2 5) were used to manage and process the waste sludges resulting from the closure of the K-1407-B/C Ponds (see Sect 2 4) From February 1987 to June 1989, raw sludges were removed from the K-1407-B/C Ponds and treated or placed directly into drums and moved to the drum storage yards At the time the ponds were undergoing closure, DOE expected to obtain EPA approval to delist the treated sludge as nonhazardous with disposal as low-level radioactive waste The drum storage yards were therefore designed to be a temporary (1 to 2 years) storage facility

In September 1991, TDEC issued a Commissioner's Order requiring the implementation of the "Plan for the Management of K-1407-B and K-1407-C Pond Waste at the Oak Ridge K-25 Site" dated August 16, 1991 The plan included the following elements

- dewatering of raw sludges and repackaging in compatible containers,
- treatment of all liquids using existing treatment facilities, and
- storage of all containers in new or existing indoor facilities

The K-1417-A and K-1417-B Drum Storage Yards IROD (DOE 1991a) involved the treatment and repackaging of waste sludges The interim action was intended to prevent or mitigate the threat of release of contaminants from deteriorating drums In June 1994, TDEC issued another Commissioner's Order after DOE failed to meet the final milestone date (June 1993) for the repackaging of drums containing raw sludge The order required implementation and completion of a revised action plan and schedule for management of the sludge The revised action plan was approved in November 1994, and project activities were completed in December 1994 The RAR was issued in February 1995

The CERCLA interim action addressed the treatment, repackaging, and compliant storage of the waste sludges Raw wastes have been repackaged and properly stored prior to treatment and disposal, and stabilized wastes have been placed in permitted storage pending disposal Subsequent actions for final disposition of the sludges from the Resource Conservation and Recovery Act (RCRA) storage facilities will be managed under RCRA The final closure of the drum storage yards and the storage treatment facility has been completed as a RCRA closure

2.2.2 Evaluation of Decision Document Requirements for Performance and Stewardship

2.2.2.1 Goals of decision

The purpose of this interim action was to "prevent or mitigate the imminent threat of release of contaminants from the sludges to the surrounding environment and to minimize the threat to human health An additional goal of this interim action is to assure that the sludges are managed in compliance with the requirements of RCRA Removal of the liquids from the sludges, repair of the stabilized sludge drums, and removal of all the drums from the drum storage yards will eliminate the chronic release of

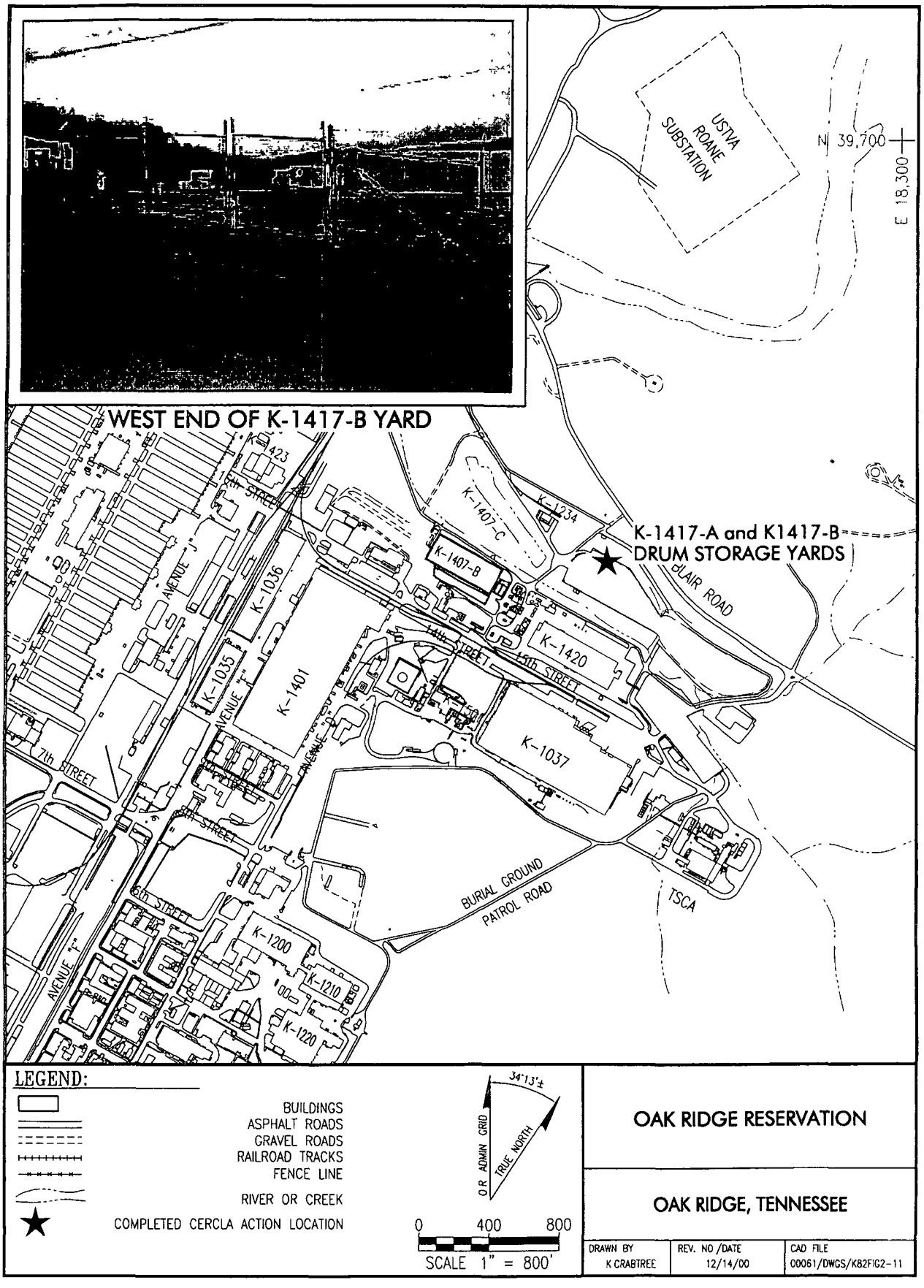


Fig. 2.5. K-1417-A and K-1417-B Drum Storage Yards.

contaminants from leaking drums as well as the potential for a large release of sludge It will also eliminate the threat to human health from drums toppling over" (DOE 1991a)

2.2.2.2 Monitoring and stewardship required

No CERCLA monitoring is required at this time Removal of the drummed wastes achieved the remedial action objectives for the project. The K-1417-A and K-1417-B Drum Storage Yards and the K-1419 Storage Treatment Facility have been closed under RCRA

2.2.3 Implementation of Previous Year's Recommendations

No changes were recommended for the current year

2.2.4 Evaluation of Performance and Stewardship Data—K-1417-A and K-1417-B Drum Storage Yards Interim Remedial Action

Table 2 2 provides a summary of the Five-Year Review questions and answers for the K-1417-A and K-1417-B Drum Yards Interim Remedial Action Further details are provided in subsequent subsections

2.2.4.1 Site visit

A site visit was conducted with Ms Lisa Shipe, Environmental Compliance (ENSAFE/CDM), on November 17, 2000 An interview with Mr Mike Dawley, Building Operator [Facilities Management, Surveillance, Inspection, and Testing Services (FMSIT)], was conducted on December 6, 2000 The K-1417-A and K-1417-B Drum Storage Yards are located in the northeastern portion of the ETTP The drum storage yards consist of two adjacent asphalt pads covering approximately 6 acres on the north side of Mitchell Branch The pads generally slope slightly to the south toward Mitchell Branch A 6-in curb is present along most of the length of the south boundary of the pads This curb directs runoff to separate catch basins for each yard The catch basins discharge through storm drain outfalls to the north side of Mitchell Branch Available data for the storm drain outfalls indicate that the runoff from the yards has not exceeded applicable reference levels

A DOE subcontractor is currently using the yards for storage of materials and equipment associated with the decontamination activities in Bldg K-1420 Although stewardship requirements are not specified in the Decision Documents, the facilities are located within the security fence of the ETTP and are enclosed by an additional interior fence There are only three access gates from the main plant area of the ETTP into the drum storage yards Two of the three gates were locked at the time of the site visit Signs on the gates indicate no unauthorized access Additional signs, erected during the period of drum storage, are present warning of the presence of hazardous materials FMSIT personnel conduct weekly drive-by inspections of the K-1417 area, and the records are maintained at the on-site FMSIT offices

Although there have been no changes in land use, there have been changes to activities conducted at the yards Material and equipment associated with the decontamination of Bldg K-1420 are currently being stored on the pads The materials are generally stored in large-volume, trailer-type containers Two large rubberized canvas structures, in addition to the former cure shed, used during the repackaging of the sludges remain on the drum storage yards The asphalt pads appear to be in relatively good condition and the grass surrounding the yards appears to be mowed routinely during the growing season

Table 2.2. K-1417-A and K-1417-B Drum Storage Yards Interim Remedial Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Dewatering, repackaging, and storage of the sludges has been completed
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in IROD, however, site is within ETTP security fence (Sect 2 2 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required by decision document
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Storage yards closed under RCRA and sludges remain in RCRA storage area
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed in IROD
Have there been any changes in land use or expected land use on or near the site?	No	Land remains in government control (Sect 2 2 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	No	Site visit (Sect 2 2 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	No BRA/ERA performed
Were there significant changes in the standardized risk assessment methodologies?	NA	No BRA/ERA performed
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risk not addressed by IROD, ecological risks may be addressed through future watershed-scale decisions
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
ERA = ecological risk assessment
ETTP = East Tennessee Technology Park
IROD = interim record of decision
NA = not applicable
RCRA = Resource Conservation and Recovery Act of 1976
ROD = record of decision
TBC = to be considered

2.2.5 Conclusions and Recommendations

This site consists of two adjacent asphalt pads formerly used to manage and process the waste sludges resulting from the closure of the former K-1407-B/C Ponds. The selected remedial action presented in the ROD has been completed. There are no wastes remaining from the original action, and there are no monitoring or stewardship requirements specified in the Decision Documents.

2.3 K-1070 OPERABLE UNIT SW-31 SPRING INTERIM REMEDIAL ACTION

- IROD September 30, 1992
- Field Activities Complete July 1996

2.3.1 Project Description

The K-1070 Operable Unit (OU) consists of several potential source areas on the ETTP site, including the K-1070-C/D trenches, the K-1070-C/D pits, the K-1070-D diked drum storage areas, and a maintenance storage yard SW-31 is a perennially flowing spring located west and downhill from the K-1070-C/D Burial Grounds (Fig 2 6) The spring is contaminated primarily with VOCs Heavy metals have also been detected in the water, with traces of PCBs and other constituents (including minimal alpha and beta radioactivity) Flow at the spring was estimated to range from 3 to 6 gal/min, and it originally discharged to a storm drain that led to Poplar Creek via Mitchell Branch The interim action involved intercepting the SW-31 flow and removing contaminants from the discharge

The IROD (DOE 1992a) was approved on September 30, 1992, stipulating source control measures to eliminate pathways for potential human receptors and wildlife to SW-31 discharge The IROD recommended collection of the SW-31 flow for on-site treatment for organics removal (including an air stripping tower and carbon adsorption polishing unit) Beginning in January 1994, SW-31 discharge was collected and transported by truck to the Y-12 NPDES-permitted treatment facility for removal of organic and metal contaminants Since July 1996, when the ETTP CNF upgraded its capability for organics treatment and received an NPDES permit modification allowing treatment of organic waste streams, SW-31 discharge has been treated and disposed of at the CNF

2.3.2 Evaluation of Decision Document Requirements for Performance

2.3.2.1 Goals of decision

The goal of this interim action was to "quickly reduce the migration of contaminants and degradation of the environment " The objective of the interim remedial action for SW-31 Spring was "simply to terminate the direct discharge of contaminants to surface waters by intercepting and routing contaminated waters for treatment [air stripping and treatment at the CNF] prior to discharge to surface waters via a NPDES-permitted outfall The contaminants found in the SW-31 Spring are amenable to removal by proven physical/chemical treatment technologies" (DOE 1992a)

The SW-31 Spring has been diverted and no longer discharges contaminants to the ETTP storm drain network or Mitchell Branch Since the summer of 1996, water from SW-31 has been processed at the CNF and discharged through an NPDES outfall

2.3.2.2 Monitoring and stewardship required

No monitoring is performed under CERCLA to evaluate these discharges As part of the CNF wastewater control program, water from the SW-31 Spring collection system, which has been combined with the K-1070-C/D Groundwater Collection System, is sampled semiannually to evaluate contaminant levels Routine inspections of the area of the spring are conducted to look for indications of flow and obvious odor No additional spring discharges have been identified

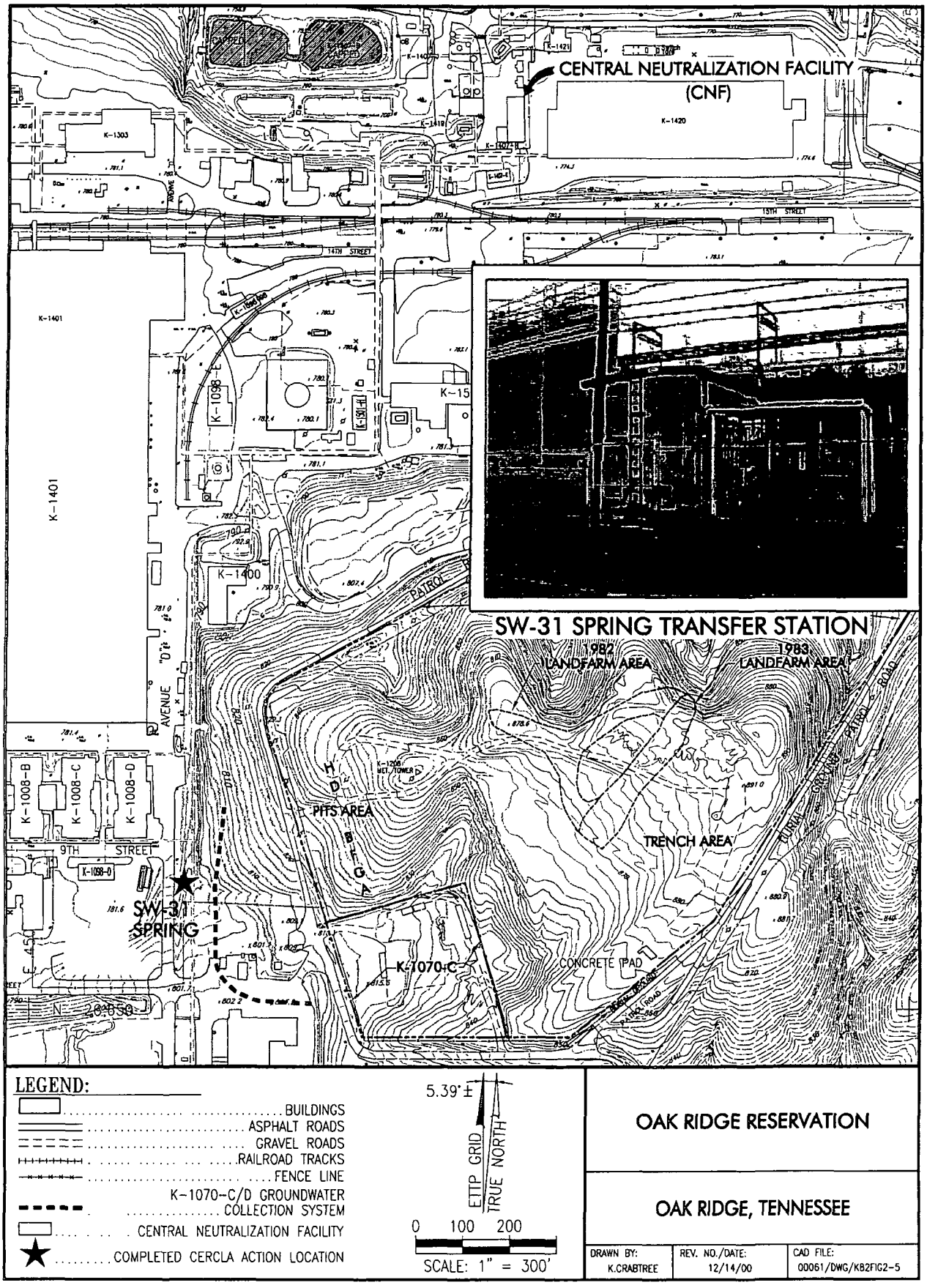


Fig. 2.6. Location of K-1070 Operable Unit SW-31 Spring.

Beginning in September 1998, the flow from the K-1070-C/D Groundwater Collection System was combined with the SW-31 Spring flow at the SW-31 Sump However, no substantial change in total flow has been observed at the SW-31 Sump since the addition of the K-1070-C/D collection system flow

Currently, the impact of the K-1070-C/D collection system on SW-31 cannot be discerned because of the combined flows

2.3.3 Implementation of Previous Year's Recommendations

The FY 1999 RER stated that an evaluation of potential monitoring approaches that would provide data on the individual collection systems (SW-31 and K-1070-C/D) would be performed It was determined that modifications to the current piping arrangement would be necessary to accomplish this Currently, there are no plans to modify the system

2.3.4 Evaluation of Performance and Stewardship Data—SW-31 Spring

Table 2 3 provides a summary of the Five-Year Review questions and answers for the SW-31 Spring Interim Remedial Action Further details are provided in subsequent subsections

2.3.4.1 Site visit

A site visit and interview was conducted with Mr Tommy Bowers, Facility Manager (BJC), and Mr Deron Hendron, CNF Engineer (Radian International), on October 30, 2000 The SW-31 Spring is located on the east side of Avenue D, which runs along the western border of the K-1070-C/D Burial Ground The area of the original spring location is grass-covered with no signs of additional seepage The collection sump, transfer building, and surge tanks, which are located approximately 200 ft north of the former spring location, are completely enclosed by a fence, and the gates are locked at all times unless workers are present Signs are present indicating the contact person and phone number for information and access to the facility The transfer building houses the pumps, valves, and prefilters associated with the SW-31 Spring system Two 20,000-gal surge tanks are available for temporary storage of the combined SW-31/K-1070-C/D effluent prior to transfer to CNF Flow from the SW-31/K-1070-C/D system averages approximately 5000 gallons per day (gpd)

The IROD was completed in 1992 and did not specify monitoring or stewardship requirements for the SW-31 Spring However, CNF personnel conduct daily inspections of the SW-31 Spring system, and these records are maintained at CNF Samples of the effluent are collected twice a year and analyzed for a full suite of parameters including VOCs, SVOCs, metals, PCBs, and radionuclides In addition, samples for the analysis of isotopic uranium activity concentrations are collected monthly

In 1998 the K-1070-C/D Groundwater Collection System was installed upgradient of the former SW-31 Spring location The effluent from the K-1070-C/D collection system is also piped, after first discharging to an oil/water separator, to the SW-31 sump, where the effluent from both systems commingles From the sump, the effluent is transferred to CNF Iron precipitate deposits in the oil/water separator are common, but appear to vary seasonally Monitoring results for samples collected from the K-1007 collection/transfer sump indicate total VOC concentrations from 200 to 400 µg/L were detected during FY 2000

2.3.5 Conclusions and Recommendations

This site will continue to be evaluated as part of the annual RER and Five-Year Review cycle

Table 2.3. SW-31 Spring Interim Remedial Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Spring discharge is collected and treated at CNF prior to discharge through NPDES permitted outfall
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	No problems with system have been encountered
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in IROD, however, site is within ETTP security fence (Sect 2 3 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required by decision document
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	CNF maintains operation of the system
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Although changes to standards have occurred, the discharge meets current NPDES Permit requirements
Have there been any changes in land use or expected land use on or near the site?	No	Land remains in government control
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Site visit (Sect 2 3 4 1)
Have there been any changes in the physical site conditions?	Yes	Installation of the K-1070-C/D Groundwater Collection System upgradient of the spring (Site visit, Sect 2 3 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	Spring discharge is captured and treated
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	No ERA performed, but discharge meets NPDES Permit requirements
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
CNF = Central Neutralization Facility
ERA = ecological risk assessment
ETTP = East Tennessee Technology Park
IROD = interim record of decision
NA = not applicable
NPDES = National Pollutant Discharge Elimination System
ROD = record of decision
TBC = to be considered

2.4 K-1407-B/C PONDS REMEDIAL ACTION

- ROD: September 30, 1993
- Field Activities Complete: January 1995
- RAR: July 1995

2.4.1 Project Description

The K-1407-B/C Ponds were built as settling and holding ponds primarily for the secondary treatment of metal hydroxide and other wastes generated at ETTP (Fig. 2.7). The K-1407-B Pond was used primarily for settling of metal hydroxide precipitates generated during neutralization and precipitation of metal-laden solutions treated in the K-1407-A Neutralization Unit. The K-1407-B Pond also received discharge from the K-1420 Metals Decontamination Building and wastes from the K-1501 Steam Plant. The K-1407-C Pond was used primarily to store potassium hydroxide scrubber sludge generated at ETTP. The primary contaminants of concern at this location are residual metal, radiological (including ^{137}Cs and ^{99}Tc), and VOCs.

Removal of sludges from the ponds was conducted as a RCRA closure action The K-1407-B Pond removal began in February 1987 and was completed in October 1988. Sludge removal from the K-1407-C Pond began in November 1988 and was completed in August 1989. Sludges were containerized and placed in the K-1417 Drum Storage Yards and the K-1419 Storage Treatment Facility awaiting final treatment and/or disposal (see Sect. 2.1)

The ROD for the K-1407-B/C Ponds was issued in September 1993 (DOE 1993a) and addressed potential risks associated with residual wastes and soils remaining in the K-1407-B/C Ponds. Remedial action was implemented from July 1994 to January 1995, and included the following:

- placement of clean soil in the excavations and rock fill over the surface,
- groundwater monitoring, and
- maintenance of access and activity controls at the areas.

2.4.2 Evaluation of Decision Document Requirements for Performance and Stewardship

2.4.2.1 Goals of decision

The goal of the K-1407-B/C Ponds remedial action was to "reduce potential threats to human health and the environment posed by residual metal, radiological, and volatile organic compound (VOC) contamination within the K-1407-B/C Ponds." Major components of the selected remedy include the following (DOE 1993a):

- placement of clean soil and rock fill for isolation and shielding,
- maintenance of institutional controls, and
- groundwater monitoring to assess performance of the action and to develop information for use in reviewing the effectiveness of the remedy.

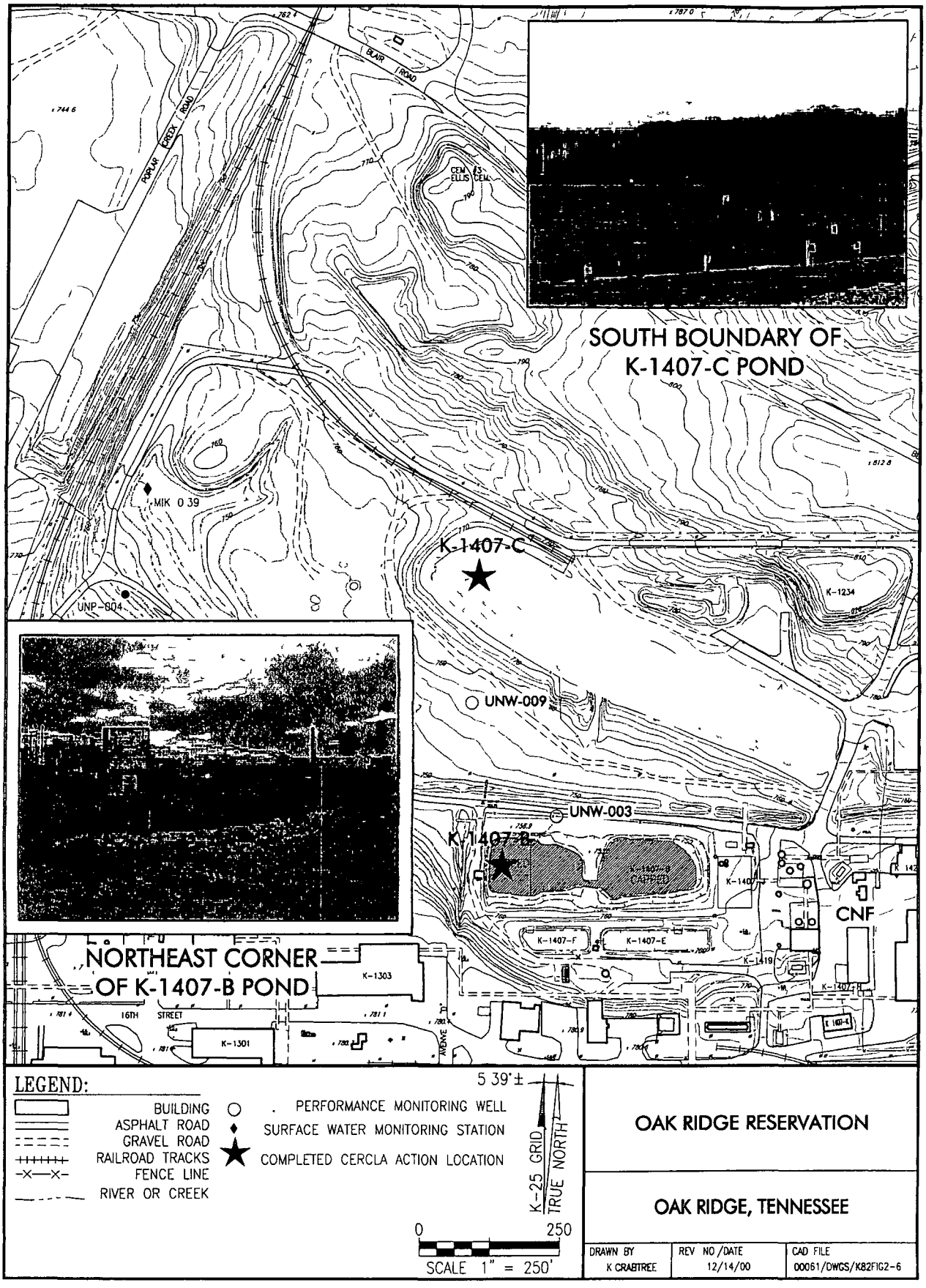


Fig. 2.7. Location of K-1407-B/C Ponds.

2.4.2.2 Monitoring and stewardship required

Semiannual monitoring of groundwater and surface water began in February 1996. Groundwater is currently sampled at two wells (UNW-003 and UNW-009) with Mitchell Branch surface water being monitored at Mitchell Branch kilometer (MIK) 0.39, which is near the outfall of SD-195 (Fig. 2.6). Metals and selected radionuclides are the designated analytes (Table 2.4). Remediation target concentrations were not established in the CERCLA project documents for use in post-remediation monitoring.

2.4.3 Implementation of Previous Year's Recommendations

The 2000 RER recommended that the continued monitoring of UNW-003, UNW-009, and MIK 0.39 for evaluation of the effectiveness of the remedial action be discontinued following the Five-Year Review. This recommendation was based on the fact that the remedial action taken at the former K-1407-B/C Ponds was a source removal/filling and capping and did not address groundwater at the site

2.4.4 Evaluation of Performance and Stewardship Data—K-1407-B/C Ponds Remedial Action

Table 2.5 provides a summary of the Five-Year Review questions and answers for the K-1407-B/C Ponds Remedial Action Further details are provided in subsequent subsections.

2.4.4.1 Site visit

A site visit was conducted with Ms Lisa Shipe, Environmental Compliance (ENSAFE/CDM), on November 17, 2000 An interview with Mr. Mike Dawley, Building Operator (FMSIT), was conducted on December 6, 2000. The former ponds are located in the northeastern portion of the ETTP near CNF The K-1407-B Pond is located on the south side of Mitchell Branch and the K-1407-C Pond lies opposite the K-1407-B Pond on the north side of Mitchell Branch. The K-1407-B/C Ponds are within the security fence of the ETTP A valid DOE badge or visitor's pass is required for access to the former ponds A fence has been erected around the CNF area and the Decontamination and Decommissioning (D&D) facilities to the west of CNF and the former K-1407-B Pond. The caps on both of the former K-1407-B/C Ponds are raised above the surrounding grade and are grass-covered. Perimeter drainage ditches around the ponds are gravel-lined to prevent erosion There are no signs of significant erosion of the caps and both appear to be adequately maintained.

Initially, difficulties were experienced establishing the vegetative cover over the ponds, however, there have been no problems experienced since with the selected remedy Inspections of the ponds are conducted weekly to verify conditions and identify potential problems. An annual inspection is conducted to verify the effectiveness of the routine surveillance and maintenance activities. Inspection records are maintained at the on-site FMSIT offices

Although there have been no direct changes to the ponds, the Mitchell Branch Groundwater Collection System has been installed immediately downgradient of the K-1407-B Pond The groundwater collection system began operation in 1998 and consists of 29 recovery wells, most of which are located between the former pond and Mitchell Branch, and an interceptor trench paralleling Mitchell Branch west of the former K-1407-B Pond

2.4.4.2 Evaluation of performance data

Monitoring at the K-1407-B/C Ponds includes wells UNW-003 and UNW-009 and surface water in Mitchell Branch (MIK 0 39). Water samples collected at these three locations are analyzed for radionuclides and metals. Fig 2 8 presents the results for gross alpha and gross beta since 1994 at these

Table 2.4. Summary of post-remediation groundwater and surface water monitoring at the K-1407-B/C Ponds

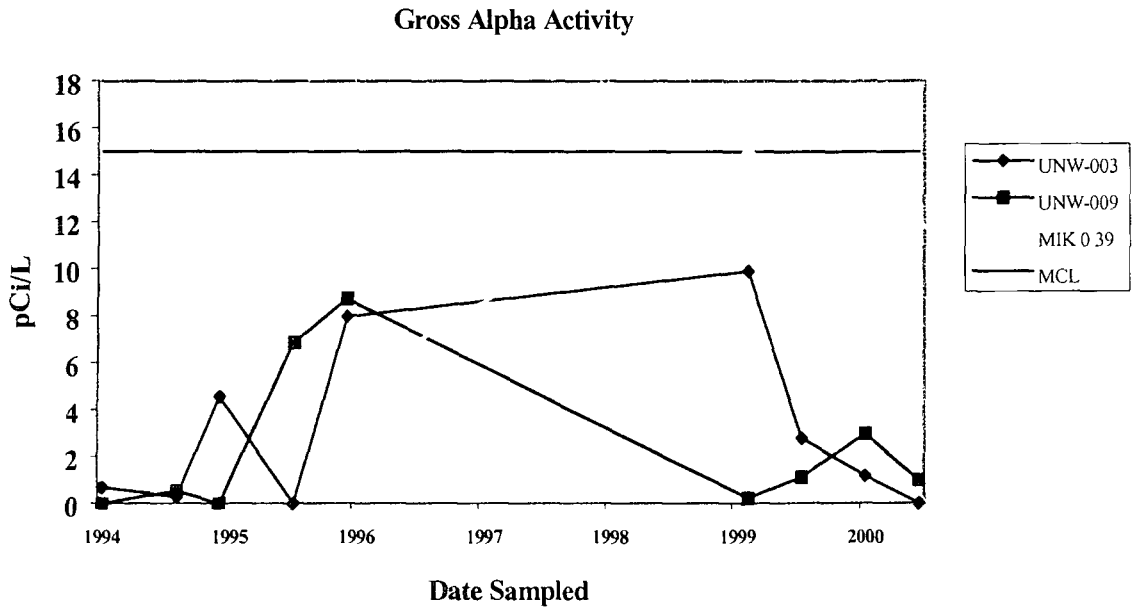
	UNW-003			UNW-009			MIK 0.39	
Parameter (mg/L; pCi/L)	Baseline[a]	March 2, 2000	August 30, 2000	Baseline[a]	March 2, 2000	August 30, 2000	March 2, 2000	August 31, 2000
Arsenic	<0.005	0.02 (U)	0.0017 (U)	<0.005	0.02 (U)	0.0017 (U)	0.02 (U)	0.0017 (U)
Barium	0.05	0.06	0.082	0.034	0.011 (J)	0.042 (J)	0.045	0.075 (J)
Cadmium	<0.003	0.003 (J)	0.001 (U)	<0.003	0.0023 (U)	0.0013 (U)	0.002 (U)	0.0013 (U)
Iron	0.097	2.35	0.647	6.24	0.58	1.45 (J)	0.29 (J)	0.55
Lead	<0.004	0.02 (U)	0.016 (U)	<0.004	0.02 (U)	0.016 (U)	0.02 (U)	0.016 (U)
Manganese	7.1	4.31	4.36 (J)	17.5	2.47	10.5	0.23 (J)	0.420
Mercury	<0.0002	NA	NA	<0.0002	NA	NA	NA	NA
Selenium	<0.005	0.03 (U)	0.016 (U)	<0.005	0.03 (U)	0.034 (J)	0.03 (U)	0.016 (U)
Sodium	148	72.1	83.5	96	112	111	5.77	10.9
Parameter								
Gross alpha	6.55 ± 5.2	2.4 ± 3.4	0.00	5.32 ± 2.4	(R)	2.0 ± 4 (U)	16.1± 6.8	12 ± 6
Gross beta	24.21 ± 7.1	38.6 ± 11.6	78 ± 16	15.27 ± 3.3	12.3 ± 7.8	13 ± 8	15.7 ± 7.9	21± 9
^{90}Sr		3.6 ± 5.3 (U)	5.4 ± 5.8 (U)		7.5 ± 5.4 (U)	4.5 ± 5.8 (U)	2.3 ± 5.2 (U)	2.5 ± 5.7 (U)
^{99}Tc		30 ± 9	36 ± 9		1.0 ± 11 (U)	-2.0 ± 8 (U)	3.0 ± 8 (U)	1.0 ± 8 (U)
^{234}U		1.2 ± 0.28	1.7 ± 0.35		0.28 ± 0.17	0 46 ± 0.19 (J)	5.6 ± 0.61	12 ± 0.87
^{235}U		-0.01± 0.5 (U)	0.1 ± 0.09		0.04±0.08 (U)	0.02 ± 0.7 (U)	0.17 ± 0.11	0.55 ± 0.21
^{238}U		0.44 ± 0.17	0.68 ± 0.22		0.17 ± 0.12	0 032 ± 0.064 (U)	2.9 ± 0.43	5.5 ± 0.59
^{228}Th		0.11± 0.23 (U)	0.14 ± 0.28 (U)		0.29 ± 0.16	0.12 ± 0.25 (U)	0.26± 0.2 (U)	0.0 ± 0.15 (U)
^{232}Th		(R)	0.01 ± 0.1		(R)	0.017 ± 0.034 (U)	0.01± 0.03 (U)	0.059 ± 0.084 (U)
^{137}Cs		27.9 ± 60 (U)	5.64 ± 77.9 (U)		5.6 ± 60.3 (U)	56 ± 71.5 (U)	2.89 ± 60.9 (U)	23.1± 51.5 (U)
^{234}Th		0.44 ± 0.17	615 ± 570		0.17 ± 0.12	NA	2.9 ± 0.43	NA

[a]Baseline designates pre-1996 data
(J) = Estimated concentration
NA = Not analyzed
(R) = Rejected results due to analytical problems
(U) = Analyte not present at concentrations above detection limit

Table 2.5. K-1407-B/C Ponds Remedial Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Ponds have been filled and capped eliminating potential exposure pathway
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in ROD, however, site is within ETTP security fence (Sect 2 4 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required to address immediate threats, but groundwater is to be addressed in future decision documents
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Monitoring (gw and sw), S&M inspections
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed in ROD
Have there been any changes in land use or expected land use on or near the site?	No	Land remains in government control (Sect 2 4 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Site visit (Sect 2 4 4 1)
Have there been any changes in the physical site conditions?	Yes	Installation of the Mitchell Branch groundwater collection system adjacent to K-1407-B Pond (Site visit, Sect 2 4 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	Yes	There have been minor changes in reference doses and slope factors for metals and radionuclides, however, there would be no changes to conclusions in the ROD based on these changes
Were there significant changes in the standardized risk assessment methodologies?	No	
C. *Has any other information come to light that could call into question the protectiveness of the remedy?*		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	ROD concluded impacts to ecological receptors to be negligible
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes, located in 100-year floodplain

ARAR = applicable or relevant and appropriate requirement
ETTP = East Tennessee Technology Park
NA = not applicable
ROD = record of decision
S&M = surveillance and maintenance
TBC = to be considered



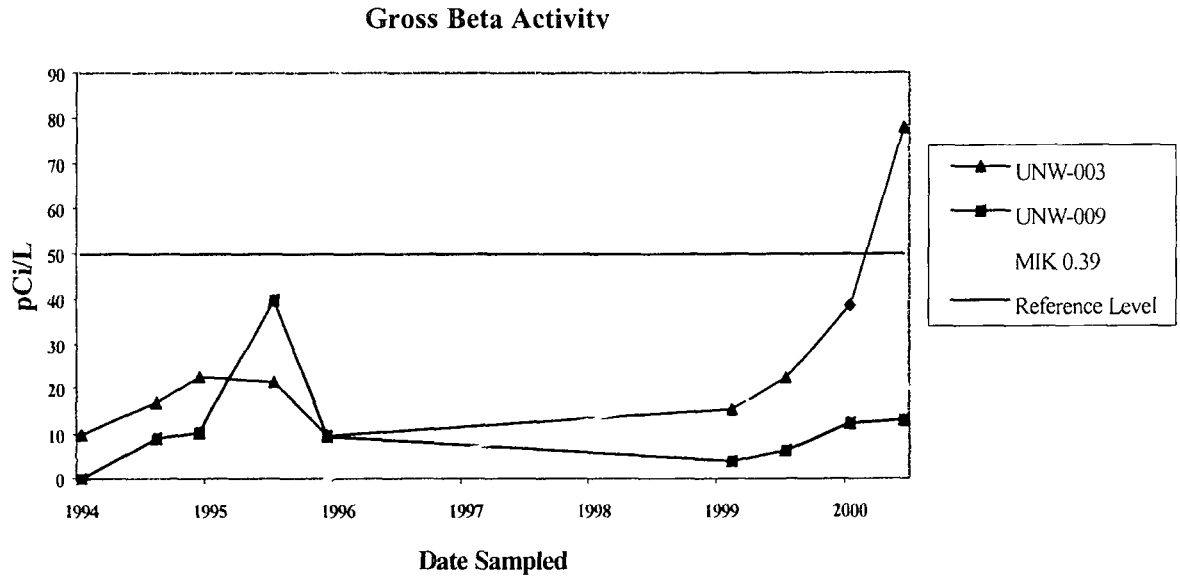


Fig. 2.8. Monitoring results for the K-1407-B/C Ponds.

locations. This figure indicates that gross alpha activity concentrations in the wells are very low (<10 pCi/L); however, surface water activity concentrations are generally higher and exceeded the 15 pCi/L drinking water maximum contaminant level (MCL) on two occasions. Radiological contamination in surface soils adjacent to Mitchell Branch is known to exist upstream of the former ponds. Gross beta activity concentrations have generally increased since 1999 at all three monitoring locations, however, higher levels of radioactivity have historically been detected in groundwater upgradient of UNW-003. It is unlikely that fluctuations in radioactivity at these locations can be attributed to the K-1407-B/C Ponds.

2.4.5 Conclusions and Recommendations

Based on the monitoring results for UNW-003, UNW-009, and MIK 0 39, no significant improvement or degradation of groundwater is apparent (see Table 2 2 and Fig 2 8) However, although the required monitoring includes analyses for metals and radionuclides, VOCs, which are present in groundwater upgradient of the K-1407-B Pond, are the primary groundwater contaminants in this area of the ETTP The remedial action for the K-1407-B/C Ponds was a source removal that did not address groundwater beneath the former ponds. The ROD states that groundwater will be addressed in future CERCLA decisions. Also, a groundwater collection system, which has a requirement for performance monitoring, has been installed downgradient of the K-1407-B Pond

2.5 K-1070-C/D AND MITCHELL BRANCH REMOVAL ACTION

- AM: August 1997
- Field Activities Complete: June 1998
- RmAR: December 1998

2.5.1 Project Description

The K-1070-C/D area is a former burial ground located in the eastern portion of the main plant area at ETTP. Mitchell Branch is a small perennial creek draining the northeastern portion of the ETTP (Fig. 2.9). Shallow groundwater plumes have been identified emanating from the K-1070-C/D area and also discharging to the lower reaches of Mitchell Branch. The primary contaminants of concern are VOCs, uranium isotopes, and ^{99}Tc.

The K-1070-C/D and Mitchell Branch Removal Action was conducted as a nontime-critical removal action designed to capture and treat contaminated groundwater emanating from the K-1070-C/D and Mitchell Branch areas. The removal action involved the installation of a groundwater collection system, transport of the collected groundwater to the CNF for treatment, and discharge of the treated groundwater under the CNF NPDES Permit.

The groundwater collection system in the K-1070-C/D area consists of approximately 600 linear feet of interceptor trench installed to the top of bedrock Groundwater is collected and pumped from the trench to the pre-existing SW-31 Spring sump. The groundwater is then transferred by pipeline to the CNF for treatment and discharge. The Mitchell Branch collection system consists of approximately 1100 linear feet of interceptor trench and 29 extraction wells. A subsurface vertical barrier was installed between the interceptor trench and Mitchell Branch to prevent dewatering of the stream. In addition, a bottom liner system was installed along approximately 700 ft of Mitchell Branch opposite the extraction wells to prevent dewatering of this reach of the stream Groundwater is routed from both collection systems to a central collection point and then transferred by pipeline to the CNF for treatment and discharge.

2.5.2 Evaluation of Decision Document Requirements for Performance

2.5.2.1 Goals of decision

The removal action involves the "capture and treatment of shallow contaminated groundwater to reduce the mass of contaminants migrating from these areas" (DOE 1997d). Installation of groundwater collection systems in the Mitchell Branch and K-1070-C/D areas will capture contaminated groundwater. The groundwater will be transported by pipeline to the CNF for treatment and discharge. The scope of this action is limited to treatment of contaminated groundwater that is collected from the unconsolidated zone on the downgradient side of the K-1070-C/D Burial Grounds and between the area bounded by K-1401, K-1420, and Mitchell Branch. (DOE 1997d).

2.5.2.2 Monitoring and stewardship required

Per the RmAR (DOE 1998j), post removal action sampling includes semi-annual monitoring of water quality and measurement of water levels at selected surface water and monitoring well locations, and monitoring of collection system effluent. Performance monitoring was initiated in April 1999 and continued through FY 2000.

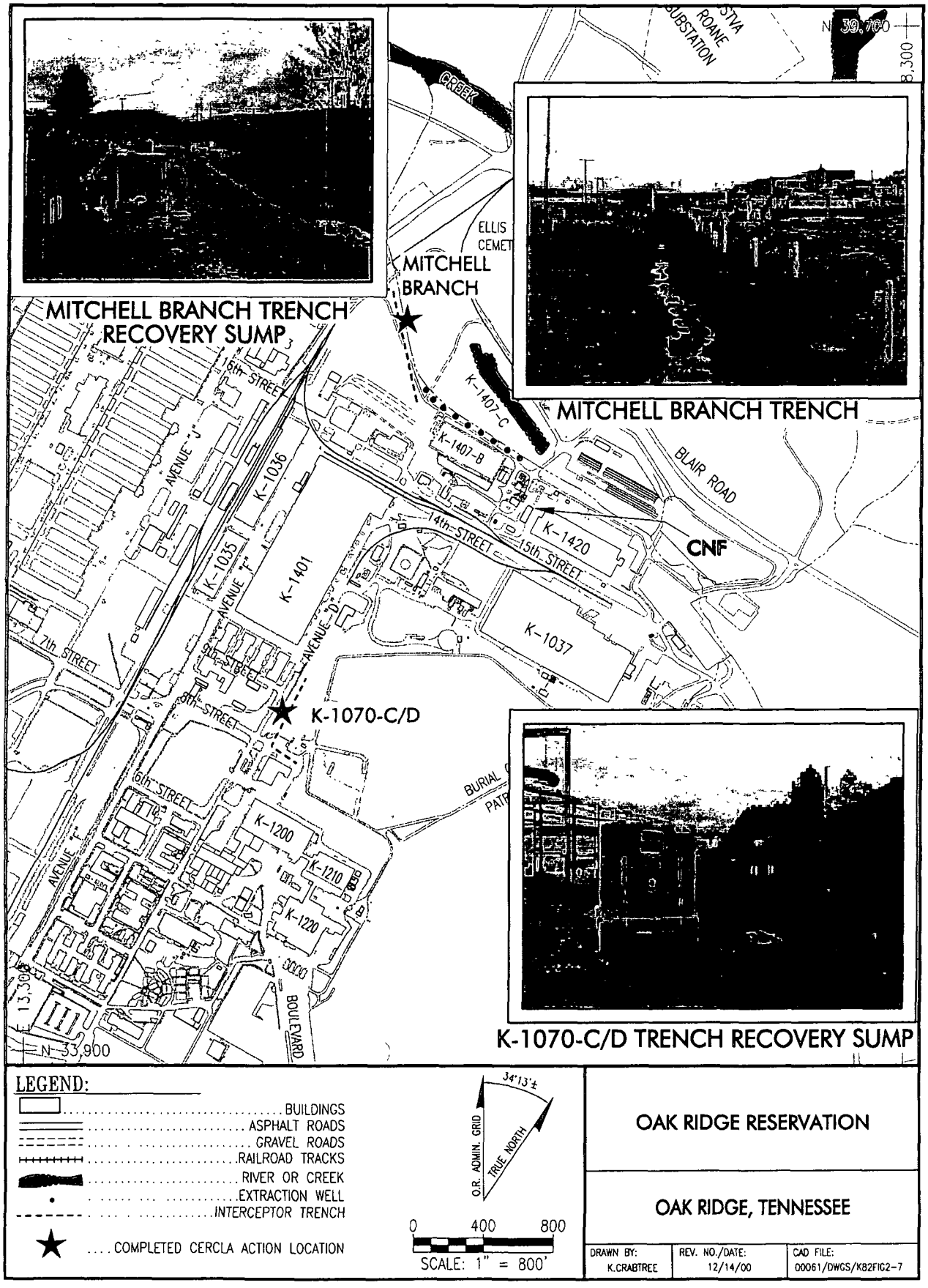


Fig. 2.9. Location of K-1070-C/D and Mitchell Branch.

2.5.3 Implementation of Previous Year's Recommendations

Recommendations from the previous year (FY 1999) included continued monitoring of plume characteristics in the Mitchell Branch and K-1070-C/D areas to determine potential impacts of operation of the groundwater collection systems It was also recommended that locations sampled during FY 1999 should be maintained as required monitoring locations (DOE 2000a)

2.5.4 Evaluation of Performance and Stewardship Data—K-1070-C/D and Mitchell Branch Removal Action

Table 2 6 provides a summary of the Five-Year Review questions and answers for the K-1070-C/D and Mitchell Branch Removal Action Further details are provided in subsequent subsections

2.5.4.1 Site visit

A site visit and interview was conducted with Mr Tommy Bowers, Facility Manager (BJC), and Mr Deron Hendron, CNF Engineer (Radian International), on October 30, 2000 With the exception of approximately 250 ft of the westernmost segment of the Mitchell Branch trench, the collection systems are located within the fenced security zone of the ETTP, which requires a valid DOE badge or visitor s pass for access The western trench segment is patrolled by Park Security personnel

The groundwater collection system in the K-1070-C/D area consists of approximately 600 linear feet of interceptor trench installed to the top of bedrock Groundwater is collected and pumped from the trench to the pre-existing SW-31 Spring sump The groundwater is then transferred by pipeline to the CNF for treatment and discharge The Mitchell Branch collection system consists of approximately 1100 linear feet of interceptor trench and 29 extraction wells A subsurface vertical barrier was installed between the interceptor trench and Mitchell Branch to prevent dewatering of the stream In addition, a bottom liner system was installed along approximately 700 ft of Mitchell Branch opposite the extraction wells to prevent dewatering of this reach of the stream Groundwater is routed from both the trench and the recovery wells to a central collection point and then transferred by pipeline to the CNF for treatment and discharge

Although the decision documents do not specify stewardship requirements, both the Mitchell Branch and K-1070-C/D systems are inspected daily due to their potential impacts on operations at the CNF During the daily rounds, CNF personnel check pump-and-transfer-system operation and perform maintenance as needed These activities are documented in Round Sheets maintained at CNF

The K-1070-C/D collection system is located on the western slope of the K-1070-C/D Burial Ground The trench transects the northern portion of the K-1414 Garage area, which is completely paved, and then turns northward paralleling Avenue D through a grass-covered area west of K-1070-C/D The grass-covered portion is mowed and no fencing surrounds the collection system and associated Recovery Sump Pump enclosures The Mitchell Branch system parallels Mitchell Branch from the area of CNF westward to the railroad spur adjacent to Portal 5 The trench stops at the railroad and begins again on the west side of the railroad bed This western trench segment extends beneath the Portal 5 access road and ends opposite the area where Mitchell Branch turns northward towards Poplar Creek The grass-covered portions of the system are mowed routinely The reach of Mitchell Branch opposite the recovery wells was lined with an impermeable geomembrane and geotextile fabric to prevent the drawing of water from Mitchell Branch by the recovery wells Articulating concrete blocks were placed on top of the geomembrane and geotextile layers to form the channel and to protect the geosynthetics Much of the

Table 2.6. K-1070-C/D and Mitchell Branch Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Groundwater is collected and treated at CNF
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	Yes	Operational problems have resulted in intermittent operation of the system (Sect 2 5 4 1)
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use in AM, however, site is within the ETTP security fence (Site visit, Sect 2 5 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required by decision documents
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	No	Operational problems with the system have diminished the effectiveness (Sect 2 5 4 2)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed in AM
Have there been any changes in land use or expected land use on or near the site?	No	Site remains in government control (Sect 2 5 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	However, iron buildup in the collection sump results in increased maintenance efforts
Have there been any changes in the physical site conditions?	No	Site visit (Sect 2 5 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	No BRA/ERA performed
Were there significant changes in the standardized risk assessment methodologies?	NA	No BRA/ERA performed
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risk not addressed by AM, but may be addressed through future watershed-scale decisions
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes, located in 100-year floodplain

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
CNF = Central Neutralization Facility
ERA = ecological risk assessment
ETTP = East Tennessee Technology Park
NA = not applicable
ROD = record of decision
TBC = to be considered

original pea gravel used to fill the gaps between the concrete blocks has been washed out during storm surges Sediment, which has replaced the gravel, has allowed natural vegetation to return to the banks of this reach of Mitchell Branch

Declines in total flow from the collection systems over the past year and indications that contaminant concentrations downgradient of the systems are unchanged or may be increasing since 1999 suggest the extraction systems are inefficient or ineffective Problems have been experienced with operation of all seven of the Recovery Sump Pumps, installed in the trench segments of the recovery systems, since system operations began in 1998 These problems have included periodic failure and/or plugging of the Recovery Sump Pumps resulting in extended downtime for individual pumps while maintenance is performed Periodic maintenance has been performed in an effort to keep the pumps operational, and adjustments to increase the pumping rates have been performed However, due to the rapid deterioration of pump performance following maintenance, the system continues to perform ineffectively Additionally, equipment failure has also been experienced with components of the recovery well pumping system located along a portion of Mitchell Branch This portion of the system consists of 29 recovery wells equipped with pneumatic pumps Air lines associated with these pumps have begun to degrade where exposed above ground, and ruptures/failures have occurred

Although unexpected toxic by-products have not been encountered in operation of the systems, it was noted by CNF that iron fouling of the coalescing tubes in the K-1070-C/D oil/water separator may impair separator operation at times This condition is being monitored by CNF personnel

Steps are being taken by BJC to evaluate system performance and develop potential options for improved operation of the systems

2.5.4.2 Evaluation of performance data

The FMSIT subcontractor conducted an interim performance evaluation of both the Mitchell Branch and K-1070-C/D collection systems during the latter half of FY 2000 A site walk-down to review the systems' construction and operational characteristics was conducted in June 2000 This was followed by review of the remedial action objectives (RAOs), as-built information, operational and analytical data, and associated removal action documentation A memorandum entitled "Interim Recommendations on the K-1070-C/D and Mitchell Branch Groundwater Collection Systems Operational Concerns" was generated (ATI 2000) Details regarding the interim performance evaluation, conclusions, and recommendations can be found in that document Performance evaluation findings are summarized below

The interim evaluation focused on performance by following a logically structured process Both of the groundwater collection systems were subdivided into *functional/support subsystems* to evaluate the function, efficiency, and effectiveness of the subsystem to assess its impact on the overall remedial system Following are the subsystems for the two groundwater collection systems

- pretreatment/treatment systems,
- pumping/conveyance systems, and
- extractions systems

Analysis and assessment of parameters within the shallow aquifer and surface water body (i e , Mitchell Branch), which can be referred to as the environmental media "system," also provide a great understanding of the systems' performance characteristics Hydraulic performance based on hydraulic head response (e g , draw-down, radius of influence, capture zone analysis), water chemistry, size, and concentration distribution within the plume provides the standard by which the removal action is ultimately judged for appropriateness to meet the RAOs

Based on the site walk-down, it was determined that the performance evaluation should be based on review of the pumping/conveyance system, the extraction system, and the systems' impact on the environmental media (i.e., shallow groundwater, surface water, and sediments). The pretreatment/treatment system at CNF is reported to be functioning within the design operating range, operating efficiently, and has effectively reduced VOCs to acceptable levels. The pretreatment/treatment system has not experienced any significant problems. In addition, influent concentrations and flow rates from the two groundwater collection systems have not overstressed the treatment capacity of CNF.

Evaluation of the pumping/conveyance and extraction subsystems indicates specific problems and some potential problems. The pumping and conveyance system functions irregularly. Several of the recovery sump pumps installed in the trenches are not functioning because of low-water/no-flow circumstances, or are inoperable because of sediment plugging or fouling problems. Quantitative pump efficiencies are not available; only limited hydraulic test data have been collected. Based on the pumps' operational characteristics and the high-maintenance nature of these low-shear pumps, the pumps are inefficient and likely limit the effectiveness of the trenches. The pneumatic pumps used to extract groundwater from the 29 recovery wells at Mitchell Branch appear to be functioning properly, however, due to problematical system design, pump performance is difficult to discern.

Based on operational data obtained during FY 2000, at least some of the recovery sump pumps at both the Mitchell Branch and K-1070-C/D collection trenches may not be extracting groundwater, rendering sections of the trench ineffective. Contaminants within the groundwater likely pass through these zones continuing on towards Mitchell Branch The pump problems discussed above and/or potential problems with the trench filter media and recovery sump screen/filter pack materials (i.e., aggregate-pore space plugging) likely contribute to the less-than-optimal system operation. Trench and well yields are low and, as discussed below, have decreased over the past year of operation.

System Flow. Flow into the groundwater collection system(s) is influenced and/or limited by a number of parameters, such as the transmissive properties of the shallow aquifer As stated above, problems associated with either the pumping/conveyance subsystem or extraction system will likely limit the systems' effectiveness. There has been a significant loss in total flow from these two systems over the last year (FY 2000). Combined, the systems initially handled between 12,000 and 18,000 gpd, and current estimates are generally closer to 8000 gpd. Decreases in flow are most likely associated with pump/conveyance system and extraction system problems.

The average daily flow for the Mitchell Branch groundwater collection system for FY 2000, based on data collected by CNF, was 7356 gpd (Fig. 2.10). A low flow of 1632 gpd was measured on February 8, 2000, and the high flow of 18,375 gpd was measured on April 5, 2000. In early FY 2000, the Mitchell Branch system yielded approximately 10,400 gpd but decreased to approximately 4400 gpd by year end, 40% below the average daily flow of 7356 gpd. This represents a decrease in flow of approximately 58% over the course of the year.

The average daily flow for the K-1070-C/D Groundwater Collection System, based on data collected by CNF in FY 2000, was 5646 gpd (Fig. 2.10). A low flow of 0 gpd was measured on August 16 and 17, 2000, and the high flow of 14,902 gpd was measured on August 20, 2000. In early FY 2000, the K-1070-C/D system yielded approximately 5300 gpd but decreased to approximately 4100 gpd by year end, 27% below the average daily flow of 5646 gpd. This represents a decrease in flow of approximately 22% over the course of the year.

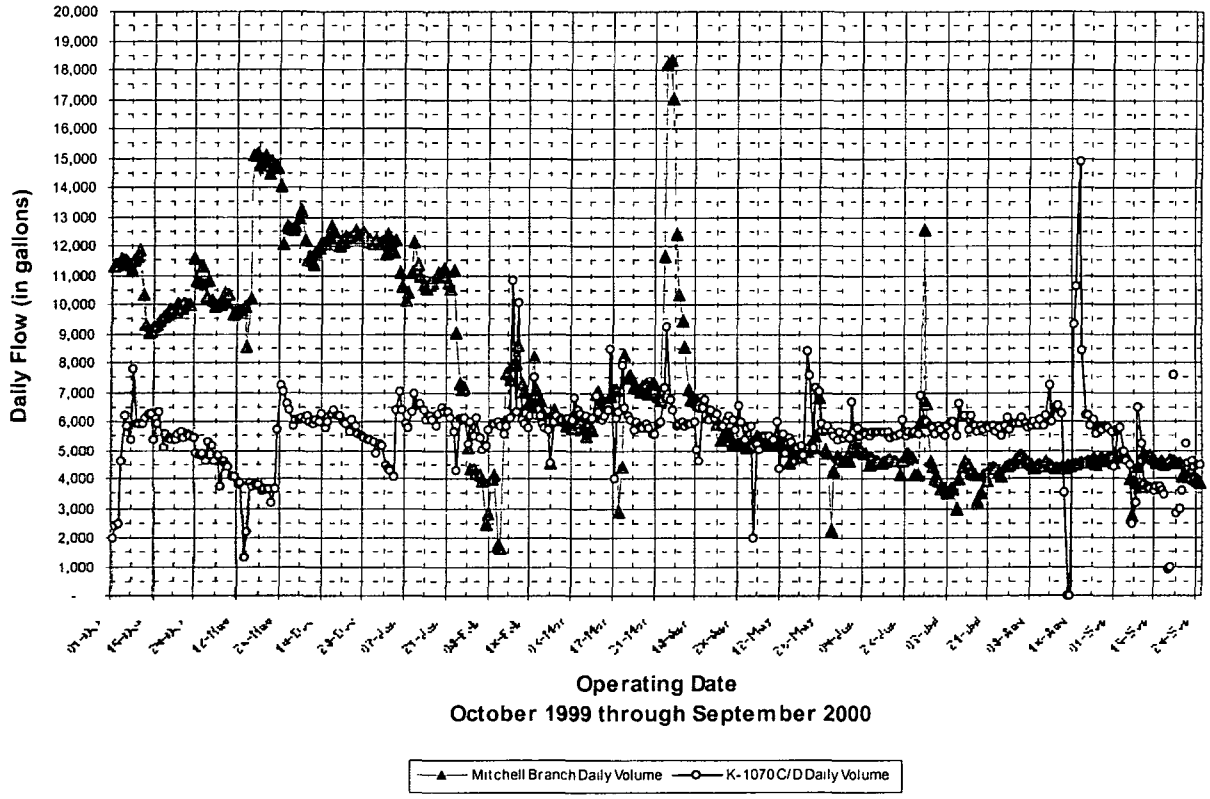


Fig. 2.10. Flow from the Mitchell Branch and K-1070-C/D groundwater collection systems.

Potentiometric Surface. A potentiometric surface map of the Mitchell Branch area is included as Fig. 2 11 This map is based on water levels collected from wells and piezometers representing the shallow aquifer unit The potentiometric surface forms a trough-like pattern that centers over Mitchell Branch and the groundwater collection system The potentiometric surface is depressed in the Mitchell Branch area, indicating that these two features influence groundwater drainage. Some of this drainage is likely associated with the interceptor trench and the 29 recovery wells, but a considerable portion of this drainage is likely associated with the stream (i e , Mitchell Branch).

A potentiometric map of the K-1070-C/D area is included as Fig 2 12 This map is based on water levels collected from wells and piezometers representing the shallow aquifer unit The potentiometric surface forms a hydraulic low, or depression, centered over recovery sump RS-09 and the southern leg of the K-1070-C/D trench. This depression does not extend northward toward RS-07 This indicates the strongest area of hydraulic response within the aquifer is in the area that surrounds the southern leg of the trench.

Water Quality Trends. Several contaminants of concern, representative of the groundwater plumes for both the Mitchell Branch and K-1070-C/D systems, are discussed below and shown in Figs 2 13 through 2.17. As shown in the figures, no data are provided for the piezometers at Mitchell Branch for the August/September 2000 sampling event This is because the piezometers were abandoned prior to the August sampling event

During FY 2000, concentrations of TCE and its degradation product cis-1,2-DCE, in general, have increased in monitoring wells and piezometers representing the shallow groundwater associated with Mitchell Branch from levels obtained at the end of FY 1999 as shown on the monitoring results graph (Figs. 2.13 through 2 15). The exception is UNP-005 (Fig 2 14), which is located adjacent to the upgradient side of the Mitchell Branch trench, where TCE is no longer present at detectable concentrations Although the most recent sample from DPZA-008 shows an increase in TCE concentration (Fig 2 13), overall there has been a decreasing trend in TCE concentrations, however, the low concentrations in 1998 and 1999 may be indicative of more effective operation of the system TCE levels have been relatively steady in most of the samples collected from monitoring locations around the K-1070-C/D system (Fig 2 16) BRW-086 and UNW-110 (Fig 2 16) represent a well pair located downgradient of the collection system and on the southwestern edge of the plume It can be seen in Fig. 2 16 that increasing trends in TCE concentrations are indicated by the data form these wells However, it can be seen in Fig 2.17 that a significant decreasing trend (determined using the Mann-Kendall test) in TCE concentrations is evident at wells TMW-011 and UNW-114 (Fig 2 17) It should be noted that UNW-114 is located upgradient of the groundwater collection system and TMW-011 is downgradient of UNW-114 and the K-1070-C/D trench

As shown on Fig 2.15, DCE concentration levels in samples representing shallow groundwater downgradient of the Mitchell Branch system increased during FY 2000, with the exception of DPZA-008, which remained relatively consistent with samples collected during the prior (dry season) event in August 1999. DCE concentrations in most of the samples collected from monitoring locations around the K-1070-C/D system have been relatively steady

Surface Water Trends. Surface water quality within Mitchell Branch has remained relatively stable with a general increase in VOC concentrations between the two FY 2000 sampling events as shown in Fig 2 18 VOC concentrations, specifically TCE, DCE, and vinyl chloride, in samples collected during the August 2000 (dry season) sampling event increased from the March 2000 (wet season) sampling event. However, these higher concentrations are consistent with concentrations from the prior year and

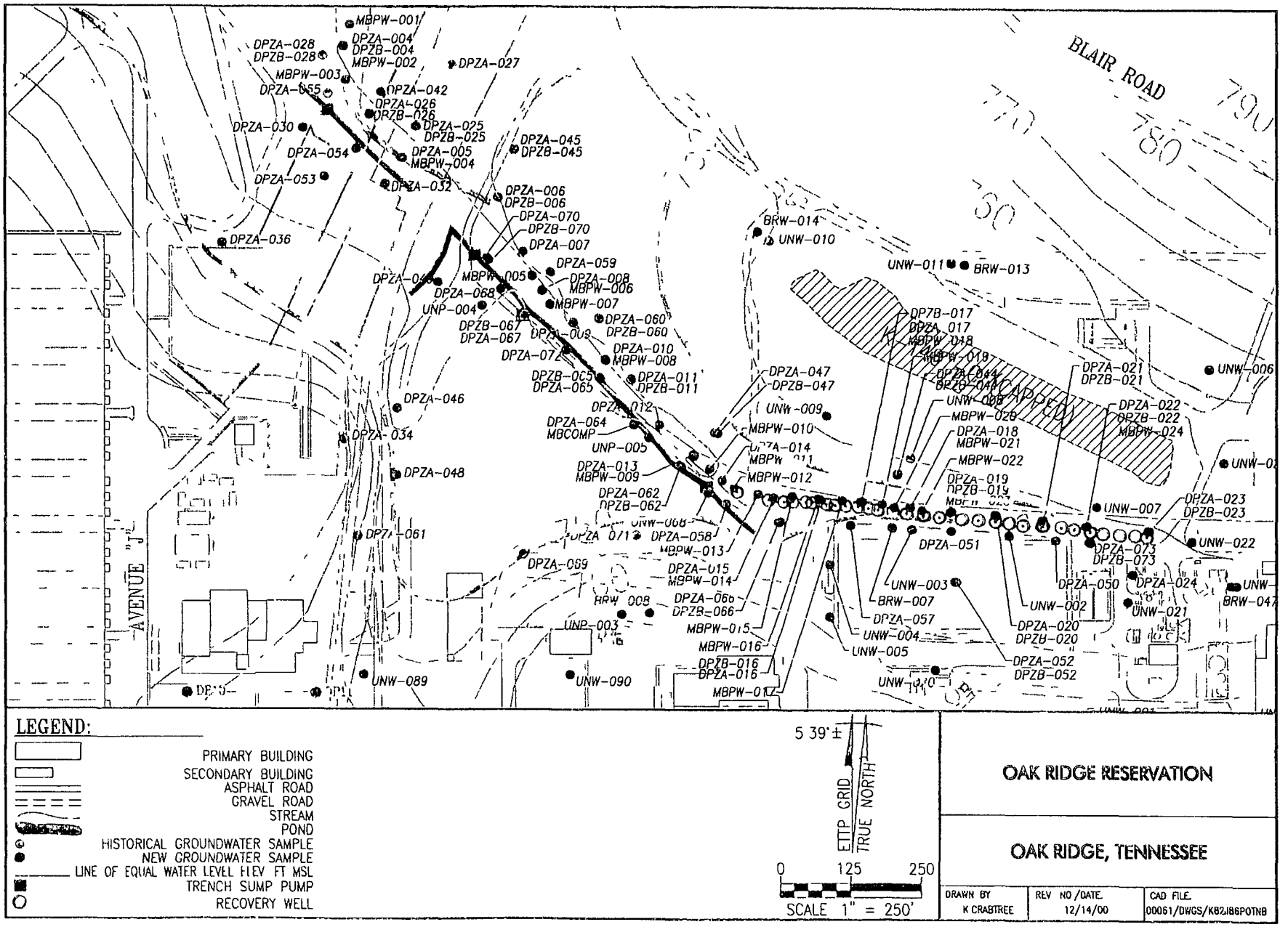


Fig. 2.11. Potentiometric map of the Mitchell Branch area, June 2000

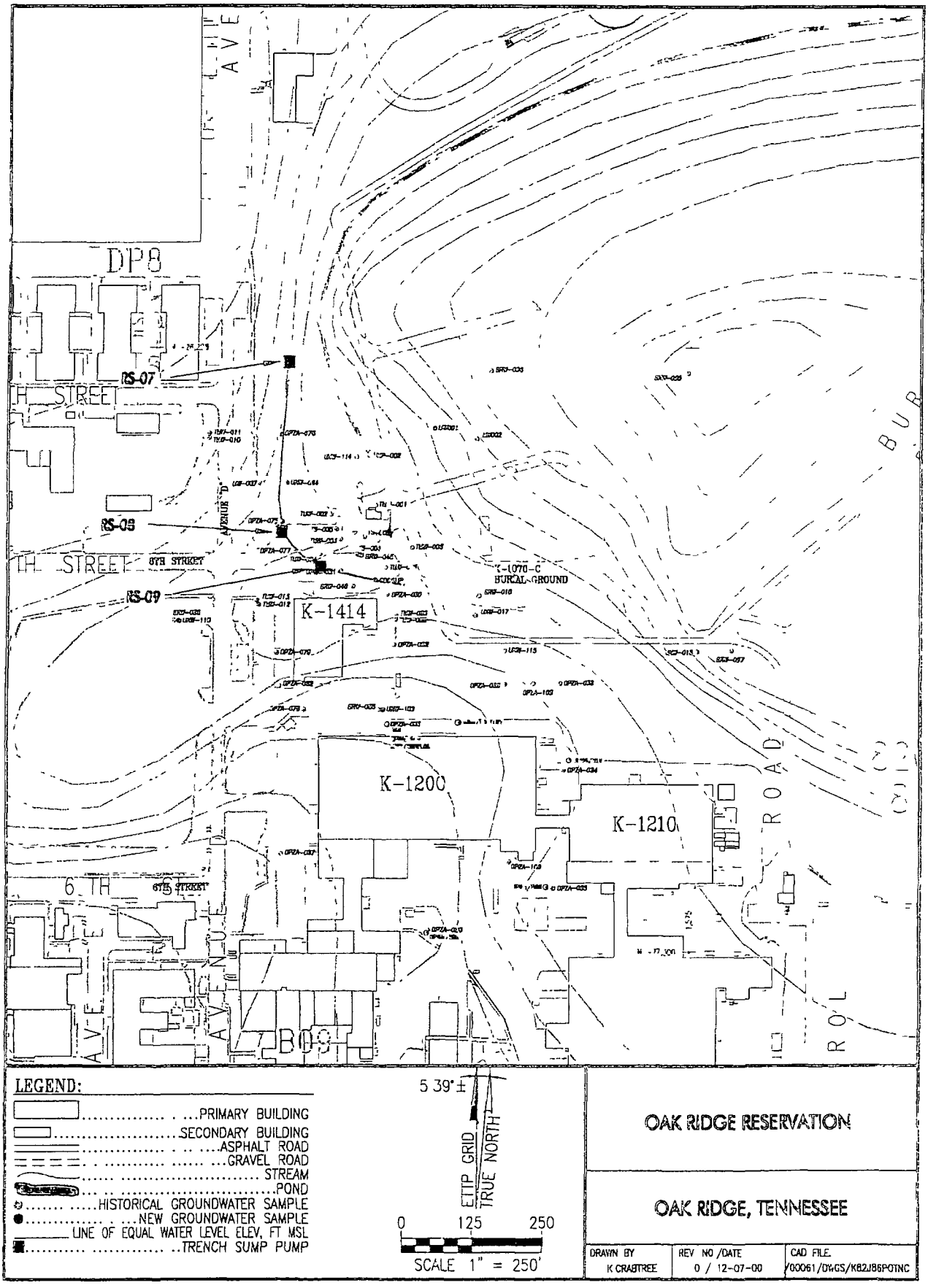


Fig. 2.12. Potentiometric map of the K-1070-C/D area, June 2000.

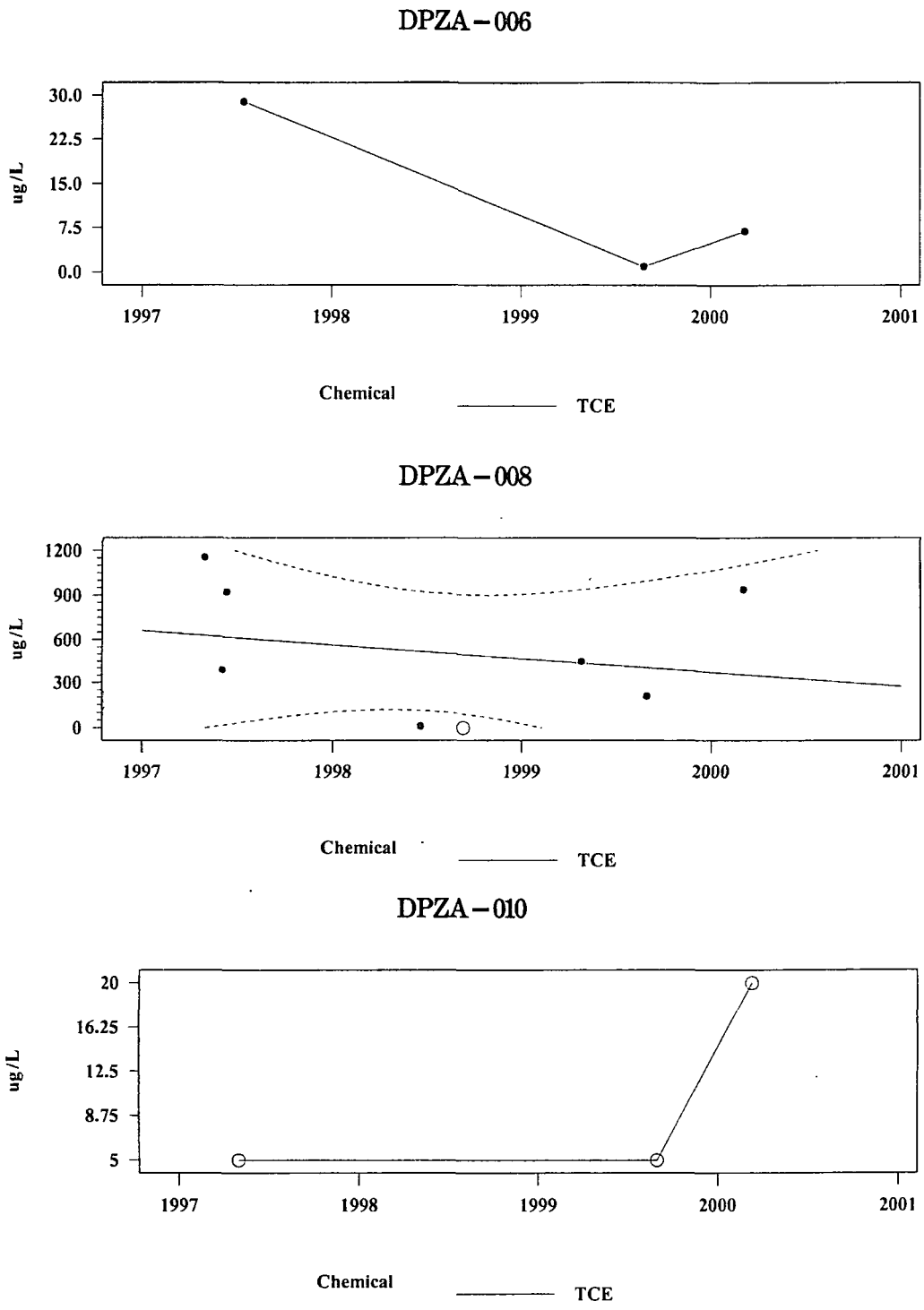
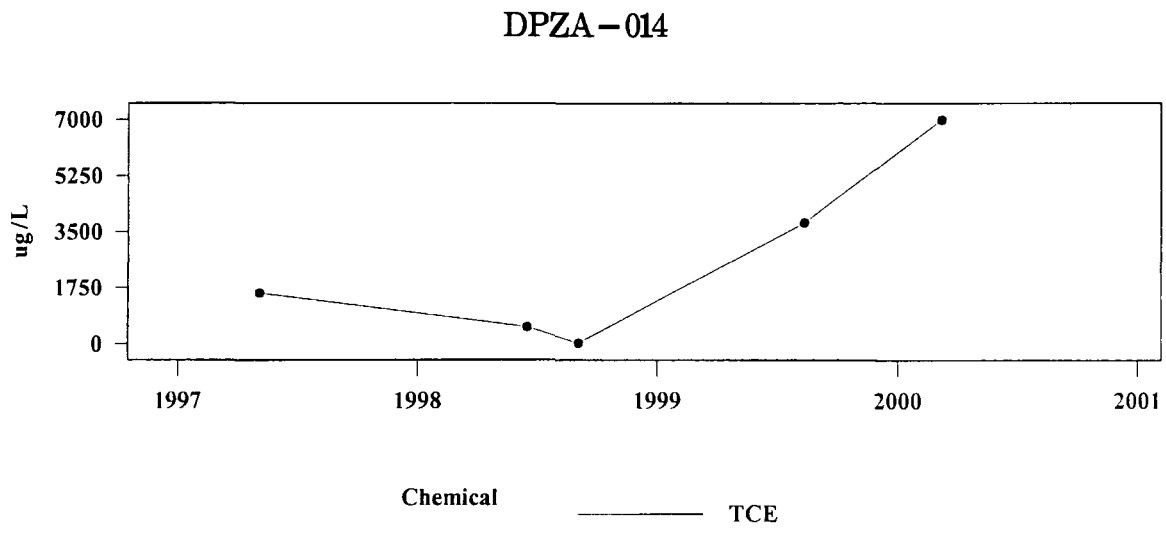


Fig. 2.13. TCE concentrations at monitoring locations downgradient of the Mitchell Branch collection system.



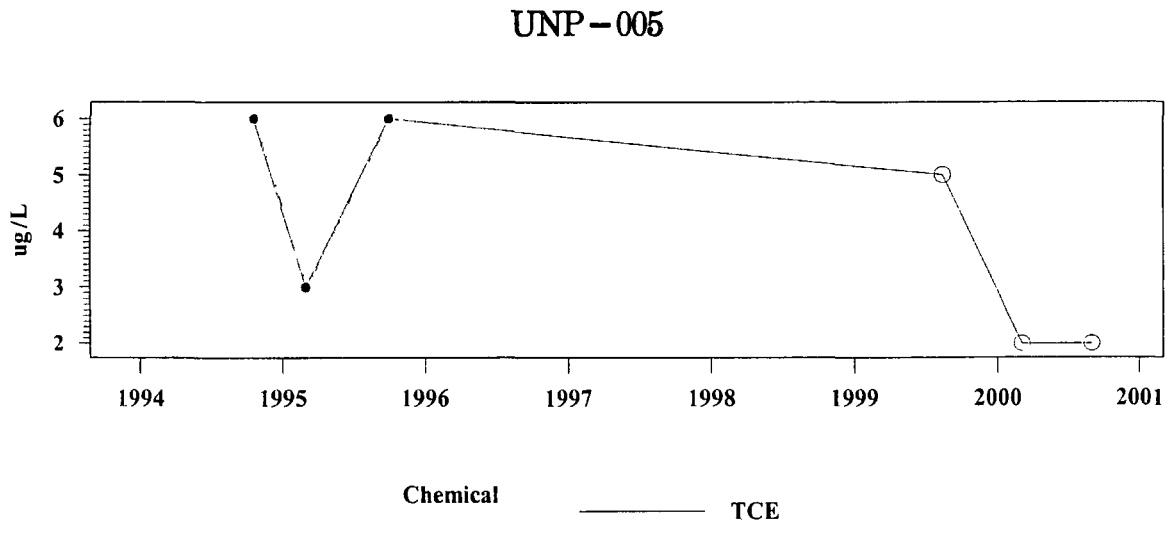


Fig. 2.14. TCE concentrations at monitoring locations in the Mitchell Branch area.

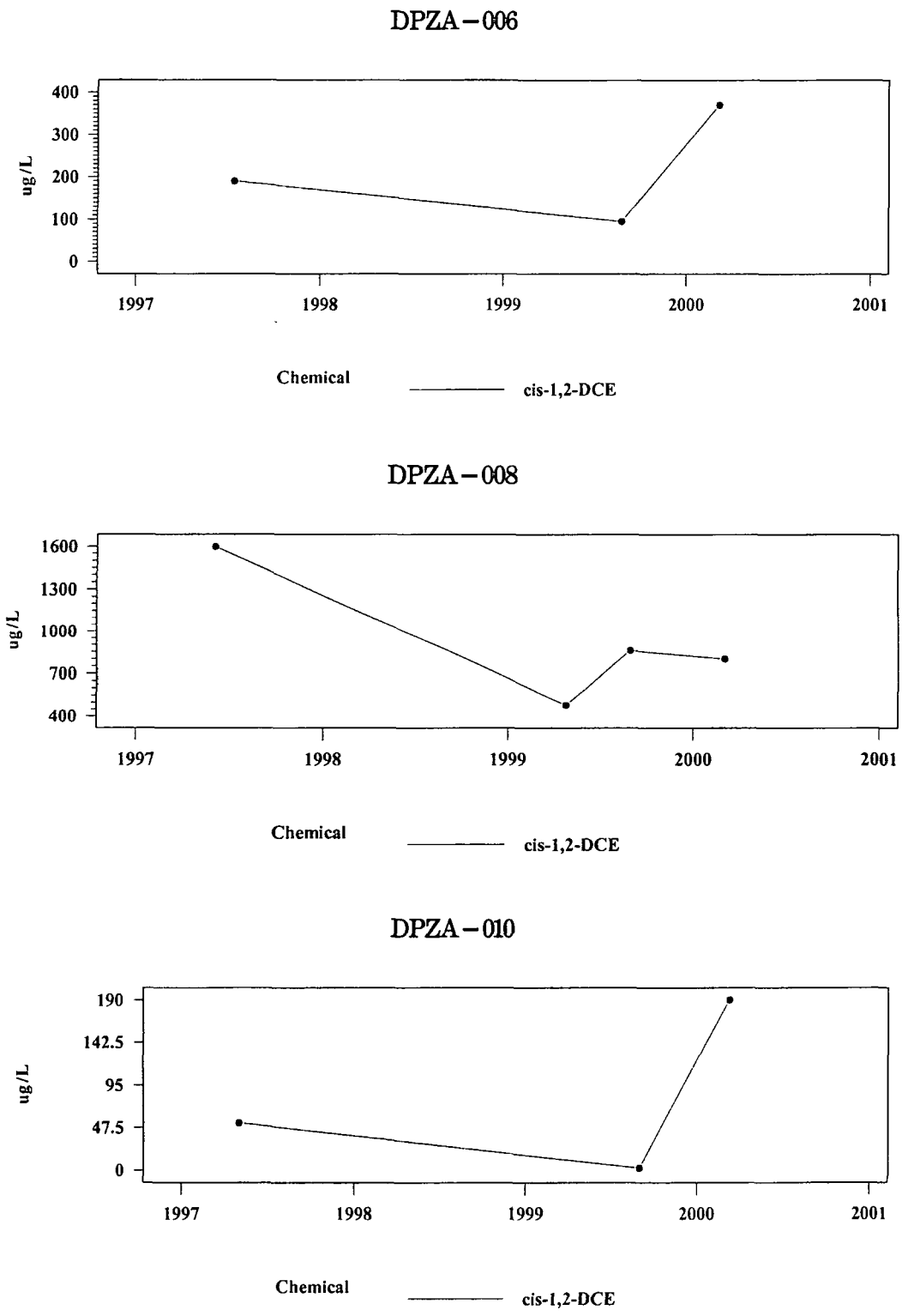
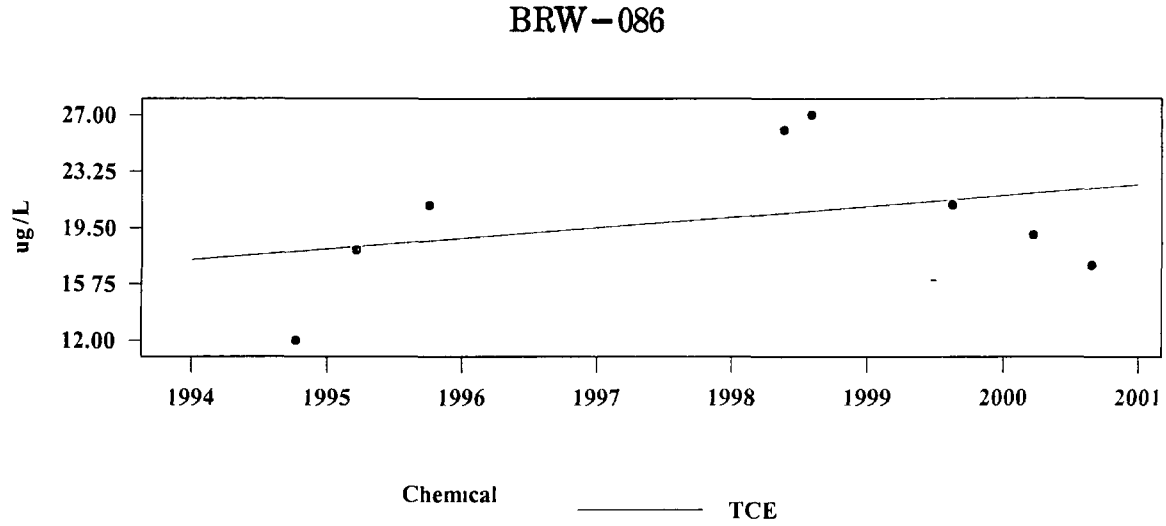


Fig. 2.15. Concentrations of cis-1,2-dichloroethene at monitoring locations downgradient of the Mitchell Branch collection system.



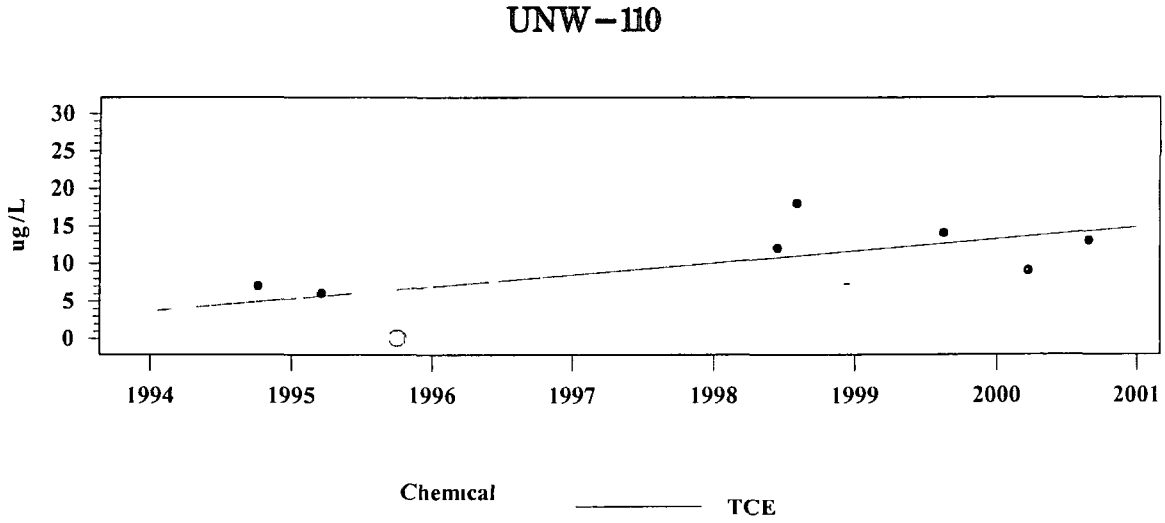
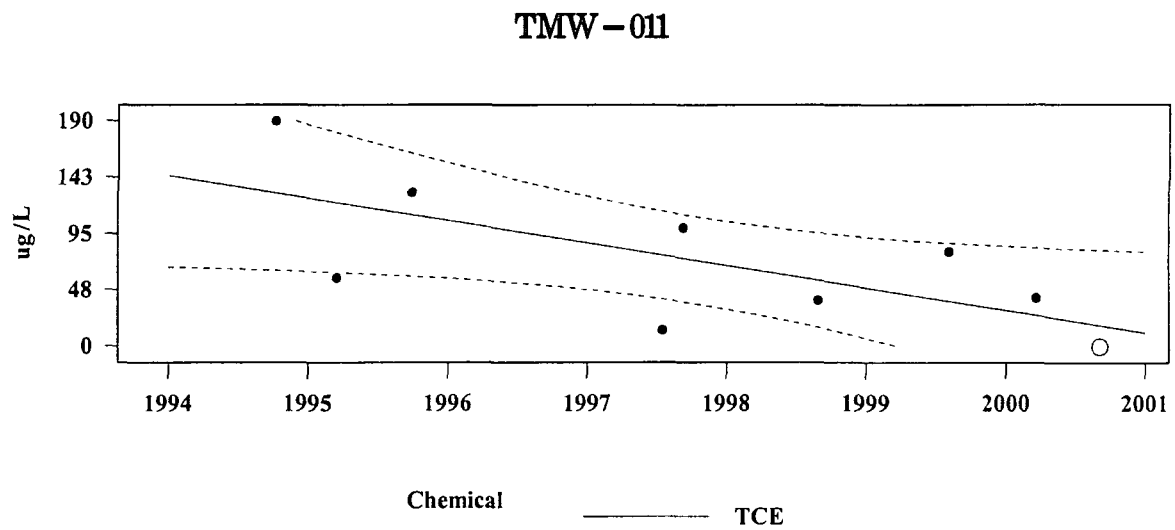


Fig. 2.16. TCE concentrations at monitoring locations downgradient at the K-1070-C/D collection system.



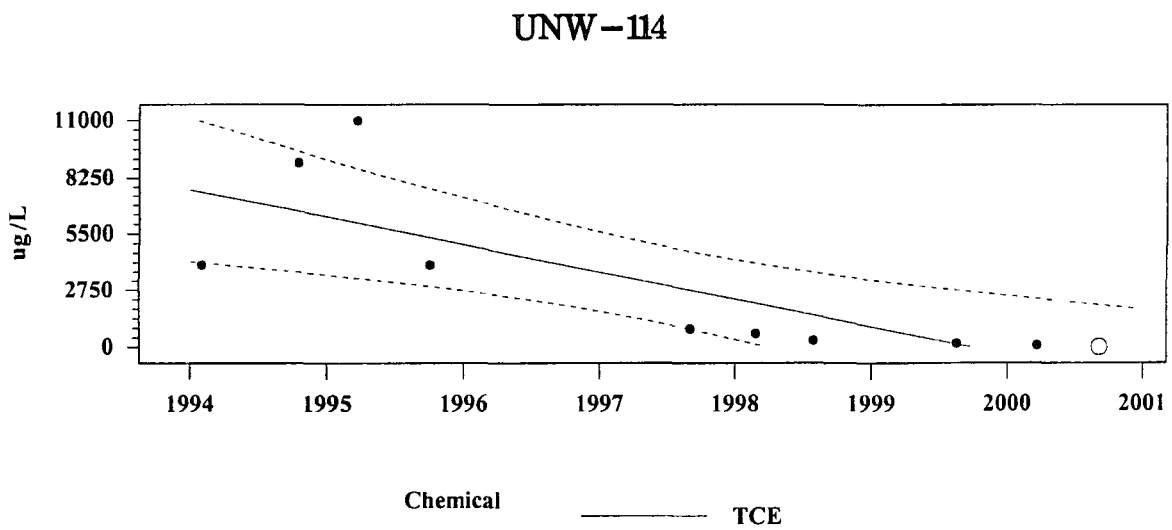


Fig. 2.17. TCE concentrations at monitoring locations in the K-1070-C/D area.

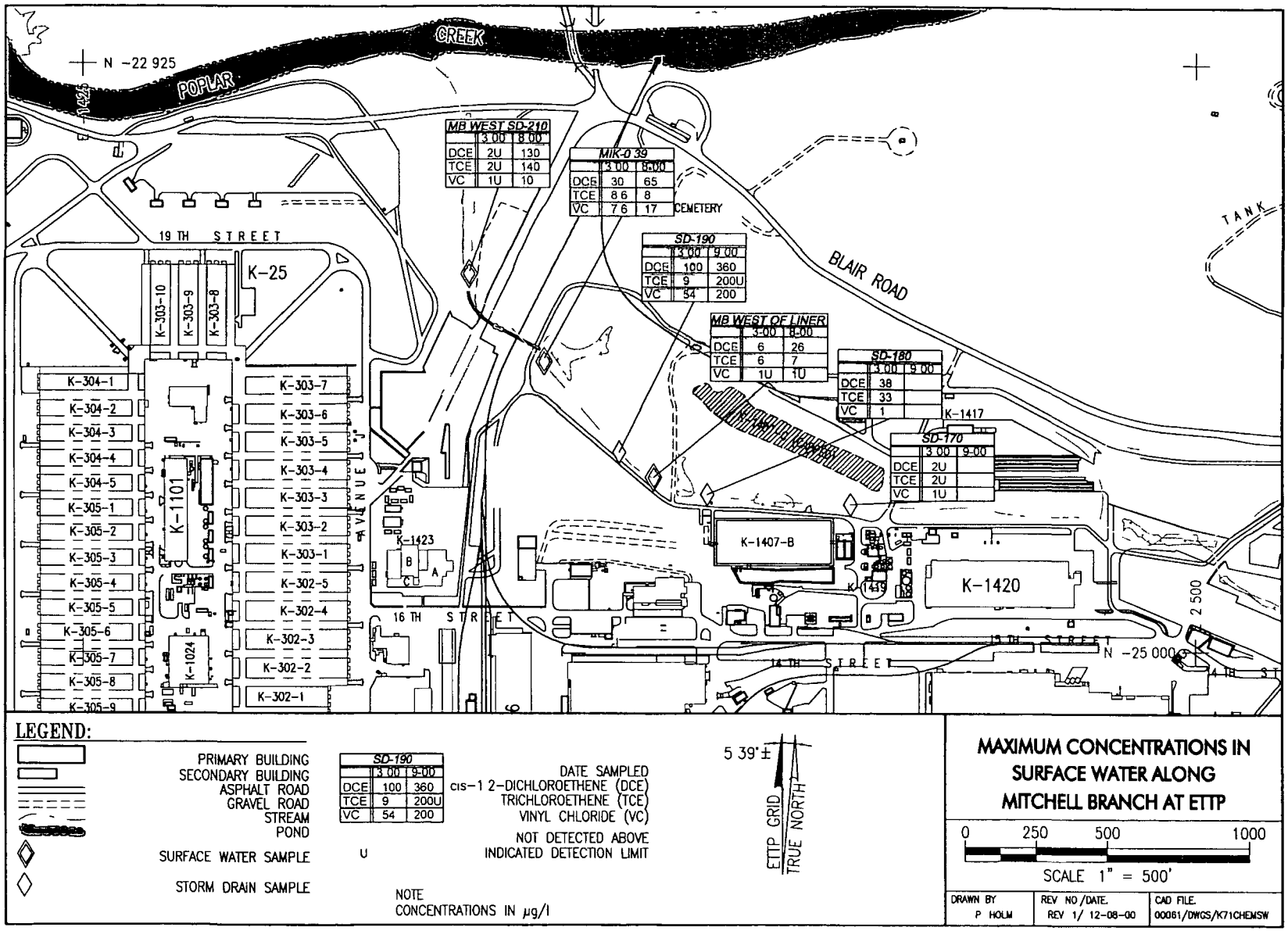


Fig. 2.18. Maximum VOC concentrations in surface water along Mitchell Granch, FY 2000z

represent a rebound trend This trend may be caused by a seasonal response to variations in groundwater discharge during the wet versus dry seasons VOC concentrations are higher in the dry season and decrease in the wet (March) season The FY 2000 dry season (August/September) results are consistent with the FY 1999 dry season results

Sediment Trends. Concentrations of constituents of concern within the sediments of Mitchell Branch have remained relatively stable near the upstream end of the Mitchell Branch and were variable at the downstream stations during the FY 2000, as shown in Fig 2 19 Concentrations of TCE, DCE, and vinyl chloride were found at or below the detection limits at the sample location situated near the west of the liner These VOCs decreased from the March to the August 2000 sampling events at location MIK 0 39 These same VOCs increased in concentration from the March to the August 2000 sampling events at the sample location west of storm drain SD-210

Groundwater Plume Characteristics. Plume maps, based on water quality results from the March 2000 (wet season) and late August/September 2000 (dry season) sampling events, are included as Figs 2 20 to 2 23 Plume maps are included for both of the groundwater collection systems and were generated from data representing TCE concentrations Plume areas and concentration distribution are based on these relatively recent analytical results combined with historical results from previous sampling events The current sampling program is focused on water quality and impact on the Mitchell Branch area and not on changing conditions within the "body" of the plumes where estimates of contaminant mass reduction may be evaluated Plume shape and concentration distribution relative to advancing time were based heavily on historical analytical results for the upgradient portion of the plume No significant changes to the shape of the plumes was apparent during FY 2000 Concentration distribution has changed slightly in some areas as discussed above

In contrast, comparison of the FY 2000 plume maps to the plume maps from August 1998 (Figs 2 24 and 2 25), which was prior to system operation, indicates significant changes in some areas At Mitchell Branch, TCE concentrations have declined at downgradient monitoring locations DPZA-006 and DPZA-008 since 1998 TCE concentrations have also declined at upgradient locations UNP-004, UNP-005, UNW-004, and DPZA-057 These locations where concentrations have declined are in areas of the collection system that is known to be operating (RS-03 and the recovery wells) more consistently than other areas of the system, suggesting that effectiveness of the system may increase with improved operations

At the K-1070-C/D area, TCE concentrations have declined since 1998 at downgradient locations TMW-010 and TMW-011, however, this decline is likely more related to the decline in upgradient concentrations (UNW-114) than trench operation Based on potentiometric data (Fig 2 12) and operation records for RS-07, this segment of the K-1070-C/D trench does not appear to be functioning effectively The decline in TCE concentrations at UNW-126 and UNW-127 southeast of the K-1070-C/D trench is not likely to be a function of the collection system, given the source and direction of groundwater flow in this area

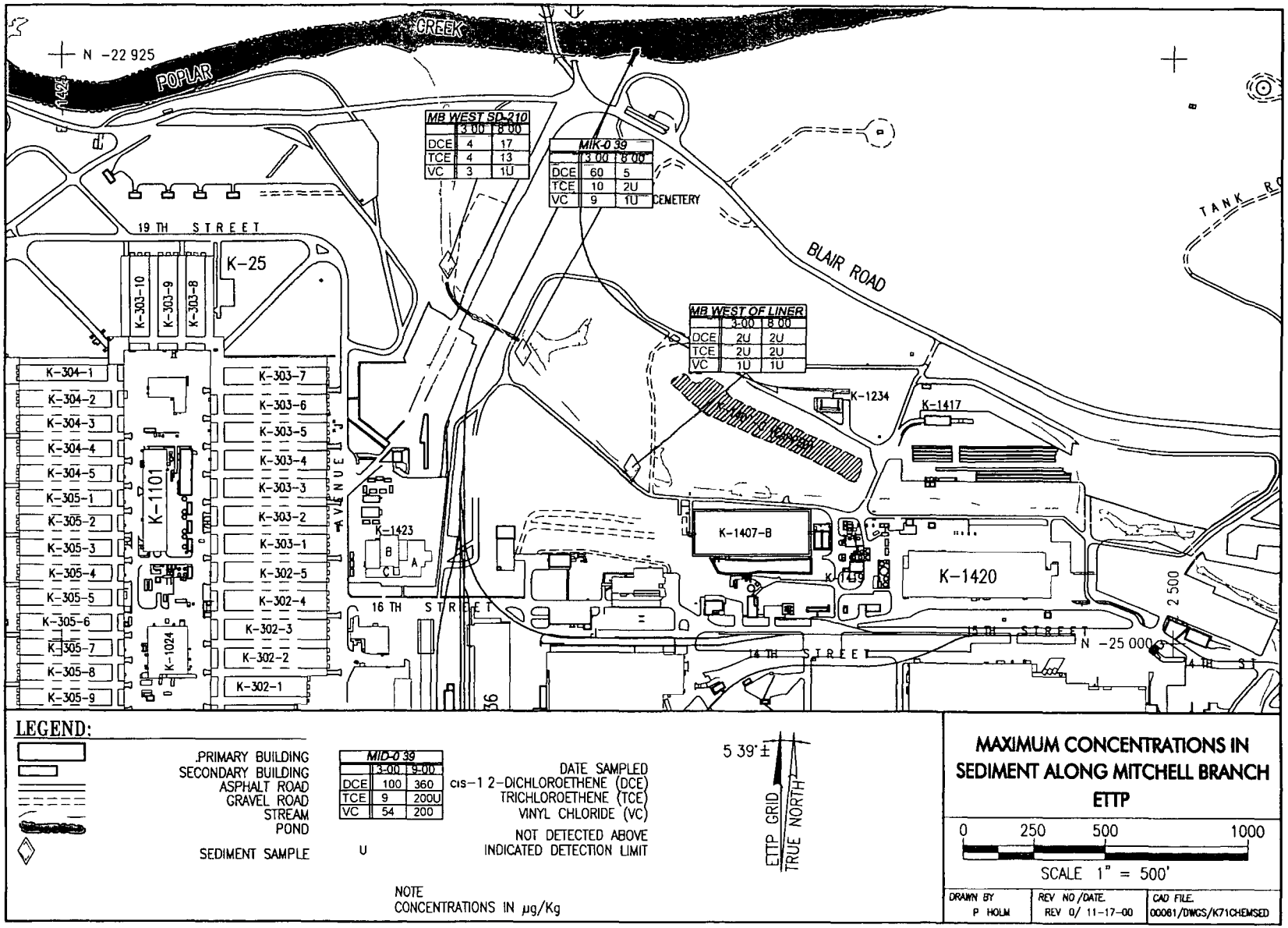


Fig. 2.19. Maximum VOC concentrations in sediment along Mitchell Branch, FY 2000.

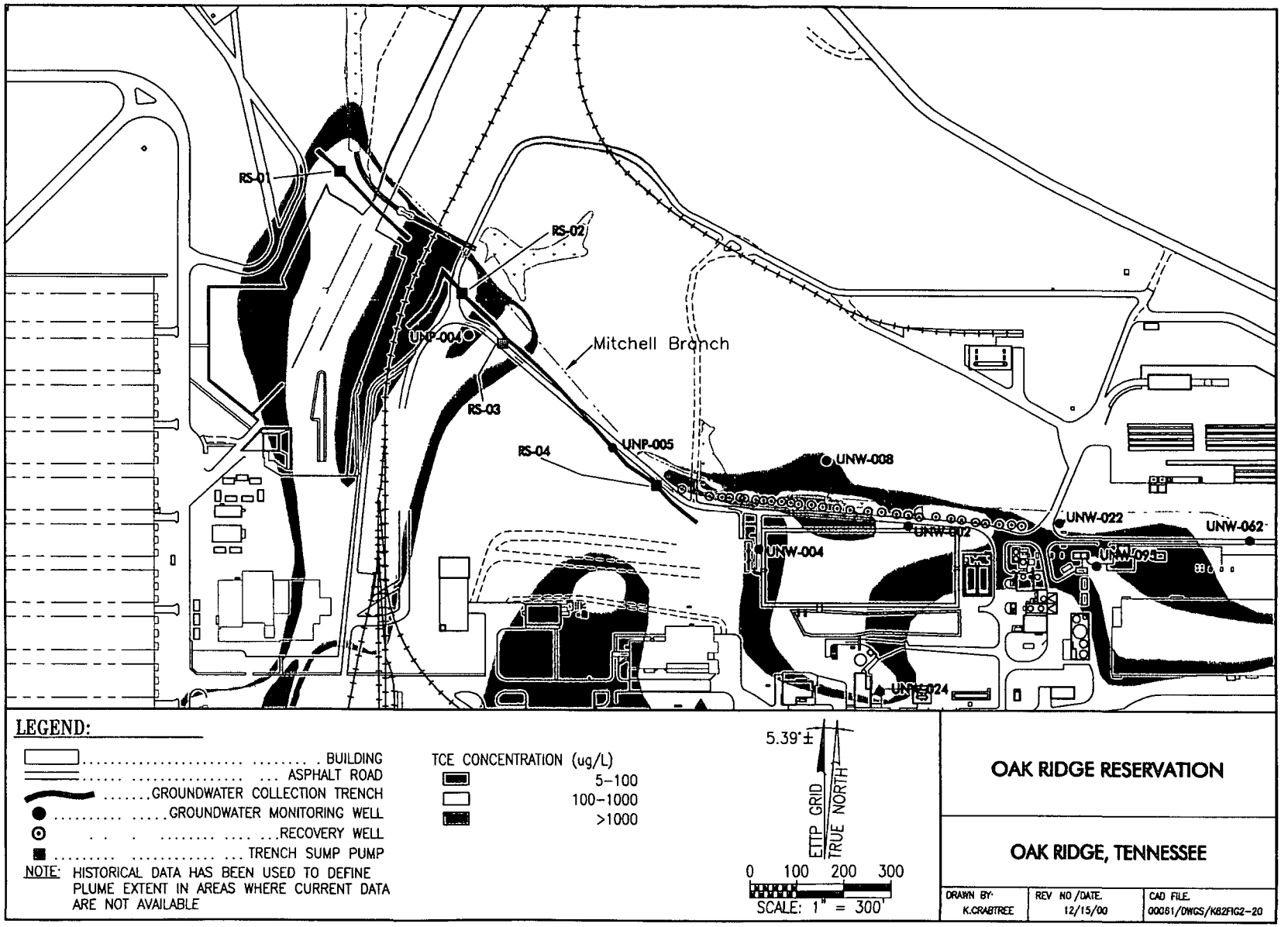


Fig. 2.20. TCE in groundwater in the Mitchell Branch area, March 2000.

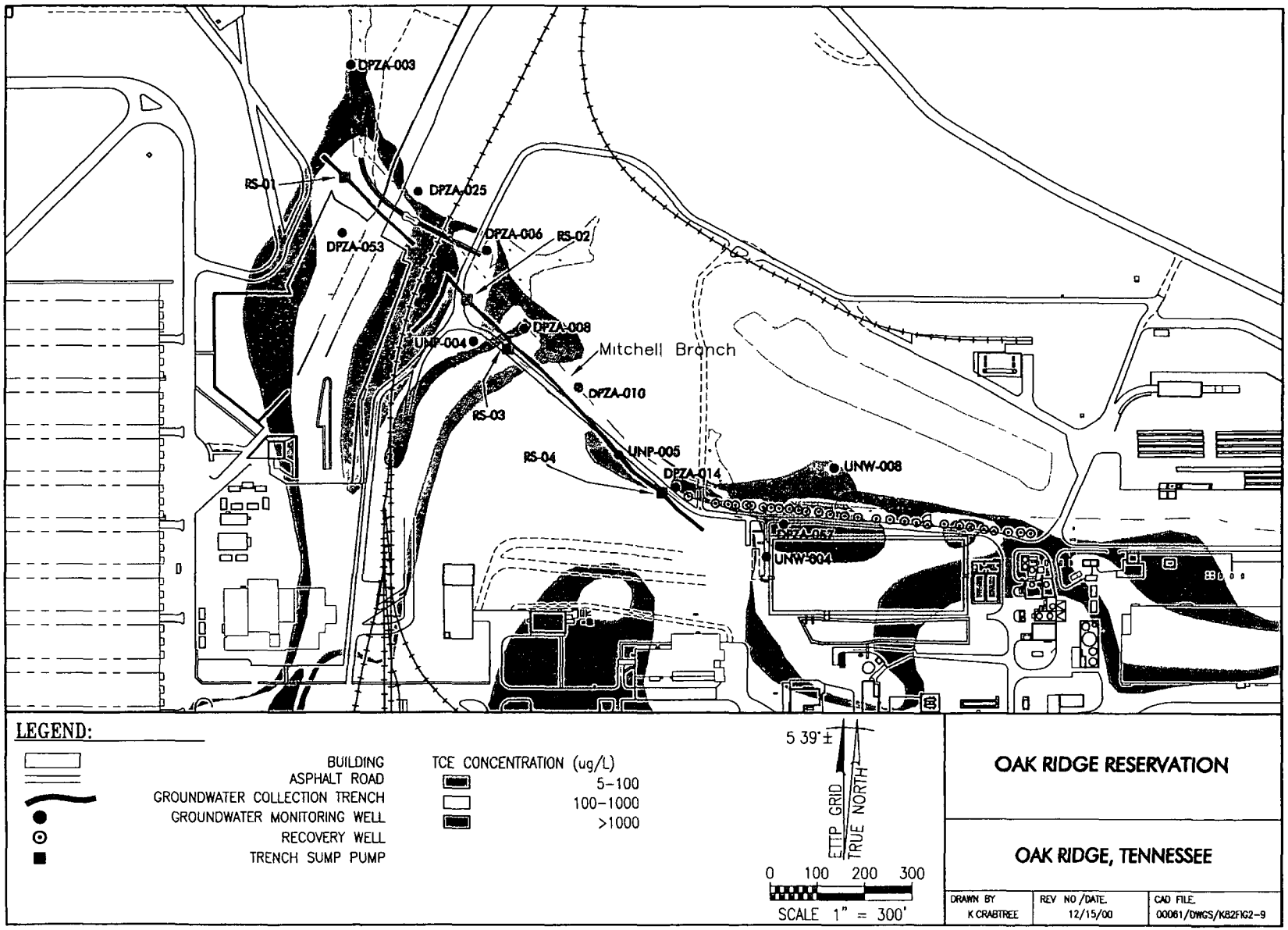


Fig. 2.21. TCE in groundwater in the Mitchell Branch area, August 2000.

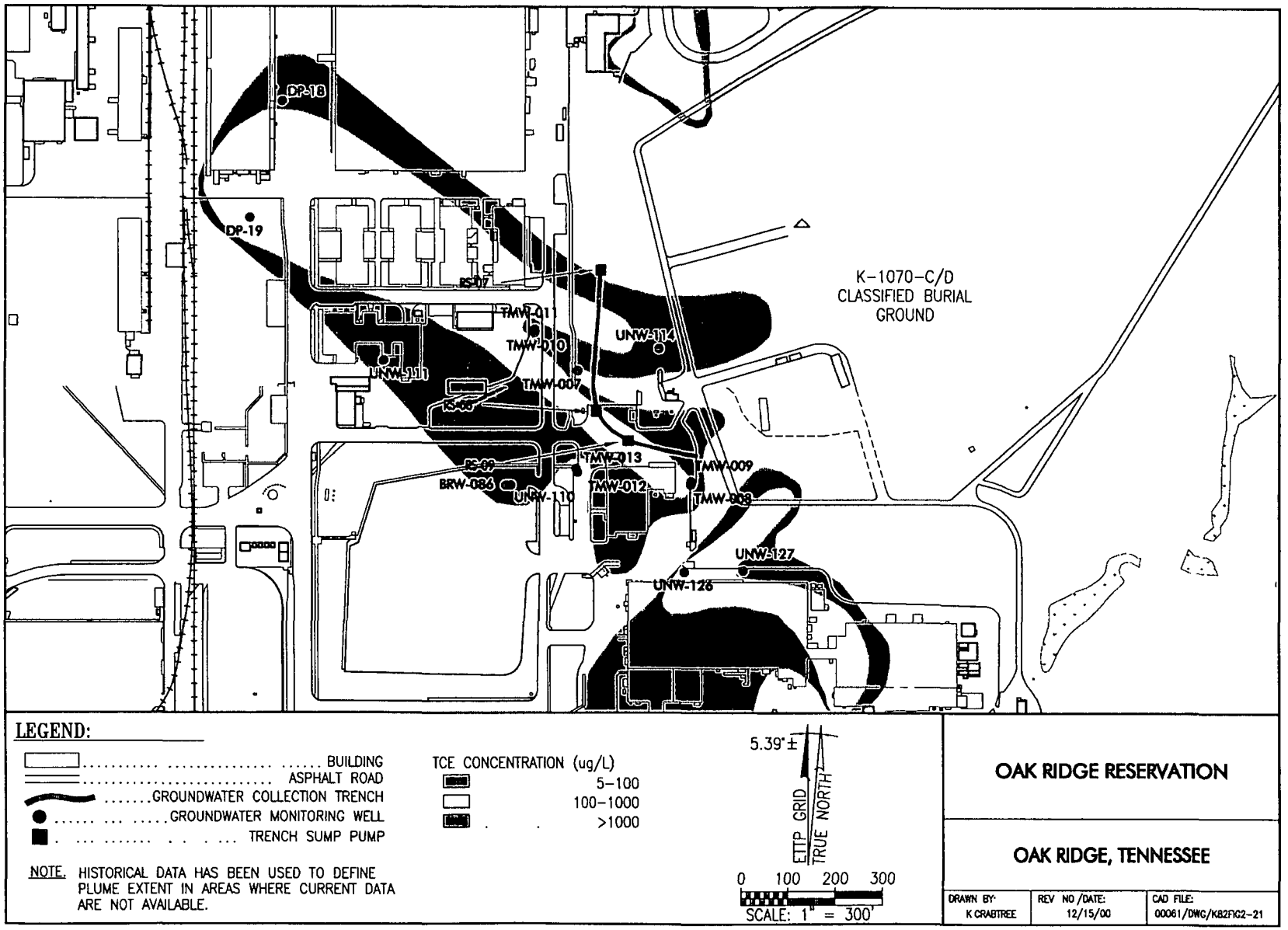


Fig. 2.22. TCE in groundwater in the K-1070-C/D area, March 2000.

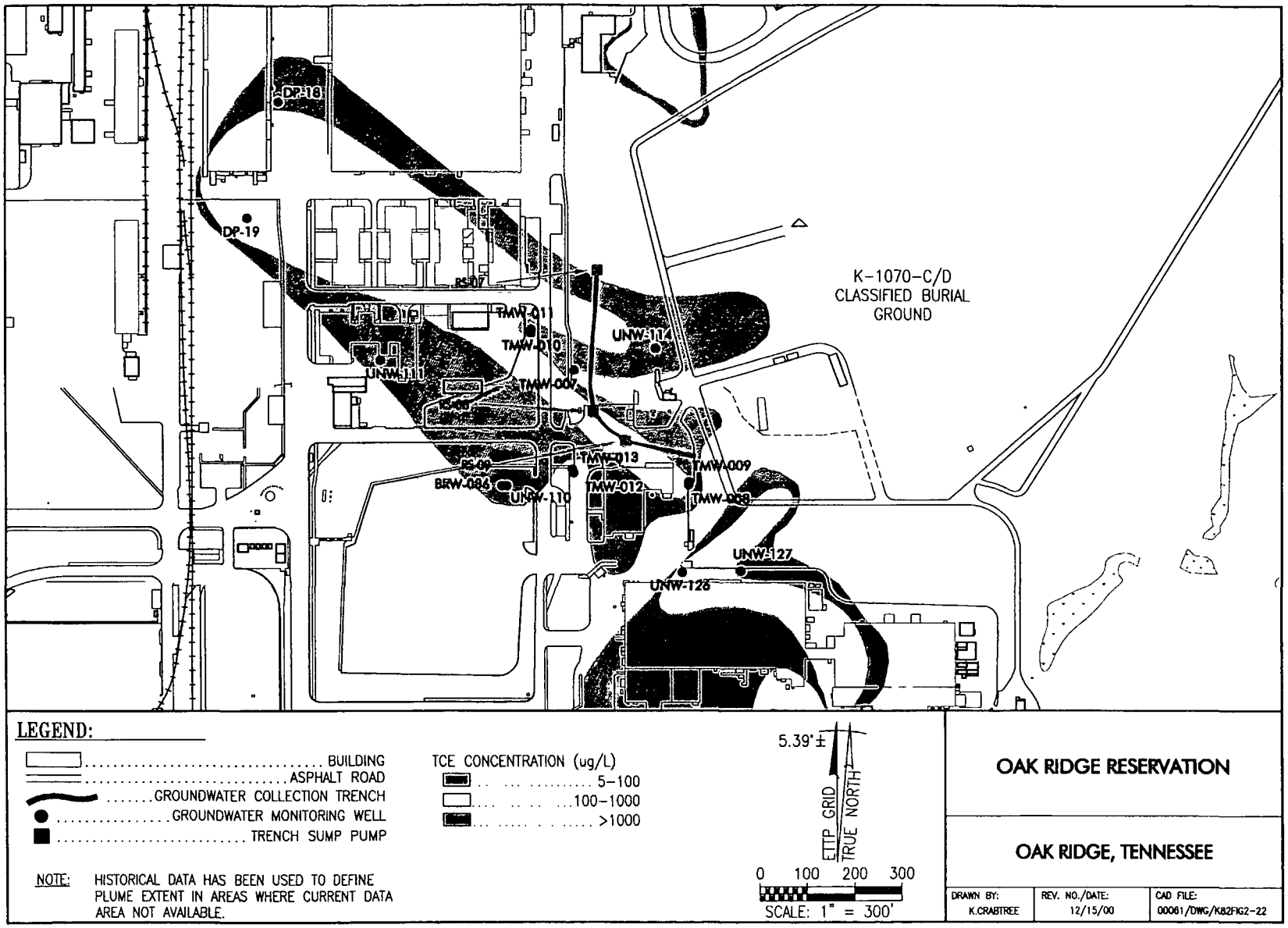


Fig. 2.23. TCE in groundwater in the K-1070-C/D area, August 2000.

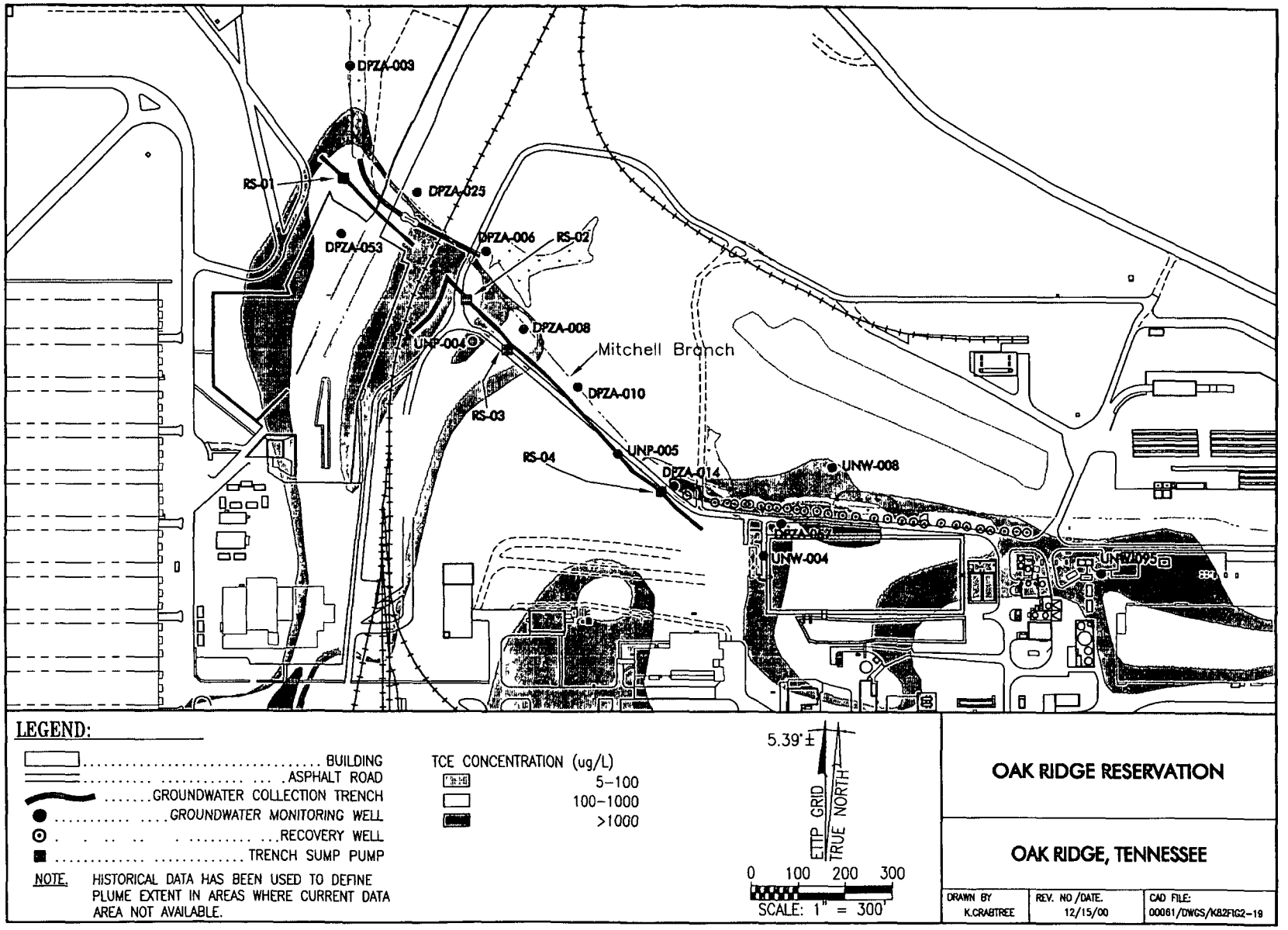


Fig. 2.24. TCE in groundwater in the Mitchell Branch area, August 1998.

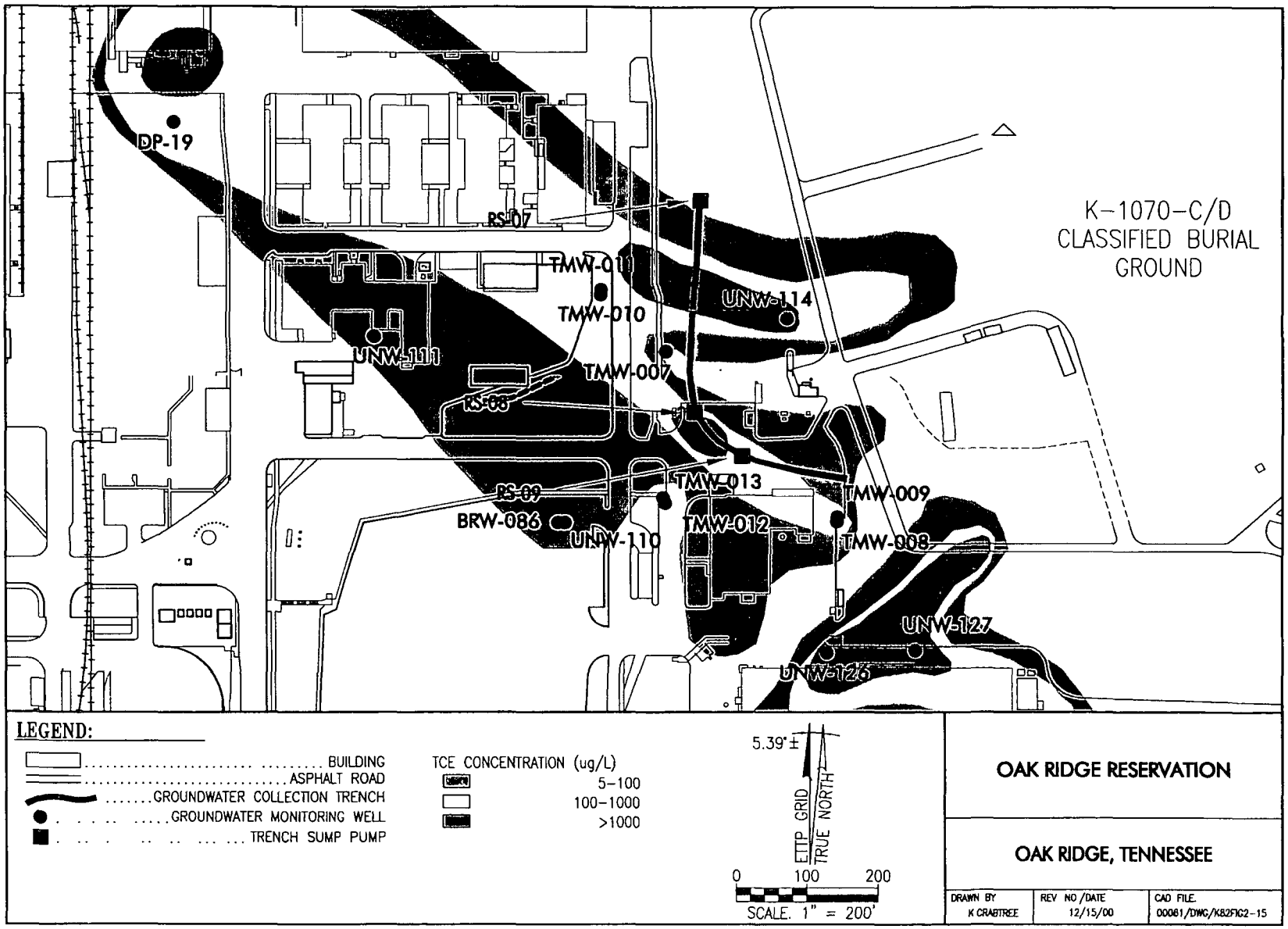


Fig. 2.25. TCE in groundwater in the K-1070-C/D area, August 1998.

2.5.5 Conclusions and Recommendations

Although the groundwater collection systems are capturing and extracting contaminated groundwater, as required in the Decision Documents for this removal action, from both the Mitchell Branch and K-1070-C/D plumes, these two remediation systems are not performing to the standards that were identified for this removal action

Extraction system (i e , recovery well, recovery sump, and trench) construction data are limited and, based on initial maintenance activities performed over the past year, may be questionable in some instances, such as depths of the recovery sumps In addition, little or no hydraulic performance-related data are available for the extraction systems, and the available data are focused on the surrounding aquifer and contaminant plume only In some cases, groundwater intercepted by the trenches is not extracted due to problems that may be associated with the filter media (i e , stone aggregate and well sand pack) and/or position of the recovery sumps relative to the trench morphology These problems may be due to plugging, or clogging, of the filter media caused by intrusion of fine particulate material (i e , clay and silt), precipitates, and/or biofouling processes Plugging problems will lower extraction system efficiencies and likely limit effectiveness Without rehabilitation/redevelopment, system efficiencies associated with the trench recovery sumps will likely continue to decrease A performance-related monitoring program designed to provide hydraulic head data to support evaluation of these conditions does not exist Effectiveness and efficiency (and loss of efficiency) related to the extraction trenches and recovery wells cannot be assessed without an active monitoring program

Recent water quality data indicate that problems associated with the pumping/conveyance and extraction systems may be contributing to a decline in water quality (i e , slight increases in VOC concentrations) downgradient of the Mitchell Branch and K-1070-C/D groundwater collection systems as discussed previously Inefficiencies associated with the extraction systems (i e , wells and trenches) and conveyance (i e , pumps) system, and/or degradation of the systems' operational characteristics, will impact its future performance These two groundwater collection systems can be operated in a more efficient and effective manner if efforts can be focused to diagnose/evaluate specific conditions and functional characteristics Those findings can then be used to implement a corrective action/rehabilitation program This diagnostic approach will lead to an improved understanding of these systems and provide a basis to improve and optimize each of the groundwater collection systems

It is recommended that the following activities be conducted in order to improve and optimize the effectiveness of the collection systems

- Conduct a hydraulic performance assessment of the extraction system to assess the hydraulic connection between (1) the recovery sumps and the trenches, (2) the trenches and the overburden aquifer, and (3) the recovery wells with the overburden aquifer These activities will provide a baseline understanding of the current extraction system efficiencies and operating conditions The hydraulic performance assessment should initially address one of the recovery sumps and include the aggressive redevelopment of the recovery sump well using a jetting technique, the installation of an alternative pump capable of pumping suspended sediment, and pilot test using the alternative pump for extraction of water from the sump for an extended period of time while monitoring water levels in the trench and surrounding formation to determine impacts of the pumping

- Develop a trench and well rehabilitation program as necessary from the results of the hydraulic testing If the results of the testing are determined to be successful, implement these actions at all of the recovery sumps (or, at least at those that currently are not functioning) If the results are determined to be unsuccessful, a more comprehensive rehabilitation program for the trench is likely to be necessary Implement a periodic rehabilitation program to maintain system operation The

rehabilitation program design would be based on results of the analyses outlined above. The frequency of implementation could be based on a preset operational standard (e.g., quarterly, or percentage decrease in well efficiency).

- Continue to monitor function, efficiency, and effectiveness of (1) the pump and conveyance system, (2) the extraction system(s), and (3) the environmental media. This should include (1) monitoring water levels in piezometers, monitoring wells, recovery sumps, and selected recovery wells on a regular basis; (2) continued monitoring of water quality in selected monitoring wells situated downgradient of the two groundwater collection systems and within the upgradient plume/residual-source area with a focus on evaluating changes to plume morphology relative to the hydraulic capture zone; and (3) periodic retesting of the groundwater collection systems by implementing the items above.

2.6 K-901-A POND REMOVAL ACTION

- AM: September 1997
- Field Activities Complete: December 1998
- RmAR: September 1999

2.6.1 Project Description

The K-901-A Holding Pond is a north–south elongated impoundment that occupies 10.3 acres within a topographic low in the northwest portion of the ETTP (Fig. 2.26) The pond received chemical discharges and sludge from the gaseous diffusion process. The volume of discharge was greatly reduced in 1985 and discontinued in 1989. The pond also served as a disposal basin for the contents of cylinders and other hazardous chemical containers. Currently, the pond receives storm water runoff from a portion of the K-31/33 area of the ETTP. The former K-895 Cylinder Destruct Facility is adjacent to the K-901-A Pond and was used from mid-1965 to 1975 to dispose of the contents of cylinders and other chemical containers.

The components of the removal action, completed in December 1998, included the following actions:

- dewatering of the pond;
- harvesting and disposal of the fish in an on-site disposal cell,
- removal of cylinders, containers, and other debris from the pond,
- treatment and disposal of the contents remaining in unbreached or incompletely reacted cylinders; and
- disposal of the cylinders, containers, and debris

2.6.2 Evaluation of Decision Document Requirements for Performance

2.6.2.1 Goals of decision

The purpose of this action is to reduce risk by removing gas cylinders and other hazardous material containers and metal debris from the ponds and removing the pathways for ingestion of PCB-contaminated fish from the ponds by humans or piscivorous wildlife The goal is to "ensure that the risk to human health and the environment posed by PCBs will be eliminated or reduced to acceptable levels." Two objectives for the K-901-A Holding Pond were identified for this removal action (DOE 1997g), to control health risks from ingestion in the following ways.

- mitigating current and future human health risk from the PCB-contaminated fish ingestion pathway to $<10^{-4}$ at the K-901-A Holding Pond, and
- mitigating and controlling future ecological risk from PCBs to populations of piscivorous wildlife through fish ingestion from the K-901-A Holding Pond

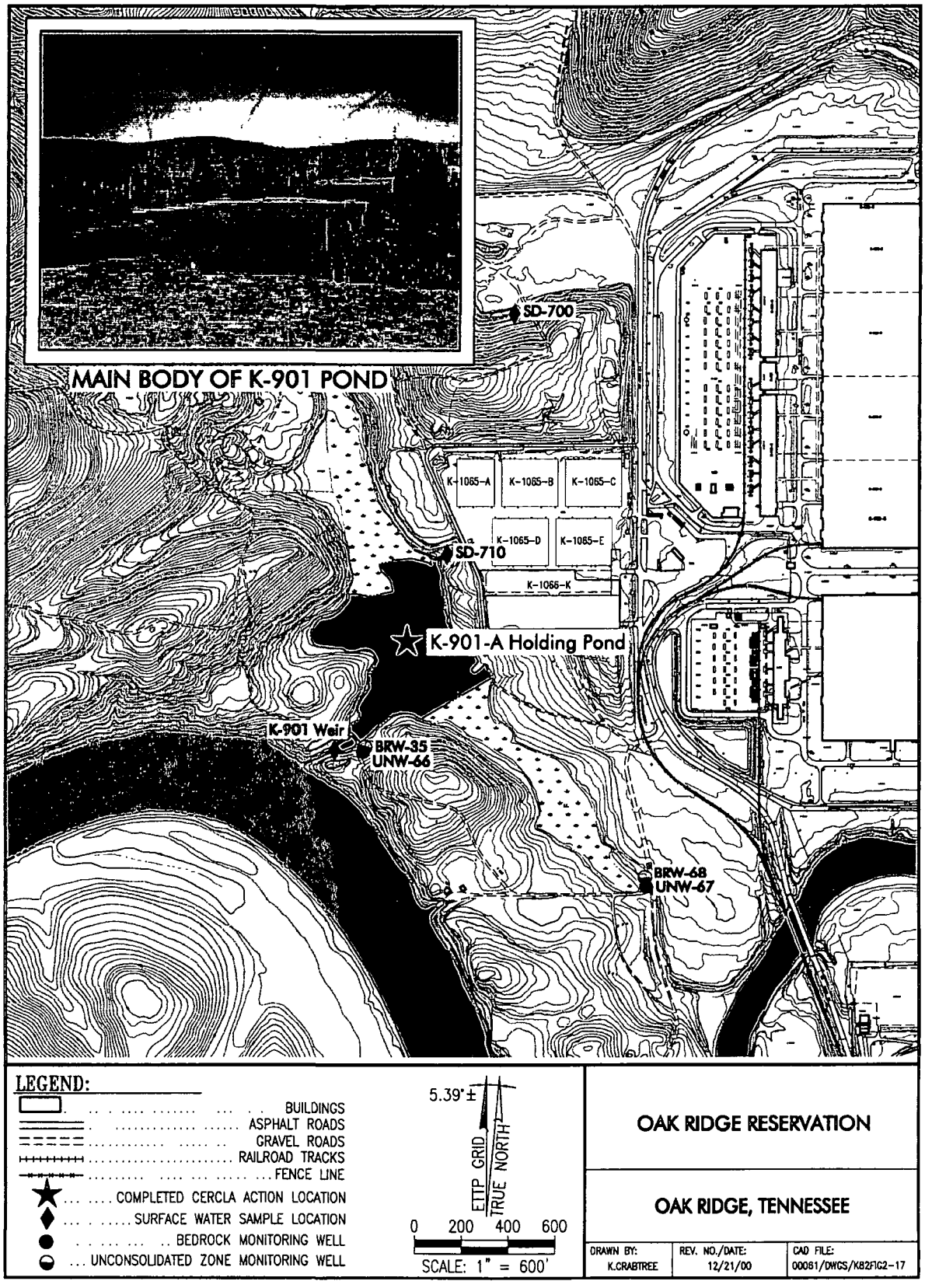


Fig. 2.26. Location of K-901-A Holding Pond and sample collection points.

2.6.2.2 Monitoring and stewardship required

Performance monitoring proposed in the RmAR as "required sampling" includes annual biological accumulation data Also included as "additional sampling" is the semiannual sampling of four monitoring wells (Fig 2 26) for VOCs, uranium isotopes, and ^{99}Tc Although the additional sampling includes monthly samples at the K-901 weir for metals and radiological parameters and quarterly sampling for PCBs and mercury, the Environmental Compliance organization collects only semiannual samples for radionuclides at the weir One sample will be collected at storm drain SD-710 and analyzed for PCBs and metals while monthly monitoring of general water quality parameters will be conducted at this location and additionally at storm drain SD-700 Performance monitoring commenced in 1999 at the K-901-A Pond

2.6.3 Implementation of Previous Year's Recommendations

The 2000 RER recommended that the data obtained from storm drain outfalls SD-700 and SD-710 be excluded from reporting in the RER based on the fact that these monitoring results are not relevant to the removal action taken at the pond, and the available data are reported under the ETTP NPDES Program Thus, monitoring results for these storm drains will not be reported in the 2001 RER

2.6.4 Evaluation of Performance and Stewardship Data—K-901 Pond Removal Action

Table 2 7 provides a summary of the Five-Year Review questions and answers for the K-901 Ponds Removal Action Further details are provided in subsequent subsections

2.6.4.1 Site visit

A site visit and interview was conducted with Mr Mike Coffey, Environmental Compliance (ENSAFE/CDM), on October 30, 2000 Additional discussions were held with Mr Mike Dawley, Building Operator (FMSIT), on December 6, 2000 The K-901 Pond is located on the western border of the ETTP The pond is elongated north–south, and the area surrounding the pond is largely wooded The north and south arms of the pond are occupied by marshes Access to the pond from the east is restricted by bar gates across roads leading to the pond off of West Perimeter Road, however, while the facility is posted as government property, there are no significant impediments to access from the Clinch River The pond receives natural surface water flow, primarily from the north, spring discharge, surface runoff from the surrounding area, and storm drain discharge from the K-31/33 area of the ETTP Two concrete and earthen barriers, approximately 75 ft apart, located at the western outfall to the Clinch River, serve to confine the pond Discharge from the pond is through a corrugated metal pipe directly to the Clinch River During high pond water level periods, some water discharges through drainage ditches to the south towards Poplar Creek The disposal cell used for the fish removed from the pond is located in a wooded area along the western side of the pond and is covered with a healthy stand of grass Signs warning of no fishing or water contact are posted conspicuously around the pond

The FMSIT subcontractor conducts weekly surveillances of the pond, which include identification and repair of flood damage, verification that signs are present and visible, and maintenance of the weir at the pond outfall to the Clinch River Surveillance records are maintained at the on-site ETTP FMSIT offices

The Removal Action included fish removal from the pond to mitigate current and future human health and ecological risks from ingestion of the fish However, despite the removal of the fish in 1997, the pond has been repopulated by fish Thus, the potential for a complete pathway via fish ingestion is available No additional actions at the pond have been taken

Table 2.7. K-901 Pond Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	No	Fish have returned to pond, providing potential for a complete exposure pathway
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	Yes	Risk to human health not mitigated due to the return of fish to the pond.
Are the land use controls (fencing, security guards, etc.) in place and preventing exposure?	Yes	Signs are visible and surveillance is conducted by Protective Services. Fence? (Site visit, Sect. 2.6.4.1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required by AM
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	No	Ongoing operations consist of weekly surveillance of the pond, which has not prevented the fish returning to the pond
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed in AM
Have there been any changes in land use or expected land use on or near the site?	No	Site remains in government control (Sect. 2.6.4.1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Site visit (Sect. 2.6.4.1)
Have there been any changes in the physical site conditions?	No	Site visit (Sect. 2.6.4.1)
Have there been any changes in the toxicity factors for contaminants of concern?	Yes	The oral slope factor for aroclors has been revised for evaluating the ingestion pathway
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	ERA performed for AM
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes; located in 100-year floodplain

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
ERA = ecological risk assessment
ROD = record of decision
TBC = to be considered

2.6.4.2 Evaluation of performance data

Monitoring of fish in the K-901-A pond is intended to allow evaluation of any possible trends in bioaccumulation of pesticides, PCBs, mercury, ^{137}Cs, ^{60}Co, and ^{40}K. Results of sampling a largemouth bass in FY 2000 are shown in Table 2.8. Only mercury and ^{40}K were detected at concentrations above the detection limits. The mercury concentration was less than two-fold above concentrations (60 to 110 µg/kg) in typical samples from streams with no source of mercury contamination The concentration was below the limit of 1000 µg/kg for marketability of fish. Exposure models have established benchmark concentrations of 60 µg/kg and 27 µg/kg for mink and great blue herons, respectively. The concentration of mercury in the K-901-A sample is above those benchmarks, but background samples are also above the benchmarks. The concentration of ^{40}K is well below any concentration of concern for exposure of biota.

Table 2.8. Results of fish sample from K-901 Pond

Analyte	Concentration (µg/kg)	Analyte	Concentration (µg/kg or pCi/g)
4,4'-DDD	0 6*	Heptachlors	22U
4,4'-DDE	6U	Aroclor-1254	100U
4,4'-DDT	1 8*	Aroclor-1260	99*
Chlordane	12U	Mercury	191
Dieldrin	0 9*	^{137}Cs	0 2*
Endosulfans	7*U	^{60}Co	0
Endrins	3*	^{40}K	6 3

U = Constituent not detected above the method detection limit
* = estimated result below detection limits
*U = result was calculated by using both estimated values for some isomers and half the detection limit for others

Figure 2 27 presents Biological Monitoring and Abatement Program (BMAP) data from the years 1993 through 1999 and FY 2000 sampling The figure may show a downward trend in PCB concentrations in largemouth bass in the K-901-A Pond. However, the numbers are close to detection limits, and considerable variability is to be expected when concentrations are so low.

2.6.5 Conclusions and Recommendations

Although the removal actions specified in the AM are completed, the pond has been repopulated by fish BMAP data indicate the fish currently in the pond contain low concentrations of PCBs, offering the possibility that the K-901 Pond sediments continue to be a source of PCBs to fish However, no changes are recommended at this time pending future CERCLA decision documents to address the contaminated sediments.

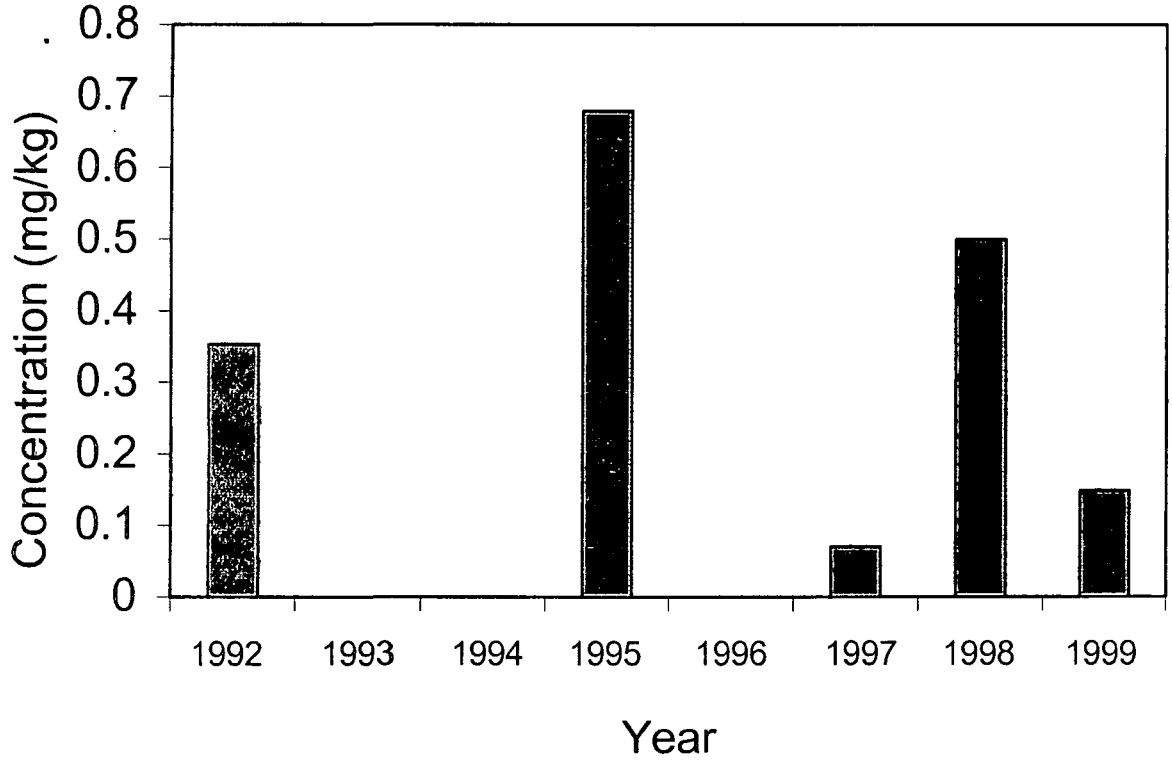


Fig. 2.27. Concentrations of PCBs in largemouth bass in the K-901-A Pond, 1993-2000.

2.7 K-1401 AND K-1420 SUMPS REMOVAL ACTION

- AM — August 1997
- Field Activities Complete — July 1998
- RmAR — December 1998

2.7.1 Project Description

Buildings K-1401 and K-1420 are located in the northeastern portion of the ETTP (Fig 2 28) Building K-1401 was used as a maintenance facility to clean equipment associated with the gaseous diffusion process Solvents and acids were used as part of the maintenance activities Ventilation canals in the basement of Bldg K-1401 are below the water table and contain standing water Building K-1420 provided decontamination and uranium recovery capability for the ETTP Process equipment from all areas of the plant, including equipment contaminated with highly enriched uranium, was decontaminated and serviced in the building Solvents were used extensively in the decontamination process, which was conducted primarily in the basement of the building The sumps in the basement of K-1420 are also below the water table The sumps in both of these buildings collect contaminated groundwater and formerly discharged the collected groundwater to the storm drain system that ultimately discharged to Mitchell Branch

The removal action consisted of the rerouting of the discharge from the sumps directly to the CNF for treatment The treated groundwater is then discharged directly to the Clinch River under the CNF NPDES Permit The purpose of this action was to preclude contaminated groundwater collected in the sumps from contaminating surface waters, thereby reducing the risk or threat posed by contaminants to human health and the environment The system has been in operation since August 1998 and 6,000 to 12,000 gpd from the K-1420 sumps and 8,000 to 12,000 gpd from the K-1401 sumps have been treated at the CNF

2.7.2 Evaluation of Decision Document Requirements for Performance and Stewardship

2.7.2.1 Goals of decision

The purpose of this action is to "reduce the risk to human health and the environment by preventing contaminated groundwater in the sumps from entering nearby surface waters This time-critical removal action consisted of collecting and piping contaminated groundwater from the sumps to the Central Neutralization Facility (CNF), a wastewater treatment facility in the Technology park The treated wastewater would then be discharged directly to the Clinch River "

2.7.2.2 Monitoring and stewardship required

No CERCLA monitoring is required at this time Rerouting and treatment of the discharge from the sumps achieved the removal action objectives for the K-1401 and K-1420 sumps

2.7.3 Implementation of Previous Year's Recommendations

No changes were recommended for the current year

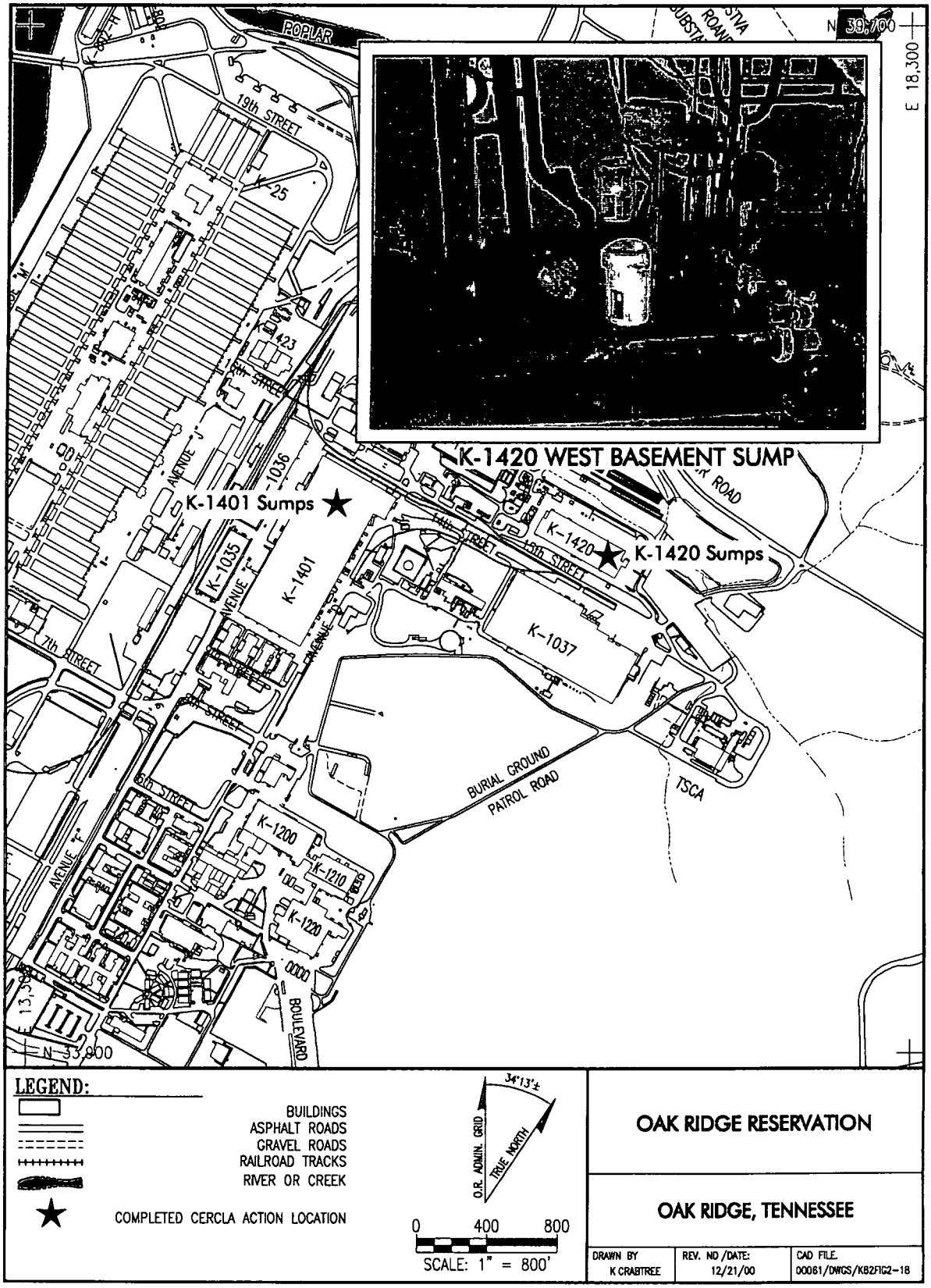


FIg. 2.28. Location of K-1401 sumps and K-1420 sumps.

2.7.4 Evaluation of Performance and Stewardship Data—K-1401 and K-1420 Sumps Removal Action

Table 2.9 provides a summary of the Five-Year Review questions and answers for the K-1401 and K-1420 Sumps Removal Action. Further details are provided in subsequent subsections.

2.7.4.1 Site visit/interview

A site visit to the K-1401 building was conducted on December 12, 2000, with Mr John Hicks, Building Operator (FMSIT), and Mr Ken Skinner (BJC) A site visit to the K-1420 Building was conducted on December 21, 2000, with Mr. Gary Harold (Decon and Recovery Services). Additional discussions were held with Mr. Deron Hendron (Radian International) of CNF, which has overall responsibility for the operation of the sump collection systems The K-1401 and K-1420 buildings and associated basement sumps are located within the fenced security zone of the ETTP, which requires a valid badge or visitor's pass for access. Additional authorization is required to access the basement areas of these two buildings. Access doors to the basement of K-1401 are locked at all times. Access to the K-1420 Building is controlled by Decon and Recovery Services and ingress and egress to interior areas of the building, including the basement, is through radiological boundary control stations. Anti-contamination clothing and respirators must be worn to enter the basement.

The basement of Bldg. K-1401 contains ventilation canals for distributing air throughout the basement. Water collects in these canals, which drain to individual sumps located at the blowers The canal sumps are piped to a drain tank located in the north fan room sump Water also collects in the south fan room sump, the drain tank sump, and the K-1402 switch house sump. The water from all of these collection points has been rerouted to the drain tank in the basement of K-1401. The water is pumped from the drain tank to CNF for treatment and discharge.

Building basement dewatering tiles located beneath K-1420 collect groundwater, which gravity-drains into two basement sumps located at the east and west ends of the basement The discharge from the sump pumps is routed directly to the CNF K-1407-M sump. High-level alarms alert building occupants of potential pump operation problems

CNF personnel conduct daily rounds of the K-1410 and K-1420 sump collection systems to check pump operation and perform maintenance as needed These activities are documented in Round Sheets maintained at CNF. CNF maintains results of the effluent monitoring conducted at both of the sumps prior to conveyance to CNF Inspection reports are also maintained at CNF. The piping and pumps installed in K-1401 appear to be well maintained and in good condition.

2.7.5 Conclusions and Recommendations

The K-1401 and K-1420 removal action consisted of rerouting discharge from the sump directly to CNF for treatment The treated water is discharged directly to the Clinch River under the CNF NPDES permit. The removal action has been completed and the goals stated in the decision document have been met There is no environmental monitoring specified in the decision document

Table 2.9. K-1401 and K-1420 Sumps Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Contaminated groundwater is collected and treated at CNF
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in AM, however, site is within the ETTP security fence (Sect 2 7 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required by decision document
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	All water from sumps is treated at CNF and discharged through NPDES-permitted outfall (Site visit, Sect 2 7 4 1)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed in AM
Have there been any changes in land use or expected land use on or near the site?	No	Site remains in government control (Site visit, Sect 2 7 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Site visit (Sect 2 7 4 1)
Have there been any changes in the physical site conditions?	No	Visual survey (Sect 2 7 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	No BRA/ERA performed
Were there significant changes in the standardized risk assessment methodologies?	NA	No BRA/ERA performed
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	No ERA performed Ecological risks may be addressed through future watershed-scale decisions
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
CNF = Central Neutralization Facility
ERA = ecological risk assessment
ETTP = East Tennessee Technology Park
NA = not applicable
NPDES = National Pollutant Discharge Elimination System
ROD = record of decision
TBC = to be considered

2.8 K-25 AUXILIARY FACILITIES GROUP I BUILDING DEMOLITION REMOVAL ACTION

- AM: January 17, 1997
- Field Activities Complete: June 1999
- RmAR: August 1999 (approval by state pending receipt of letter from DOE stating that disposition of the waste from the project is complete)

2.8.1 Project Description

Buildings K-724, K-725 (the Beryllium Building), K-1031, K-1131 (the Feed and Tails Facility), and K-1410 (the Plating Facility) are known collectively as the Group I Buildings (Fig. 2.29). Used at various times for laboratories, machine shops, materials and records storage, cascade maintenance, UF_6 production, and as housing for the Nuclear Energy Propulsion for Aircraft Project, the buildings have deteriorated significantly since shutdown of the K-25 uranium enrichment operations in 1985 Although contamination is confined to building interiors, the very poor condition of the buildings could eventually lead to contaminant releases. The first phase of D&D at ETTP included removal of hazardous materials (PCBs, asbestos, oils, etc.), deactivation of electrical systems, and installation or modification of safety-related systems (monitoring, fire protection, and security)

The AM for the Group I Auxiliary Facilities required the dismantlement of the five buildings because of poor physical condition, proximity to surface water and other structures, and the expense of surveillance and maintenance activities Removal activities included the characterization, decontamination, demolition, material and waste disposition, and site restoration to a maintainable condition. After demolition, the building concrete slabs were scabbled in an attempt to remove fixed contamination. The K-724 slab and a large portion of the K-725 slab were successfully cleaned to unrestricted use levels. After two passes with scabbling equipment, contamination was still present on the K-1031, K-1131, and K-1410 concrete slabs. The exposed concrete slabs from K-1031, K-1131, and K-1410 had the potential to weather and create mobile, transferable contamination in close proximity to surface waters and storm drains. A 2-in layer of asphalt was applied to cover the concrete slabs to stop the weathering of the fixed contamination and, therefore, help reduce the potential for the spread of radioactive contamination Because the Group I Auxiliary Facilities removal action is an interim action, the ETTP Sitewide ROD will determine the final remedy for the contaminated slabs, soils, and below-grade structures.

2.8.2 Evaluation of Decision Document Requirement for Performance and Stewardship

2.8.2.1 Goals of decision

The action selected to dismantle the five Group I non-process facilities "reduces the potential health and environmental hazards caused by the uncontrolled release of contaminated dust, process wastes, equipment, building surfaces, and construction materials" (DOE 1997f)

2.8.2.2 Monitoring and stewardship required

No CERCLA monitoring is required for this action Demolition of the building achieved the removal action objectives for this project.

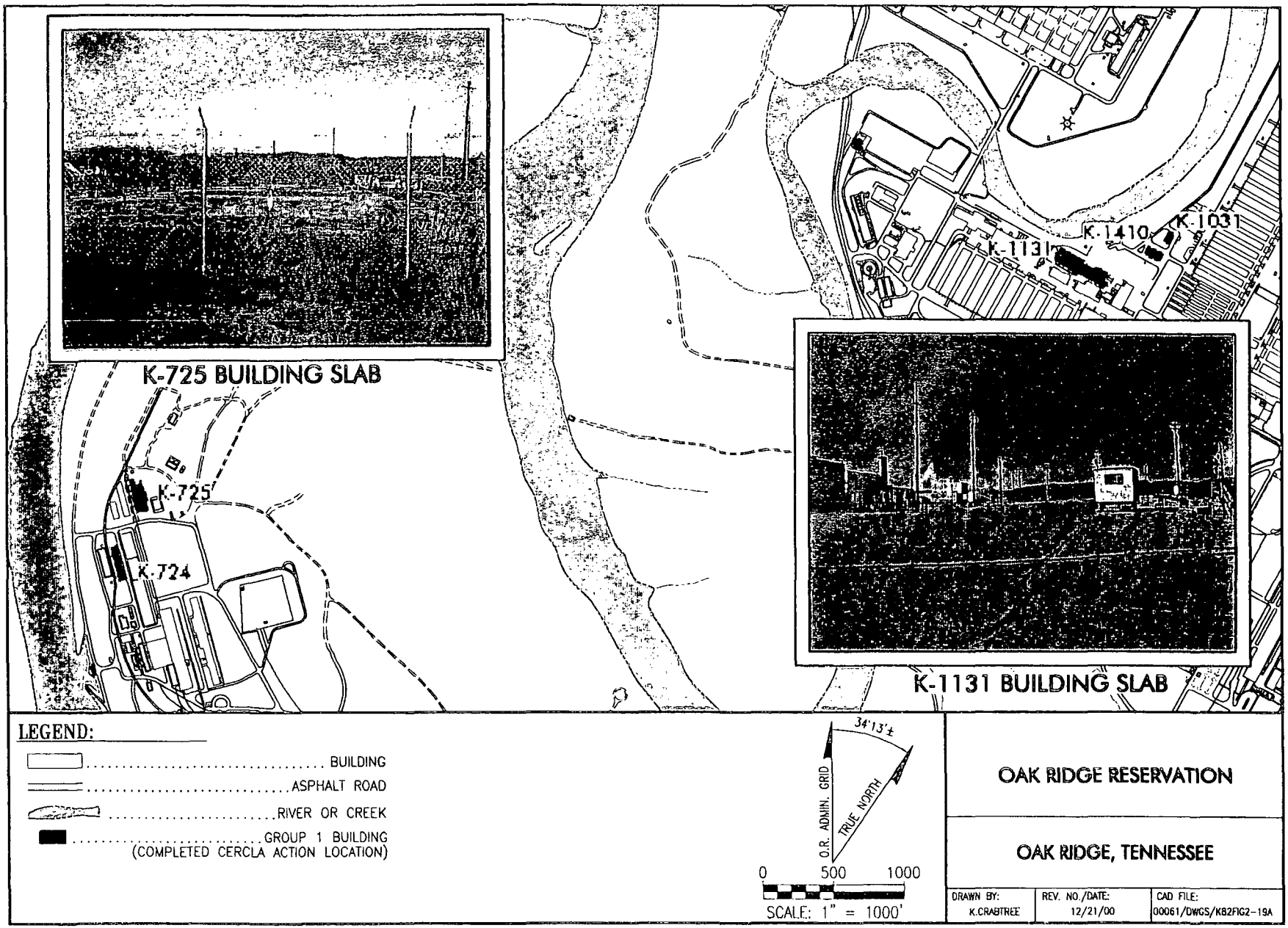


Fig. 2.29. Location of K-25 Auxiliary Facilities Group 1 Buildings.

2.8.3 Implementation of Previous Year's Recommendations

There were no recommendations made for the current year.

2.8.4 Evaluation of Performance and Stewardship Data—K-25 Auxiliary Facilities Group I Buildings Demolition Removal Action

Table 2 10 provides a summary of the Five-Year Review questions and answers for the K-25 Auxiliary Facilities Group I Buildings Demolition Removal Action. Further details are provided in subsequent subsections

2.8.4.1 Site visit

A site visit and interview was conducted with Ms Lisa Shipe, Environmental Compliance (ENSAFE/CDM), on November 17, 2000 Additional discussions were held with Mr Mike Dawley, Building Operator (FMSIT), on December 6, 2000.

The location of the former K-724 and K-725 buildings is within the security fence surrounding the Powerhouse facilities on the east bank of the Clinch River. The location of the former K-1031, K-1131, and K-1410 buildings is within the limited access area of the ETTP on the east bank of Poplar Creek. Access to the Powerhouse area is restricted by several gates which remained locked unless workers are present in the Powerhouse area Access to both the K-724 and K-725 is through two gates, one to access the general Powerhouse area and a second to access the secondary fences enclosing the former building locations The only indication of the former presence of the K-724 and K-725 buildings is provided by the concrete slabs that remain. The K-725 slab is indicated as being a radiological contamination area The remaining concrete slabs of the former buildings are surrounded by paved and gravel roads with isolated grass-covered areas. Much of the Powerhouse area is under lease to Community Reuse Organization of East Tennessee, but the area is patrolled by ETTP Security.

Access to the limited area of the ETTP requires a valid DOE L clearance and passage through two guard portals. The slab of the former K-1131 building has been paved over with asphalt to prevent the potential mobilization of radiological contamination by weathering processes The concrete pads remain as an indication of the location of the former K-1410 and K-1031 buildings A variety of equipment and materials are currently stored on the K-1131 pad. Most of these items were generated from the removal action. They include roll-off boxes, storage tanks, B-25 boxes, and miscellaneous equipment and debris A small amount of miscellaneous debris and containers was present on the K-1410 and K-1031 pads This area is patrolled by ETTP Security and is under camera surveillance by the Park Shift Superintendent

2.8.5 Conclusions and Recommendations

Demolition of the building achieved the removal action objectives for this project. Environmental monitoring is not specified to verify protectiveness of this remedy Because the Group I Auxiliary Facilities removal action is an interim action, the ETTP Sitewide ROD will determine the final remedy for the contaminated slabs, soils, and below-grade structures.

Table 2.10. K-25 Auxiliary Facilities Group I Buildings Demolition Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Buildings have been disassembled and demolished
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use in AM, however, facilities are within the ETTP security fence (Site visit, Sect 2 8 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required by AM, but soil and groundwater are to be addressed under future CERCLA decision documents
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	No ongoing operations are required
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs are not addressed in the AM
Have there been any changes in land use or expected land use on or near the site?	No	Area remains in government control
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	Yes	Buildings demolished (Sect 2 8 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	No BRA/ERA performed
Were there significant changes in the standardized risk assessment methodologies?	NA	No BRA/ERA performed
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	No ERA performed
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes, partially located in 500-year floodplain

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
CERCLA = Comprehensive Environmental Response Compensation, and Liability Act of 1980
ERA = ecological risk assessment
ETTP = East Tennessee Technology Park
NA = not applicable
ROD = record of decision
TBC = to be considered

2.9 K-1007-P PONDS REMOVAL ACTION

- AM: September 15, 1997
- Field Activities Complete: December 1998
- RmAR: September 1999

2.9.1 Project Description

The K-1007-P Ponds constitute a series of small holding ponds located along Highway 58 on the south side of the ETTP facility (Fig. 2.30). The ponds receive both surface water runoff and groundwater discharge from an area of approximately 1000 acres. Additionally, the ponds receive direct discharge from eight storm drains. From the beginning of the gaseous diffusion operations through 1985, the ponds received waste through storm drain SD-100 from laboratory operations in Bldgs. K-1004-A, -B, -C, -D, -J, and -L; K-1003; K-1005; and K-1006. The AM for the K-1007-P Ponds is the same as that for the K-901-A Pond, which calls for one of two alternatives pond removal, including draining the pond, fish removal disposal, grading, reclamation, and preservation as a wetland; or pond sampling and container removal, which includes lowering the water level, sampling sediment, and removing cylinders, drums, and debris The field investigation of the K-1007-P Ponds included sampling, a human health risk assessment, and an ecological risk assessment The investigation concluded that metals, radionuclides, and organic contaminants are present in the sediment of the ponds. Contamination was probably dispersed through the stormwater drainage system The human health risk assessment concluded these sediments pose a risk to human health.

The fish in the K-1007-P Ponds were not terminated, and the pond was not drained Although draining these ponds as part of this removal action had been proposed, further research into studies of the storm drain system and a review of the previous maintenance actions (which required draining the pond) demonstrated this was not required to evaluate the actions required by the AM The action did not alter risk to wildlife. However, this work will be completed pending the outcome of future CERCLA decisions.

Administrative controls were determined adequate to mitigate human health risks from ingestion of fish containing PCBs until the continued PCB contamination of the K-1007-P1 Ponds from the storm drain system is addressed by future CERCLA decisions.

2.9.2 Evaluation of Decision Document Requirements for Performance and Stewardship

2.9.2.1 Goals of decision

The goal of this action is to reduce risk by removing gas cylinders and other hazardous material containers and metal debris from the ponds and removing the pathways for ingestion of PCB-contaminated fish from the ponds by humans or piscivorous wildlife The goal is to "ensure that the risk to human health and the environment posed by PCBs will be eliminated or reduced to acceptable levels " Two objectives for the K-1007-P1 Pond were identified for this removal action (DOE 1997g), to control risks from health ingestion in the following ways.

- mitigating current and future human health risk from the PCB-contaminated fish ingestion pathway to $< 10^{-4}$ at the K-1007-P1 Pond, and

- mitigating and controlling future ecological risk from PCBs to populations of piscivorous wildlife through fish ingestion from the K-1007-P1 Pond.

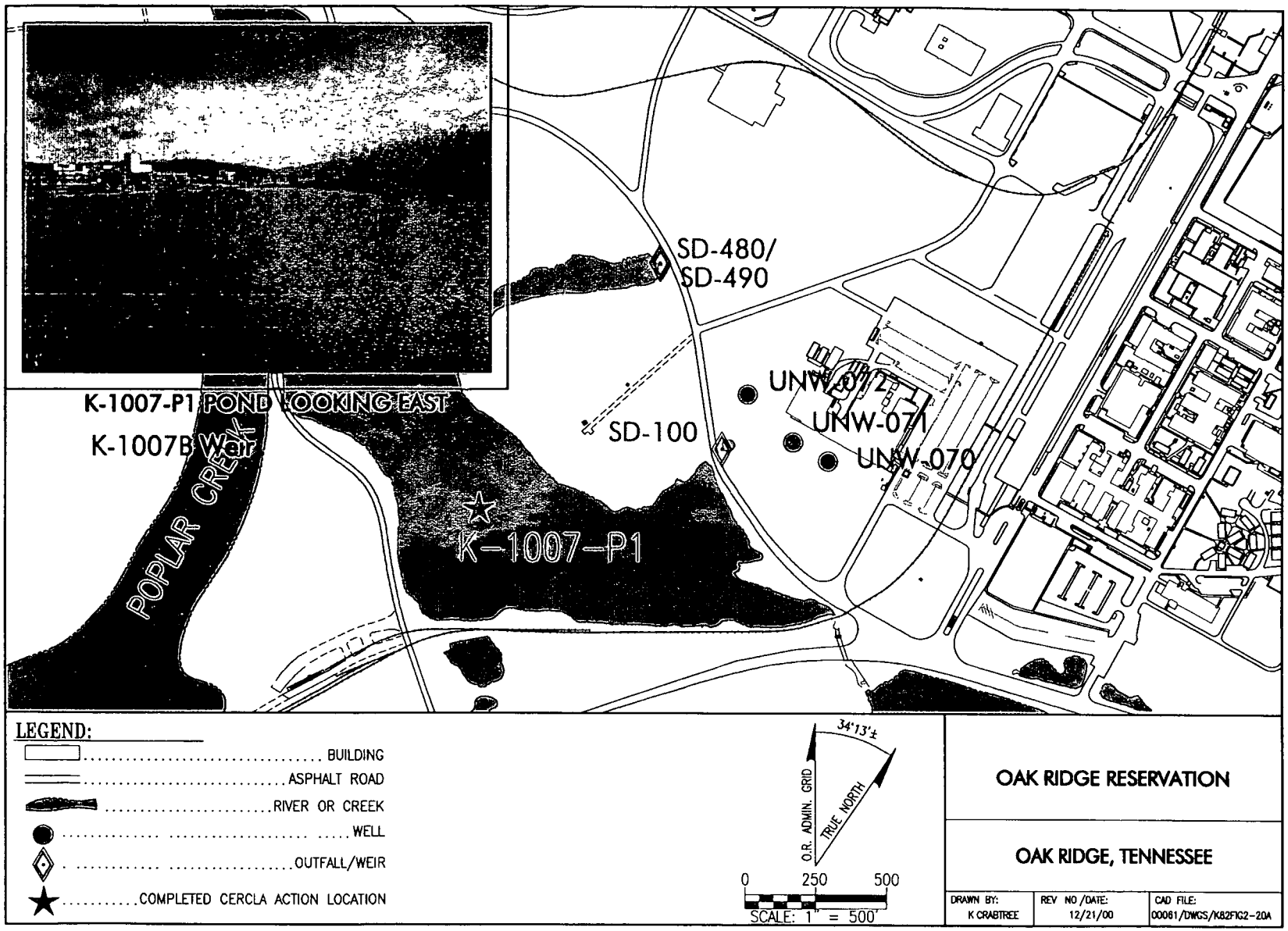


Fig. 2.30. Location of K-1007-PI Pond.

2.9.2.2 Monitoring and stewardship required

Performance monitoring proposed in the RmAR as "required sampling" includes annual biological accumulation data. Also included as "additional sampling" is the semiannual sampling of three monitoring wells (UNW-070, UNW-071, and UNW-072) for VOCs and metals Monthly and quarterly sampling at the K-1007-B weir for metals, radiological parameters, and PCBs is also included as "additional sampling." One sample will be collected at storm drains SD-100 and SD-480/490 and analyzed for PCBs, VOCs, and metals while monthly monitoring of general water quality parameters will be conducted at these locations. Performance monitoring was initiated in 1999.

2.9.3 Implementation of Previous Year's Recommendations

Although monitoring at wells UNW-070, UNW-071, and UNW-072 and storm drains SD-100 and SD-480/490 was reported in previous RERs, it was recommended that these locations not be reported as performance monitoring locations because they are not required by the AM.

2.9.4 Evaluation of Performance and Stewardship Data—K-1007-P Ponds Removal Action

Table 2.11 provides a summary of the Five-Year Review questions and answers for the K-1007-P Ponds Removal Action Further details are provided in subsequent subsections.

2.9.4.1 Site visit

A site visit and interview was conducted with Mr. Mike Coffey, Environmental Compliance (ENSAFE/CDM), on October 30, 2000. Additional discussions were held with Mr. Mike Dawley, Building Operator (FMSIT), on December 6, 2000 The K-1007-P1 Pond is located at the southwestern corner of the ETTP. The pond receives surface runoff from the southern portion of the ETTP in addition to surface water from the K-1007-P3, -P4, and -P5 Ponds. The former K-1007-P2 Pond, which was located on the north edge of the P1 Pond, has been filled. Discharge from the P1 Pond is at the western end of the pond across a weir structure to Poplar Creek. The pond water flows through a metal grate designed to prevent fish from leaving the pond over the top of the weir, and down a concrete headwall to three box culverts beneath Burchfield Road Access to the pond is not restricted; however, sign postings warning of no fishing or water contact are present and visible around the pond. The grass-covered areas surrounding the east, west, and north areas of the pond appear to receive routine mowing In general, the south side of the pond is heavily wooded The pond and dam appear to be in good condition. There is no visual evidence of waste materials in the pond.

Although stewardship requirements are not specified in the Decision Documents, the FMSIT subcontractor conducts weekly surveillances of the pond, which include identification and repair of flood damage, verification that signs are present and visible, and maintenance of the weir at the pond outfall to Poplar Creek Annual drive-by inspections are also conducted. Inspection records are maintained at the on-site ETTP FMSIT offices.

Administrative controls (sign postings and Security patrols) were cited as being adequate to mitigate the human health risk; this provided justification for not terminating the fish and draining the pond as described in the AM. However, the future ecological risk to piscivorous wildlife was not addressed by the action. There have been no additional actions taken at the pond.

Table 2.11. K-1007-P Ponds Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	No	Fish were not removed from the pond, thus, potential risk from fish ingestion has not been addressed
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	Yes	Mitigation and control of current and future risks were not attained
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	Signs are posted and surveillance is conducted by Protective Services Fences? (Site visit, Sect 2 9 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	No	Additional actions have not been taken to complete the removal action objectives
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Ongoing operations consist of weekly surveillances of the ponds land posting of signs
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed in AM
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under government control (Site visit, Sect 2 9 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Site visit (Sect 2 9 4 1)
Have there been any changes in the physical site conditions?	No	Site visit (Sect 2 9 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	Yes	The oral slope factor for aroclors has been revised for evaluating the ingestion pathway
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	ERA performed during field investigation
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes, located in 100-year floodplain

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
ERA = ecological risk assessment
NA = not applicable
ROD = record of decision
TBC = to be considered

2.9.4.2 Evaluation of performance data

Monitoring of fish in the K-1007-P1 pond is intended to allow evaluation of any possible trends in bioaccumulation of pesticides, PCBs, mercury, ^{137}Cs, ^{60}Co, and ^{40}K. Results of sampling a largemouth bass in FY 2000 are shown in Table 2.12. Only PCBs, mercury, and ^{40}K were detected at concentrations above the detection limits. PCBs are elevated above background concentrations. The combined concentration of Aroclor-1254 and -1260 is 1210 µg/kg, above the benchmark concentration of 1000 µg/kg for mink, but it is below the benchmark concentration of 7000 µg/kg for great blue herons. The mercury concentration was less than two-fold above concentrations (60 to 110 µg/kg) in typical samples from streams with no source of mercury contamination. The concentration was below the limit of 1000 µg/kg for marketability of fish. Exposure models have established benchmark concentrations of 60 µg/kg and 27 µg/kg for mink and great blue herons, respectively. The concentration of mercury in the K-1007-P1 sample is above those benchmarks, but background samples are also above the benchmarks. The concentration of ^{40}K is well below any concentration of concern for exposure of biota.

Table 2.12. Results of fish sample from K-1007-P1 Pond

Analyte	Concentration (µg/kg)	Analyte	Concentration (µg/kg or pCi/g)
4,4'-DDD	30U	Heptachlors	11*
4,4'-DDE	16*	Aroclor-1254	590
4,4'-DDT	30U	Aroclor-1260	620
Chlordane	60U	Mercury	205
Dieldrin	30U	^{137}Cs	0U
Endosulfans	36 1*U	^{60}Co	0U
Endrins	43*	^{40}K	2 2

U = Constituent not detected above the method detection limit
* = estimated result below detection limits
*U = result was calculated by using both estimated values for some isomers and half the detection limit for others

Figure 2.31 presents BMAP data from the years 1993 through 1999 and FY 2000 sampling. The figure may show a downward trend in the previously very high PCB concentrations in largemouth bass in the K-1007-P1 Pond since 1998.

2.9.5 Conclusions and Recommendations

Although the removal actions specified in the AM were not completed, it was determined that administrative controls were adequate to mitigate the human health risks from ingestion of fish containing PCBs until the continued PCB contamination of the pond from the storm drain system can be addressed by future CERCLA decision documents. No changes are recommended pending further identification and mitigation of the source of the PCBs present in the storm drain system discharging to the K-1007-P1 Pond.

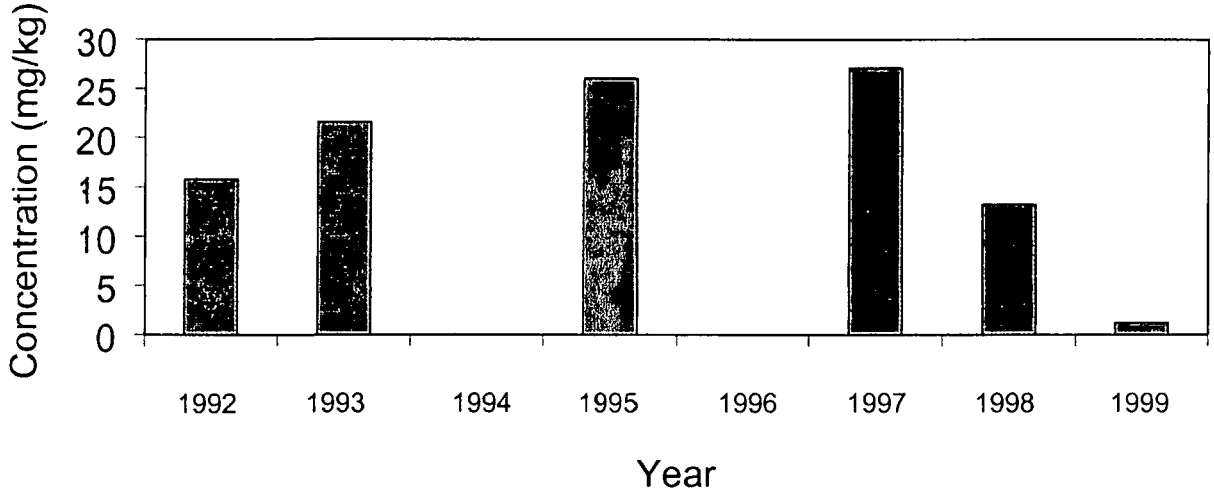


Fig. 2.31. Concentrations of PCBs in largemouth bass in the K-1007-P1 Pond, 1993-2000.

2.10 K-29, K-31, AND K-33 EQUIPMENT REMOVAL AND BUILDING DECONTAMINATION REMOVAL ACTION

- AM: September 30, 1997
- Field Activities: In progress

2.10.1 Project Description

Buildings K-29, K-31, and K-33 are located within the security fence in the western portion of ETTP and were originally designed and built to house the low enrichment segment of the gaseous diffusion cascade. The buildings have been deactivated and have not been used since 1987 The buildings are structurally sound; however, many areas in the buildings, and much of the equipment, are contaminated with radiological and hazardous substances from past operations. Though the current risk is negligible because the contaminants are contained within the buildings, future releases might pose a threat to human health and the environment. The selected alternative for these buildings is equipment removal and building decontamination.

Characterization activities in the buildings were completed during late 1997 and early 1998 Responsibility for Bldgs. K-31 and K-33 was formally transferred from DOE to British Nuclear Fuels Limited in January 1998 Removal of nonprocess-related materials began in March 1998 About 75% of the cleanup of the first floor of Bldg K-33 has been completed. More than 8 million lbs of metal designated for free release have been removed from the building, and more than 27 million lbs of waste materials have been removed and shipped to Utah for disposal.

In addition, the removal and shipment of over 17,000 drums of stabilized sludge previously stored in the K-31 and K-33 buildings has been completed. The last shipment of solidified sludges from the former Pond Waste Management Project was sent to Utah for final disposal in February 2000

2.10.2 Decision Document Requirements for Performance and Stewardship

2.10.2.1 Goals of decision

The goal of the action is to "eliminate the threat of release and reduce the potential health and environmental risks from exposure to radiation and hazardous substances present in these buildings" (DOE 1997b)

2.11 K-1070-C/D G-PIT AND CONCRETE PAD REMEDIAL ACTION

- ROD — November 1997
- Field Activities — In progress

2.11.1 Project Description

The K-1070-C/D G-Pit and Concrete Pad are located in the K-1070-C/D area, which occupies a topographic high in the eastern portion of the ETTP The K-1070-C/D G-Pit is the primary source of organic contamination releases to the K-1070-C/D area soil and groundwater Leachate samples from the pit contain elevated concentrations of various contaminants, indicating the pit is a continuing source of soil and groundwater contamination The primary contaminants of concern are chlorinated hydrocarbons, VOCs and SVOCs, and radionuclides

The Concrete Pad, located in the southeastern portion of the K-1070-C/D area, has been determined to pose an unacceptable health risk to workers from future exposure to soil radiological contaminants Remediation will consist of excavation of the G-Pit contents, placement of the excavated material into interim storage, and the eventual treatment and disposal of the excavated material A soil cover to provide protection for workers from direct exposure to ionizing radiation was placed over the Concrete Pad in April 1999 The G-Pit excavation began on December 28, 1999, and was completed in early 2000 The contaminated soil excavated from the former pit area is being stored until it can be treated and disposed The approximately 230 cubic yards of soil, which contains VOCs and low concentrations of PCBs and ^{99}Tc, will be treated using low temperature thermal desorption The treated soil will then be characterized to determine the appropriate disposal option Soil treatment is scheduled to begin in early 2001 Institutional controls will be continued as long as buried waste remains in the K-1070-C/D area

2.11.2 Decision Document Requirements for Performance and Stewardship

2.11.2.1 Goals of decision

The objective of the Remedial Action was to "address the principal threats to industrial workers and mitigate the primary release mechanism to groundwater by (1) using a soil cover to prevent direct contact and provide radiation shielding at the concrete Pad Area, (2) using excavation and removal of waste to eliminate future organic contaminant releases at the G Pit, and (3) continuing restricted site access "

2.12 K-1070-A REMEDIAL ACTION

- ROD: January 2000
- Field Activities. In progress

2.12.1 Project Description

The K-1070-A Burial Ground consists of approximately 3 acres located in the northwest corner of ETTP outside the main plant area on the southern slope of Blackoak Ridge The burial ground contains largely uranium-contaminated waste, from ETTP and other operations, buried in unlined trenches and pits The site consists of several distinct disposal areas with a total of 26 trenches and 62 circular, mechanically augered pits collectively referred to as "graves." The trenches are generally 3 ft in diameter and approximately 12 ft deep The top 4 ft of the trenches and pits were backfilled with soil Contamination is present in the trenches and pits and in groundwater beneath and downgradient of the burial ground Groundwater impacted by contaminants from the burial ground emerges to the south at Spring 21-002, flows into the K-901 Pond, and subsequently flows into the Clinch River The primary contaminants of concern are chlorinated solvents and radionuclides

A subcontract was awarded in September 2000 for the planning, engineering design, excavation, waste characterization, waste disposal, and revegetation of the site In addition, eight monitoring wells located within the fenced portion of the K-1070-A Burial Ground were plugged and abandoned during FY 2000 in preparation for the excavation activities Remedial actions are scheduled to begin in August 2001 and be completed by summer of 2002

2.12.2 Decision Document Requirements for Performance and Stewardship

2.12.2.1 Goals of decision

The selected remedy is a source removal action that addresses the present and projected future principal threats posed by the K-1070-A Burial Ground through excavation and permanent disposal of waste in an approved disposal facility. No cleanup standards for environmental media were identified for this action A final remedy for groundwater and surface water at and downgradient of the K-1070-A Burial Ground is not included in this action; these media will be addressed under future CERCLA decisions

2.13 K-25 AUXILIARY FACILITIES GROUP II BUILDING DEMOLITION, MAIN PLANT BUILDINGS

- AM: August 2000
- Field Activities: In progress

2.13.1 Project Description

The Group II building D&D activities include 89 contaminated above-ground facilities. Demolition of these facilities, which include buildings, sheds, tanks, and other above-grade structures, will be performed in groupings of facilities. The first facility grouping to be addressed as nontime-critical removal action is the main plant building grouping. The main plant buildings include the K-1300 stack used to discharge off-gases from fluorine-associated facilities, the K-1301 fluorine and nitrogen production facility, the K-1302 fluorine storage facility, the K-1303 fluorine liquifaction and vaporization and test facility, the K-1405 laboratory, the K-1407 facility used for acid neutralization, equipment decontamination and testing, and the K-1413 building used as a uranium enrichment research and development facility

The preferred alternative for this project is near-term demolition to slab, which involves pre-demolition removal of excess materials/equipment, demolishing buildings down to slab, and disposing of all associated wastes. The removal of the main plant buildings includes characterization as needed to meet waste acceptance criteria (WAC) and to determine health and safety requirements, decontamination in accordance with project specifications, removal of equipment and piping, demolition of structural and architectural components to ground level, and the approved disposition of all resultant materials Each building site, including remaining slabs and foundations, will be left in a safe, stable condition

A subcontract was awarded in June 2000 to demolish the ten main plant buildings The subcontractor is also responsible for sampling and characterization, hazardous materials abatement, and management of the waste created Demolition of the first building, K-1301, began in the fall of 2000, and the project is expected to be completed by November of 2001.

2.13.2 Decision Document Requirements for Performance and Stewardship

2.13.2.1 Goals of decision

The preferred alternative for the main plant buildings was selected to achieve the remedial action objectives for the buildings, which include removal of potential health and safety hazards to on-site personnel from deterioration of the contaminated structures, and reduction of potential health and environmental hazards of radiation and hazardous material exposure caused by uncontrolled release of contaminated dust, equipment, and building materials

3. CERCLA ACTIONS IN BETHEL VALLEY WATERSHED

This section presents a summary of CERCLA actions in Bethel Valley watershed The actions are summarized in Table 3.1. The location of each action is shown in Fig 3.1 In addition to five completed actions in Bethel Valley, five additional actions are currently in progress. The Bethel Valley watershed, which encompasses ORNL, is bounded to the southwest by the Clinch River arm of Watts Bar Lake, to the northeast by Bearden Creek, to the southeast by the crest of Haw Ridge, and to the northwest by the toe of Chestnut Ridge

At this time only, one Bethel Valley site requires post-remediation monitoring, the Corehole 8 Plume collection system Samples are collected at the Corehole 8 sump and at First Creek to evaluate the effectiveness of the action (Sect. 3.1) The five completed actions in Bethel Valley are being evaluated under the CERCLA Five-Year Review Update on the status of the remaining five is also provided

Table 3.1. CERCLA actions in Bethel Valley Watershed

CERCLA action	CERCLA areas	Decision document date signed	Action status	Monitoring required
		Five-Year Review Sites		
WAG 1 Corehole 8 Plume	WAG 1 Groundwater	AM November 10, 1994	Complete RmAR approved August 2 1995 contaminated groundwater being collected	Yes
LLLW Tank WC-14	(1) Inactive LLLW Collection Tank WC-14 – liquid removal	AM February 16, 1995	Complete tank contents removed RmAR approved August 1 1995	Discontinued
	(2) Inactive LLLW Collection Tank WC-14 – sludge removal	AM September 3, 1997	RmAR completed December 1998	No
Waste Evaporator Facility	Waste Evaporator Facility 3506	AM July 28, 1995	Complete, RmAR approved December 2, 1996	No
Building 3001 Canal	3001 Storage Canal	AM November 18, 1996	Complete, RmAR approved July 1, 1997, canal filled with grout	No
		Actions in Progress		
Surface Impoundments		ROD September 24, 1997	In progress	TBD
GAAT Sludge		ROD September 2, 1997	In progress	TBD
Corehole 8 Plume Source (Tank W-1A)		AM September 18, 1998, amended in 1999	In progress	TBD
Inactive LLLW Tanks		AM April 15, 1999	In progress	TBD
Metal Recovery Facility	Building 3505	AM January 2000	In progress	TBD

AM = action memorandum
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
GAAT = Gunite and Associated Tanks
LLW = liquid low-level waste
ROD = record of decision
RmAR = removal action report
TBD = to be decided
WAG = Waste Area Group

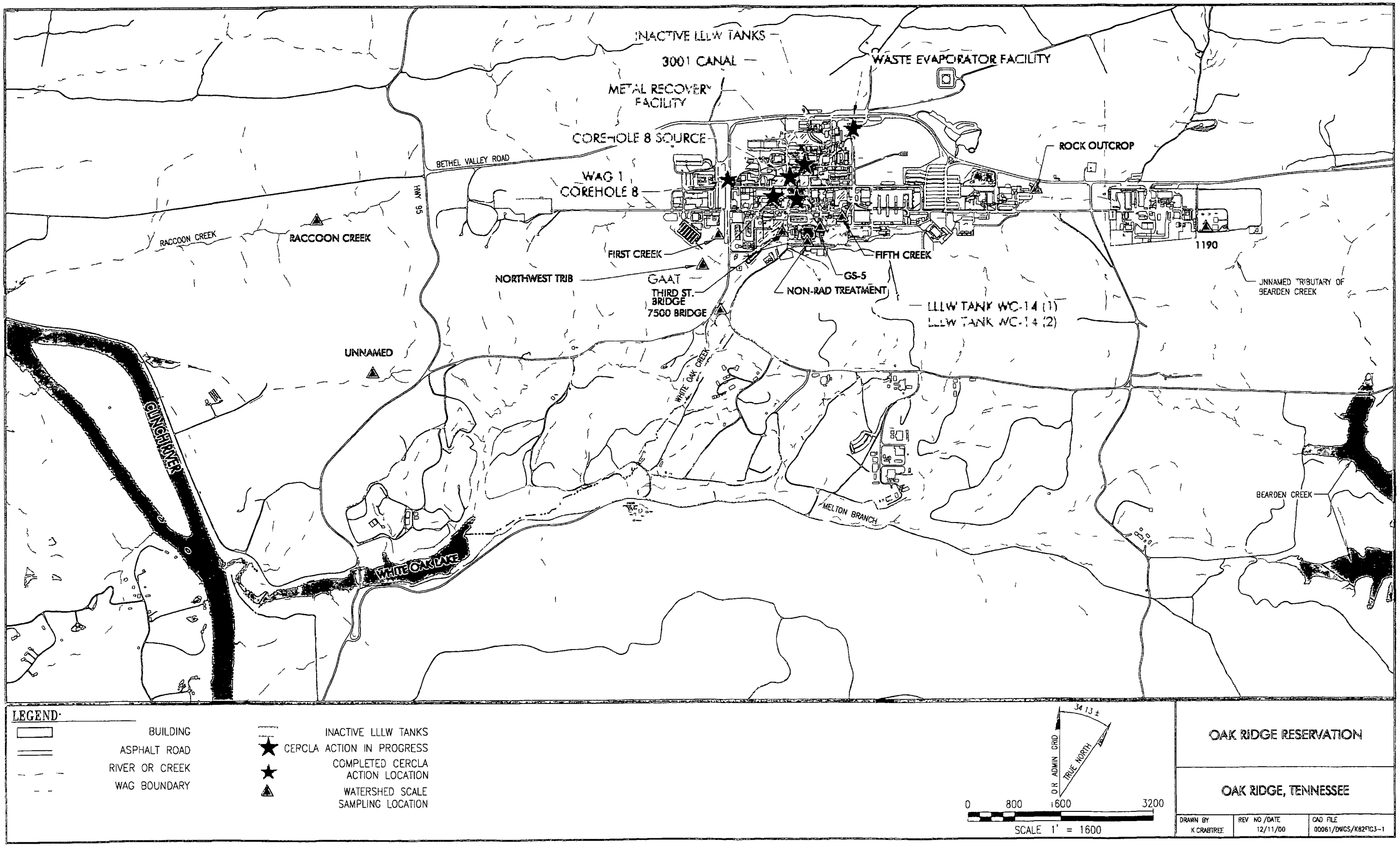


Fig. 3.1. Bethel Valley Watershed RER site map.

The following sections present history highlights, a project description, a local-scale map, evaluation of the decision document requirements for performance, and evaluation of additional available data for each completed individual action. Ongoing activities in the Bethel Valley watershed are described briefly in Chap. 6.

DOE has determined that the remedies already implemented within the Bethel Valley watershed remain protective of public health and the environment in the context of the scope and objectives of each action.

3.1 WATERSHED OVERVIEW

3.1.1 Bethel Valley Conceptual Model

Bethel Valley, located in the southeastern portion of the ORR, is the site of the main plant of ORNL ORNL's original mission was to produce plutonium to support the first atomic bomb Since then, ORNL has become a leader in nuclear reactor technology and other technologies. Reactor waste processes have resulted in some of the most concentrated releases to the environment of long-lived radionuclides on the ORR.

Bethel Valley lies between two prominent ridges Chestnut Ridge to the north and Haw Ridge to the south. Bethel Valley is not a watershed proper, rather, it is an administrative watershed that includes the following:

- The upper reach of the White Oak Creek watershed, which continues through Melton Valley to the Clinch River. The point where the Bethel Valley administrative watershed ends and the Melton Valley watershed begins is the gap in Haw Ridge, designated by the 7500 Bridge monitoring location on White Oak Creek (Fig. 3 1)
- The Raccoon Creek watershed, west of ORNL, which drains directly to the Clinch River.
- The Bearden Creek watershed, to the east of ORNL, which drains into the Melton Hill Reservoir

Several years of groundwater and surface water characterization efforts, along with two major RIs, the Surface Impoundments RI (DOE 1995l) and the Gunite and Associated Tanks RI (DOE 1994g), have led to several early actions and two final actions in Bethel Valley (Table 3.1). In addition, the recent Bethel Valley watershed-scale RI/Feasibility Study (FS) effort will result in a ROD for several additional Interim Actions.

Bethel Valley has been an industrial site for more than 50 years. It contains several types of waste units, including a total of 69 tanks, with and without secondary containment systems, four impoundments, buildings and reactors, buried waste transfer pipelines, and, outside of the main plant area, burial grounds and landfills. There are no major waste units within the Raccoon Creek or Bearden Creek watersheds proper. Provided below is a summary of the major source units and modes of contaminant migration away from those units Figure 3 2 provides a conceptual model summary of the Bethel Valley watershed

Raccoon Creek and West Bethel Valley areas have groundwater and surface water contamination from releases from Solid Waste Storage Area (SWSA) 3 and adjacent landfills. SWSA 3 received radiological wastes from 1946 until 1951 from ORNL and sites elsewhere in the United States The burial ground covers approximately 7 acres, and the adjacent landfills occupy an additional 11 acres. Rainfall and seasonal surface water infiltration contacts buried wastes and leaches soluble contaminants into

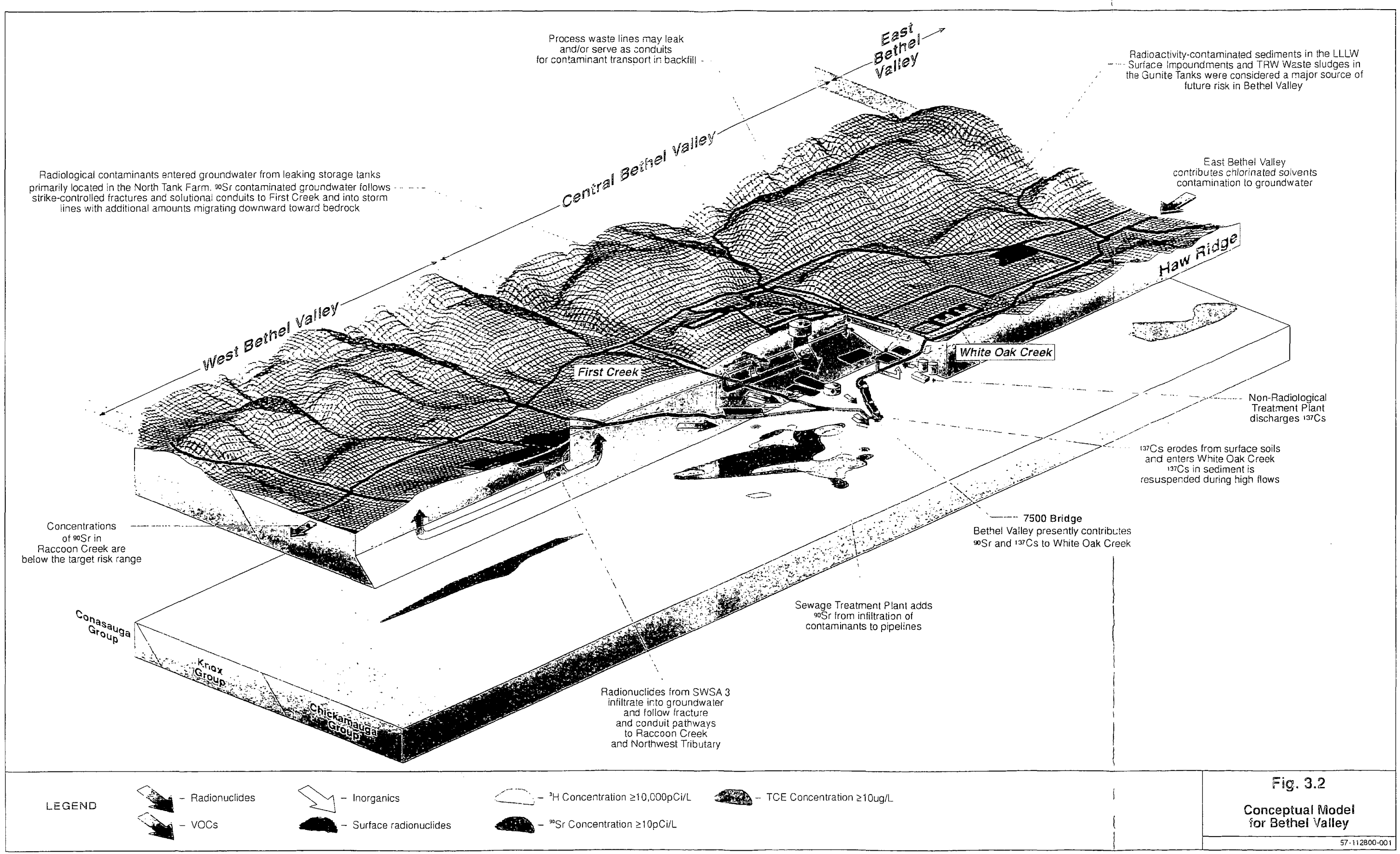


Fig. 3.2. Conceptual model for Bethel Valley Watershed.

groundwater, where they are transported through diffuse and conduit flow to both Raccoon Creek to the southwest and the Northwest Tributary to the northeast A narrow groundwater ^{90}Sr contaminant plume, with concentrations in excess of MCLs, identified beneath SWSA 3 probably serves as a continuous source of discharge to surface streams (DOE 1994)

Central Bethel Valley contains key areas of contamination associated with releases from ORNL. The leading AOCs are the Corehole 8 Plume and ^{137}Cs-contaminated soil and sediment in the floodplain of White Oak Creek upstream of the 7500 Bridge. The Corehole 8 Plume has spread radionuclides in groundwater throughout the central portion of the northern Central Bethel Valley Area Concentrations of ^{90}Sr exceed the MCL by several orders of magnitude. The plume released radionuclides to First Creek and contributed to releases to the Clinch River at White Oak Dam. A groundwater collection system installed for this plume has markedly decreased concentrations of ^{90}Sr in First Creek and flux of ungauged releases of ^{90}Sr in White Oak Creek. Soils and sediment along White Oak Creek in the Central Bethel Valley Area contain radionuclides (especially ^{137}Cs) at elevated activities These contaminants are derived from releases in Central Bethel Valley, adsorbed to sediment, then scoured and redeposited on the floodplain of White Oak Creek during high flows.

Central Bethel Valley also includes several known source areas the "Hot Bank" area (vicinity of Bldgs 3019 and 3001), Isotopes Area, North Tank Farm, South Tank Farm, and Surface Impoundments The research areas in Central Bethel Valley include contaminated hot cells and several areas of mercury contamination Mercury is found in soils and in groundwater collected in building sumps The sumps are the leading source of mercury contamination to the Process Waste Treatment Complex Mercury from outfalls that drain the Central Bethel Valley 4000 Area exceeds AWQC at times

East Bethel Valley is located approximately 1 mile east of the main ORNL complex and houses the ORNL Services Area Releases from the Services Area have resulted in a groundwater plume dominated by TCE at concentrations that suggest the possibility of DNAPL. The exact source of this plume is not known Tritium from the Tritium Target facility is also detected in groundwater, but at concentrations below MCLs.

White Oak Creek is the primary exit pathway for mobile contaminants in Bethel Valley The point of integration for contaminants in Bethel Valley is where White Oak Creek exits the watershed at 7500 Bridge. Monitoring at this location provides a watershed-scale measure for remedial action effectiveness The Bethel Valley watershed currently discharges to the Melton Valley watershed, where additional contaminants enter White Oak Creek before being discharged over White Oak Dam to the Clinch River

3.1.2 FY 1999 Summary

3.1.2.1 Surface water

Since Bethel Valley encompasses three true watersheds, there are three surface water exit points from the valley Only two of these, White Oak Creek and Raccoon Creek, contain contaminants from CERCLA waste units. Low levels of tritium are detected in Bearden Creek (417 pCi/ wet, 948 dry) but have not been tied to specific source releases

Figure 3 3 presents watershed-wide surface water sampling results This figure presents a mix of wet/dry grab samples and flow composite samples from February and August The results highlight the need to review surface water data in light of total stream flow (e g , ^{90}Sr concentration at 7500 Bridge is 39 5 pCi/L in February 2000, ^{90}Sr is 56 9 at Northwest Tributary) However, the total mass of ^{90}Sr at these two locations are 21 mCi (7500 Bridge) and 4 8 mCi (Northwest Tributary)

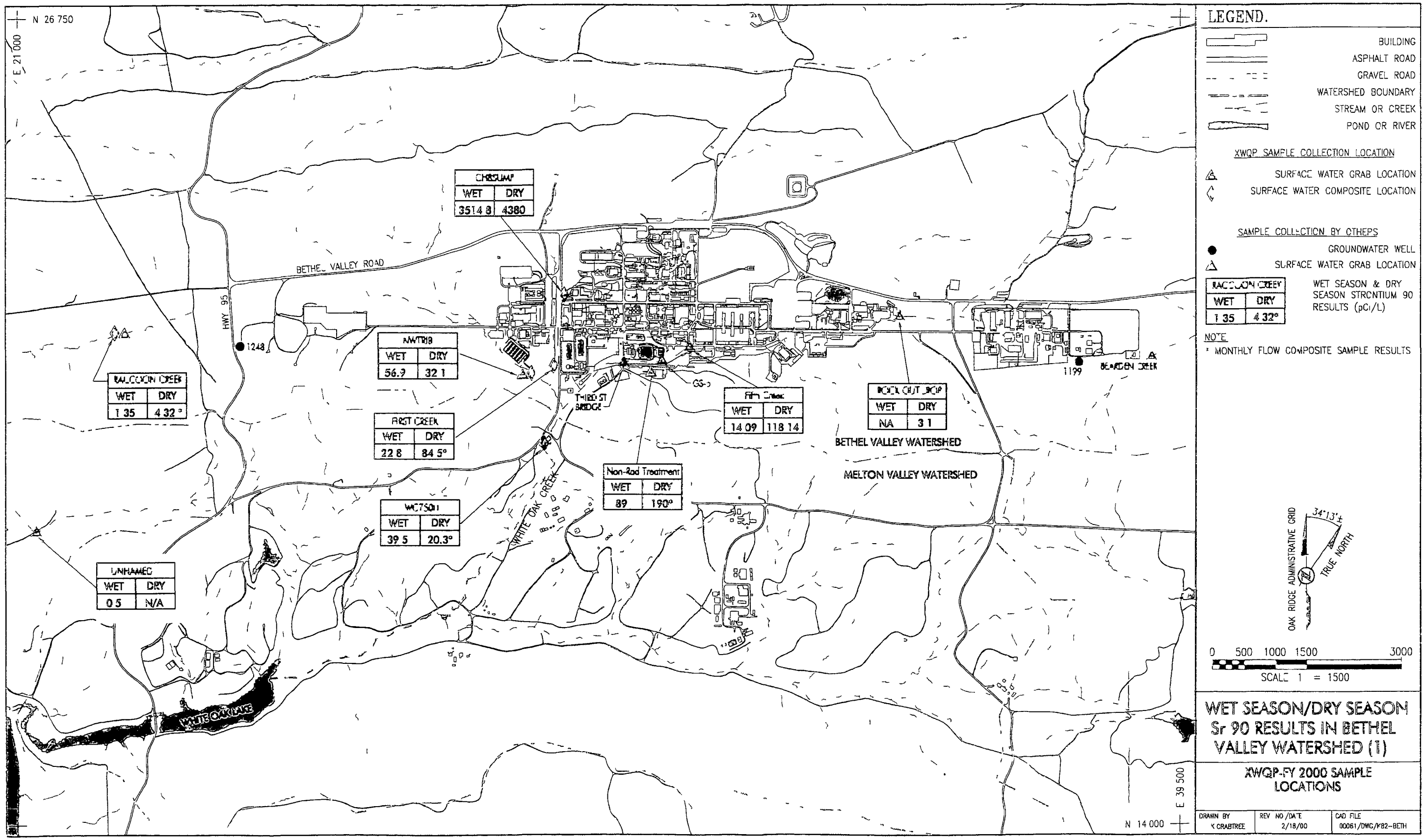


Fig 3 3 FY 2000 sample results in Bethel Valley

The figure does reveal some important information.

- ^{90}Sr at the Corehole 8 sump must continue to be collected and treated
- There do not appear to be ^{90}Sr sources at the headwaters of the creek (above Rock Outcrop)
- Minimal releases occur in West Bethel Valley.
- The percent of ^{90}Sr leaving Bethel Valley via the Northwest Tributary likely is increasing as actions reduce inputs from other sites

Routine monitoring occurs at both 7500 Bridge, the exit point from Bethel Valley in the White Oak Creek watershed, and at Raccoon Creek and Bearden Creek. In FY 1999, monitoring at 7500 Bridge was done by the ORNL compliance organization. Monitoring of Raccoon Creek and Bearden Creek was performed by the X-10 Water Quality Program. The primary CERCLA contaminants of concern at these locations are ^{90}Sr, ^{3}H, and ^{137}Cs at 7500 Bridge, ^{90}Sr at Raccoon Creek, and ^{3}H at Bearden Creek.

Tables 3 2 and 3.3 show the results of the FY 2000 flow composite sampling at 7500 Bridge and Raccoon Creek, respectively Evaluation of these and additional data on a Bethel Valley watershed scale sheds some light on the priority source areas in the valley (Table 3 4). An unusual measurement at 7500 Bridge makes it difficult to perform a mass balance analysis of the watershed for FY 2000 According to lab analysis, the flow composite sample result for August for 7500 Bridge is 924 pCi/L, more than an order of magnitude higher than for any other month, and higher than results at the downstream Melton Valley location on White Oak Creek. The analytical result has been confirmed through check with the laboratory If the value is correct, it suggests a slug of ^{90}Sr left Bethel Valley in the August/September time frame (perhaps in conjunction with activities at the Surface Impoundment action or the Non-Rad Treatment Plant) This explanation does not explain why the ^{90}Sr "slug" did not show up at the downstream WOC Weir location. Note that this evaluation has been done by both including and excluding a questionable August 2000 ^{90}Sr value at 7500 Bridge The data analysis of the adjusted values indicates that as First Creek releases are addressed, releases from the Northwest Tributary and the Non-Rad Treatment Plant become more prominent.

Table 3 5 presents the grab sample results for Bearden Creek Since FY 1998, several grab samples indicated increased levels of ^{3}H reaching Bearden Creek One wet season sample indicated almost a million pCi/L of ^{3}H The source of ^{3}H to Bearden Creek was not clear However, in FY 2000, the ^{3}H concentrations decreased back to pre-1998 levels Continued monitoring is necessary to better understand if the 1998-1999 results were real or a sampling artifact

3.1.2.2 Groundwater

The only groundwater plume that is routinely monitored on the watershed scale is the Corehole 8 Plume This plume emanates from its source in the North Tank Farm and migrates westward to First Creek Table 3 6 shows the levels of contamination in the plume at well 4411, a well located in one of the hottest portions of the plume In FY 2000, the well became operational as an extraction well and thus is not used for monitoring This activity is described in more detail in Sect 3 9 The ^{233}U isotopic uranium is an indicator chemical for the Corehole 8 Plume

As presented later in Sect 4 1, Bethel Valley contributes approximately 19% of the ^{90}Sr released from the White Oak Creek watershed Most of this comes from Corehole 8 Plume releases to First Creek. After completion of the Corehole 8 sump collection systems, there were noticeable reductions of ^{90}Sr at 7500 Bridge Although ^{90}Sr fluxes remain below the 1994 pre-action levels, there have been no additional

decreases since that action was implemented. A majority of the ^{137}Cs releases from White Oak Creek watershed come from Bethel Valley.

3.1.3 Recommendations

Bethel Valley watershed-scale monitoring will be addressed as part of the Bethel Valley Interim ROD. Until a long-term monitoring approach is defined, the following recommendations should be implemented.

- Wet and dry season grab samples should be collected at all identified stations. Samples should be collected within 8 hours at each location and should not be collected within a 72-hour period of rainfall.

- Biannual grab samples should be collected at the Third Street Bridge to help delineate releases from groundwater beneath the closed surface impoundments and upstream areas.

Table 3.2. Results of 7500 Bridge flow composite samples

Month	Volume (gal)	Flow volume (liters)	^{90}Sr result (pCi/L)	^{90}Sr flux (Ci)	^{3}H result (pCi/L)	^{3}H flux (Ci)	^{137}Cs result (pCi/L)	^{137}Cs flux (Ci)
Oct-1999	NA	NA	NA	NA	NA	NA	NA	NA
Nov-1999	83,742,000	3.17E+08	16.72	0.005	6,287	1.99	47.82	0.02
Dec-1999	99,187,000	3.75E+08	25.7	0.010	53.879	20.23	42	0.02
Jan-2000	118,587,000	4.49E+08	21.69	0.010	3,242	1.46	53.89	0.02
Feb-2000	142,056,000	5.38E+08	39.48	0.021	18,932	10.18	27.6	0.01
Mar-2000	247,052,000	9.35E+08	24.78	0.023	4,945	4.62	41.3	0.04
Apr-2000	296,508,000	1.12E+09	4.78	0.005	9,829	11.03	75.76	0.09
May-2000	177,133,000	6.70E+08	41.59	0.028	8,349	5.60	60.67	0.04
Jun-2000	140,099,000	5.30E+08	13.7	0.007	7,392	3.92	45.45	0.02
Jul-2000	168,555,000	6.38E+08	20.3	0.013	12,000	6.77	358.2	0.23
Aug-2000	118,215,000	4.47E+08	924.35	0.414	11,600	5.19	870.6	0.39
Sep-2000	101,457,000	3.84E+08	49.46	0.019	24,100	9.25	266.1	0.10
Total	For 11 months	**6.41E+09**		**0.56**		**81.13**		**0.98**

NA = not applicable

Table 3.3. Results of Raccoon Creek composite samples

Month	^{90}Sr results (pCi/L)	Qualifier	Volume (gal)	Volume (liters)	^{90}Sr flux (mCi)
Oct-1999	39.49	=	62,075	2.35E+05	0.009
Nov-1999	24	=	131,510	4 98E+05	0.012
Dec-1999	15.5	=	462,657	1.75E+-6	0.027
Jan-2000	11.92	=	4,148,472	1.57E+07	0.187
Feb-2000	1.35	U	5,268.556	1.99E+07	0.027
Mar-2000	1.12	U	9,564,878	3.62E+07	0.041
Apr-2000	-0.02	U	16,327,676	6.18E+07	-0.001
May-2000	4.21	J	8,476,686	3.21E+07	0.135
Jun-2000	0.09	U	2,132,182	8.07E+06	0.001
Jul-2000	9.08	=	2,123,074	8.04E+06	0.073
Aug-2000	4.32	=	3,900,052	1 48E+07	0.064
Sep-2000	5.92	=	670,034	2.54E+06	0.015
Total					**0.37 (FY 1999)** **0.59 (FY 2000)**

[a]J = estimated concentration, U = not detected; "=" = validated result, detected and unqualified.

Table 3.4. Contaminants from monitored source areas in Bethel Valley

Reach/ subwatershed	Source areas	^{90}Sr Flux (Ci)	% Contribution to 7500 Bridge	Adjusted[a] ^{90}Sr Flux (Ci)	Adjusted[a] % Contribution to 7500 Bridge
Northwest Tributary	SWSA 3	0.039	6.9	0.039	25.7
First Creek	Corehole 8 Plume	0.024	4.3	0.024	15.9
Non-Rad Treatment Plant	Treatment Plant	0.055	9.8	0.055	36.7
Ungauged Sources	Various	0 44	79	0 033	21.8
7500 Bridge		0.56		0.15	

[a]Adjusted values ignore a questionable August 2000 sample result
SWSA = solid waste storage area

Table 3.5. Tritium results for Bearden Creek monitoring location, 1993 – 2000

Date collected	Results (pCi/L)	Qualifier[a]	Measurement error
10/1/1993	-108.12	U	621.69
10/1/1993	-243.27	U	621.69
9/26/1994	1729.92	=	702.78
9/26/1994	1351.5	=	675.75
9/11/1995	297.33	U	648.72
9/11/1995	-108.12	U	594.66
9/11/1996	216.24	U	756.84
9/11/1996	-270.3	U	702.78
3/27/1997	1470	=	200
1/21/1998	963709.6	=	4143.13
7/15/1998	1658.54	J	247.01
1/13/1999	175.17	UJ	164.08
7/27/1999	28614.88	=	8737.04
2/24/2000	417.41	=	172.6
8/24/2000	948.98	=	352.7

[a]J = estimated concentration; U = not detected; UJ = not detected at indicated estimated concentration; "=" = validated result, detected and unqualified.

Table 3.6. Radiological analysis results for well 4411

Sample date	Radionuclide*	Results (pCi/L)	Qualifier[a]	Uncertainty
08/28/1997	Strontium	341264	=	701.7
01/29/1998	Strontium	1035262	=	791.37
03/17/1998	Strontium	1321621	=	7378.92
01/26/1999	^{90}Sr	824000	J	3660
08/28/1997	^{232}U	530.1	=	50.1
01/29/1998	^{232}U	2040	=	298
03/17/1998	^{232}U	5420	=	1070
01/29/1998	$^{233/234}U$	50500	=	7940
03/17/1998	$^{233/234}U$	123000	=	21200
01/26/1999	$^{233/234}U$	10100	=	1230

*Analyte as reported by laboratory
[a]J = Estimated value; "=" = detected at reported level

3.2 WAG 1 COREHOLE 8 PLUME REMOVAL ACTION (PLUME COLLECTION)

- AM: November 1994
- Field Activities Complete: March 1995
- RmAR: July 1995

3.2.1 Project Description

In 1991, CERCLA characterization efforts identified a plume of ^{90}Sr-contaminated groundwater, referred to as the Corehole 8 Plume (Fig. 3.4) A removal site evaluation performed in 1994 concluded that contaminated groundwater seeping into the ORNL storm sewer system was being discharged into First Creek at storm water Outfall 342. First Creek is a tributary to White Oak Creek and ultimately to the Clinch River. Further investigation showed that contaminated groundwater entered the storm drain system by leakage to three catch basins in the western part of ORNL.

The AM for the project was approved in November 1994. Installation of the groundwater collection and transmission system began in December Two storm water catch basins were replaced with porous sumps; the third basin remained operational but was modified so that groundwater entered a porous sump beneath the basin while the basin itself was sealed to prevent groundwater infiltration Startup of the system occurred on March 31, 1995. Collected groundwater is now piped to the ORNL Process Waste Treatment Plant for treatment and discharged through an existing NPDES outfall.

In October 1997, monitoring of surface water in First Creek identified elevated levels of ^{90}Sr and ^{233}U. Additional sampling conducted in December 1997 identified two unlined storm sewer manholes as the point of entry for the contamination In March 1998, an additional groundwater interceptor trench was installed that connects to one of the Corehole 8 plume collection sumps. This trench provides additional contamination release control until the final remedy is implemented to address source control

Two source control actions are in the planning stages The Corehole 8 soils source removal is ongoing and described in Sect. 3.9. A groundwater source control action at well 4411 was added under an addendum to the Corehole 8 source action, completed in late 1999 This action involves groundwater extraction of the most concentrated portion of the plume from well 4411. Strontium-90 concentrations as high as 80,000 pCi/L have been detected in a pre-action pumping test from this well. A Removal Action Work Plan (RmAWP) was being developed for this action in FY 2000.

3.2.2 Evaluation of Decision Document Requirements for Performance and Stewardship

3.2.2.1 Goals of decision

The goal of this action is to intercept and remove ^{90}Sr-contaminated groundwater from the storm sewers associated with Outfalls 341 and 342 and "reduce the ^{90}Sr contaminated water reaching First Creek by an estimated 20 – 50 percent." This action will correspondingly "reduce the amount of Sr-90 detected at White Oak Dam by an estimated 2 – 5 percent " This action will "reduce the risk to human health, welfare, and the environment until additional and/or permanent actions to eliminate the source of contamination are taken" (DOE 1994a)

3.2.2.2 Monitoring required

The RmAR specifies monthly monitoring at the flume located downstream of the targeted storm sewer outfall, near the confluence of First Creek and Northwest Tributary ("First Creek Weir") The 1997

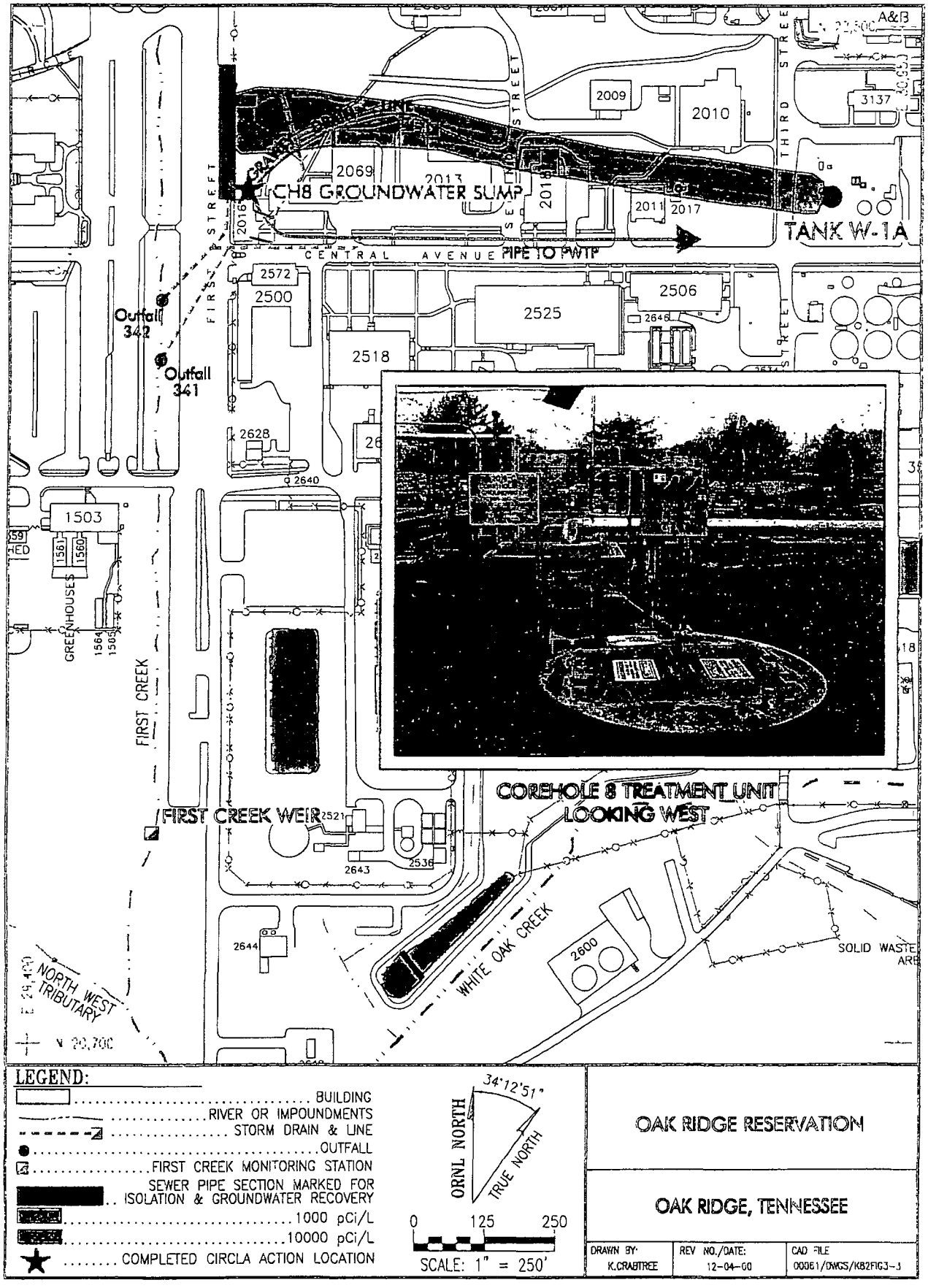


Fig. 3.4. WAG 1 Corehole 8 Plume Removal Action.

RER recommended that sampling of collected groundwater be conducted to determine the amount of ^{90}Sr collected and piped to the ORNL Process Waste Treatment Plant for treatment. EPA (1997a) and TDEC (1997a) concurred with the recommendation. Monthly flow-proportional composite samples are collected at First Creek and the Corehole 8 Sump.

3.2.3 Implementation of Previous Year's Recommendations

There were no recommendations made for this site in the 2000 RER.

3.2.4 Evaluation of Performance and Stewardship Data—Corehole 8 Plume

Table 3.7 presents a summary of the Five-Year Review for the Corehole 8 Plume Details are provided in the following section

3.2.4.1 Evaluation of monitoring data

The only monitoring required in the Corehole Plume decision document was the requirement to collect samples at the First Creek weir location, located at the confluence of First Creek and the Northwest Tributary. In 1997, a recommendation was made to add monitoring of the Corehole 8 effluent, so now it is possible to determine the relationship between changes in releases at First Creek and Corehole 8.

Table 3.8 shows that since the system became operational (spring 1995), ^{90}Sr fluxes within First Creek have been reduced to achieve the goal of a 20% to 50% reduction. The actual estimated reduction in First Creek between calendar year (CY) 1994 and FY 2000 is approximately 80%. The fluxes estimated for FY 2000 are lower than in the previous several years. Data collected at the Corehole 8 sump suggest that less ^{90}Sr was entering the treatment system from October 1999 through January 2000. During this time, pumping of the Corehole 8 Plume was occurring from well 4411. It is thought that the groundwater treatment system was acting to reduce both flow and ^{90}Sr mass into the treatment system. This, in turn, may have resulted in the decreased ^{90}Sr flux into First Creek. November through January is usually a time for elevated fluxes due to higher flows.

Tables 3.9 and 3.10 show results of the FY 2000 Corehole 8 sump and First Creek fluxes, respectively, compared to the pre-action CY 1994 fluxes. Strontium-90 concentrations and fluxes at First Creek have decreased under similar flow conditions. For example, concentrations from June sampling from 1994 to 2000 decreased from 297 pCi/L to 44 pCi/L, with corresponding flux decreases of 9 8 to 1.7 mCi, a decrease of approximately 80%. Fluxes at Corehole 8 appear to be slightly down from FY 1999, primarily due to low flux values in the early part of the fiscal year. It is believed that the low flows and low ^{90}Sr concentrations measured at the Corehole 8 system are due to pumping at nearby well 4411, the new groundwater recovery well for the Corehole 8 Plume (see Sect. 3.9). Data are missing for a few FY 2000 months, due to Y2K issues with the flow meter.

Figures 3.5 and 3.6 show changes in ^{90}Sr flux over the past several years at First Creek and Corehole 8. The First Creek time series plot is very revealing, because flux data were available both pre- and post-action. As indicated in Fig. 3.5, fluxes decreased immediately after system startup in the spring of 1995 from more than 15 mCi to less that 5 mCi Fluxes generally have remained less than 5 mCi since that time. As indicated above, FY 2000 fluxes are even less than previous years, likely due to the startup of the pumping at Corehole 8 recovery well 4411.

Table 3.7. Corehole 8 Plume Five-Year summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Action has achieved >50% reduction of ^{90}Sr at First Creek (Sect 3 2 4 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Additional actions have followed to address source
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in AM, however, land within DOE control area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	Additional action to address source was initiated in 1999 (Sect 3 9)
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Confirmed with Site visit (Sect 3 2 4 2)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Chemical-specific ARAR includes 40 *CFR* 61, 10 mrem/yr public exposure from DOE facilities
Have there been any changes in land use or expected land use on or near the site?	No	Confirmed with Site visit (Sect 3 2 4 2)
Have new human health or ecological exposure pathways or receptors been identified?	NA	Further evaluation is addressed on watershed scale
Have new contaminants or contaminant sources been identified?	Yes	COC = ^{90}Sr, Uranium isotopes detected in First Creek in 1997
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Confirmed with Site visit (Sect 3 2 4 2)
Have there been any changes in the physical site conditions?	No	Confirmed with Site visit (Sect 3 2 4 2)
Have there been any changes in the toxicity factors for contaminants of concern?	No	
Were there significant changes in the standardized risk assessment methodologies?	NA	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	No ERA performed for AM Ecological risks are being considered in the Bethel Valley ROD discussion
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes and tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
COC = contaminant of concern
DOE = U S Department of Energy
ERA = ecological risk assessment
NA = not applicable
ROD = record of decision
TBC = to be considered

Table 3.8. ^{90}Sr flux changes at First Creek

Year	^{90}Sr flux at First Creek (Ci)
CY 1993	0.13
CY 1994	0.15
CY 1995	0.067
FY 1997	0.036[a]
FY 1998	0.044[b]
FY 1999	0.044[c]
FY 2000	0.026
Change (1994–2000)	81%

[a]Represents 10 months of data
[b]Represents 11 months of data
[c]Represents 11 months of data

CY = calendar year
FY = fiscal year

Table 3.9. Results of Corehole 8 sump flow composite samples

	FY 1997 (October 1996–September 1997)			FY 2000 (October 1999–September 2000)		
Month	^{90}Sr (pCi/L)	Total flow (1000 L)	Flux (mCi)	^{90}Sr (pCi/L)	Total Flow (1000 L)	Flux (mCi)
October	8700	933	8.1	7,548	852	6.43
November	8800	1845	16.2	4,849	706	3.43
December	7230	2595	18.8	3,021	29	0.09
January	6890	1711	11.8	6,118	NA	NA
February	8390	1858	15.6	3,515	NA	NA
March	7350	2162	15.9	4,934	2,821	13.92
April	9870	1946	19.2	458	2,319	1.07
May	6750	1697	11.5	6,330	2,162	13.69
June	7280	2631	91.2	3,893	1,650	6.42
July	7463	1705	12.7	3,977	1,905	7.58
August	6647	1131	7.5	4,381	1,854	7.25
September	9465	953	9	NA	NA	NA
Total						

FY = fiscal year

NA = not available due to instrument problems

Table 3.10. Results of First Creek flow composite samples

	CY 1994 Pre-action				FY 2000		
Month	^{90}Sr results (pCi/L)	Flow volume (1000 L)	^{90}Sr flux (mCi)	Month	^{90}Sr results (pCi/L)	Flow volume (1000 L)	^{90}Sr flux (mCi)
January	124.4	102,894	12.8	October	228.89	10,909	2.50
February	95.6	126,569	12.1	November	119.02	10,614	1.26
March	89.2	228,600	20.4	December	128.17	18,925	2.43
April	105.4	166,983	17.6	January	63.15	40,025	2.53
May	236.5	41,438	9.8	February	22.86	50,792	1.16
June	297.3	32,963	9.8	March	28.78	107,339	3.09
July	324 4	25,586	8.3	April	1.64	131,741	0.22
August	378.4	30,920	11.7	May	35.21	75,019	2.64
September	364.9	26,857	9.8	June	44.07	39,977	1.76
October	133.6	24,701	3.3	July	84.48	54,057	4.57
November	260.9	37,179	9.7	August	77.58	42,010	3.26
December	179.8	66,741	12	September	73.84	11,798	0.87
Total			**0.137 pCi**		**51.0**		**0.26**

CY = calendar year

FY = fiscal year

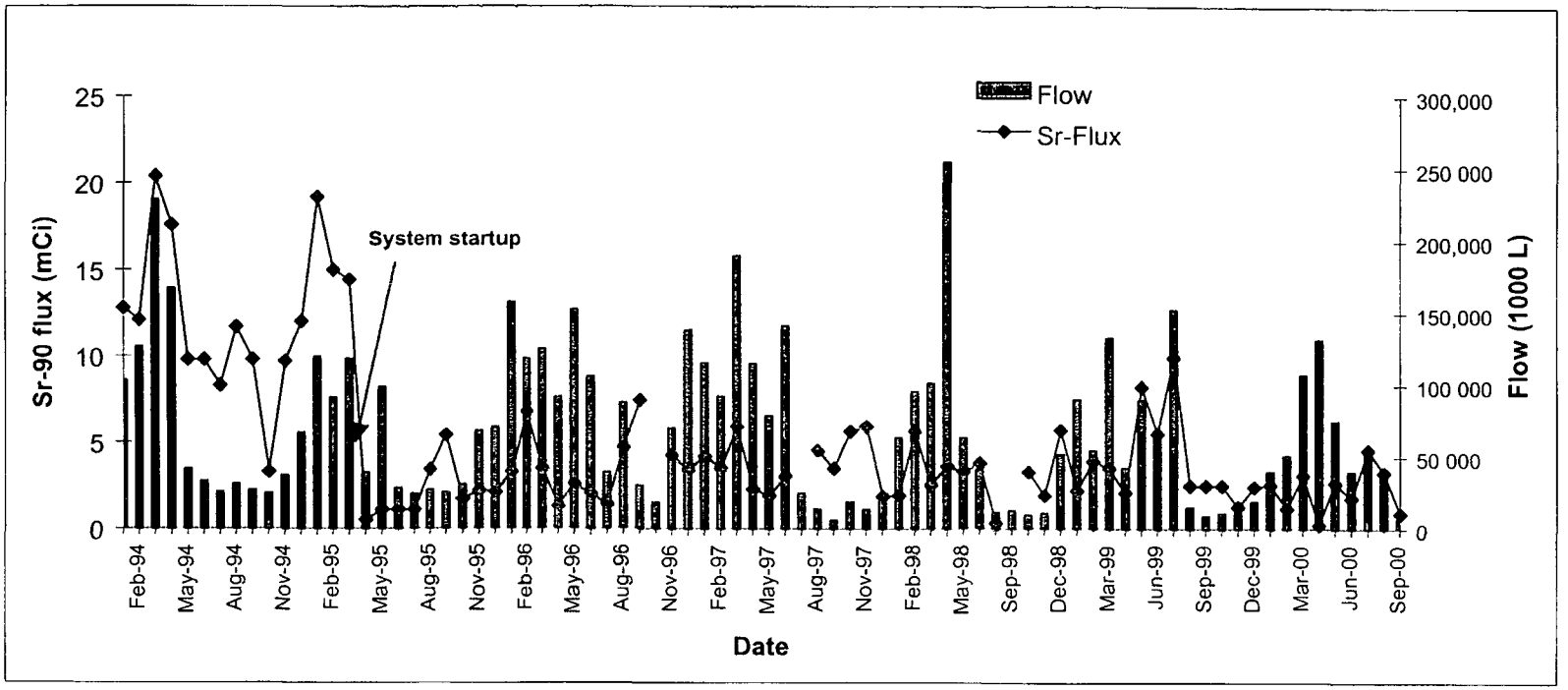


Fig. 3.5. Strontium-90 flux changes at First Creek.

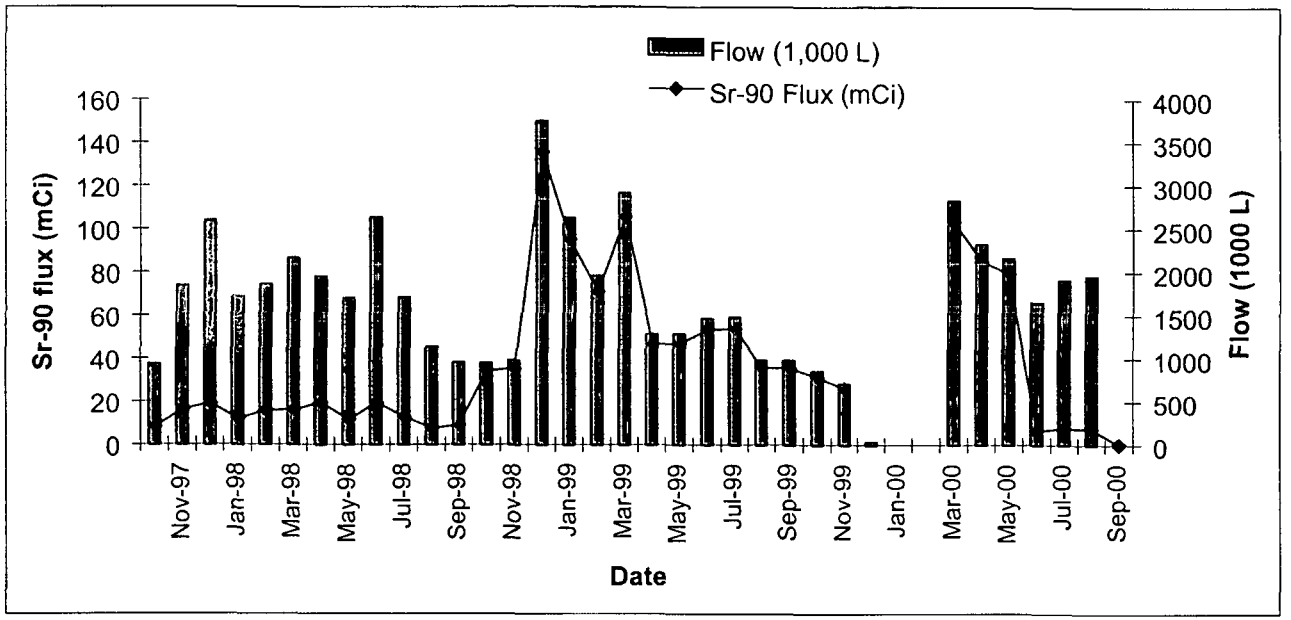


Fig. 3.6. Strontium-90 flux changes at Corehole 8.

3.2.4.2 Site visit

A site visit was performed at the site on October 27, 2000. The site visit forms are presented in Appendix A. The above-ground portion of the "site" consists of the sump well, which has the automated process controls in place. The system is well marked, indicating the Facility Manager and access requirements. If any problems occur with the system there is an automated process control system that sends alarm signals to the system operators. Waste Management Federal Services (WMFS) liquid waste operations are responsible for operations and inspections of the system No surveillance and maintenance grounds inspections are required, since the system is underground.

As indicated during the interview, during recent excavation activities in the area, a portion of the pipe that sends the collected water to the treatment facility was hit by excavating equipment and required repair.

3.2.5 Recommendations

The Corehole 8 Plume action has successfully achieved the goals of the action There are no recommended changes for this site at this time. Because of the two related actions that are taking place at the Corehole Plume source (Sect. 3.9), the next several years will likely result in changes in the releases to First Creek. At this time, it would be best to leave consistent monitoring protocols in place in order to quantitatively evaluate the preaction and postaction effect of those actions.

3.3 WAG 1 TANK WC-14 TIME-CRITICAL REMOVAL ACTION—LIQUID REMOVAL

- TC AM February 1995
- Field Activities Complete May 1995

3.3.1 Project Description

Tank WC-14, located in the WC-10 Tank Farm at ORNL, was used for the collection and transfer of liquid low-level waste (LLLW) from processes, sumps, and laboratories in Bldgs 4501 and 4507 (Fig 3 7) The tank was removed from programmatic service in January 1992 Residual waste from past operations remained in the tank in both aqueous and sludge forms Sampling efforts in 1992 and 1993 indicated the presence of PCBs in the liquid at levels below 1 ppm, which is below Toxic Substance Control Act (TSCA) actions limits DOE pumped the 370 gal of liquid into metal containers filled with absorbent material so that the liquids were absorbed completely and free-draining liquids were eliminated The containers are stored in the tumulus in SWSA 6 The BJC Waste Operations Project maintains custody of the metal containers

3.3.2 Evaluation of Decision Document Requirements for Performance and Stewardship

3.3.2.1 Goals of decision

This Time-Critical Removal Action (TC RmA) removed enough liquid to lower the total volume of waste in the tank to approximately 10% of the tank's capacity The aqueous phase contains elevated levels of beta/gamma emitters, primarily ^{137}Cs and ^{90}Sr, and trace levels of a PCB The goal of the removal of the aqueous phase was to reduce the risk of potential overflow (DOE 1995b)

3.3.2.2 Monitoring and stewardship requirements

The RmAR identified continued monitoring of the liquid level in the tank by the ORNL Waste Operations Control Center until final remedial action Since tank stabilization activities were completed in FY 1998, tank water level monitoring was discontinued There were no stewardship requirements specified in the decision documents

3.3.3 Implementation of Previous Year's Recommendations

There were no recommendations made for the current year

3.3.4 Evaluation of Performance and Stewardship Data—WAG 1—Tank WC-14 Liquid Removal

Table 3 11 presents a summary of the Five-Year Review for Tank WC-14 Liquid Removal

3.3.4.1 Site visit

A formal site visit and interview was not attempted for the WAG 1 WC-14 Tank The building in which the former tank is located was identified and photographed The TC RmA (liquid) has been superceded by the sludge removal and grouting of the tank in place (Sect 3 4)

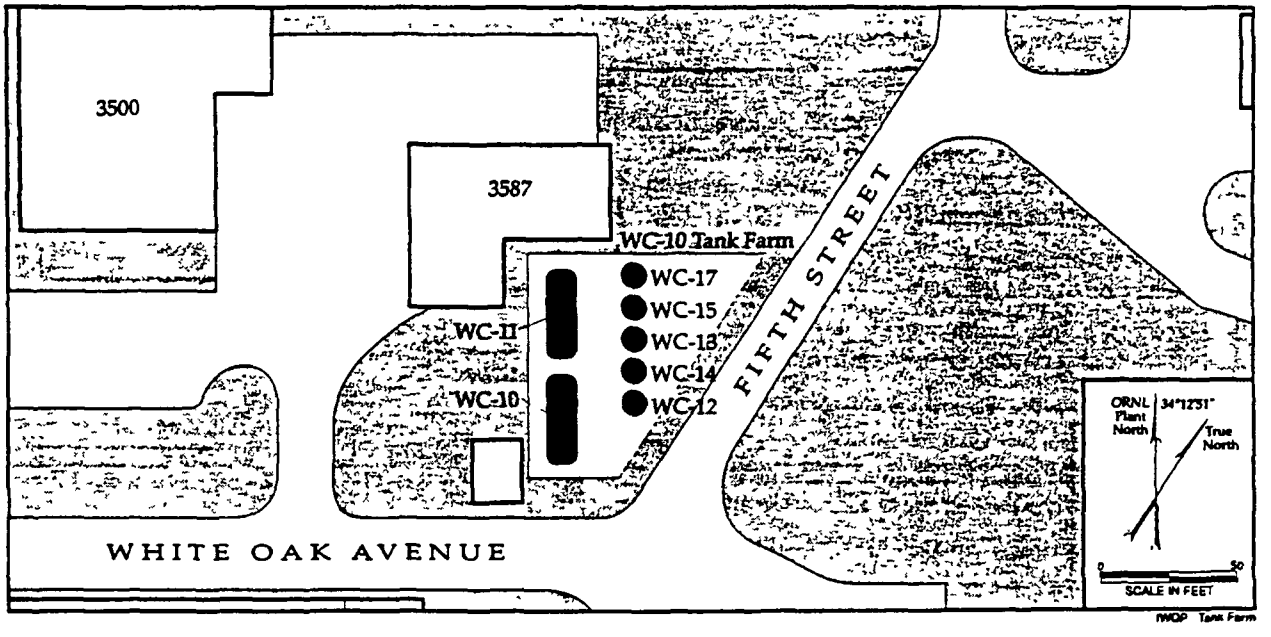


Fig. 3.7. Location of WAG 1 Tank WC-14.

Table 3.11. Tank WC-14 Liquid Removal Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	370 gal liquid removed in 1995 (Sect. 3.3.1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Liquid level was monitored until tank was removed
Are the land use controls (fencing, security guards, etc.) in place and preventing exposure?	Yes	No specific land use controls in AM; however, land within DOE control area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	Sludge stabilization performed following this action (Sect. 3.4.1)
Are operating procedures, as implemented, maintaining the effectiveness of response actions?		Liquid levels were monitored until tank was stabilized
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	TSCA PCB action limit of 1 ppm
Have there been any changes in land use or expected land use on or near the site?	No	
Have new human health or ecological exposure pathways or receptors been identified?	NA	Waste has been stabilized; further evaluation on watershed scale
Have new contaminants or contaminant sources been identified?	NA	Waste has been stabilized; further evaluation on watershed scale
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	No	
Have there been any changes in the toxicity factors for contaminants of concern?	NA	No BRA/ERA was performed
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risk not addressed by action
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes and tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
DOE = U S Department of Energy
ERA = ecological risk assessment
NA = not applicable
PCB = polychlorinated biphenyl
ROD = record of decision
TBC = to be considered
TSCA = Toxic Substances Control Act of 1976

3.3.5 Conclusions and Recommendations

The TC RmA for the WC-14 tanks was performed in 1995 and, the remaining sludge was later removed and the tank grouted in place. The goal of the initial action was simply to remove liquid to prevent overflow until the tank could be stabilized. The TC RmA was successful at accomplishing this goal, but it is moot in light of the fact that the tank has been grouted.

3.4 WAG 1 TANK WC-14 TIME-CRITICAL REMOVAL ACTION—SLUDGE REMOVAL

- TC AM· September 1997
- Field Activities Completed March 1998

3.4.1 Project Description

A second TC RmA for Tank WC-14 was completed in February 1998 This action involved removal of 80 gal of dewatered sludge from the tank on February 17, 1998, and grouting of the tank on March 4, 1998 Sludge samples showed elevated levels of alpha emitters, europium isotopes, ^{137}Cs, ^{60}Co, and ^{90}Sr PCB concentrations ranged from 105 to 241 ppm The sludge was classified a RCRA characteristic waste, regulated under TSCA, and classified as a transuranic (TRU) waste, containing about 1000 mCi/g (wet basis) of TRU elements with half-lives greater than 20 years. The removed dewatered sludge was contained in two partially filled 55-gal drums, placed in a concrete cask, and stored in the ORNL Transuranic Waste Storage Facility, Bldg 7883 The BJC Waste Operations Project maintains custody of the concrete cask

3.4.2 Evaluation of Decision Document Requirements for Performance and Stewardship

3.4.2.1 Goals of decision

The goals of the removal action were to remove sludge to the extent practical and reduce the quantity of contaminants in Tank WC-14, reduce the PCB/RCRA/TRU contaminant volume in tank WC-14, eliminate nonprogrammatic inflow into Tank WC-14, and mitigate the pathways for contaminant migration from Tank WC-14 The sludge was removed and the tank grouted (DOE 1997q)

3.4.2.2 Monitoring and stewardship requirements

No monitoring is required No stewardship requirements are specified in the decision documents

3.4.3 Implementation of Previous Year's Recommendations

There were no recommendations made for the current year

3.4.4 Evaluation of Performance and Stewardship Data—WAG 1 WC-14 Tank—Sludge Removal

Table 3 12 presents a summary of the Five-Year Review for WC-14 Tank Sludge Removal

3.4.4.1 Site visit

A formal site visit and interview was not attempted for the WAG 1 WC-14 Tank The building in which the former tank is located was identified and photographed The source material—liquid and sludge—has been removed and the tank has been grouted in place

Table 3.12. WC-14 Sludge Removal Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	80 gal of sludge removed from tank, remaining sludge grouted in 1998
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Remaining sludge stabilized
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in AM, however, land within DOE control area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	Liquid removal action occurred prior to sludge removal
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	No operating procedures in place since tank is grouted
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Chemical-specific ARAR include 40 *CFR* 61 92, TDEC 1200-3-11- 08, 10 mrem/yr public exposure to airborne radiation emission from DOE facilities, 100 mrem/yr general public all sources (TBC), others, TSCA PCB action limit of 1 ppm
Have there been any changes in land use or expected land use on or near the site?	No	Inside ORNL fence
Have new human health or ecological exposure pathways or receptors been identified?	No	Source has been removed
Have new contaminants or contaminant sources been identified?	No	Source has been removed
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	No	
Have there been any changes in the toxicity factors for contaminants of concern?	No	
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risks not addressed by action
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes and tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
DOE = U S Department of Energy
NA = not applicable
ORNL = Oak Ridge National Laboratory
PCB = polychlorinated biphenyl
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation
TSCA = Toxic Substances Control Act of 1976

3.4.5 Conclusions and Recommendations

The TC RmA for liquid in the WC-14 tank was performed in 1995. In February 1998, the remaining sludge was removed and the tank grouted in place. The goal of the initial action was to stabilize the tank, thus mitigating risk to human health and the environment. The action was successful at accomplishing this goal.

3.5 WASTE EVAPORATOR FACILITY REMOVAL ACTION

- AM: July 1995
- Action Complete: June 1996
- RmAR: July 1996

3.5.1 Project Description

Building 3506, the Waste Evaporator Facility, was adjacent to the South Tank Farm at the ORNL main plant complex (Fig. 3.8). During operations between 1949 and 1954, the facility was used to concentrate LLLW contaminants generated by ORNL operations No known releases occurred from the Waste Evaporator Facility. The primary goals of the removal action are to address possible contaminant releases from the deteriorating structure, in which the primary contaminants of concern were ^{137}Cs and mercury. Components of the removal action included dismantling of the above-ground portion of the Waste Evaporator Facility, removal of rainwater accumulated in the cell, removal of accumulated cell sediment, and removal of mercury/radiologically-contaminated soils from the floor of the gallery crawlspace. Field activities began in December 1995 and were completed in June 1996. The scope of the removal action was fulfilled without exceptions or incident. The work areas were backfilled to grade with clean soil, and the sampling and disposal of soil and rubble was completed according to the project requirements.

3.5.2 Evaluation of Decision Document Requirements for Performance and Stewardship

3.5.2.1 Goals of decision

The goal of this action is to "reduce the risk to human health and eliminate the risk of a chemical release to the environment." The removal of the above-grade portion of Bldg. 3506 will "effectively mitigate the external radiation exposure pathway and remove the chemical contaminants that could affect workers and hypothetical adult trespassers" (DOE 1995a)

3.5.2.2 Monitoring and stewardship required

There are no post-action monitoring requirements associated with this action. No stewardship requirements were specified in the decision documents

3.5.3 Implementation of Previous Year's Recommendations

No changes were recommended for the current year

3.5.4 Evaluation of Performance and Stewardship Data

Table 3.13 provides a summary of the Five-Year Review for the Waste Evaporator Facility

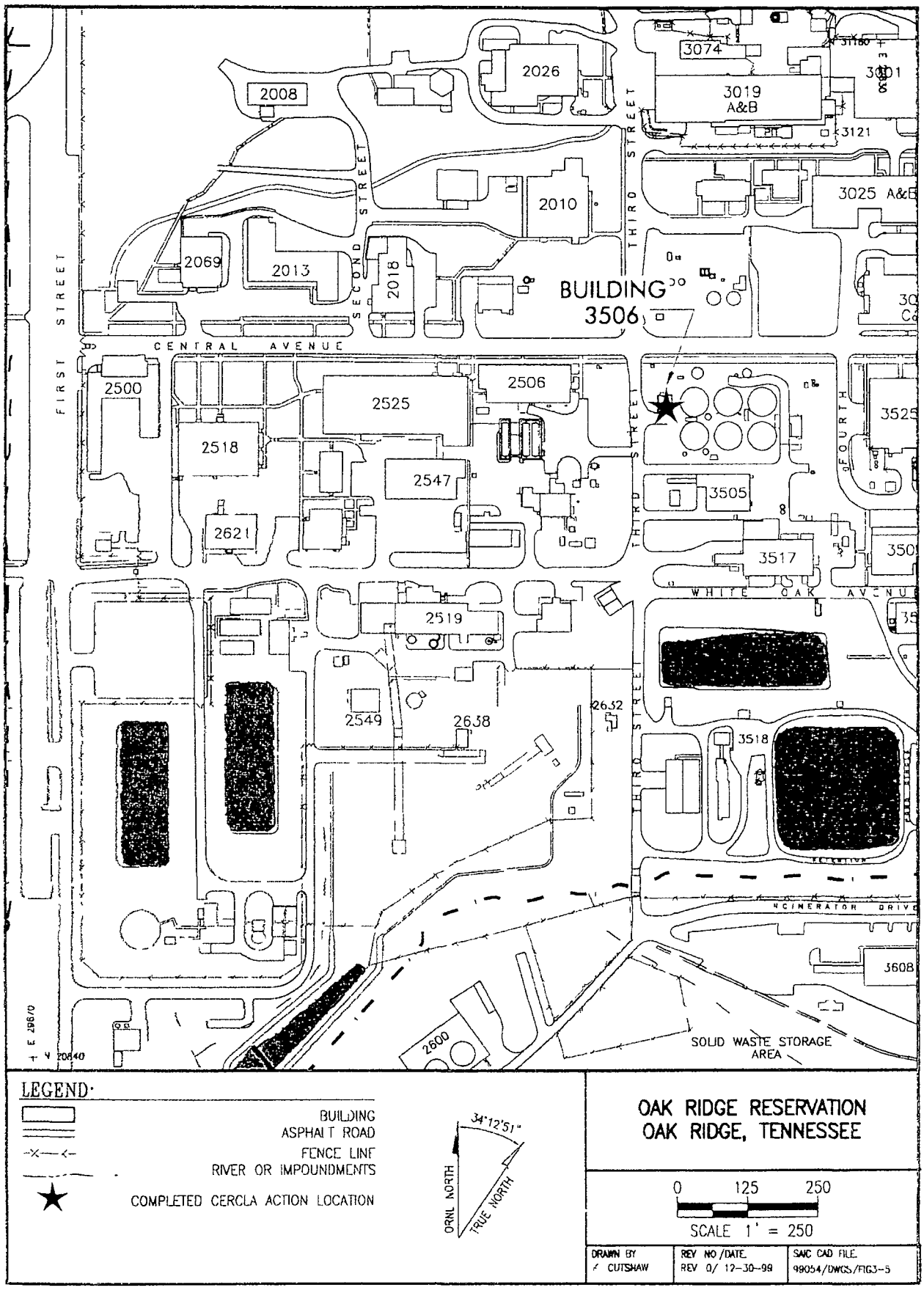


Fig. 3.8. Location of Waste Evaporator Facility.

Table 3.13. Waste Evaporator Facility Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Sect 3 5 2
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Building has been removed above grade
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls were specified, however, land within DOE control area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	No	No additional actions specific in RmAR, however, additional CERCLA actions will address South Tank Farm area
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	No operating procedures—building has been removed
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	No chemical-specific ARARs identified in RmAR
Have there been any changes in land use or expected land use on or near the site?	Yes	Area used for staging during GAAT remedial action
Have new human health or ecological exposure pathways or receptors been identified?	No	
Have new contaminants or contaminant sources been identified?	No	COCs were Cs and Hg, further evaluation is being addressed on watershed scale
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Chemical treatment not part of remedy
Have there been any changes in the physical site conditions?	Yes	Building is gone
Have there been any changes in the toxicity factors for contaminants of concern?	No	
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risk not addressed by action, but is being considered in the Bethel Valley ROD discussion
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes and tornadoes

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC = contaminant of concern
DOE = U S Department of Energy
GAAT = Gunite and Associated Tanks
NA = not applicable
RmAR = removal action report
ROD = record of decision
TBC = to be considered

Site visit

Because the building has been removed, and the footprint excavated and back-filled with clean soil, a formal site visit and interview was not attempted for this site The site of the former building was located and photographed. Currently, several Rubb® buildings associated with the Gunite and Associated Tanks (GAAT) (Sect. 3.8) remedial action occupy the former site of the Waste Evaporator Facility

3.5.5 Conclusions and Recommendations

The Removal Action for the Waste Evaporator Facility was completed in 1996 The goal of the action was to "effectively mitigate the external radiation exposure pathway and remove the chemical contaminants that could affect workers and hypothetical adult trespassers" by the removal of the above-grade portion of Bldg. 3506. The completion of this action meets the stated goal There are no postaction monitoring or stewardship goals specified in the decision document.

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3.6 BUILDING 3001 CANAL REMOVAL ACTION

- AM. November 1996
- Field Activities Complete: November 1996
- RmAR: July 1997

3.6.1 Project Description

The canal under the Graphite Reactor in Bldg. 3001 underwent RCRA clean closure in 1992 after lead- and cadmium-contaminated sediments were removed (Fig 3.9). Demineralized water in the canal was found to contain 2700 pCi/L of ^{137}Cs and 2160 pCi/L of ^{90}Sr. The area around the canal was designated as both a radiation and contamination zone. The quantity of water in the canal was automatically maintained at approximately 10 in. below the top of the canal, or at approximately 74,600 gal, for shielding the radiologically contaminated walls of the canal. Leakage and evaporation required the addition of about 400 gpd of demineralized water to maintain the necessary shielding volume. According to the AM, although the canal walls were slightly damaged by the low pH of demineralized water used during reactor operations, they are essentially intact However, construction joints along the canal bottom and walls were sealed with oakum, an expansion joint compound, placed into formed recesses at the bottom of the canal walls Also, a water stop made of copper sheets was embedded in the concrete between the wall sections. Some of these joints may have failed, allowing water to leak from the canal. The AM further states that the fate of the contaminated water is unknown The removal action was implemented to reduce risks and also lower surveillance and maintenance costs Water in the canal was displaced by a low-strength grout in April 1997 The grout is a stable shielding material for residual contamination that also eliminates further leakage and hydraulic transport After the canal area was cleared of miscellaneous materials, the canal and vault walls were painted to isolate contact-smearable contamination. Painting was completed in summer 1997, with project closeout in July 1997.

3.6.2 Evaluation of Decision Document Requirements for Performance and Stewardship

3.6.2.1 Goals of decision

The objective for this action is to replace the shielding protection provided by water with a specific grout formulation (controlled, low-strength material, or CLSM) to "reduce or eliminate potential future risk to human health and the environment and to reduce surveillance and maintenance cost of this canal" (DOE 1996a) The technical objective of the CLSM was to eliminate the internal sources of leakage out of the canal and mitigate the potential for groundwater in-leakage to the canal.

3.6.2.2 Monitoring and stewardship required

There were no post-action monitoring or stewardship requirements specified in the decision documents for the 3001 Canal However, as part of routine surveillance and maintenance (S&M) activities, routine site inspections are performed.

3.6.3 Implementation of Previous Year's Recommendations

There were no recommendations made for the current year.

3.6.4 Evaluation of Performance and Stewardship Data

Table 3.14 presents the Five-Year Review Summary for the 3001 Canal.

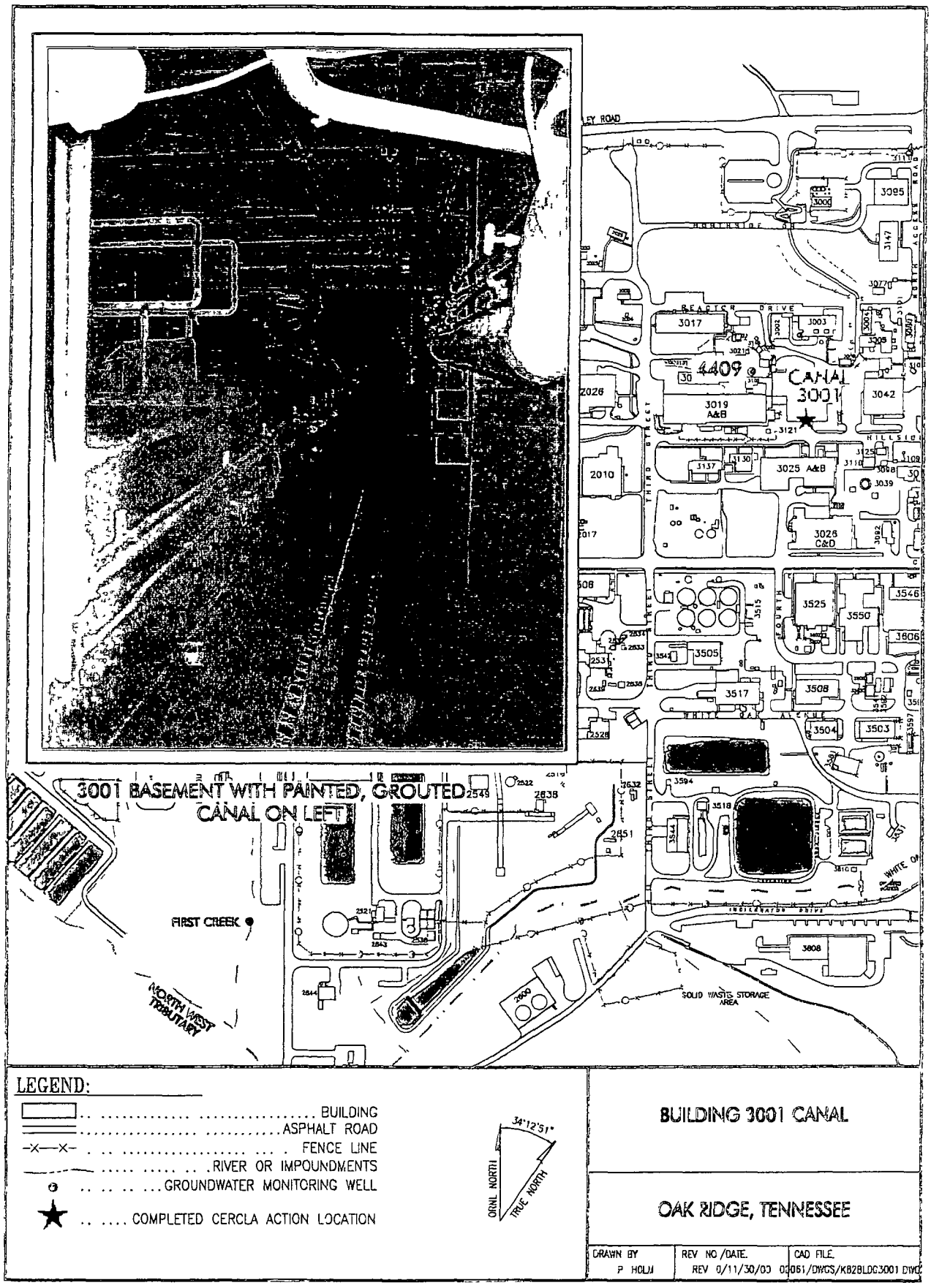

Fig. 3.9. Location of Bldg. 3001 Canal.

Table 3.14. Building 3001 Canal Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Grout formulation provides adequate radiation shielding
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Paint coating is regularly inspected to ensure adequate shielding
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in AM, however, land within DOE control area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required by RmAR, lead-contaminated sediments removed in 1990
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	Removal action—no ongoing operating procedures
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Chemical-specific ARAR includes 40 *CFR* 61 92, TDEC 1200-3-11- 08, 10 mrem/yr public exposure to airborne radiation emission from DOE facilities, 100 mrem/yr general public all sources (TBC)
Have there been any changes in land use or expected land use on or near the site?	Yes	Building 3001 planned to be turned into ORNL Visitor Center
Have new human health or ecological exposure pathways or receptors been identified?	No	
Have new contaminants or contaminant sources been identified?	No	
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Chemical treatment not part of remedy
Have there been any changes in the physical site conditions?	No	None following grouting and painting
Have there been any changes in the toxicity factors for contaminants of concern?	No	
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risks not addressed by action
Is the site located in an area subject to natural disasters?	Yes	Low probability for earthquakes and tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
CFR = *Code of Federal Regulations*
DOE = U S Department of Energy
NA = not applicable
ORNL = Oak Ridge National Laboratory
RmAR = removal action report
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation

3.6.4.1 Site visit

A site visit and interview with the Facility Manager, Ms. Britati Lynn, was conducted on October 27, 2000 (Appendix A). The former canal is located in the basement of Bldg. 3001. The decision documents do not specify access controls, but Bldg 3001 is located within the ORNL security fencing, and, as such, a valid badge or visitor's pass is required for access. The door to the basement area is kept locked at all times. The site is clean, well marked ("Contamination Area and Radiological Area" signs posted prominently), and well maintained As stated in the project description (Sect 3 6 1), the canal has been filled in with a CLSM to meet the stated goal to "reduce or eliminate potential future risk to human health and the environment and to reduce surveillance and maintenance cost of this canal " A coating of white paint has been applied to the canal and grout material to isolate contact-smearable contamination, thus mitigating risk to human health and reducing surveillance and maintenance costs.

There are no monitoring requirements for the Bldg. 3001 canal The site is inspected weekly to ensure that there is no water on the canal floor and that the negative pressure in the containment duct is maintained The inspections are documented on inspection sheets ("check sheets") which are submitted to the Facility Manager. The check sheets are filed by date of inspection and retained on-site

To support the Five-Year Review, a radiological survey was performed to determine if the action has been effective at providing radiological shielding The survey was performed on December 1, 2000, and included gross alpha and beta counts on 29 smear samples. All sample results were below the MDA (minimum detectable activity), with the exception of two samples taken on the stairs leading down to the canal basement These results were 827 DPM and 27 DPM, both below the 1000 DPM action level Shoe covers are required to enter the stairs and basement area

The Facility Manager is not aware of any problems with the remedy Control of Bldg 3001 is scheduled to be turned over to UT-Battelle, LLC, for use as a Visitor's Center following decontamination of rad sources in the reactor There is some uncertainty as to whether BJC will retain control of the canal area.

3.6.5 Conclusions and Recommendations

The removal action was completed in 1997 and meets the stated goals to "reduce or eliminate potential future risk to human health and the environment and to reduce surveillance and maintenance cost of this canal " There are no post-action monitoring requirements other than to conduct surveillance and maintenance inspections of the canal

3.7 SURFACE IMPOUNDMENTS OPERABLE UNIT

- ROD: September 25, 1997
- Action Status: Impoundments C and D completed
  Impoundments A and B ongoing
- RAR: Impoundments C and D, March 1999

3.7.1 Project Description

The Surface Impoundments OU consists of Impoundment A (3524), Impoundment B (3513), Impoundment C (3539), and Impoundment D (3540) (Fig. 3.10) These impoundments were used to manage LLLW generated from experiments and material processing at ORNL Waste settling that occurred in the unlined impoundments (A and B) resulted in radioactively contaminated sediments (1400 yd^3 in A and 3160 yd^3 in B). Impoundments C and D were dry-lined and were found to contain only 40 yd of sediments contaminated with a very low level of radioactivity

The selected alternative for the site was two stand-alone sediment removal/treatment/disposal projects. The first phase of the project involved additional sampling of Impoundments C and D followed by sediment removal This action was initiated August 6, 1998, and completed September 18, 1998 Water, sediment, and 0.1 to 0 2 ft of soil was transferred to Impoundment B. The C and D impoundments were backfilled with stone and fill

The RAWP/Remedial Design Report for the final phases of the action was completed and submitted to the regulatory agencies in November 1999 In FY 2000, excavation and backfilling work was started at Impoundment A As indicated in Sect 3 1, excavations activities in the summer (July—September) may have led to short-term releases of additional ^{90}Sr and ^{137}Cs to White Oak Creek and the treatment plant

3.7.2 Goals of Decision

The purpose of the Surface Impoundments Remedial Action was to "reduce the potential threats to human health and the environment by cleanup and remediation of the four surface impoundments" Specific remedial action objectives include the following

- prevent direct exposure to, direct contact with, and inhalation or ingestion of contaminated sediments by humans and animals,
- prevent movement of contaminants to groundwater and surface water,
- control failure of the impoundments' berms and embankments, and
- prevent the bioaccumulation of contaminants in ecological receptors

3.7.3 Monitoring Required

There is no monitoring required for Impoundments C and D (3539 and 3540), and monitoring requirements have not been established for A and B (3524 and 3513) Monitoring requirements for all Impoundments likely will be identified in the final RAR

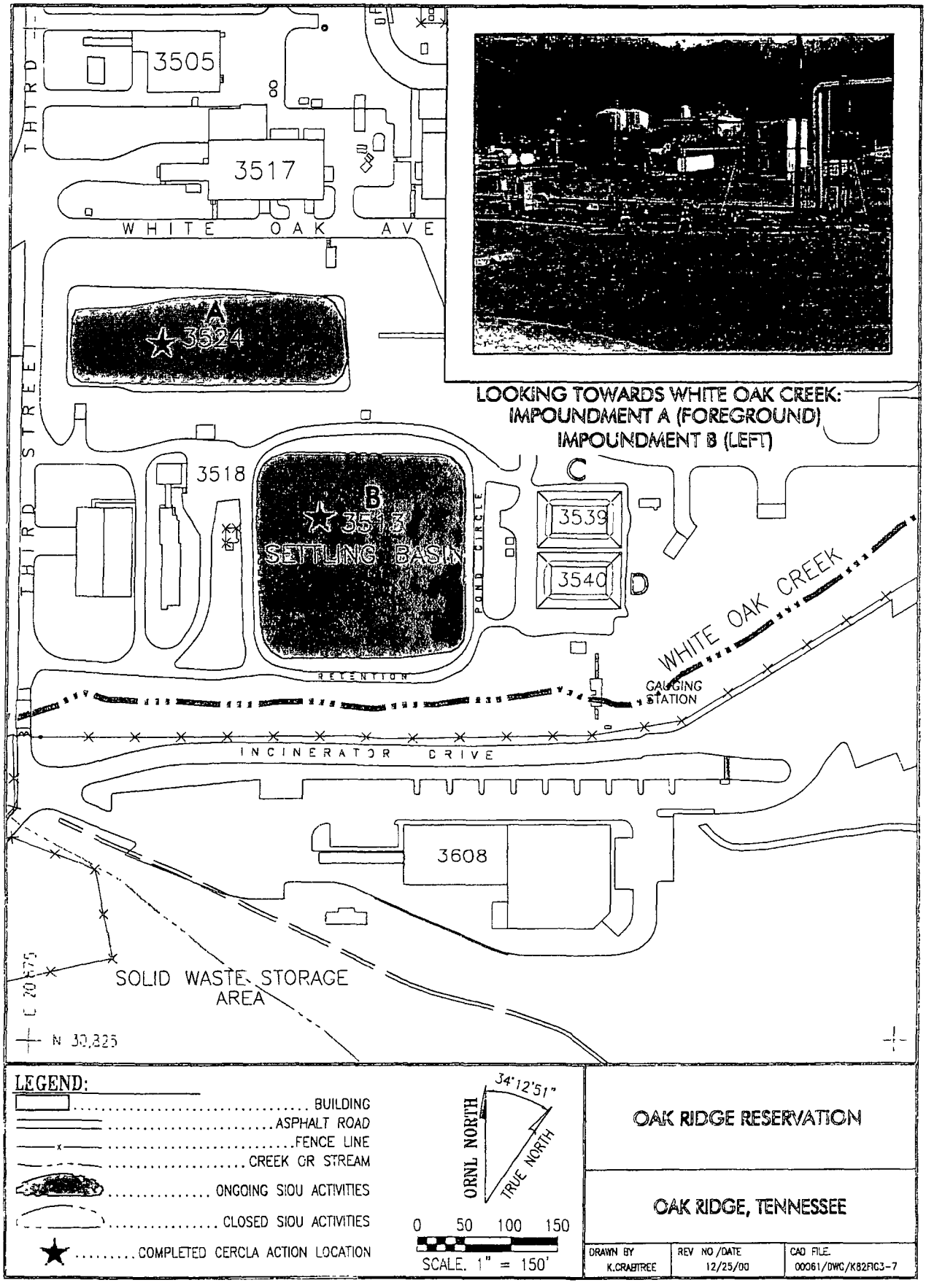

Fig. 3.10. Surface Impoundments Operable Unit.

3.8 GUNITE AND ASSOCIATED TANKS

- ROD: September 2, 1997
- Action Status:

3.8.1 Project Description

The GAAT are located near the center of WAG 1, in the ORNL main plant area (Fig. 3.11). An interim action was selected for the GAAT that calls for removal of the mixed TRU waste sludge from the tanks and transfer of the sludge to the Melton Valley Storage Tanks. Equipment and debris will be removed, packaged, and disposed of. This action is designed to remove and temporarily store the sludge before final treatment and disposal.

The Interim ROD actions were completed in August 2000. The RAR is currently in progress. This action likely will be addressed as a completed action in the 2002 RER.

The final action for the GAAT will be in accordance with the Bethel Valley ROD.

3.8.2 Goals of Decision

The objective for the interim remedial action for removing mixed TRU waste sludge from eight tanks in the GAAT WAG 1 is to "reduce the potential for on- and off-site risk from the tank contents" (DOE 1997i).

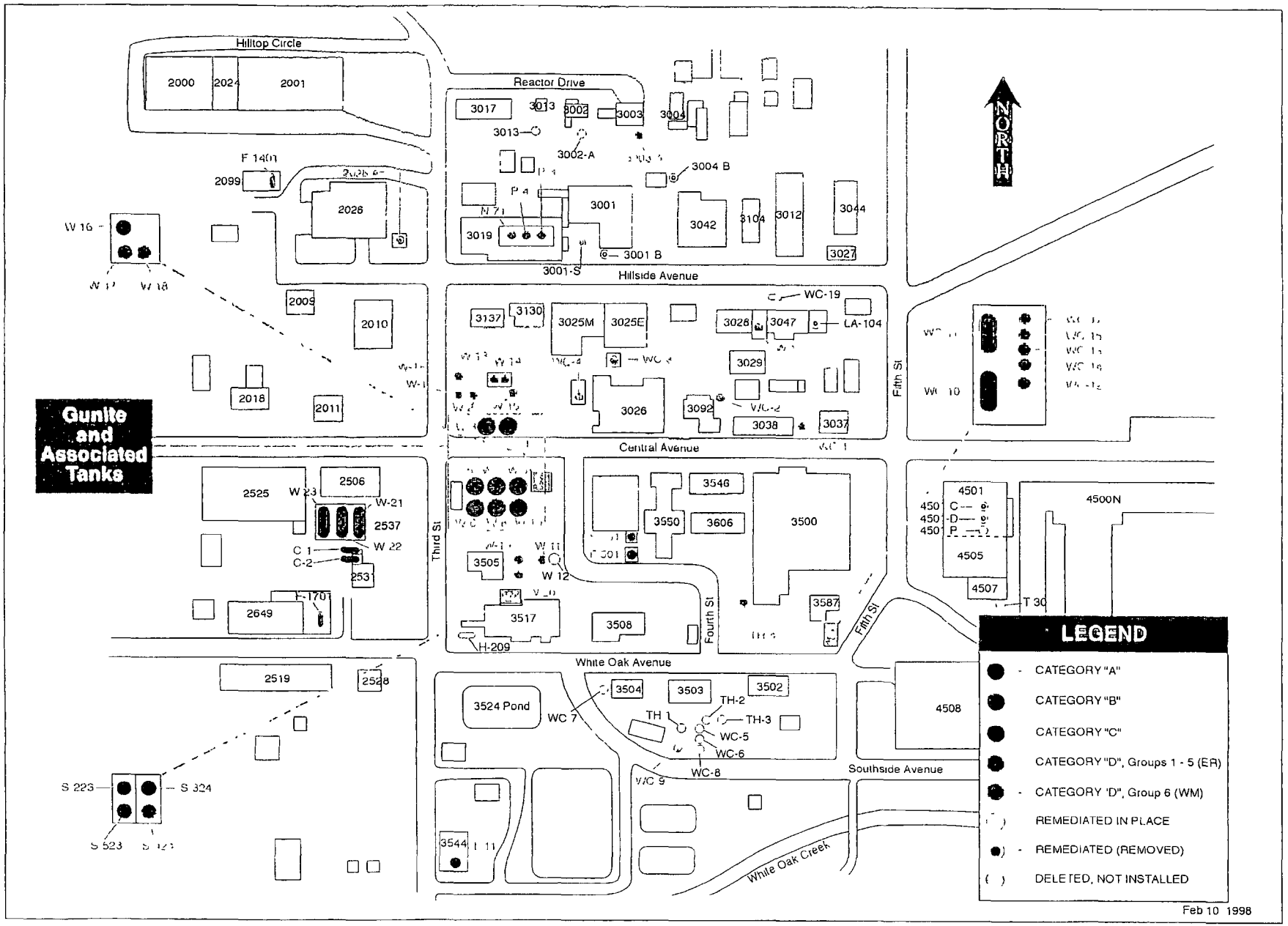

Fig. 3.11. Bethel Valley Tanks.

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3.9 COREHOLE 8 PLUME SOURCE (TANK W-1A) REMOVAL ACTION

- AM: September 14, 1998
- Action Status: Ongoing

3.9.1 Project Description

Tank W-1A in the North Tank Farm in Central Bethel Valley has been identified as the source of the Corehole 8 Plume (see Sect. 3.2). An Engineering Evaluation/Cost Analysis (EE/CA) performed on the tank area indicated that the tank contents and contaminated soils surrounding the tank would be removed. The goal of the action was to remove the source of ^{90}Sr and uranium that feeds the Corehole 8 Plume that enters First Creek and subsequently White Oak Creek (see Fig. 3.2).

Because of the high concentrations of radionuclides in the soil surrounding the tank, extra measures will be taken during the excavation to ensure worker safety. An RmAWP was developed and accepted by the regulatory agencies in February 1999. Based on the RmAWP, a subcontractor was selected in May 1999 to remove soil from an area of 40 × 50 × 15 ft from around Tank W-1A. The goals of this action were to "address a known source of ^{90}Sr, uranium, and other radionuclide contaminants being released to groundwater and migrating to First Creek and White Oak Creek."

In 1999 the AM, was addended to include a related action to address the Corehole 8 Plume source. The addendum addresses groundwater withdrawal and treatment in the highest concentration area of the plume from well 4411. Pumping from well 4411 occurred from October through December 1999. Operation of this system was successful and was performed primarily to identify optimal pumping rates. Rates must be optimized to maintain the most efficient ^{90}Sr removal. Pumping will restart and continue into FY 2001.

3.9.2 Goals of Decision

The goals of this action were to "address a known source of ^{90}Sr, uranium, and other radionuclide contaminants being released to groundwater and migrating to First Creek and White Oak Creek."

3.10 ORNL LIQUID LOW-LEVEL TANKS

- AM: April 15, 1999, September 1999
- Action Status: Ongoing

3.10.1 Project Description

There were 11 inactive LLLW tanks included in the original action (see Fig. 3.11) WC-1, WC-4, WC-10, WC-11, WC-12, WC-13, WC-15, WC-17, W-19, W-20, and 2026-A The purpose of the action is to remove the potential risk associated with the possible future leakage of tank contents. The general approach is to remove tanks contents (liquids and solids); package any waste not meeting WAC to treatment facility or storage; transfer waste meeting WAC to ORNL LLLW system (liquids) or ORNL solid waste storage (solids); and isolate and stabilize or remove tank structures It is recognized that the method for achieving these steps may be slightly different for each tank

In September 1999, an addendum to the AM added 16 additional tanks to the scope of the project 3003-A, WC-9, W-17, W-18, WC-3, T-1, T-2, F-501, WI-I, HFIR Tank, WC-20, TH-4, W-1, W-2, W-11, and T-14.

Seven tanks identified in the original action were completed in FY 2000, including sludge removal and stabilization. Tanks included WC-1, WC-15, WC-17, WC-10, WC-11, WC-12, and WC-13 In addition, four addendum tanks were completed In FY 2001, all remaining original and addendum tanks will be remediated, with the exception of T-1, T-2, and HFIR Tank These three tanks will be addressed in FY 2003/2004 as part of some planned privatization work

3.10.2 Goals of the Decision

"This removal action will remove, treat (if required), and store or dispose of tank contents It will stabilize in place or remove and dispose of contaminated inactive tank shells. These actions will meet the removal action objective to achieve and maintain risks at acceptable levels from releases of or exposure to residual contamination associated with the tanks for on- and off-site human and ecological receptors" (DOE 1999m).

3.11 METAL RECOVERY FACILITY

- AM: January 2000
- Action Status: Ongoing

3.11.1 Project Description

The Metal Recovery Facility (MRF), Bldg. 3505, is a one-story building that was used as a small-scale nuclear-fuel reprocessing plant from 1952 to 1960. Seven hot cells were used to recover ^{238}U, ^{239}Pu, ^{237}Np, and ^{241}Am, separating out fission products including ^{90}Sr, ^{137}Cs and ^{99}Tc. In addition, PCBs, asbestos, and lead are present within the building materials.

The structures at the MRF include a dissolver pit, small storage building, and an exterior concrete canal with a protective canopy. Process equipment has already been removed from the building.

The remediation activities include the following:

- building demolition;
- decontamination of residual contamination on building interior,
- controlled demolition of hot cells;
- removal of loose material in dissolver pit;
- stabilization of contamination below slab (e.g., plug and grout drains),
- decontamination of slab;
- disposal of contaminated materials at an approved facility; and
- administrative controls to prevent uncontrolled excavation, penetration, or access to slab or below-slab surfaces.

3.11.2 Goals of Decision

The removal action objectives for the MRF include the following:

- reducing the threat of release of hazardous substances from within the MRF,
- removing potential hazards to on-site personnel from the deteriorating contaminated above-ground slab structure,
- reducing the potential health and environmental hazards of residual contamination from slab and below-slab structures left in place, and
- facilitating (or not precluding) future remediation in the Bethel Valley watershed.

4. CERCLA ACTIONS IN MELTON VALLEY WATERSHED

This section describes CERCLA actions in the Melton Valley Watershed The actions are summarized in Table 4.1, and locations of the actions are shown in the map in Fig. 4.1. In addition to nine CERCLA actions previously tracked in the RER, the 2001 RER introduces the new actions planned as part of the watershed-scale Melton Valley ROD, signed September 2000. The seven completed actions in Melton Valley are evaluated as part of the CERCLA Five-Year Review.

Table 4.1. CERCLA actions in Melton Valley Watershed

CERCLA action	CERCLA areas	Decision document date signed	Action status	Monitoring required
		Five-Year Review sites		
White Oak Creek Embayment	White Oak Lake and Embayment	Decision November 9, 1990	RA completed June 1992	Yes
WAG 5 Seep C	Solid Waste Storage Area 5-south	AM March 30, 1994	Complete, RmAR approved January 12 1995, collection of contaminated groundwater ongoing	Yes
WAG 5 Seep D	Solid Waste Storage Area 5-south	AM July 26, 1994	Complete, RmAR approved January 12, 1995, collection of contaminated groundwater ongoing	Yes
WAG 4 Seep Control	Solid Waste Storage Area 4 Seeps 4 and 6	AM February 12, 1996	Complete, RmAR approved January 16, 1997	Yes
WAG 13 Cesium Plots	^{137}Cs-contaminated experiment plots	ROD October 6, 1992	RA complete	No
MSRE D&D* Reactive Gas	MSRE	AM August 25, 1995	Complete, RAR approved February 12, 1998	No
Old Hydrofracture Facility Tanks	OHF Tanks	AM September 13, 1996	Complete, RAR approved September 17, 1998	No
		Actions in progress		
MSRE D&D Fuel Salt Removal	MSRE	July 1998	Ongoing	TBD
MSRE D&D Uranium Deposit Removal	MSRE	AM August 6 1998 August 14, 1998	Ongoing	TBD
Old Hydrofracture Tanks and Impoundment	OHF tanks, Impoundment, PWSB, and T-4 Cells	AM May 1999 Addendum March 2000	Ongoing	TBD
Melton Valley Interim ROD	Various	ROD September 2000	Ongoing	TBD

*This time-critical removal action will be evaluated in the 2006 Five-Year Review upon completion of the related MSRE actions

AM = action memorandum
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
D&D = decontamination and decommissioning
MSRE = Molten Salt Reactor Experiment
OHF = Old Hydrofracture Facility
PWSB = Process Waste Sludge Basin
RA = remedial action
RAR = remedial action report
RmAR = removal action report
ROD = record of decision
TBD = to be determined
WAG = Waste Area Grouping

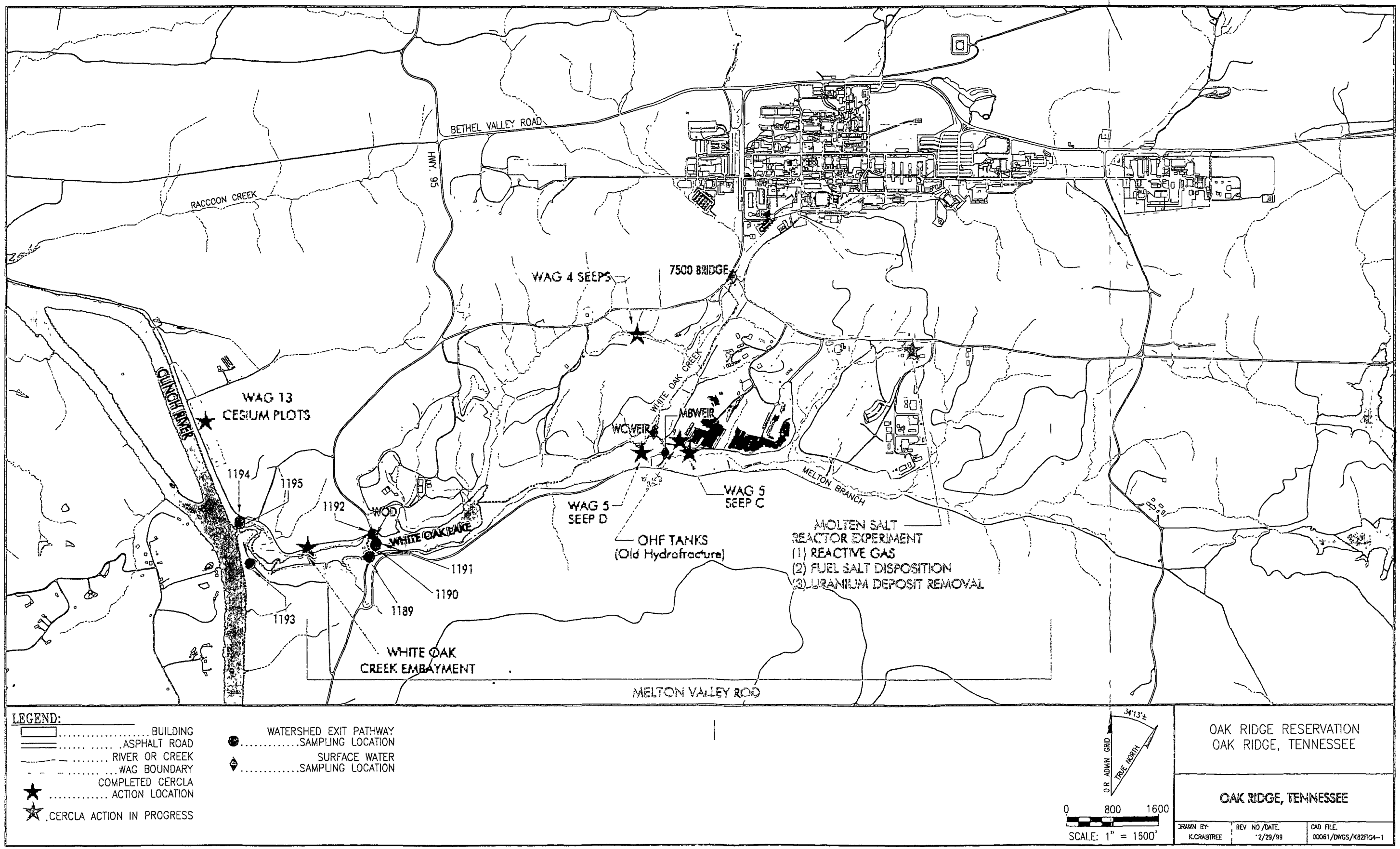

Fig. 4.1. Melton Valley Watershed RER site map.

DOE has determined that the remedies already implemented within the Melton Valley Watershed remain protective of public health and the environment in the context of the scope and objectives of each action.

4.1 WATERSHED OVERVIEW

4.1.1 Melton Valley Conceptual Model

Melton Valley lies within the southeastern portion of the ORR, approximately 10 miles southwest of the city of Oak Ridge. Melton Valley is one of two valleys that comprise the ORNL land area and the White Oak Creek watershed (Bethel Valley is the other). Melton Valley and Bethel Valley are separated by Haw Ridge. White Oak Creek flows from Bethel Valley through the water gap on Haw Ridge (location of 7500 Bridge monitoring station) and continues through White Oak Lake and the White Oak Creek Embayment in Melton Valley before entering the Clinch River drainage system (Fig. 4.2). The entire White Oak Creek watershed is delineated by four primary subwatersheds· Upper White Oak Creek (Bethel Valley), Middle White Oak Creek, Melton Branch, and Lower White Oak Creek.

Melton Valley is of primary importance on the ORR because, along with Bear Creek Valley, it is one of the major waste disposal and storage areas on the reservation. However, unlike Bear Creek Valley, the contaminant releases from Melton Valley flow directly off the ORR via surface water to the Clinch River One of the first CERCLA actions on the ORR was to address the releases of contaminated sediment from the White Oak Creek Embayment to the Clinch River (Sect 4.2).

RIs were completed in Melton Valley (one at WAG 6 and one at WAG 5) before the watershed RI approach was implemented in 1995. The Melton Valley RI was issued in May 1997 and the Melton Valley ROD was signed in September 2000 (Sect. 4.11)

Melton Valley is the location of several types of waste units, including shallow burial trenches and auger holes, landfills, tanks, impoundments, seepage pits and trenches, hydrofracture wells and grout sheets, waste transfer pipelines and associated leak sites, and surface structures. Releases from waste units have resulted in the development of secondary contaminant sources, including contaminated soil, sediment, and groundwater It should be noted that Tank T-1, Tank T-2, and the High Flux Isotope Reactor (HFIR) Tank in Melton Valley will be remediated under the ROD for interim actions in Bethel Valley (DOE 2001). These tanks were previously included with 24 other inactive tanks under an action memorandum. The action memorandum specified sludge removal from the tanks and transfer of the sludge to the Melton Valley Storage Tanks to await final processing at the TRU Waste Treatment Facility. However, sludge in the HFIR Tank and Tanks T-1 and T-2 contain ion exchange resin that is not compatible with the process employed at the TRU Waste Treatment Facility, and there is no proven technology that can be readily applied to resolve the incompatibility. Since the sludge from the three tanks will need to be evaluated and treated separately from the sludge of the other inactive tanks, remediation of the three tanks has been incorporated into the ROD for interim actions in Bethel Valley.

Most of the waste units in Melton Valley lie within the Nolichucky Shale and the Maryville Limestone geologic formation, which are aquitard formations within the Conasauga Group Shallow groundwater and surface water are tightly coupled, resulting in a large fraction of rainwater (>95%) moving to and through the surface water system and across White Oak Dam There is a small percentage of water that may intersect groundwater fractures and move along strike through the groundwater system Because shallow groundwater release to surface water is the primary component of the Melton Valley conceptual model, environmental monitoring in the Melton Valley watershed has focused on the contaminant releases across White Oak Dam and the major surface water sites within the watershed that

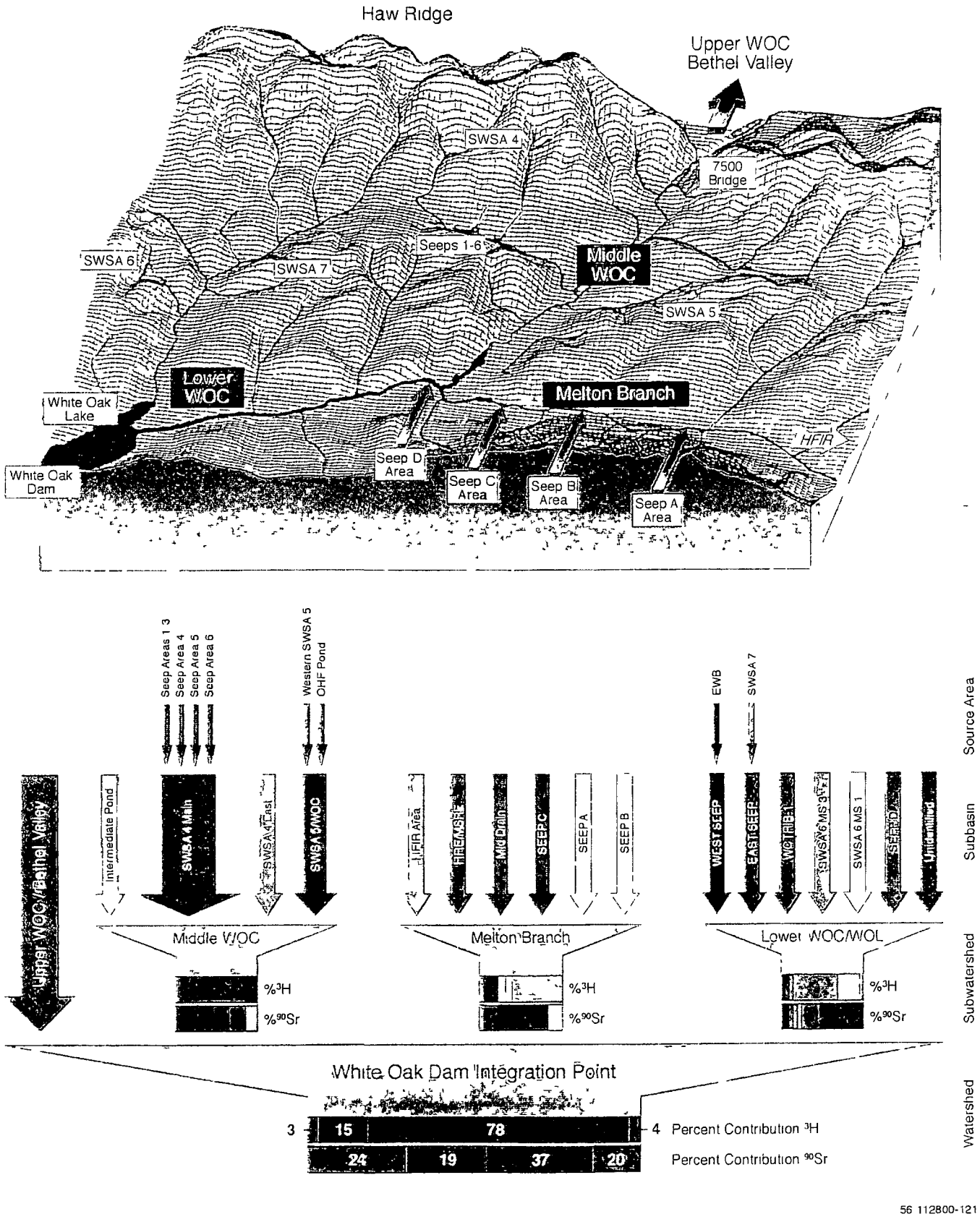

Fig. 4.2. Melton Valley Watershed conceptual model.

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contribute contamination at White Oak Dam WRRP monitoring activities in Melton Valley are heavily focused on monitoring the effectiveness of several actions that were implemented in the past four years to decrease ^{90}Sr releases to the Clinch River, primarily actions at WAG 5 Seeps C and D, and WAG 4 trenches Part of monitoring the effectiveness of these actions is to re-evaluate the distribution of contaminant releases to the surface water system in the watershed to help identify the next areas for remediation

The primary contaminants of concern in the valley are ^{3}H, ^{90}Sr, ^{137}Cs, and ^{60}Co Tritium and ^{90}Sr were placed in most of the shallow burial areas Cesium-137 is present primarily in the floodplain soils of the White Oak Creek floodplain, having been deposited on the creekbed through years of process releases from ORNL The major hazard associated with ^{137}Cs is the potential for direct gamma radiation exposures and sediment-bound migration to the Clinch River Alpha emitters, primarily uranium and TRU elements, are present in some locations of the valley

4.1.2 FY 1999 Summary

Melton Valley is a good example of a watershed system in which it is possible to identify the major contributors of contamination to the ultimate watershed discharge point, in this case White Oak Dam This concept was identified and used in the 1990s to identify the primary contributors to off-site releases From the early WAG 2 Surface Water OU studies, DOE was able to identify the WAG 5 Seeps, the WAG 4 Seeps, and the Corehole 8 Plume in Bethel Valley as the major contributors of ^{90}Sr and ^{3}H contamination at White Oak Dam This concept was also used to help make the decision to defer action at WAG 6 after the WAG 6 RI/FS was completed, since WAG 6 was shown to contribute little to releases at the dam

Based on the results of planning meetings with regulators, the WRRP monitors several watershed locations to determine if the ongoing and completed actions have been successful at reducing contaminant releases on a watershed scale As indicated by the conceptual model in Sect 4 1 1, most of the water infiltrating through waste units in Melton Valley quickly resurfaces and enters Melton Branch and White Oak Creek The major exception to this is the deep hydrofracture grout sheets and associated wells, for which there currently is no known exit pathway and therefore no exit pathway monitoring locations

Provided below is a summary of the FY 2000 watershed-scale monitoring results for Melton Valley The majority of the discussion centers on surface water releases

4.1.2.1 Surface water

Figure 4 3 shows the historical trend of ^{90}Sr and ^{3}H releases at White Oak Dam As indicated, contaminant releases have decreased continuously over time This trend continued in FY 2000 Table 4 2 shows the calculated contaminant flux results previously reported, as well as results from the flow composite sampling performed at White Oak Dam by the ORNL Office of Environmental Protection (OEP) From FY 1999 to FY 2000, there was a decrease in both ^{90}Sr and ^{3}H fluxes Estimated fluxes for FY 2000 were 1 1 Ci ^{90}Sr and 892 Ci ^{3}H This is significantly lower than fluxes seen in the mid-1990s, prior to the WAG 5 Seeps and the Corehole 8 actions

Table 4 3 shows the percent contribution of ^{90}Sr and ^{3}H from the subwatersheds in Melton Valley At this time, an unusual measurement at 7500 Bridge has skewed the ^{90}Sr mass balance for FY 2000 According to lab analysis, results of the flow composite sample result for August for 7500 Bridge is 924 pCi/L, more than an order of magnitude higher than any other month, and higher than results at the downstream monitoring stations If this value is confirmed, it suggests that a "slug" of ^{90}Sr exited Bethel Valley in July/August Table 4 4 shows the changes in the total curies released at the White Oak Dam from 1993, the time the WAG 5 actions were occurring, to the present Releases continue to decrease over time

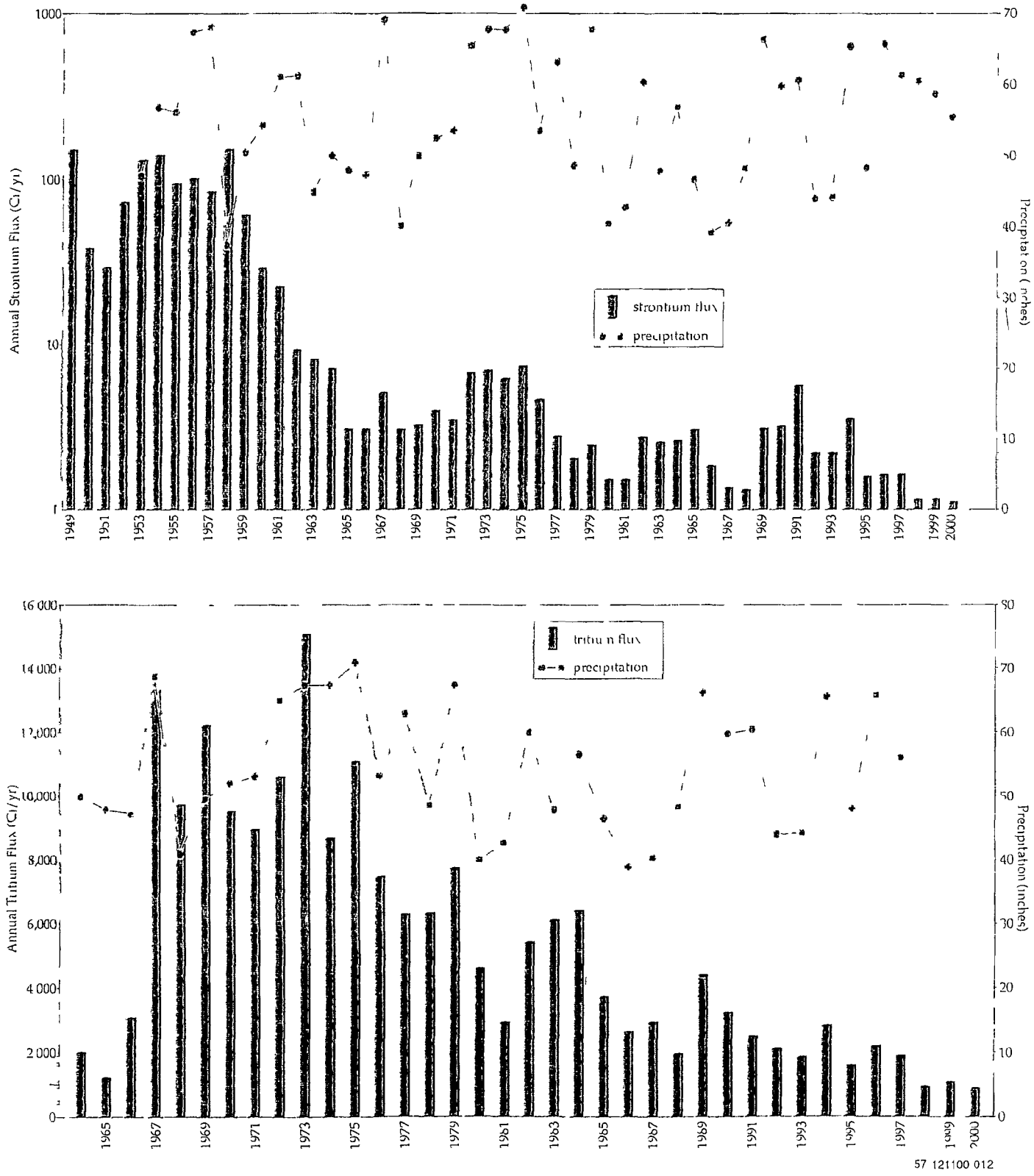


Fig. 4.3. Long-term changes in contaminant releases at White Oak Dam.

Table 4.2. Changes in tritium and strontium flux at White Oak Dam, 1993–2000

Year[a]	Source	Total Rainfall (inches)	White Oak Dam flux (Ci) ^{3}H	White Oak Dam flux (Ci) ^{90}Sr
CY 1993	Fourth Annual ERMA (DOE 1995c)	NA	2141	2.44
CY 1994	Fourth Annual ERMA (DOE 1995c)	65.57	2783	3.37
CY 1995	Melton Valley RI (DOE 1997s)	48.71	2340	1.55
FY 1996	Fifth Annual ERMA (BJC 1998b)	66.57	2250	2 04
FY 1997	FY 1997 IWQP monitoring results[b]	61 41	1860	1.99
FY 1998	FY 1998 IWQP monitoring results[b]	60.71	937	1.37
FY 1999	FY 1999 IWQP[b]	58.97	1080	1 45
FY 2000	FY 2000 WRRP[b]	55.64	892	1 1

[a]In past years estimates have been made for the 12-month calendar year (CY) Since 1996, estimates are provided for the 12-month fiscal year (FY) (October 1997 through September 1998)

[b]These data are collected by the ORNL and shared with the X-10 Water Quality Program/WRRP.

CY = calendar year

ERMA = Environmental Restoration Monitoring and Assessment Report

FY = fiscal year

IWQP = Integrated Water Quality Program

NA = not available for this report

RI = remedial investigation

WRRP = Water Resources Restoration Program

Table 4.3. Percent contaminants contributed by major source areas in Melton Valley in FY 2000

Reach/subwatershed	Monitoring locations	Major source areas	Percent ^{90}Sr contribution to White Oak Dam: Preactions[a]	Percent ^{90}Sr contribution to White Oak Dam: FY 2000[b]	Percent ^{3}H contribution to White Oak Dam: Preactions[a]	Percent ^{3}H contribution to White Oak Dam: FY 2000
Lower White Oak Creek	Downstream of MB Weir and White Oak Creek Weir	Seep D, WAG 6, WAG 7	23.4	18 0 (18)	6 4	4 8
Middle White Oak Creek	White Oak Creek Weir to 7500 Bridge	WAG 4, SWSA 5 North	15.4	-7 3 (31)	16	16.1
Melton Branch	Upstream of MB Weir	WAG 5 Seeps, WAG 9	36 1	37 (37)	77 7	70
Upper White Oak Creek	Upstream of 7500 Bridge	Bethel Valley	25	52.6 (14)	2 7	9 45

[a]Based on calculations performed in 1993, prior to WAG 5 and Corehole 8 action

[b]Calculations include questionable August 2000 results at 7500 Bridge Adjusted values excluding this result are presented in parenthesis

FY = fiscal year

MB = Melton Branch

SWSA = Solid Waste Storage Area

WAG = Waste Area Grouping

Table 4.4. Changes in contaminant flux at White Oak Dam

Reach/subwatershed	Monitoring location	^{90}Sr flux (Ci) Preactions[a]	FY 2000	^{3}H flux (Ci) Preactions[a]	FY 2000
White Oak Dam	White Oak Dam	2 4	1 1	2100	891
Middle White Oak Creek	WOC Weir		0 49	340	609
Melton Branch	MB Weir	0 88	0 397	1700	229
Upper White Oak Creek	7500 Bridge	0 61	NA[b]	58	NA[b]

[a]Based on calculations performed in 1993 prior to WAG 5 and Corehole 8 action
[b]A 12-month flux was not available for 7500 Bridge The 11 month flux was 0 56 Ci ^{90}Sr and 81 Ci ^{3}H
FY = fiscal year
MB = Melton Branch
NA = not available
WAG = Waste Area Group
WOC – White Oak Creek

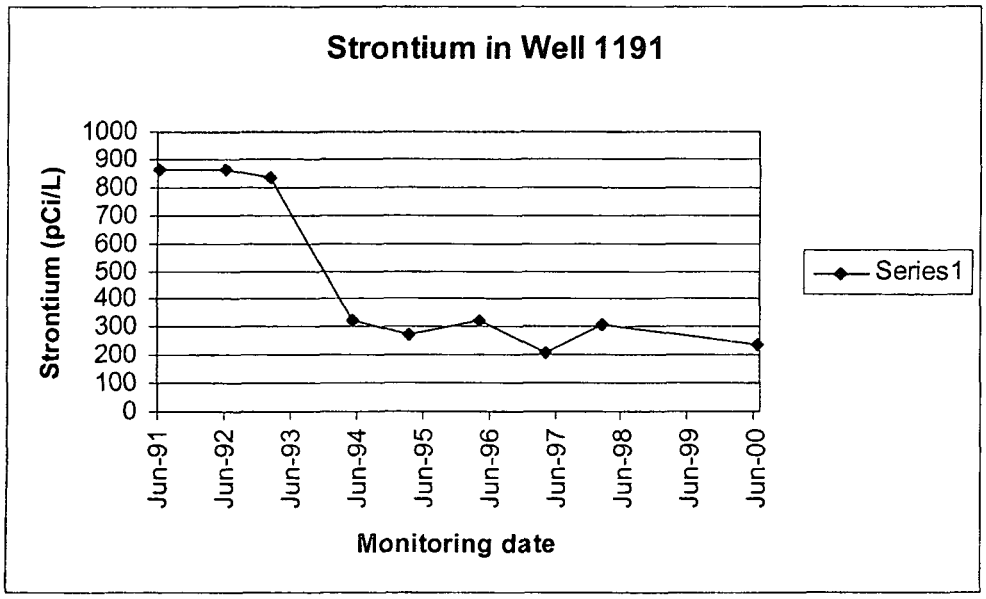
4.1.2.2 Groundwater

In general, groundwater monitoring is not used on the watershed scale in Melton Valley to evaluate actions upstream, primarily since shallow groundwater plumes resurface prior to leaving the watershed However, the ORNL OEP monitors several wells to comply with DOE Order 5400 Several of these wells are close to White Oak Dam (Fig 4 1), shallow wells at this location generally reflect the same shallow groundwater/surface water that is monitored at the dam Concentrations detected in the exit point shallow wells are shown on Fig 4 4 As in the past, well 1191 best represents the ^{90}Sr release pathway at the dam with 240 pCi/L of radioactive ^{90}Sr No ^{90}Sr contamination was measured in the deeper well, 1190, but, there is elevated ^{3}H There are three wells located along the Clinch River (1193, 1194, and 1195) These wells have historically been free of contamination FY 2000 results again indicate no contamination in these wells, with the exception of one hit of gross alpha in well 1194 of 17 pCi/L (counting error = 6 9 pCi/L) The total uranium measured in the well was 2 4 pCi/L (error = 0 82 pCi/L)

4.1.3 Conclusions and Recommendations

The mass of radioactive contamination leaving the ORR via White Oak Creek has decreased significantly since several CERCLA removal actions were implemented in the mid-1990s, primarily the WAG 5 Seeps actions and the Corehole 8 plume action (located in Bethel Valley) This is exaggerated by the low rainfall values seen just prior to the actions Changes since FY 1996 have decreased, but appear to correlate to lower rainfall amounts There do not appear to be measurable decreases since the FY 1996 action at WAG 4

In FY 2001, the WRRP will continue to monitor watershed sampling locations As plans are made to support the September 2000 Melton Valley Interim ROD, the watershed-scale monitoring requirements will be more clearly defined



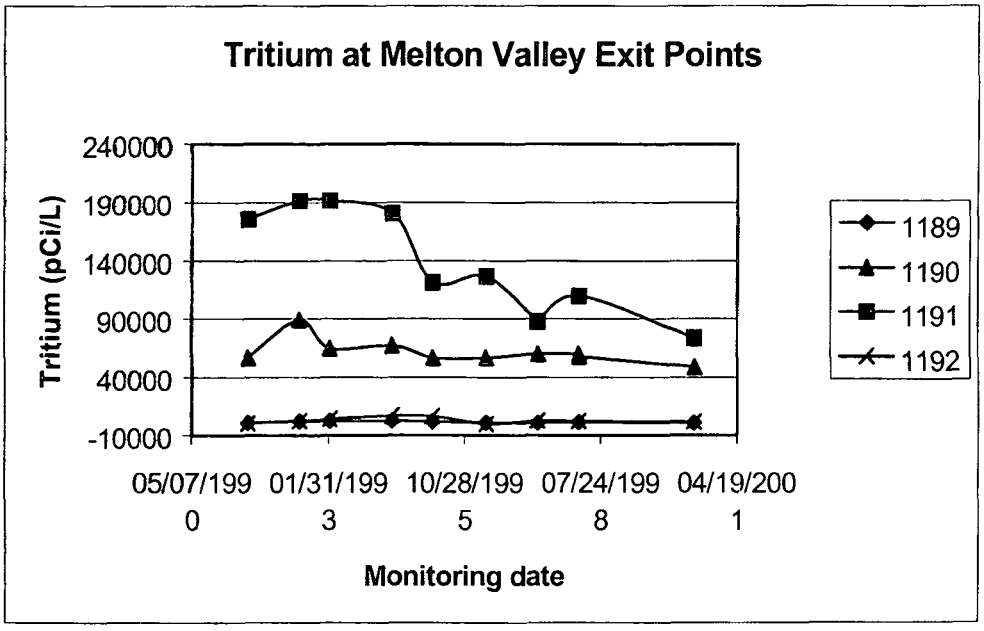


Fig. 4.4. Strontium-89/90 and tritium concentrations at groundwater exit point monitoring locations.

4.2 WHITE OAK CREEK EMBAYMENT TIME-CRITICAL REMOVAL ACTION

- TC RmA November 1990
- Field Activities Complete April 1992
- RmAR June 1992

4.2.1 Project Description

The White Oak Creek Embayment TC RmA was initiated in 1991 after site characterization data indicated that the embayment was an uncontrolled source of ^{137}Cs and other sediment-bound contaminants to the Clinch River system Before the removal action, sediment cores taken from the lower part of the embayment showed elevated levels of ^{137}Cs near the surface of the sediments (ORNL 1993) The surging of water into and out of the embayment caused by daily releases of water from Melton Hill Dam and flood flows in White Oak Creek eroded sediments containing ^{137}Cs and other contaminants Erosion was greatest during winter, when the Clinch River was at low-pool elevation, thus exposing a large portion of the bottom sediment directly to rainfall The removal action involved the construction of a sediment retention structure (SRS) at the mouth of White Oak Creek to contain the sediments in lower White Oak Creek Embayment and minimize transport off-site to the Clinch River and Watts Bar Reservoir (Fig 4 5) The removal action was implemented between June 1991 and April 1992

The sheet piling and coffer-cell construction of the SRS (Fig 4 6) reduced disruption of the bed sediments that would normally occur during the construction of a conventional small dam The rock-filled gabions on the top of the structure were designed to be porous, allowing the embayment to drain slowly during nonstorm periods while still maintaining a minimum water level to cover the bed sediments and reduce bed erosion Information collected on as-built dimensions of the structure indicate that the average top of gabion elevation is 743 70 ft mean sea level (msl), and that the average elevations for the top of the coffer dam (base of gabion) are 739 63 ft msl (sides of structure) and 738 39 ft msl (center of structure)

Because this project was conducted as a TC RmA, no EE/CA or AM was prepared CERCLA objectives for the SRS were documented from a presentation titled "Off-reservation Activities of the DOE Oak Ridge Environmental Restoration Program Briefing for the State of Tennessee Governor's Office," May 30, 1991

4.2.2 Evaluation of Decision Document Requirements for Performance

4.2.2.1 Goals of decision

The primary objective of the White Oak Creek Embayment (WOCE) Project is to achieve control of the contaminated sediments in WOCE and to prevent their downstream transport off-site and into the Clinch River and Watts Bar Reservoir Functional requirements include the following

- contain contaminated sediments in the lower WOCE and prevent their transport into the Clinch River for a period of time consistent with the eventual remediation of up-gradient OUs,
- minimize erosion and off-site transport of WOCE sediment by flow events in the White Oak Creek watershed and/or in the Clinch River,
- minimize the surging of water into and out of the lower portion of the WOCE,

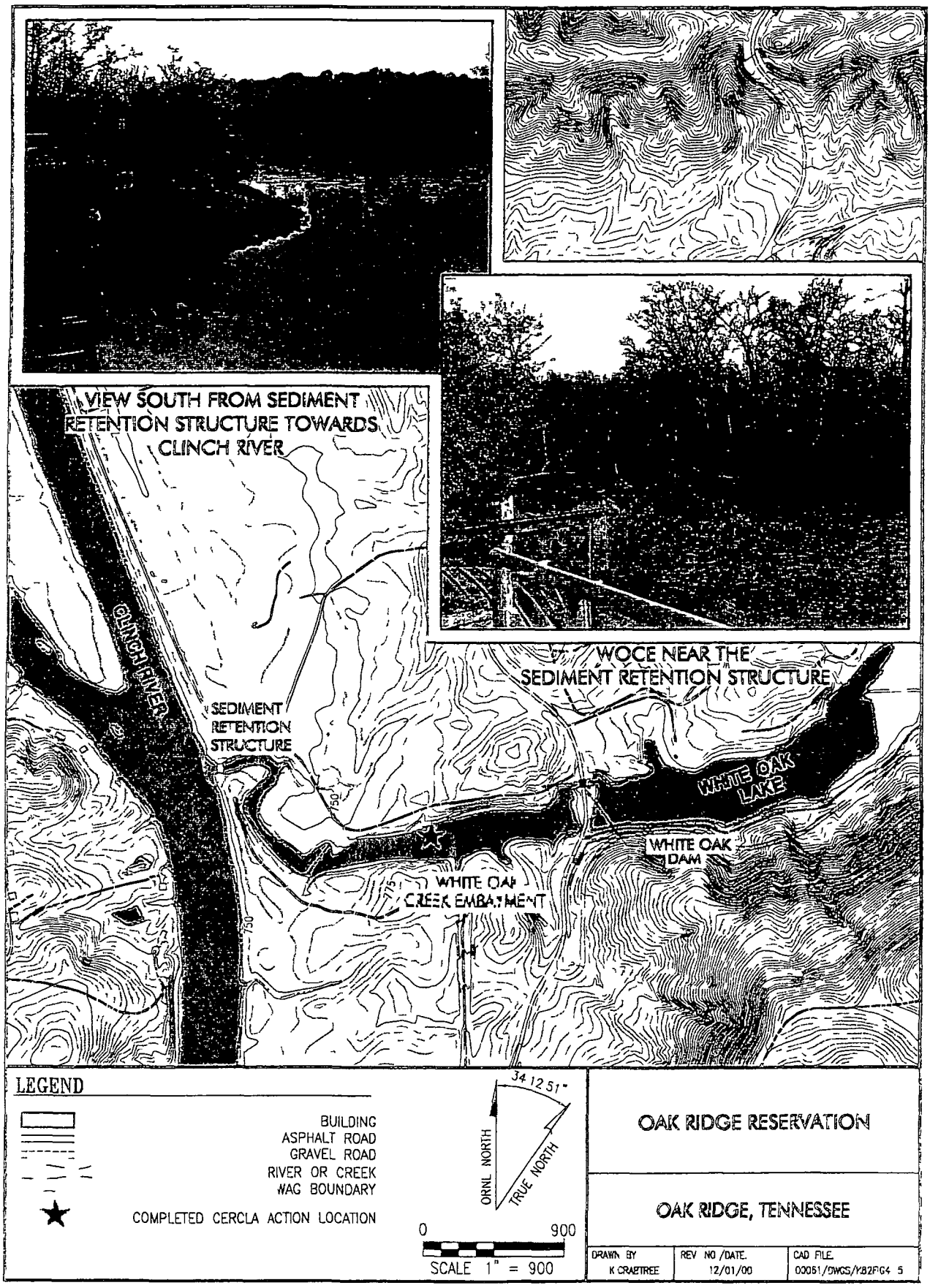
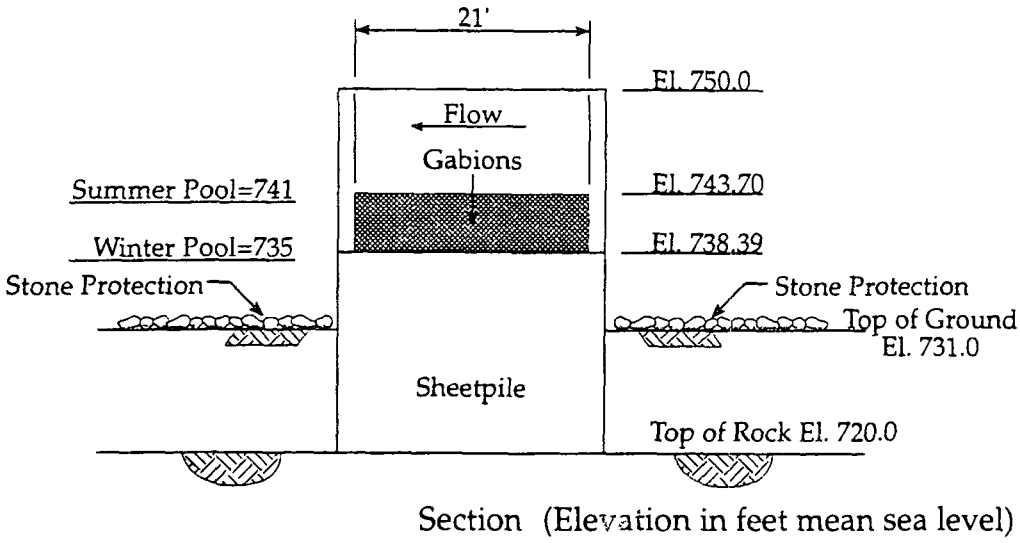


Fig. 4.5. Location of White Oak Creek Embayment.



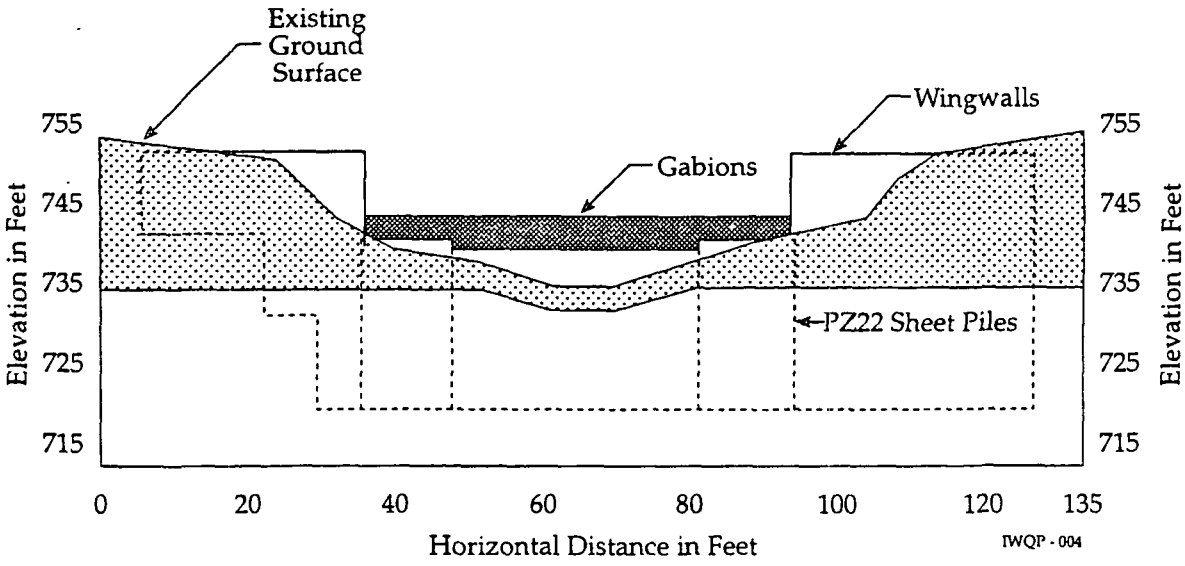


Fig. 4.6. Conceptual profile drawing of the White Oak Creek Embayment sediment retention structure.

- achieve year-round inundation of WOCE sediments to minimize risk due to direct exposure to contaminated sediment, and

- minimize movement of fishes into and out of the WOCE.

4.2.2.2 Monitoring required

Following the Five-Year Review for the WOCE in 1996, DOE recommended the following surveillance and maintenance measures be implemented for the WOCE (DOE 1997o):

- continue continuous water level monitoring in the embayment,

- measure ^{137}Cs concentrations in sediment cores every five years (core samples were collected and reported in the 1997 RER; no samples were collected in FY 2000), and

- consider measures to enhance and maintain the permeability of the SRS

4.2.3 Implementation of Previous Year's Recommendations

No recommendations were made for this site in the 2000 RER.

4.2.4 Evaluation of Performance and Stewardship Data—White Oak Creek Embayment

Table 4.5 provides a summary of the Five-Year Review questions and answers for the WOCE. The embayment is one of the few CERCLA sites on which a thorough Five-Year Review was performed prior to determining that all reviews would be conducted in concert The first Five-Year Review was published in the 1997 RER. No comprehensive sample collection has been performed after that time.

4.2.4.1 1997 Five-Year Review summary

An extensive Five-Year Review of the WOCE action was performed for the 1997 RER. The continuous water level measurements continued to show the effectiveness of the SRS in maintaining a higher water level in the embayment. In addition depth soundings and sediment cores were collected in the embayment to determine if enhanced sediment deposition within the embayment had covered the more contaminated sediments. The data showed that the ^{137}Cs depth profiles in the embayment changed drastically from 1990 to 1996. In 1990 the top 20 cm of sediment contained 2000—45,000 pCi/g of ^{137}Cs In 1996 the top 20 cm of sediment contained 200—600 pCi/g, indicating that less contaminated sediments have settled on top of the older contaminated sediments. The actual depth of the highly contaminated pre-SRS sediments was not clearly delineated and will be an issue for a final ROD in the area.

In FY 2000, a sediment sample was collected in White Oak Lake and in the WOCE as part of the Clinch River/Poplar Creek–Lower Watts Bar Reservoir sediment sampling program (Sects. 7.1 and 7.3), since White Oak Creek watershed sources were the source of most of the ^{137}Cs in the Clinch River. Results for samples collected in the top foot of sediment for White Oak Lake are 81.7 pCi/g ^{137}Cs and for WOCE, 455.3 pCi/g. There is no clear reason why these results vary between the lake and the embayment, but it could be attributed to the specific sample location. The 455.3 pCi/g value for WOCE reaffirms that post-SRS sediments concentrations are lower than before the action.

A risk screening was presented as part of the 1997 Review using the assumption that potential receptors would be exposed to the new, cleaner top sediments The results showed a decrease in risk from 5.8×10^{1} in 1990–91 to 1.6×10^{-4} in 1996. Since no additional data were collected for this year's

Table 4.5. White Oak Creek Embayment Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	The SRS virtually eliminates sediment migration and maintains high water levels (Sect 4 2 4 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	Yes	SRS must remain semi-permeable to allow water through, there is a potential for continued loading to Clinch River during wet weather storms
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific requirements in TC RmA Report, however, a fence and high-water levels block contact with contaminated sediments
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional action discussed in TC RmA Report
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	No	Water level changes may allow sediments to be exposed or allow White Oak Creek to overflow the retention structure
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	TC RmA—no documentation of ARARs
Have there been any changes in land use or expected land use on or near the site?	No	Confirmed with site visit (Sect 4 2 4 3)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No BRA performed
Have new contaminants or contaminant sources been identified?	No	COC = ^{137}Cs, inputs to WOCE monitored at White Oak Dam
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	Yes	Higher post-action water levels prevent exposure to sediments (Sect 4 2 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	No	
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risks not addressed by action, future evaluation addressed on watershed scale
Is the site located in an area subject to natural disasters?	Yes	Located in Clinch River floodplain, low probability of earthquakes and tornadoes

ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
COC = contaminant of concern
NA = not applicable
ROD = record of decision
SRS = sediment retention structure
TBC = to be considered
TC RmA = time-critical removal action
WOCE = White Oak Creek Embayment

RER/Five-Year Review, and since no additional actions have been taken to address the embayment, there is no attempt to reassess the risks associated with the top sediments in the embayment.

4.2.4.2 FY 2000 embayment water levels

Water level measurements are collected continuously at the embayment to track whether or not the SRS is successful at maintaining elevated water levels The goal of maintaining elevated water levels is to ensure that embayment sediments are underwater, thereby shutting off the potential for direct exposure to the ^{137}Cs in the sediments, and to prevent further scouring of the embayment.

Water levels are collected at two locations: on the embayment side of the SRS, and on the Clinch River side of the SRS. Figure 4.7 shows the results of the measurements As indicated, the SRS successfully maintains water levels in the embayment at approximately 2 to 5 ft higher than the Clinch River water levels. Fluctuations in the embayment due to opening and closing of the sluice gate at White Oak Dam do not result in drops below the Clinch River water levels

The gauge on the river side malfunctioned for a few months after it was accidentally snagged by a fisherman. The figure shows the "drift" in measurements when this first occurred.

In the past, wet weather storms have resulted in flow over the top of the SRS In these rare instances, ^{137}Cs-bound sediments may migrate off-site, but at much lower concentration levels than pre-action

4.2.4.3 Site visit

A site visit was performed on October 27, 2000, and documented in Appendix A Access to the embayment is restricted by fences from a restricted access road and from the river by the SRS itself During the site visit there were no unusual activities occurring at the site. The SRS was acting as planned to maintain elevated water levels in the embayment, effectively covering any ^{137}Cs-contaminated sediments. The site Facility Manager conveyed information on the 1999 effort to lower the SRS by 8 in to restore the structure to the original design specifications. The SRS as built was almost as high as the elevation of White Oak Dam, resulting in higher than planned water levels in the embayment, which in turn caused high water levels at White Oak Dam. The Facility Manager also indicated that the SRS media, although designed to be porous to allow some water flow, was "clogged" by sediment, plant growth and debris, and was essentially non-porous

On the Clinch River side of the SRS, there is clear signage indicating DOE property and "Warning Radiation Hazard Area Contamination Keep Out " The Facility Manager indicated that he has seen fishermen in boats tied up along the SRS

WMFS performs a monthly inspection of the embayment structure surface features They supply the check sheet to BJC, who in turn submits it to the Document Management Center after review

4.2.5 Recommendations

The WOCE action was performed more than 10 years ago to cover ^{137}Cs-contaminated sediments and to prevent them from migrating into the Clinch River This removal action has been successful at accomplishing this goal. A final action for the embayment sediments will be included in a future ROD At this time, it is recommended that the continuous monitoring of embayment water levels be discontinued, since many years of data have indicated that the water levels in the embayment remain significantly above the contaminated sediments The information is costly to gather and is rarely reviewed Periodic surveillance should be continued, including surveillance immediately after heavy storms

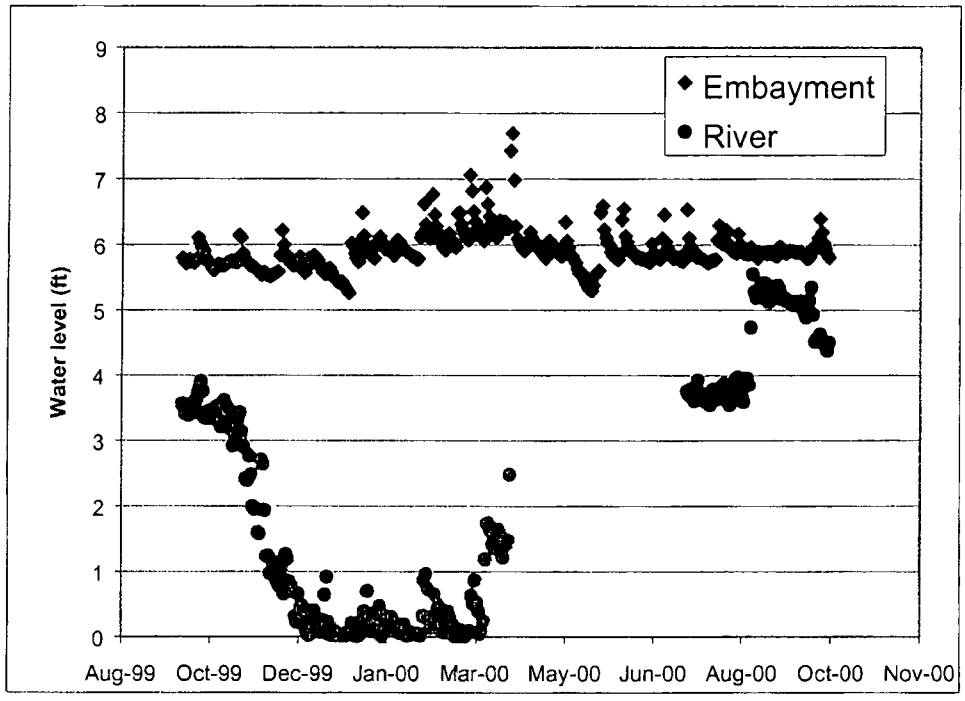


Fig. 4.7. Measurement results of FY 2000 White Oak Creek Embayment water levels.

4.3 WAG 5 SEEP C REMOVAL ACTION

- AM — March 1994
- Field Activities Complete· — November 1994
- PCR. — June 1995

4.3.1 Project Description

The WAG 5 RI identified Seep Area C in the southern section of WAG 5 as a major contributor of ^{90}Sr to White Oak Creek (Fig 4.8). In 1993–1994, Seep C contributed 20% to 30% of the total ^{90}Sr monitored at White Oak Dam. An EE/CA for the area was submitted in December 1993, the AM was approved in March 1994

Construction activities began in July 1994 and were completed in November 1994. A french drain collects groundwater and routes it by gravity flow to a treatment unit in which zeolite-filled drums sorb ^{90}Sr via ion exchange. The sole objective of the removal action is to reduce the release of ^{90}Sr to Melton Branch and, hence, off-site. Treated groundwater is discharged to Melton Branch without regard for other contaminants that may be present. Melton Branch is currently monitoied for strontium, gross alpha, gross beta, gamma, and tritium downstream of the Seep C collection and treatment system

It is anticipated that the planned SWSA 5 South remedial action will replace the Seep C collection and treatment system

4.3.2 Evaluation of Decision Document Requirements for Performance and Stewardship

4.3.2.1 Goals of decision

The goal of the removal action is to "reduce the Sr-90 in the collected groundwater by at least 90% " It was thought that this would nearly eliminate the contribution of Seep C to White Oak Dam (from 25% of the total ^{90}Sr at the dam), thus "significantly reducing the risk to human health, welfare, and environment until additional and/or permanent actions to eliminate the source of contaminants are taken" (DOE 1994b)

4.3.2.2 Monitoring required

Monthly flow proportional samples must be collected from both the treatment unit influent and effluent Additional monitoring activities related to operational efficiency of the zeolite units include monthly grab samples from the effluent of each zeolite drum, analyzed for gross beta to determine the remaining ^{90}Sr retention capacity of the drum and schedule replacement if necessary, and monthly grab samples from Melton Branch upstream (MB-5) and downstream (MB weir) of Seep C

4.3.3 Implementation of Previous Year's Recommendations

There were no recommendations for Seep C in the 2000 RER

4.3.4 Evaluation of Performance and Stewardship Data—WAG 5 Seep C Removal Action

Table 4.6 provides a summary of the Five-Year Review questions and answers for the WAG 5 Seep C action. Necessary details are discussed in the following sections

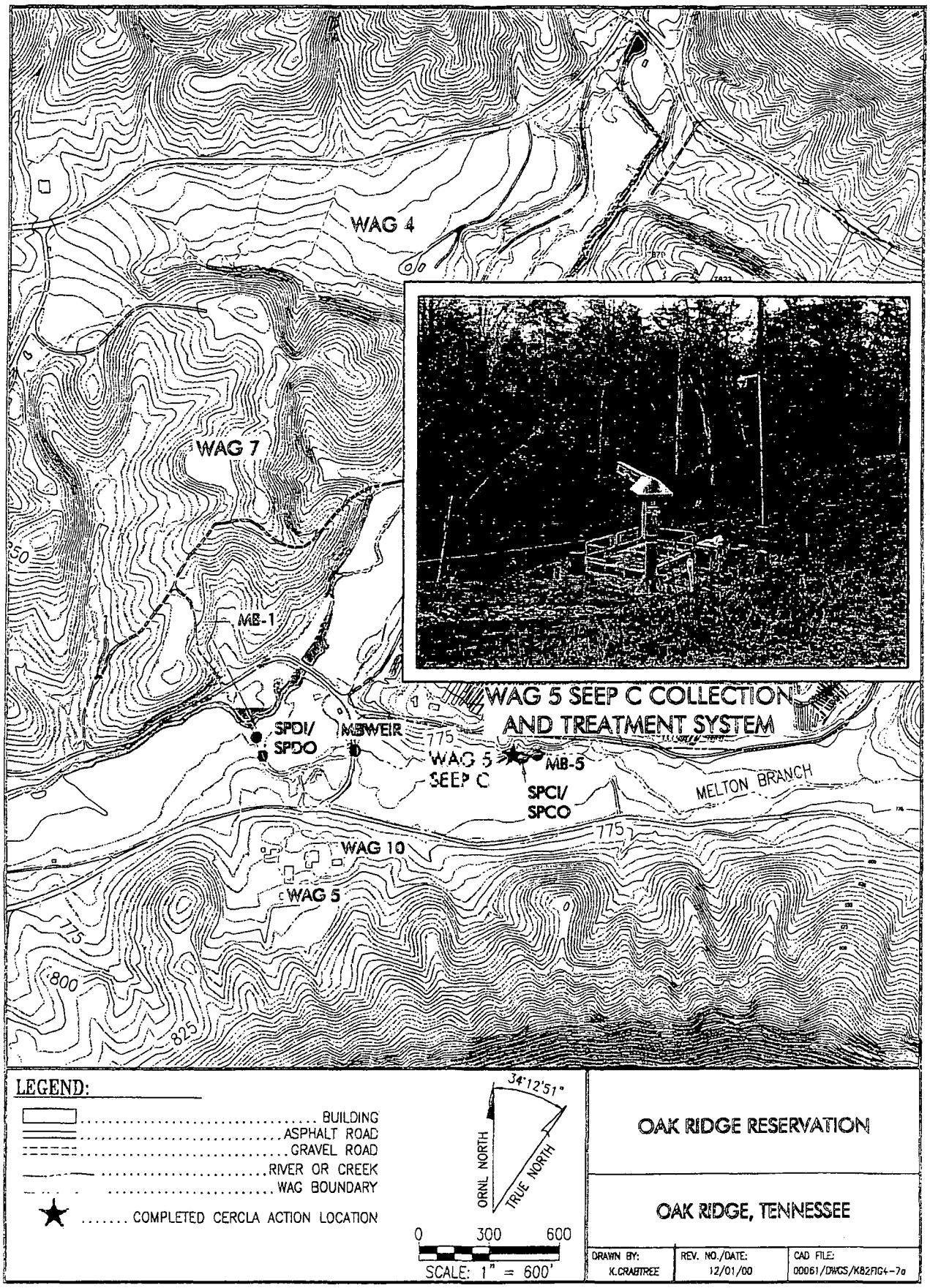


Fig. 4.8. Location of WAG 5 Seep C non-time-critical removal actions.

Table 4.6. WAG 5 Seep C Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Treatment unit is >90% effective (Sect. 4.3.4.1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	Yes	In 1997–98 high iron in water clogged the zeolite treatment unit; unit effectiveness was <90%
Are the land use controls (fencing, security guards, etc.) in place and preventing exposure?	Yes	No specific land use controls in AM; however, land within DOE control area (Sect. 4.3.4.2)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional action specified in AM; Seep D unit developed at same time
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes/No	Problems seen in the past could not be checked in FY 2000 due to sample collection problems
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Chemical-specific ARARs included: 40 *CFR* 61.92; TDEC 1200-3-11-.08; 10 mrem/yr public exposure to airborne radiation emission from DOE facilities; 100 mrem/yr general public all sources (TBC)
Have there been any changes in land use or expected land use on or near the site?	No	Confirmed with site visit (Sect. 4.3.4.2)
Have new human health or ecological exposure pathways or receptors been identified?	NA	Evaluation occurring on watershed scale
Have new contaminants or contaminant sources been identified?	NA	COCs = ^{90}Sr, ^{3}H; further evaluation of COCs on watershed scale
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Concentrations of iron in system do not indicate a toxic by-product
Have there been any changes in the physical site conditions?	No	Confirmed with site visit (Sect. 4.3.4.2)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	No BRA/ERA performed
Were there significant changes in the standardized risk assessment methodologies?	NA	No BRA/ERA performed
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risks are being addressed on watershed scale (see Sect. 4.12)
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquake; 100-year floodplain

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
CFR = *Code of Federal Regulations*
COC = contaminant of concern
DOE = U.S. Department of Energy
ERA = ecological risk assessment
FY = fiscal year
NA = not applicable
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation

4.3.4.1 Evaluation of performance data

Due to major data collection issues in FY 2000, the ability to evaluate the effectiveness of the Seep C treatment unit is limited. The influent flow meter was nonfunctional for several months. Shortly after it came on line, an animal chewed a hole in the cable of the sampling device. Once back on line, the influent and effluent data indicate that the zeolite treatment is acting at the >90% effectiveness rate for the water that passes through the unit (Table 4.7). As indicated in Table 4.8, concentrations downstream of Seep C are still greater than concentrations upstream, by as much as 40% but on average about 20%, suggesting the risk from the Seep C area has not been eliminated. Figure 4.9a shows changes in concentrations at the grab sample locations since grab sample collection began, while Fig. 4 9b shows concentration changes at the influent to the collection system. Overall, Fig. 4.9 indicates that ^{90}Sr concentrations in Melton Branch have increased slightly over the past three years. However, there is no attempt to prove a significant increase, since the increase may be related to reduced rainfall and reduced surface flows over the past three years. This information will be useful for evaluating a final action at SWSA 5. As with other individual seep actions, especially where passive gravity flow is the method for capturing water, the action is only effective on treating the water that passes through the units; it cannot address water that flows around it.

4.3.4.2 Site visit

A site visit was performed on October 27, 2000, and documented in Appendix A. Access to the Seep C area of SWSA 5 is restricted by heavy fencing that restricts vehicle access to SWSA 5 at all times The Seep C treatment area is clearly marked with signs indicating the Facility Manager and access requirements. WMFS performs two types of inspections at Seep C· a weekly grounds inspection and monitoring of the treatment unit. The grounds inspection is performed by a surveillance and maintenance crew to look at signs, road conditions, vegetation control, etc. The documentation for the inspections is submitted to BJC and sent to the Document Management Center. WMFS liquid waste operations personnel perform the inspections on the operations of the treatment system They collect "unofficial" samples approximately bimonthly and perform an inspection of the operations features (hoses, etc). WMFS notifies BJC when the zeolite drums need to be changed out. In the case of Seep C, they are changed approximately once per year. The unofficial sample results are reviewed, but not maintained in a official fashion According to the Facility Manager, iron oxide causes general clogging of the drums, which in turn causes water to backup in the French drain and overflow/bypass the treatment unit. Because of this there is reduced flow through the treatment unit

Heavy equipment is located at the site for changing out the zeolite drums

4.3.5 Recommendations

The zeolite treatment unit routinely meets the goal of the AM. However, based on historical data and site interviews, the system is not effective if/when the zeolites became clogged with iron Monthly sampling of the unit helps to identify if iron clogging occurs. In general, the Seep C system collects as much as 2 to 3 Ci/month that would otherwise migrate to and across White Oak Dam. For this reason the unit should remain active until a final action is implemented for SWSA 5

Seep C is an operating treatment unit and, as such, should continue to be tracked in the RER Flow-composite samples and grab sampling should be used to continue to track the effectiveness of the unit If possible, the waste management and WRRP projects should attempt to collect and share influent-effluent sample results in a timely manner to avoid duplication of effort.

Table 4.7. Strontium-90 removal efficiency of Seep C treatment unit

Month	Influent (nCi/L)	Effluent (nCi/L)	Total flow (1000 L)	^{90}Sr retained (mCi)	Reduction (%)
October–1999	N/A	N/A	N/A	N/A	N/A
November–1999	N/A	N/A	N/A	N/A	N/A
December–1999	N/A	N/A	N/A	N/A	N/A
January–2000	N/A	N/A	N/A	N/A	N/A
February–2000	N/A	N/A	N/A	N/A	N/A
March–2000	N/A	N/A	N/A	N/A	N/A
April–2000	N/A	N/A	N/A	N/A	N/A
May–2000	N/A	N/A	N/A	N/A	N/A
June–2000	N/A	N/A	N/A	N/A	N/A
July–2000	N/A	N/A	N/A	N/A	N/A
August–2000*	241.000	-0.036	11,529	2,779	100
September–2000	223.923	0.084	11,552	2,586	99.96
Total					

*August 2000 effluent sample was qualified "U" or non detect
NA = Data not available because influent flow meter was not functional.

Table 4.8. Strontium-90 contribution to Melton Branch by Seep C

Month	Grab sample date	MB-5 (upstream) ^{90}Sr (pCi/L)	MB Weir (downstream) ^{90}Sr (pCi/L)	Percentage increase downstream vs. upstream
October–1999	10/19/99	230.6	330.2	30.2
November–1999	11/23/99	166.1	232 4	28.5
December–1999	12/16/99	219.2	282.0	22.3
January–2000	1/27/00	148 0	225.4	34.3
February–2000	2/24/00	128.8	210.5	38 8
March–2000	3/23/00	155.4	226.9	31 5
April–2000	04/27/2000	168.4	284.3	40 8
May–2000	05/16/2000	265.3	413.4	35.8
June–2000	06/13/2000	394.2	445.3	11.5
July–2000	07/18/2000	290.9	333.8	12.9
August–2000	08/08/2000	197.6	199 1	0 73
September–2000	09/12/2000	204.5	176 9	-15 6

MB = Melton Branch

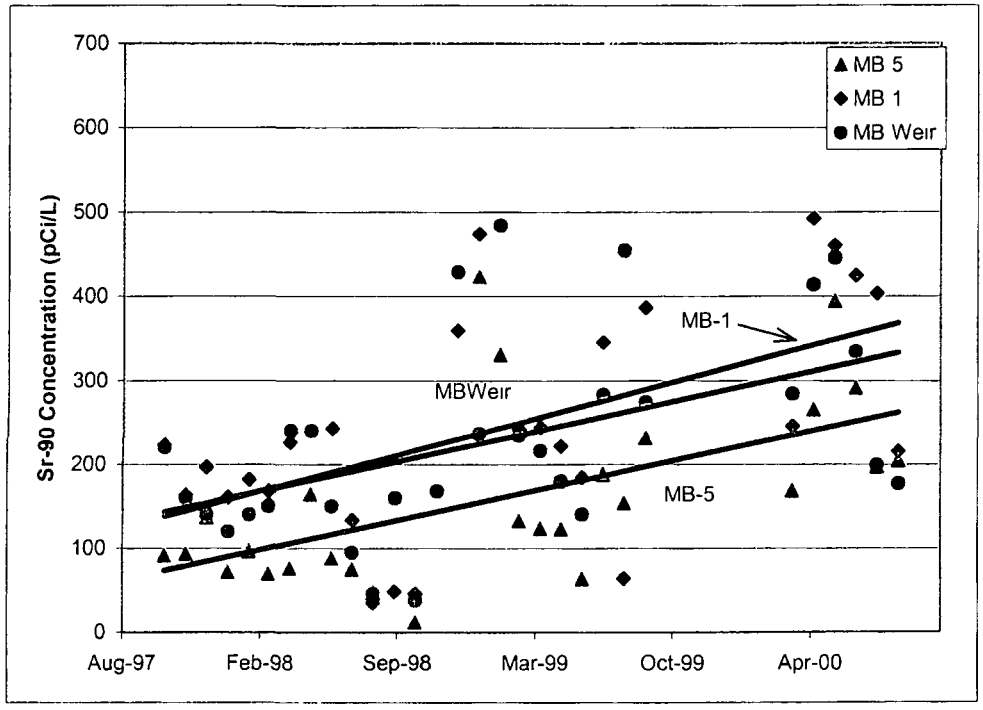


Fig. 4.9a. Concentration of ^{90}Sr in grab samples collected from MB5, MB1, and MB Weir locations.

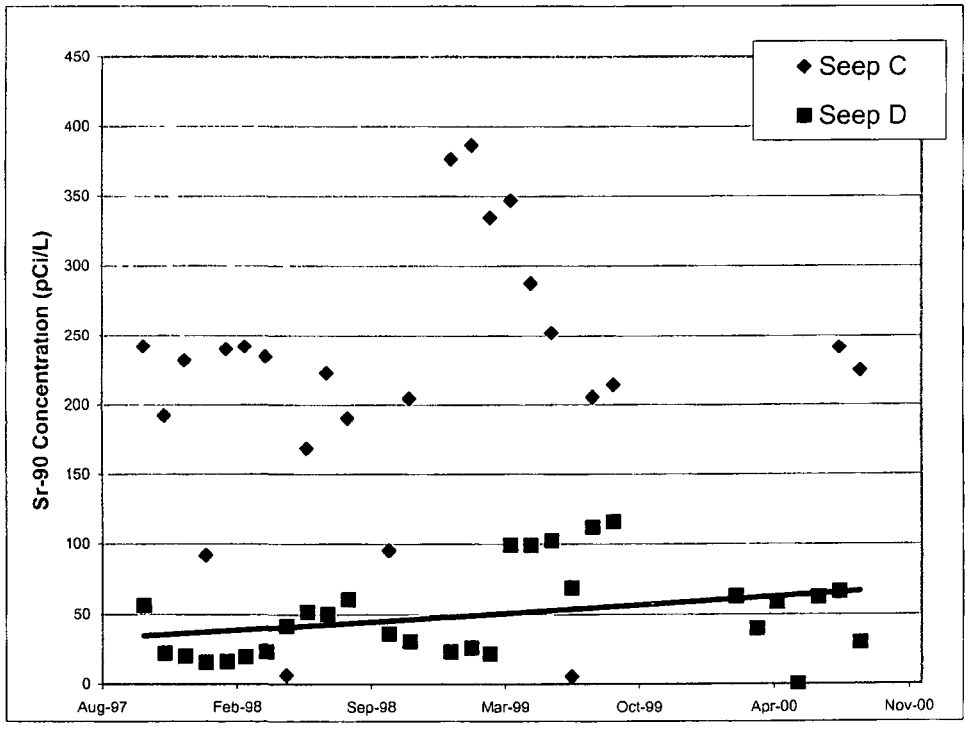


Fig. 4.9b. Concentration of ^{90}Sr in the influents of Seep C and Seep D treatment units.

Fig. 4.9. Concentration of ^{90}Sr in grab samples and influents.

4.4 WAG 5 SEEP D REMOVAL ACTION

- AM: July 1994
- Field Activities Complete: November 1994
- PCR: June 1995

4.4.1 Project Description

The WAG 5 RI identified Seep Area D in the southern section of WAG 5 as a major contributor of ^{90}Sr to the White Oak Creek watershed (Fig. 4 10). A steeply dipping fracture zone discharges more or less vertically into the bed of the Melton Branch. In 1993–1994, Seep D contributed about 7% of the ^{90}Sr released from the watershed at White Oak Dam An AM was approved in July 1994

Construction activities began in July 1994 and the treatment unit became operational in November 1994. Groundwater is collected from the bed of Melton Branch and pumped through a series of ion-exchange columns filled with zeolite for treatment. The objective of the removal action is to reduce the release of ^{90}Sr into Melton Branch and consequently off-site over White Oak Dam. Treated water is returned to Melton Branch without regard for other contaminants that may be present.

4.4.2 Evaluation of Decision Document Requirements for Performance and Stewardship

4.4.2.1 Goals of decision

The goal of the removal action is "reduce the ^{90}Sr in the collected and treated groundwater by at least 90% " This would nearly eliminate the contribution of Seep D to White Oak Dam (from 10% of the total ^{90}Sr at the dam), thus "significantly reducing the risk to human health, welfare, and environment until additional and/or permanent actions to eliminate the source of contaminants are taken" (DOE 1994c).

4.4.2.2 Monitoring required

Monthly flow proportional samples are collected from both the treatment unit influent and effluent. Additional monitoring activities related to operational efficiency of the zeolite units include monthly grab samples from the effluent of each zeolite drum, analyzed for gross beta to determine the remaining ^{90}Sr retention capacity of the drum and schedule replacement if necessary, and monthly grab samples from Melton Branch upstream (MB weir) and downstream (MB-1) of Seep D

4.4.3 Implementation of Previous Year's Recommendations

There were no recommendations for the Seep D Unit in the 2000 RER.

4.4.4 Evaluation of Performance and Stewardship Data—WAG 5 Seep D Removal Action

Table 4 9 presents a summary of the Seep D Five-Year Review. Necessary details of the review are provided below.

4.4.4.1 Evaluation of monitoring data

Table 4.10 presents the FY 2000 analytical data collected to evaluate the effectiveness of the Seep D treatment unit. The AM goal for the treatment unit is to achieve >90% effectiveness in reducing the ^{90}Sr in the treated water As indicated in the table, the unit has performed at >99% effectiveness in FY 2000.

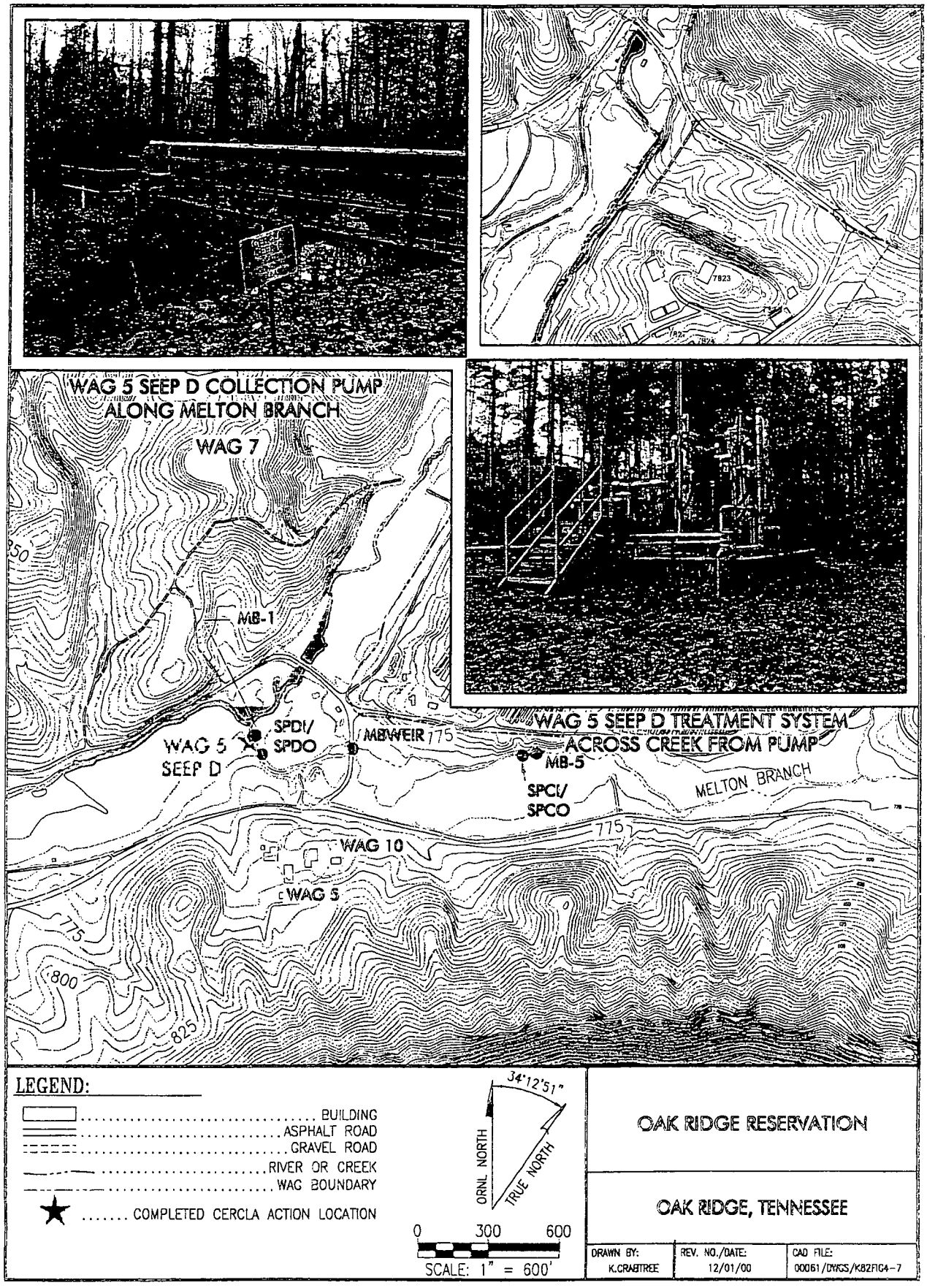


Fig. 4.10. Location of WAG 5 Seep D non-time-critical removal actions.

Table 4.9. WAG 5 Seep D Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Treatment unit is >90% effective (Sect. 4 4.4.1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Seep D pump solves problem with iron build-up seen at Seep C, system inspections occur daily
Are the land use controls (fencing, security guards, etc.) in place and preventing exposure?	Yes	No specific land use controls in AM; however, land within DOE control area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional action required in AM
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Confirmed with site visit (Sect. 4.4 4.2)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Chemical-specific ARARs included: 40 *CFR* 61.92, TDEC 1200-3-11-.08; 10 mrem/yr public exposure to airborne radiation emission from DOE facilities; 100 mrem/yr general public all sources (TBC)
Have there been any changes in land use or expected land use on or near the site?	No	Land remains in DOE control
Have new human health or ecological exposure pathways or receptors been identified?	NA	Evaluation occurring on watershed scale
Have new contaminants or contaminant sources been identified?	NA	COCs = ^{90}Sr, ^{3}H; further evaluation of COC on watershed scale
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	Yes	New road between Highway 95 and Seep D area (Sect. 4 4 4.2)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	No BRA/ERA performed
Were there significant changes in the standardized risk assessment methodologies?	NA	No BRA/ERA performed
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risks are being addressed on watershed scale (Sect. 4.12)
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes and tornadoes; 100-year floodplain

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
CFR = *Code of Federal Regulations*
COC = contaminant of concern
DOE = U S. Department of Energy
ERA = ecological risk assessment
NA = not applicable
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation

Table 4.10. Strontium-90 removal efficiency of Seep D treatment unit

Month	Influent (nCi/L)	Effluent (nCi/L)	Total flow (1000 L)	^{90}Sr retained (mCi)	Reduction (%)
October–1999	NA	NA	230.6	NA	NA
November–1999	NA	NA	260.7	NA	NA
December–1999	NA	NA	335.5	NA	NA
January–2000	NA	NA	308.7	NA	NA
February–2000	NA	NA	308.8	NA	NA
March–2000	63.02	2.560	407.9	24 66	95.938
April–2000	39.97	0.139	444 4	17.70	99 651
May–2000	58.82	0.052	398.5	23.42	99 912
June–2000	0.06	0.698	275 8	-0.17	-976 705
July–2000	62 40	0.101	281.3	17.53	99 838
August–2000	66.20	0.125	341.0	22 53	99 812
September–2000	29.76	372 481	264.2	-90 54	-1151 560
Total			**3,857.6**	**-9.53**	

NA = not available

This is consistent with past years' effectiveness. Table 4 11 indicates that ^{90}Sr concentrations downgradient of Seep D are higher than upstream concentrations, indicating that ^{90}Sr is entering Melton Branch from areas other than the actual Seep D pumping area. These data represent grabs samples taken on the same day, under similar flow conditions. This is consistent with previous years of sampling the upstream and downstream locations at Seep D, which have suggested that much of the ^{90}Sr-contaminated water is being captured by the treatment unit, but that some is not. For example, the FY 2000 grab sample data suggest an average of an 80% decrease in ^{90}Sr concentrations between the upstream (MB Weir) and downstream (MB-1) locations, leaving a 20% increase coming from other sources.

Table 4.11. Strontium-90 contribution to Melton Branch by Seep D

Month	Grab sample date	MB Weir (upstream) ^{90}Sr (pCi/L)	MB-1 (downstream) ^{90}Sr (pCi/L)	Percentage increase downstream vs. upstream
October–1999	10/19/99	330 2	401.8	17 8
November–1999	11/23/99	232 4	272 5	14 7
December–1999	12/16/99	282.0	401.5	29 8
January–2000	1/27/00	225.4	278 9	19.2
February–2000	2/24/00	210.5	250 8	16.1
March–2000	3/23/00	226.9	NA	NA
April–2000	04/27/2000	284.3	245 43	-15 84
May–2000	05/16/2000	413.4	492 09	15 98
June–2000	06/13/2000	445.3	460 04	3.20
July–2000	07/18/2000	333.8	424.2	21 31
August–2000	08/08/2000	199 1	403 02	50 61
September–2000	09/12/2000	176 9	215 42	17 88

NA = not available, reported result of –2.02 pCi/L is rejected

4.4.4.2 Site visit

A site visit was performed on October 27, 2000, and is documented in Appendix A Access to the Seep D area of SWSA 5 is restricted by heavy fencing that restricts vehicle access to SWSA 5 at all times The Seep D treatment area is well kept and clearly marked with signs indicating the Facility Manager and access requirements However, over the past year, a new road built to access the new TRU waste treatment facility runs near the Seep D area This road leads from the area to Highway 95, just east of White Oak Dam

WMFS performs daily inspections of the system since it is an active pumping system (as opposed to passive gravity fed at Seep C) Influent–effluent samples are collected every month, and Seep D zeolite drums are changed out about every other month

4.4.5 Recommendations

Based on monitoring data collected since the Seep D system was brought on line in early 1995, the treatment unit has achieved the AM goal of >90% treatment efficiency However, some ^{90}Sr continues to bypass the collection system and migrate downstream to White Oak Dam Because the unit continues to capture almost a curie of ^{90}Sr that would otherwise migrate to White Oak Dam, the system should remain operating until the inflowing seep water would no longer increase ^{90}Sr releases at White Oak Dam

As with the Seep C unit, it is recommended that monthly grabs sample from the upstream and downstream locations be collected until such a time that baseline information is needed for future actions at SWSA 5

If possible, the waste management and WRRP projects should attempt to collect and share influent–effluent sample results to avoid duplication of effort In addition, an effort should be made to determine if automated process controls could be designed to avoid the daily inspections currently performed

4.5 WAG 4 SEEPS REMOVAL ACTION

- AM: February 1996
- Action Completed: October 1996
- RmAR: December 1996

4.5.1 Project Description

An AM was developed for the WAG 4 seeps area in 1996 after several years of information indicated that this area contributed about 25% of the total ^{90}Sr released over White Oak Dam (DOE 1996b). The primary WAG 4 source is SWSA 4, a 23-acre area used for burial of radioactive and industrial waste from 1951 to 1974 (Fig. 4.11). Many burial trenches at SWSA 4 are inundated. Affected groundwater discharges to an ephemeral stream, which flows to White Oak Creek Site investigations showed that most of the ^{90}Sr releases occur at two seeps, from parts of four upgradient trenches To improve the physical stability and reduce the hydraulic conductivity of the trenches, a sequence of various grouts were injected using a low-pressure permeation technology Grouting activities were completed in October 1996

4.5.2 Evaluation of Decision Document Requirements for Performance and Stewardship

4.5.2.1 Goals of decision

The goal of this removal action was to "reduce the ^{90}Sr released from WAG 4 seeps by 35% within the first 3 years and 75% within 10 years." As a limited action to control sources and prevent contaminant migration, this removal action is expected to significantly reduce the amount of ^{90}Sr entering White Oak Creek, and to reduce the risks to human health and the environment until additional and/or permanent actions to eliminate or further control the sources of contamination are taken. (DOE 1996b)

4.5.2.2 Monitoring required

The RmAR identifies five monitoring stations, with monthly grab sampling at W4T4, SCS4, W4T6, and SCS6 (^{90}Sr and tritium), and monthly flow composite samples at WAG 4-MS1 (also ^{90}Sr and tritium) (DOE 1996i).

4.5.3 Implementation of Previous Year's Recommendations

The FY 2000 RER made a recommendation that grab samples more representative of storm-flow conditions be collected in order to evaluate high flow contaminant releases

Data collected in FY 2000 were evaluated to determine if this occurred At W4T4, the range of flow conditions was 0 L/sec to 245 L/sec The range of flow conditions under which FY 2000 grab samples were collected was 0.36 L/sec (7/17/2000; 10,209 pCi/L ^{90}Sr) to 8.25 L/sec (1/10/2000, 4212 pCi/ ^{90}Sr). The maximum flow conditions for the pre-action grab sampling was 20.69 L/sec in 1996, and, in 1997, it was 42 L/sec. The hydrograph for this location shows that the 8.25 L/sec flow rate likely represents a heavy rain but not a major storm. The greatest daily flow at W4T4 in FY 2000 was 62 5 L/sec during an April storm event (4/3/00) in which almost 3 in. of rain fell (Fig. 4 12). The remaining seep and tributary shows similar findings

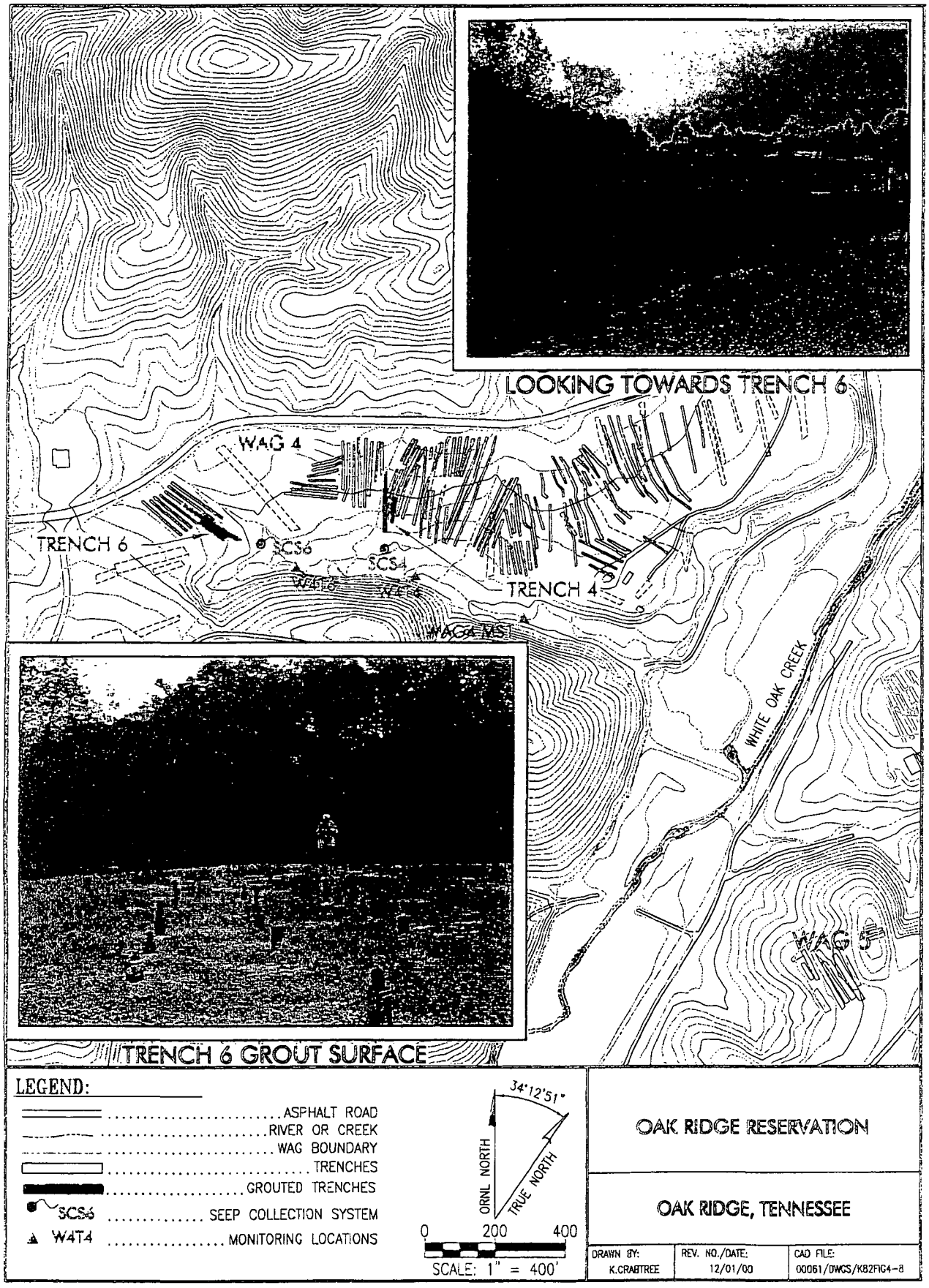


Fig. 4.11. Location of WAG 4 Seeps monitoring locations.

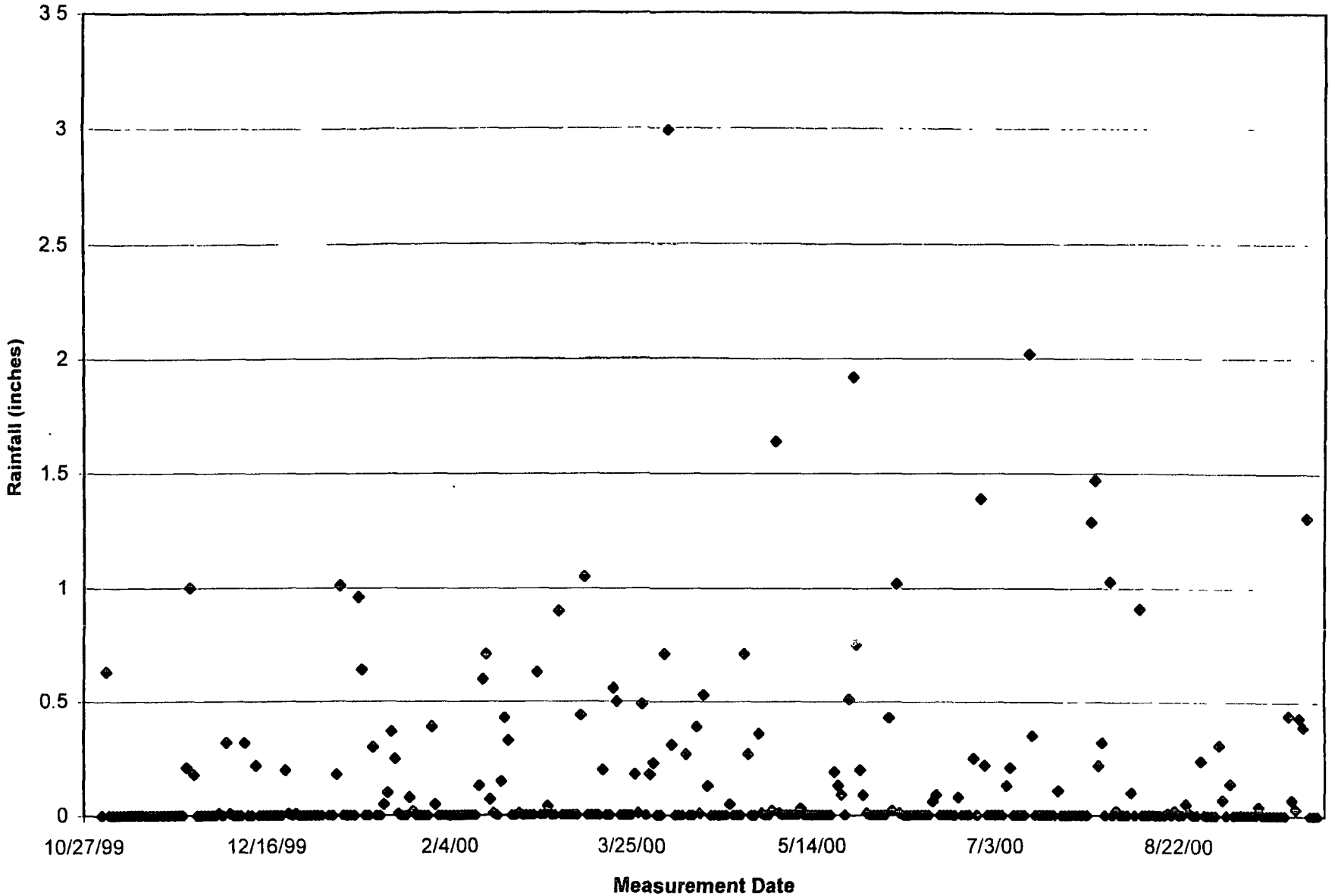


Fig. 4.12. Precipitation results at W4T4.

For a quality control method to be established as a viable data collection and data analysis tool on the ORR, storm-flow conditions need to be represented better in the data sets pre- and post-actions.

4.5.4 Evaluation of Performance and Stewardship Data—WAG 4 Seeps

Table 4.12 presents a summary of the WAG 4 Seeps Five-Year Review. WAG 4 is only 3 years into the action and, thus, conclusions may be premature.

4.5.4.1 Evaluation of performance monitoring data

The performance goal for the WAG 4 Trench grouting action was to achieve a 35% reduction in ^{90}Sr releases within 3 years after the action. The simplest way to show this would have been to compare pre-action contaminant ^{90}Sr mass fluxes at WAG 4MS1 to post-action fluxes. Unfortunately there are no pre-action monthly flow-paced samples at WAG 4 MS1 with which to calculate pre-action mass fluxes There are pre-action grab samples. Project planners proposed measuring potential reductions using a data analysis method that relies strongly on developing a pre-action and post-action flow-versus-concentration (C-Q) relationship at the monitoring locations and using total flow data and the C-Q relationship to estimate changes in flux. This report attempts to perform this using available pre- and post-action grab sample data and measurements of total flow; however, lack of storm-flow sampling creates uncertainty in this approach.

As indicated in Figs. 4 13 through 4 15, the ^{90}Sr concentrations associated with similar flows have decreased post-action at all monitoring locations, as indicated by the change in the intercept of the slope of the C-Q graphs. Data used to develop the graphs is provided in Table 4 13. Data on the graphs have been log-transformed to clearly show the decrease. Figure 4.13 provides an example of the C-Q relationship for WAG 4 MS1 prior to log-transforming the data. This change in intercept means that for the same flow rate (e.g., ~20 L/sec on Fig 4 13), the ^{90}Sr concentration is lower (e.g , a drop from >8000 pCi/L to ~5000 pCi/L), indicating that the total mass flux at that location is lower post-action

The C-Q graph for WAG 4 MS1 clearly shows the slope change in releases of ^{90}Sr from the SWSA 4 seep area pre- and post-actions Using this information and assuming the change slope is constant across all flow rates, it appears that the ^{90}Sr reduction is about 26%, slightly lower than the goal of 35% However, this conclusion must be carefully evaluated in light of the many data uncertainties.

Reduction rates are higher at the sampling location closer to the grouted trenches This indicates that while the grouting has been effective for single trenches, it does not address releases from the nearby ungrouted trenches. It is also of some concern that the ^{90}Sr concentrations at the seeps have not decreased even more to show almost complete binding of the ^{90}Sr to the grout

4.5.4.2 Site visit

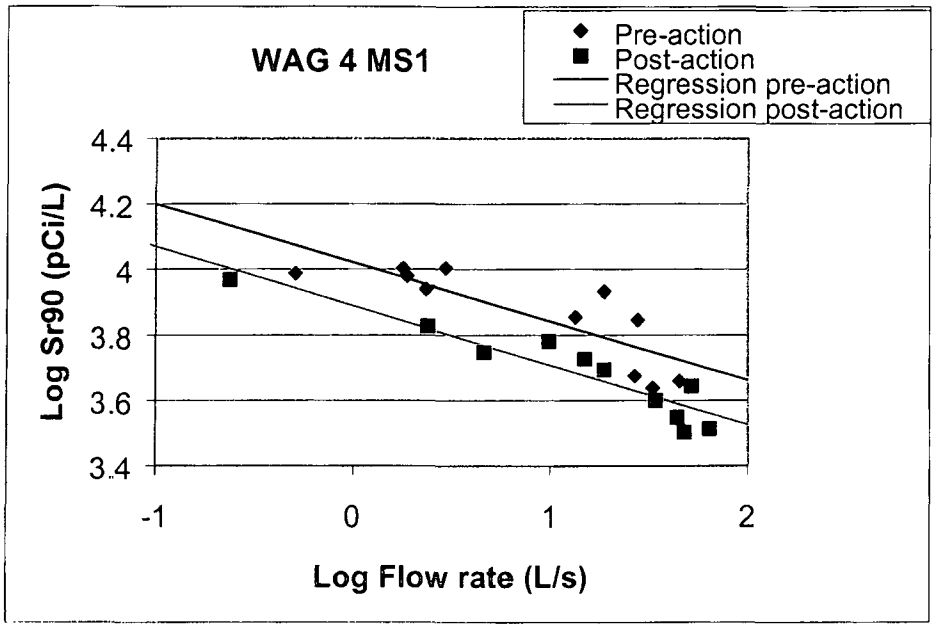
A site visit was performed on October 27, 2000, and is documented in Appendix A. Access to the WAG 4 seeps area is restricted by heavy fencing that restricts vehicle access The SWSA 4 Seep area is well kept and clearly marked with signs indicating the Facility Manager and access requirements WMFS performs weekly inspections of the SWSA 4 burial grounds; the inspection requirements do not require direct inspection of the seep areas Inspection reports are submitted to BJC and placed in the Document Management Center.

There were no identified problems associated with the action. Since the action is a passive containment action, there are no long-term operations in place.

Table 4.12. WAG 4 Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes/No	Estimated reduction indicates action is close to achieving 35% goal (Sect 4 5 4 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	Yes/No	Action addresses releases only from grouted trenches, not all trenches, performance is good at seeps below grouted trenches, less effectiveness seen at downstream locations
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in AM, however, land within DOE fenced and controlled area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	Reference to actions at Seep C for addressing ^{90}Sr inputs to WOC
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Performance data indicate action is close to achieving 35% reduction in ^{90}Sr releases at seeps below grouted trenches
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Chemical-specific ARARs included 40 *CFR* 61 92, TDEC 1200-3-11- 08, 10 mrem/yr public exposure to airborne radiation emission from DOE facilities, 100 mrem/yr general public all sources (TBC)
Have there been any changes in land use or expected land use on or near the site?	No	Confirmed with site visit (Sect 4 5 4 2)
Have new human health or ecological exposure pathways or receptors been identified?	NA	Evaluation occurring on watershed scale
Have new contaminants or contaminant sources been identified?	No	COC = ^{90}Sr, further evaluation of COCs on watershed scale
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	No	Confirmed with site visit (Sect 4 5 4 2)
Have there been any changes in the toxicity factors for contaminants of concern?	No	No BRA/ERA performed
Were there significant changes in the standardized risk assessment methodologies?	No	No BRA/ERA performed
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risks are being addressed on watershed scale (Sect 4 12)
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes and tornadoes, 100-year floodplain

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
CFR = *Code of Federal Regulations*
COC = contaminant of concern
DOE = U S Department of Energy
ERA = ecological risk assessment
NA = not applicable
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation
WOC = White Oak Creek



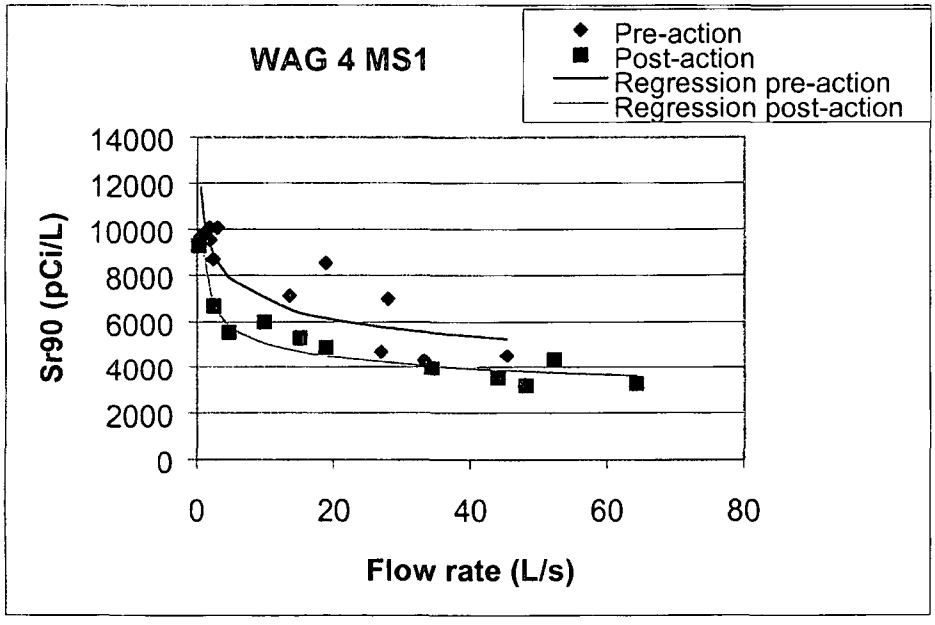
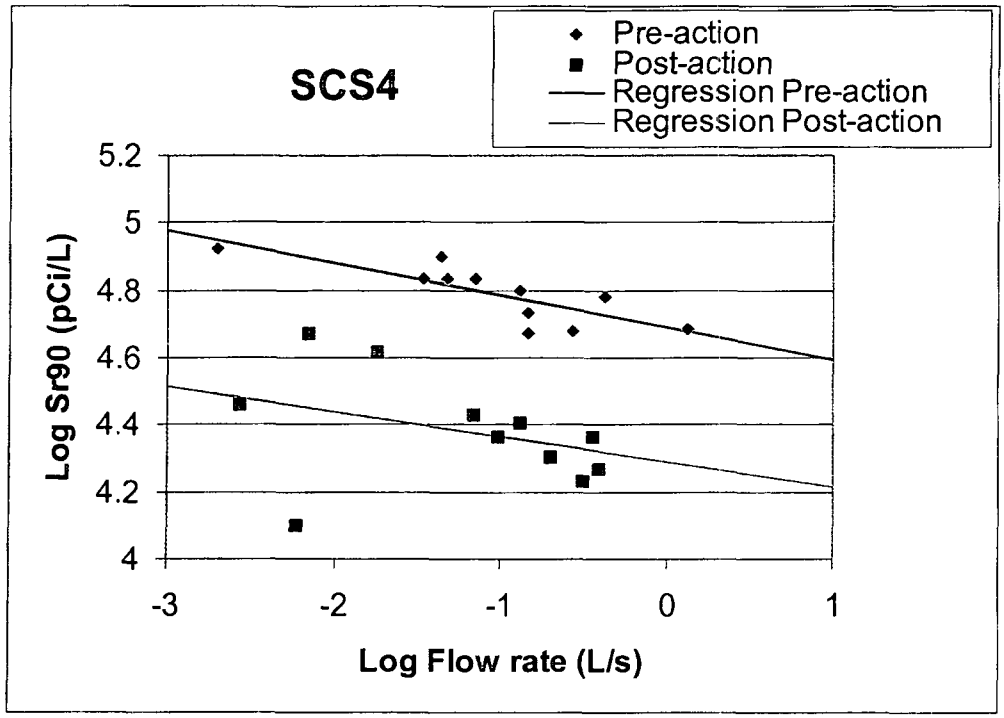


Fig. 4.13. Comparison of WAG 4 pre- and post-action monitoring results at MS1.



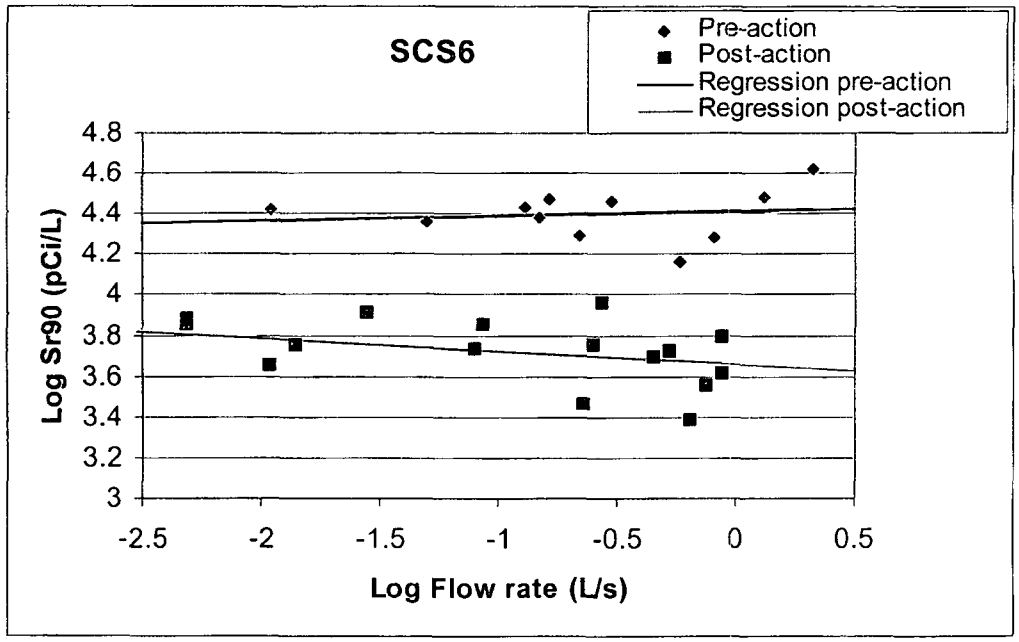
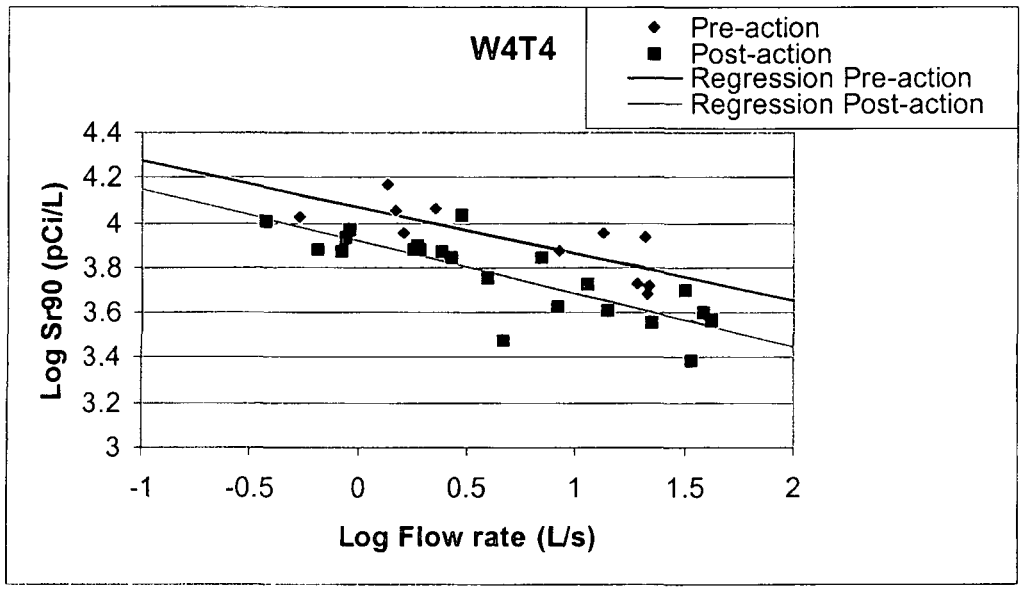


Fig. 4.14. Comparison of WAG 4 pre- and post-action monitoring results at SCS4 and SCS6.



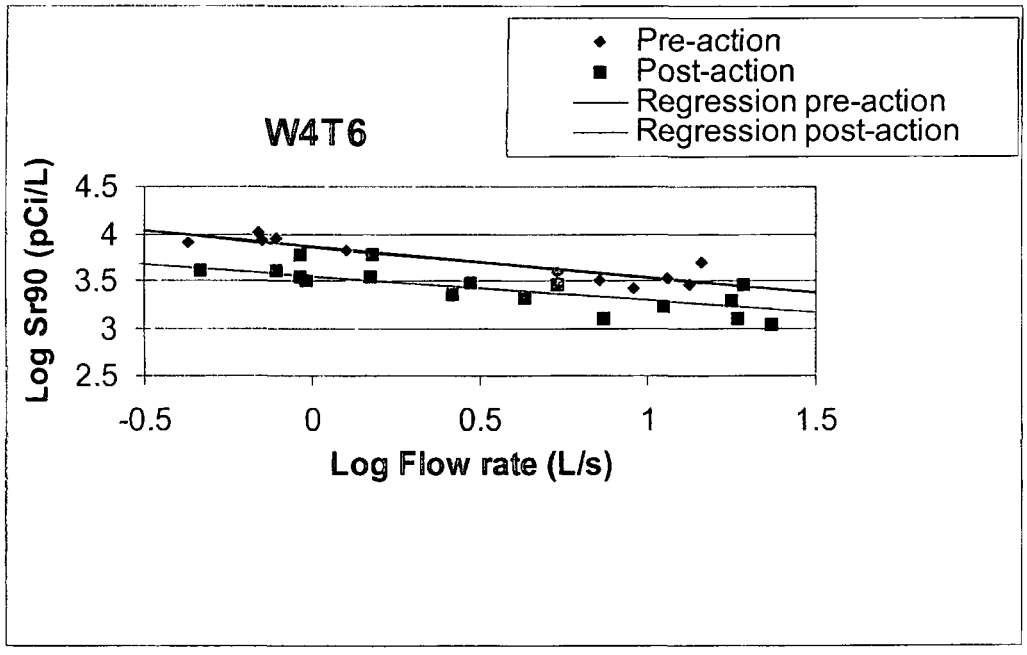


Fig. 4.15. Comparison of WAG 4 pre- and post-action monitoring results at W4T4 and W4T6.

Table 4.13. WAG 4 surface water grab sample data

MS1			W4T6			W4T4			SCS6			SCS4		
Date	Flow (L/S)	90Sr	Date	Flow (L/S)	90Sr	Date	Flow (L/S)	90Sr	Date	Flow (L/S)	90Sr	Date	Flow (L/S)	90Sr
							Pre-Action							
12/12/1995	0 5	9720	12/12/1995	0 43	8019	12/12/1995	0 5	10503	12/19/1995	2 100	42147	12/12/1995	0 002	83619
12/19/1995	26 9	4725	12/19/1995	14 53	4806	12/19/1995	21 5	4806	01/23/1996	0 130	27081	12/19/1995	0 149	46845
01/23/1996	1 9	9558	01/23/1996	0 72	8262	01/23/1996	1 3	14688	03/06/1996	0 297	29268	01/23/1996	0 072	67824
03/05/1996	2 3	8721	03/05/1996	0 79	8937	03/05/1996	1 6	8964	03/07/1996	1 310	30267	03/05/1996	0 035	68337
03/06/1996	13 5	7155	03/06/1996	5 34	3888	03/06/1996	8 3	7425	03/12/1996	0 162	29565	03/06/1996	0 132	63045
03/07/1996	45 3	4563	03/07/1996	11 48	3294	03/07/1996	21 7	5238	04/26/1996	0 050	22977	03/07/1996	0 275	47466
03/12/1996	1 8	10098	03/12/1996	0 70	10098	03/12/1996	1 5	11178	05/06/1996	0 803	19089	03/12/1996	0 049	68526
04/26/1996	2 9	10098	04/26/1996	1 27	6507	04/26/1996	2 2	11502	05/15/1996	0 219	19791	04/26/1996	0 044	79326
05/06/1996	27 9	7020	05/06/1996	13 27	2916	05/06/1996	20 7	8613	06/08/1996	0 578	14580	05/06/1996	1 329	48465
05/15/1996	18 8	8559	05/15/1996	7 17	3240	05/15/1996	13 4	8883	12/12/1996	0 011	26676	05/15/1996	0 430	60102
06/08/1996	33 2	4347	06/08/1996	9 09	2565	06/08/1996	19 0	5292	03/05/1997	0 149	24165	06/08/1996	0 147	54054
							Post-Action							
03/20/1997	4 6	5589	01/09/1997	5 40	2849 1	01/09/1997	11 3	5295 7	01/09/1997	0 524	5292 0	01/09/1997	0 070	27199 8
01/09/1997	15 0	5346	01/24/1997	23 40	1083 1	01/24/1997	42 2	3651 8	01/24/1997	0 750	3645 0	01/24/1997	0 390	18540 9
02/27/1997	18 8	4941	02/21/1997	18 50	1259 6	02/21/1997	33 7	2421 0	02/21/1997	0 640	2430 0	02/21/1997	0 310	17215 2
02/28/1997	44 0	3537	02/27/1997	17 80	1970 8	02/27/1997	31 8	4965 5	02/27/1997	0 448	4968 0	02/27/1997	0 132	25625 7
02/21/1997	48 0	3186	02/28/1997	7 40	1275 3	02/28/1997	13 8	4058 9	02/28/1997	0 880	4158 0	02/28/1997	0 360	23247 0
01/24/1997	64 2	3267	03/20/1997	1 50	3495 3	03/20/1997	3 9	5711 4	03/20/1997	0 250	5697 0	03/20/1997	0 007	46988 1
04/29/1999	9 8	6048	04/29/1999	2 99	3081 3	04/29/1999	6 9	6968 9	04/29/1999	0 028	8152 5	04/29/1999	0 018	41585 7
05/06/1999	34 3	3981	05/06/1999	11 14	1666 1	05/06/1999	22 4	3630 3	05/06/1999	0 879	6284 0	05/06/1999	0 096	23106 2
06/28/1999	2 4	6725	06/28/1999	0 78	3956 1	06/28/1999	0 8	7450 3	06/28/1999	0 005	7684 6	06/29/1999	0 202	20272 0
07/12/1999	52 2	4402	07/12/1999	19 27	2893 6	07/12/1999	38 2	3980 5	08/25/1999	0 005	7219 7	07/12/1999	0 096	
08/25/1999	0 2	9317	08/25/1999	0 19	6848 3	08/25/1999	0 6	7591 5	11/02/1999	0 079	5493 2	01/04/00	0 006	12599 6
			11/02/1999	0 92	6058 3	11/02/1999	1 9	7514 9	12/13/1999	0 001	4098 6	04/25/2000	0 003	28995 9
			12/13/1999	0 15	5323 4	12/13/1999	0 9	8564 5	01/10/2000		7206 7			
			01/10/2000	4 32	1988 8	01/10/2000	8 2	4212 4	03/13/2000	0 271	9212 0			
			02/29/2000	0 47	4041 9	02/29/2000	1 8	7506 8	04/25/2000	0 086	7204 0			
			03/13/2000	0 96	3210 0	03/13/2000	2 7	6946 2	06/29/2000	0 014	5763 4			
			04/25/2000	0 92	3513 3	04/25/2000	2 4	7349 9	07/17/2000	0 001	8417 3			
			05/31/2000	0 15	4916 9	05/31/2000	0 9	9248 9	08/08/2000	0 011	4537 9			
			06/28/2000	1 52	6011 2	06/28/2000	3 0	10842 9	09/25/2000	0 228	2910 4			
			07/17/2000	0 13	5309 5	07/17/2000	0 4	10209 7						
			08/08/2000	0 15	3907 3	08/08/2000	1 9	7894 3						
			09/25/2000	2 64	2246 0	09/25/2000	4 6	2975 3						

WAG = Waste Area Grouping

4.5.5 Conclusions and Recommendations

The WAG 4 seeps action has been effective at reducing ^{90}Sr inputs to White Oak Creek but may not have achieved the goal of a 35% reduction within three years. Releases from the grouted trench areas have decreased significantly, but this reduction is less clear on a larger scale.

As indicated by the difficulty in using the pre- and post-action data, the use of the C-Q method and the collection of grab data and total flow data at all WAG 4 locations should be closely re-evaluated prior to developing the WRRP Sampling and Analysis Plan for FY 2002.

No further recommendations are made for this site, since larger-scale actions are occurring at SWSA 4 under the new Melton Valley IROD process (see Sect. 4.11).

4.6 WAG 13 CESIUM PLOTS INTERIM REMEDIAL ACTION

- IROD September 1992
- Field Activities Complete July 1994
- RAR July 1994

4.6.1 Project Description

The WAG 13 interim remedial action was intended to reduce potential exposures to gamma radiation emitted from the WAG 13 cesium plots located adjacent to and accessible from the Clinch River (Fig 4 16) A perimeter fence at the WAG encloses an area approximately 1000 ft × 250 ft, within which eight experimental plots were used for simulated nuclear weapons fallout studies Four of the plots were inoculated with ^{137}Cs Each of the eight plots was 33 ft × 33 ft and bounded by sheet metal extending 18 in below ground surface (bgs) An interim remedial measures study completed in July 1992 determined that elevated gamma radiation levels emitting from the contaminated plots posed a potential threat to human health and the environment The IROD was approved in September 1992 Field activities were completed in July 1994 Major components of the interim action included the following

- excavation of ^{137}Cs-contaminated soil until residual contamination was ≤120 pCi/g,
- containerization of the excavated soil in steel boxes designed for the storage of low-level radioactive waste,
- transport of the excavated soil to WAG 6 low-level waste silos by truck, and
- placement of a permeable liner in each excavated plot and backfill with clean compacted fill material and a topsoil layer

4.6.2 Evaluation of Decision Document Requirements for Performance and Stewardship

4.6.2.1 Goals of decision

"The purpose of this interim action is to reduce the risk to human health and the environment resulting from current elevated levels of gamma radiation on the site and at areas accessible to the public and adjacent to the site" (DOE 1992e)

The major components of the remedy are listed in Sect 4 6 1

4.6.2.2 Monitoring and stewardship required

There are no requirements for post-remedial monitoring Stewardship requirements include physical and institutional controls (fencing), and regular surveillance and maintenance inspections that include maintenance of access controls (fence enclosure) and periodic inspection and maintenance of the surface cover

4.6.3 Implementation of Previous Year's Recommendations

There were no recommendations for the current year

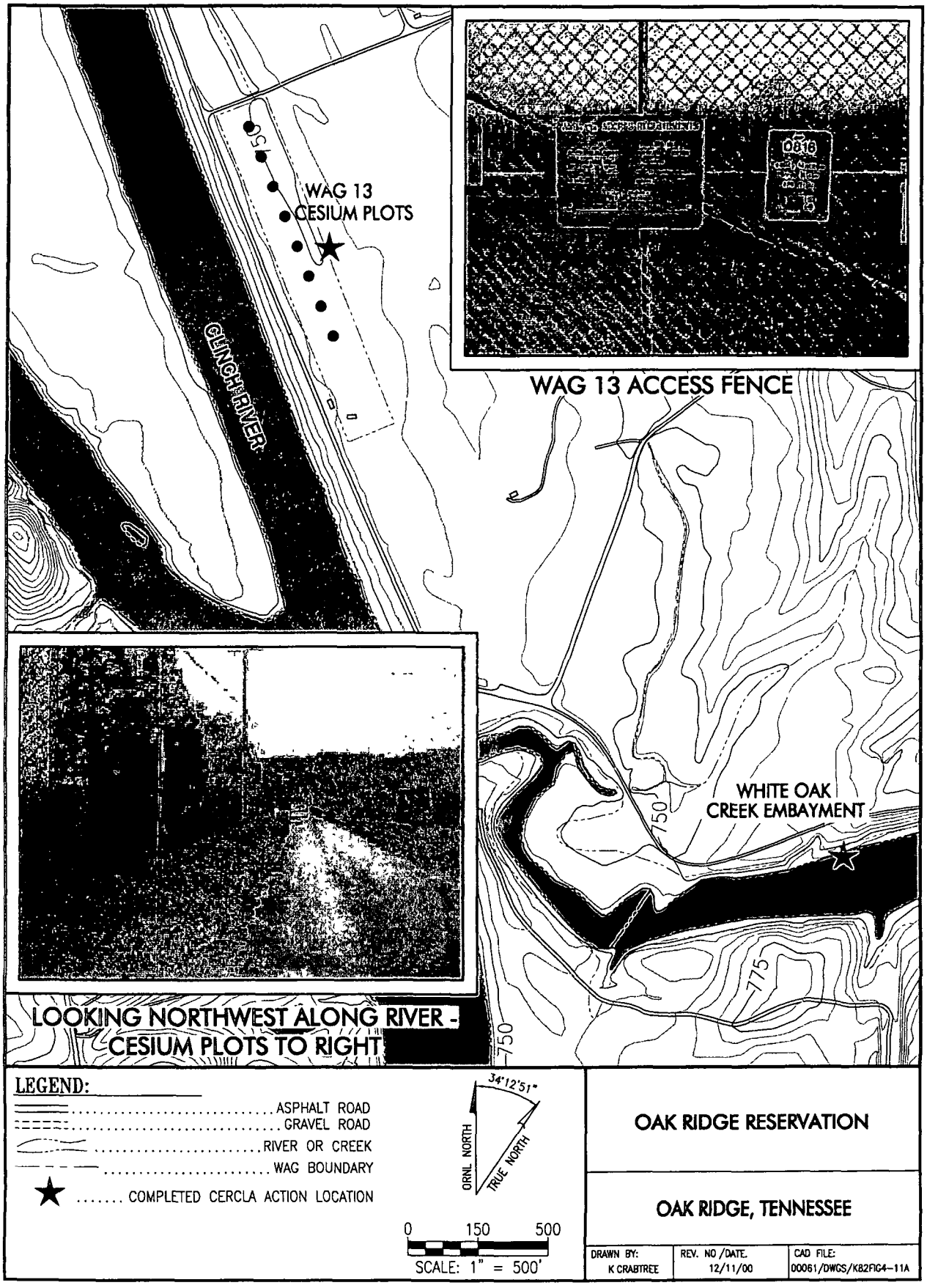


Fig. 4.16. Location of WAG 13 Cesium Plots.

4.6.4 Evaluation of Performance and Stewardship Data—WAG 13 Cesium Plots

Table 4 14 presents a summary of the WAG 13 Cesium Plots Five-Year Review The primary data used to evaluate the effectiveness of the action are the confirmation sampling performed during the action

4.6.4.1 Confirmation sampling

Confirmation soil sampling was performed during excavation to ensure that all soil ≤ 120 pCi/g were removed, confirmation was performed with an on-site lab using a multi-channel analyzer with a sodium iodide detector Once soils reached <90 pCi/g, samples were collected and analyzed at the ORNL Analytical Chemistry Division to verify that excavation had reached ≤120 pCi/g

4.6.4.2 Site visit

A site visit and interview with the Facility Manager, Steve Nolan, were conducted on October 27, 2000 (Appendix A) The WAG 13 site lies within 50 yd of the Clinch River, it consists of a rectangular field surrounded by a chain-link fence and secured by several locked gates The site is patrolled at night, although there are no access controls during the day to prevent the public from accessing the site fence from the river During the site visit, it was noted that the fence is in need of repair, with the barbed wire at the top of the fence having been cut in at least one place The site is well marked and posted with signage indicating "Soil Contamination Area" and listing the Facility Manager's name and phone number

The site undergoes regular quarterly surveillance and maintenance inspections, conducted by WMFS Inspections included vegetation, fences, gates, etc The inspection check sheet is supplied to the Facility Manager, who submits it to the Document Management Center The OEP also conducts rad surveys as needed, the last one posted on the fence is dated February 1999 The Facility Manager noted that 2 years ago, a Lockheed Martin Energy Systems rad survey found a "hot spot" outside of the fence between the western end of the site and the Clinch River The origin of the "hot spot" is unknown, but it is thought it may have resulted from old debris in the area Lockheed Martin Energy Systems excavated the soil down to 7 ft, and surveyed the area in all directions up and down river to make sure the occurrence was isolated There is annual compliance monitoring to check dose rates at the river The site will be further addressed as part of a future ROD

4.6.5 Conclusions and Recommendations

The WAG 13 Cesium Plots interim remedial action was performed more than 6 years ago to remove ^{137}Cs-contaminated soils and, by maintaining the existing fencing, to mitigate the threat from gamma radiation to human health or the environment This remedial action has been successful at accomplishing this goal A final action for the Cesium Plots will be included in a future ROD for ORNL boundary sites Until that time, the fence around the Cesium Plots must be maintained Maintenance of the portion of fencing that is in need of repair should take place immediately At this time, there is no monitoring conducted

Table 4.14. WAG 13 Cesium Plots Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Confirmation sampling verified excavation to $^{137}Cs \leq 120$ pCi/g (Sect 4 6 3 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Remedy addresses risk to workers, "off-site receptors" must remain outside of area and there were no preventive land use controls required by the IROD
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific requirements identified by IROD, however, site in DOE controlled area (Sect 4 6 4 2)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	However, "Remediation of entire site will be addressed in future CERCLA actions"
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	Source removal—no ongoing operations
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	No chemical-specific ARAR identified in IROD
Have there been any changes in land use or expected land use on or near the site?	Yes	Carbon Dioxide Column test site (ORNL project) located adjacent to WAG 13 (Sect 4 6 4 2)
Have new human health or ecological exposure pathways or receptors been identified?	No	
Have new contaminants or contaminant sources been identified?	No	
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	No	Confirm with site visit (Sect 4 6 4 2)
Have there been any changes in the toxicity factors for contaminants of concern?	No	COC = ^{137}Cs
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Ecological risk not quantitatively addressed by action
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes, lies within the Clinch River floodplain

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
COC = contaminant of concern
DOE = U S Department of Energy
IROD = interim record of decision
NA = not applicable
ORNL = Oak Ridge National Laboratory
ROD = record of decision
TBC = to be considered
WAG = Waste Area Grouping

4.7 MOLTEN SALT REACTOR EXPERIMENT TIME-CRITICAL REMOVAL ACTION (REACTIVE GAS)

- Tc AM: August 25, 1995
- Status: Four actions completed, one action ongoing
- RAR: February 12, 1998

4.7.1 Project Description

The Molten Salt Reactor Experiment (MSRE) operated at ORNL as an experimental reactor from 1965 to 1969 to test the feasibility of molten salt reactors for nuclear power generation (Fig. 4.17). The reactor was fueled with ^{235}U and ^{233}U and small amounts of plutonium When the reactor was shut down in 1969, fuel was drained into tanks at the facility and solidified.

A surveillance in 1994 indicated uranium hexafluoride (UF_6) and fluorine (F_2) gas had been generated during salt storage. The gas had flowed through the MSRE off-gas piping system into several components of the reactor, resulting in the potential for a nuclear criticality situation in the charcoal bed filter

A TC RmA was initiated in 1994, which included the following components

- Removal of water from the charcoal bed filter to eliminate the possibility of a criticality accident (completed in November 1994).
- Partitioning off of the off-gas system to prevent uranium gas entering the auxiliary charcoal bed (completed November 1995).
- Confinement of the charcoal bed cell (CBC) to prevent further releases (completed September 1995)
- Elimination of water in other locations to improve criticality safety (completed November 1995).
- Removal of UF_6 and F_2 reactive gases from the MSRE off-gas piping system, systems purged to less than 100 ppm in March 1999; periodic purges to remove gases from continuous radioanalysis (scheduled to be complete in 2002).

4.7.2 Goals of Decision

The primary goal described in the AM (ORNL 1995a) was to establish and implement a systematic risk reduction strategy that would eliminate the highest risk factors first These include (1) the risk of an accidental nuclear criticality, (2) the risk of an exothermic chemical reaction, and (3) the risk of an accidental release from the off-gas system.

This interim action was one part of a multi-action process for decommissioning the MSRE and reducing any risk of criticality. The other two actions are described in Sects 4.8 and 4.9. The total effect of the three MSRE decisions will be evaluated as part of the next Five-Year Review

4.7.3 Monitoring Required

Routine monitoring of the off-gas system and the amount of residual fuel and flush salt in the piping system is being performed during ongoing remediation Performance monitoring for the MSRE will be determined at the end of the two ongoing remediation efforts

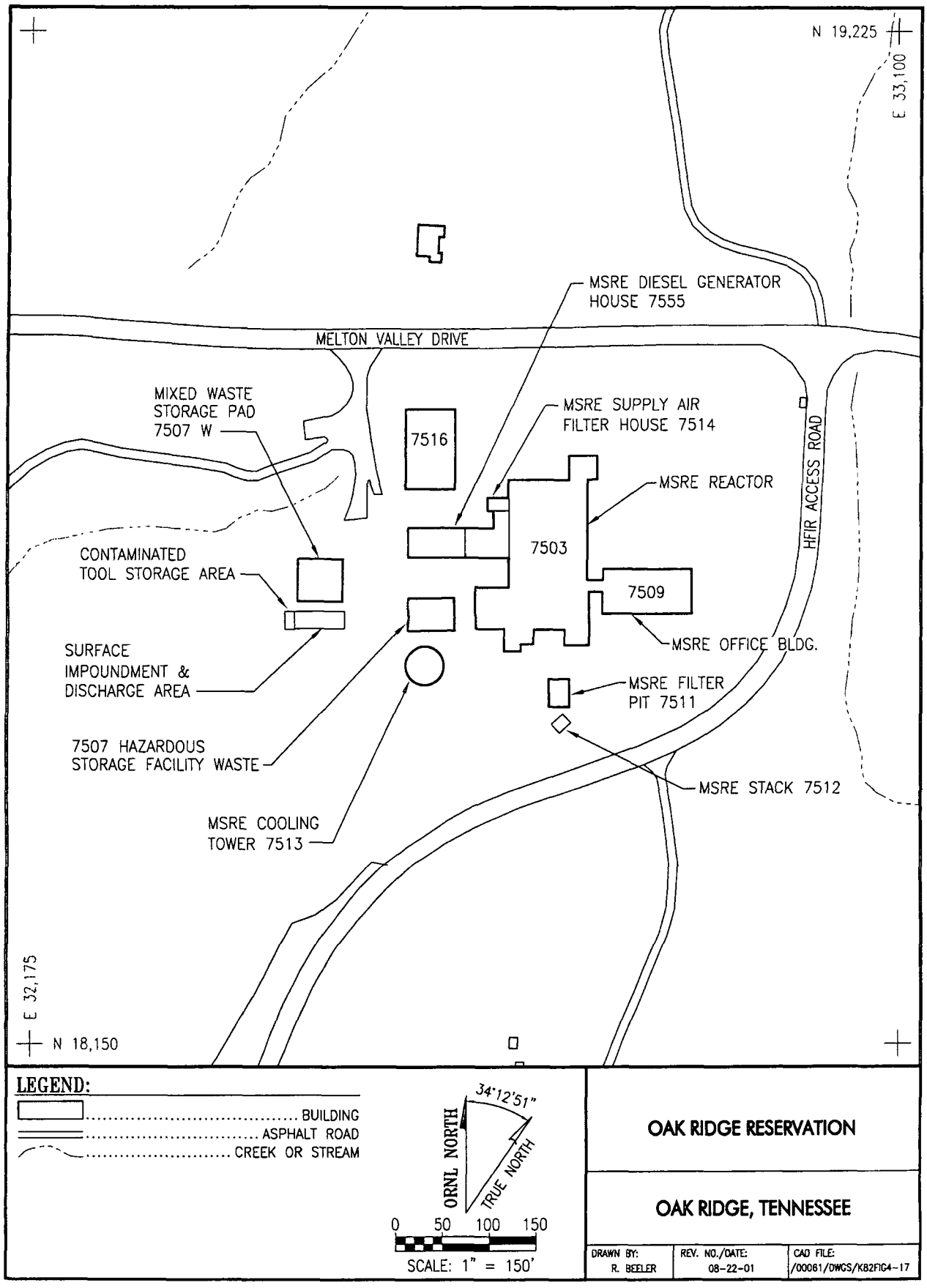


Fig. 4.17. Location of Molten Salt Reactor Experiment.

4.8 MOLTEN SALT REACTOR EXPERIMENT FUEL AND FLUSH SALT REMOVAL

- ROD July 1998
- Status: Ongoing

4.8.1 Project Description

The MSRE project is described in Sect. 4 7.1 The fuel and flush salt tanks are located below the floor of Bldg 7503 (Fig. 4.17) in the Fuel Drain Tank Cell This remedial action addresses removal of fuel and flush salts from the drain tanks; separating out of the uranium, converting it to an oxide form and storing it as part of the ^{233}U repository inventory, and stabilizing and storing the residual salt This action was designed to eliminate the criticality risk associated with the formation of UF_6 and F_2 gas from the salts and potential releases to the environment.

Several activities are ongoing on this action. These include decontamination of equipment used for installation of the primary contaminant isolation valves, a demonstration of the UF_6 cold trapping, specifications for the salt probe, and procurement activities for the salt canning oven

4.8.2 Goals of Decision

The objective of this interim action is "to reduce current potential on- and off-site risk from the salts [in the MSRE drain tanks], pending final action" (DOE 1998d).

4.9 MOLTEN SALT REACTOR EXPERIMENT—URANIUM DEPOSIT REMOVAL

- AM: August 1996
- Status: Ongoing

4.9.1 Project Description

The site description of the MSRE is presented in Sect 4.7.1. The uranium deposit removal action was initiated to address uranium deposits, located in the upper 30 cm of the auxiliary charcoal bed, which pose a potential for a nuclear critically accident and/or deflagration.

The action to address these issues is to break up and remove the uranium-contaminated charcoal to less than 0.55 lb of ^{233}U remaining in the auxiliary charcoal bed

Recent activities include verifying the dimensions of the CBC to complete design, polishing the top section of the auxiliary charcoal bed to help prevent an improper seal, and structurally evaluating the CBC mockup that will be needed to support the final fabricated removal components Recent investigations have shown that the top 6 to 8 in. is not amenable to vacuuming, and the alternative removal approach described in the AM is being pursued.

4.9.2 Goals of Decision

The first objective is to "reduce the amount of fissile uranium in the CBC to 250 g (0 55 lb), which is significantly less than the critical mass for U-233 " The second objective is to "reduce the risk of uranium release to a level within the EPA target risk range, which can be accomplished by further removal of uranium or actions to reduce the potential for a carbon-fluorine deflagration" (DOE 1996c)

4.10 OLD HYDROFRACTURE FACILITY TANK CONTENTS REMOVAL

- AM: September 6, 1996
- Status: Completed
- RmAR: September 1998

4.10.1 Project Description

The Old Hydrofracture Facility (OHF) lies in WAG 5 in Melton Valley (Fig. 4.18) and was used for deep shale injection of waste/grout mixtures from 1963 to 1980. Five underground LLLW storage tanks were left in place, with a total of 52,600 gal (30,000 Curies) of radioactive and hazardous supernatant and sludge. The close proximity of this large inventory of waste to White Oak Creek made it a threat to environmental receptors.

An AM was prepared in 1996 outlining a sluicing-and-pumping system to remove the tank contents and transfer the waste to interim storage in the Melton Valley Storage Tanks via an above-ground, double-walled hose. Some treatment had to occur in order for the OHF waste to meet the WAC for the Melton Valley Storage Tanks. The removal began in June 1998 and was completed in July 1998 The action was completed in the summer of 2000 when the tanks were grouted in place.

4.10.2 Evaluation of Decision Document Requirements for Performance and Stewardship

4.10.2.1 Goals of decision

The objective for removal of the OHF tank contents was to reduce the risk to human health and the environment that could result from a leak or a spill of the contents. The goal of the removal action was to "remove the hazardous and mixed transuranic liquid and sludge contents of the tanks to the maximum extent practicable" (DOE 1996d)

4.10.2.2 Monitoring and stewardship required

There are no specific post-action monitoring requirements identified in the RmAR No stewardship requirements were specified, other than that the OHF tanks will continue to be part of the surveillance and maintenance program at ORNL.

4.10.3 Implementation of Previous Year's Recommendations

There were no recommendations made for the current year.

4.10.4 Evaluation of Performance and Stewardship Data—OHF Tank Contents Removal

Table 4.15 provides a summary of the Five-Year Review questions and answers for the OHF Tank Contents Removal Action. Further details are provided in subsequent subsections.

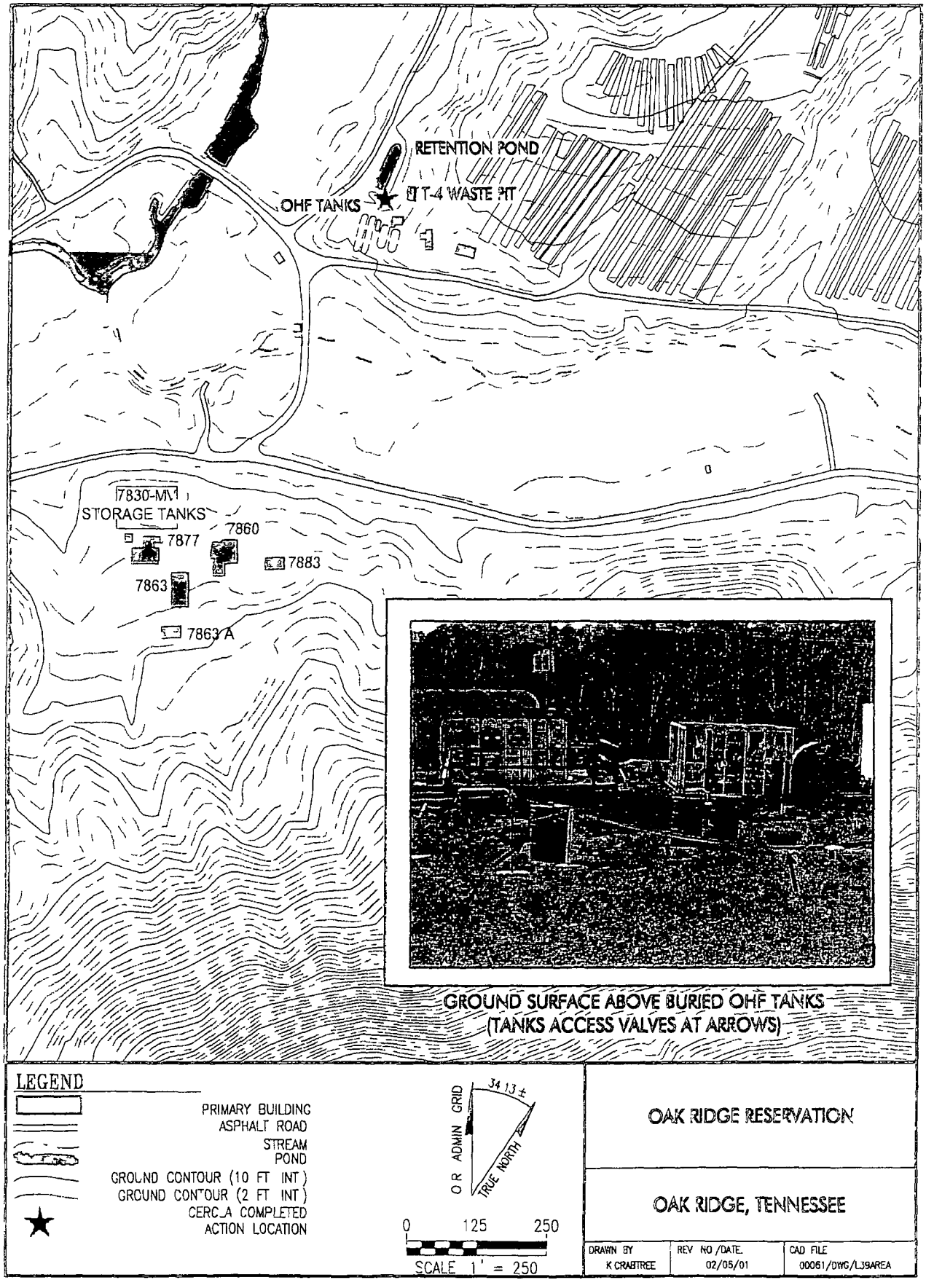


Fig. 4.18. Location of Old Hydrofracture Facility Tanks.

Table 4.15. Old Hydrofracture Facility Tank Contents Removal Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Tanks have been drained and grouted
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	Not required by the decision documents, but site is within the ORNL security fencing
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional action required in AM
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	Source removal—no ongoing operating procedures
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	No chemical-specific ARARs identified in AM
Have there been any changes in land use or expected land use on or near the site?	No	Confirmed with site visit (Sect 4 10 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	No	
Have new contaminants or contaminant sources been identified?	No	COCs = ^{90}Sr, ^{238}Pu, ^{239}Pu, ^{233}U, ^{137}Cs, no requirement to evaluate further
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Remedy did not include chemical treatments
Have there been any changes in the physical site conditions?	Yes	Equipment used by CDM Federal in remediation has been left on-site
Have there been any changes in the toxicity factors for contaminants of concern?	No	
Were there significant changes in the standardized risk assessment methodologies?	NA	Risk assessment was not conducted
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Action does not address ecological risks
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
COC = contaminant of concern
NA = not applicable
ORNL = Oak Ridge National Laboratory
ROD = record of decision
TBC = to be considered

4.10.4.1 Site visit

A site visit and interview was conducted on December 12, 2000. The site access is through a gated fence, requiring a valid badge to operate. A gravel pad covers the buried tanks, which can be located by the access ports sticking up above grade. An assortment of abandoned equipment belonging to CDM Federal covers most of the pad surface. The action was completed in summer 2000 with the grouting of the tanks. The site is still under the purveyance of ORNL surveillance and maintenance. The Project Manager was not aware of any problems with the remedy.

4.10.5 Conclusions and Recommendations

This action is completed and there are no requirements for continued monitoring. The source (contaminated liquid and sludge) was removed, and the tanks filled with grout. It is recommended that this action be discontinued from annual reporting in the RER, and that the Old Hydrofracture Facility Tanks be eliminated from further CERCLA Five-Year Review cycles.

4.11 OLD HYDROFRACTURE FACILITY TANKS AND IMPOUNDMENT

- AM: May, 1999; Addendum, March, 2000
- Status: Completed
- RmAR: In progress

4.11.1 Project Description

The Old Hydrofracture Facility (OHF) lies in Melton Valley (Fig. 4.18) and was used for deep shale injection of waste/grout mixtures from 1963 to 1980. In 1999, the contents of the OHF tanks were removed under a first AM for the site (Sect. 4.10). Upon completion of that work, a second AM was prepared (DOE 1999n) to address stabilization of the tanks and the associated surface impoundment sediments.

The requirements of the AM for the OHF tanks included the following.

- Removal of the tank piping system, submersible pumps (which were to be placed into the tanks), riser interface spool pieces mixer motor/mixer impeller; and

- Grouting of the tanks with CLSM.

4.12 MELTON VALLEY

- ROD: September 2000
- Status: Ongoing
- RDWP: In progress

4.12.1 Project Description

In September of FY 2000, the second ORR watershed-scale ROD for Interim Actions was signed into action by FFA parties. The Melton Valley watershed ROD specifies a remedy composed of different remedial actions for principal threat wastes, contaminated structures, other primary sources, and contaminated media. The major remedial actions are shown in Fig. 4.19 and include the following actions.

- Multilayer caps to cover SWSA 4, SWSA 5 South, SWSA 6, the upper four trenches in SWSA 5 North, and portions of the Seepage Pits and Trenches area.

- Upgradient surface water and stormflow diversion trenches as needed at SWSA 4 and SWSA 6

- Downgradient contaminated groundwater interceptor trenches as needed at SWSA 4, SWSA 5 South, and Seepage Pits and Trenches.

- Disposal of contaminated soils from the lower 23 trenches in SWSA 5 North at the Nevada Test Site or the planned Environmental Management Waste Management Facility, or management at another suitable facility.

- Removal of contaminated sediment at the High Flux Isotope Reactor ponds, and removal of backfill and contaminated soils at the Homogeneous Reactor Experiment (HRE) Pond. The cryogenic barrier at the HRE Pond will be maintained until HRE Pond removal occurs. (Note: the Process Waste Sludge Basin sediment was transferred to the OHF Pond and grouted in situ with the OHF Pond sediments as part of a removal action.) The OHF Pond, with its consolidated sediments, will ultimately be included under the SWSA 5 South cap.

- Grouting of the HRE fuel wells.

- Removal, stabilization, or isolation of inactive waste pipelines as necessary to address contamination.

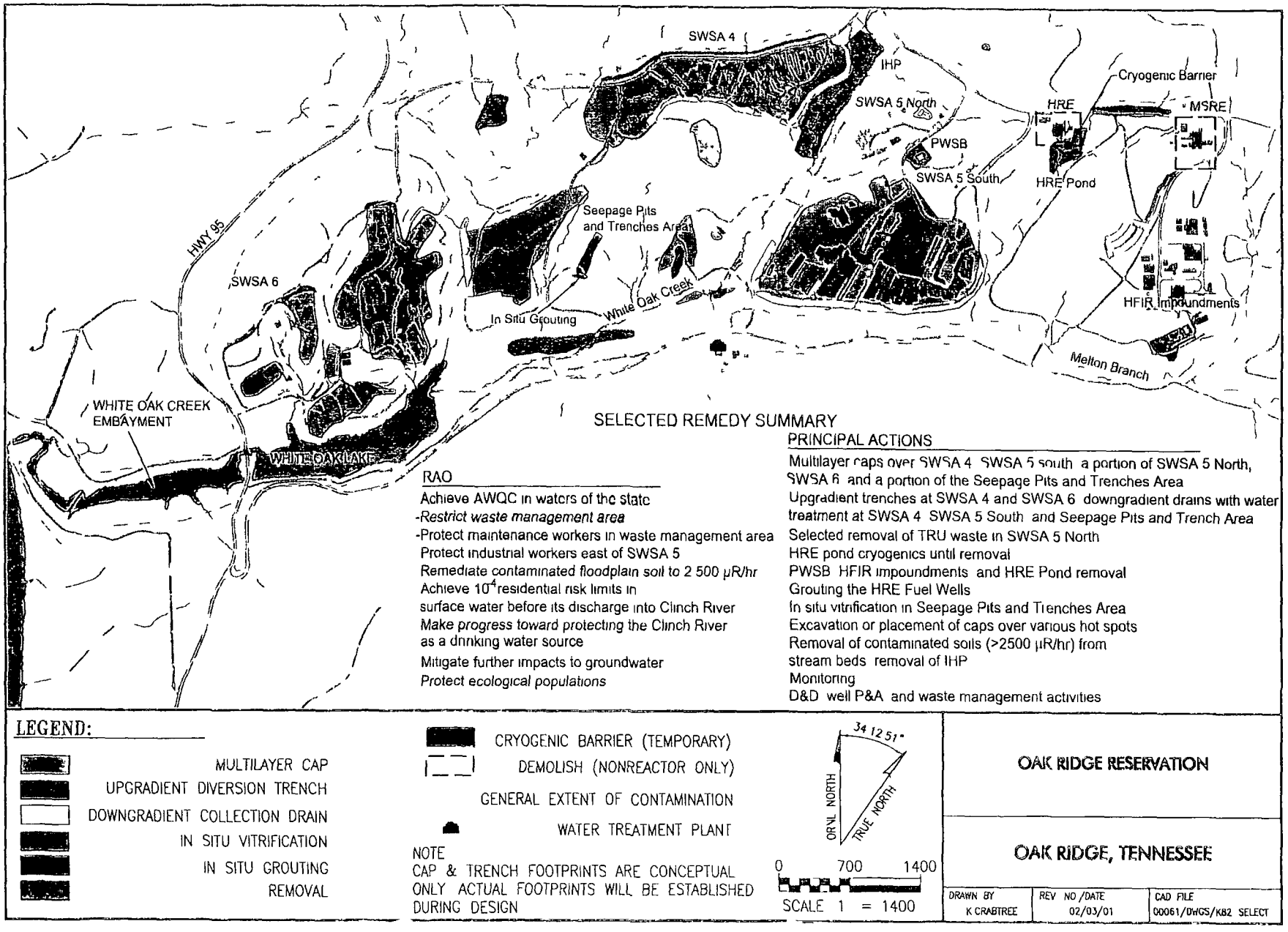


Fig 4 19 Summary of selected remedy for the Melton Valley Watershed

Various land use controls will be in place during and after implementation of the individual remedial actions. Some of these controls are required as part of the remedy to ensure protection of human health and the environment, (i.e., CERCLA controls), while others are not (i.e., non-CERCLA controls). CERCLA controls required to be in place during the implementation of the remedy will be described in individual RAWPs or equivalent documents CERCLA controls that are required after all remedy construction is complete are introduced in the Land Use Control Implementation Plan Non-CERCLA controls are implemented pursuant to other authorities and for purposes other than remedy protectiveness under CERCLA; they are expected to be in place both during and after the remedial actions. While these additional non-CERCLA controls may enhance the protectiveness of the remedial actions, they are not necessary as part of the remedy.

An integral part of Melton Valley cleanup is removal of the buried TRU waste from 23 trenches in SWSA 5 North. This removal will occur separate from the remedy under authority of the Atomic Energy Act

Remedial actions included in the remedy are expected to require on the order of 1 million cubic yards of soil for use as cap material or clean backfill in excavated areas Soils suitable for this use have been identified in an area on Copper Ridge to the southeast of Melton Valley A borrow area will be opened as part of the first capping action (i.e , SWSA 4) to provide qualified capping and fill soil.

Table 4 16 shows those principal remedial actions assigned to each subproject or associated task

4.12.2 Goals of Decision

Specific remedial goals have been developed for each action in Melton Valley Each set of goals follows a general set of goals developed under the watershed approach.

The major problems identified in Melton Valley are the presence of large inventories of short half-life radiological waste and lesser quantities of long half-life radiological wastes, contaminant releases to surface water, and widespread contamination in secondary media. Table 4 17 shows the RAO developed to focus remedial planning that addresses the environmental problems

Melton Valley is currently a restricted area under DOE control Remediation levels have been established to achieve the reasonably anticipated future use of each remediation area within the ROD and are consistent with recommendations from stakeholders [including the Site Specific Advisory Board (SSAB)]. The remedy meets surface water quality objectives and protects workers in the area. As a result of public comment from the SSAB End Use Working Group and discussions with regulatory agencies, DOE intends to accomplish the following conditions in Melton Valley:

(1) The eastern portion of Melton Valley, which contains the reactor sites, will be remediated to a condition that allows industrial use with limited restrictions.

(2) Much of the western portion of Melton Valley, occupied by the waste disposal sites, will continue to be a waste management area with wastes contained in place.

(3) Surface water, designated as waters of the state, will be remediated consistently with the state's stream use classification (e g , recreation and fish and aquatic life) Radiologically contaminated floodplain soils will be remediated by removal of those soils that exceed the 2,500 μR/h exposure level. The hypothetical recreational user is protected under the remedy through a combination of remedial actions including land use controls

Table 4.16. Organization of Melton Valley Watershed remedial actions under the ORNL Project, ORNL, Oak Ridge, Tennessee

Subproject	Subproject task	Major remedial actions
ORNL Burial Grounds	SWSA 4	• Remove IHP soil • Open the borrow pit • Hydraulically isolate SWSA 4 and Pit 1 • Remove portions of LLW line
	SWSA 5 South	Hydraulically isolate SWSA 5 South and neighboring waste units (e g , OHF area)
	SWSA 6	Hydraulically isolate SWSA 6
MV Liquid Waste Disposal Sites (located in Seepage Pits and Trenches Area)	MV Liquid Waste Disposal Sites	• Grout HRE fuel wells • Hydraulically isolate Pit 2, Pit 3, Pit 4, Trench 6, and secondary contaminated soil areas • In situ vitrify Trenches 5 and 7
ORNL Soils and Sediments	MV Impoundments	• Remove backfill and contaminated soil at the HRE Pond • Remove contaminated sediment at the four HFIR Ponds
	MV Soils	Generally remove miscellaneous contaminated surface soil that exceeds remediation levels
	WOC Floodplain Soils and Sediments	Remove contaminated floodplain soil with an exposure level > 2,500 μR/h
MV TRU Waste Disposal Sites	MV TRU Waste Disposal Sites[a]	• Manage the contaminated soil from the lower 23 trenches in SWSA 5 North (removal of the buried TRU waste will be performed separate from the remedy under DOE authority) • Hydraulically isolate the upper four trenches in SWSA 5 North
ORNL Non-HF Well P&A	ORNL Non-HF Well P&A	Plug and abandon the shallow monitoring wells
MV HF D&D	HF Well P&A	Plug and abandon the HF injection and monitoring wells
	OHF D&D	Demolish OHF site surface facilities
	NHF D&D	Demolish NHF site surface facilities
ORNL Small Facilities D&D	Cooling Tower Basins	Demolish the HRE cooling tower basin (superstructure removed under an earlier maintenance action)
	SWSA 4 Small Facilities	• Demolish the Alpha Greenhouse Facility, the Pilot Pits structure, and the Decontamination Facility • Grout and dispose of the five STTs
MSRE D&D	MSRE D&D	Demolish MSRE ancillary facilities
MV HRE D&D	MV HRE D&D	Demolish HRE ancillary facilities
MV ROD Special Studies[a]	TRU Waste Engineering Study	Prepare buried TRU waste engineering study
	Ecological Survey	Perform baseline ecological study
	Watershed Integration Monitoring Plan	Prepare watershed integration surface water and groundwater monitoring plan
	Floodplain Soil Survey	Perform floodplain soil investigation

Table 4.16. Organization of Melton Valley watershed remedial actions under the ORNL Project, ORNL, Oak Ridge, Tennessee (continued)

Notes *Subproject* refers to the Level 6 work breakdown structure (WBS) element under the ORNL Project life cycle baseline *Subproject task* refers to the Level 7 WBS element The Level 6 or Level 7 WBS elements generally correspond to the anticipated work packages to be put out for competitive bid These subprojects and tasks are based on the current life cycle baseline development that is modified and updated at least annually Therefore, the subprojects and tasks are subject to change

[a] The subproject, MV ROD Special Studies, is an exception to the notes above in that it is not part of the current life cycle baseline It was invented for this document as a convenient way of grouping four special studies or evaluations required by the ROD, and separating them from other construction packages Each of the four studies is in the life cycle baseline but is part of other subprojects

D&D = decontamination and decommissioning
DOE = U S Department of Energy
HF = hydrofracture
HFIR = High Flux Isotope Reactor
HRE = Homogeneous Reactor Experiment
IHP = Intermediate Holding Pond
LLW = low level waste
MSRE = Molten Salt Reactor Experiment
MV = Melton Valley
NHF = New Hydrofracture Facility
OHF = Old Hydrofracture Facility
ORNL = Oak Ridge National Laboratory
P&A = plugging and abandonment
ROD = record of decision
STT = Shielded Transfer Tank
SWSA = solid waste storage area
TRU = transuranic
WOC = White Oak Creek

Table 4.17. RAO for the Melton Valley Watershed remedy, ORNL, Oak Ridge, Tennessee

Area/receptor	Goal
Waste management area (includes SWSAs 4, 5, and 6 and Seepage Pits and Trenches)	• Manage waste disposal sites as a restricted waste management area • Protect maintenance workers • Meet AWQC in surface water in a reasonable amount of time • Mitigate further impact to groundwater
Industrial use area (generally the area east of SWSA 5)	• Manage areas generally east of SWSA 5 as an industrial area • Protect industrial workers • Meet AWQC in surface water in a reasonable amount of time • Mitigate further impact to groundwater
Surface water and floodplain area	• Achieve numeric and narrative AWQC for waters of the state in a reasonable amount of time • Remediate contaminated floodplain soils to 2,500 μR/h[a] • Protect an off-site resident user of surface water at the confluence of White Oak Creek with the Clinch River from contaminant sources in Melton Valley • Make progress toward meeting Clinch River's stream use classification as a drinking water source at the confluence of White Oak Creek and the Clinch River
Human receptors	• Protect maintenance workers, industrial workers, and off-site resident users of surface water (at the confluence of White Oak Creek and the Clinch River) to a 10^{-4}-to-10^{-6} excess lifetime cancer risk and an HI of 1 • Protect hypothetical recreational users of waters of the state[b]
Ecological receptors	• Protect ecological populations[c]

[a]A future CERCLA decision will be prepared to determine whether additional actions are required for floodplain soil <2,500 μR/h

[b]This remedy addresses water quality but does not fully address fish consumption or sediment/floodplain soil contact or exposure under the recreational scenario This remedy protects the hypothetical recreational user through a combination of remedial actions including land use controls A future CERCLA decision will be prepared to assess whether any additional actions are required

[c]The remedy enhances overall protection of valleywide ecological populations and subbasin-level populations over a majority of the valley However, portions of the valley that are not addressed by the remedy may pose potential unacceptable risks to ecological receptors Additional data collection and evaluation will be conducted as part of this remedy to further assess the status of ecological receptors in these areas Results of this ecological monitoring and any additional actions as necessary will be included in a future remedial decision

AWQC = ambient water quality criteria
CERCLA = Comprehensive Environmental Response Compensation and Liability Act of 1980
HI = hazard index
ORNL = Oak Ridge National Laboratory
RAO = remedial action objective
SWSA = solid waste storage area

5. CERCLA ACTIONS IN BEAR CREEK WATERSHED

This section presents the remediation history of CERCLA actions in the Bear Creek watershed. The completed and in-progress actions are summarized in Table 5.1, and locations of the actions are shown on the accompanying map (Fig. 5.1). The Bear Creek administrative watershed encompasses the portion of Bear Creek Valley extending from the west end of the Y-12 Plant westward to Highway 95, and the catchment area of Bear Creek and its tributaries north of Pine Ridge to its confluence with East Fork Poplar Creek (Fig. 1.2).

DOE has determined that the remedies already implemented within the Bear Creek Watershed remain protective of public health and the environment in the context of the scope and objectives of each action.

Table 5.1. CERCLA actions in Bear Creek Watershed

CERCLA action	CERCLA areas	Decision document date signed	Action status	Monitoring required
		Five-Year Review sites		
White Wing Scrap Yard Surface Debris, Interim Remedial Action (WAG 11)	White Wing Scrapyard	IROD October 6, 1992	Remedial action complete	No
Bear Creek OU 2 Remedial Action	SY-200 Yard/ YS-125, Spoil Area 1	ROD January 23, 1997	No Further Action approved Institutional control and surveillance and maintenance ongoing	No
		Actions in progress		
S-3 Site Tributary Interception	S-3 Site (Pathways 1 and 2)	AM June 25, 1998	Ongoing	Yes
Bear Creek Valley Phase I ROD	Bear Creek Watershed S-3 Site (Pathway 3) Boneyard/Burnyard Oil Landfarm Containment Pad DARA	ROD July, 2000	Ongoing	Yes

AM = action memorandum
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
DARA = disposal area remedial action
IROD = interim record of decision
OU = operable unit
ROD = record of decision
WAG = Waste Area Grouping

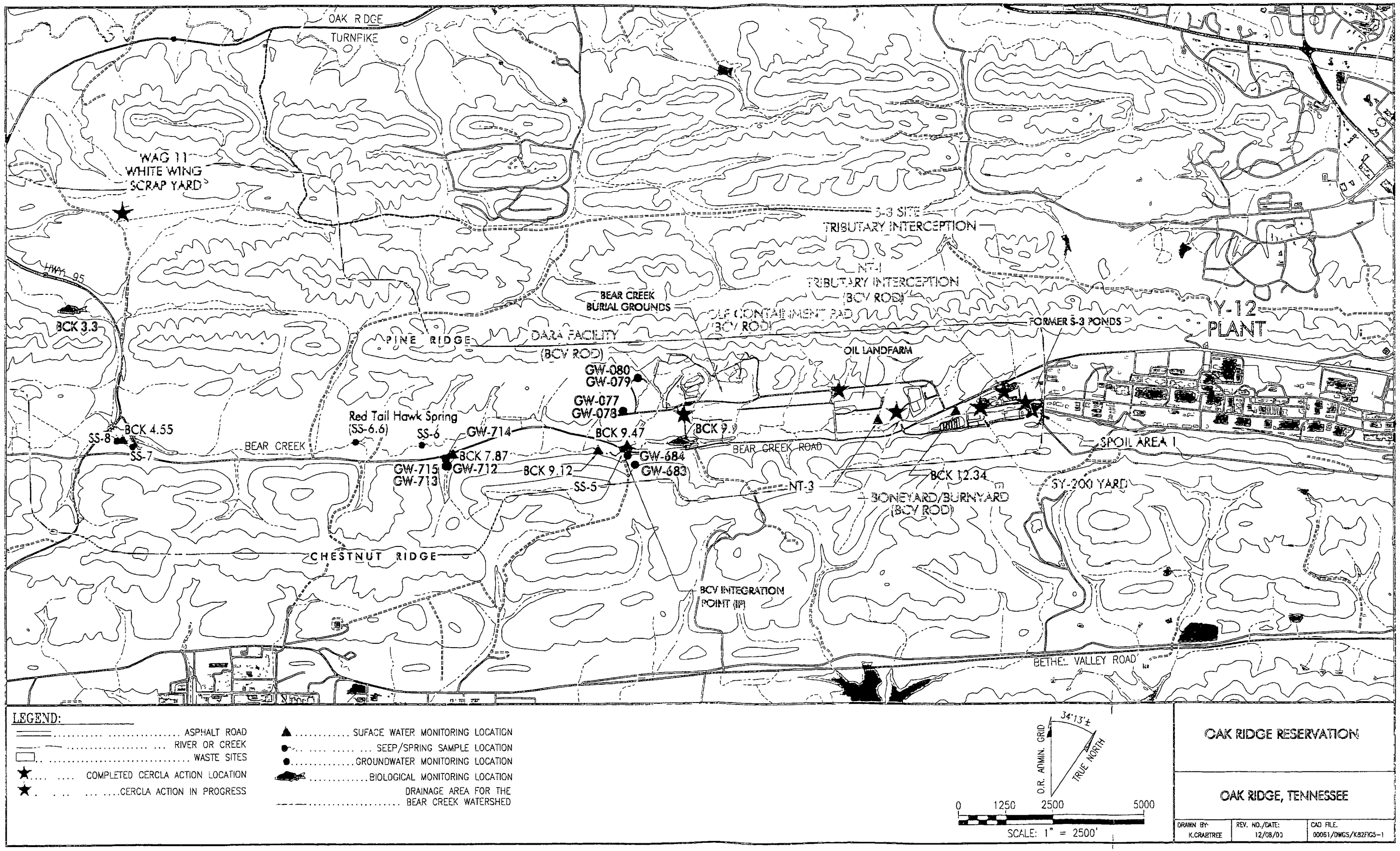


Fig. 5.1. Bear Creek Watershed RER site map.

5.1 WATERSHED OVERVIEW

5.1.1 Bear Creek Valley Conceptual Model

The Bear Creek watershed encompasses two principal drainage areas: (1) the area of Bear Creek Valley from the western end of the Y-12 Plant to approximately 0 25 miles west of Highway 95 (enclosed between Pine Ridge and Chestnut Ridge), and (2) an area between the Bear Creek water gap in Pine Ridge and Lower East Fork Poplar Creek (Fig 5.1).

In 1994 and 1995, an RI was conducted for the Bear Creek watershed (DOE 1997). Since the RI was completed, environmental monitoring has been conducted annually by DOE and reported in the annual RER. Section 5 1 summarizes the findings of the RI and results of subsequent annual monitoring.

Bear Creek Valley contains three former waste disposal areas that account for more than 95% of the radiological and inorganic contamination that currently leaves the valley (DOE 1997). These sites are the Boneyard/Burnyard (BYBY), the S-3 Site, and the Bear Creek Burial Grounds (BCBG) (Fig. 5.2). All of these sites are located in the upper one-third of the valley (Fig. 5.1). In addition to releases from these known waste areas, the Maynardville Limestone also contains a plume of VOC-contaminated groundwater from an unknown past source (DOE 1997).

The migration pathways for contaminants to exit the watershed are surface water transport in Bear Creek and groundwater transport in the Maynardville Limestone Contaminants of concern in the exit pathway are uranium, nitrate, and VOCs. Cadmium is an ecological contaminant of concern in the section of Bear Creek close to the S-3 Site. Contamination in surface streams and contaminant plumes in groundwater derived from the individual sources commingle in the exit pathway downstream of the sources. The largest mass of water (97%) exits the watershed via surface water in Bear Creek. Consequently, the largest mass of contaminants also exits the valley via surface water. A location in the exit pathway—Bear Creek kilometer (BCK) 9 47/SS-5 (Fig. 5 1) was selected as the contaminant Integration Point (IP) for the watershed. This is the point for measuring the total flux of contaminants leaving the waste disposal sites in groundwater and surface water. It is located immediately downstream of the BCBG and is a location that more than 99% of contaminants exiting the former disposal sites pass through (Fig. 5 2).

Waste and contamination at the sources in Bear Creek Valley is situated in the subsurface, and shallow groundwater is the principal mechanism and pathway for release of contaminants. After release, most contaminants travel via short pathways in shallow groundwater to be discharged into surface water. The main groundwater flow and contaminant transport pathways in groundwater within the watershed are along strike. At the waste units, the pathways are shallow, with the discharge points at tributaries to Bear Creek In the center of the valley, groundwater flow is in the Maynardville Limestone, which contains well-developed solution conduits It is both shallow and deep. The direction of flow is along strike parallel to Bear Creek toward the southwest, and large springs mark the locations of discharge from both the shallow and deep flow systems Flow in this formation is closely connected to Bear Creek, and this system of central stream and underlying karst acts as a drain for the valley.

Storm flow is also an important component of the hydrogeologic system in Bear Creek. The nature, rate, and direction of water flow in both surface water and groundwater are transient and vary based on the rainfall and seasonal conditions. This dynamic nature of the hydrogeology of Bear Creek Valley is extremely important to the rate of contaminant transport, both at the sources and in the exit pathway.

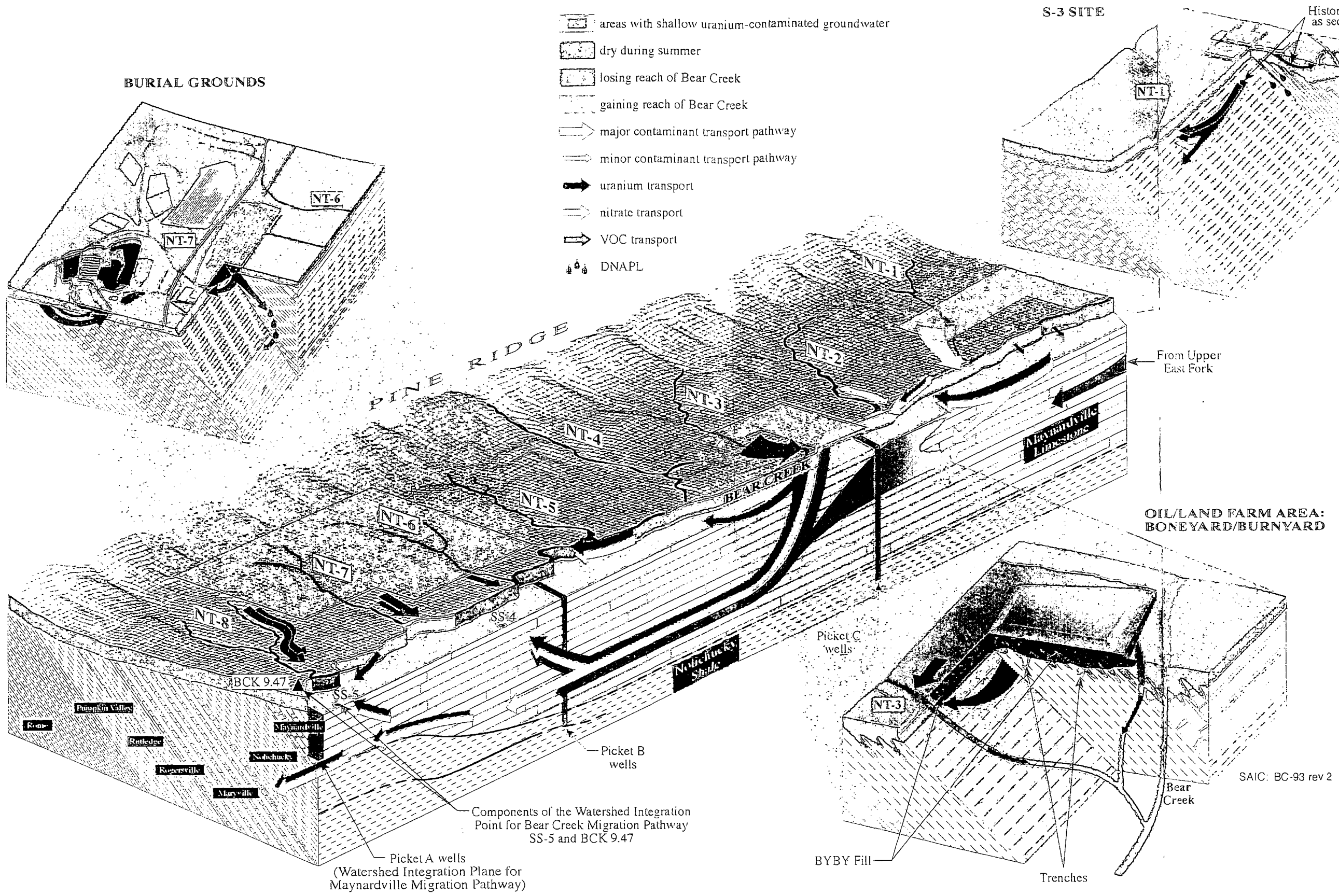


Fig. 5.2. Conceptual model for contaminant migration in Bear Creek Valley.

During 1994–95, when the RI for Bear Creek Valley was completed, uranium accounted for approximately 87% of the risk to human health at the IP. During this time period, it is estimated that 70% of the uranium at the IP came from the BYBY, 17% from the S-3 Site, and 13% from the BCBG (Fig. 5.3).

5.1.2 FY 2000 Summary

5.1.2.1 Exit pathways

The exit pathway for Bear Creek Valley is composed of surface water flowing in Bear Creek and groundwater moving along strike to the west in the Maynardville Limestone (Fig. 5.2). In 1994, a water mass balance budget was calculated for the valley upstream of the IP, BCK 9.47/SS-5. In this mass balance, it was calculated that more than 97% of the water in the waste areas passed through the IP as surface water and the remaining 3% as groundwater (DOE 1997). Less than 0.1% of water flowing west along the valley may travel around the IP by flowing west in the Nolichucky Shale—the formation that underlies the waste disposal areas.

Long-term trends for surface water quality are measured by various means: (1) measurement of the uranium flux at the IP (sample locations SS-5 and BCK 9.47), (2) measurement of bioaccumulation of contaminants of concern in selected fish species throughout the valley, (3) measurement of biological density and diversity throughout the valley, and (4) measurement of contaminants of potential concern in key groundwater wells and springs downstream of the IP

Surface Water. Flux of isotopic uranium was measured by the WRRP at the IP over the past three years using flow-paced monitoring. The total fluxes of uranium for both FY 1998 and FY 1999 exceed that calculated for the RI in 1994–1995, whereas the total flux of uranium at the IP in FY 2000 was slightly smaller than the RI value (101.8 kg compared to 109.2 kg). Table 5.2 and Fig. 5.3 present the results of flux measurements for FY 1999 and FY 2000 and include the results from the RI in 1994–1995 In both FY 1999 and FY 2000, the total flux of uranium exiting the BYBY and S-3 Sites exceeded the flux of uranium at the IP. This indicates a consistent sink for uranium between the monitoring points for NT-3 (BYBY) and BCK 12.36 (S-3 Site), and the IP and BCK 9.47. For both years, the proportions of uranium flux allocated to each site are consistent (e.g., BYBY accounted for 79% of uranium in FY 1999, and 74% in FY 2000).

Table 5.2. Flux for total uranium at flow-paced monitoring locations in Bear Creek Valley

	SS-5 (kg)	BCK 9.47[a] (kg)	IP total (SS-5 and BCK 9.47) (kg)	NT-3 (kg)	BCK 12.34 (kg)
February–September 1998 (8 month)	10 1	96 4	106 5	NA	NA
FY 1999	20 1	144 8	164 9	161 1	27 2
FY 2000	26 5	75 3	101 8	120 4	25 9
Bear Creek Valley RI (FY 1995)	16 9	92 3	109 2	42 9	18 7
	SS-5 (%)	**BCK 9.47 (%)**	**IP total (%)**	**NT-3 (%)**	**BCK 12.34 (%)**
February–September 1998	9 5	90 5	100 0	NA	NA
Total FY 1999	12 2	87 8	100 0	97 7	16 5
FY 2000	26 0	74 0	100 0		
Bear Creek Valley RI (FY 1995)	15 5	84 5	100 0	39 3	17 1

[a]Calculated using a new rating curve in Bear Creek at BCK 9 47
BCK = Bear Creek kilometer
FY = fiscal year
IP = integration point
NA = not applicable
NT = North Tributary
RI = remedial investigation

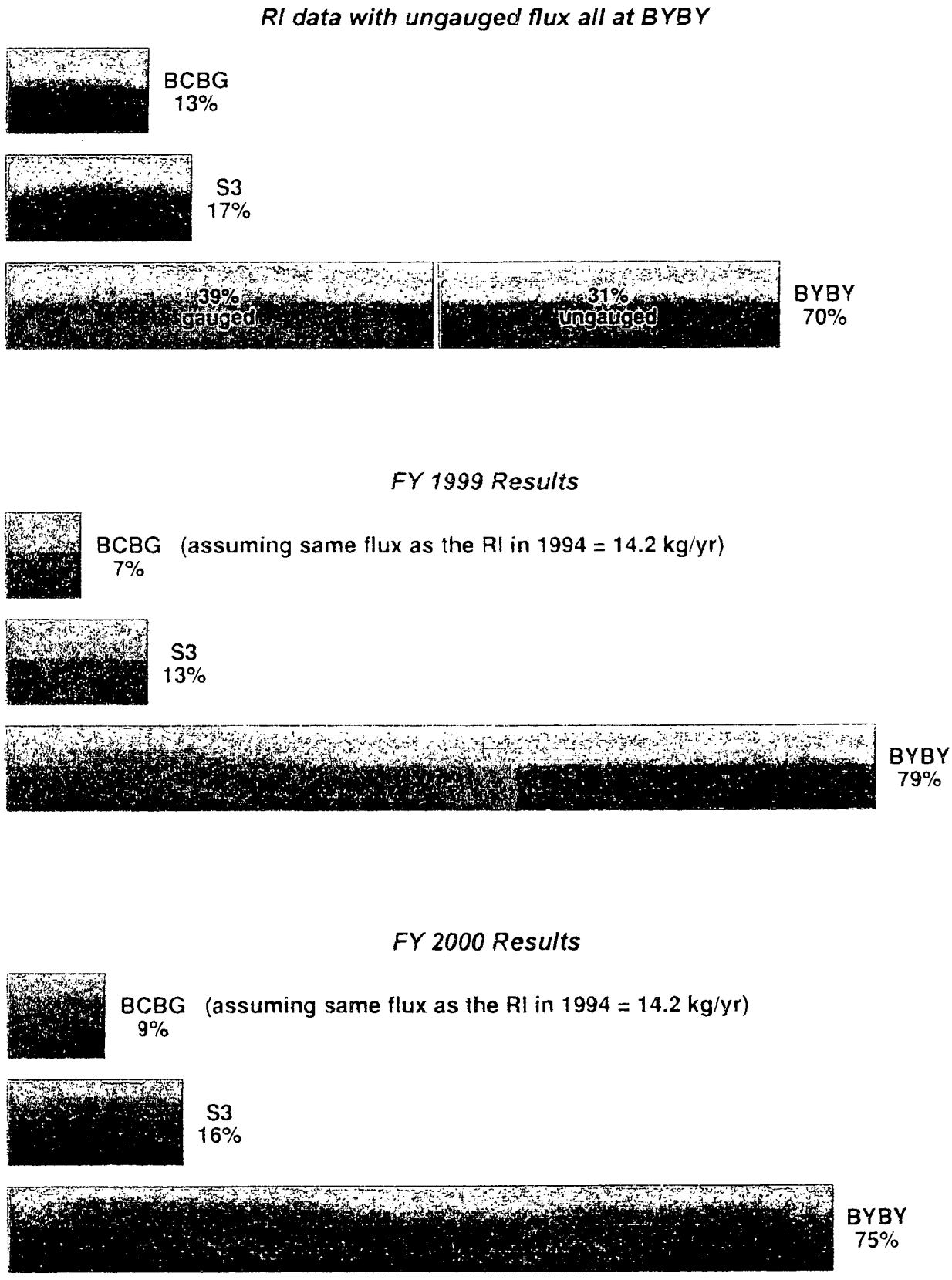


Fig. 5.3. Relative contribution of uranium at the IP from source areas in the RI and for FY 2000 (see Table 5.2).

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Analysis of the average daily flux rate at NT-3, BCK 12.34, and the IP reveals that nearly all uranium migration in surface water occurred between January 5, 2000, and July 5, 2000 (Fig. 5.4), and that the uranium flux at BCK 9.47 mirrors that at NT-3. This time period coincides with the only time period of consistent daily flow of water in NT-3. For the remainder of the year, NT-3 was dry. These data support existing hypotheses for flux of uranium in Bear Creek Valley

- Most annual flux of uranium occurs during a few, high-flow periods dominated by high rainfall conditions (Fig. 5.5).

- During dry periods of the year, there is almost no movement of uranium away from the BYBY source area.

- Annual variation of the BCK 9 47 component of uranium flux at the IP is closely related to the flux at the NT-3 monitoring location. The flux at SS-5 varies less and reflects a more constant transport of uranium groundwater to the IP.

During FY 2000, the first remedial action, installation of a hydraulic diversion ditch and regrading of NT-3, was taken at BYBY to reduce releases of uranium into NT-3 Success of that action should have considerable consequences on the total flux of uranium at the IP in FY 2001

Biological monitoring and toxicity data from Bear Creek were compared to data from reference sites at Pinhook Branch, Mill Branch, and McCoy Branch. The reference sites are considered not to be contaminated by activities at Y-12. They have been used as reference sites for Bear Creek studies since 1984 (Southworth et al. 1994) and therefore provide a long-term basis of comparison to Bear Creek data. The monitoring and toxicity data show a definite spatial trend of decreasing impact with distance from Y-12 and a gradual improvement of water quality over time since 1984 This pattern is consistent with two trends: (1) the steady improvement of environmental conditions in Bear Creek after cessation of waste disposal, particularly at the S-3 Site; and (2) the progressive dilution of contaminants in Bear Creek and in groundwater observed along the valley downstream from the former S-3 Ponds (e.g , cadmium in Bear Creek) Figure 5.6 demonstrates spatial and temporal trends in several parameters:

- Ecological effects remain greatest in the headwaters of Bear Creek, where inputs from contaminated groundwater at the S-3 Site are least attenuated. Downstream sources, BCBG and BYBY, contributed PCBs (stonerollers) and uranium. However, previously identified trends over the last few years that indicate reductions of cadmium concentrations at BCK 12.4 and of PCB concentrations at BCK 9 9 appear to continue in FY 2000.

- Bioaccumulation data showed that cadmium concentrations in fish decline with distance from the S-3 Site and have decreased to just over half the concentration at BCK 12.4 since 1994 This is consistent with the surface water data at the sampling location nearest to BCK 12.4 (BCK 12 34), which is the only surface water location in Bear Creek where cadmium is consistently detected.

- Due to an administrative error, no uranium data for fish are available for FY 2000. The error has been rectified to avoid this problem in the future. During FY 1999, uranium concentrations were elevated in fish near the S-3 Site but remained high throughout Bear Creek This is consistent with elevated uranium in surface water and groundwater in Bear Creek from the S-3 Site to the IP, reflecting that uranium is the contaminant with the largest mass in the Bear Creek Valley waste disposal sites and exit pathway.

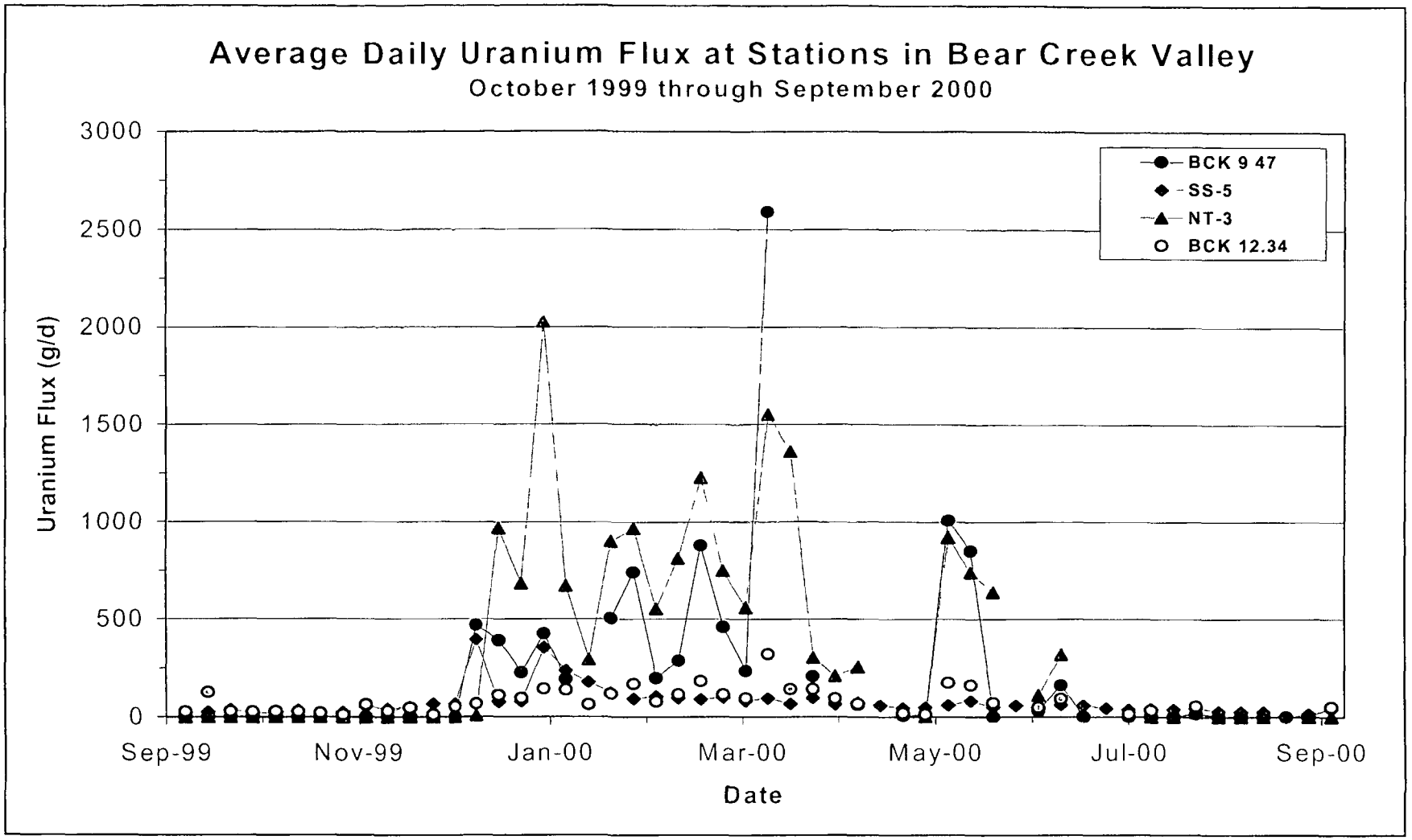

Fig. 5.4. Average daily fluxes of uranium in FY 2000 calculated from weekly flow-paced composite samples. (Zero values indicate no or very low flow conditions)

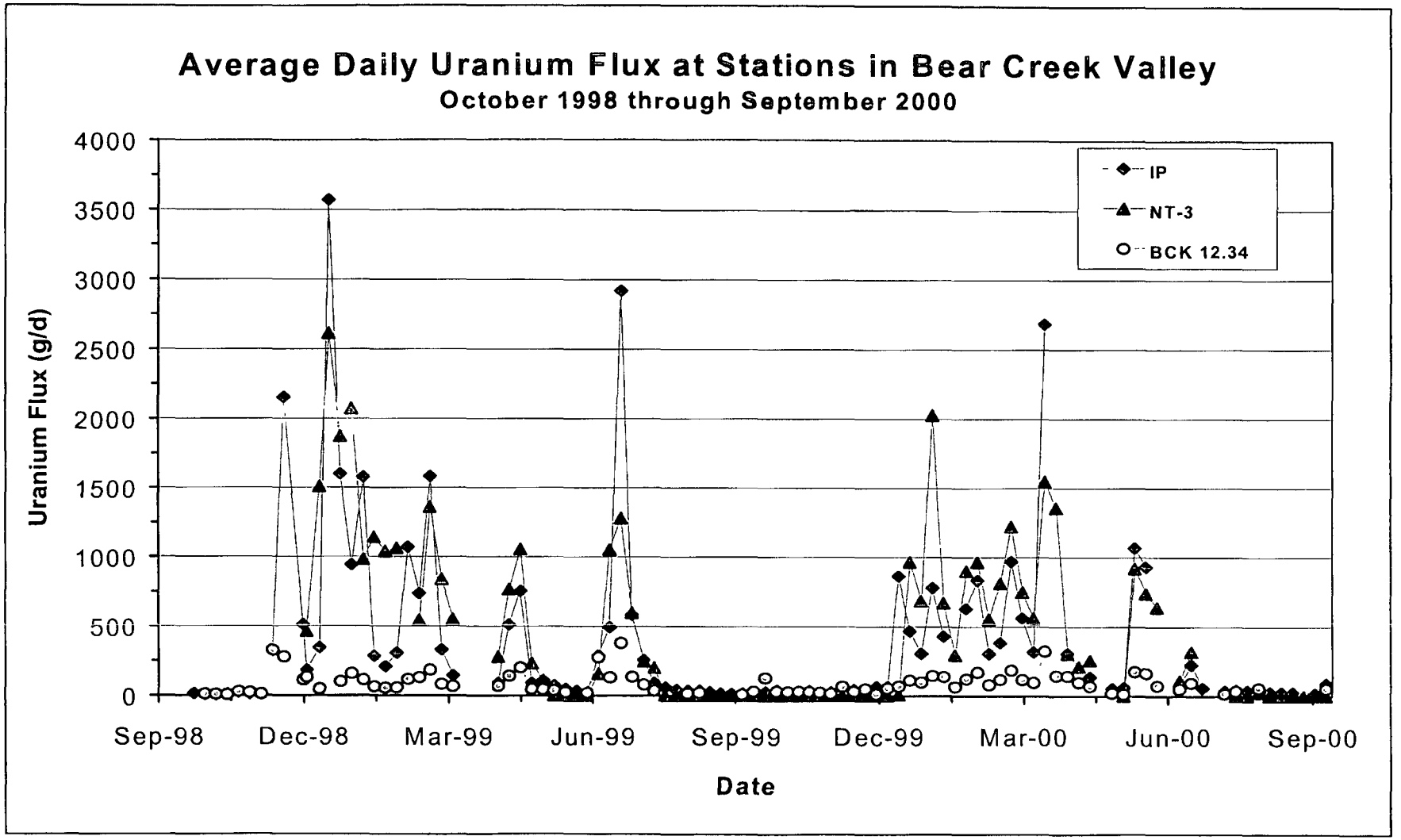

Fig. 5.5. Average daily uranium flux in Bear Creek Valley for FY 1999 and FY 2000.

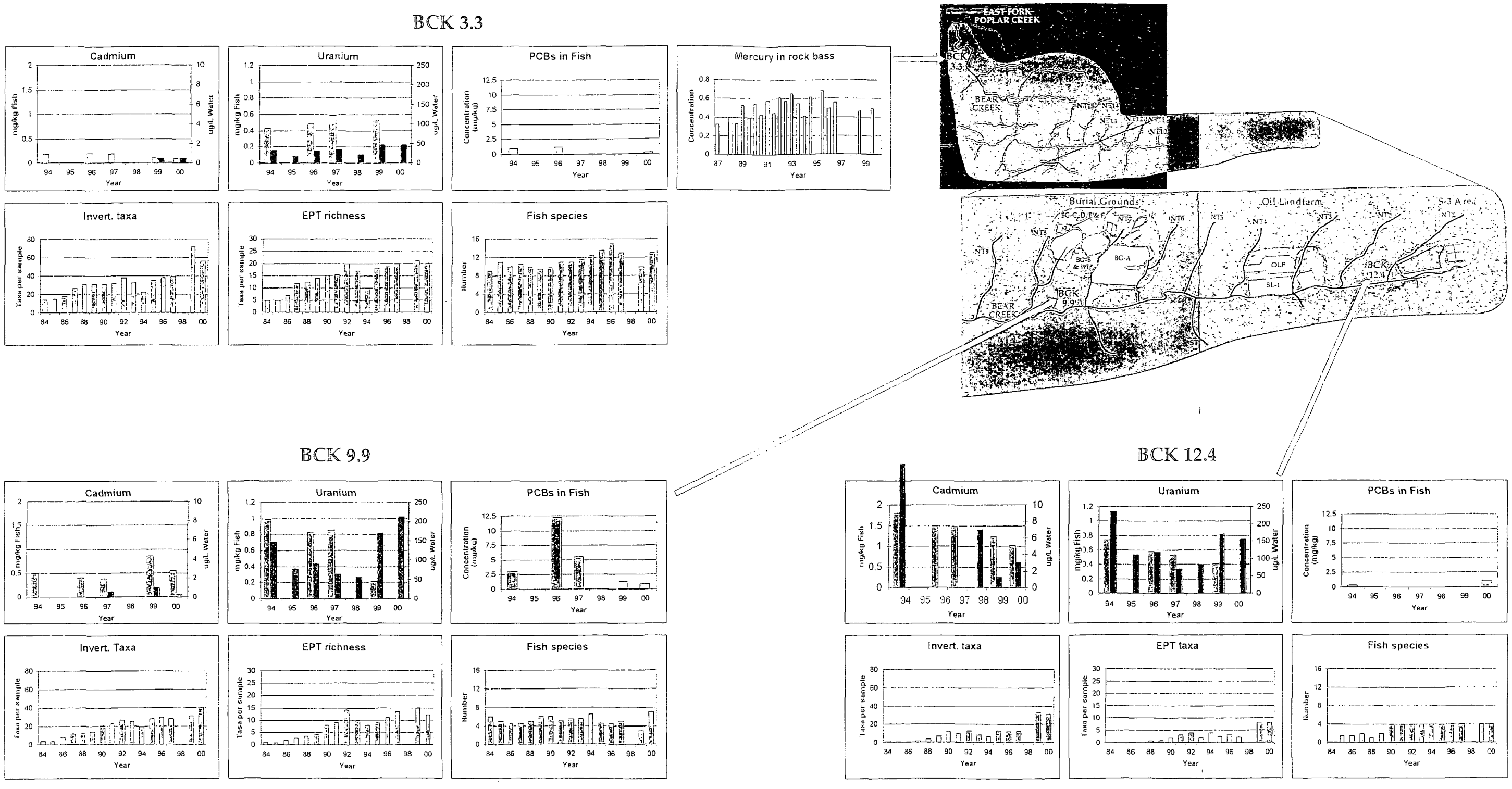

Fig. 5.6. Spatial and temporal trends of contaminant impacts to aquatic biota in Bear Creek.

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- In terms of the community structure of benthic macroinvertebrates, total taxonomic richness and taxonomic richness of pollution-intolerant taxa (EPT richness) remain lower at BCK 12.4 than at BCK 9.9, reflecting the overall higher concentrations of contaminants in this stream reach compared to BCK 9.9. However, the values at both of these sites fell below the range of reference conditions Only BCK 3.3 had total richness and Ephimeroptera, Plecoptera, and Trichoptera (EPT) richness values within the range of the reference sites. A gradual increase in total and EPT richness can be seen at all sites.

- The fish community data from fall 1999 and spring 2000 showed that there continues to be a spatial improvement with distance from the S-3 Site influences as exemplified by numbers of fish species Impacts on the fish community have been attributed to high specific conductivity of groundwater discharges to Bear Creek during dry weather periods (DOE 1998e). The resulting toxicity to fish eggs and larvae reduces fish populations in subsequent years.

Groundwater. Downstream of the IP, a number of springs and groundwater wells are monitored in the exit pathway (Fig. 5 1). Results from the groundwater wells and the springs in FY 2000 were within previous monitoring results, with the exception of the following.

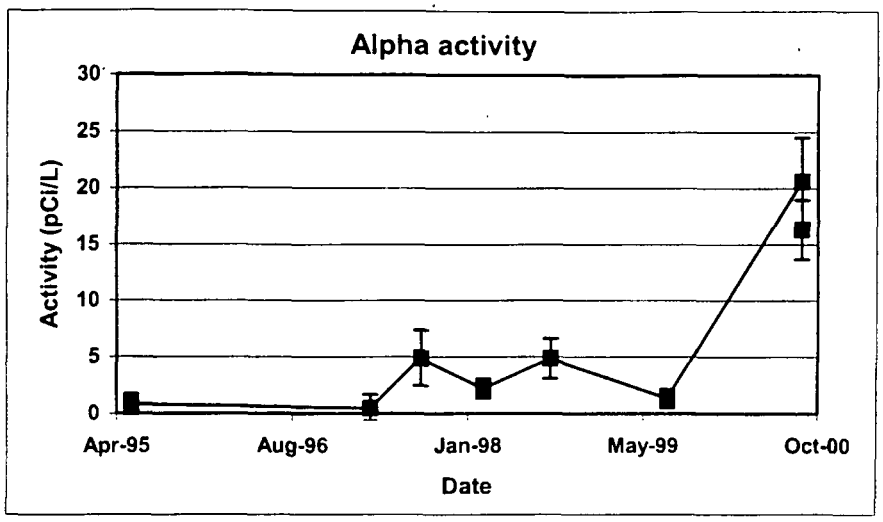
- In FY 2000, one sample from SS-6.6 (Red Tail Hawk Spring) on August 16, 2000, had elevated gross alpha activity (18.5 pCi/L) and gross beta activity (19.1 pCi/L). These results are not accompanied by a concordant elevated concentration of uranium as might be expected based on historical data from other springs in Bear Creek Valley (Fig. 5 7)

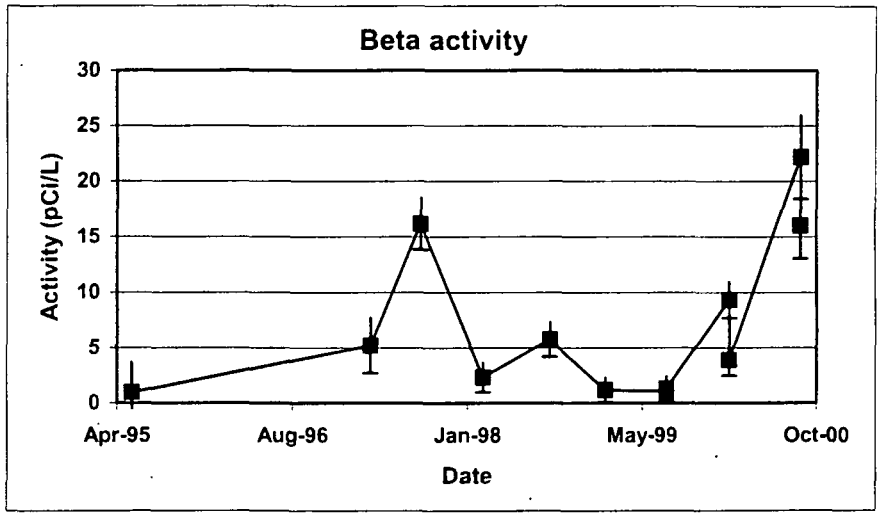
- One sample from GW-713 (Western Picket wells, shallow well) reported an elevated concentration for gross beta activity at 17 0 pCi/L. All other parameters in this well were within previously reported ranges.

Analysis of historical data for these two sites does not reveal obvious trends of increasing concentrations for these parameters, rather, it shows peaks in concentration. Concentrations of uranium and nitrate in spring SS-6 that were identified as elevated in FY 1999 were within previously reported ranges in FY 2000

5.1.3 Recommendations

With signing of the Bear Creek Valley Phase I ROD in July 2000, most of the sampling locations discussed in this section have been included in the future performance assessment Reporting of watershed-scale changes will be included in the performance assessment for the Phase I ROD in next year's RER





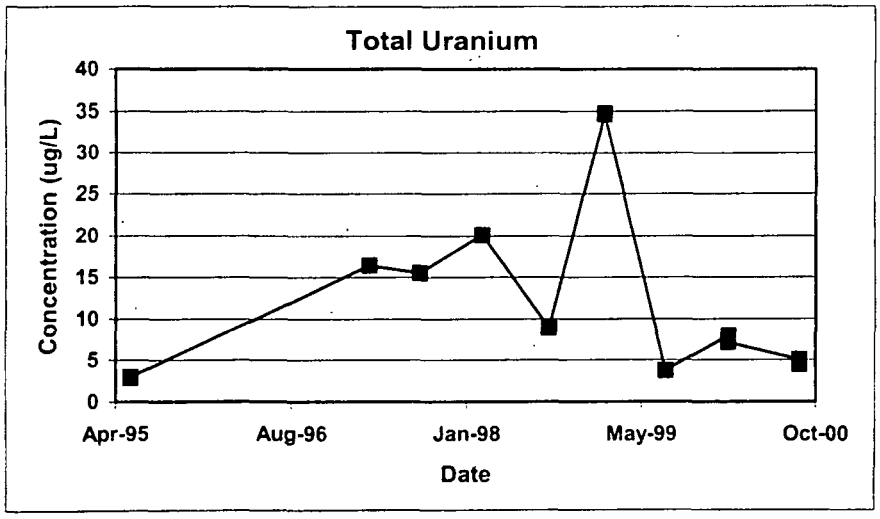


Fig. 5.7. Concentrations of gross alpha, gross beta, and uranium at SS-6.6 (Red Tail Hawk Spring).

5.2 WHITE WING SCRAP YARD SURFACE DEBRIS INTERIM REMEDIAL ACTION

- IROD: October 1992
- Field Activities Complete: May 1994
- RAR: July 1994
- Five-Year Review: 1998

5.2.1 Project Description

The White Wing Scrap Yard (WWSY, formerly known as WAG 11, Fig 5.8) was used as a storage area for scrap and debris from ORNL, Y-12, and ETTP. Material disposed at this site included steel tanks, metal, glass, concrete, and miscellaneous industrial trash contaminated with alpha, beta, and gamma emitters. During active use, the area of the scrap yard north of Hot Yard Road was enclosed with a chain-link fence, and the area south of the road was fenced with barbed wire. In 1966, most of the larger scrap was removed and buried in SWSA 5 at ORNL. Scrap removal continued until October 1970, when some 6000 yd^3 of contaminated debris had been removed from the site

An interim remedial measures study was completed in July 1992, and the IROD was approved in October 1992 to address potential risks associated with radiological and physical hazards associated with remaining debris on the surface of the scrap yard. Remedial action for this IROD began in November 1993, field activities were completed in May 1994. Components of the interim action included the following.

- collection and containerization of surface debris at WWSY retrievable without excavation,
- transportation of the collected debris to WAG 6 at ORNL for disposal in underground silos, and
- replanting of all areas disturbed during debris removal.

5.2.2 Evaluation of Decision Document Requirements for Performance and Stewardship

5.2.2.1 Goals of decision

The goals of the interim action at WWSY were as follows (DOE 1992b).

- a reduction in further degradation of the environment by eliminating surface debris as a source of environmental contamination;

- a reduction in the difficulty, expense, and possible physical harm associated with site surveillance, maintenance activities, and future remedial actions by eliminating debris that interferes with mowing, clearing, and characterizing the site; and

- an increased likelihood of success for future subsurface investigations by eliminating surface debris that interferes with most subsurface investigative methods.

The goals of the remedial action have been achieved, as demonstrated by (1) removal of the debris that could be a source for contamination and (2) the successful completion of an investigation since the remedial action (ORNL 1995b) and continued monthly inspections without the occurrence of health and safety problems.

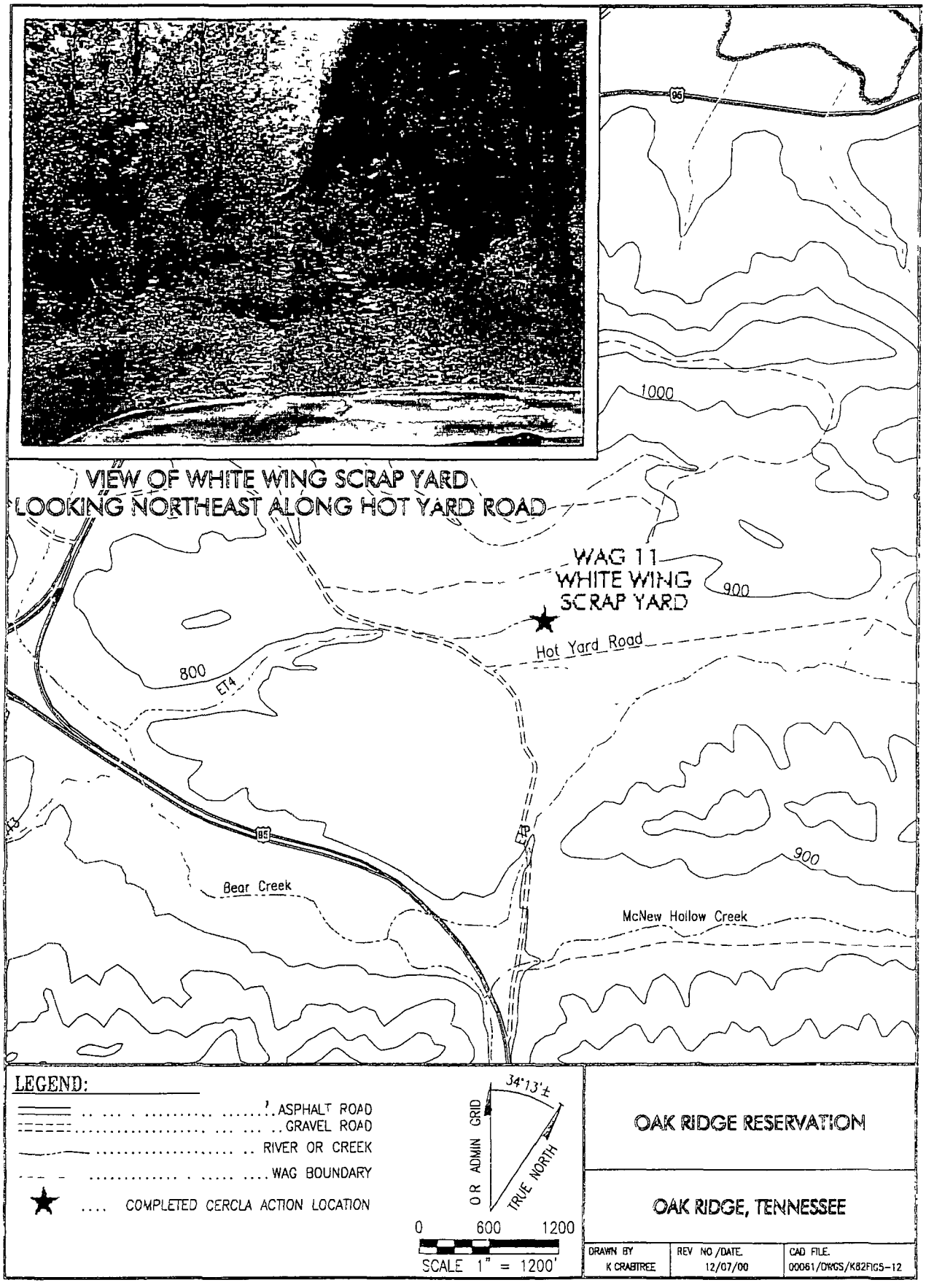


Fig. 5.8. Location of WAG 11 (White Wing Scrap Yard).

Since some buried materials remain at the site, the WWSY area is inspected on a monthly basis as a best management practice (there are no IROD requirements for inspection). Inspections monitor the condition of the access controls and identify any surface erosion or settlement that might require repairs to the surface cover. No unusual maintenance conditions or problems have been noted since the completion of the action in 1994.

5.2.2.2 Monitoring and stewardship requirements

There are no requirements for post-remedial monitoring and no stewardship requirements are listed in the ROD However, the entire boundary of the site is fenced, and signs are posted on the fencing

5.2.3 Implementation of Previous Year's Recommendations

No changes were recommended.

5.2.4 Evaluation of Performance and Stewardship Data—White Wing Scrap Yard

Table 5.3 presents a summary of the Five-Year Review questions and answers for the WWSY Further details are provided in the subsequent subsections

5.2.4.1 Site visit

A site visit and interview with Mr Greg Wayland, Site Manager (BJC), was conducted on October 12, 2000 (Appendix A). The WWSY is a densely wooded area covering approximately 30 acres. The site is located north of Bear Creek and south of the East Fork Poplar Creek floodplain. The topography at the site is gently rolling hills, and two tributaries to Bear Creek run through the site. The perimeter of WWSY is completely surrounded by a fence. A section of one of the tributaries downstream of the site is also enclosed by a fence. The access road ("Hot Yard Road") runs down the middle of the site. On either side there are occasional clearings. Two groundwater wells are located at the east end of the site.

The IROD for the WWSY was completed in 1992, and was one of the earliest decision documents for CERCLA actions on the ORR. No post-removal action monitoring was specified, and no stewardship requirements were mentioned in the IROD. However, the entire boundary of the site is fenced, and signs are posted on the fencing identifying the site and directing inquires to Greg Wayland. Surveillance and maintenance visits occur on a quarterly basis, and inspections are made each month. The IROD does not stipulate any form of surveillance activities, so these are performed as a best management practice and in response to DOE orders. These activities are documented in inspection reports that are available in the Site Manager's office and sent to the Document Management Center at the end of each fiscal year

This area has been opened up to public access for the purposes of hunting during three weekends each year The WWSY is closed to public access, and the fence prevents direct exposure to the site. It was noted that public access provides additional potential exposure pathways not considered by the original remedy Access controls and the S&M activities have mitigated these potential exposure pathways

Table 5.3. White Wing Scrap Yard Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Surface debris removed
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Site Manager not aware of any problems under current operating procedures
Are the land use controls (fencing, security guards, etc.) in place and preventing exposure?	Yes	No specific land use controls listed in IROD, however, site is surrounded by fencing, and inspected regularly (See Site Visit, Sect 5 2 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	Surface debris removed
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	See site visit (Sect 5 2 4 1)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	No chemical-specific or location-specific standards identified in the ROD
Have there been any changes in land use or expected land use on or near the site?	Yes	Area immediately surrounding site is open to public access for hunting 3 weekends per year Site remains in government control with access controls (Site visit, Sect 5 2 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	Yes	Access controls and S&M activities have mitigated the risk, these controls and S&M activities should be included in ROD
Have new contaminants or contaminant sources been identified?	No	
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	No	Site visit, Sect 5 2 4 1
Have there been any changes in the toxicity factors for contaminants of concern?	NA	BRA/ERA not performed, deferred to the watershed ROD
Were there significant changes in the standardized risk assessment methodologies?	NA	BRA/ERA not performed, deferred to the watershed ROD
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	ERA not addressed in IROD, ecological risk was evaluated in the watershed RI
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
ERA = ecological risk assessment
IROD = record of decision
RI = remedial investigation
ROD = record of decision
S&M = surveillance and maintenance
TBC = to be considered

5.2.5 Conclusions and Recommendations

The current fencing and S&M operating procedures, conducted as best management practice, are maintaining the effectiveness of the remedy and mitigating risk to the public. It is recommended that the controls and S&M activities be included in an addendum to the ROD. This site will continue to be evaluated in the annual RER and ORR-wide Five-Year Review cycles. In addition, surveillance and maintenance records will be maintained and be publicly available in the Site Manager's office and sent to the Document Management Center at the end of each Fiscal Year. Should S&M activities identify a change in the protectiveness of the remedy due to a change in the site (other than maintenance issues), that will be reported in the RER.

5.3 SPOIL AREA 1 AND SY-200 YARD (BEAR CREEK VALLEY OU 2) REMEDIAL ACTION

- ROD: January 23, 1997
- Field Activities Complete: No further action required.

5.3.1 Project Description

The Bear Creek Valley OU 2 ROD included two areas. Spoil Area 1 and SY-200 Yard (Fig. 5.9). Spoil Area 1, west of Y-12 on Old Bear Creek Road, received construction debris from various renovation, maintenance, and construction operations at Y-12. Concrete, asphalt, brick, rock, and tile were disposed of in Spoil Area 1 from 1980 to 1985 and covered with soil in 1985. Spoil Area 1 is a Class IV landfill, permitted by TDEC (permit number DNL-01-103-0012) for the disposal of construction and demolition waste. The SY-200 Yard is west of Y-12 on Old Bear Creek Road between Spoil Area 1 and the Rust Spoil Area. From the 1950s to 1986, the SY-200 Yard was an above-ground storage facility for machinery and miscellaneous items No chemicals or waste materials were stored at the site, and all containers at the site were empty. However, after visible mercury was observed in the soil, a soil cover of 3 to 5 ft was installed at the yard. A portion of the SY-200 Yard area is currently being used as a parking lot.

5.3.2 Evaluation of Decision Document Requirements for Performance and Stewardship

5.3.2.1 Goals of decision

The primary objective of this remedial action was to mitigate risks to human health and the environment from exposure to contaminated soil and waste (DOE 1996f). This was to be accomplished through the following actions

- Maintenance of physical barriers (gates and signs) to limit access to the site,
- Future deed restrictions to (1) restrict construction at the sites, (2) incorporate indoor radon mitigative measures in accordance with EPA guidelines for any future structures built on the site, and (3) prohibit waste intrusion to mitigate direct exposure; and
- Periodic physical surveillance of the soil cover and other features of the site (i e., a vegetated bank descending to Bear Creek at SY-200) and maintenance or repair, as required [ROD for Bear Creek Valley OU 2 (DOE, 1996f)]

5.3.2.2 Monitoring and stewardship required

No CERCLA performance monitoring is required under the No Further Action ROD for Spoil Area 1 and SY-200 Yard Stewardship requirements include access and use restrictions to prevent unacceptable exposure to contaminants Deed restrictions have been implemented to restrict construction that could negatively impact the integrity of the covers at the sites and prohibit waste intrusion. Restrictions also require incorporation of indoor radon mitigative measures in accordance with EPA guidelines for any future structure built on-site These sites are designated in the restricted industrial use area in the Phase I Bear Creek Valley ROD (DOE 2000e)

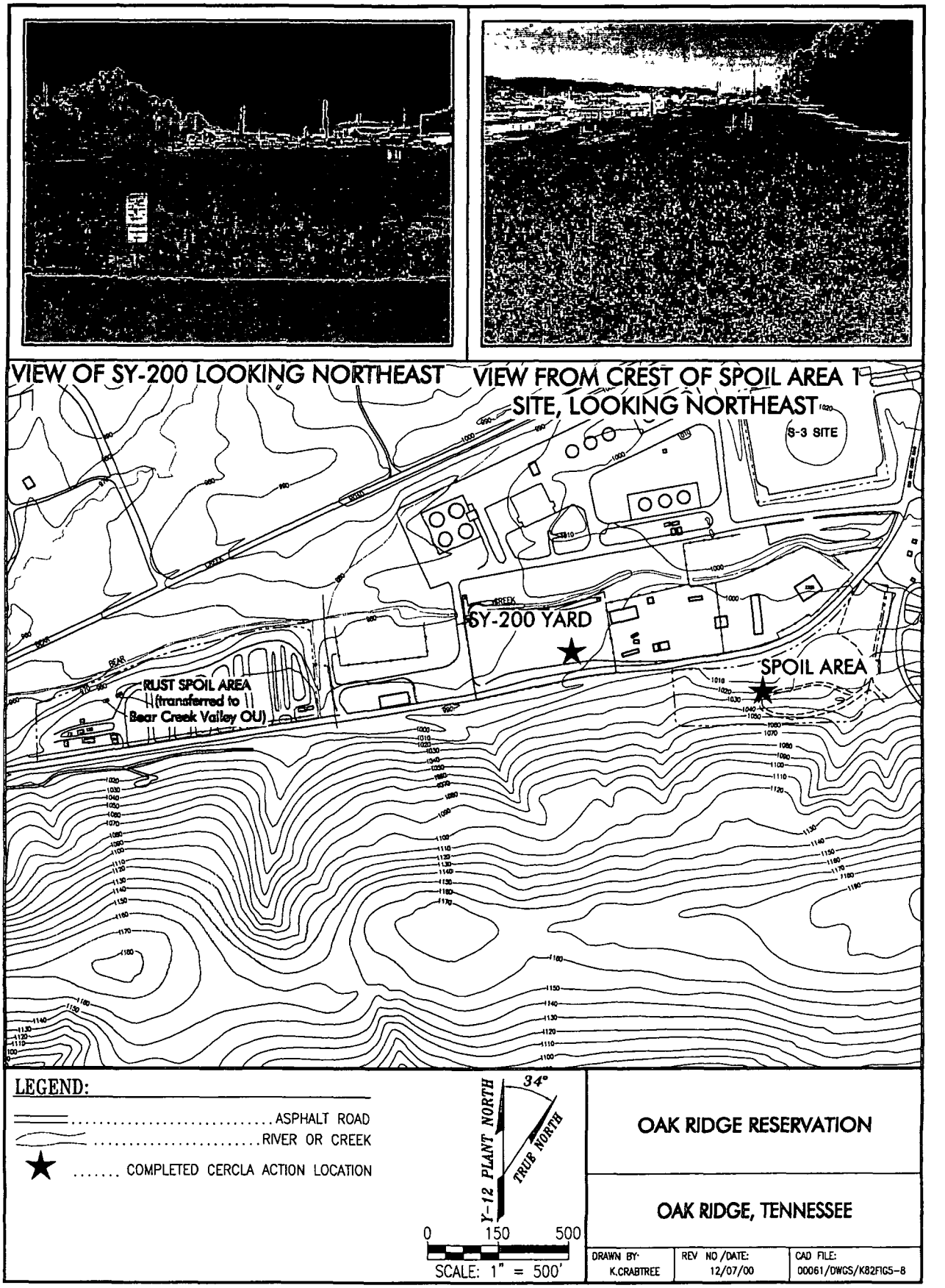


Fig. 5.9. Location of Spoil Area 1 and SY-200 Yard.

Maintaining the soil covers and restricting access to these sites provides the necessary protection of human health and the environment to satisfy CERCLA requirements. Quarterly and monthly inspections indicate no significant problems related to maintenance of physical barriers and signs at these sites. Soil cover and erosion protection features have been maintained intact with only routine maintenance required.

5.3.3 Implementation of Previous Year's Recommendations

No changes were recommended.

5.3.4 Evaluation of Performance and Stewardship Data—Spoil Area 1 and SY 200 Yard Remedial Action

Table 5 4 presents a summary of the Five-Year Review questions and answers for the Spoil Area 1/SY-200 Yard Remedial Action. Further details are provide in subsequent subsections

5.3.4.1 Site visit

A site visit and interview with Mr. Greg Wayland, Facility Manager (BJC), was conducted on October 12, 2000. Separate forms were completed for each site (Appendix A) The SY-200 site is a level area located between Old Bear Creek Road and Bear Creek The portions of the site that are not covered with the parking lot (located at the east end of the site) are covered with mowed grass There are no fences surrounding the site There are signs located on each side indicating that this is a former site in the remediation program, that prior permission is required before working on the site, and that Greg Wayland is the site custodian The bank down to Bear Creek on the north side of the side is covered with rip rap and heavily vegetated There is no sign of erosion Two groundwater wells are located at the west end of the site

There have been no problems with the selected remedy other than initial difficulty in establishing and maintaining vegetative cover Approximately 6 in. of topsoil was added to the site to promote growth of plant cover The site has undergone slight physical modification with the relocation of Old Bear Creek Road, which covers a portion of the south side of the yard, and a gravel parking lot which covers approximately the eastern quarter of the SY-200 Yard. Neither of these changes has resulted in changes to the exposure pathways at the site

The Spoil Area 1 site is a hill with steep banks located south of Old Bear Creek Road on the flank of Chestnut Ridge. The whole site is covered with mowed grass There are no fences surrounding the site. There are signs located on each side indicating that this is a former site in the remediation program, that prior permission is required before working on the site, and that Greg Wayland is the site custodian. There is no sign of erosion of the cap The road providing access to the top of the cap has a locked gate preventing unauthorized access. Two groundwater wells are located at the crest of the SA-1 cap

The only physical modification to the Spoil Area 1 site occurred in the vicinity of a seep located on the north side of SP-1 This seep and the moist soil associated with it presented a hazard to tractors mowing the steep bank of the SP-1 site (i e , from the potential for the tractors to slip on the wet soil) Rip rap was added to the seep to promote drainage and minimize the area of moist soil

Both sites are well maintained, with surveillance and maintenance visits occurring on a quarterly basis and inspections made each month as part of best management practice These activities are documented in inspection reports that are available in the Site Manager's office and sent to the Document Management Center at the end of each fiscal year

Table 5.4. Spoil Area 1 and SY-200 Yard Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	No problems under current operating procedures
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	Site is within Y-12 security fence, and a valid badge is required for access
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Site Visit, Sect 5 3 4 1
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Chemical-specific ARARs addressed for radionuclide air emissions only, no location-specific ARARs
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under government control, portions of SY-200 Yard are now a parking lot
Have new human health or ecological exposure pathways or receptors been identified?	No	
Have new contaminants or contaminant sources been identified?	No	
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	Yes	Portions of SY-200 Yard are now a parking lot (Sect 5 3 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	No	Addressed in the BCV RI/FS
Were there significant changes in the standardized risk assessment methodologies?	No	Addressed in the BCV RI/FS
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	Addressed in the BCV RI/FS
Is the site located in an area subject to natural disasters?	Yes	Low probability of tornadoes or earthquakes

ARAR = applicable or relevant and appropriate requirement
BCV = Bear Creek Valley
FS = feasibility study
RI = remedial investigation
ROD = record of decision
TBC = to be considered

5.3.5 Conclusions and Recommendations

This site will continue to be evaluated in the annual RER and ORR-wide Five-Year Review cycles. In addition, S&M records will be maintained and be publicly available. Should S&M activities identify a change in the protectiveness of the remedy due to a change in the site (other than maintenance issues), then that will be reported in the RER.

5.4 S-3 SITE TRIBUTARY INTERCEPTION REMOVAL ACTION

- AM: June 25, 1998
- AM Addendum October 2000
- Field Activities: In progress
- RmAR: In progress

5.4.1 Project Description

The S-3 Site (Fig. 5.10) originally consisted of four unlined ponds adjacent to the west end of Y-12, just west of the natural groundwater divide between Bear Creek watershed and UEFPC watershed. The ponds were constructed in 1951 and used until 1984 for disposal of depleted uranium-contaminated nitric acid solutions generated by Y-12 operations and other DOE facilities (DOE 1997r).

The RI for Bear Creek Valley identified that uranium-contaminated groundwater resulting from disposal at the S-3 Site discharges via two pathways from shallow groundwater to the main stem of Bear Creek upstream of its confluence with NT-1. This uranium discharge accounted for 17% of the total uranium transported in Bear Creek at the IP in FY 1995, 13% in FY 1999, and 16% in FY 2000.

The S-3 Ponds Tributary interception removal actions is being constructed in three phases:

- The Pathway 1 Reactive Barrier system was constructed beginning in November 1997. Pathway 1 consists of a funnel and gate system featuring an impermeable membrane wall with sand-filled trenches on the up- and down-gradient sides. It focuses groundwater flow on a treatment box located in the center of the configuration.

- The Pathway 2 treatment system trench was installed in November 1997 and modified in May and June 1999 to include a siphon to draw water through the reactive media. The Pathway 2 system features a 350-ft long trench with a middle section filled with zero-valent iron. The downgradient end of the trench is connected to two treatment boxes, also containing zero-valent iron, by a siphon. The siphon serves to draw groundwater into and through the trench and then through the treatment boxes.

- Modifications to the Pathway 1 and Pathway 2 systems to resolve problems and improve performance will be conducted during FY 2001. The proposed modifications include conveying Pathway 1 water to Pathway 2 and installing a pump in the Pathway 2 siphon to allow the system to operate continuously.

Both Pathway 1 and Pathway 2 systems have demonstrated successful treatment of uranium-contaminated groundwater. However, in both systems, flow through the reactive media has been intermittent during FY 2000, and at the end of FY 2000 both systems were not in operation.

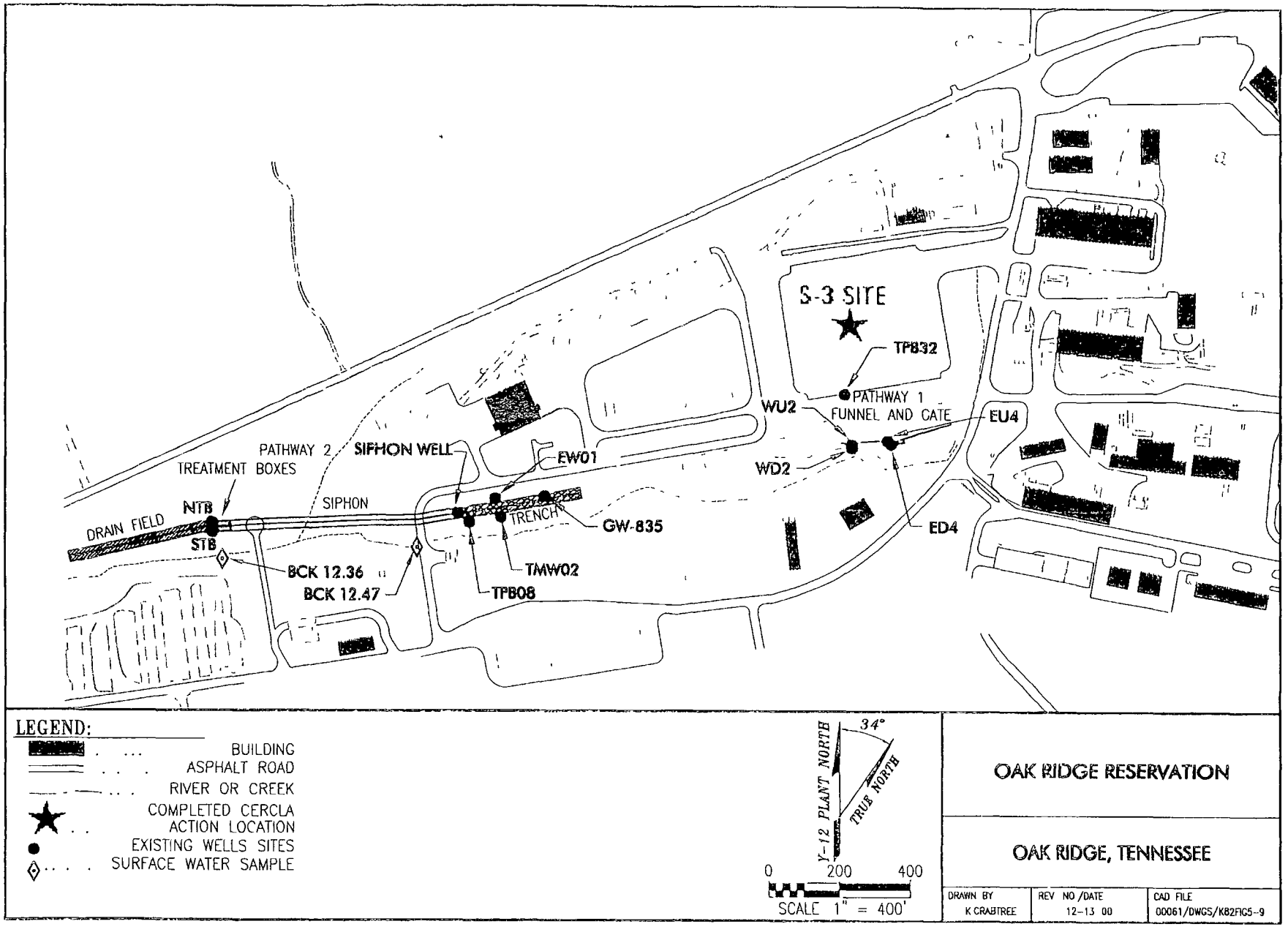


Fig. 5.10. Location of S-3 Site Tributary interception project and monitoring locations.

5.4.2 Decision Document Requirements for Performance and Stewardship

5.4.2.1 Goals of decision

The performance goal of the S-3 Site Tributary Interception Removal Action is to reduce the flux of uranium in Bear Creek that is associated with discharge from shallow groundwater at the S-3 Site Pathways 1 and 2 (Table 1 1) (DOE 1998a)

5.4.2.2 Monitoring and stewardship required

Monitoring for this performance goal, which will be recommended in the RmAR in FY 2001, Proposed Monitoring in the Draft RmAR (DOE 1999g), is as follows (Table 1 2 and Fig 5 10)

- Quarterly sampling at Pathway 1 wells TPB32, EU4, ED4, WU2, and WD2, Pathway 2 wells GW-835, EW01, TMW02, and TPB08, and the Siphon Well These locations will be analyzed for metals, nitrate, VOCs, and uranium Quarterly sampling of well GW-837 is also recommended in the Draft RmAR, however, this well was destroyed during installation of the Pathway 1 treatment system

- Quarterly monitoring for iron at downgradient the North and South Treatment boxes for the Pathway 2 system (sample locations NTB and STB), and immediately downgradient of the iron in the Pathway 1 treatment system. The location of the Pathway 1 sampling point will be determined after alterations to the system have been completed in FY 2001

- Monthly sampling of surface water at BCK 12 47 and BCK 12 36 These samples analyzed for metals, gross alpha, gross beta, nitrate, and anions

- Weekly flow-paced sampling of surface water at BCK 12 47 and BCK 12 36 These samples are analyzed for isotopic uranium only

In addition, watershed-scale monitoring of surface water at BCK 9 47 and SS-5, and biological monitoring at BCK 3 3, BCK 9 9, and BCK 12 4 measure the changes in total uranium flux and changes in the quality of aquatic habitat that are affected by releases from the S-3 Site

5.4.3 Implementation of Previous Year's Recommendations

No changes were recommended

5.4.4 Evaluation of Baseline Data for FY 2000

During the first year of operation of the S-3 Site Tributary Interception System, the Geosyphon did not function as originally planned, and intermittent flow through the iron fillings was achieved only between December 6, 1999, and July 15, 2000 The initial removal action was redesigned during FY 2000, and the resultant modifications will be completed early in FY 2001 Therefore, this is an action in progress However, 210,000 gallons of groundwater were processed through this system in FY 2000, and data from the first year of monitoring are available and are presented here

Surface water and groundwater at the S-3 Site Tributary Interception Site were monitored during FY 2000 Uranium is the target contaminant of concern for the tributary interception, and results for

monitoring of uranium in surface water in Bear Creek are presented in Table 5.5. Table 5.5 also includes results of monitoring for cadmium, which is an ecological contaminant of concern at the S-3 Site, and for iron, which is a potential byproduct of the remediation system. Figures 5.11 and 5.12 depict the results from Table 5.5 for uranium and cadmium, respectively. Tables 5.6, 5.7, and 5.8 present the results of groundwater monitoring and monitoring of the treatment system for uranium and cadmium.

The following observations from these monitoring data can be made:

- The concentration of uranium at BCK 12.47 is greater than that at BCK 12.34. These results are consistent with results from the RI in 1994–95 and from samples taken during the S-3 Site treatability study (Energy Systems 1997). Flow-paced samples could not be taken at BCK 12 47 during this time period for two reasons. First, flow backup for Beaver Dams on upper Bear Creek restricted the location where flow could be reserved. Second, this location proved to be difficult to measure flow reliability with the available equipment. New equipment has been installed and flow will be reviewed in FY 2001.

- The concentration of uranium at BCK 12 47 was consistently lower in the second half of FY 2000 (May 31 through October 4, 2000, average concentration = 374 μg/L) than in the first half (January 27 through May 17, 2000, average concentration = 616 μg/L) This is opposite the typical observation that concentrations of contaminants in surface water are relatively elevated during the summer months compared to winter months. In addition, this is lower than the average value of 460 μg/L for samples at BCK 12 47, taken between 1997 and 1999.

- Cadmium concentrations are lower at BCK 12 47 compared to BCK 12 34. This indicates most cadmium at BCK 12.34 is derived from NT-1, not from the upper reach of Bear Creek.

- Cadmium concentrations at BCK 12.34 exceeded the maximum concentration criterion for cadmium (3.9 μg/L) 12 times during FY 2000, and 69% of samples exceeded the continuous concentration criterion (1.1 μg/L). These results are reflected in the biological monitoring results from BCK 12 4 (Fig. 5.6) that show that aquatic biota populations and species diversity are impacted at this site compared to sites downstream in Bear Creek and at reference sites.

- Iron concentrations are lower at BCK 12 47 than at BCK 12.34

- Uranium and cadmium concentrations in the effluent streams from both treatment boxes are lower than the concentrations in the Siphon Well (input stream for the treatment boxes) These data indicate that both these metals are removed from the groundwater by the treatment process The removal rate for uranium averaged 98% during FY 2000 Iron concentrations in the treatment box effluent were elevated in each of the sampling events. However, this has not impacted surface water in upper Bear Creek.

The observations of uranium and cadmium distribution are consistent with conclusions made in the RI that NT-1 is the principal source of cadmium at BCK 12.34, and that the main stem of Bear Creek above NT-1 is the principal source for uranium at BCK 12.34. Although the FY 2000 data show a decrease in concentration of uranium in Bear Creek during the second half of the year and a lower average concentration than the previous year's samples, it is probably too early to identify this as a result of treatment of uranium-contaminated groundwater at the S-3 Site The results do indicate that the treatment system has not impacted surface water with elevated iron concentrations and that the treatment system is removing uranium from the groundwater with an efficiency of 98%

Table 5.5. Results for uranium, cadmium, and iron monitoring in Bear Creek adjacent to the S-3 Site during FY 2000

Date	Uranium concentrations (µg/L)								Cadmium concentrations (µg/L)				Iron concentrations (µg/L)			
	BCK 12.34				BCK 12.47				BCK 12.34		BCK 12.47		BCK 12.34		BCK 12.47	
10/06/1999	150	+/-	10	=					9.9	=			11.1	=		
10/13/1999	140	+/-	10	=					1.9	U			0.3	J		
10/20/1999	210	+/-	10	=					10.0	=			11.2	=		
10/21/1999	230	+/-	10	Q					10.0	Q			12.6	Q		
10/27/1999	230	+/-	10	=					10.0	=			11.5	=		
11/03/1999	160	+/-	10	=					6.1	=			6.0	=		
11/10/1999	170	+/-	10	=					1.6	=			1.3	=		
11/17/1999	180	+/-	10	=												
11/23/1999	210	+/-	10	=					1.3	=			0.0	J		
11/24/1999	210	+/-	10	=												
12/01/1999	120	+/-	8	=												
12/08/1999	170	+/-	10	=					3.7	=			1.3	=		
12/15/1999	140	+/-	10	=					1.4	=			0.2	=		
12/22/1999	200	+/-	8	=					1.5	=			0.5	=		
12/27/1999	200	+/-	8	=					3.2	=			0.1	=		
12/29/1999	210	+/-	9	=					10.0	=			3.7	=		
01/05/2000	90	+/-	2	=					3.4	=			1.9	=		
01/12/2000	90	+/-	5	=					0.6	J			0.4	=		
01/19/2000	130	+/-	6	=					1.1	=			0.3	=		
01/26/2000	210	+/-	9	=					2.3	=			0.8	=		
01/27/2000	180	+/-	8	=	480	+/-	10	=	2.8	=	0.2	J	0.1	=	0.2	=
02/02/2000	240	+/-	10	=					4.5	=			0.6	=		
02/09/2000	180	+/-	7	=	570	+/-	20	=	3.5	=	0.2	J	0.4	=	0.1	=
02/16/2000	80	+/-	3	=					2.1	=			1.4	=		
02/23/2000	80	+/-	3	=					0.6	J			0.9	=		
02/24/2000	170	+/-	7	=	560	+/-	20	=	4.2	=	0.2	J	0.3	=	0.2	=
03/01/2000	141	+/-	5	=	565	+/-	21	=	1.8	=	0.1	J	1.2	=	0.1	=
03/08/2000	108	+/-	4	=	721	+/-	24	=	0.4	J	0.1	U	0.3	=	0.1	=
03/15/2000	274	+/-	10	=	819	+/-	15	=	1.6	=	0.1	J	0.2	=	0.1	=
03/22/2000	90	+/-	3	=	637	+/-	21	=	0.7	J	0.1	J	0.8	=	0.1	=
03/29/2000	124	+/-	4	=	548	+/-	17	=	1.3	U	0.1	U	0.7	=	0.1	=
04/05/2000	64	+/-	2	=					1.3	=			1.6	=		
04/12/2000	151	+/-	5	=					0.3	J			0.2	=		
04/19/2000	163	+/-	5	=	637	+/-	21	=	0.5	J	0.1	J	0.2	=	0.0	=
04/26/2000	166	+/-	5	=					2.7	=			1.6	=		
04/27/2000	328	+/-	10	=	682	+/-	21	=	1.4	=	0.1	U	0.3	=	0.0	=
05/03/2000	241	+/-	8	=					3.9	=			0.6	=		
05/17/2000	215	+/-	7	=	561	+/-	18	=	6.9	=	0.2	J	3.7	=	0.1	=
05/24/2000	56	+/-	2	=					1.4	=			0.9	=		
05/31/2000	56	+/-	2	=	161	+/-	5	=	0.1	J	0.6	J	0.2	=	1.6	=
05/31/2000	187	+/-	6	=					0.8	J			0.1	=		
06/07/2000	62	+/-	2	=					0.2	J			0.4	=		
06/13/2000	284	+/-	6	=					0.7	J			0.1	=		
06/14/2000	129	+/-	4	=					1.7	=			1.1	=		
06/21/2000	158	+/-	5	=	484	+/-	16	=			0.1	U			0.0	=
06/28/2000	98	+/-	3	=	490	+/-	17	=	1.7	=	0.6	J	0.5	=	1.9	=
07/05/2000	69	+/-	2	=					0.6	J			0.3	=		
07/12/2000	170	+/-	6	=												
07/26/2000	116	+/-	4	=	326	+/-	10	=			0.1	J			0.1	=
07/27/2000	159	+/-	5	=	299	+/-	10	=	0.5	J	0.1	J	0.1	=	0.0	=
08/02/2000	104	+/-	3	=					4.5	=			2.2	=		
08/09/2000	146	+/-	5	=	373	+/-	13	=	7.8	=	0.2	J	4.4	=	0.2	=
08/16/2000					357	+/-	12	=			0.1	J			0.2	=
08/17/2000	177	+/-	6	=	360	+/-	11	=	0.8	J	0.1	U	0.1	=	0.1	=
08/23/2000					262	+/-	8	=			0.1	U			0.1	=
08/30/2000					368	+/-	13	=			0.1	U			0.1	=

Table 5.5. Results for uranium, cadmium, and iron monitoring in Bear Creek adjacent to the S-3 Site during FY 2000 (continued)

Date	Uranium Concentrations (µg/L) BCK 12.34	Uranium Concentrations (µg/L) BCK 12.47	Cadmium Concentrations (µg/L) BCK 12.34	Cadmium Concentrations (µg/L) BCK 12.47	Iron Concentrations (µg/L) BCK 12.34	Iron Concentrations (µg/L) BCK 12.47
09/06/2000		334 +/- 12 =		0.1 U		0.1 =
09/25/2000	74 +/- 3 =		2.6 =		0.2 =	
09/27/2000		417 +/- 14 =		1.0 U		0.2 =
09/28/2000		505 +/- 20 =		1.0 U		0.3 =
10/04/2000		506 +/- 17 =				

= - Detected at value shown
BCK - Bear Creek kilometer
FY - fiscal year
J - Estimated value
U - Not detected

Table 5.6. Results for uranium monitoring at the S-3 Site Tributary Interception Removal Action during FY 2000

Station	Total Uranium (µg/L) Q1	Q2	Q3	Q4
		Pathway 1		
ED4	30 +/- 0.74	140 +/- 5.79	156 +/- 4.94	94.2 +/- 3.05
EU4	40 +/- 2.76	160 +/- 6.03	337 +/- 10.7	326 +/- 10.4
WD2	70 +/- 5.82	400 +/- 10	370 +/- 10	175 +/- 5.58
WU2	940 +/- 60	980 +/- 30	1560 +/- 50	NA
		Pathway 2		
GW-835	1040 +/- 60	730 +/- 20	1050 +/- 33	883 +/- 38.4
EW01	780 +/- 50	790 +/- 20	NA	1540 +/- 52.9
TMW02	6.61 +/- 0.16	8.89 +/- 0.14	8.02 +/- 0.1	0.374 +/- 0.0554
TPB08	390 +/- 30	320 +/- 10	353 +/- 11.5	336
		Pathway 2 Treatment System		
Siphon Well	100 +/- 7.93	40 +/- 1.88	105 +/- 3.4	241 +/- 8.39
North Treatment Box	7.54 +/- 0.17	NA	0.702 +/- 0.02	0.881 +/- 0.0319
South Treatment Box	0.631 +/- 0.02	0.885 +/- 0.02	0.538 +/- 0.01	NA

FY = fiscal year
NA = not available

Table 5.7. Results for cadmium monitoring at the S-3 Site Tributary Interception Removal Action during FY 2000

	Cadmium (µg/L)			
Station	**Q1**	**Q2**	**Q3**	**Q4**
		Pathway 1		
ED4	0.19J	0.14J	0.1U	0.08U
EU4	0.15J	0.08U	0.1U	0.12J
WD2	0.22J	0.21J	0.1U	0.08U
WU2	0.31J	0.16J	0.1U	0.22J
		Pathway 2		
GW-835	10=	8=	4.5=	8.9=
EW01	0.1U	0.1J	0.1U	0.14J
TMW02	0.1U	0.08U	0.1U	0.08U
TPB08	10=	10=	9.7=	11.2=
		Pathway 2 Treatment System		
SIPHON WL	0.1U	0.31J	0.12J	0.17J
North Treatment Box	0.1U	0.08U	0.1U	0.08U
South Treatment Box	0.1U	0.08U	0 1U	0.08U

= - Detected at value shown
FY - fiscal year
J - Estimated value
U - Not detected

Table 5.8. Results for iron monitoring at the S-3 Site Tributary Interception Removal Action during FY 2000

	Iron (mg/L)			
Station	**Q1**	**Q2**	**Q3**	**Q4**
		Pathway 1		
ED4	33.8=	17.3=	16.3=	16.7=
EU4	17=	6.95=	6.49=	11.2=
WD2	23.4=	22.6=	21.5=	25.9=
WU2	21.4=	12.7=	6.01=	6.74=
		Pathway 2		
GW-835	0.05=	0.0016U	0.0037J	0.0237=
EW01	4.33=	0.78=	4.26=	2.93=
TMW02	0.01=	0.04=	0.0345=	0.0041U
TPB08	67.3=	28=	40.9=	59.3=
		Pathway 2 Treatment System		
SIPHON WL	0.07=	0.0045J	0.0194=	0 0041U
NTB	28.6=	8.04=	9.35=	0.271=
STB	0.8=	0.7=	3 55=	0.0421=

= - Detected at value shown
FY - fiscal year
J - Estimated value
U - Not detected

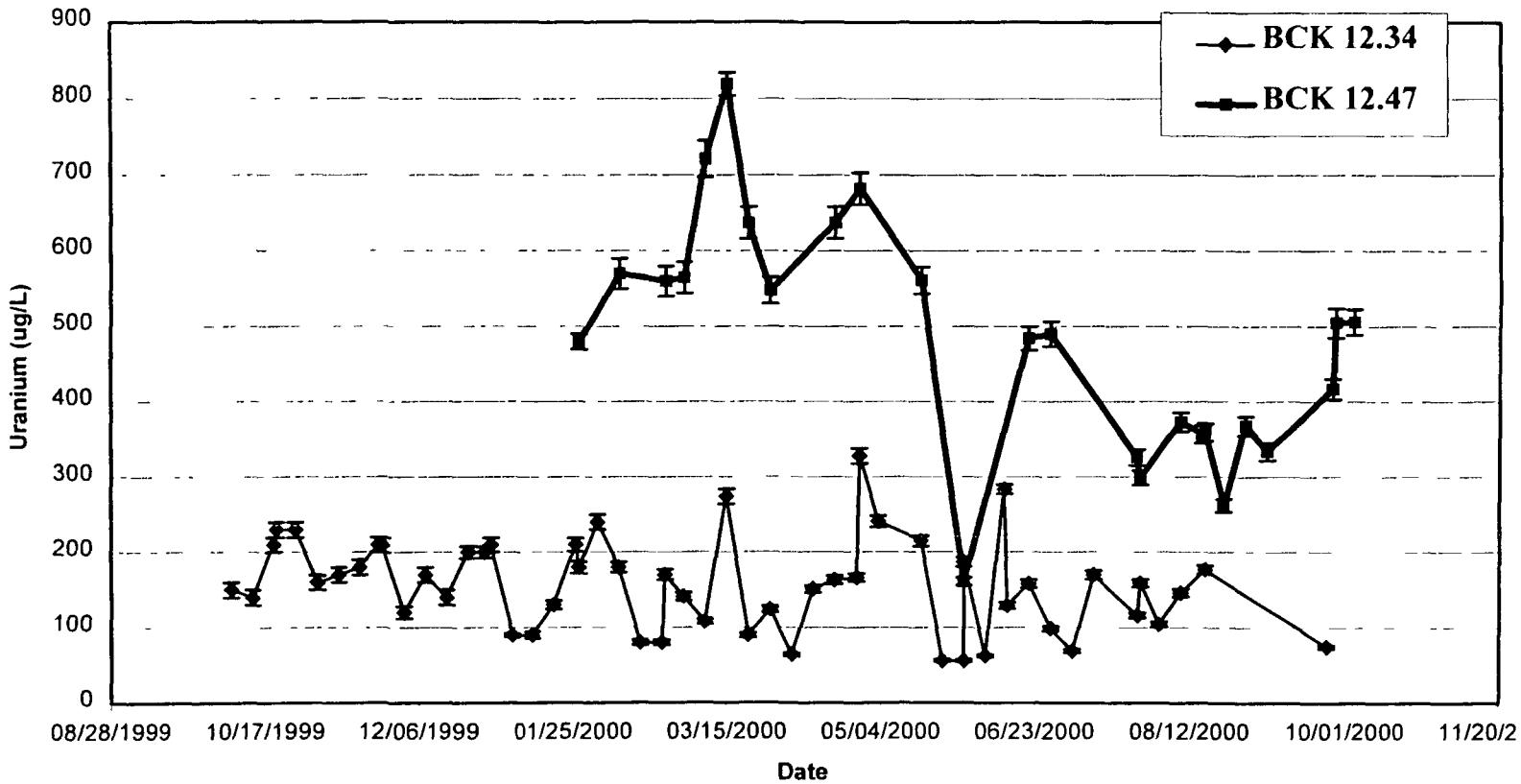
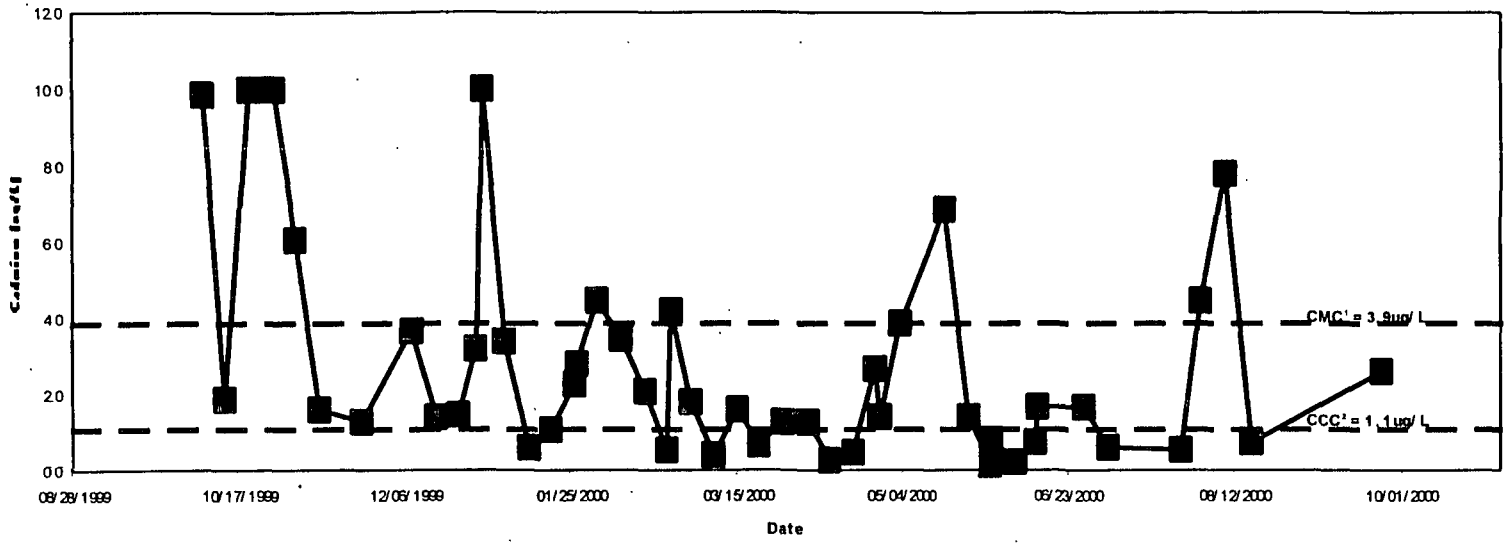


Fig. 5.11. Uranium concentrations in Bear Creek adjacent to the S-3 Site during FY 2000.



[1]CMC = The highest concentration to which aquatic life can be exposed for a 1-hour average time period.
[2]CCC = The highest concentration to which aquatic life can be exposed in a 4-day time period.

Fig. 5.12. Cadmium concentrations in Bear Creek adjacent to the S-3 Site during FY 2000.

5.5 PHASE I BEAR CREEK VALLEY RECORD OF DECISION

- ROD — July 2000 (D4)
- Field Activities Completed — In progress

5.5.1 Project Description

The selected remedy cited in the Phase I Bear Creek Valley ROD involves specific actions at four facilities in Bear Creek Valley (Fig 5 1) the S-3 Site, the BYBY, the Oil Landfarm Soil Containment Pad, and the Disposal Area Remedial Action (DARA) facility Specifically the following actions are listed in the ROD (DOE 2000e)

- **S-3 Site.** Install trench at NT-1 for passive in situ treatment of shallow groundwater

- **Oil Landfarm Area.** Excavate source areas in BYBY and contaminated floodplain soils and sediments for on-site disposal of excavated materials meeting WAC of the ORR on-site disposal facility Materials exceeding on-site disposal facility WAC will be disposed off-site

  - Remove waste stored in Oil Landfarm Soil Containment Pad for commercial off-site disposal, and dismantle structure
  - Install clay cap over uncapped disposal areas at BYBY, and maintain existing caps
  - Implement hydraulic isolation measures at BYBY, including reconstruction of NT-3, elimination of stagnation points, and installation of drains or well points

- **Other Sites** Remove waste stored in the DARA facility for off-site disposal, and dismantle structure

In FY 2000, field activities under this ROD were started at the BYBY Specifically, the following actions were initiated in FY 2000 and were completed early in FY 2001

- The section of NT-3 immediately downstream of the haul road was regraded to promote flow in the channel and prevent ponding

- A drain was installed at the north end of BYBY to prevent groundwater flow into BYBY

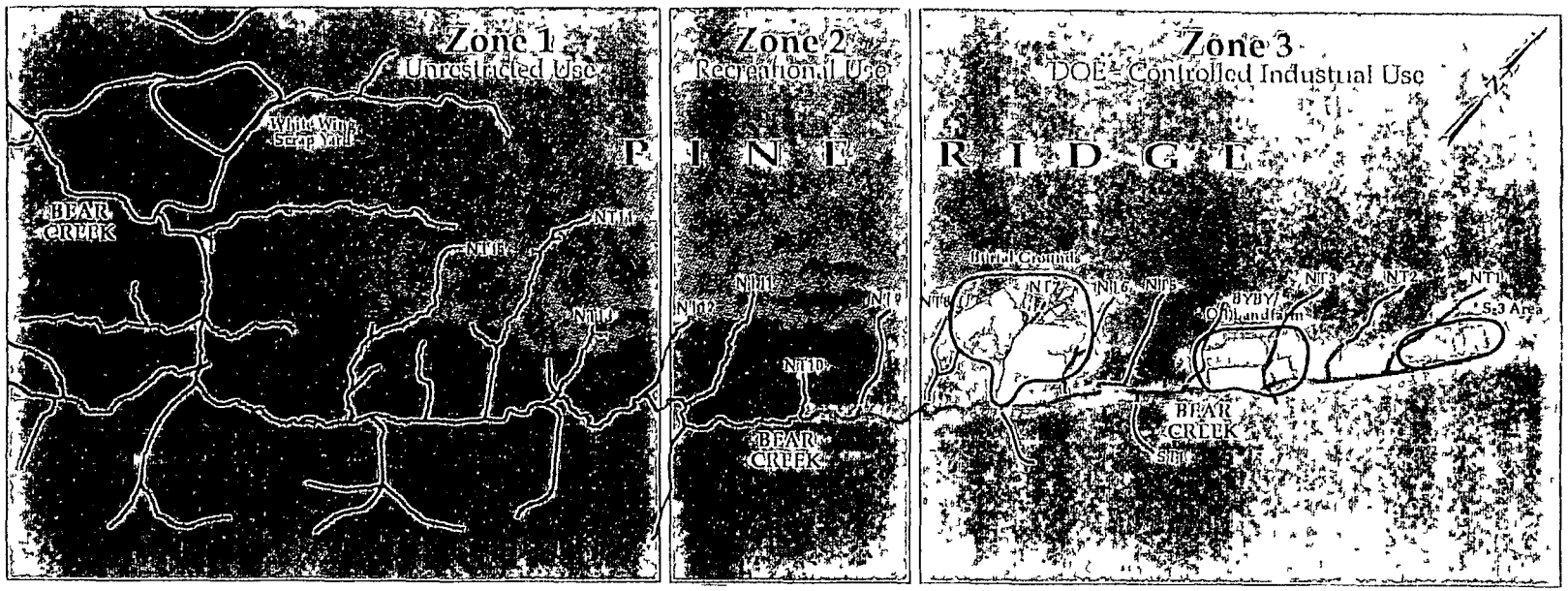
- Drains for the HCDA cap were extended so that runoff from the cap flows directly into NT-3

- The structure at the Oil Landfarm Containment Pad was dismantled, the soil pile was removed and disposed offsite, and the Pad was dismantled

5.5.2 Evaluation of Decision Document Requirements for Performance and Stewardship

5.5.2.1 Goals of decision

The ROD lists specific performance standards of the selected remedy and the expected outcome of the selected remedy (Table 5 9) against which effectiveness will be measured In addition to these specific performance standards for the selected remedy, the ROD also addresses groundwater and surface water by dividing the valley into three zones and establishing agreed-upon goals for each (Fig 5 13) The agreed-upon goals for groundwater and surface water in Bear Creek Valley are shown in Table 5 10



Disposal Area

Reaches of the creek exceeding AWQCs

Area with groundwater exceeding MCLs

Fig 5 13 Bear Creek Valley Zones 1, 2, and 3 as defined in the Phase I ROD

Table 5.9. Performance standards for the selected remedy (DOE 2000e)

Remedy component	Boneyard/Burnyard	S-3 Ponds Pathway 3
Performance standard (surface water)	Uranium flux = 4 3 kg/year Mercury = 51 ng/L	Uranium flux = 27 2 kg/year Cadmium = 3 9 µg/L Nitrates = 40% seasonal reduction (benchmark to be determined)
Technology performance standard	Excavation – 36,000 yd^3 Excavate to native soils plus up to 18 in	Reactive barrier trench (metal filings) 40% removal of nitrate Removal of cadmium to meet AWQC
Monitoring locations (surface water)	In NT-3 at confluence with Bear Creek	BCK 12 34
Compliance time frames	5 years	2 years
Residual risk/hazard index		1×10^{-7}/1 0
Compliance point		BCK 9 47

Source DOE 2000e
AWQC = ambient water quality criteria
BCK = Bear Creek kilometer

Table 5.10. Groundwater and surface water goals, Bear Creek Valley, Y-12 Plant, Oak Ridge, Tennessee (DOE 2000e)

Area of the valley[a]	Pre-ROD situation	Agreed-upon goal
Zone 1—western half of Bear Creek Valley	No unacceptable risk posed to a resident or a recreational user AWQC and groundwater MCLs are not exceeded	Maintain clean groundwater and surface water so that this area continues to be acceptable for unrestricted use Land use unrestricted
Zone 2—a 1-mile-wide buffer zone between Zones 1 and 3	No unacceptable risk posed to a recreational user Risk to a resident is within the acceptable risk range except for a small area of groundwater contamination Groundwater MCLs are exceeded, but AWQC are not	Improve groundwater and surface water quality in this zone consistent with eventually achieving conditions compatible with unrestricted use Land use recreational (short-term), unrestricted (long-term)
Zone 3—eastern half of Bear Creek Valley	Contains all the disposal areas that pose considerable risk Groundwater MCLs and AWQC are exceeded	Conduct source control actions to (1) achieve AWQC in all surface water, (2) improve conditions in groundwater to allow Zones 1 and 2 to achieve the intended goals, and (3) reduce risk from direct contact to create conditions compatible with future industrial use Land use controlled industrial

Source DOE 2000e
[a]See Fig 5 13
AWQC = ambient water quality criteria
MCL = maximum contaminant level
ROD = record of decision

These goals focus on preservation of groundwater and surface water quality in Zone 1 of Bear Creek Valley and attaining improvements in water quality in Zones 2 and 3 of Bear Creek Valley Although final remediation goals for groundwater are deferred to future CERCLA decision documents, the specific remedies in the Phase I ROD will help to achieve the agreed-upon goals through reduction of mass flux from the source areas. The effectiveness of the specific Phase I actions in achieving all or part of the agreed-upon goals will be evaluated through environmental monitoring

The objectives for remedial actions in the Bear Creek watershed are targeted to reduce the total mass of contaminants migrating from sources to tributaries to Bear Creek and, therefore, the total mass of contaminants migrating in the exit pathway A sufficient reduction in mass flux of contaminants from the source sites will relate to reduced concentrations of contaminants in the exit pathway surface water and groundwater. For this reason, although the Phase I ROD does not include numeric performance standards for groundwater, there are expectations of improvement in groundwater quality such that agreed-upon goals for groundwater can be met These agreed-upon goals focus on preservation of the existing quality of groundwater and surface water in Zone 1, which currently is in compliance with MCLs and AWQCs, and attaining improvements in water quality in Zones 2 and 3 (Table 5 10)

5.5.2.2 Monitoring and stewardship requirements

The specific monitoring requirements to meet the performance standards of the selected remedy are listed in Table 5 9 In addition, the following text from the ROD identifies specific monitoring requirements for the monitoring plan (DOE 2000e)

- Selected Remedy—Performance Monitoring (p 2-69 of DOE 2000e) *"Monitoring of surface water will include reaches of Bear Creek and its tributaries that have historically exceeded AWQC (i e Upper Bear Creek, NT-1, NT-3)"*

- Selected Remedy—Performance Monitoring (p 2-69 of DOE 2000e) *"Surface water will be monitored for COCs in Bear Creek below the confluence with NT-1, Bear Creek upstream and downstream of the confluence with NT-3, and within NT-3"*

The proposed monitoring locations and schedule for parameters that satisfy the monitoring requirements, allowing for evaluation of the effectiveness of the selected remedy in meeting the performance standards, are contained in the Draft Bear Creek Valley Remedial Design Work Plan (RDWP) (DOE 2000g) and are listed in Table 5 11

The proposed monitoring requirements for measuring the performance of the selected remedy against the agreed-upon goals are also contained in the Draft Bear Creek Valley RDWP and listed in Table 5 12 These goals include preserving groundwater in Zone 1 and achieving improvement of groundwater quality in Zones 2 and 3 (Table 5 10) The monitoring locations, and the schedule for parameters that satisfy the monitoring requirements and will allow for evaluation of the effectiveness of the selected remedy in meeting the performance standards, are listed in Table 5 12

Following implementation of the remedial action, monitoring and enforcement of use restrictions on groundwater and surface water will be conducted as part of the Y-12 site-wide S&M and water quality programs pending the completion of future CERCLA decisions Current land use restrictions in Bear Creek Valley (i e , controlled industrial land use in Zone 3 and access restrictions in Zones 1 and 2) will be maintained, together with any additional restrictions that may be needed to achieve the land use objectives identified in the ROD

Table 5.11. Proposed monitoring locations and schedule for parameters to meet the performance standards of the selected remedy from the Bear Creek Valley RDWP (DOE 2000)

Site	Bear Creek Valley ROD goal	Site and performance standard	Monitoring location	Schedule and parameters
BYBY	Risk reduction at the compliance point	Uranium flux ≤4 3 kg/year	NT-3	Continuous flow-paced monitoring for uranium
BYBY	Meet AWQC in surface water	Mercury concentration ≤51 ng/L	NT-3	Monthly grab samples for mercury and metals (including calcium)
S-3 Ponds Pathway 3	Risk reduction at the compliance point	Uranium flux ≤27 2 kg/year	BCK 12 34	Continuous flow-paced monitoring for uranium
S-3 Ponds Pathway 3	Meet AWQC in surface water	Cadmium concentration ≤3 9 μg/L	BCK 12 34	Monthly grab samples for metals (including cadmium and calcium)
S-3 Ponds Pathway 3	Risk reduction at the compliance point	Nitrate – 40% seasonal reduction	BCK 12 34	Continuous flow-paced monitoring for nitrate
S-3 Ponds Pathway 3	Risk reduction at the compliance point	Nitrate – 40% seasonal reduction	NT-2	Continuous flow-paced monitoring for nitrate
Phase I ROD	ROD p 2-69 *Monitoring of surface water will include reaches of Bear Creek and its tributaries that have historically exceeded AWQC (i e , Upper Bear Creek, NT-1, NT-3)*	Cadmium concentration ≤3 9 μg/L, mercury concentration ≤51 ng/L	BCK 12 34, NT-1, and NT-3	Monthly grab samples for mercury and metals (including cadmium and calcium)
Phase I ROD	ROD p 2-69 *Surface water will be monitored for COCs in Bear Creek below the confluence with NT-1, Bear Creek upstream and downstream of the confluence with NT-3 and within NT-3*	Uranium metal, isotopic uranium, and nitrate	BCK 12 34, BCK 11 59, BCK 11 97, and NT-3	Monthly grab samples for isotopic uranium, nitrate (all sites except NT-3), and instantaneous flow
Phase I ROD	Risk reduction at the compliance point	Uranium flux ≤34 kg/year[a]	BCK 9 47 and SS-5 combined[b]	Continuous flow-paced monitoring for uranium

[a] A flux of 34 kg/year is equivalent to a residual human health risk of 1×10^{5} The expected post-action flux is expected to be 16 5 kg/year (Table 2 19 in Phase I ROD)

[b] Current plans are to relocate the IP downstream of BCK 9 47 to location BCK 9 2 Surface water monitoring since the RI indicates that there may be underflow of the monitoring locations at BCK 9 47 and SS-5 that is captured at BCK 9 2

AWQC = ambient water quality criteria
BYBY = Boneyard/Burnyard
COC = contaminant of concern
IP = integration point
RDWP = Remedial Design Work Plan
RI = remedial investigation
ROD = record of decision

Table 5.12. Proposed monitoring locations and schedule for parameters to measure the performance standards of the selected remedy against the agreed-upon goals from the Bear Creek Valley RDWP (DOE 2000)

Zone	Bear Creek Valley ROD goal	Monitoring locations	Schedule and parameters
Zone 1	MCLs in groundwater	Groundwater in Picket W wells and water in springs in Zone 1	Semiannual grab samples for nitrate, metals, and VOCs
Zone 1	AWQC in surface water	Surface water at BCK 3 3, BCK 4 55, and BCK 7 87	Semiannual grab samples for metals (including calcium) and anions (hardness)
Zone 1	Risk to residential receptor below RAO of 1×10^{-5}	Groundwater in Picket W wells (GW-712, GW-713, GW-714, and GW-715), water in springs in Zone 1 (SS-6, SS-6 6, SS-7, and SS-8), surface water at BCK 3 3, BCK 4 55, and BCK 7 87, and biota at BCK 3 3	Semiannual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc Bioaccumulation of Hg, metals, and PCBs in fish [one species stoneroller minnows (whole body)]
Zone 1	Preserve groundwater and surface water	Biota monitoring at BCK 3 3	Fish community and benthic macroinvertebrate community species diversity and density
Zone 2	AWQC in surface water	Surface water at BCK 7 87 and BCK 9 47	Semiannual grab samples for metals (including calcium) and anions (hardness)
Zone 2	Risk to residential receptor below RAO of 1×10^{-5}	Groundwater in Picket A wells (GW-684 and GW-683) and wells on the integration plane in the Nolichucky Shale (GW-079, GW-080, GW-077, and GW-078), surface water at BCK 7 87, BCK 9 47, and SS-5[a], and Biota at BCK 9 9	Semiannual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc Bioaccumulation of Hg, metals, and PCBs in fish [one species stoneroller minnows (whole body)]
Zone 1	Improve groundwater and surface water consistent with eventually achieving conditions compatible with unrestricted use	Biota monitoring at BCK 9 9	Fish community and benthic macroinvertebrate community species diversity and density
Zone 3–S-3 Site Pathways 1 and 2	Impacted surface water will be restored (reduce uranium flux to Bear Creek)	Pathway 1 wells TPB 32, EU4, ED4, WU2, WD2, sample point within or downgradient of iron filings[b]	Quarterly grab samples for metals (ICP), nitrate, total uranium, isotopic uranium, VOCs, Fe^{+2}, water quality parameters, fluoride bicarbonate, water levels
		Pathway 2 Wells GW-835, EW01, TMN02, siphon well, TPB08, North and South Boxes	Quarterly grab samples for metals (ICP), nitrate, total uranium, isotopic uranium VOCs, Fe^{+2}, water quality parameters, fluoride bicarbonate, water levels

Table 5.12. Proposed monitoring locations and schedule for parameters to measure the performance standards of the selected remedy against the agreed-upon goals from the Bear Creek Valley RDWP (DOE 2000g) (continued)

Zone	Bear Creek Valley ROD Goal	Monitoring Locations	Schedule and parameters
Zone 3–S-3 Site Pathways 1 and 2 (continued)		BCK 12.47 and BCK 12.34	Continuous flow monitoring with flow-paced composite samples (weekly) for metals, nitrate, total uranium, and isotopic uranium. Monthly grab samples for sulfate, chloride, fluoride, bicarbonate, nitrate, gross alpha, gross beta, ^{99}Tc, VOCs, and water quality parameters
Zone 3–S-3 Site Pathway 3	Meet AWQC in surface water	Refer to Table 5 11	
Zone 3–S-3 Site Pathway 3	Direct exposure risk to industrial/terrestrial receptors eliminated	Surface water at NT-1 and BCK 12.34 Biota monitoring at BCK 12.4	Semiannual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc Fish community and benthic macroinvertebrate community species diversity and density
Zone 3–S-3 Site Pathway 3	Risk to industrial receptor below RAO of 1×10^{-5}	Surface water at NT-1 and BCK 12 34	Semiannual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc
Zone 3–S-3 Site Pathway 3	Reduce seasonal nitrate flux at NT-1 Bear Creek confluence by 40%	Refer to Table 5.11	
Zone 3–BYBY	Meet AWQC in surface water	Refer to Table 5.11	
Zone 3–BYBY	Risk to industrial receptor below RAO of 1×10^{-5}	Surface water at NT-3	Semiannual grab samples for metals, anions, VOCs, isotopic uranium, and ^{99}Tc
Zone 3–Groundwater	Improvement in groundwater quality to allow achievement of numeric goals for Zones 1 and 2	Groundwater at Picket B wells (GW-704 and GW-706) and surface water at SS-4	Semiannual grab samples for nitrate, metals, anions, VOCs, isotopic uranium, and ^{99}Tc

[a]Current plans are to relocate the IP downstream of BCK 9 47 to location BCK 9 2 Surface water monitoring since the RI indicates that there may be underflow of the monitoring locations at BCK 9 47 and SS-5 that is captured at BCK 9 2

[b]Location of sampling point to be determined after completion of system alterations in FY 2001

AWQC = ambient water quality criteria
BCK = Bear Creek kilometer
BYBY = Boneyard/Barnyard
FY = fiscal year
ICP = inductively coupled plasma
IP = integration point
MCL = maximum contaminant level
NT = North Tributary
PCB = polychlorinated biphenyl
RAO = remedial action objectives
RDWP = remedial design work plan
VOC = volatile organic compound

5.5.3 Implementation of Previous Year's Recommendations

This is the first year of the ROD

5.5.4 Evaluation of Performance and Stewardship Data

Action is in progress, table will be included in subsequent RERs

6. CERCLA ACTIONS IN UEFPC WATERSHED

This chapter presents the remedial effectiveness evaluation and Five-Year Review for CERCLA actions in the UEFPC watershed. The actions are summarized in Table 6.1 and locations of the actions are shown on Fig. 6.1. The UEFPC administrative watershed encompasses (1) Y-12, extending from the west end of the facility eastward to Scarboro Road, and (2) the Chestnut Ridge hydrogeologic regime, located on the southern slope of Chestnut Ridge (Fig. 1.2). Although the Chestnut Ridge hydrogeologic regime is

Table 6.1. Completed CERCLA actions in UEFPC Watershed

CERCLA action	CERCLA areas	Decision document date signed	Action status	Monitoring required
Five-Year Review Sites				
United Nuclear Corporation Disposal Site Remedial Action	United Nuclear Landfill	ROD June 28, 1991	Remedial action complete, surveillance and maintenance ongoing	Yes
Mercury Tanks Interim Remedial Action	Tank 2100-U Tank 2101-U Tank 2104-U	IROD September 26, 1991	Remedial action complete	No
Plating Shop Container Areas NFA	Building 9401-2 East Yard Accumulation Area Building 9401-2	ROD September 30, 1991	No Further Action, no 5-year review required	No
UEFPC OU 2	Abandoned Nitric Acid Pipeline	ROD September 12, 1994	No Further Action	No
Kerr Hollow Quarry Remedial Action	Kerr Hollow Quarry	ROD September 29, 1995	Closure under RCRA/CERCLA, No Further Action approved Institutional control, surface water and RCRA detection monitoring	Yes
Filled Coal Ash Pond/ Upper McCoy Branch Remedial Action	Filled Coal Ash Pond (McCoy Branch)	ROD February 21, 1996	Remedial action complete RAR approved May 29, 1997	Yes
Building 9201-4 Exterior Process Piping	Building 9201-4	AM August 25, 1997	Removal action complete RmAR approved September 29, 1999	No
Union Valley Interim Remedial Action	Union Valley	IROD July 10, 1997	Administrative controls to prevent groundwater use	No
Lead Source Removal of Former YS-860, Firing Ranges Removal Action	YS-860 Firing Ranges	AM March 11, 1998	Removal action complete RmAR approved February 23, 1999	No
9822 Sediment Basin and 81-10 Sump	Y-12 Plant 9822 Sediment Basin Building 81-10 Sump	AM June 19, 1998	Removal action complete RmAR approved February 25, 1999	No
Actions in progress				
Y-12 Plant East End VOC Plume Removal Action	UEFPC East End Eastern UEFPC Watershed Plume	AM August 23, 1999	RmAWP approved July 9, 1999	Yes

AM = action memorandum
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
IROD = record of decision
NFA = no further action
OU = operable unit
RAR = remedial action report
RCRA = Resource Conservation and Recovery Act of 1976
RmAR = removal action report
RmAWP = remedial action work plan
ROD = record of decision
UEFPC = Upper East Fork Poplar Creek

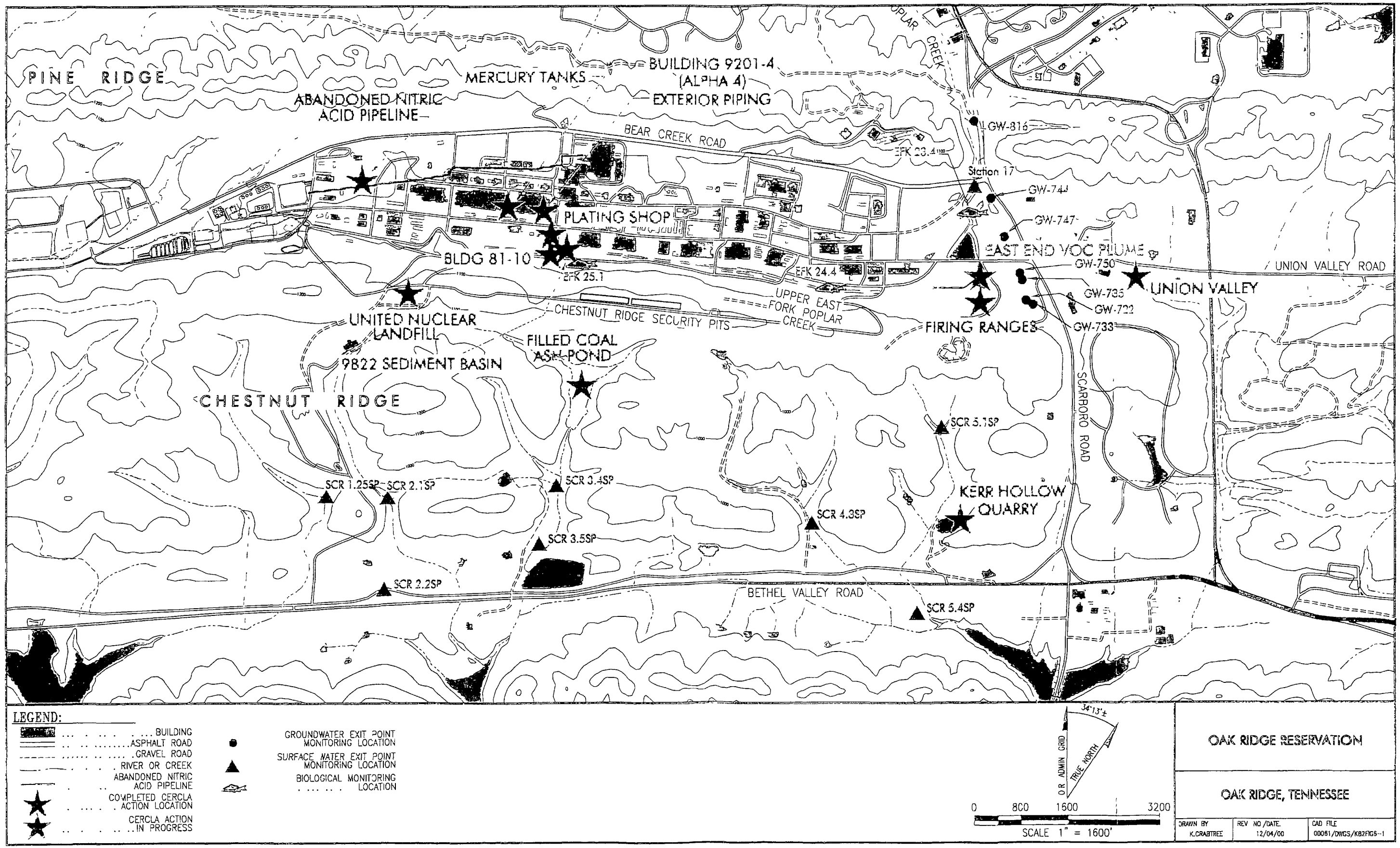


Fig. 6.1. UEFPC Watershed RER site map.

not physically in the UEFPC watershed, it is administratively included in this watershed because waste disposal units in the regime have historically been associated with and managed by Y-12 In addition, groundwater contamination in Union Valley is administratively included within the UEPFC watershed because it is contiguous with contamination beneath Y-12. The summit of Pine Ridge forms the northern boundary of the watershed, and Bethel Valley is the southern boundary.

6.1 WATERSHED OVERVIEW

The UEFPC watershed encompasses a drainage area of about 1170 acres in the eastern portion of the ORR and is dominated by the heavily industrialized portions of Y-12, which occupies about 800 acres of the watershed (Fig. 6.1). This watershed overview section presents the current watershed conceptual model, a summary of FY 2000 watershed-scale water quality monitoring results, and recommendations for watershed-scale monitoring to evaluate the aggregate impacts of remedial actions on water quality within the watershed

DOE has determined that the remedies already implemented within the Upper East Fork Poplar Creek Watershed remain protective of public health and the environment in the context of the scope and objectives of each action.

6.1.1 UEFPC Watershed Conceptual Model

Figure 6.2 presents the current watershed conceptual model illustrating the principal source areas, contaminant migration pathways, and discharge points discussed below As illustrated on Fig. 6 2, the principal watershed exit points include (1) Station 17, which is the surface water exit point for the UEFPC, and (2) the Maynardville Limestone at the eastern end of the watershed, a karst, fractured carbonate formation that functions as the principal groundwater flow pathway in the valley Migration pathways leading to these exit points include (1) storm drains that capture the former UEFPC tributary system, (2) strike-parallel fracture flow pathways in the shale-dominated bedrock formations in the valley, (3) seeps and springs, and (4) an underdrain system beneath the UEFPC distribution channel to Lake Reality that functions as a highly permeable shallow groundwater pathway.

Seventy-five primary sources or secondary areas of contamination (i.e., groundwater plumes) included in the FFA and regulated under CERCLA were addressed by the UEFPC RI (DOE 1998f) An additional 29 potential AOCs not listed in the FFA were also examined by the RI where historical and operational data were available. These source areas were categorized based on their potential to contribute contaminants to off-site exit points from the UEFPC watershed. Detailed discussion of each of these areas may be found in the RI report. In addition to the listed areas of contamination, the storm drain system, which contains contaminated sediments entrained over the operational period of Y-12 also acts as a source term to surface water and groundwater

Surface water contamination in UEFPC is the result of the commingling of releases from multiple point sources The storm drain system that drains Y-12 provides a pathway for these contaminants to migrate to UEFPC In addition, nonpoint runoff from contaminated soils and groundwater discharge to the creek are contributors to surface water contamination The principal contaminants detected in surface water include mercury, methylmercury, and uranium Principal contaminants detected in UEFPC sediment and biota are mercury, uranium, and PCBs

Source areas have contributed to an area of groundwater contamination that extends the entire length of the watershed and east into Union Valley off of the ORR Release mechanisms to groundwater include historical spills, leaks, and probable DNAPL sources in both the unconsolidated and bedrock intervals

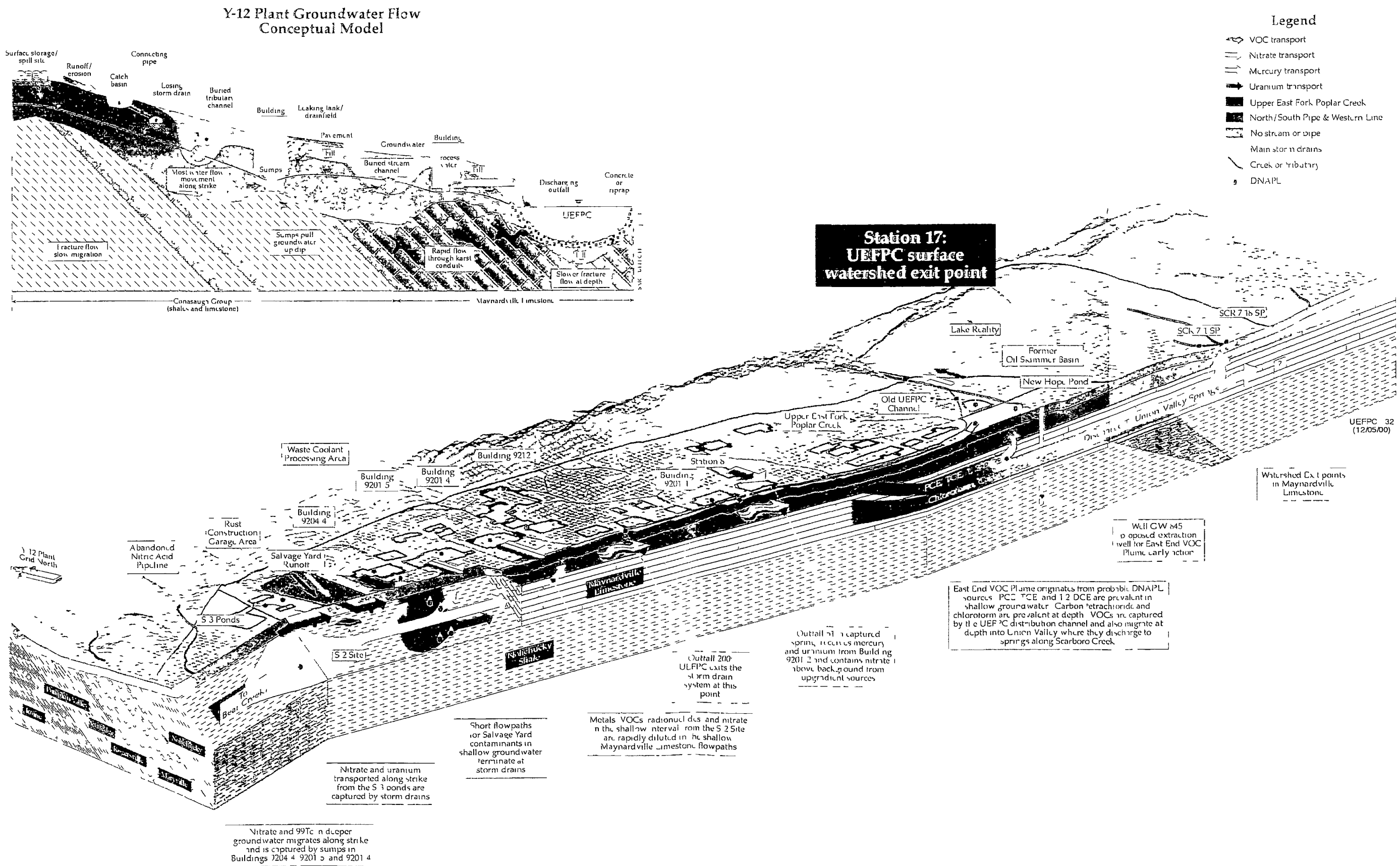


Fig. 6.2. Generalized conceptual model for contaminant transport in the UEFPC watershed.

Although a high degree of commingling exists, signature contaminants associated with some source areas can be identified and targeted during monitoring to assess the effectiveness of specific remedial actions

VOCs [tetrachloroethene (PCE), TCE, various DCE isomers, carbon tetrachloride, chloroform, and benzene, toluene, ethylbenzene, and xylenes] are the most widespread contaminant class in groundwater in the UEFPC watershed. VOCs emanate from multiple source areas throughout the watershed, primarily the Rust Garage; Waste Coolant Processing Area; S-2 Site; Bldgs. 9204-4, 9201-5, and 9201-4, Bldg. 9212 complex, and DNAPL sources in the eastern plant area (Fig. 6 2). Nitrate, gross alpha activity (primarily uranium isotopes), gross beta activity (primarily uranium isotopes and ^{99}Tc) are also widespread in the western plant area, originating primarily at the S-3 Ponds and S-2 Site. Localized areas of uranium isotopic contamination are also present near the Salvage Yard; Bldgs. 9204-4, 9201-5, and 9201-4; Bldg. 81-10 Area, Tank 0134-U; Wells GW-605 and GW-606, and the former Oil Skimmer Basin. Localized metals contamination in groundwater is found in association with the S-3 Ponds (barium, uranium, cadmium), S-2 Site (copper. cadmium, nickel, uranium, mercury); Salvage Yard (lead, barium, nickel, beryllium, cadmium, uranium), Bldg. 81-10 Area (mercury); Bldgs 9204-4, 9201-5, and 9201-4 (mercury, uranium); the former Oil Skimmer Basin (uranium); and Bldgs. 9201-1 and 9201-2 (mercury).

The Chestnut Ridge hydrogeologic regime encompasses about 1800 acres of the crest and southeast flank of the ridge between Scarboro Road and an unnamed tributary west of Centralized Sanitary Landfill II (Fig. 6.1). A single defining watershed is not present within the regime; therefore, an integrated hydrogeologic conceptual model has not been developed to date. In general, groundwater flow both parallel and normal to geologic strike occurs within karst solution features and fractures within the Copper Ridge Dolomite and younger formations within the Knox Group. Springs represent the principal exit points. Remedial effectiveness monitoring at the CERCLA sites having completed actions [United Nuclear Corporation (UNC) Site, Kerr Hollow Quarry, and Filled Coal Ash Pond (FCAP)] focuses on receptors, such as springs or tributaries and monitoring wells immediately adjacent to the sites, that are most likely to show changes as a result of the actions.

6.1.2 FY 2000 Summary

Monitoring was performed at key exit point locations during FY 2000. Within the UEFPC watershed, the key exit points for surface water and groundwater are presented separately below In addition, biological monitoring data for UEFPC are presented to evaluate general surface water quality. Exit point monitoring locations in the UEFPC watershed include Station 17 on UEFPC and wells located along the eastern boundary of the ORR (Fig 6 1) Additional monitoring locations within the eastern plant area and Union Valley also monitor the Maynardville Limestone exit pathway; however, these locations pertain specifically to remedial actions for the East End VOC Plume or Union Valley and are discussed in those sections (Sects 6 9 and 6 12)

In the Chestnut Ridge hydrogeologic regime, key exit point locations include spring stations located along the flanks of the ridge.

6.1.2.1 Surface water

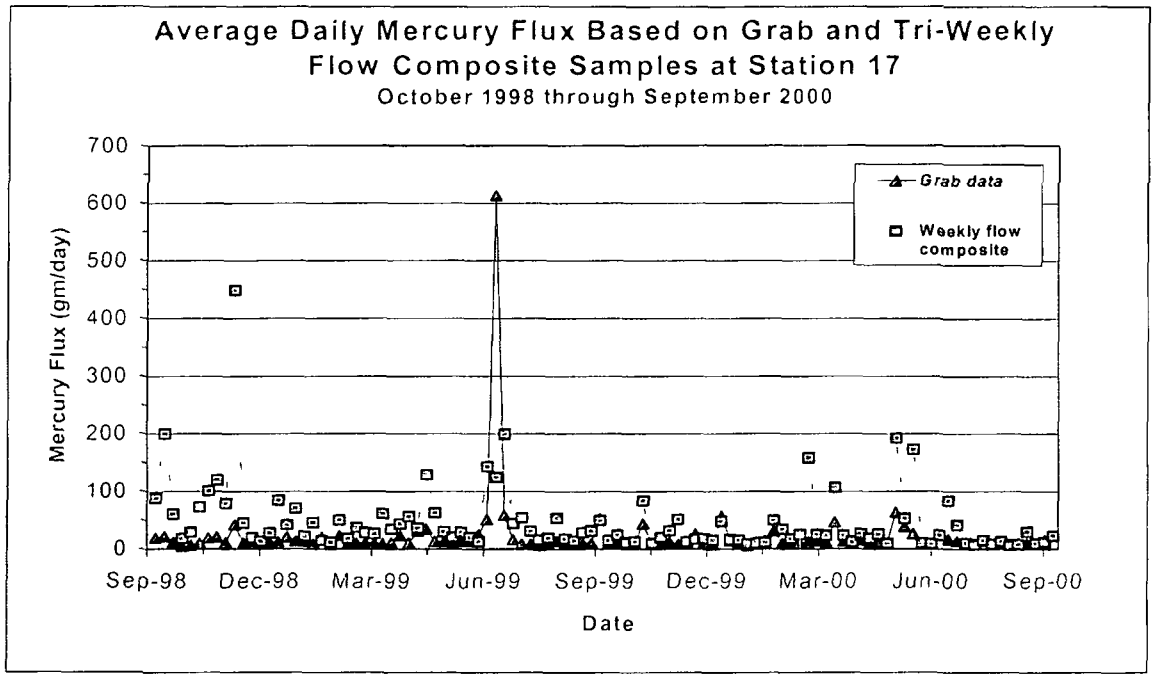
Station 17 at the ORR boundary is the principal monitoring location to evaluate water quality changes within UEFPC as remedial actions progress (Fig 6.1). Flux values for contaminants at Station 17 represent the total mass exiting the watershed via the surface water exit pathway Flux data for the two principal contaminants historically detected in surface water (uranium and mercury) are evaluated annually

Reductions in mercury mass in UEFPC have been achieved largely through remedial measures implemented under the Reduction of Mercury in Plant Effluents (RMPE) program in the mid- to late 1990s (DOE 1998f) The other major impact on contaminant flux was the implementation of Flow Management beginning in July 1996 to improve general water quality conditions in UEFPC. Flow Management involves the addition of raw water pumped from the Clinch River to maintain flow at Station 17 at a minimum monthly daily average of 7 million gallons per day (mgd) Regular flows of about 4.5 mgd were achieved beginning in January 1997. Implementation of flow management resulted in the addition of approximately 6 to 8 grams per day (gm/day) of mercury to the flow of UEFPC in the reach between Outfall 200 (North/South Pipe) and Station 8 (Fig. 6.2), apparently due to bank erosion and/or mobilization from streambed sediment. To help reduce the source of mercury flux along this portion of the creek, a stream bank stabilization project, including runoff controls and placement of rip rap along the banks, was initiated as a CERCLA treatability study under RMPE and completed in January 2000 (DOE 1999j and 2000h)

Total uranium flux for FY 2000 was derived exclusively through weekly flow-paced composite samples Average daily flux values derived on a weekly interval ranged from a low value of 78 3 gm/day (week ending September 13, 2000) to a high of 2172 gm/day (week ending April 5, 2000) Figure 6 3 illustrates average daily flux for total uranium over the past two years. As evident from the graph, flux values are seasonally variable and appear to be higher in general during months with high rainfall, as expected. Overall, average daily flux values appear to be decreasing over this time period. The total FY 2000 flux value for total uranium was 131,079 g, which is less than that calculated for FY 1999 (171,187 g) and which also compares favorably with the flux value established by the UEFPC RI (DOE 1998k) for the first 9 months (July 1996 to April 1997) following implementation of Flow Management (139,745 g).

Mercury fluxes at Station 17 have been routinely calculated by the NPDES and RMPE programs over discrete monthly intervals and 3-month intervals using data from daily grab samples. During FY 2000, grab samples were collected each work day (Monday–Friday) In response to recommendations in the FY 1999 RER, the most appropriate sample types to use for flux calculations were reviewed early in FY 2000 This review indicated that grab samples allow evaluation of short-term influences on mercury flux, as well as longer term (i e., seasonal) patterns. Flow-paced composite samples, however, were noted to be more representative with respect to estimates of total loading over time and more likely to represent changes related to storm events. The current configuration of the composite sampling apparatus at Station 17 places the sample intake at the bottom of a concrete flume Such a configuration for the intake line can result in higher sediment-bound mercury uptake during operation of the sampling pump than that observed in grab samples Accordingly, the flux values derived from composite samples are typically higher than that for grab samples Average daily mercury flux values calculated from grab samples on a weekly basis (Table 6.2) range from a low of 6.2 gm/day (week ending January 26, 2000) to a high of 63.6 gm/day (week ending May 24, 2000). For comparative purposes, available data from tri-weekly flow-paced composite samples were also used in this report to estimate mercury flux. The average daily flux for mercury from both grab and composite samples over the past two years is illustrated on Fig 6 3. The graph shows seasonal variations with peak values typically occurring during seasonally high rainfall periods Overall, the seasonal effects do not appear to be as pronounced as that for total uranium, and values derived from daily grab samples do not show the degree of variability evident in the flow composite data For both sets of samples, the calculated average daily flux values for each period are generally lower than observed in FY 1999, particularly during the July, August, and September months These decreases likely result from the low precipitation conditions that prevailed throughout the region during the summer months

Over the past 10 years, mercury concentrations in grab samples exhibit a decreasing trend, where monthly average aqueous mercury concentrations have decreased by a factor of approximately four (Fig 6 4). The rate of decline of mercury concentrations has slowed somewhat over the past 3.5 years



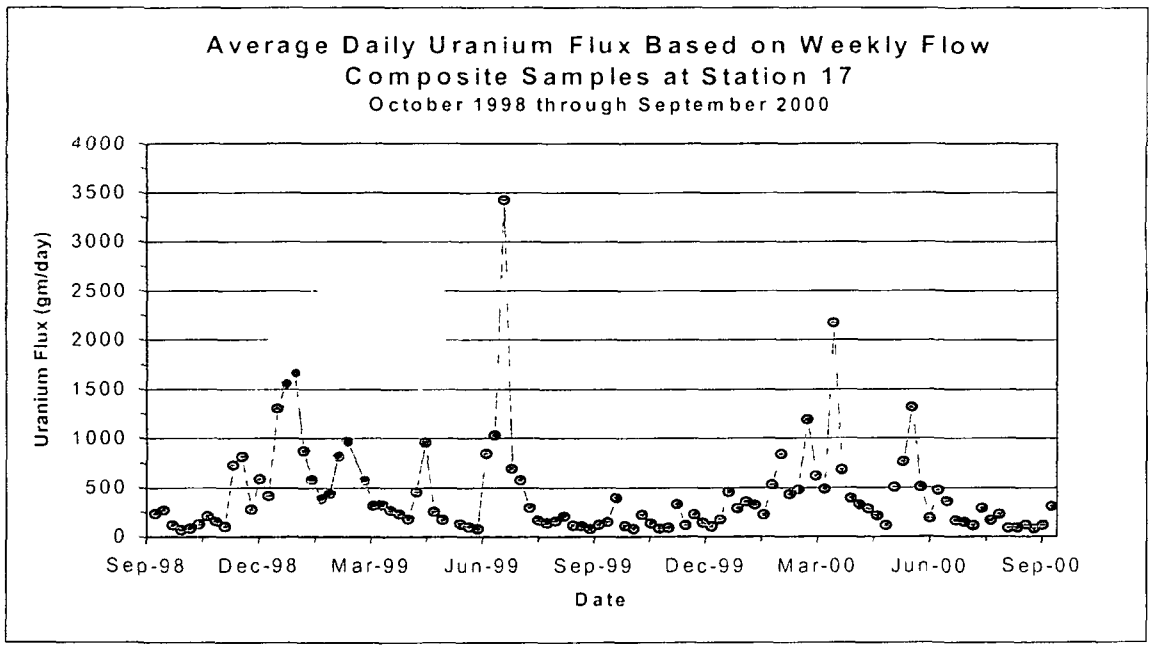


Fig. 6.3. Average daily mercury and total uranium flux at Station 17, FY 1999 and FY 2000.

Table 6.2. Average daily flux for mercury and total uranium at Station 17, FY 2000

	Grab samples[a]	Flow composite samples[b]	
Sample week ending	Hg Flux (gm/day)	Hg Flux (gm/day)	U Flux (gm/day)
10/06/1999	12 3	15 4	146 1
10/13/1999	10 8	24 6	394 8
10/20/1999	10 6	12 2	109 4
10/27/1999	10 8	13 6	80 5
11/03/1999	43 8	84 2	221 9
11/10/1999	9 0	10 6	134 4
11/17/1999	10 1	20 5	82 6
11/24/1999	12 5	32 2	89 5
12/01/1999	9 3	51 8	330 9
12/08/1999	9 5	13 0	115 3
12/15/1999	26 5	17 9	222 9
12/22/1999	9 4	18 3	141 7
12/29/1999	8 2	15 9	103 4
01/05/2000	57 4	48 1	173 0
01/12/2000	14 3	16 6	454 8
01/19/2000	12 6	15 7	286 1
01/26/2000	6 2	9 1	355 6
02/02/2000	11 7	10 9	321 8
02/09/2000	15 0	12 1	219 3
02/16/2000	30 9	50 1	528 4
02/23/2000	10 3	34 6	838 6
03/01/2000	11 7	18 1	432 2
03/08/2000	9 9	25 5	478 4
03/15/2000	13 1	158 3	1190 0
03/22/2000	14 1	25 3	617 7
03/29/2000	12 1	24 0	484 2
04/05/2000	46 7	107 1	2172 4
04/12/2000	13 9	24 0	681 3
04/19/2000	13 0	12 6	388 0
04/26/2000	16 1	27 2	325 0
05/03/2000	10 4	18 9	281 3
05/10/2000	10 4	25 9	208 9
05/17/2000	10 8	9 6	111 4
05/24/2000	63 6	192 9	503 5
05/31/2000	39 0	53 1	761 3
06/07/2000	25 9	173 4	1314 5
06/14/2000	9 8	10 0	506 1
06/21/2000	10 0	9 4	185 9
06/28/2000	23 7	23 9	472 6
07/05/2000	17 4	84 1	358 1
07/12/2000	14 0	41 9	162 8
07/19/2000	11 6	10 0	145 5
07/26/2000	9 0	8 1	114 2
08/02/2000	14 3	15 4	289 4

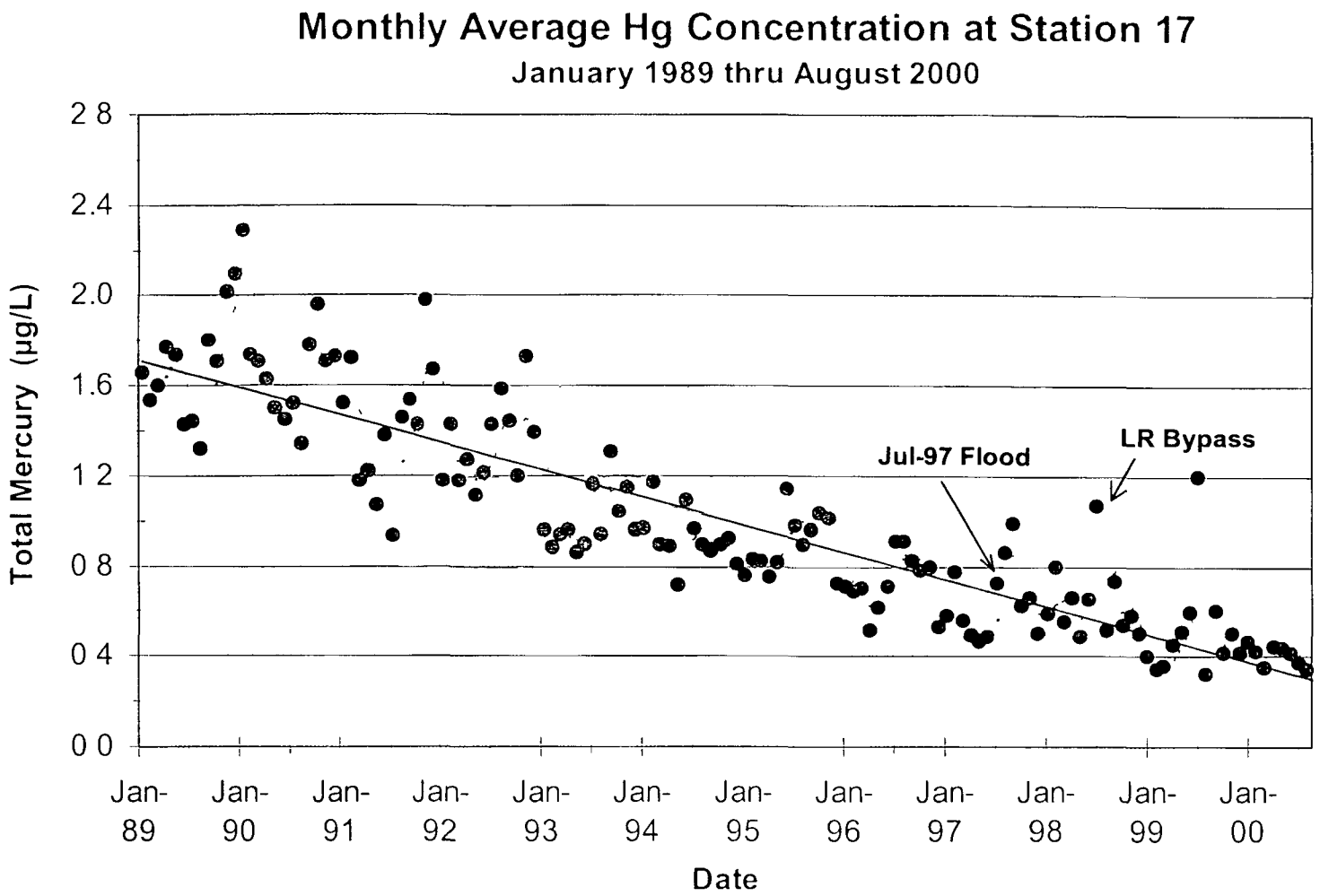
Table 6.2. Average daily flux for mercury and total uranium at Station 17, FY 2000 (continued)

	Grab samples[a]	Flow composite samples[b]	
Sample week ending	Hg Flux (gm/day)	Hg Flux (gm/day)	U Flux (gm/day)
08/09/2000	8.4	9.0	166.8
08/16/2000	13.4	13.7	226.3
08/23/2000	9.2	7.3	88.1
08/30/2000	10.1	8.2	88.2
09/06/2000	9.4	30.5	120.7
09/13/2000	10.2	10.1	78.3
09/20/2000	15.8	12.5	114.8
09/27/2000	22.7	23 4	306.6

[a] Daily grab samples collected at Station 17 during work days Daily average is collected on a weekly basis

[b] Mercury flow composite samples collected at Station 17 on a tri-weekly basis (24-hr, 48-hour, and 72-hr intervals) Total uranium flow composite samples collected weekly Daily average is calculated on a weekly basis

FY = fiscal year



Source: Y-12 Plant Mercury Abatement Report for FY 2000 (BJC 2000c)

Fig. 6.4. Monthly average aqueous mercury concentrations at Station 17 (grab samples).

Quantitative analysis of daily mercury grab sample results using a Mann-Kendall Test since January 1997 (stable conditions of flow management) do not indicate a significant increasing or decreasing trend Total uranium values have also generally declined at Station 17 Quantitative analysis (Mann-Kendall Test) of total uranium results (grab samples) since January 1997 indicates a significantly decreasing trend These constituents exhibited short-term concentration increases, as flow rates in UEFPC were ramped up during implementation of Flow Management, followed by decreases relative to the period prior to Flow Management In FY 2000, total mercury concentrations at Station 17 exhibited less variability than typically observed in previous years, which may reflect, in part, the very dry summer and fall seasons or the effects of bank stabilization noted above Such summertime decreases were not evident in the total uranium grab sample data

6.1.2.2 Human health and ecological risks at the UEFPC integration point

Remedial actions under CERCLA to specifically address UEPFC are pending upon approval of the watershed ROD The majority of corrective actions that have resulted in improvements in water quality in UEFPC to date have been initiated under other programs, such as RMPE or NPDES compliance The expected outcomes for two CERCLA actions, the Mercury Tanks removal action (Sect 6 3) and the 9822 Sediment Basin and Bldg 81-10 Sump removal action (Sect 6 11), include reductions of mercury flux to UEFPC However, for the purposes of the Five-Year Review and to illustrate current conditions in UEFPC, FY 2000 results for principal human health contaminants of concern were evaluated with respected risk-based remedial goal options (RGOs) developed during the UEFPC RI To illustrate current conditions related to ecological impacts to UEFPC, an evaluation of FY 2000 results derived from the BMAP are also presented

Human Health. Based on conditions in the lower reaches of UEFPC following the implementation of Flow Management (represented by Station 17), the baseline human health risk assessment in the RI report identified no surface water chemicals of concern for industrial or open recreational land-use receptors in the lower segment of the creek For a hypothetical residential land-use scenario, fluoride, carbon tetrachloride, and di-n-octylphthalate were identified as the chemicals of concern that were the primary contributors to chemical hazards The chemicals listed as primary noncarcinogenic contaminants of concern (COCs) all have individual hazards of 0 2 (fluoride and carbon tetrachloride) or 0 8 (di-n-octylphthalate) The cumulative effect across all three chemicals causes the total residential hazard index to exceed 1 0 Benzo(b)fluoranthene, carbon tetrachloride, and chloroform were the chemicals of concern identified as the primary contributors to cancer risk The cumulative effect for the chemicals listed as primary carcinogenic COCs causes the total residential risk to exceed 1×10^{4} Individually, the risk for benzo(b)fluoranthene ($9\ 0 \times 10^{-5}$) is slightly higher than that for carbon tetrachloride ($3\ 0 \times 10^{-5}$) or chloroform ($2\ 0 \times 10^{-5}$)

Evaluation of FY 2000 monitoring data for surface water shows that concentrations of carbon tetrachloride and chloroform, the primary risk contributors, were well below the RGO values established in the RI report for both the child recreator and the industrial worker Fluoride concentrations, the primary chemical hazard contributor, was also less than RGOs Monitoring for benzo(b)fluoranthene or di-n-octylphthalate was not performed during FY 2000 at Station 17

Ecological Conditions. During development of DQOs for the UEFPC RI, the decision was reached that insufficient habitat existed within Y-12 to merit evaluation of ecological risk to terrestrial receptors Ecological baseline risk was evaluated for surface water and sediment within UEFPC and at spring discharge points within the watershed

Biological monitoring within UEFPC in FY 2000 showed that concentrations of mercury in fish are consistent with the gradual decline previously noted at Station 17, while mercury levels in surface water have continued to drop more rapidly since the closing of New Hope Pond in 1989 (Fig 6 5) Mercury

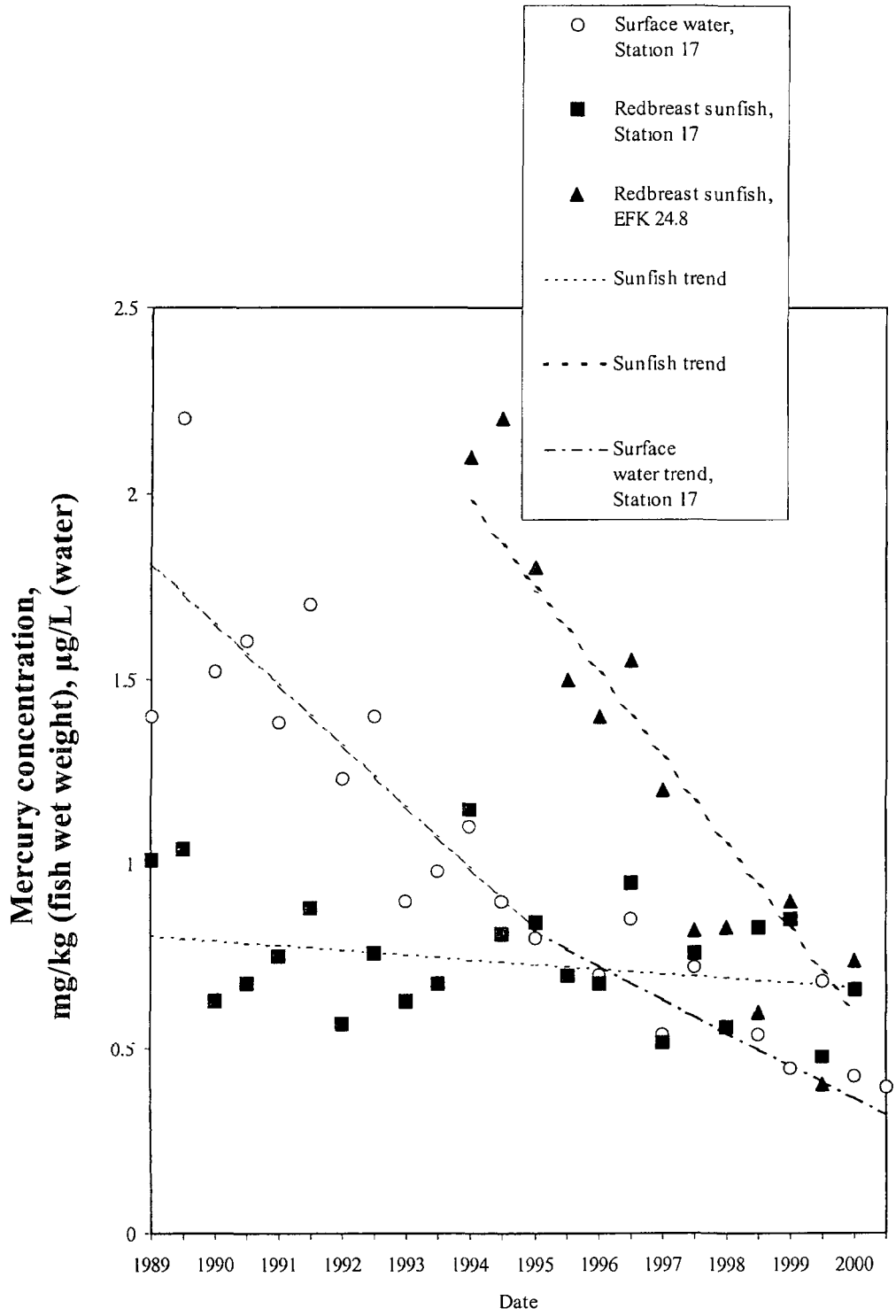


Fig. 6.5. Mercury concentrations in grab samples of surface water and in sunfish at the Y-12 boundary and at EFK 24.8 since Lake Reality was completed.
(Data from Y-12 Biological Monitoring and Abatement Program)

concentrations in sunfish at East Fork kilometer (EFK) 24.8 were much higher several years ago than at Station 17, but have decreased to levels very similar to those at Station 17 (Fig. 6 5).

Lake Reality was isolated from UEFPC in 1998. Since that time, mercury concentrations in fish in Lake Reality have dropped dramatically. The average concentration in bluegill and redbreast sunfish fillets was 0.17 mg/kg in fall 1999 and 0.12 mg/kg in spring 2000 (BMAP quarterly progress report, October 2000). In comparison, concentrations in the reference stream have averaged below 0.1 mg/kg for the last several years. The decrease in mercury concentrations in the fish while mercury concentrations in Lake Reality sediment remain above 50 mg/kg implies that the sediment mercury is probably not a major source of mercury to these fish.

Evidence continues to suggest that upstream of Station 17, biota in UEFPC are exposed to contaminants and are negatively impacted by poor water quality (ORNL 2000a, b, and c). Concentrations of contaminants (i e., mercury, some other metals, and PCBs) in fish at the UEFPC exit point have declined erratically over the last several years, but PCB concentrations at Station 17 remain more than 50 fold above concentrations in fish from reference streams. The PCB concentrations in sunfish at Station 17 have not shown consistent changes since 1997 (BMAP data), but the PCB flux in surface water has decreased, and it will be important to determine whether the PCB concentrations in fish decrease in the future as a result.

The total number of taxa and number of pollution-intolerant taxa of macroinvertebrates and fish were substantially lower at EFK 24 4 downstream of Station 8 in the plant area, and at EFK 23 4 near Station 17, than at the reference stream However, several improvements have occurred over time Improvements in the macroinvertebrate community at EFK 24 4 and EFK 23 4 have occurred, there has been a general trend of increases in total richness since 1985 and in richness of pollution-intolerant taxa since the mid-1990s (BMAP data) The total number of macroinvertebrate taxa and the number of pollution-intolerant taxa at EFK 24.4 is now very similar to or higher than at EFK 23 4, thus suggesting that further recovery may have occurred at EFK 24 4

Bioassays of UEFPC that evaluated caged clams for survival and growth during summer 2000 resulted in death in 12 weeks of more than 70% of the clams at EFK 24 4 and of more than 85% at EFK 23 4 (Station 17). This contrasts with 100% survival and a consistent growth during the exposure period at the reference site. These results are further indication that, despite the evidence of ongoing improvements in water quality, conditions in UEFPC still do not allow contamination-sensitive populations to flourish

6.1.2.3 Groundwater

Monitoring conducted at exit points along the eastern portion of the watershed (Fig. 6 1) includes the following

- Wells GW-744, -747, and -816 located along UEFPC and within the water gap (Rome Formation) through Pine Ridge north of the ORR boundary, and
- Wells GW-733, -735, -722, and -750 in the Maynardville Limestone exit pathway near the ORR boundary.

The monitoring locations within the UEFPC water gap through Pine Ridge historically have not indicated off-site transport to the north or east within the bedrock units below the Maynardville Limestone Data collected during FY 2000 continue to show no evidence of migration of signature groundwater contaminants (VOCs, radiological constituents, or nitrate) along this pathway

Exit point monitoring locations GW-722, -735, and -750 were also monitored as part of the baseline characterization monitoring for the East End VOC Plume Data from FY 2000 for these three locations are presented in Sect. 6.12. Data for FY 2000 from well GW-722 shows continuing migration of VOCs with the deep and intermediate intervals of the Maynardville Limestone; however, concentrations continued to increase relative to FY 1998 and 1999 results. Wells GW-735 and GW-750 did not indicate migration of VOCs in the shallow bedrock interval of the Maynardville Limestone, which is consistent with historical data. Well GW-733 is monitored under terms of the RCRA post-closure permit for the S-3 Site and New Hope Pond. However, well GW-733 also intercepts the East End VOC Plume characterized by carbon tetrachloride and chloroform. Carbon tetrachloride (maximum of 11 µg/L) and chloroform (maximum of 2J µg/L) results for well GW-733 in FY 2000 were consistent with previous FY 1998 and 1999 results and show that the concentrations of this class of compounds in the well has decreased slowly over time.

In summary, exit point groundwater monitoring results for FY 2000 in the UEFPC watershed show a continuation of existing trends. Substantial anomalies or changing patterns of contaminant migration were not evident from the most recent data. As such, evaluation of the monitoring results does not indicate that any substantial changes to the UEFPC watershed conceptual model are required at this time

Evaluation of overall water quality changes within the Chestnut Ridge hydrogeologic regime is best accomplished through monitoring of springs and seeps, which represent exit points for karst conduits and fractures acting as groundwater flow pathways. Eight springs and seeps (SCR stations) monitored by the WRRP and Y-12 Environmental Management Division (EMD) in FY 2000 were identified as key exit pathway locations to establish baseline conditions (Fig 6 1)

Analytical data for the eight springs in FY 2000 show no detected values for signature VOCs indicative of waste disposal units in the Chestnut Ridge hydrogeologic regime [1,1,1-trichloroethane (TCA); 1,1-dichloroethane (DCA); 1,1-DCE; PCE; TCE, and 1,2-DCE]. Trace levels of methylene chloride were detected on four occasions with a maximum concentration of 9J µg/L at station SCR 3.5 on 8/29/00. Maximum gross alpha activity (2.36 +/- 1.44 pCi/L), gross beta activity (4.8 +/- 3.4 pCi/L), total uranium (5.56 µg/L), and nitrate (4.31 mg/L) further indicate that retardation and attenuation within the clay-rich Knox Group residuum, bedrock fractures, and karst conduits have, to date, minimized the extent of contaminant migration within the exit pathways terminating at these springs.

6.1.3 Recommendations

As all parties move forward in developing a CERCLA ROD(s) for UEFPC, it will be necessary to establish some watershed-scale required monitoring locations. As part of this effort, the best methods to sample the Station 17 (either using flow composite or daily grab samples to obtain baseline flux values for both dissolved and particle-bound mercury and uranium) should be identified and implemented This and other potential performance assessment sites will be specified in future FFA documents.

6.2 UNITED NUCLEAR CORPORATION DISPOSAL SITE REMEDIAL ACTION

- ROD: June 28, 1991
- Field Activities Complete: August 1992
- PCR: June 1993

6.2.1 Project Description

The UNC Disposal Site is a 1.3-acre landfill located near the crest of Chestnut Ridge south of Y-12 (Fig. 6.6). The landfill was originally established to receive waste resulting from the decommissioning of a UNC facility in Wood River Junction, Rhode Island. Following shutdown of uranium recovery operations in 1980, UNC decontaminated its Rhode Island facilities, excavated contaminated soil and sludge from associated ponds and trenches, and removed low-level radioactive waste. Material was transported to Y-12 for disposal between June 1982 and November 1984, and included some 11,000 55-gal drums of cement-fixed sludge, 18,000 drums of contaminated soil, and 288 wooden boxes of contaminated building and process equipment demolition debris In addition, between October 1991 and January 1992, about 7000 yd^3 of radioactively contaminated soil and concrete were disposed of at the UNC site. This material was excavated as part of the remediation of the Elza Gate Site under DOE's Formerly Utilized Sites Remedial Action Program. Material in the landfill is classified as nonhazardous waste as defined by RCRA. Contaminants of concern at this site are nitrate and ^{90}Sr.

The ROD for the UNC site was approved in June 1991 (DOE 1991c) Field activities began in May 1992 and were completed in August 1992. Remedial activities included construction of a multilayer cover system, installation of access controls, and implementation of a groundwater monitoring program using existing wells

6.2.2 Evaluation of Decision Document Requirements for Performance

6.2.2.1 Goals of decision

The major goal of this action per the ROD is to "ensure that mobile contaminants in the UNC waste, principally nitrate and strontium-90, are not leached to groundwater at a rate that would result in concentrations of these contaminants above safe drinking water standards" (DOE 1991c)

The expected performance of the remedy is to control contaminant migration so that no more than 8 mg/L nitrate and 2 pCi/L of ^{90}Sr would occur in groundwater, which is within the CERCLA risk range of 10^{-4} to 10^{-6}.

6.2.2.2 Monitoring and stewardship required

The PCR (DOE 1993b) specifies long-term care of the landfill cap and the implementation of a groundwater monitoring program Requirements include the following

- Visual inspections of the cap to be performed on a quarterly basis for the first 2 years after construction, and semi-annually thereafter. If necessary, restorative measures will be implemented following observation The site inspections would be continued for 30 years following completion of construction activities.

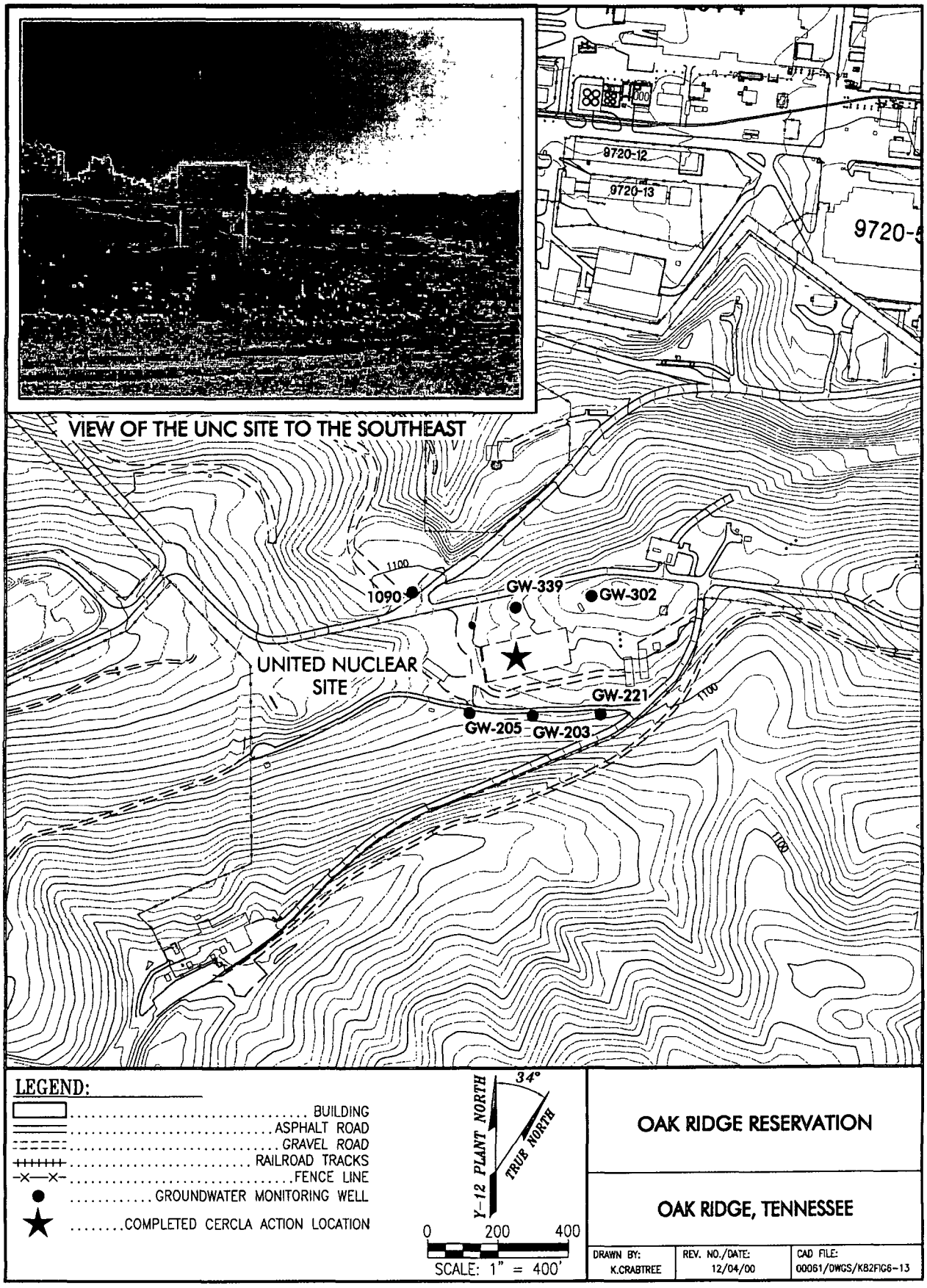


Fig. 6.6. United Nuclear Corporation site map.

- Groundwater monitoring on a semi-annual basis Although not stated in the PCR, groundwater is monitored for contaminants of concern (nitrate and ^{90}Sr)

6.2.3 Implementation of Previous Year's Recommendations

No changes to the monitoring or stewardship requirements were recommended for FY 2000

6.2.4 Evaluation of Performance and Stewardship Data

Evaluation of performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are summarized in Table 6 3 Supporting discussions pertaining to the site visit and visual survey, site manager interview, and remedial performance monitoring are presented below

6.2.4.1 Site visit and visual survey

A site visit and visual survey of the UNC Site was conducted on October 13, 2000 As shown on Fig 6 6, the site is currently a gently sloped, open, grass-covered area The majority of the cap slopes to the south–southwest Drainage controls consist of a rip-rap lined ditch along South Patrol Road at the northern boundary of the site and a drainage swale oriented east–west that directs storm runoff from the cap west toward the drainage ditch noted above

Land use controls and warning signs were observed to be in place The UNC Site is located within the Y-12 property protection area and, as such, is not accessible to the public The area is routinely patrolled by security personnel No observed changes in land use have occurred within the past five years in the site vicinity No notable changes in physical site conditions were observed, however, recent upgrades to the vegetative cap cover have been implemented through reseeding using a seed drill device

6.2.4.2 Interviews

Information from the interview with the Bechtel Jacobs site manager conducted at the time of the site visit indicate that all stewardship requirements are being met Quarterly inspections of the cap are conducted and recorded on inspection forms, cap inspections are also conducted following heavy rainfall events Monthly inspections of monitoring wells, the cap cover, signs, and access controls are also conducted as a best management practice All inspection records are maintained in the administrative record Operating procedures are maintaining the effectiveness of response actions Site management personnel noted that well GW-205 has shown an increase in gross beta activity, however, no corresponding increase in $^{89/90}Sr$ has been noted Additional evaluation of this potential issue is presented in Sect 6 2 4 3 below No other problems with the remedy or site-specific concerns were noted during the interview with environmental management staff

6.2.4.3 Data evaluation

Groundwater sampling under the ROD was performed semiannually from 1992 to 1997, annually in 1998, and again semi-annually in 1999 and 2000 Samples in FY 2000 were analyzed for nitrate, gross alpha and beta activity, and $^{89/90}Sr$ These data, along with the data from FY 1999, are summarized in Table 6 4 Nitrate concentrations downgradient of the site have remained well below the 10 mg/L Safe Drinking Water Act MCL and the downgradient concentrations in GW-203, -205, and -221 have been comparable to the concentrations in upgradient wells, as shown in Table 6 4 These results are similar to

Table 6.3. Evaluation of Performance and Stewardship Data—United Nuclear Corporation Disposal Site Remedial Action

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	See Sect 6 2 4
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	No evidence of cap failure, subsidence, etc during inspections to date
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls are specified in the ROD, however, site is within the Y-12 Property Protection Area (Sect 6 2 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions specified
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Site manager interview (Sect 6 2 4 2)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Safe drinking water standards for nitrate and ^{90}Sr unchanged
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under government control, visual survey (Sect 6 2 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	No	Based on systematic monitoring results, contamination has not reached groundwater (Sect 6 2 4 3)
Have new contaminants or contaminant sources been identified?	No	Data collected under ongoing post-remedial action monitoring are continuing to be evaluated
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Site manager interview (Sect 6 2 4 2)
Have there been any changes in the physical site conditions?	No	Visual survey (Sect 6 2 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	No	No changes for ^{90}Sr or nitrate since the remedy was implemented (Sect 6 4 2 3)
Were there significant changes in the standardized risk assessment methodologies?	No	No significant changes since the remedy was implemented
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Action not driven by ecological RAOs Ecological risks may be addressed through future watershed-scale decisions Remedial action objectives determined that wildlife exposure is expected to be minimal due to continued institutional controls
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
NA = not applicable
NA = not applicable
RAO = remedial action objective
ROD = record of decision
TBC = to be considered

Table 6.4. Analytical results for performance indicator constituents at the UNC Site, FY 1999 and 2000

Well	Nitrate as N (mg/L)				Gross beta (pCi/L)			
	02/4-5/99	08/9-15/99	02/22-23/00	08/9-15/00	02/4-5/99	08/9-15/99	02/22-23/00	08/9-15/00
Upgradient Wells								
1090	0.8	0.82	0.35	0.76	<1.41	2.84+/-1.44	<-0.1	4.49+/-1.28
GW-302	1.2	0.98	1	3.3	<0.94	4.43+/-1/91	<1.03	7.9+/-0.93
GW-339	0.81	0.75	0.78	2.8	<-0.98	2.98+/-1.58	1.23+/-0.99	2.11+/-1.36
Downgradient Wells								
GW-203	0.86	1.4	0.6	N/A	49.58+/-2.54	0.99+/-0.95	<0.81	<0.75
GW-205	0.06	0.05	0.02U	8.4	<-0.22	71.88+/-3.35	74.39+/-3.13	81.21+/-3.53
GW-221	0.65	0.64	0.02U	2.4	<0.86	<0.39	<0.47	<-0.38

Well	Gross alpha (pCi/L)				Sr-89/90 (pCi/L)			
	02/4-5/99	08/9-15/99	02/22-23/00	08/9-15/00	02/4-5/99	08/9-15/99	02/22-23/00	08/9-15/00
Upgradient Wells								
1090	1.04+/-0.66	<1.1	2.11+/-1.41	<0.52	<0.34	<0.15	<1.52	2.22+/-1.27
GW-302	<0.61	5.41+/-2.16	<0.9	2.8+/-1.03	<-0.21	<-0.31	<0.26	<0.93
GW-339	<-0.04	<1.97	1.0+/-0.84	<0.58	<0.68	<0.51	<0.33	5.17+/-2.72
Downgradient Wells								
GW-203	<0.06	<0.49	1.07+/-0.62	1.07+/-0.94	<0.82	<-0.79	<1.18	<0.19
GW-205	<0.85	<-1.19	<-.76	<0.28	<-0.62	<0.26	<-0.43	<-0.63
GW-221	<0.04	<0.35	<0.81	<0.81	<1.16	<-0.5	<0.82	<0.0

FY = fiscal year
UNC = United Nuclear Corporation

the data available for these wells since 1992 and consistent with the conclusions of the Five-Year Review conducted in the 1998 RER (see Sect 9 1, DOE 1998e)

As observed for nitrate, gross alpha activities have remained well below the 15 pCi/L MCL over the past two years. Gross beta activity in groundwater both up- and downgradient of the site has historically been well below the 50 pCi/L presumptive drinking water screening value for compliance with a 4 mrem/yr dose limit for man-made radionuclides Gross beta activity in well GW-203 was approximately equal to the 50 pCi/L screening value in the February 1999 sample, but results have consistently been near or below MDAs since that time. Wells GW-205 (downgradient) and GW-203 (upgradient) are exceptions. In well GW-205, the gross beta activity has exceeded 50 pCi/L in three of the last four semiannual samples, and data are suggestive of a possible upward trend (71 88 pCi/L in August 1999, 74.39 pCi/L in February 2000, and 81.21 pCi/L in August 2000). Prior to this time, gross beta had been reported at values less than the MDA and, therefore, was considered as nondetected Strontium-90 is the specific radionuclide contaminant of concern at UNC and a beta-emitting radionuclide Strontium-90 was not detected in well GW-205 during FY 1999 or FY 2000 sampling Thus, the ^{90}Sr results are not consistent with the gross beta results for GW-205. In addition, ^{99}Tc, a suspected constituent of potential concern based on site operational history, was analyzed as a possible source for the observed increases in beta activity However, activities for this radioisotope were also less than MDAs (< 6 01 pCi/L in February 2000 and <5 28 pCi/L in August) Total uranium concentrations for both sampling events were estimated values less than reporting limits (maximum value of 0 000269 mg/L in February 2000) and do not indicate that uranium daughter products are a source for the observed beta activity Based on the data collected in FY 2000, the cause for elevated gross beta in this well still cannot be determined Accordingly, a recommendation to evaluate potential causes for the elevated gross beta values is made in Sect 6 2 5

Other radiological results of interest, in addition to elevated gross beta in well GW-205, include the low activities of ^{90}Sr detected above MDAs in upgradient wells GW-1090 and GW-339 As evident in Table 6 4, these detected results appear to be anomalous, as this constituent was below MDAs over the preceding three semi-annual sampling events and historically has not been above detection limits in these wells

A review of toxicity factors for nitrate and ^{90}Sr show no changes since implementation of the remedy, and no significant changes in risk methodologies have occurred Therefore, no changes to risk factors has occurred and the assumptions used to evaluate the protectiveness of the remedy remain valid

6.2.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the UNC Site are presented in Table 6 3 Evaluation of groundwater monitoring data over the past five years shows that the primary goal of the action, preventing migration of mobile contaminants to groundwater in excess of drinking water standards, has been achieved to date. In light of continuing increases in gross beta activity observed in well GW-205, analyses for a comprehensive suite of radioisotopes (including, but not limited to, uranium and daughter products, ^{99}Tc, and $^{226/228}$Ra) are recommended in FY 2001 for this well to attempt to identify the potential cause. No other changes in the monitoring and stewardship program are recommended

6.3 MERCURY TANKS INTERIM REMEDIAL ACTION

- IROD: September 26, 1991
- Field Activities Complete: March 1993
- RAR: December 1993

6.3.1 Project Description

The Mercury Tanks (Tanks 2101-U, 2100-U, and 2104-U) are located adjacent to Bldgs. 9201-4 and 9201-5 in the western area of Y-12 (Fig. 6.7). Until 1993, these concrete sedimentation tanks received discharges from dewatering sumps within the basements of Bldgs. 9201-4 and 9201-5, which housed mercury-based lithium separation processes. The interim remedial objective was to remove mercury-contaminated sediment from the tanks and to prevent elemental mercury from entering the storm sewer system. The Proposed Plan for the removal of sludges from the three tanks was issued in June 1991, and the IROD (DOE 1991b) for the project was approved in September 1991 Field activities began in December 1992 and were completed in March 1993. Components of the interim action included the following:

- removal of oil, water, and emulsions from all three tanks,
- removal of mercury-contaminated sediment from Tanks 2100-U and 2101-U, and
- removal and solidification of mixed wastes from Tank 2104-U.

Upon completion of the interim action, Tank 2101-U was abandoned in place. Tank 2104-U was removed from service on November 3, 1996, and abandoned in place. Tank 2100-U was drained and inspected in November 1995 No accumulation of sediments or sludges was noted at that time. All sump discharges from Bldgs 9201-4 and 9201-5 were routed to Tank 2100-U. Discharge from Tank 2100-U was redirected to the Central Mercury Treatment Facility in November 1996. With this change, the storm water collection system completely bypasses the mercury tanks.

6.3.2 Evaluation of Decision Document Requirements for Performance

6.3.2.1 Goals of decision

The major goal of this interim action was to "reduce the amount of mercury-contaminated sediment and elemental mercury entering the storm sewer system from three tanks at the site " The storm sewer system empties into UEFPC. Removal of sediments from the three tanks will eliminate a known source of mercury-contaminated sediment from contact with surface water in the storm sewer system This action was completed in conjunction with the RMPE program for controlling mercury releases to UEFPC Subsequent actions under CERCLA will be defined when the RI/FS for UEFPC and/or for Mercury Use Areas have been completed. (DOE 1991b).

6.3.2.2 Monitoring and stewardship required

The PCR (DOE 1993c) required that the rate of sludge accumulation be monitored in Tanks 2100-U and 2104-U. The PCR also noted that the water in the tanks would also be characterized periodically as part of the ongoing RMPE program. In 1995, occasional overflows of Tank 2100-U exhibited mercury contamination under 200 μg/L. With isolation of all three tanks from the stormwater system, the recommendation in the 1997 RER to discontinue data collection for the Mercury Tanks was approved by

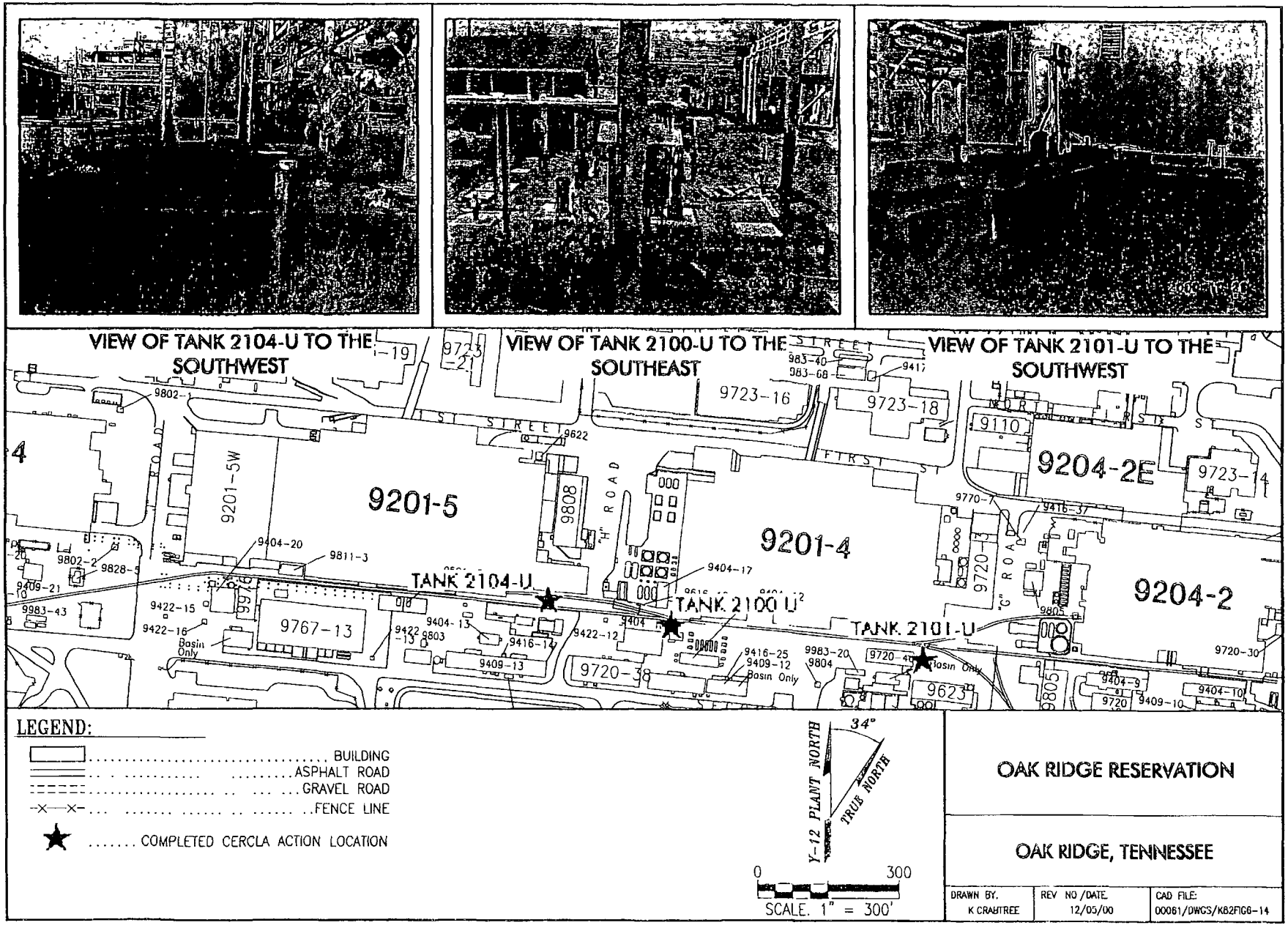


Fig. 6.7. Mercury Tanks site map.

TDEC (1997b) and EPA (1997b). No surveillance and maintenance inspections of these tanks are required and no monitoring is conducted.

6.3.3 Implementation of Previous Year's Recommendations

No changes to the monitoring or stewardship requirements were recommended for FY 2000.

6.3.4 Evaluation of Performance and Stewardship Data

Evaluation of performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance is summarized in Table 6.5. Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below.

6.3.4.1 Site visit and visual survey

A site visit and visual survey of the Mercury Tanks was conducted on October 26, 2000. The present condition of the exterior of the three tanks is shown on Fig. 6.7. Tanks 2101-U and 2104-U both extend approximately 2 ft above grade and are not maintained. Remnants of vapor monitoring systems and pumping equipment remain in place on top of tank 2101-U. Access ports are covered with steel plates and are bolted shut on both tanks. Primary valve pits for both Tank 2101-U and 2104-U (approximately 6 ft deep) were observed to be intact and covered with steel grating. The valve pit for Tank 2101-U was dry at the time of the site visit. The valve pit for Tank 2104-U contained approximately 3 ft of accumulated rainwater. As evident in Fig. 6.7, Tank 2100-U is actively used as a collection station for dewatering sump effluent from the basements of Bldgs. 9201-4 and 9201-5. The top of the tank lies at grade, and pumping control equipment is located on the top of the tank. Identification signs are not required for the Mercury Tanks, nor were they observed to be present. The tanks are located within the Y-12 Plant [illegible]ted (high security) area and, as such, are not accessible to the public. No observed changes in land [illegible]ve occurred within the past five years in the site vicinity.

6.3.4.2 Interviews

No post-remedial action stewardship requirements currently apply for the Mercury Tanks Information from the interview with the BJC site manager conducted at the time of the site visit indicates that the pumping system in Tank 2100-U is routinely maintained because it is part of the active operating basement dewatering systems for Bldgs. 9201-4 and 9201-5. No significant future land use changes were noted by the site manager However, a pending change of stewardship for Bldg 9201-5 adjacent to Tank 2104-U from Defense Programs to EMD was noted to be tentatively planned for FY 2003 or 2004. No problems with the remedy or site-specific concerns were noted during the interview with environmental management staff.

6.3.4.3 Data evaluation

No monitoring of the Mercury Tanks is currently required.

Table 6.5. Evaluation of performance and stewardship data—Mercury Tanks Interim RA

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Sect 6 3 2 1
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Tanks have been removed from service and isolated from the storm sewer system
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls are defined in the IROD, however, site is within the Y-12 Property Protection Area (visual survey, Sect 6 3 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	Sect 6 3 2 1
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	No post-action operating procedures or stewardship requirements apply under CERCLA, Sect 6 3 4 2
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	No chemical-specific ARARs addressed by the IROD
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under government control, visual survey (Sect 6 3 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate, tanks are permanently isolated from the storm sewer system
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate, tanks are permanently isolated from the storm sewer system
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	NA	No chemical treatment methods were employed (Sect 6 3 4 2)
Have there been any changes in the physical site conditions?	No	Visual survey (Sect 6 3 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	BRA/ERA not performed for the IROD
Were there significant changes in the standardized risk assessment methodologies?	NA	BRA/ERA not performed for the IROD
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	No ERA performed for the IROD Ecological risks may be addressed through future watershed-scale decisions
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
ERA = ecological risk assessment
IROD = record of decision
NA = not applicable
ROD = record of decision
TBC = to be considered

6.3.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the Mercury Tanks are presented in Table 6.5. There are no post-remedial action stewardship or monitoring requirements that apply to the Mercury Tanks.

6.4 PLATING SHOP CONTAINER AREAS REMEDIAL ACTION

- ROD — September 30, 1992
- Field Activities — No Further Action

6.4.1 Project Description

The Plating Shop Container Areas were collection and storage sites for spent plating solutions and sludges generated in the plating shop at Bldg 9401-2 (Fig 6 8) Areas S-334 and S-351 are adjacent to Bldgs 9401-2 and 9720-29, respectively, in the southern portion of Y-12 A site investigation was conducted in 1989 to estimate impacts to soil, surface water, and groundwater, resulting in an RI published in May 1992 (DOE 1992d) Although some residual contamination may remain, the current and future industrial land use exposure scenario evaluated in the RI indicates (1) a total cancer risk well below the EPA-established range of concern and (2) noncarcinogenic health effects well below the threshold for potential concern As a result, DOE recommended a no-action alternative for the site The ROD was approved in September 1992

6.4.2 Evaluation of Decision Document Requirements for Performance

6.4.2.1 Goals of decision

Based on a conservative exposure scenario for current and future industrial land use at the Plating Shop Container Areas. the total excess cancer risk is below the EPA-established range of concern, and noncarcinogenic health effects are below the threshold for potential concern Thus, no action was identified as protective of human health and the environment at this site (DOE 1992c) Ecological risks were addressed as part of the UEFPC Watershed RI, terrestrial receptors were not evaluated due to insufficient habitat within Y-12

6.4.2.2 Monitoring and stewardship required

No performance monitoring is required under the approved ROD No engineering or institutional controls or other stewardship requirements apply under the approved ROD Land use for the former container areas is not restricted in any fashion No site inspection or maintenance activities are performed under CERCLA environmental management programs

6.4.2.3 Data evaluation

No monitoring of the Plating Shop Container Areas is currently required

6.4.3 Implementation of Previous Year's Recommendations

No recommendations were made for the Plating Shop Container Areas for FY 2000

6.4.4 Evaluation of Performance and Stewardship Data

Evaluation of performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are summarized in Table 6 6 Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below

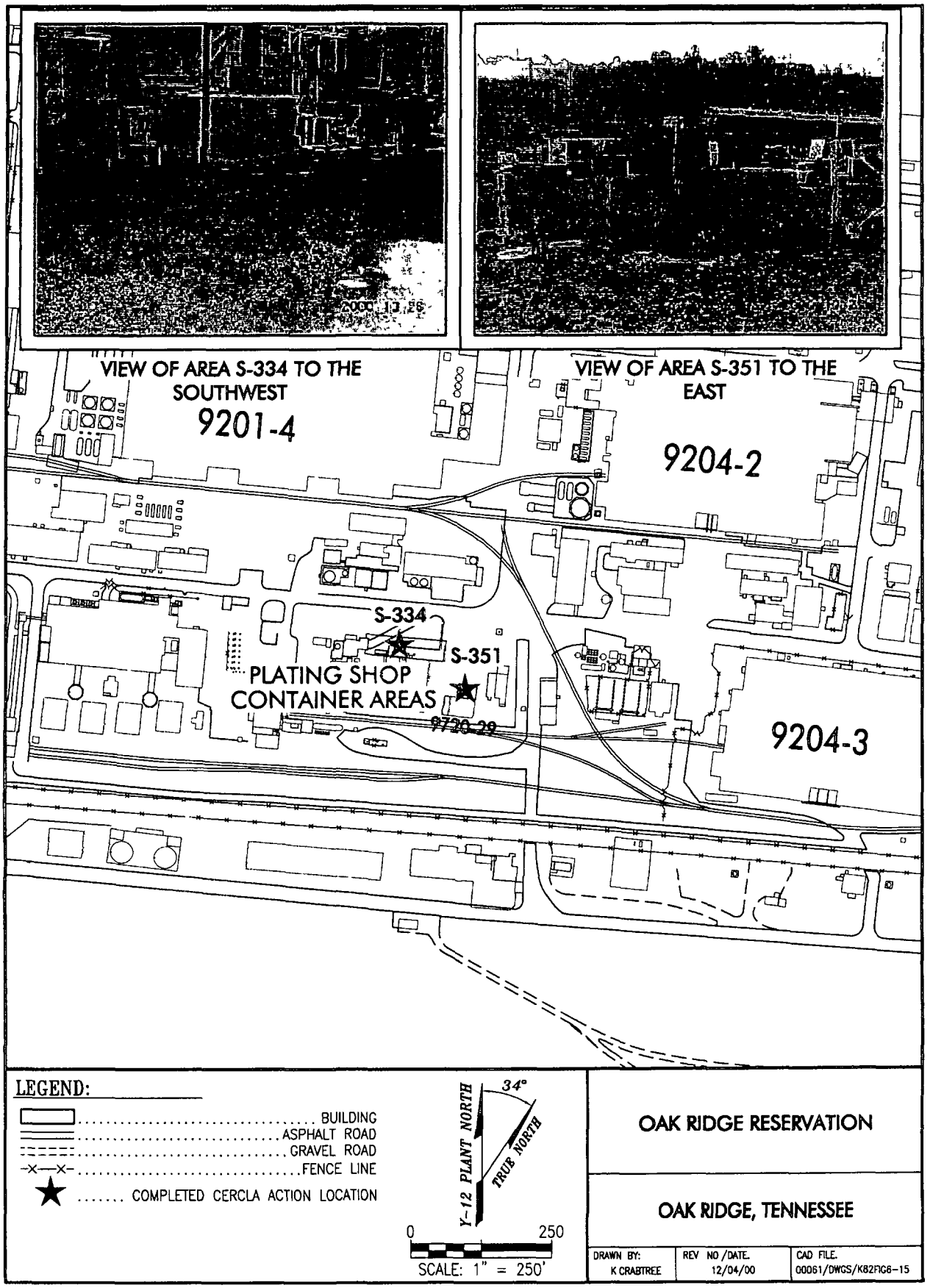


Fig. 6.8. Plating Shop Container Areas site map.

Table 6.6. Evaluation of performance and stewardship data—Plating Shop Container Areas Remedial Action

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Sect 6 4 2 1
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	NFA decision, no hazardous substances above risk-based standards
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in ROD, however, site is located within the Y-12 Property Protection Area (visual survey, Sect 6 4 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	Sect 6 4 2 1
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	NFA decision, no operating procedures or stewardship requirements apply under CERCLA (Sect 6 4 4 2)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	NFA decision, chemical-specific ARARs not addressed in ROD
Have there been any changes in land use or expected land use on or near the site?	Yes	Area S-351 is currently used to stored surplus equipment and non-RCRA waste materials contained in storage boxes Portion of S-351 area is a designated radiological management area Site is under Defense Programs control and is managed according to RMA protocols No future land use changes are foreseen (Sect 6 4 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	NA	No chemical treatment remedies were employed (Sect 6 4 4 2)
Have there been any changes in the physical site conditions?	Yes	See Item B 2 above regarding land use (Sect 6 4 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	No	No changes for constituents evaluated in the risk assessment since the remedy was implemented, no toxicity factor is available for lead
Were there significant changes in the standardized risk assessment methodologies?	No	No significant changes since the remedy was implemented
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	Action not driven by ecological RAOs The ROD notes no anticipated discernable impacts Ecological risks were addressed under the UEFPC Watershed RI, terrestrial receptors were not evaluated due to insufficient habitat within Y-12
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
CERCLA = Comprehensive Environmental Response Compensation and Liability Act of 1980
NA = not applicable
NFA = no further action
RAO = remedial action objective
RCRA = Resource Conservation and Recovery Act of 1976
RI = remedial investigation
RMA = radiological management area
TBC = to be considered
UEFPC = Upper East Fork Poplar Creek

6.4.4.1 Site visit and visual survey

A site visit and visual survey of the Plating Shop Container Areas was conducted on October 26, 2000. The present condition of the two former storage areas (S-334 and S-351) is illustrated on Fig. 6.8 (Photo). Both container storage areas are located within the Y-12 protected (high security) area and, as such, are not accessible to the public. The Plating Shop and both former container areas are currently under Defense Programs ownership.

Area S-334 located north of Bldg. 9401-2 is now an open gravel-covered area and is not demarcated in any fashion. Identification signs are not required, nor were they observed for this former container area. No observed changes in land use have occurred within the past five years in the vicinity of the S-334 area.

The S-351 area is gravel-covered, fenced in its entirety, and is used to store defunct laboratory equipment and non-RCRA waste materials (both non-radiological and radiological) derived from the Bldg. 9212 complex. As such, the land use for this particular container area has changed during the five-year evaluation period. Access to the fenced area is controlled by locked gates The southern half of the fenced area is designated as a radiological management area (RMA) with entry restricted to authorized personnel having the appropriate level of training As a designated RMA, the area is managed and maintained according to DOE radiological control protocols Waste materials within both the non-RMA and RMA portions of the are contained within steel B-25 container boxes or larger land-sea containers.

6.4.4.2 Interviews

No CERCLA post-remedial action stewardship requirements currently apply for the Plating Shop Container Areas. As noted above, the S-351 area is managed and maintained by Defense Programs as an RMA No significant future land use changes are anticipated No problems with the remedy or site-specific concerns were noted during the interviews with BJC environmental management staff.

6.4.4.3 Data evaluation

No monitoring of the Plating Shop Container Areas is currently required. A review of the toxicity factors for constituents addressed in the risk assessment (cyanide, nickel, methylene chloride, and PCE) indicate no changes since implementation of the remedy. No toxicity factor for lead, which was also a detected soil constituent, has been established to date Risk methodologies and potential exposure pathways have not changed These factors indicate that the conclusions of the risk assessment at the time of the decision (no excess risk under the most conservative exposure scenario) remain valid

6.4.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the Plating Shop Container Areas are presented in Table 6.6. No post-remedial action stewardship or monitoring requirements apply to the Plating Shop Container Areas.

6.5 ABANDONED NITRIC ACID PIPELINE REMEDIAL ACTION (UEFPC OU 2)

- ROD: September 12, 1994
- Field Activities: No Further Action

6.5.1 Project Description

The Abandoned Nitric Acid Pipeline is a 1.5- to 3-in diameter underground stainless steel pipeline that runs 4800 ft east to west from Bldg 9818 to the S-3 Ponds (Fig 6 9) The pipeline carried waste from a uranium recovery process Materials known to have been discharged through the pipeline include nitric acid, depleted and enriched uranium, various metal nitrates, salts, and lead skimmings The pipeline has many turns, bends, joints, and low points along its length where effluent might have collected or leaked The pipeline was originally buried 0.5 ft to 14 ft bgs, with an average depth of 5 ft An RI (DOE 1994h) was conducted to address possible impacts to soil, surface water, and groundwater from the pipeline The baseline risk assessment indicates that conditions related to the pipeline pose minimal threats to human health and the environment As a result, DOE proposed a decision of No Further Action The ROD was issued in September 1994

6.5.2 Evaluation of Decision Document Requirements for Performance

6.5.2.1 Goals of decision

No further remedial action for soils was determined to be necessary to achieve protection of human health and the environment for the Abandoned Nitric Acid Pipeline The no further action remedy protects human health and the environment, complies with federal and state ARARs, and is cost-effective The baseline risk assessment indicated that previous cleanup and maintenance activities reduced the concentrations of radiological and hazardous constituents in the soils to levels below those indicative of unacceptable carcinogenic and noncarcinogenic risk to human health Groundwater was not addressed as part of the RI and was deferred to the UEFPC watershed RI/FS (DOE 1994h) Ecological risk assessment and associated remedial goals were deferred to the UEFPC watershed RI/FS, terrestrial receptors were not evaluated due to insufficient habitat within Y-12.

6.5.2.2 Monitoring and stewardship required

No CERCLA performance monitoring or institutional controls are required under the ROD for the Abandoned Nitric Acid Pipeline because no hazardous substances above action levels were left on-site and groundwater is to be addressed by the UEFPC watershed ROD

6.5.3 Implementation of Previous Year's Recommendations

No recommendations were made for the Abandoned Nitric Acid Pipeline for FY 2000

6.5.4 Evaluation of Performance and Stewardship Data

Evaluation of performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are summarized in Table 6 7 Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below

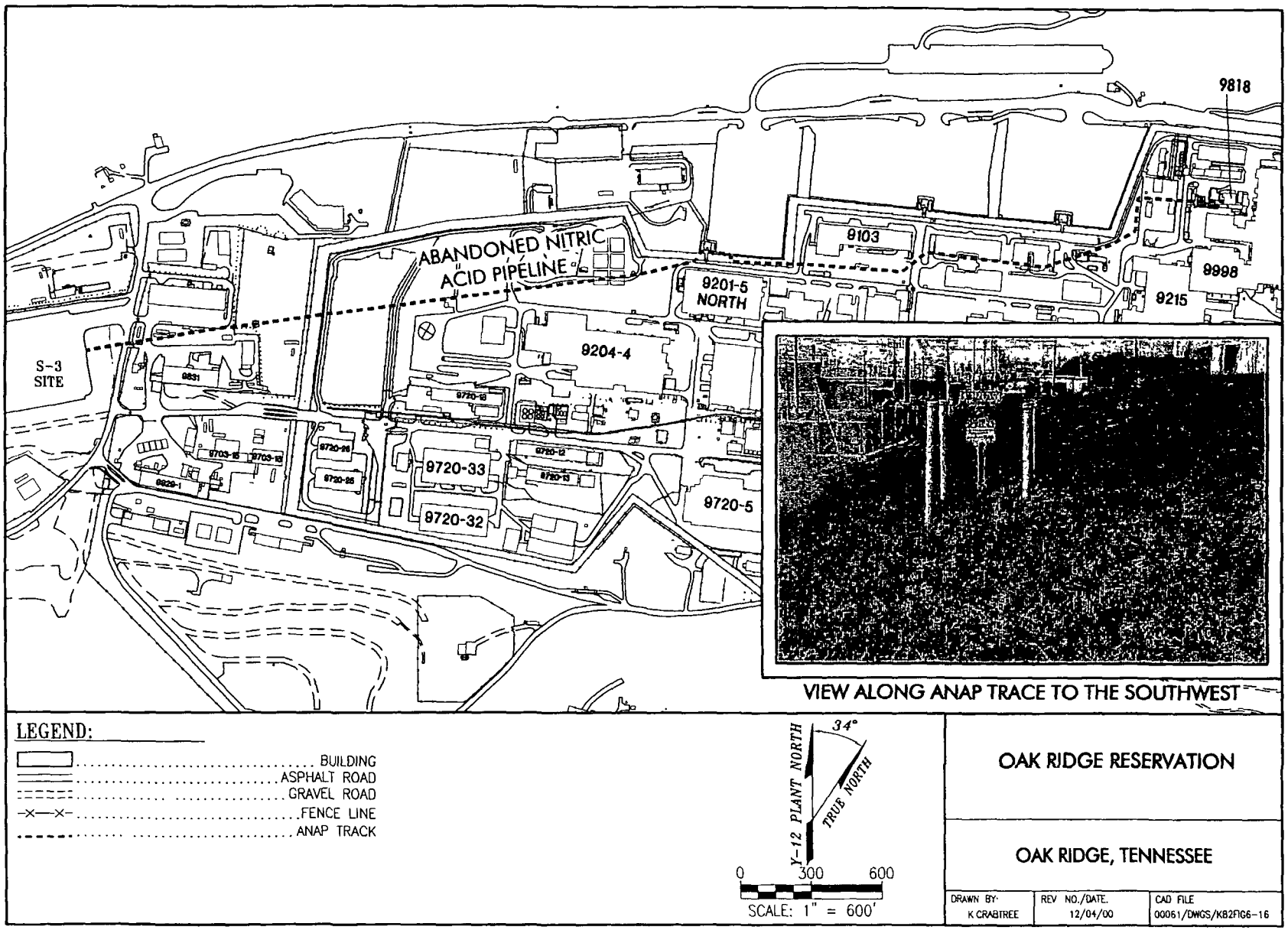


Fig. 6.9. Abandoned Nitric Acid Pipeline site map.

Table 6.7. Evaluation of performance and stewardship data—Abandoned Nitric Acid Pipeline Remedial Action

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	NFA decision, no hazardous substances above action levels were left on site (Sect 6 5 2 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls were specified by the ROD, however, the site is within the Y-12 Property Protection Area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	Sect 6 5 2 1
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	No action required
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed in ROD
Have there been any changes in land use or expected land use on or near the site?	Yes	Land use is currently unchanged New facilities may be built during facility modernization efforts No impacts to the pipeline are foreseen Visual survey (Sect 6 5 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	NA	No chemical treatment remedy was applied as part of the no action decision
Have there been any changes in the physical site conditions?	No	Surface land use is unchanged, visual survey (Sect 6 5 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	Yes	Toxicity values changed or reference doses established for ^{234}U, ^{235}U, ^{238}U, Cr^{+6}, and Be since implementation of the remedial action These changes do not affect risk levels established in the RI or result in only minor changes (Sect 6 5 4 3)
Were there significant changes in the standardized risk assessment methodologies?	No	Sect 6 5 4 3
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Action not driven by ecological RAOs Ecological risks deferred to the UEFPC watershed RI, terrestrial receptors were not evaluated due to insufficient habitat within Y-12
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
NA = not applicable
NFA = no further action
RAO = remedial action objective
RI = remedial investigation
ROD = record of decision
TBC = to be considered

6.5.4.1 Site visit and visual survey

A site visit and visual survey of the Abandoned Nitric Acid Pipeline was conducted on October 26, 2000. Site conditions along the pipeline trace at the ground surface are illustrated on Fig. 6.9 The pipeline trace is located entirely within the Y-12 property protection area, and a large portion of it is within the protected (high security) area. Accordingly, the pipeline area is not accessible to the public. Defense Programs currently have landlord responsibilities for the areas beneath which the pipeline is located.

Because the pipeline is underground, it could not be observed directly. The route of the pipeline is periodically marked with caution signs indicating its location. Surface land use along the pipeline trace has remained unchanged within the past five years.

6.5.4.2 Interviews

No CERCLA post-remedial action stewardship requirements currently apply for the Abandoned Nitric Acid Pipeline. As noted above, surface facilities along the route of the pipeline are managed and maintained by Defense Programs. Potential construction of new facilities north of Bldg 9201-4 as part of Y-12 modernization efforts are the only anticipated land use changes in the vicinity of the pipeline At present, construction related to modernization is not expected to impact the pipeline directly. No problems with the remedy or site-specific concerns were noted during the interviews with BJC environmental management staff.

6.5.4.3 Data evaluation

No monitoring of the Abandoned Nitric Acid Pipeline is currently required. A review of toxicity factors and potential exposure pathways shows that some changes have occurred since conclusions of the risk assessment were developed. Nickel (as nickel salts), molybdenum, nitrate, nitrite, ^{234}U, ^{235}U, ^{238}U, hexavalent chromium (Cr^{+6}), and beryllium were evaluated as potential risk or chemical hazard contributors in the risk assessment. No changes to toxicity factors for nickel, molybdenum, nitrite, and nitrate have occurred since implementation of the action. Toxicity factors for ^{234}U, ^{235}U, and ^{238}U have changed slightly; however, these changes do not result in increases to risk factors as determined in the RI (DOE 1994h).

For Cr^{+6}, a minor change to the non-cancer oral reference dose (RfD) was made and a non-cancer inhalation pathway reference concentration (RfC) was established in 1998. The change to the oral RfD increases the ingestion and dermal hazards by a factor of 1.67. The addition of the inhalation RfC is negligible because the inhalation hazard at a given Cr^{+6} concentration is two orders of magnitude less than the ingestion hazard. The overall net change in effects for Cr^{+6} is minor.

Similarly, for beryllium, three changes occurred in 1998 with respect to RfDs and exposure pathways. These changes include (1) a minor change in the oral RfD (non-cancer), (2) addition of an inhalation RfD, and (3) elimination of the oral slope factor (for evaluating ingestion cancer risk). The change in the oral RfD increases the ingestion and dermal hazards by a factor of 2.5 with respect to chemical hazard. Addition of the inhalation pathway is insignificant as it relates to the ingestion pathway for the exposure scenario employed by the RI (i.e., dermal and ingestion pathways did not result in elevated risk, and the soil inhalation hazard for a given beryllium concentration is two orders of magnitude less than ingestion of soil hazard. The elimination of the oral slope factor for evaluating cancer risk would result in a net risk reduction as compared to that calculated in the RI report (if the ingestion and dermal pathway risks are not quantified). The overall effect on risk levels for beryllium considering

these three changes is minor; therefore, the original conclusion of the risk assessment (only minimal risk to human health and the environment under the most conservative exposure scenario) remains valid.

6.5.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the Abandoned Nitric Acid Pipeline are presented in Table 6.7. No post-remedial action stewardship or monitoring requirements apply, although there are potential land use changes in the vicinity of the site (i.e., Y-12 modernization).

6.6 KERR HOLLOW QUARRY REMEDIAL ACTION

- RCRA Post Closure Permit: June 11, 1996
- ROD: September 29, 1995
- Action Complete: No Further Action

6.6.1 Project Description

Kerr Hollow Quarry, located on the southeast side of Chestnut Ridge near Bethel Valley Road, (Fig. 6.10) is a 3-acre flooded limestone rock quarry about 55 ft deep, sheltered on three sides by 60-ft high cliffs with a drainage outlet on the southern side (Outfall 301). It was abandoned in the late 1940s and allowed to fill with water The quarry was used as a treatment site for water-reactive, corrosive, or ignitable wastes from Y-12 and ORNL from 1951 until 1988. The site received containers of waste in various sizes consisting mainly of gas cylinders, drums, and buckets. A RCRA closure action was initiated in 1991. From 1991 to 1993, containers and materials at the bottom of the quarry was removed, shredded, evaluated by health physics personnel, and placed in B-25 boxes. Shredded debris from the quarry was placed in concrete vaults and placed adjacent to the Walk-In Pits in the BCBG (DOE 1995e) Monitoring wells around the quarry were sampled before and during removal operations as part of RCRA interim status requirements. Kerr Hollow Quarry was added to the Chestnut Ridge Post-Closure Permit on June 11, 1996 (TDEC 1996b). Restricted access provides the necessary protection of human health and environment to satisfy CERCLA requirements Therefore, a No Further Action determination was proposed for the site in 1995 and accepted by EPA and TDEC in a ROD approved shortly before the site was added to the Chestnut Ridge Post-Closure Permit (DOE 1995e). Results from monitoring of groundwater have not indicated a statistically significant release of contamination to groundwater in downgradient monitoring wells. Until 1995, surface water discharge from Kerr Hollow Quarry was monitored under the Y-12 NPDES compliance monitoring program. The NPDES permit was revised and reissued in 1995 with no requirement for continued monitoring of the quarry discharge under that program.

6.6.2 Evaluation of Decision Document Requirements for Performance

6.6.2.1 Goals of decision

The RCRA closure process was undertaken to prevent physical exposure to contaminants and mitigate migration of contaminants to groundwater or surface water runoff The RCRA closure was certified with waste (contaminated sediment and non-visible debris) remaining in place. Because of the closure status, a post-closure maintenance, monitoring, and reporting program was required. These requirements were stipulated in Post-Closure Permit for the Chestnut Ridge Hydrogeologic Regime (TNHW-088) as modified on June 11, 1996. The RCRA closure activities were deemed protective of human health and the environment; therefore, no further action was required under the CERCLA ROD.

6.6.2.2 Monitoring and stewardship required

Semi-annual detection monitoring of five wells (GW-231, -144, -145, -142, and -143) is specified in the RCRA Post-Closure Permit (TNHW-088). Data from these wells are reported in the annual Groundwater Monitoring Reports required under RCRA. The ROD specified monitoring of the surface water discharge point (Outfall 301) from the quarry as a best management practice Monitoring of this outfall is done in conjunction with groundwater monitoring when sufficient flow exists at the outfall The ROD also denotes that DOE will monitor groundwater and surface water to ensure continued protection

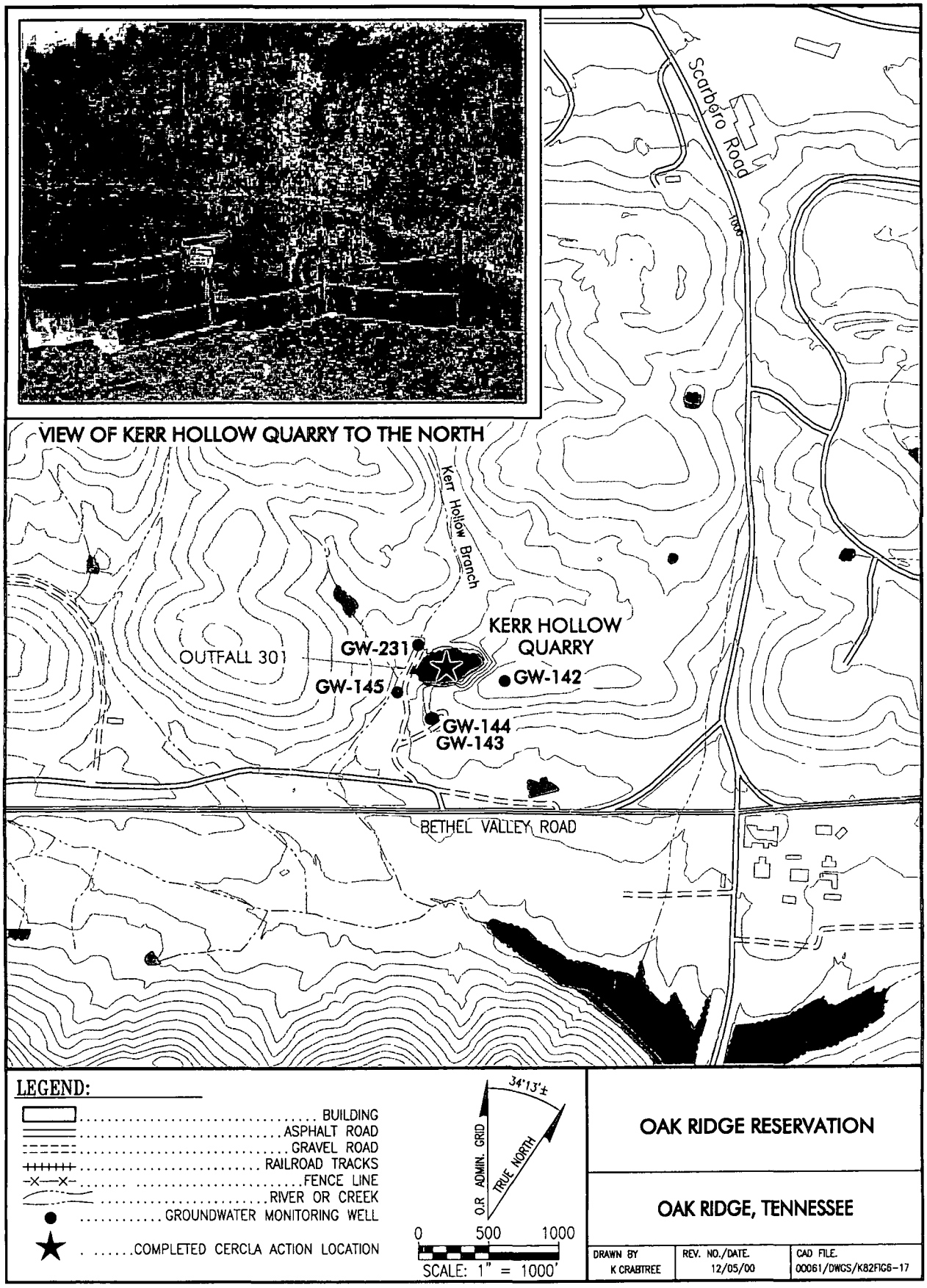


Fig. 6.10. Kerr Hollow Quarry site map.

of human health and the environment and to meet post-ROD requirements These surface water and groundwater monitoring requirements are met by the monitoring of Outfall 301 as a best management practice and the groundwater monitoring conducted to satisfy the requirements of the RCRA post-closure permit Monitoring results for Outfall 301 are compared to generic ecological preliminary remediation goals (PRGs) as a best management practice to evaluate any potential degradation of surface water quality

6.6.3 Implementation of Previous Year's Recommendations

Considering the difficulty in obtaining samples from Outfall 301 due to the absence of flow from the quarry during most of the year and the large amount of historical data that have been collected to evaluate the impacts to surface water, the recommendation was made to evaluate the feasibility of continued sampling of the outfall in the Five-Year Review This evaluation is presented in Sect 6 6 4 3 below

6.6.4 Evaluation of Performance and Stewardship Data

Evaluation of performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are summarized in Table 6 8 Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below

6.6.4.1 Site visit and visual survey

A site visit and visual survey of Kerr Hollow Quarry was conducted on October 13, 2000 The present condition of the quarry is illustrated on Fig 6 10 Kerr Hollow Quarry is surrounded by an outer, barbed-wire fence posted with signs and an inner, 6-ft high, chain-link security fence with a locked gate The area is routinely patrolled by security personnel Signs denoting that the site is subject to restricted entry are posted along the fence and at the entry gate

At the time of the site visit, the security fence, signs, and gate were in good condition The water level in the quarry was observed to be about 4 ft lower than the typical wet season water levels No water was flowing out of the quarry through Outfall 301, the quarry water level was about 3 ft below the level of the discharge point Two former operations areas, the remote submarine staging pad and an area near the quarry shore, were designated as RMAs Several storage boxes containing remediation equipment and a pair of flotation pontoons were staged alongside the main access road near the quarry within an RMA The BJC site manager noted that the items were scheduled for imminent removal from the site No observed changes in land use have occurred within the past 5 years in the vicinity of Kerr Hollow Quarry The city of Oak Ridge continues to conduct treated sewage sludge land application north and west of the quarry

6.6.4.2 Interviews

Information from the interview with the Bechtel Jacobs site manager conducted at the time of the site visit indicate that all monitoring, stewardship, and reporting requirements specified by the RCRA post-closure permit are being met Quarterly and monthly inspections of the security fence, signage, and the monitoring system is conducted as a best management practice An annual RCRA compliance evaluation inspection is conducted by TDEC-Division of Solid Waste Management staff All inspection records are maintained in the administrative record Operating procedures are maintaining the effectiveness of response actions Site management personnel noted that sporadic, low levels of VOCs (carbon tetrachloride and PCE) have been noted in wells GW-142 and GW-144 since 1993, but MCLs have not been exceeded and no statistically significant indications of a contaminant release to

Table 6.8. Evaluation of performance and stewardship data—Kerr Hollow Quarry Remedial Action

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	No releases to groundwater or surface water documented to date (Sect 6 6 4 3)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	No releases to groundwater or surface water documented to date
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	NA	No additional actions required by ROD (Sect 6 6 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	Sect 6 6 2 1
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Site Manager Interview (Sect 6 6 4 2)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Performance standards are statistical evaluations required under RCRA post-closure detection monitoring
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under government control, visual survey (Sect 6 6 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	No	Based on systematic monitoring results, no contaminant releases to groundwater or surface water have been documented (Sect 6 6 4 3)
Have new contaminants or contaminant sources been identified?	No	Sect 6 6 4 3
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	NA	No chemical treatment remedies were employed (Sect 6 6 4 2)
Have there been any changes in the physical site conditions?	No	Visual survey (Sect 6 6 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	BRA/ERA not performed for the ROD
Were there significant changes in the standardized risk assessment methodologies?	NA	BRA/ERA not performed for the ROD
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	Qualitative evaluation of ecological risks at Outfall 301 prior to and following closure indicate no apparent concern
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
ERA = ecological risk assessment
NA = not applicable
RCRA = Resource Conservation and Recovery Act of 1976
ROD = record of decision
TBC = to be considered

been observed. No other problems with the remedy or site-specific concerns were noted during the interview with environmental management staff.

6.6.4.3 Data evaluation

Surface Water. Between CY 1989 and CY 1993, the year of site closure, 182 samples were collected from Outfall 301 under the Y-12 NPDES program. The results for these samples are summarized in the RCRA closure report and the 1993 preliminary assessment/site investigation report. The outfall was sampled 18 times in CY 1995 by the Y-12 NPDES Program No samples were collected in CY 1996 by Y-12 nor by the WRRP in FY 1997 (dry) and FY 1998 (dry); therefore, no data are available for this time period. The outfall was sampled three times in FY 1999: in October 1998 for anions and fecal coliform and in March and July 1999 for a full range of constituents. In FY 2000, the outfall was sampled in October 1999 and May 2000 for a full range of constituents.

Radiological constituents exceeding MDAs in FY 2000 included only gross beta in October 1999 (1.77 +/- 0.91) and in May 2000 (1.83 +/- 1.17); the activity concentrations were low enough so that both of these results were qualified as estimated (J-flagged) values. Inorganic constituents were compared to Safe Drinking Water Act MCLs and to ecological PRGs as screening levels No constituent exceeded MCLs in FY 2000.

Evaluation of FY 2000 monitoring results against ecological PRGs indicate that the only constituent exceeding ecological PRGs was barium. Barium concentrations in samples collected during both the October 1999 sampling event (0 06 mg/L) and the May 2000 sampling event (0.0584 mg/L) also exceeded the PRG for chronic exposure (0.0038 mg/L). By comparison, the Safe Drinking Water Act MCL for barium is 2 mg/L. Also by comparison, the barium background value derived from a reference stream on the ORR and used as a screening criteria in the RIs for UEPFC and the Bear Creek watershed was 0.21 mg/L. The observed results for FY 2000 sampling of Outfall 301 are consistent with those observed for the previous year (FY 1999). In FY 1999, aluminum slightly exceeded its chronic PRG of 0.0876 mg/L once (0.116 mg/L in March 1999) and barium exceeded its chronic PRG on one occasion (0.0594 mg/L in July 1999). The concentrations of barium over the past three semi-annual sampling events, while above chronic PRGs, do not suggest an increasing trend.

Groundwater. Groundwater monitoring at Kerr Hollow Quarry has been conducted under RCRA interim status and post-closure detection monitoring programs since 1986 No contaminant release to groundwater has been confirmed using statistical analyses required under these programs Historically, low levels of carbon tetrachloride, chloroform, and TCE have been sporadically detected in groundwater from wells GW-142 and GW-144 All detection monitoring wells were sampled in October 1999 and April 2000. These VOCs were not detected during sampling of these wells in FY 2000 Statistical evaluations of data from the FY 2000 monitoring events showed no indication of a contaminant release to groundwater (BJC 2000a and b).

6.6.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for Kerr Hollow Quarry are presented in Table 6 8. Available data from Outfall 301 have not indicated substantial potential ecological impacts related to surface water contaminant concentrations at Outfall 301. Barium in Outfall 301 discharges, however, has exceeded chronic ecological PRGs during the past three sampling events. No statistically significant releases of contaminants to groundwater have been documented On the basis of the Five-Year Review, the remedial action for Kerr Hollow Quarry remains effective. Given that (1) potential effects related to disturbance of sediment in the quarry floor during closure have had 7 years to dissipate, (2) no observable barium concentration trend is evident, and (3) barium concentrations at Outfall 301 are less

than those observed in an ORR reference stream, the presence of barium at the observed concentrations likely reflect ambient conditions In consideration of the evaluation of Outfall 301 data and frequent lack of flow, continued monitoring of the outfall is not anticipated to show ecological impacts to surface water It is recommended that sampling of the outfall be discontinued

6.7 FILLED COAL ASH POND/UPPER McCOY BRANCH REMEDIAL ACTION

- ROD — February 21, 1996
- Field Activities Complete — April 8, 1997
- RAR — May 29, 1997

6.7.1 Project Description

The FCAP is situated 0 5 mile south of Y-12 along the southern slope of Chestnut Ridge (Fig 6 11) The pond was built in 1955 as a settling basin for coal ash from the Y-12 steam plant by constructing a 62-ft-high earthen dam across Upper McCoy Branch A slurry composed of ash from the steam plant and untreated Clinch River water was pumped over the crest of Chestnut Ridge and flowed from there by gravity down the slope to the pond The pond had a storage capacity, when built, of approximately 42 million gal and was expected to have a 20-year capacity for ash By 1967, ash had filled the pond, and slurry was allowed to overtop the dam and flow down Upper McCoy Branch to Rogers Quarry This practice was stopped in 1989 Vegetation was allowed to grow on the dam and, with time, the dam and spillway deteriorated

The ROD (DOE 1996e) was approved on February 21, 1996 The remedial action was intended to stabilize the dam to prevent further release of coal ash slurry to Upper McCoy Branch and to construct an oxygenation weir and wetland to prevent release of contaminants from ash to surface water Field activities began in August 1996 and were completed in April 1997 The RAR (DOE 1997m) was approved on May 29, 1997, documenting the following actions The crest of the dam was raised, the face of the dam was reinforced, a subsurface drain was installed, large trees from the face of the dam were removed, the emergency spillway was repaired (including removing the steep slope to the east of the spillway), a settling basin and oxygenation weir were constructed at the foot of the dam, and a small wetland was replaced downstream of the settling basin The remedial action also includes long-term monitoring of the dam and controls to limit access

6.7.2 Evaluation of Decision Document Requirements for Performance

6.7.2.1 Goals of decision

The response action reduces risk from the site to "plants, animals and humans by (1) upgrading containment of the coal ash with dam improvements and stabilization, (2) reducing contaminant migration into Upper McCoy Branch with a passive treatment system (existing wetland), and (3) restricting human access to the contamination by implementing institutional controls " The functional goals per the ROD (DOE 1996e) are to do the following

- minimize the migration of contaminants into surface water,
- minimize direct contact of humans and animals with the ash,
- reduce the potential for future failure of the dam, and
- preserve the local habitat in the long term

6.7.2.2 Monitoring and stewardship required

The RAR recommends adequate maintenance and monitoring of the facility This includes the following

- Inspection of the dam, spillway channel, adjacent slopes, settling basin, and wetland area Inspections will be conducted quarterly throughout the post-remediation care period Any required

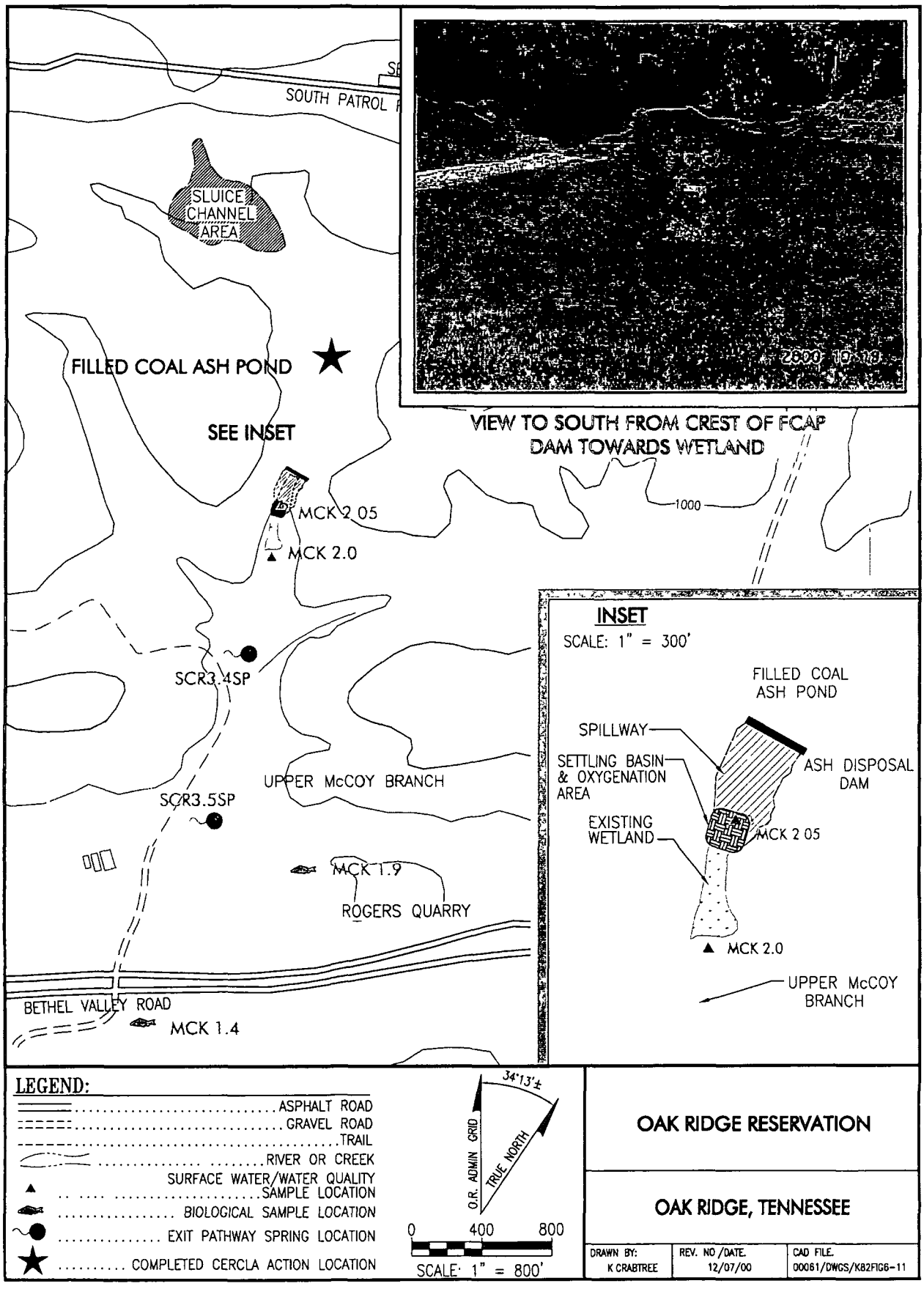


Fig. 6.11. Location of Filled Coal Ash Pond and sampling locations.

maintenance will be conducted based on inspection findings The dam and spillway will also be inspected following any rainfall event equivalent to a 25-year, 24-hour intensity

- Monitoring of surface water for the primary contaminants of concern and other constituents of relevance Selection of specific sampling locations, frequency, and necessary analytes was assigned to the Integrated Water Quality Program (IWQP), predecessor program to the WRRP (DOE 1997o) Two locations, one at the outlet to the dam [McCoy kilometer (MCK) 2 05] and one below the wetland (MCK 2 0) will be monitored for metals, radionuclides, and water quality parameters on a semi-annual basis

Stewardship requirements specified in the decision documents include deed restrictions, access controls (e g , fencing) and dam improvements and stabilization

6.7.3 Implementation of Previous Year's Recommendations

No changes were recommended for the current year

6.7.4 Evaluation of Performance and Stewardship Data—Filled Coal Ash Pond/Upper McCoy Branch Remedial Action

Table 6 9 presents a summary of the Five-Year Review questions and answers for the FCAP/Upper McCoy Branch Remedial Action Further details are provided in the subsequent sections

6.7.4.1 Site visit and visual survey

A site visit and visual survey was conducted on October 13, 2000 (Appendix A) The site is surrounded by fencing and clearly marked with signs identifying the site and Facility Manager The area behind the dam has mostly filled in with ash and is covered in evergreen trees A spillway constructed of concrete pillow runs along the side of the side perpendicular to the dam to convey overflow during storm events The slope of the dam is covered with vegetation (mostly grass) Previously, vegetation along the slope of the dam had been sparse, leading to erosion of the cherty soil At the toe of the slope is a small settling basin where influent water samples are taken, effluent samples are taken on the other side of a small, but extremely well-established, wetland McCoy Branch then winds off-site from the wetland area The surrounding area is open for public access for ORR-wide game hunts several times a year, but "NO HUNTING" signs are posted and visible at the FCAP site

6.7.4.2 Interviews

An interview with BJC environmental management staff was conducted at the time of the site visit The site undergoes quarterly inspections as required in the decision documents, with monthly inspections as a part of best management practice (BMP) The records (inspection checksheets) are maintained in the Facility Manager's office and sent to the Document Management Center at the end of each fiscal year Quarterly influent and effluent water samples are collected up-slope and down-slope of the wetland area Biomonitoring data (bioaccumulation of metals in fish, and community density and diversity studies) is collected in McCoy Branch and Rogers Quarry These samples are not a requirement of the FCAP decision documents, but are related to this site

Table 6.9. Filled Coal Ash Pond/Upper McCoy Branch Remedial Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	See Sect 6 7 4 2–metals concentrations at MCK 2 0 and 2 05 < AWQCs in FY 2000
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Performance data show remedial systems, dam stabilization, and runoff control measures are functioning as intended
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	See Sect 6 7 4 1
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	N/A	See Sect 6 7 4 1
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	See Sects 6 7 2 2 and 6 7 4 1
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	Numerical performance standards not required and no chemical-specific ARARs were identified by the ROD AWQCs are addressed as location-specific ARARs, which were not exceeded in FY 2000
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under general DOE ownership with industrial land use
Have new human health or ecological exposure pathways or receptors been identified?	No	Site use unchanged, monitoring to date shows no new impacts to surface water in McCoy Branch (Sect 6 7 4 2)
Have new contaminants or contaminant sources been identified?	No	See Sect 6 7 4 2
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	No chemical treatment remedies were applied as part of the remedial action at FCAP
Have there been any changes in the physical site conditions?	No	See Sect 6 7 4 1
Have there been any changes in the toxicity factors for contaminants of concern?	No	
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	Data evaluation through FY 2000 shows no new or increased impacts to surface water (Sect 6 6 4 2)
Is the site located in an area subject to natural disasters?	Yes	No flooding hazard exists, low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
AWQC = ambient water quality criteria
FCAP = Filled Coal Ash Pond
FY = fiscal year
MCK = McCoy kilometer
ROD = record of decision
TBC = to be considered

6.7.4.3 Evaluation of monitoring data

Sampling of FCAP wetland influent and effluent in June 1996, prior to the remedial action, provides a baseline data for comparison These sampling data (1) illustrate contaminant concentrations above and below the existing wetland below the pond and (2) establish baseline measures of other parameters sensitive to changes in leachate or water chemistry Analytical results from the baseline sampling indicate that metal concentrations in surface water were highly variable for unfiltered samples and less variable for filtered samples within each sampling zone (wetland entry and wetland exit) Concentrations of dissolved (filtered sample) iron and zinc decreased slightly from the wetland entry zone to the wetland exit, whereas concentrations of arsenic increased The variability in these baseline data makes the results ambiguous and of limited usefulness (Table 6 10)

Table 6.10. Summary of baseline monitoring results

	Arsenic	Iron	Manganese	Zinc
		Total (µg/L)		
Dam effluent/ wetland influent	7–1,400	5 6–43 0	470–3,800	56–94
Wetland effluent	1 2–29	0 6–48 0	600–39,000	ND–200
		Filtered (µg/L)		
Dam effluent/ wetland influent	1 1–11	20–260	1 7–39,000	ND–52
Wetland effluent	11–17	ND–14	0 15–2 2	ND–9 4

ND = Not detected

Results of sampling above (MCK 2 05) and below the wetland (MCK 2 0) in FY 2000 are provided in Table 6 11 These data show the following results related to the effectiveness of the FCAP remedial action

1 Concentrations of zinc at both MCK 2 05 and 2 0 continue to be significantly lower in FY 2000 than those measured in the pre-remediation baseline sampling (Table 6 4) Arsenic concentrations at MCK 2 05 and 2 0 remain within the baseline range Manganese values for wetland influent (MCK 2 05) samples remain within the baseline range, whereas effluent (MCK 2 0) values were consistently lower than the reference data Iron concentrations were consistently higher in both influent and effluent samples as compared to baseline data

2 In addition to the four indicator metals above, concentrations of most other metals were lower in the wetland "effluent" than in the "influent" from the FCAP dam drain Concentrations of aluminum, boron, calcium, potassium, and sodium, however, consistently increased from upstream to downstream in both wet and dry season sampling

Metal concentrations at MCK 2 0 and MCK 2 05 are all less than the continuous and maximum fish and aquatic life AWQC (TDEC 1999) In addition, suspended solids were negligible in each sample taken in FY 2000, indicating success in prevention of erosion and bank stabilization at the dam and stream channel Based on these data, the FCAP remedial action has met and exceeded its goals and can be considered effective

Table 6.11. Summary of post-remediation data from MCK 2.0 and MCK 2.05

Analyte	Wet season (February 7, 2000)				Dry season (August 29, 2000)			
	MCK 2.05		MCK 2.0		MCK 2.05		MCK 2.0	
			Metals (µg/L)					
Aluminum	30.0	J	60.0	=	10.0	J	60.2	=
Antimony	0.45	U	0.45	U	0.52	U	0.52	U
Arsenic	110.0	=	20.0	=	44.2	=	15.9	=
Barium	80.0	=	80.0	=	78.4	=	58.8	=
Beryllium	0.11	J	0.09	J	0.04	J	0.03	J
Boron	230	=	240	=	205	=	212	=
Cadmium	0.8	U	0.8	U	0.08	U	0.08	U
Calcium	46200	=	46800	=	40700	=	42300	=
Chromium	0.25	J	0.21	J	0.22	U	0.34	J
Cobalt	2.3	J	0.2	U	2.2	J	0.2	J
Copper	0.2	U	0.2	U	0.2	U	0 2	U
Iron	2200	=	80	=	785	=	112	=
Lead	0.58	U	0.78	J	0.52	U	0.52	U
Lithium	70.0	=	70 0	=	65.3	=	67.8	=
Magnesium	16400	=	16300	=	14500	=	14900	=
Manganese	1220	=	70	=	1040	=	90	=
Mercury	0.1	U	0.1	U	NA		NA	
Nickel	1.3	J	0.46	J	1.3	J	0.61	J
Potassium	4170	=	4360	=	3830	=	3990	=
Selenium	1.1	U	1.1	U	1.1	U	1.1	J
Silver	0.22	U	0.22	U	0.28	U	0.28	U
Sodium	2050	=	2120	=	1890	=	1980	=
Strontium	790	=	800	=	749	=	772	=
Thallium	0.92	U	0.92	U	0.9	U	0.9	U
Total Uranium	0.72	J	0.75	J	0.0	=	0.0	=
Vanadium	0.15	U	0.15	U	0.22	U	0.22	U
Zinc	0.53	J	0.20	U	1.8	J	0.83	J
			Anions and miscellaneous parameters (mg/L)					
Bicarbonate	137	=	160	=	156	=	146	=
Carbonate	2.0	U	2.0	U	2.0	U	2.0	U
Chloride	1.9	=	1.8	=	1.9	=	1.8	=
Fluoride	0.12	=	0.14	=	0.13	=	0.13	=
Sulfate	20.8	=	20.6	=	22.8	=	22 7	=
Dissolved solids	200	=	200	=	190	=	210	=
Suspended solids	5	U	5	U	5	U	5	U
			Radionuclides (pCi/L)					
Alpha activity	1.25	=	1.12	U	0.30	U.	0.89	U
Beta activity	4.82	=	5.25	=	5 43	=	4.89	=

J = Estimated concentration less than reporting limits
U = Not detected
= = Validated result, detected and unqualified
MCK = McCoy kilometer
NA = No analysis completed

In addition to the performance monitoring locations, two exit pathway springs (SCR 3.4SP and SCR 3.5SP), which are located within the subwatershed containing the FCAP, were sampled during wet and dry seasons in FY 2000. No VOCs indicative of waste disposals in the Chestnut Ridge hydrogeologic regime were detected in any of the samples analyzed. Gross alpha was detected at SCR 3.5 (1.52 = pCi/L); gross beta was also detected at this station (2.99 J pCi/L). Analyses for metals show exceedances of UEFPC groundwater background values (Cluster 10 water types) for manganese, total uranium, and

zinc at SCR 3.4SP. Exceedances at SCR 3.5SP were noted for only manganese. All of these constituents were only slightly elevated with respect to background

Filled Coal Ash Pond/McCoy Branch Biological Monitoring. Biological monitoring studies prior to FY 2000 had documented contaminants in fish and impacts to biota in the McCoy Branch watershed. Current selenium and mercury concentrations in largemouth bass are 2 and 20 times higher, respectively, than concentrations in bass from reference sites. Mercury concentrations in bass exceed levels that are of concern for human consumption and have shown an increasing trend since 1990, while selenium concentrations have been dropping (Fig. 6.12). In FY 2000, the selenium concentration in a single sample of largemouth bass was higher than in FY 1999, and the mercury concentration was slightly lower. However, the data are highly variable from year to year even when they show a definite trend, and a change in one year should not be interpreted as predictive for subsequent years.

Taxonomic richness of pollution-intolerant benthic macroinvertebrate taxa was lower in McCoy Branch than in a nearby reference site, and total taxonomic richness appeared to be variably lower or the same (Table 6.12). In FY 2000, both total species richness and EPT richness (a count of pollution-sensitive species that can exist at the site) in the fall sample at MCK 1 9, upstream of Rogers Quarry (Fig 6.10), were much below the richness observed at two reference sites. However, in spring 2000 EPT richness at MCK 1.4, downstream of Rogers Quarry, was still below that at the reference streams, but total richness was near the reference level At MCK 1.9, EPT richness was only slightly below one of the reference sites, and total species richness was higher than at the reference sites. In the past, the fish community at MCK 1.9 remained limited to a single species that was introduced in 1995. At MCK 1.6, in previous years, total density, biomass, and species richness of fish were within or near the reference site range (BJC 1998c). The FY 2000 fish communities collected at MCK 1.4 show similar results Data are not available to evaluate fish communities at MCK 1.9 in FY 2000; monitoring was discontinued at this location because the population comprises a single introduced species and does not represent local natural fish populations.

Overall, total species richness of both benthic macroinvertebrates and fish communities are close to reference levels, indicating little impact of site-related contaminants on species that are not especially sensitive to pollution. The reduced proportion of pollution-sensitive benthic macroinvertibrate species and high proportion of a pollution-tolerant fish species at these stations may indicate that the aquatic communities are still being subtly impacted (BJC 1998c)

Previous analysis (BJC 1998c) concluded that the historical pattern of biological impact in McCoy Branch appears to be closely related to remedial actions in the late 1980s that decreased fly ash discharges to the watershed. Selenium, a common constituent in fly ash, was highest in Rogers Quarry fish in the early 1990s, but has gradually decreased since fly ash disposal to the quarry ceased in 1993 (Fig. 6 12). Conversely, concentrations of mercury in fish have risen sharply over the last nine years and are currently above 1 mg/kg (Fig 6.12). The increase in mercury in fish may be due to (1) the reduction in selenium inputs to the quarry (selenium is known to reduce mercury bioaccumulation) and (2) the chemical/ecological characteristics of the system, which has resulted in an old, slow-growing largemouth bass population exposed to relatively high aqueous methylmercury concentrations. The macroinvertebrate community may now be showing some evidence of improving conditions both upstream and downstream of Rogers Quarry, although a definite trend has not been demonstrated, especially with pollution-sensitive species

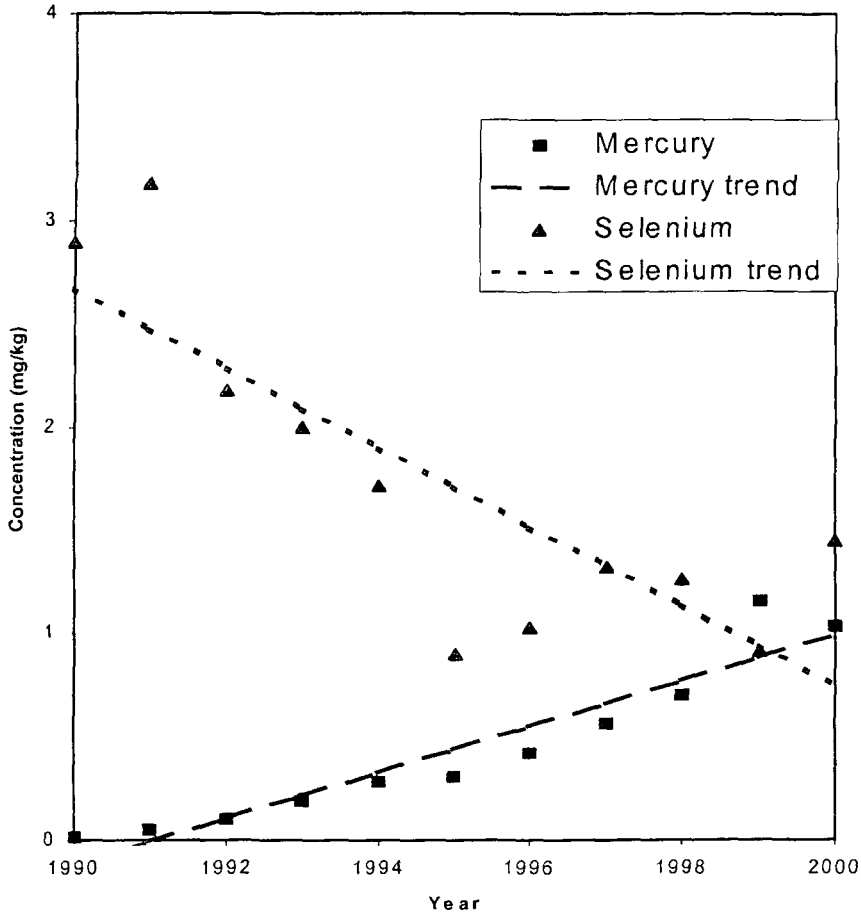


Fig. 6.12. FCAP Hg and Se trends in fish in McCoy Branch.

Table 6.12. Community taxonomic richness in McCoy Branch during FY 2000

Date	Location	Community taxonomic richness		
		Total	EPT	Fish
October 1999	MCK 1.4	No data	No data	No data
	MCK 1.9	34	6	No data
	Reference	55	16	No data
	Reference	58	21	No data
May 2000	MCK 1.4	48	11	11
	MCK 1 9	59	16	No data
	Reference	43	19	3
	Reference	55	21	7

EPT = Ephimeroptera, Plecoptera, and Trichoptera
FY = fiscal year
MCK = McCoy kilometer

6.7.5 Conclusions and Recommendations

No changes are recommended.

6.8 BUILDING 9201-4 (ALPHA 4) EXTERIOR PROCESS PIPING REMOVAL ACTION

- AM: April 22, 1997
- Removal Action Complete: June 30, 1997
- RmAR: Approved September 29, 1999

6.8.1 Project Description

Operation of the column exchange process at Bldg 9201-4 (Alpha 4) (Fig. 6.13) between 1955 and 1962, required large quantities of elemental mercury (more than 20 million lb) Numerous mercury spills and leaks occurred at or near Alpha 4 during operation of the process. Most residual mercury drained from the system at the time the operation was terminated. Mercury recovery activities began in 1983, with an estimated 100,000 lb of mercury initially recovered by opening pipe flanges or disconnecting equipment Various sections of exterior piping remained in place after operations were discontinued at Alpha 4. The physical condition, lengths, and materials of construction of the exterior piping were verified and quantified by field inspection in August 1995 and September 1996 Most of the piping was assumed to be asbestos based and was insulated

The AM (DOE 1997a) was approved on April 22, 1997. The removal action began on June 13, 1997, and was completed on June 30, 1997 The removal action was limited to the mercury feed and hydrogen lines outside Alpha 4 that were determined to be in poor condition and have a high probability of containing mercury, based on the field inspections

Mercury Feed Pipe Removal. The mercury feed pipeline consisted of about 375 ft of uninsulated, carbon steel pipe The pipe was cut either manually or mechanically into sections 20 ft or less in length A drip pan was used to collect mercury leaking out of the cut joint, and visible mercury in the pipe sections was collected. Pipe sections were capped on both ends and consolidated inside the Alpha 4 building.

Hydrogen Pipe Removal. The hydrogen line was about 520 ft of insulated, carbon steel pipe Asbestos was removed from the piping, and pipes were cut into sections 20 ft or less in length A drip pan was used to collect mercury leaking out of the cut joint, and visible mercury in the pipe sections was collected Pipe sections were capped on both ends and consolidated inside the Alpha 4 building

The Alpha 4 exterior piping is stored in the Alpha 4 basement pending disposition at the time the building undergoes D&D The asbestos insulation was disposed of in the operating Y-12 industrial landfill

6.8.2 Evaluation of Decision Document Requirements for Performance

6.8.2.1 Goals of decision

"The objective for removal of the mercury feed and hydrogen lines is to reduce the risk that a mercury release poses to human health and the environment" (DOE 1997a) Ecological risks were addressed under the UEFPC Watershed RI, terrestrial receptors were not evaluated due to insufficient habitat within Y-12

6.8.2.2 Monitoring and stewardship required

No requirements for performance or data collection were defined either in the AM or the RmAR

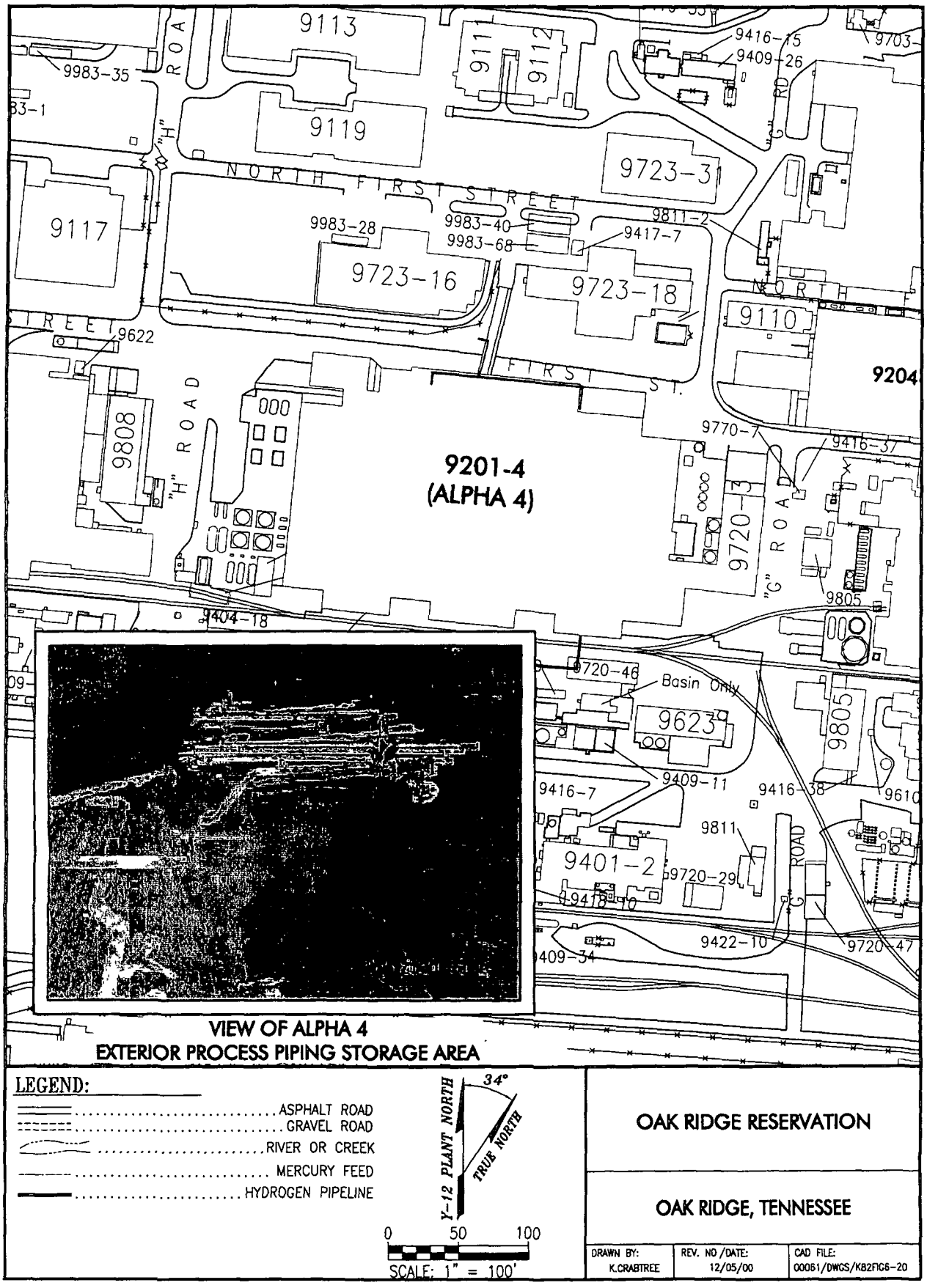


Fig. 6.13. Building 9201-4 Alpha 4 Exterior Process Piping site map.

6.8.3 Implementation of Previous Year's Recommendations

No recommendations were made for the Alpha 4 Exterior Process Piping for FY 2000

6.8.4 Evaluation of Performance and Stewardship Data—Bldg. 9201-4 (Alpha 4) Exterior Process Piping Removal Action

Evaluation of Bldg 9201-4 (Alpha 4) Exterior Process Piping performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are summarized in Table 6 13 Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below

6.8.4.1 Site visit and visual survey

A site visit and visual survey of the Alpha 4 Exterior Process Piping storage area was conducted on October 26, 2000 The present condition of the storage area is illustrated on Fig 6 13 Access to the piping storage area within Bldg 9201-4 is controlled through a locked door, and the interior of the building is considered as a hazardous waste operations area Furthermore, Bldg 9201-4 is located within the Y-12 protected (high security) area and, as such, is not accessible to the public

The piping storage area is demarcated by flagging A portion of the piping is stored directly on the floor surface, and a portion is stored on a wooden pallet Insulation has been removed from all of the pipe, and the ends of the cut pipe sections are covered with either plastic plugs or plastic bags and heavy tape The land use for the storage area has not changed during the five-year evaluation period It was noted by environmental management personnel during the site visit that Bldg 9201-4 is scheduled for D&D in CY 2008

6.8.4.2 Interviews

No CERCLA post-remedial action stewardship requirements currently apply for the Alpha 4 Exterior Process Piping action As noted above, the interior Bldg 9201-4 area is managed as a HAZWOPER (Hazardous Waste Operation) area and is access controlled, and the relevant training requirements of 40 CFR 1910 120 apply to personnel accessing the area for work purposes BJC environmental management staff noted that a daily visual inspection of the building interior is conducted, including the basement storage area, to check the former process system for fluid or mercury leaks Mercury vapor monitoring within the interior of the building is routinely conducted No problems with the remedy or site-specific concerns were noted during the interviews with environmental management staff

6.8.4.3 Data evaluation

No monitoring for the Alpha 4 Exterior Process Piping action is currently required As best management practice, the basement area of Alpha 4, where the piping is stored, is subject to daily mercury vapor monitoring as part of building maintenance activities

6.8.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the Alpha 4 Exterior Process Piping action are presented in Table 6 13 There are no post-remedial action stewardship or monitoring requirements that apply to the Bldg 9201-4 (Alpha 4) exterior process piping removal action

Table 6.13. Building 9201-4 (Alpha 4) Exterior Process Piping Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Removal action completed (Sect 6 8 2 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Removal action completed (Sect 6 8 2 1)
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in AM or RmAR, however, site is located within the Y-12 Property Protection Area
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions required (Sect 6 8 2 1)
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	Source was removed
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	N/A	Chemical-specific ARARs not addressed by the AM or RmAR
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under government control, visual survey (Sect 6 8 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	No chemical treatment remedies were employed (Sect 6 8 4 2)
Have there been any changes in the physical site conditions?	No	Visual survey (Sect 6 8 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	NFA decision
Were there significant changes in the standardized risk assessment methodologies?	NA	NFA decision
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	ERA addressed by UEFPC watershed RI
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
ERA = ecological risk assessment
NA = not applicable
NFA = no further action
RI = remedial investigation
RmAR = removal action report
ROD = record of decision
TBC = to be considered
UEFPC = Upper East Fork Poplar Creek

6.9 UEFPC WATERSHED INTERIM ROD UNION VALLEY REMEDIAL ACTION

- IROD: July 10, 1997
- Field Activities Complete: No Further Action

6.9.1 Project Description

Union Valley lies east of Y-12 and extends about 3.6 miles from Scarboro Road to the Clinch River in the city of Oak Ridge, Tennessee (Fig. 6.14). Illinois Avenue (State Route 62) crosses the area 0.6 mile east of Scarboro Road. Union Valley Road runs the length of the valley. Most properties in Union Valley are privately owned tracts of variable size. The city of Oak Ridge and the University of Tennessee also hold property within the valley.

Contamination associated with known contaminant discharges from Y-12 has been detected in the groundwater below privately owned land in Union Valley east of the facility. No groundwater users currently exist in Union Valley; however, the potential for risk to human health from ingestion of contaminated groundwater and a possibility that future actions taken by property owners may cause the contamination plume to expand were identified

The Maynardville Limestone underlies the southern portion of Bear Creek Valley and Y-12, as well as Union Valley This geologic unit is a principal pathway for contaminant migration within the valley. Contaminants including carbon tetrachloride, chloroform, and other VOCs have been detected in several of the six monitoring wells completed in the Maynardville Limestone in Union Valley (e.g., GW-169 and GW-170) and in two springs (SCR 7.1SP and SCR 7.18SP) that feed Scarboro Creek near State Route 62 (Illinois Avenue) This contamination is consistent with that observed in the Maynardville Limestone at the east end of Y-12. In addition, contamination detected in a single well east of Illinois Avenue screened at approximately 400 ft (GW-230) may or may not be related to Y-12

The IROD (DOE 1997h) was approved on July 10, 1997, and considered only interim actions, deferring final decisions regarding long-range remedial actions affecting Union Valley to UEFPC watershed decisions The IROD is based on a strategy of implementing institutional controls within the interim remedial action boundary to prevent potentially unacceptable exposure to contamination and to reduce its potential spread until final decisions are made for the UEFPC watershed. Controls to be instituted by DOE during the term of this IROD include the following:

- Establishing license agreements between DOE and all affected property owners within the interim remedial action boundary that require property owners to notify DOE 90 days before extraction or use of groundwater is proposed.

- Conducting annual title searches to determine whether any affected property changed ownership, and verify that any new owner has been notified of the provisions of the license agreement.

- Notifying affected property owners and the city of Oak Ridge to remind them of their obligations under the agreement.

- Surveying owners by telephone to determine whether any new groundwater wells have been constructed or planned, or if there are any new uses for surface water.

- Notifying licensed well drillers in Tennessee of the license agreements and their terms

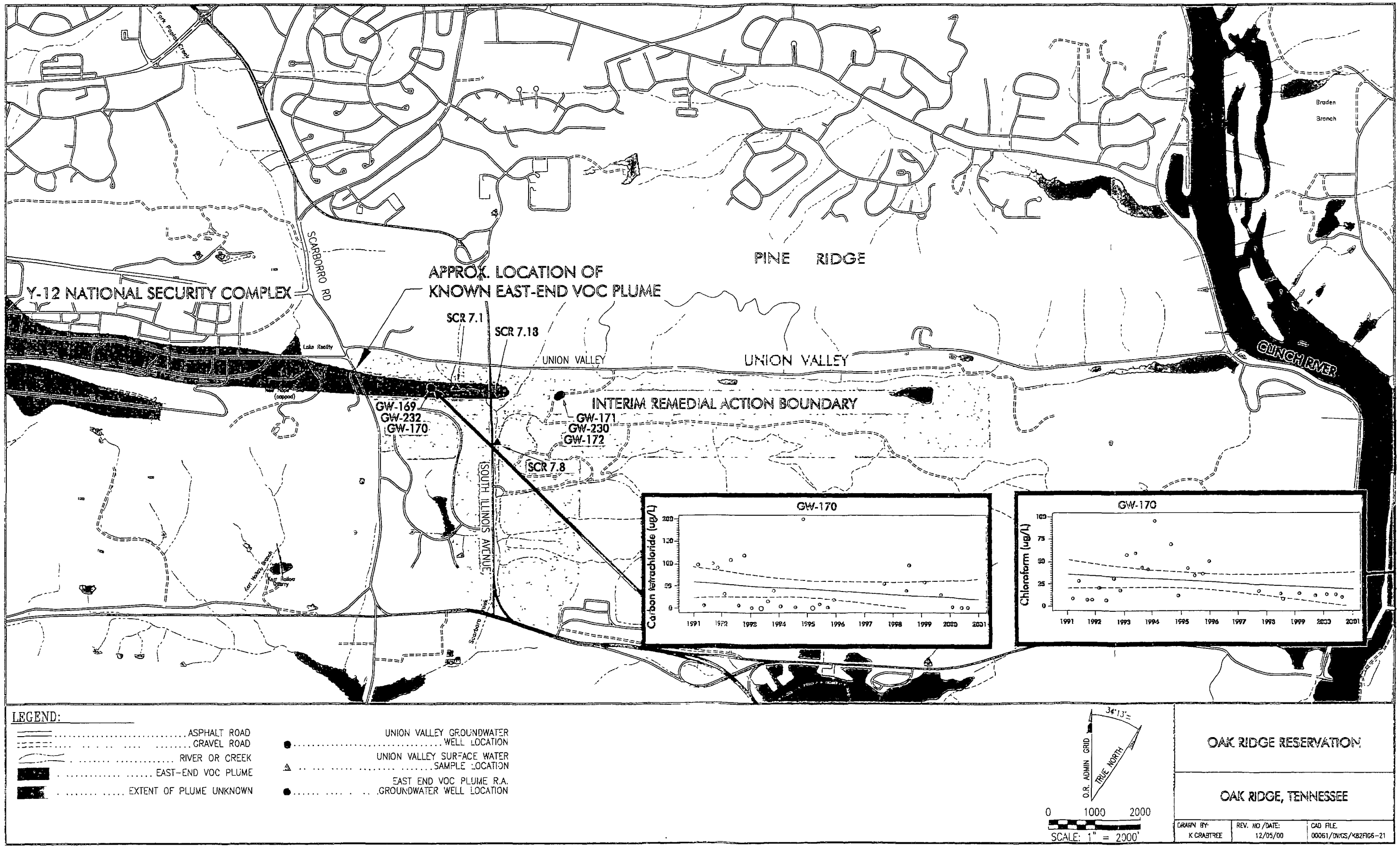


Fig. 6.14. Monitoring locations and signature VOC trends for the eastern UEPFC Watershed and Union Valley area.

6.9.2 Evaluation of Decision Document Requirements for Performance

6.9.2.1 Goals of decision

The institutional controls interim remedy had two goals

- ensure that public health is protected while final actions are being developed and implemented, and
- "identify and, if necessary, prohibit future activities with a potential to accelerate the rate of contaminant migration from the CA or increase the extent of the contaminant plume" (DOE 1997h) Stewardship requirements include annual property owner notification and title searches

6.9.2.2 Monitoring and stewardship required

No monitoring of groundwater or surface water is required by the Union Valley IROD Site inspections or other visual surveys are not required Monitoring wells in Union Valley are inspected during each sampling event as a best management practice Discretionary monitoring of two clusters of wells (GW-169, -170, -232 west of Illinois Avenue and wells GW-170, -171, and -230 east of Illinois Avenue) and two springs in Union Valley (SCR 7 1 and SCR 7 18) has been conducted for three years under the WRRP to monitor contaminant migration in the Maynardville Limestone exit pathway This monitoring also serves, in part, as a baseline for the Y-12 Plant East End VOC Plume remedial action (Sect 6 12) The monitoring wells also have a preceding monitoring history dating to the early 1990s as part of DOE Order 5400 1 programs administered by Y-12 Each location has been sampled at least semi-annually over the past three years In FY 2000, these locations were sampled three times (January, May, and August/September) Station SCR 7 18 was eliminated due to highway construction along Illinois Avenue following the May 2000 sampling event Therefore, this station was not sampled during the dry season (August/September) monitoring event Spring station SCR 7 8, located along Scarboro Creek south of Union Valley Road (Fig 6 14), was also sampled in FY 2000

6.9.3 Implementation of Previous Year's Recommendations

No recommendations were made for the Union Valley IROD for FY 2000

6.9.4 Evaluation of Performance and Stewardship Data

Evaluation of performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are summarized in Table 6 14 Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below

6.9.4.1 Site visit and visual survey

A site visit and visual survey of the Union Valley area was conducted on December 11, 2000 The area is currently all state or privately owned property and is currently zoned for industrial and commercial use only No surveillance and maintenance activities are required for the site, however, groundwater monitoring wells are inspected during sampling events and regularly maintained Changes in land use have occurred within the past five years in the vicinity of the site and include construction of several new office/commercial buildings in the area and, most recently, widening of Illinois Avenue between Union Valley Road and Edgemoor Road

Table 6.14. UEFPC Watershed Union Valley IROD Remedial Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Sect 6 9 2 1
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	Yes	Failure to notify property owners or maintain prohibitions on groundwater use could lead to accelerated contaminant migration
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	Physical land use controls not required by the IROD, however, administrative prohibitions and controls are specified, Site Manager Interview (Sect 6 9 4 2)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No immediate actions, final remedial decisions are in process (Sect 6 12)
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Interview with DOE Site Manager (Sect 6 9 4 2)
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	NA	Chemical-specific ARARs not addressed by the IROD (Sect 6 9 2 1)
Have there been any changes in land use or expected land use on or near the site?	Yes	Significant highway improvements within the site, visual survey (Sect 6 9 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	No requirement to evaluate
Have new contaminants or contaminant sources been identified?	NA	No requirement to evaluate
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	Institutional controls only
Have there been any changes in the physical site conditions?	Yes	Significant highway improvements within the site (Sect 6 9 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	No	Sect 6 9 4 3
Were there significant changes in the standardized risk assessment methodologies?	No	Sect 6 9 4 3
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Baseline risk deferred to the UEFPC watershed ROD
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
DOE = U S Department of Energy
IROD = interim record of decision
NA = not applicable
ROD = record of decision
TBC = to be considered
UEFPC = Upper East Fork Poplar Creek

6.9.4.2 Interviews

Per interviews with DOE environmental management staff, stewardship requirements for the Union Valley Interim Action have been met, including an annual notification to all state-registered well drilling companies in Tennessee and an annual deed search to identify new property owners of restrictions regarding groundwater use. An annual written notification and a follow-up telephone call is also made to all existing property owners by DOE as a reminder of groundwater use restrictions in the area. Environmental management staff noted that some property owners had sold or transferred property prior to notifying DOE of the change; however, these transfers were accounted for by the deed search process. No other operations and maintenance activities apply. No problems with the remedy or site-specific concerns were noted during the interviews with environmental management staff.

6.9.4.3 Data evaluation

Although no monitoring is required by the Union Valley IROD, an evaluation of data collected from area sampling locations is presented as part of discretionary monitoring. Table 6.15 provides results for detected VOCs in Union Valley monitoring locations. VOCs related to the Y-12 Plant East End VOC Plume (signature VOCs including carbon tetrachloride, chloroform, PCE, and TCE) have been detected in wells GW-169 and GW-170 west of Illinois Avenue, as well as in spring stations SCR 7 1 and SCR 7.18 on a periodic basis. Signature VOCs have not been observed in wells east of Illinois Avenue, however, other VOCs, including 1,2-DCE and some chlorobenzene compounds, have been observed in a deep well (about 400 ft bgs) east of the former municipal landfill (well GW-230).

Figure 6 14 illustrates the concentrations of carbon tetrachloride and chloroform, the two most prominent signature contaminants within the Y-12 Plant East End VOC Plume, in well GW-170 over the past 10 years Well GW-170 has historically had the highest levels of VOCs. As observed from the plot of concentration over time, both carbon tetrachloride and chloroform values have been erratic. Quantitative analysis of results for these two VOCs since 1991 do not indicate a significant trend However, an obvious peak of chloroform concentrations occurred in 1994, and values have generally declined since then. The observed long-term concentrations, particularly those for carbon tetrachloride, suggest that contaminant migration is episodic and may be driven primarily by rainfall events, which produce short-term peaks in concentrations. Other VOCs observed in the wells that are likely related to the Y-12 Plant East End VOC Plume include PCE and TCE; the concentrations of these VOCs has remained relatively consistent over the past several years at between 1 and 4 μg/L. Gross alpha and gross beta values in all Union Valley monitoring locations remained well below drinking water standards, 15 and 50 pCi/L, respectively, in FY 2000 The maximum gross alpha activity (7.14 +/-2 41 pCi/L) and maximum gross beta activity (12.9 +/- 1 74 pCi/L) occurred in well GW-171 in January 2000

An interim remedial action study was conducted to support the IROD in 1995 (ORNL 1995b). A human health screening risk evaluation indicated that some contaminants in groundwater and springs would pose a threat to human health if ingested However, the lack of an exposure pathway (no residential groundwater or spring water users) precluded unacceptable risks The potential health risk to a child wading in Scarboro Creek was determined to be within acceptable limits. The baseline human health risk assessment in the UEFPC RI (DOE 1998k) also demonstrated potential risk, but lack of an exposure pathway, for groundwater and confirmed that cancer risk was $< 10^{-6}$ and chemical hazards < 1 0 for a wading child exposure scenario at springs SCR 7 1 and SCR 7.18.

Table 6.15. Detected VOCs in monitoring stations in Union Valley, FY 2000

Monitoring Station	Sample Date	1,2-DCE	VC	CCl4	Chloro-form	MeCl	Ace-tone	PCE	Tol-uene	TCE	2-Butanone	Ben-zene	Bromo-methane	Chloro-benzene	Dimethyl-benzene	1,1,1-TCA	1,1-DCA
							Well cluster west of Illinois Avenue										
GW-169	01/25/2000																
	05/18/2000					12J											
	08/09/2000					8J	4J	2J									
GW-170	01/24/2000			3J	13=			2J		2J		3J					
	05/22/2000			2J	13=	10J		4J	1J	3J		4J	5J				
	08/08/2000			2J	10=	10J	7J	2J		2J	1J	3J					
GW-232	01/25/2000																
	05/18/2000					12J											
	08/09/2000					8J	4J										
							Well cluster east of Illinois Avenue										
GW-171	01/19/2000																
	05/17/2000					6J											
	08/08/2000					8J	6J										
GW-172	01/19/2000																
	05/17/2000																
	08/08/2000					9J	5J				1J						
GW-230	01/20/2000	13=	4=									1J					
	05/17/2000	17=	4J			13J			1J								
	08/08/2000	13=	4J			9J	5J		1J			1J		1J	1J		
								Spring Stations									
SCR 7 1	01/19/2000																
	05/30/2000			1J		1J	3J										
	09/06/2000			1J		9J	13J			1J							
SCR 7.18	01/19/2000																
	05/30/2000					3J	2J			1J						1J	2J
SCR 7.8	01/19/2000																
	05/30/2000					2J	4J										
	09/06/2000					2J	4J										

= = Validated result, detected and unqualified
DCA = dichloroethane
DCE = dichloroethene
J = Estimated concentration less than reporting limits
PCE = tetrachloroethene
TCA = trichloroethan
TCE = trichloroethen
VOC = volatile organic compound

To illustrate current conditions related to potential exposure points at Union Valley springs, a comparison of VOC results for FY 2000 samples was performed against RGOs developed in the UEFPC RI or EPA residential PRGs where RGOs were not established. This evaluation showed that carbon tetrachloride and TCE are well below the RGOs established for the child recreator and the industrial worker. Concentrations of acetone, 1,1,1-TCA, and 1,1-DCA are well below residential PRG screening levels. The highest methylene chloride concentration (9 μg/L) slightly exceeds the residential PRG at the 10^{-6} level (5.4 μg/L), although no excess risk to the child recreator or industrial worker receptor exists based on risk calculations in the UEPFC RI report.

6.9.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the Union Valley IROD are presented in Table 6.14. Based on the review, the administrative requirements of the IROD remain effective for protection of public health. No changes are recommended for the Union Valley IROD. Because the Union Valley IROD does not mandate groundwater monitoring, all monitoring related to Union Valley will be addressed in the WRRP and future RERs under the Y-12 Plant East End VOC Plume removal action (see Sect. 6.12), which specifies sampling of groundwater as part of remedial action performance evaluation.

6.10 LEAD SOURCE REMOVAL AT THE FORMER YS-860 FIRING RANGES REMOVAL ACTION

- AM: August 1997
- Field Activities Complete: September 1998
- RmAR: Approved February 23, 1999

6.10.1 Project Description

The former YS-860 Firing Ranges are located at the eastern end of Y-12, at the foot of Chestnut Ridge, approximately 1000 yd west of Scarboro Road (Fig. 6.15). The site consisted of two former firing ranges, an earthen berm or embankment that bounded the site on the east, and an embankment approximately 200 ft long with a concrete trench at the base that was cut into the flank of Chestnut Ridge and served as a backstop. The former firing ranges were used by Y-12 security forces for small arms training from 1943 until the early 1990s.

A soil sample taken from the target embankment in 1996 (DOE 1997c) had a concentration of 116,000 μg/g total lead. Only soils sampled from the embankment exceeded the EPA guidance level for lead in soils of 400 μg/g. Water sampled at the foot of the embankment had a concentration of 518 μg/L lead.

The AM for Lead Source Removal at the Former YS-860 Firing Ranges, Oak Ridge Y-12 Plant, Oak Ridge, Tennessee (DOE 1997c) required removal of bullets and lead-contaminated soil in the target areas of the two former firing ranges. Lead is the only contaminant of concern addressed by this AM. Removal of structures at the site was performed by Defense Programs in late spring and early summer 1998. During August and September 1998, 846 yd^3 of lead-contaminated soils were excavated and transported off-site to an approved facility, where it was stabilized with cement kiln dust and disposed (BJC 1998). Nonhazardous wastes incidental to the removal of contaminated soils including trees and brush, asphalt, and concrete were disposed of at Construction/Demolition Landfill VI. After excavation and removal of contaminated soils, verification sampling was conducted to confirm that the requirements of the AM were met (DOE 1998).

6.10.2 Evaluation of Decision Document Requirements for Performance and Stewardship

6.10.2.1 Goals of decision

Two objectives were established for this removal action:

- protection of human health and the environment from a source of lead contamination in soils, and
- achievement of a risk-based cleanup level of 1400 μg/g lead in soil, based on a recreational scenario.

This action applied primarily to the earthen berms bounding the site and the target backstop embankment, as the majority of the firing ranges' surface area was already below the unrestricted use level of 400 μg/g per EPA guidance. (DOE 1997c).

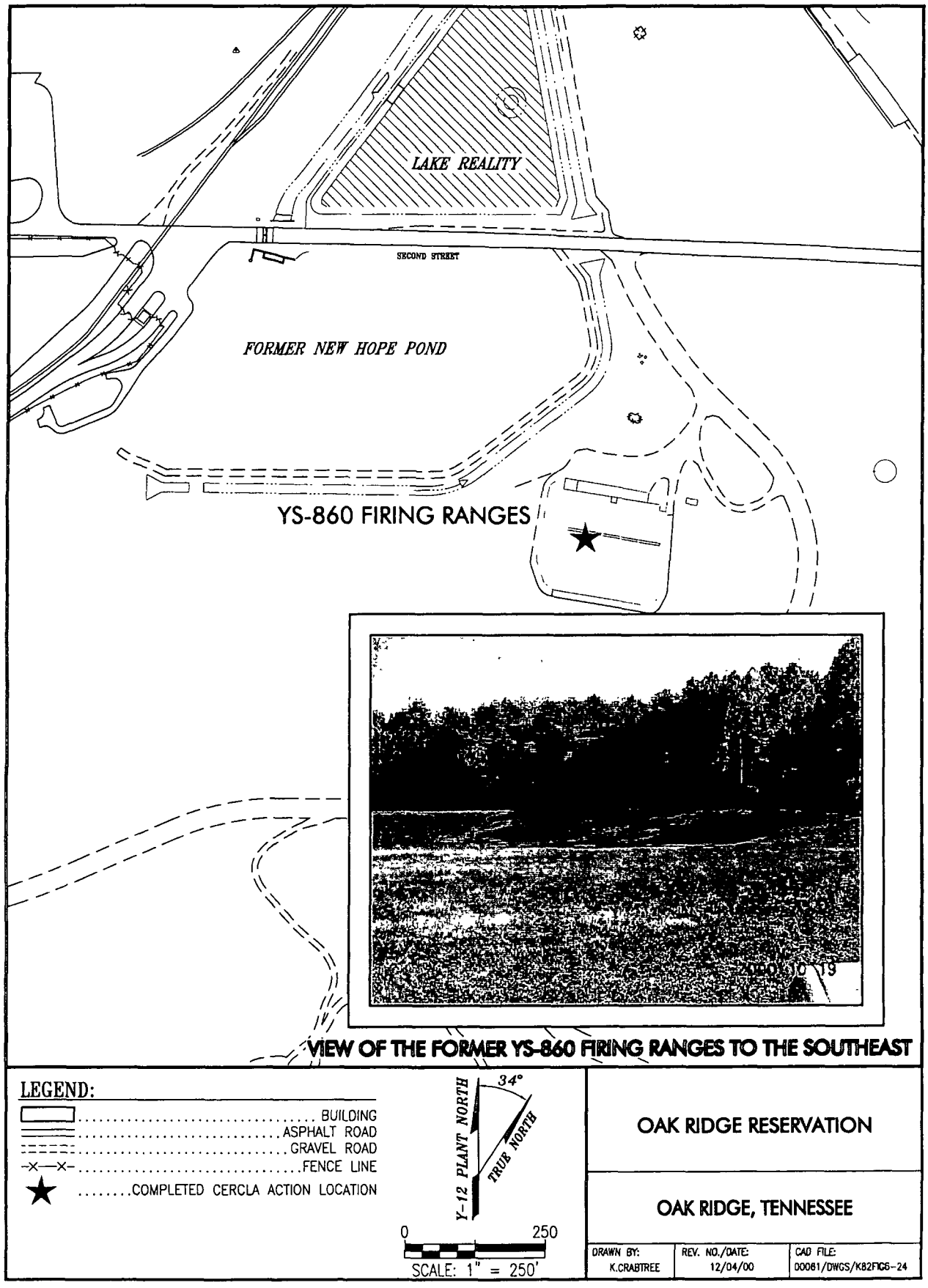


Fig. 6.15. Former YS-860 Firing Ranges site map.

6.10.2.2 Monitoring and stewardship required

Long-term monitoring requirements for this action, including five-year CERCLA reviews, were deferred to the UEFPC watershed ROD However, no hazardous substances above health-based criteria remain at this site Thus, performance monitoring, beyond the verification sampling already conducted, is not required

6.10.3 Implementation of Previous Year's Recommendations

No recommendations were made for the Former YS-860 Firing Ranges removal action for FY 2000

6.10.4 Evaluation of Performance and Stewardship Data—Lead Source Removal at the Former YS-860 Firing Ranges Removal Action

Evaluation of Former YS-860 Firing Ranges performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are summarized in Table 6 16 Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below

6.10.4.1 Site visit and visual survey

A site visit and visual survey of the Former YS-860 Firing Ranges site was conducted on October 13, 2000 The present condition of the site is illustrated on Fig 6 15 The former Firing Ranges site is currently an open, mostly level, grass-covered area and is not demarcated in any fashion The site is located within the Y-12 property protection area, outside of the perimeter security fence, which is posted as restricted access to authorized personnel Landlord responsibilities for the site currently reside with Defense Programs No surveillance and maintenance activities are required for the site, however, the grass cover is maintained and regularly mowed by the Y-12 Maintenance Organization as part of routine groundskeeping activities Identification signs are not required, nor were any observed Other than installation of well GW-845 and construction of the groundwater treatment unit for the Y-12 Plant East End VOC Plume removal action immediately east of the former ranges, no observed changes in land use have occurred within the past five years in the vicinity of the site

6.10.4.2 Interviews

No post-remedial action stewardship requirements currently apply for the Former YS-860 Firing Ranges No significant future land use changes are currently anticipated No problems with the remedy or site-specific concerns were noted during the interview with BJC environmental management staff

6.10.4.3 Data evaluation

No monitoring of the Former YS-860 Firing Ranges is currently required No reference doses for exposures to lead have been approved by EPA, and land use has not changed since implementation of the action The Integrated Exposure Uptake Biokenetic Model used to develop the 1400 μg/g cleanup level for lead in soil (protective of a child exposed under a recreational land use scenario) has not changed significantly since completion of the removal action Based on the review of current toxicity factors, risk methodologies, and potential exposure pathways, the remedy remains effective for protection of human health and the environment

Table 6.16. Lead Source Removal at the Former YS-860 Firing Ranges Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Removal action completed to risk-based standards (Sect 6 10 2 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Removal action completed to risk-based standards (Sect 6 10 2 2)
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls in AM, however, the site is within the Y-12 Property Protection Area (Sect 6 10 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional action required by AM
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	Source was removed
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	No chemical-specific ARARs in AM
Have there been any changes in land use or expected land use on or near the site?	No	Visual survey (Sect 6 10 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	Source was removed
Have new contaminants or contaminant sources been identified?	NA	Source was removed
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	No chemical treatment remedies were employed (Sect 6 10 4 2)
Have there been any changes in the physical site conditions?	No	Visual survey (Sect 6 10 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	No	No reference dose for exposures to lead have been approved by EPA
Were there significant changes in the standardized risk assessment methodologies?	No	Risk modeling employed to develop lead cleanup criteria has not changed significantly since implementation of the action
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Removal action not driven by ecological RAOs Ecological risks deferred to the UEFPC watershed RI, terrestrial receptors were not evaluated due to insufficient habitat within Y-12
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
EPA = U S Environmental Protection Agency
NA = not applicable
RAO = remedial action objective
RI = remedial investigation
ROD = record of decision
TBC = to be considered
UEFPC = Upper East Fork Poplar Creek

6.10.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the Former YS-860 Firing Ranges are presented in Table 6.16. No post-remedial action stewardship or monitoring requirements apply to the Former YS-860 Firing Ranges removal action.

6.11 Y-12 PLANT 9822 SEDIMENT BASIN AND BLDG. 81-10 SUMP REMOVAL ACTION

- EE/CA: August 1998
- AM: January 5, 1998
- Field Activities Complete: August 26, 1998
- RmAR: Approved February 23, 1999

6.11.1 Project Description

The 9822 Sediment Basin and Bldg. 81-10 site is located in the south–central portion of Y-12 (Fig. 6.16). The majority of the site is covered with concrete and, prior to this removal action, consisted of the Bldg. 81-10 concrete pad (Bldg. 81-10 was removed in 1995), the Bldg. 81-10 sump, and the 9822 Sediment Basin. The sediment basin was constructed in 1958 to collect liquid discharged from the Bldg. 81-10 Sump and discharged to UEFPC via an overflow box.

In October 1997, the 9822 Sediment Basin and Bldg. 81-10 Sump contained more than 40,000 L and 11,000 kg of liquid and sediment, respectively. Analytical results from sediment samples had total PCB concentrations ranging from 52 to 450 μg/g and mercury ranging from 5.49 to 11.38 μg/g.

The AM for the 9822 Sediment Basin and Bldg. 81-10 Sump (DOE 1998c) required the following:

- removal of the liquid from the basin and building sump with filtration and transfer of the liquid to the Y-12 groundwater treatment facility;
- removal and stabilization of the sediment;
- disposal of the sediment pursuant to the criteria in DOE Order 5400.5 at a chemical waste disposal facility permitted under the TSCA of 1976 (as amended);
- rinsing of the interior walls of the basin and the building sump, treatment of the rinsate, and plugging of the connecting drain line, and
- demolition of the basin walls and placement of fill in the basin and building sump

The removal action was conducted during August 1998 and was competed with disposal of 19 4 tons of stabilized sediment in a TSCA-permitted waste disposal facility on August 26, 1998 Sediment containing visible elemental mercury, which was encountered during evacuation of sediment from the building sump, was containerized in two 55-gal drums. Composite samples of these sediments did not meet the acceptance criteria of the TSCA-permitted receiving facility, so these sediments were placed in on-site RCRA storage for treatment evaluation. Liquids removed from the basin and building sump were transferred to the Y-12 groundwater treatment facility for treatment and release

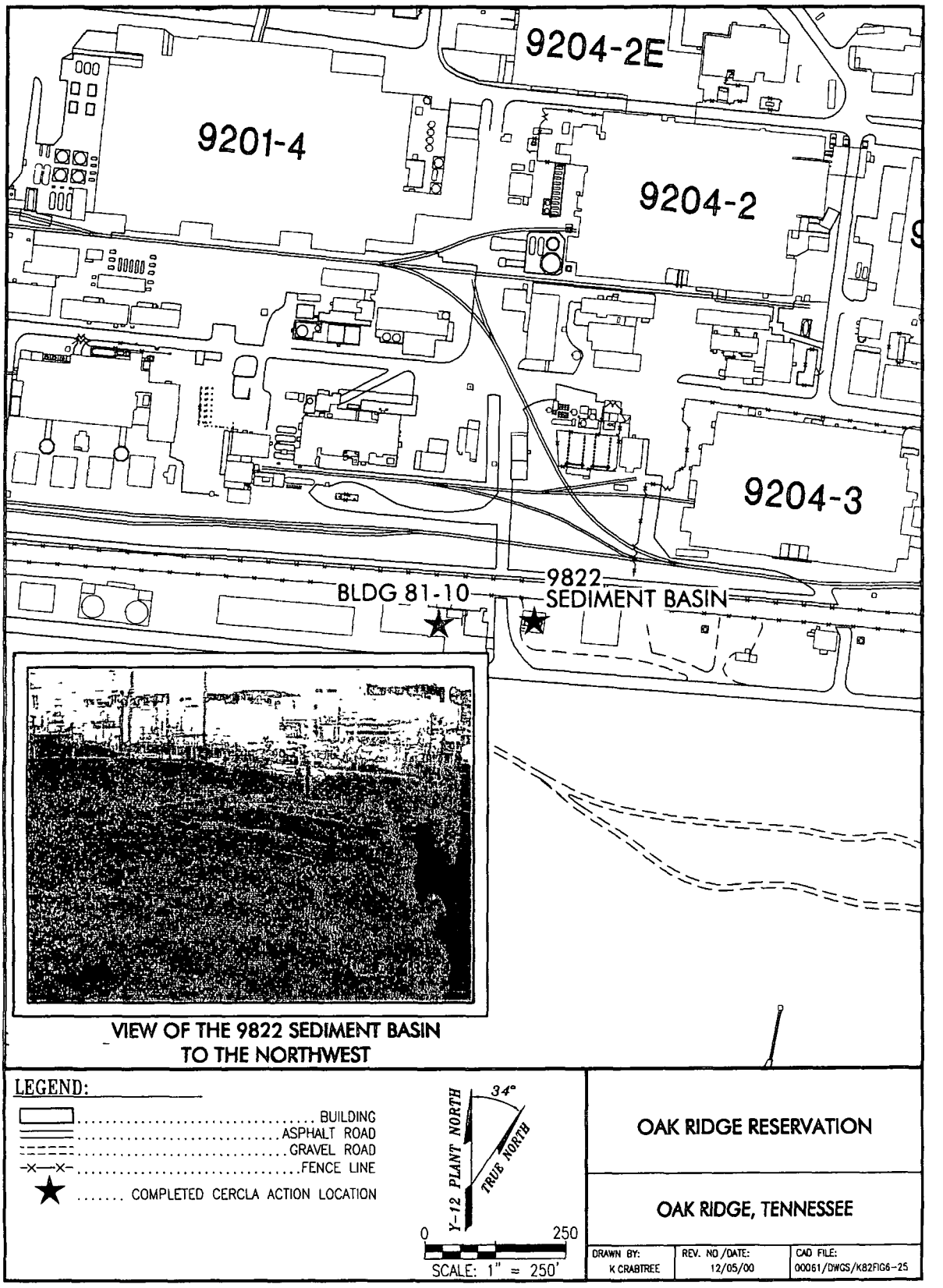


Fig. 6.16. Locations of 9822 Sediment Basin and Bldg. 81-10.

6.11.2 Evaluation of Decision Document Requirements for Performance and Stewardship

6.11.2.1 Goals of decision

This removal action was designed to "reduce the health and environmental risks associated with the release of contaminants from the 9822 Sediment Basin and the Bldg 81-10 Sump" (DOE 1998c) The action is expected to decrease the mercury levels and PCBs discharged to UEFPC Determination of existing human health or ecological risks specific to the sediment basin or sump were not performed as part of the action The RmAR denoted that performance evaluation of this removal action relative to the final remedy (e g , contaminant concentration reductions at the UEFPC surface water exit point) will be addressed under the UEFPC Watershed ROD

6.11.2.2 Monitoring and stewardship required

Long-term monitoring requirements for this action, including five-year CERCLA reviews, were deferred to the UEFPC watershed ROD However, this action removed the potential source of mercury and PCB contamination to surface water and groundwater and left the site in a condition that precludes future contamination. Thus, performance monitoring and operation and maintenance inspections are not required

6.11.3 Implementation of Previous Year's Recommendations

No recommendations were made for the 9822 Sediment Basin and Bldg 81-10 Sump removal action for FY 2000

6.11.4 Evaluation of Performance and Stewardship Data—9822 Sediment Basin and Bldg. 81-10 Sump Removal Action

Evaluation of 9822 Sediment Basin and Bldg 81-10 Sump Removal Action performance and stewardship data against the Five-Year Review criteria as required in the most current EPA guidance are arized in Table 6.17 Supporting discussions pertaining to the site visit, visual survey, and site manager interview are presented below

6.11.4.1 Site visit and visual survey

A site visit and visual survey of the 9822 Sediment Basin and Bldg 81-10 Sump removal action site were conducted on October 13, 2000 The present condition of the site is illustrated on Fig 6 16 The site is currently an open, level, gravel-covered area and is surrounded by a chain-link fence The site is located within the Y-12 property protection area and is not accessible to the public Landlord responsibilities for the site currently reside with Defense Programs Identification signs are not required, nor were any observed No observed changes in land use have occurred within the past five years in the vicinity of the site

6.11.4.2 Interviews

No post-remedial action stewardship requirements currently apply for the 9822 Sediment Basin and Bldgs 81-10 Sump removal action No significant future land use changes were noted by the site manager No problems with the remedy or site-specific concerns were noted during the interview with BJC environmental management staff

Table 6.17. Y-12 Plant 9822 Sediment Basin and Bldg. 81-10 Sump Removal Action Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	Removal action completed (Sect 6 11 2 1)
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Removal action completed (Sect 6 11 2 2)
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	No specific land use controls were addressed in the AM or RmAR, however, the site is located within the Y-12 Property Protection Area, visual survey (Sect 6 11 4 1)
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional action required by RmAR
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	NA	Source was removed
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	No chemical-specific ARARs in the AM or RmAR
Have there been any changes in land use or expected land use on or near the site?	No	Site remains under government control (Sect 6 11 4 1)
Have new human health or ecological exposure pathways or receptors been identified?	NA	Source was removed
Have new contaminants or contaminant sources been identified?	NA	Source was removed
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	NA	No chemical treatment methods were employed (Sect 6 11 4 2)
Have there been any changes in the physical site conditions?	No	Visual survey (Sect 6 11 4 1)
Have there been any changes in the toxicity factors for contaminants of concern?	NA	BRA/ERA not performed for the removal action
Were there significant changes in the standardized risk assessment methodologies?	NA	BRA/ERA not performed for the removal action
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Action not driven by ecological RAOs Ecological risks deferred to the UEFPC watershed RI, terrestrial receptors were not evaluated due to insufficient habitat within Y-12
Is the site located in an area subject to natural disasters?	Yes	Low probability of earthquakes or tornadoes

AM = action memorandum
ARAR = applicable or relevant and appropriate requirement
BRA = baseline risk assessment
ERA = ecological risk assessment
NA = not applicable
RAO = remedial action objective
RI = remedial investigation
RmAR = removal action report
ROD = record of decision
TBC = to be considered
UEFPC = Upper East Fork Poplar Creek

6.11.4.3 Data evaluation

No monitoring specific to the 9822 Sediment Basin and Bldg. 81-10 Sump removal action is currently required. Ongoing monitoring of UEFPC water quality at the watershed exit point is discussed in Sect. 6.2.

6.11.5 Conclusions and Recommendations

A summary and conclusions of the Five-Year Review for the 9822 Sediment Basin and Bldg. 81-10 Sump removal action are presented in Table 6.17. There are no post-remedial action stewardship or monitoring requirements that apply to the 9822 Sediment Basin and Bldg. 81-10 Sump removal action.

6.12 Y-12 PLANT EAST END VOLATILE ORGANIC COMPOUND PLUME REMOVAL ACTION

- EE/CA: April 1999
- AM: August 23, 1999
- RmAWP: June 25, 1999
- RA complete: October 2000
- RA operation: Ongoing
- RmAR: In Progress (following 5-year review)

6.12.1 Project Description

At the east end of Y-12, a plume of contaminated groundwater originating from probable DNAPL sources extends from the eastern UEFPC watershed through Union Valley, where it discharges to springs (SCR 7.18SP and SCR 7.1SP) in the Scarboro Creek headwaters (Fig. 6.14) Principal plume contaminants that have migrated off-site are carbon tetrachloride and chloroform Additional VOCs comprising the plume include PCE and its degradation products (TCE, 1,2-DCE isomers) The Union Valley IROD, signed in 1997 (DOE 1997h), provides protection for the public (Sect. 6.9). A non-time critical removal action was initiated in FY 1998 to evaluate more permanent alternatives for preventing further migration of contaminated groundwater off of the ORR and is currently in progress. The EE/CA was completed in April 1999 (DOE 1999k), followed by a RmAWP in June 1999 (DOE 1999l) and an AM in August 1999 (DOE 1999c). Construction of the groundwater treatment facility began in May 2000 and culminated with testing of the system in August and September 2000. Full operation of the system began in October 2000. The RmAR is scheduled to be issued to regulatory authorities for review after five years of operation and evaluation of its effectiveness to contain the plume.

The EE/CA evaluated more than 40 potential in situ and ex situ remedial technologies (DOE 1999k). The EE/CA concluded that no readily available, proven technologies existed for remediating DNAPL in fractured or karst bedrock settings, such as those present within the UEFPC watershed. Consequently, the assessment of remedial technologies focused on containment of the dissolved-phase plume to prevent further off-site migration As part of the EE/CA, an extraction well (GW-845, Fig 6.17) was installed within the Maynardville Limestone exit pathway, and a pump and dye-tracer test was conducted to evaluate the technical feasibility of plume interception within the fractured, karst aquifer (BJC 1998b) The pump and tracer test demonstrated that pumping rates of 100 gal/min produced a substantial capture zone within the exit pathway Additionally, the test demonstrated a high degree of connection between shallow groundwater, UEFPC, and the UEFPC distribution channel underdrain system (Fig 6.17)

The selected alternative consisted of plume interception using pump-and-treat technologies (DOE 1999c) Well GW-845, installed within the plume on-site, is the groundwater extraction point Treatment of groundwater to remove particulates, iron, manganese, and VOCs is conducted using an automated filtration and air stripper system housed in Bldg. 9422-22 (Figs. 6.17 and 6.18). Treatment system capacity is up to 75 gal/min; the system is currently operating at 25 gal/min. Additionally, a treatability study, scheduled for completion in fall 2004, will evaluate the possible use of in situ bioremediation to enhance or replace the pump-and-treat technology This enhancement may be considered as part of future actions depending on the results of the study.

Because the Y-12 Plant East End VOC Plume removal action was not placed into full-scale operation until the end of FY 2000, an evaluation of performance and stewardship data against the EPA Five-Year Review criteria cannot be completed at present However, a site visit and visual survey, site

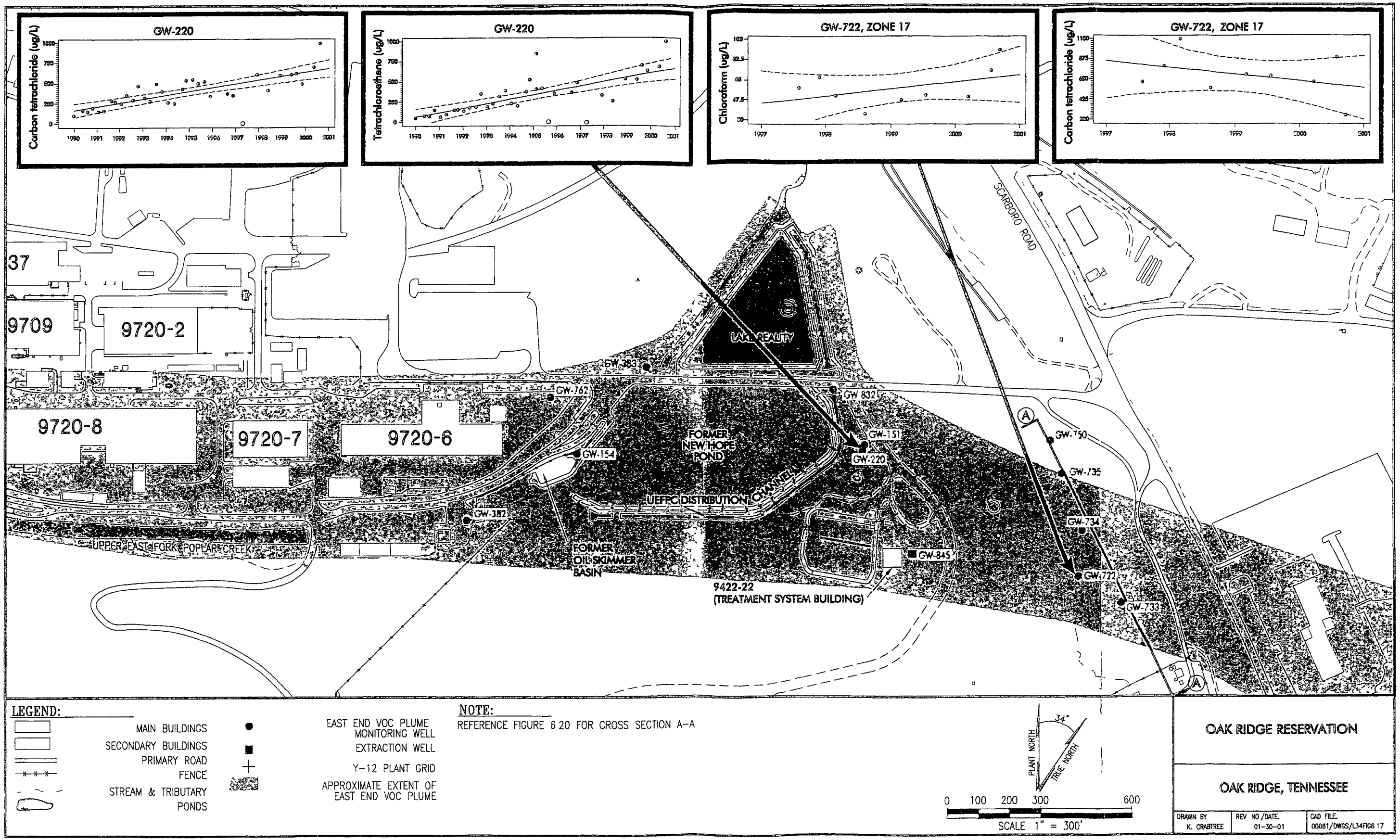


Fig. 6.17. Y-12 Plant East End VOC plume site map and selected VOC trends.

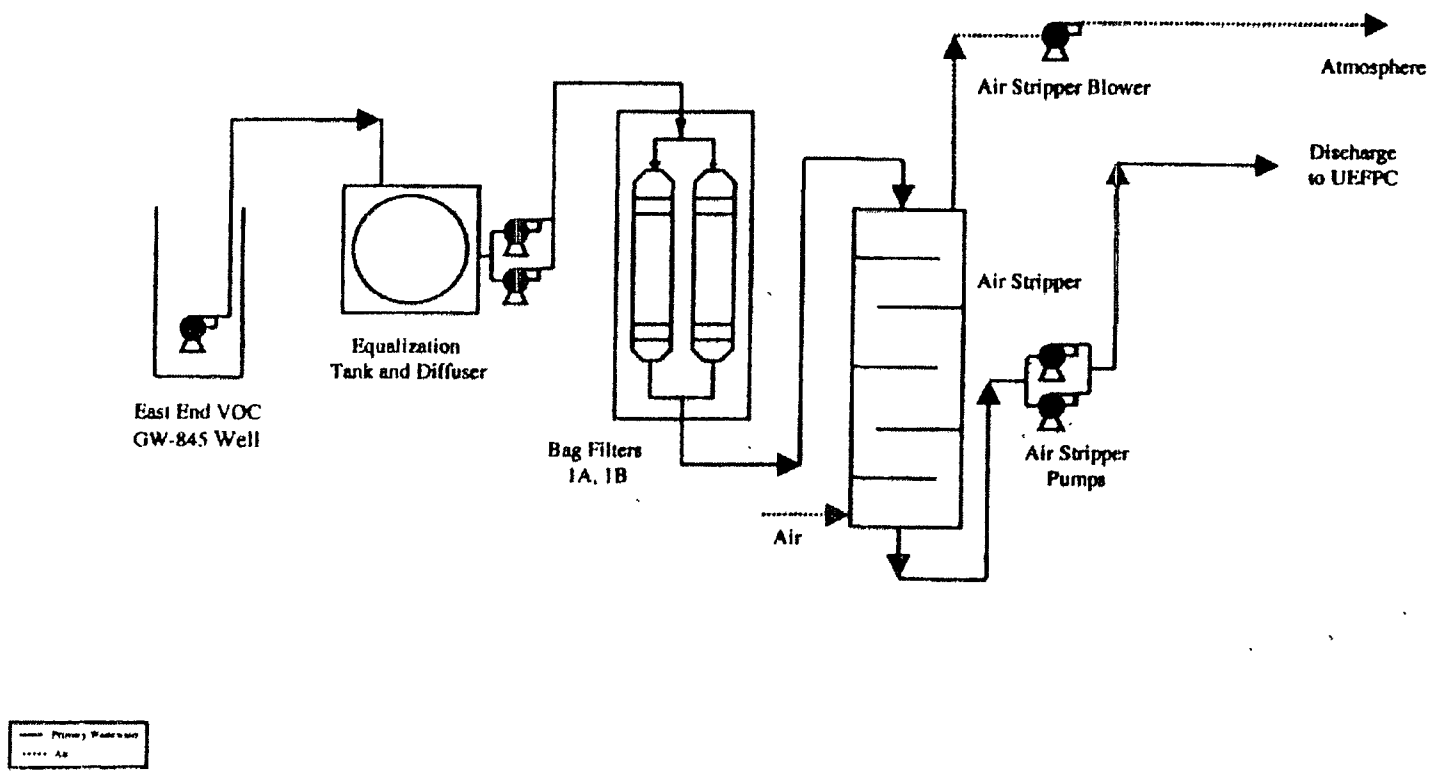


Fig. 6.18. Schematic of the Y-12 Plant East End VOC Plume Interception and Groundwater Treatment System.

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manager interview, and evaluation of FY 2000 baseline monitoring data were conducted and are discussed in the following sections.

6.12.2 Evaluation of Decision Document Requirements for Performance and Stewardship

6.12.2.1 Goals of decision

The goals of the proposed action are to "reduce health and environmental risks associated with the migration of VOC-contaminated groundwater from the east end of the Y-12 National Security Complex. In addition, it will reduce the potential risk from exposure to this contamination in off-site areas" (DOE 1999c). No specific numeric performance standards are established for the selected alternative. Determination of existing human health or ecological risks specific to groundwater conducted during the UEFPC RI and incorporated into the removal action, addressed hypothetical risks related to groundwater use, as well as potential risk related to spring discharges in Union Valley. These risk estimates form a comparative baseline for future performance evaluations.

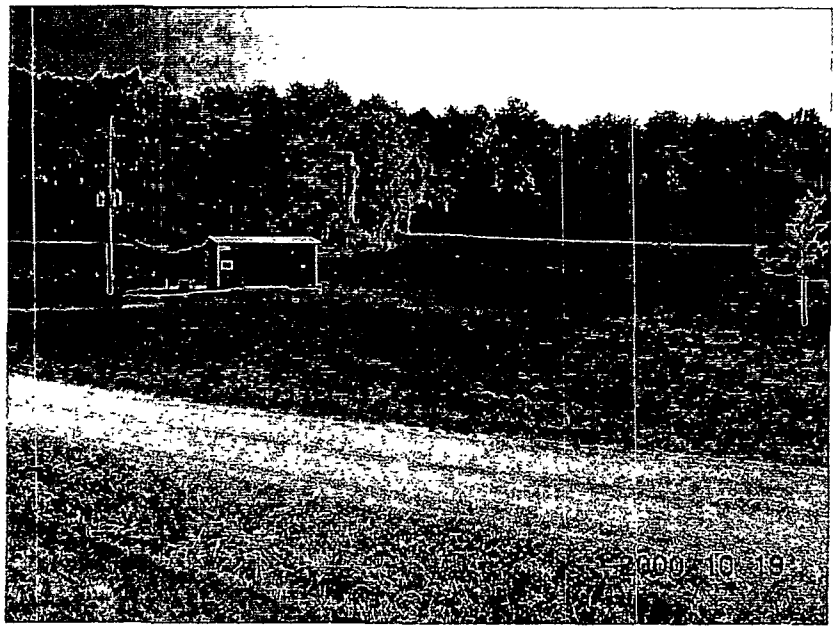
6.12.2.2 Monitoring and stewardship required

As proposed in the EE/CA and AM, system performance to effectively intercept the plume will be measured by evaluating reductions in VOC concentrations downgradient of the extraction point (well GW-845). Metals (including uranium) and nitrate are also noted as performance indicators for the alternative. Quarterly sampling and analysis is planned at the extraction well, well GW-722 located approximately 600 ft downgradient of the extraction well, and wells GW-169, -170, and -232 located about 2400 ft east along geologic strike in Union Valley (Fig. 6.14). An additional element for performance monitoring is evaluation of whether long-term pumping begins to mobilize metals and radiological contamination in shallow groundwater associated with the former Oil Skimmer Basin located approximately 1000 ft west of well GW-845 (Fig. 6.17).

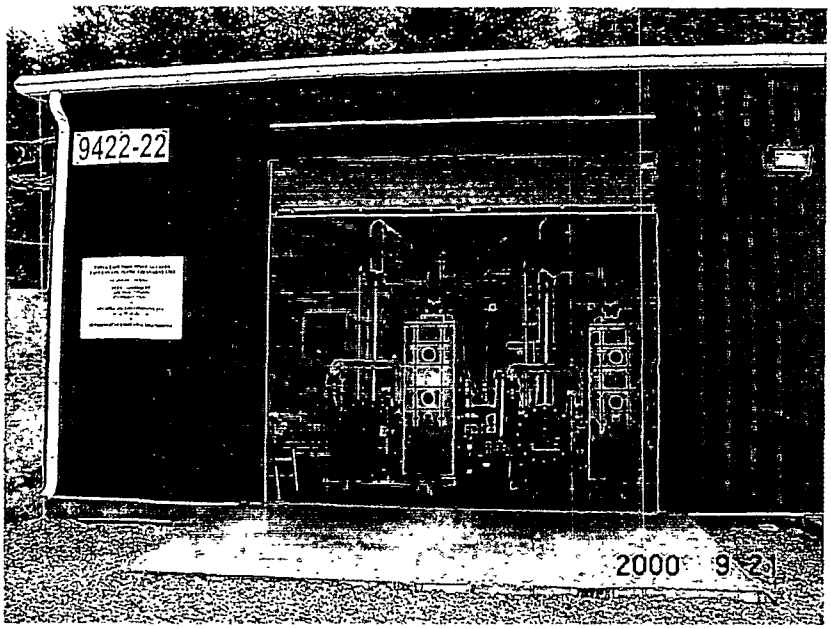
Treated groundwater will be managed according to best management practices and will be discharged into UEFPC. Discharges must not cause exceedances of any existing AWQC related to VOCs; a criterion of 44 μg/L for carbon tetrachloride must be maintained downstream of the treatment unit discharge point. Performance of the groundwater treatment system will be evaluated by quarterly sampling of effluent with analyses for VOCs, metals (including uranium), and nitrate. Performance of the air stripper component of the treatment system will be evaluated by determining mass balance for selected constituents. More frequent sampling may be required if radionuclides are detected in the influent from well GW-845. Additional details regarding the remedial effectiveness monitoring program are to be provided in the removal action report.

6.12.2.3 Site visit and visual survey

A site visit and visual survey of the Y-12 Plant East End VOC Plume removal action site was conducted on October 13, 2000. The present condition of the site is illustrated on Fig. 6.19. The treatment system is housed within a locked, metal, prefabricated building located immediately east of the former YS-860 Firing Range. The site is located within the Y-12 National Security Complex property protection area, outside of the perimeter security fence, which is posted as restricted access to authorized personnel. Landlord responsibilities and operation and maintenance of the treatment system will be overseen by the environmental management program Waste Management Organization. Identification signs are not required; however, signs were posted on the treatment facility building with the building identification number and contact information regarding responsible area manager. Other than the removal action conducted for the YS-860 Firing Ranges (Sect. 6.10), no observed changes in land use have occurred within the past five years in the vicinity of the site.



Exterior View to the South



Interior View of Treatment System Building

Fig. 6.19. Photograph of the Y-12 Plant East End VOC Plume Groundwater Treatment System.

6.12.2.4 Interviews

Stewardship requirements for the plume interception action will be implemented upon full startup of the treatment system. The pumping system will be set initially to operate at a 25-gpm rate. Inspections will include a daily operations inspection, and heat tracing will be inspected every 6 months to prevent frozen piping. Currently, system filters require changing every 12 days, and the system is fitted with an alarm indicating change out is required. The system is fitted with an automated low-flow alarm set to provide early indications of filtration system clogging prior to the filter change out alarm. Preliminary filter media analyses indicate that the medium is not RCRA-characteristic hazardous waste following operation of the unit; however, the media will be treated as such until confirmed otherwise during full-scale operation. No significant future land use changes were noted by the site manager. No problems with the remedy or site-specific concerns were noted during the interview with environmental management staff.

6.12.2.5 Baseline data evaluation

Baseline Monitoring Objectives. Baseline monitoring in FY 2000 to support the removal action was conducted to meet the following three objectives derived from the proposed monitoring in the EE/CA (DOE 1999k) and AM (DOE 1999c) and baseline monitoring objectives of the FY 2000 and FY 2001 WRRP Sampling and Analysis Plans.

- Compliance with the performance monitoring provisions of the EE/CA (wells GW-169, -170, and -232 in Union Valley and well GW-722 located on the ORR downgradient of the groundwater extraction point);

- Evaluation of VOC concentrations within the plume upgradient of the groundwater extraction point (well GW-382), the groundwater exit pathway associated with the UEFPC distribution channel (wells GW-151, -220, and -832), and the groundwater exit pathway associated with the former UEFPC creek channel west of Lake Reality (well GW-383); and

- Evaluation of whether long-term pumping begins to mobilize metals and radiological contamination in shallow groundwater associated with the Former Oil Skimmer Basin (well GW-154) or affects VOC concentrations within a suspected PCE DNAPL source in shallow groundwater east of Bldg. 9720-6 (well GW-762).

In addition, monitoring of wells at the ORR exit points downgradient of the extraction well, as discussed in Sect. 6.2, are also relevant to future evaluation of the performance of this removal action (wells GW-733, -735, -744, -747, -750, and -816).

Analyses for VOCs were conducted on samples collected from all of the wells in the eastern UEFPC watershed. Additionally, metals, gross alpha, and gross beta analyses were conducted at all of the locations. Isotopic uranium analyses (^{234}U, ^{235}U, and ^{238}U) were conducted for wells GW-151, -154, -220, -735, and -832. Nitrate analyses were also conducted to provide a baseline for future evaluation of whether pumping accelerates movement of contaminants from upgradient source areas (i.e., S-2 Site and S-3 Site). Monitoring locations are illustrated on Fig. 6.17, and they monitor the groundwater exit pathways identified in the current watershed conceptual model. Table 6.18 provides a summary of results for signature

Table 6.18. Summary of FY 2000 Y-12 Plant East End VOC Plume baseline monitoring results for selected performance indicator constituents

Analyte	Units	GW-151 5/16/00	GW-151 8/17/00	GW-154 5/17/00	GW-154 8/22/00	GW-220 11/10/99	GW-220 5/15/00	GW-220 8/22/00
Volatile Organic Constituents								
Carbon tetrachloride	µg/L	1400=	1700=	5U	5U	490=	700=	1000= (D)
Chloroform	µg/L	46=	52=	5U	5U	40=	35=	54= (D)
1,2-DCE (total)	µg/L	8=	10=	5U	5U	4J	5J	6=
PCE	µg/L	120=	140=	5U	5U	64=	69=	100= (D)
TCE	µg/L	24=	29=	5U	5U	13=	14=	20=
Radiological Constituents and Total Uranium								
Gross alpha	pCi/L	1.23 +/- 1.1	0.31 +/- 0.85	496 +/- 14.74	572.43 +/- 12.1	2.9 +/- 2.1	0.52 +/- 1.2	1.01 +/- 1.06
Gross beta	pCi/L	3.47 +/- 1.65	3.92 +/- 1.26	97.23 +/- 4.03	97.23 +/- 4.03	4.0 +/- 3.8	2.6 +/- 4.2	5.08 +/- 0.92
^{234}U	pCi/L	0.76 +/- 0.46	0.17 +/-0.27	454.5 +/- 143	438.4 +/- 85.62	ND	ND	1.14 +/- 0.53
^{235}U	pCi/L	0.16 +/- 0.24	0.23 +/- 0.33	21.34 +/- 8.17	13.52 +/- 3.56	ND	ND	0.1 +/- 0.18
^{238}U	pCi/L	0.03 +/- 0.17	0.5 +/- 0.48	312 +/- 98.59	184. 9 +/- 36.62	ND	ND	0.69 +/- 0.4
Total uranium	µg/L	0J (C)	-0.0002U (C)	0.766= (C)	0.609= (C)	0.0005=	0.0005=	0J (C)
Anions								
Nitrate (as N)	mg/L	1.4=	8.6=	0.32=	2.8=	0.885=	0.863=	3.3=

Analyte	Units	GW-382 5/18/00	GW-382 9/11/00	GW-383 11/11/99	GW-383 5/15/00	GW-383 8/17/00	GW-733 1/13/00	GW-733 7/17/00	GW-735 11/29/99	GW-735 4/25/00
Volatile Organic Constituents										
Carbon tetrachloride	µg/L	1400=	1300= (D)	5U	5U	5U	3J	11=	5U	5U
Chloroform	µg/L	540=	610= (D)	5U	5U	5U	2J	2J	5U	5U
1,2-DCE (total)	µg/L	50U	2J	140=	110=	140= (D)	5U	5U	5U	5U
PCE	µg/L	175=	13=	550=	470=	610= (D)	5U	5U	5U	5U
TCE	µg/L	50U	2J	160=	150=	200= (D)	5U	5U	5U	5U
Radiological Constituents and Total Uranium										
Gross alpha	pCi/L	2.59 +/- 1 48	4.72 +/- 1.26	2.1 +/- 2.4	1.0 +/- 1.6	-0.016 +/- 1.18	0.26 +/- 0.82	0.85 +/- 1 05	1.8 +/- 1.8	0.73 +/- 2.1
Gross beta	pCi/L	5.44 +/- 1.86	6.6 +/- 1.63	7.4 +/- 4.1	1.0 +/- 5 0	0.51 +/- 2.11	3.05 +/- 1.03	2.74 +/-1.42	0.62 +/- 4.5	2.7 +/- 4.7
^{234}U	pCi/L	NA	NA	NA	NA	NA	NA	NA	ND	ND
^{235}U	pCi/L	NA	NA	NA	NA	NA	NA	NA	ND	ND
^{238}U	pCi/L	NA	NA	NA	NA	NA	NA	NA	ND	ND
Total uranium	µg/L	0.000743= (C)	0.000383= (C)	0 0005=	0 0005=	-0.00013U (C)	0U (C)	0.000655= (C)	0.0005= (C)	0.0005= (C)
Anions										
Nitrate (as N)	mg/L	0.81=	0.04=	0 282U	0.028U	3.9=	0.1=	2 5=	0.028U	0.028U

Table 6.18. Summary of FY 2000 Y-12 Plant East End VOC Plume baseline monitoring results for selected performance indicator constituents (continued)

Analyte	Units	GW-735 5/15/00	GW-735 8/21/00	GW-744 11/17/99	GW-744 4/17/00	GW-747 11/29/99	GW-747 4/24/00	GW-750 12/01/99	GW-750 4/25/00	GW-762 5/16/00
Volatile Organic Constituents										
Carbon tetrachloride	µg/L	5U	5U	5U	5U	5U	5U	5U	5U	5U
Chloroform	µg/L	5U	5U	5U	5U	5U	5U	5U	5U	5U
1 2-DCE (total)	µg/L	5U	5U	5U	5U	5U	5U	5U	5U	74=
PCE	µg/L	5U	5U	5U	5U	5U	5U	5U	5U	2100=
TCE	µg/L	5U	5U	5U	5U	5U	5U	5U	5U	150=
Radiological Constituents and Total Uranium										
Gross alpha	pCi/L	0 41 +/- 1 6	0 4 +/- 1 06	2 3 +/- 2 4	-0 06 +/- 1 7	0 23 +/- 1 0	1 5 +/- 2 3	0 6 +/- 1 7	0 37 +/- 1 3	0 55 +/- 1 17
Gross beta	pCi/L	2 4 +/- 1 45	3 57 +/- 2 59	3 0 +/- 4 7	1 9 +/- 4 3	1 2 +/- 4 0	3 8 +/- 4 3	3 4 +/- 4 3	1 8 +/- 5 0	3 27 +/- 1 87
^{234}U	pCi/L	2 51 +/- 1 85	0 38 +/- 0 3	NA	NA	NA	NA	NA	NA	NA
^{235}U	pCi/L	0 29 +/- 0 7	0 06 +/- 0 14	NA	NA	NA	NA	NA	NA	NA
^{238}U	pCi/L	0 22 +/- 1 02	0 21+/- 0 22	NA	NA	NA	NA	NA	NA	NA
Total uranium	µg/L	0J (C)	0J (C)	0 0005=	0 0005=	0 0005=	0/000878=	0 0005=	0 0005=	0J (C)
Anions										
Nitrate (as N)	mg/L	0 02U	2 9=	0 028U	0 028U	0 028U	0 013=	0 028U	0 028U	1 0=

Analyte	Units	GW-762 8/21/00	GW-816 11/16/99	GW-816 4/10/00	GW-832 5/17/00	GW-832 8/23/00	GW-722-17 3/21/00	GW-722-17 7/26/00	GW-722-17 9/13/00
Volatile Organic Constituents									
Carbon tetrachloride	µg/L	5U	5U	5U	31=	4J	620=	890=	250= (D)
Chloroform	µg/L	5U	5U	5U	5U	4J	50=	73=	91= (D)
1,2-DCE (total)	µg/L	67=	5U	5U	5U	5U	4J	7=	4=
PCE	µg/L	2500= (D)	5U	5U	5=	4J	31=	61=	27=(D)
TCE	µg/L	150= (D)	5U	5U	5U	5U	5J	8=	4J
Radiological Constituents and Total Uranium									
Gross alpha	pCi/L	0 19 +/- 1 17	0 52 +/- 1 8	0 63 +/- 1 4	2 76 +/- 1 31	3 82 +/- 1 7	1 2 +/- 1 6	1 6 +/- 1 5	1 55 +/- 1 68
Gross beta	pCi/L	3 64 +/- 2 53	8 6 +/- 4 6	10 0 +/- 4 9	4 07 +/- 1 44	5 66 +/- 1 59	4 0 +/- 4 0	1 1 +/- 3 9	0 47 +/- 2 47
^{234}U	pCi/L	NA	NA	NA	1 78 +/-0 73	3 64 +/- 1 46	NA	NA	NA
^{235}U	pCi/L	NA	NA	NA	0 11 +/- 0 19	0 06 +/- 0 26	NA	NA	NA
^{238}U	pCi/L	NA	NA	NA	2 41 +/- 0 87	2 61 +/- 1 18	NA	NA	NA
Total uranium	µg/L	0J (C)	0 0005=	0 0005=	0 00538= (C)	0 00452= (C)	0 00142	0 0005U	0 000687= (C)
Anions									
Nitrate (as N)	mg/L	2 8=	0 028U	0 028U	1 9=	4 4=	1 77=	2 5=	2 4=

= = validated result detect and unqualified
J = Estimated concentration less than reporting limits
U = Not detected
(D) = Diluted sample result
DCE = dichloroethene
FY = fiscal year
(C) = Calculated value based on radiological analyses
NA = Not analyzed per FY 2000 Sampling and Analysis Plan
ND = Not determined sample not collected or analysis not conducted
PCE = tetrachloroethene
TCE = trichloroethene
VOC = volatile organic compound

VOCs, total uranium, radiological constituents, and nitrate in selected Y-12 Plant East End VOC Plume baseline wells for FY 2000.

Volatile Organic Constituent Results. FY 2000 monitoring data for Union Valley locations are presented in Sect. 6.9. The baseline monitoring results for the Union Valley wells GW-169, -170, and -230 (Fig. 6.14) up to the point of full-time operation of the system indicate the following:

- low, sporadic detections of VOCs in well GW-169, spring SCR 7.1, and spring SCR 7.18 (Fig. 6.14);
- consistently detectable concentrations of carbon tetrachloride and chloroform in well GW-170, but no discernable trend for signature VOCs; and
- historical lack of detectable VOCs in well GW-232 (about 400 ft depth; Fig. 6.14).

Additionally, low, but increasing, concentrations of 1,2-DCE were observed in well GW-230 located east of Scarboro Creek.

Within the Maynardville Limestone on the ORR, the best baseline data and consistently highest concentrations of signature VOCs are observed within four sampling zones in well GW-722 (Fig. 6.17), which is fitted with a multiport sampling system (Zone 14 at 425 ft bgs, Zone 17 at 385 ft bgs, Zone 20 at 333 ft bgs, and Zone 22 at 313 ft bgs). Analytical results for carbon tetrachloride and chloroform for FY 2000 from the various sampling ports are shown on Fig. 6.17. Zone 17 has exhibited the highest and most consistent VOC results to date; therefore, data from this sampling point are used to illustrate baseline carbon tetrachloride and chloroform trends for well GW-722 (Fig. 6.17). Quantitative trend analysis using a Mann-Kendall Test of the results for the two VOCs since mid-1997 do not indicate a significant trend. However, sampling data for this zone suggest a rebound of carbon tetrachloride and chloroform concentrations in well GW-722 since the pump and tracer test was conducted in mid-1998. The graphs of concentrations versus time shown on Fig. 6.17 depict a linear regression line, as well as sample results. Solid circles indicate a detected result; open circles depict results less than detection limits. The solid linear regression line is bounded by dashed lines illustrating confidence limits set at a confidence factor of 95%.

Within the Maynardville Limestone exit pathway upgradient of the plume interception well (well GW-382), signature VOC concentrations have remained relatively stable over the past two years. In well GW-382, for example, carbon tetrachloride concentrations have ranged from 1900 to 1100 μg/L and chloroform concentrations have ranged from 920 to 540 μg/L.

Monitoring locations along the UEFPC distribution channel exit pathway north of the plume interception well have shown significantly increasing concentrations of signature VOCs (i.e., carbon tetrachloride, chloroform, and PCE). This trend is illustrated by concentrations of carbon tetrachloride and PCE in well GW-220 over the past 10 years (Fig. 6.17).

Increasing PCE and TCE concentrations have also been observed in the former UEFPC creek channel located west of New Hope Pond (monitored by well GW-383); however, this particular pathway has not historically shown elevated carbon tetrachloride or chloroform indicating that the primary source is suspected DNAPL contamination located east of Bldg. 9720-6 (DOE 1998k). Maximum concentrations of PCE and TCE in well GW-762 located adjacent to the suspected DNAPL east of Bldg. 9720-6 were 2500 μg/L and 150 μg/L, respectively, in FY 2000. The FY 2000 results reflect an increase in VOC concentrations relative to the previous year (maximum PCE and TCE values in FY 1999 were 1600 μg/L and 130 μg/L, respectively).

Radiological and Inorganic Constituent Results. Analyses for gross alpha, gross beta, and isotopic uranium (GW-151, -154, -220, -735, and -832) were near or below MDAs in all of the baseline wells except GW-154. Similarly, total uranium concentrations were elevated only in well GW-154. Well GW-154 monitors shallow groundwater in the immediate vicinity of the Former Oil Skimmer Basin, which is believed to have trapped sediments in UEPFC prior to discharging into New Hope Pond (DOE 1998k). Isotopic and total uranium have historically been elevated in this well. FY 2000 maximum results for gross alpha (572.43 +/- 12.1 pCi/L), gross beta (171.56 +/- 3.49 pCi/L), ^{234}U (454.5 +/- 143 pCi/L), ^{238}U (312.1 +/- 98.59 pCi/L), and total uranium (0.766 mg/L) are consistent with historical data. Total uranium also exceeded background values in well GW-832 (0.00538 mg/L in May 2000).

Results for metals other than total uranium in FY 2000 performance baseline samples showed few exceedances of watershed groundwater background values. Exclusive of four major geochemical elements (calcium, sodium, potassium, and magnesium), exceedances for metals above background values are listed in Table 6.19.

No metal results exceeded primary MCLs in FY 2000. Nitrate values were below background values in all samples, with the exception of one sample collected from well GW-151 during August 2000 (8.6 mg/L).

Plume Interception System Testing Results. In addition to baseline monitoring of groundwater, treatment system performance data were obtained during testing of the treatment system in August and September 2000. Influent and corresponding effluent samples were collected the week of August 7 through 11, 2000, and on September 18, 2000, during system testing. During the August test, the concentrations of carbon tetrachloride and chloroform in treatment system influent from well GW-845 averaged 370 µg/L and 20 µg/L, respectively. The average concentrations in the effluent stream were 10 µg/L for carbon tetrachloride and 3 µg/L for chloroform. Similar reductions were observed for other signature VOCs detected in the influent stream (Table 6.20). System testing indicated the treatment unit attained a removal efficiency of 99% for carbon tetrachloride by the conclusion of the testing period. Similar reductions of VOCs were evident in system performance data collected in September (Table 6.21). Baseline concentrations of selected inorganic and isotopic constituents in both influent and effluent samples are also listed in Table 6.21.

6.12.3 Conclusions and Recommendations

Recommendations pertaining to the Y-12 Plant East End VOC Plume that were implemented for FY 2000 included continued monitoring of wells GW-382, 383, -220, and -832 to establish a baseline for evaluation of the impacts of the removal action on contaminant migration (1) within the Maynardville Limestone exit pathway upgradient of the extraction well, (2) along the UEPFC distribution channel underdrain, and (3) within the former UEFPC stream channel immediately west of Lake Realty. In addition, continued monitoring of wells GW-154 and GW-762 was recommended to evaluate any impacts the removal action may have on contaminant mobility from nearby known or suspected upgradient source areas (Former Oil Skimmer Basin and potential PCE DNAPL source east of Bldg. 9720-6).

As in the FY 1999 RER, the recommendation is made to continue monitoring of wells GW-382, -383, -151, -220, and -832 to evaluate the impacts of the removal action on contaminant migration within the Maynardville Limestone upgradient of the extraction well, along the UEPFC distribution channel underdrain, and within the former UEFPC stream channel immediately west of Lake Realty. In addition, continued monitoring of wells GW-154 and GW-762 is also recommended to evaluate any impacts the removal action may have on contaminant mobility from nearby known or suspected upgradient source areas (Former Oil Skimmer Basin and potential PCE DNAPL source east of Bldg. 9720-6). As noted in Sect. 6.9, monitoring data from wells and springs in Union Valley will be addressed in future RERs as an element of performance monitoring for the Y-12 Plant East End VOC Plume.

Table 6.19. Concentrations of metals exceeding groundwater background values in Y-12 Plant East End VOC Plume and watershed exit point monitoring wells, FY 2000

Analyte	Well	Result (mg/L)	Sample event (mm/yy)
Barium	GW-750	0.77	12/99
Barium	GW-750	0.738	4/00
Boron	GW-151	0.0882	5/00
Boron	GW-154	0.153	8/00
Boron	GW-204	0.228	11/99
Chromium	GW-154	0.0154	8/00
Iron	GW-816	23.2	4/00
Manganese	GW-154	1.73	5/00
Manganese	GW-154	6.62	8/00
Total strontium	GW-744	1.35	11/99
Total strontium	GW-744	1.31	4/00
Total uranium	GW-154	0.766	5/00
Total uranium	GW-154	0.609	8/00
Total uranium	GW-832	0.00538	5/00
Zinc	GW-154	0.0616	8/00

FY = fiscal year
VOC = volatile organic compound

Table 6.20. Selected Y-12 Plant East End VOC Plume Treatment System Verification Data, August 2000

		Influent		Effluent	
Chemical Name	Data Collected[a]	Project Sample ID	Results (μg/L)	Project Sample ID	Results (μg/L)
Carbon tetrachloride	08/07/2000	EEV00002	430D	EEV00007	19
	08/08/2000	EEV00018	440D	EEV00023	17
	08/09/2000	EEV00029	400D	EEV00034	9
	08/10/2000	EEV00040	370D	EEV00045	2J
	08/11/2000	EEV00051	340D	EEEV00056	3J
Average:[b]			396		10
Chloroform	08/07/2000	EEV00002	21DJ	EEV00008	5J
	08/08/2000	EEV00018	21DJ	EEV00023	4J
	08/09/2000	EEV00029	21DJ	EEV00034	3J
	08/10/2000	EEV00040	21	EEV00045	2J
	08/11/2000	EEV00051	18	EEV00056	2J
Average:[b]			20		3
Tetrachloroethene	08/07/2000	EEV00002	30D	EEV00008	2J
	08/08/2000	EEV00018	25D	EEV00023	2J
	08/09/2000	EEV00029	26	EEV00034	1J
	08/10/2000	EEV00040	21	EEV00045	5U
	08/11/2000	EEV00051	22	EEV00056	5U
Average:[b]			25		2
Trichloroethene	08/07/2000	EEV00002	3J	EEV00007	5U
	08/08/2000	EEV00018	4J	EEV00023	5U
	08/09/2000	EEV00029	3J	EEV00034	5U
	08/10/2000	EEV00040	3J	EEV00045	5U
	08/11/2000	EEV00051	3J	EEV00056	5U
Average:[b]			3		5U

[a]Operational monitoring data were collected daily during the week of August 7-11, 2001, to determine the effectiveness of the water treatment system The system operated continuously at a flowrate of 25 gpm during this time period Based on the average influent and effluent concentration August 7-11, 2000, a mass balance was performed to calculate the amount of carbon tetrachloride discharged to the atmosphere. At a flowrate of 25 gpm, carbon tetrachloride was discharged at a rate of approximately 2.2 g/hour.

[b]Results below the detection limit were not used to compute average concentration

Data Qualifiers.
D = The compound was quantified in an analysis at a secondary dilution factor.
J = Estimated result less than laboratory reporting limit
U = Not Detected
VOC = volatile organic compound

Table 6.21. Summary of Y-12 Plant East End VOC Plume interception groundwater treatment system testing results

Analyte[a]	Influent Sample (GW-845)	Effluent Sample	Units
Carbon tetrachloride	360	2J	µg/L
Chloroform	20	1J	µg/L
Chloromethane	5J	10U	µg/L
1,2-DCE	2J	5U	µg/L
TCE	3J	5U	µg/L
PCE	18	5U	µg/L
Nitrate	1.9	1.8	mg/L
Total uranium	0.00263	0.00277	mg/L
^{234}U	1.36 +/-0.79	1.33 +/- 0.58	pCi/L
^{235}U	0.14 +/- 0.31	0.09 +/- 0.17	pCi/L
^{238}U	0.92 +/- 0.63	0.65 +/- 0.39	pCi/L

[a] All VOCs detected in the influent sample are listed.
DCE = dichloroethene
J = Estimated result less than laboratory reporting limit
PCE = tetrachloroethene
TCE = trichloroethene
U = Not detected.
VOC = volatile organic compound

7. CERCLA ACTIONS AT OFF-SITE LOCATIONS

This section provides a summary of CERCLA actions that are either isolated from the major ORR watersheds or outside of the DOE property boundary. A brief outline of each of the actions is presented in Table 7.1.

Table 7.1. CERCLA actions at off-site locations

CERCLA action	CERCLA areas	Decision document date	Action status	Monitoring required
		Five-Year Review Sites		
Lower Watts Bar Reservoir	Lower Watts Bar Reservoir	ROD September 29, 1995	Continued monitoring, institutional controls	Yes
Oak Ridge Associated Universities South Campus Facility	South Campus Facility	ROD December 28, 1995	Continued monitoring, institutional controls	Yes
Clinch River/ Poplar Creek Operable Unit	Clinch River/ Poplar Creek Operable Unit	ROD September 23, 1997	Continued monitoring, institutional controls	Yes
Lower East Fork Poplar Creek	Lower East Fork Poplar Creek	ROD August 17, 1995	Continued monitoring	Yes

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980
ROD = record of decision

As indicated in Tables 1 1 and 1.2, post-ROD monitoring is conducted throughout the three major surface water systems draining the ORR (Lower East Fork Poplar Creek, Clinch River/Poplar Creek, and Lower Watts Bar Reservoir) and at one site located south of Y-12 (Oak Ridge Associated Universities South Campus Facility)

DOE has determined that the remedies already implemented within the off-site locations remain protective of public health and the environment in the context of the scope and objectives of each action

7.1 LOWER WATTS BAR RESERVOIR REMEDIAL ACTION

- ROD: September 1995
- Field Activities: None
- RAWP: March 1996

7.1.1 Project Description

The Lower Watts Bar Reservoir (LWBR) OU is defined as extending from Tennessee River mile (TRM) 567.5, at the mouth of the Clinch River, downstream approximately 38 river miles to the Watts Bar Reservoir Dam at TRM 529.9. The LWBR OU receives all surface water and sediment discharged from the ORR (Fig. 7.1). The LWBR OU is an integrator of waterborne substances from the Clinch and Tennessee Rivers. Once these substances enter the OU, they may be found in the water, sediment, or biota.

The RI/FS for the LWBR OU concluded that releases of organic, inorganic, and radioactive contaminants from the DOE-Oak Ridge Operations (ORO) facilities have contributed to contamination of the water, sediment, and biota of LWBR. The LWBR ROD identified the following chemicals of concern in sediments, surface water, and fish

- PCBs, mercury, aldrin, arsenic, and chlordane in fish,
- cadmium, chromium, mercury, and zinc in sediments dredged and used for growing foodstuffs, and
- manganese from surface water ingestion

The greatest risk to human health from contaminants in LWBR is associated with the consumption of PCB-contaminated fish species. Mercury, chlordane, aldrin, and arsenic in fish also pose potential risks (DOE 1995h) The screening level ecological risk assessment indicated that LWBR sediment is potentially toxic to benthic organisms, although conclusive evidence is lacking and the cause of any toxicity has not been established (DOE 1995h). Although ^{137}Cs is a chemical of concern in Clinch River sediment, it is not a risk driver in LWBR.

The selected remedy for LWBR uses existing institutional controls to reduce exposure to contaminated sediment, fish consumption advisories to reduce exposure to contaminants in fish tissue, and annual monitoring to detect changes in LWBR contaminant levels or mobility

7.1.2 Evaluation of Decision Document Requirements for Performance and Stewardship

7.1.2.1 Goals of decision

The objective of the selected remedy is to protect human health and the environment by reducing exposure to contaminated sediment, reducing exposure to contaminants in fish tissue, and detecting changes in LWBR contaminant levels or mobility (DOE 1995h), thereby ensuring that potential risk remains below acceptable risk levels.

7.1.2.2 Monitoring and stewardship required

The ROD for LWBR requires that DOE "... continue working with appropriate statutory authorities through the Interagency Agreement to coordinate and support the implementation of existing institutional controls and advisories. DOE must consider, propose, and implement appropriate response actions if an

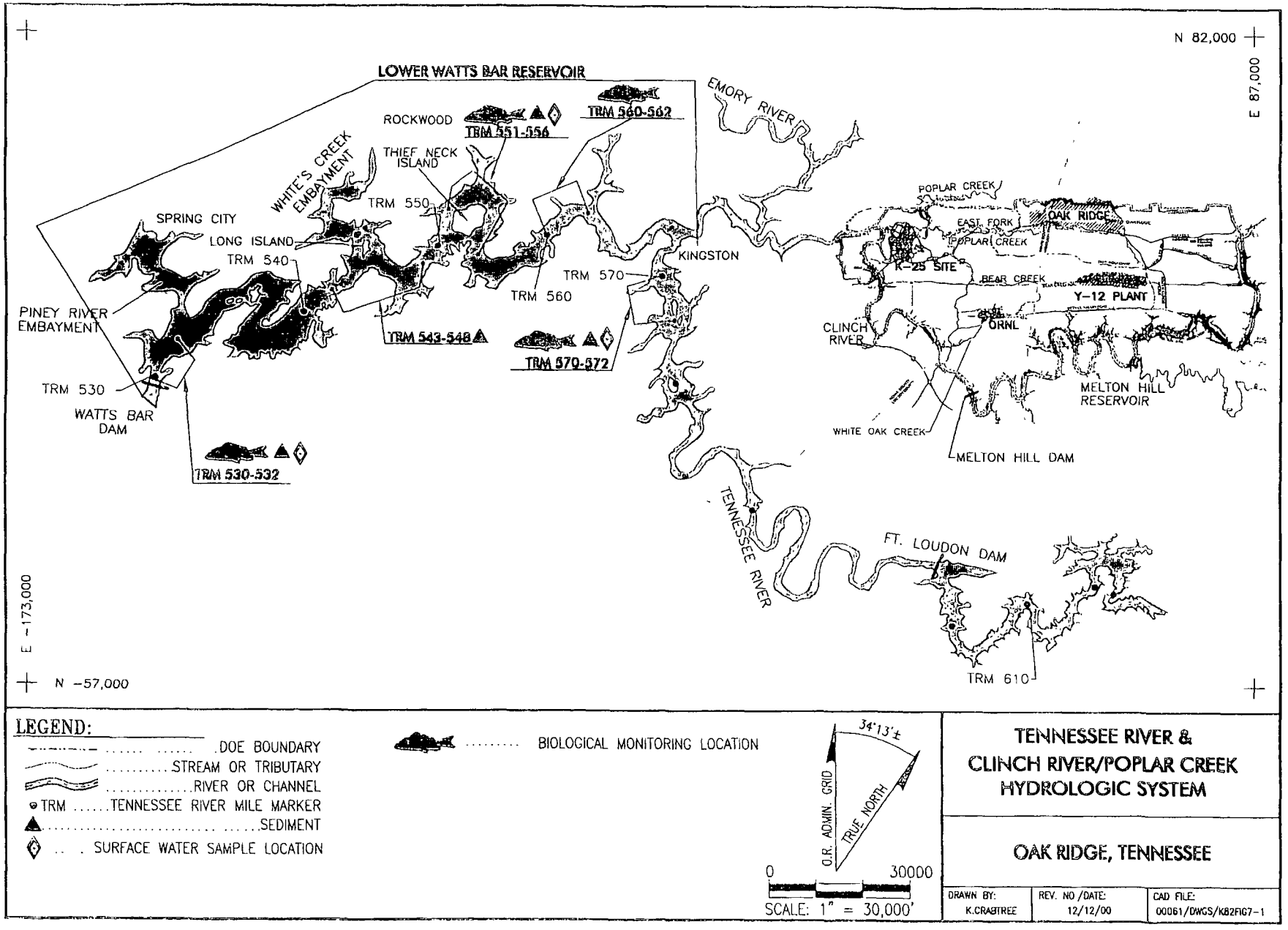


Fig. 7.1. Monitoring locations for the Lower Watts Bar Reservoir Operable Unit Remedial Action.

existing control or advisory becomes ineffective for any reason or if a sediment-disturbing activity would be potentially harmful to human health and/or the environment" because of sediments contaminated by DOE activities (DOE 1995h)

The ROD further requires that monitoring of water, sediment, and biota " be continued to determine if there is a change in the currently calculated risk that would pose a threat to human health and/or the environment" (DOE 1995h)

7.1.3 Implementation of Previous Year's Recommendations

The 2000 RER recommended that the *Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River Poplar Creek Operable Units at the Oak Ridge Reservation* be implemented in FY 2000 The combined monitoring plan was implemented as recommended

The premise of the combined monitoring plan is that an integrated monitoring program, addressing the two OUs as a single hydrologic system, will be more technically sound and economically feasible than two separate programs As presented in the combined monitoring plan, the goals of the combined program are the following

1 Meet the monitoring requirements of the LWBR and Clinch River/Poplar Creek (CR/PC) RODs

2 Supply information that directly addresses the contaminant- and risk-related issues identified in the RI/FSs

3 Provide answers to questions that will continue to be raised by stakeholders

4 Integrate with ongoing WRRP monitoring on the ORR that has been designed to track the effectiveness of the DOE remediation efforts

5 Integrate, to the extent possible, with monitoring programs conducted by other agencies [e g , Tennessee Wildlife Resources Agency (TWRA), Tennessee Valley Authority (TVA)] to take full advantage of existing data and knowledge of the Clinch River-Watts Bar Reservoir system

6 Remain cost-effective in CERCLA monitoring

A detailed description of the monitoring program that brings together the new monitoring requirements and those parts of the previous requirements that were retained is presented in Chap 2 of the combined monitoring plan

7.1.4 Evaluation of Performance and Stewardship Data

Table 7 2 provides a summary of the Five-Year Review for LWBR Detail on these activities is provided in the following sections

7.1.4.1 Watts Bar Interagency Working Group activities

The Watts Bar Interagency Working Group (WBIWG) was established by the Watts Bar Reservoir Permit Coordination Interagency Agreement in 1991 The purpose of the agreement was to establish a procedure for interagency coordination and review by the U S Army Corps of Engineers (USACE), Nashville District, and TVA of permitting and other use authorization activities that could result in the disturbance, resuspension, removal and/or disposal of contaminated sediments or potentially

Table 7.2. LWBR Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	See Sects. 7.1.4.3, 7.1.4 4, and 7.1 4.5 for discussion of monitoring results
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Advisories remain in place, and applications for dredging or other sediment disturbing activities are reviewed by the WBIWG (see Sect. 7.1.4 1)
Are the land use controls (fencing, security guards, etc.) in place and preventing exposure?	Yes	See Sect. 7.1.4.2 for discussion of advisories
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions identified in ROD
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Fish consumption advisory procedures are maintained by TDEC
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	No chemical-, location-, or action-specific ARARs identified in ROD No change in TBC guidance regarding institutional controls for long-term management of residual radioactive material (DOE Order 5400 5(IV)(6)(c))
Have there been any changes in land use or expected land use on or near the site?	Yes	Development has occurred along shore line; land use categories continue to be agricultural, recreational, residential, and industrial purposes
Have new human health or ecological exposure pathways or receptors been identified?	No	
Have new contaminants or contaminant sources been identified?	No	Sample results screened against PRGs (see Sect 7.1.4)
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	No action was performed
Have there been any changes in the physical site conditions?	No	No major changes affecting the hydrology of the LWBR system
Have there been any changes in the toxicity factors for contaminants of concern?	Yes	See Sect. 7 1 5 for discussion of changes in toxicity factors
Were there significant changes in the standardized risk assessment methodologies	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site, and if not, is there a plan to address them through a future action?	Yes	No action to reduce ecological risk was required by ROD, see Sect 7.1.4.5 for discussion of post-ROD data
Is the site located in an area subject to natural disasters?	Yes	Flooding, low potential of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
DOE = U S Department of Energy
LWBR = Lower Watts Bar Reservoir
NA = not applicable
PRG = preliminary remediation goal
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environmental and Conservation
WBIWG = Watts Bar Interagency Working Group

Table 7.3. FY 2000 LWBR surface water screening

Station	Chemical	Maximum detected result	Units	(a) TWQC criterion*	(b) EPA criterion**	Result exceed criteria	Criterion exceeded
TRM530-532	Aluminum	0.0823	mg/L		0.087	N	
	Barium	0.022	mg/L			NA	
	Boron	0.0146	mg/L		0.75	N	
	Calcium	17.7	mg/L			NA	
	Chromium	0.00028	mg/L	0.016 (f)	0.11732	N	
	Copper	0.0014	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.125	mg/L		1	N	
	Lithium	0.0019	mg/L			NA	
	Magnesium	4.47	mg/L			NA	
	Manganese	0.0239	mg/L			NA	
	Nickel	0.00037	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.5	mg/L			NA	
	Sodium	6.29	mg/L			NA	
	Strontium	0.0564	mg/L			NA	
	Vanadium	0.00061	mg/L			NA	
	Zinc	0.0041	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	1.73	pCi/L			NA	
	Uranium-238	1.49	pCi/L			NA	
TRM551-556	Aluminum	0.157	mg/L		0.087	Y	(b)
	Antimony	0.00075	mg/L		0.16	N	
	Arsenic	0.0008	mg/L	0.0014 (r)	0.19	N	
	Barium	0.025	mg/L			NA	
	Beryllium	0.00003	mg/L		0.00053	N	
	Boron	0.0158	mg/L		0.75	N	
	Calcium	20.6	mg/L			NA	
	Chromium	0.00029	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00027	mg/L			NA	
	Copper	0.0009	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.204	mg/L		1	N	
	Lithium	0.0021	mg/L			NA	
	Magnesium	5.22	mg/L			NA	
	Manganese	0.0408	mg/L			NA	
	Nickel	0.0008	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.51	mg/L			NA	
	Sodium	6.05	mg/L			NA	
	Strontium	0.0594	mg/L			NA	
	Vanadium	0.001	mg/L			NA	
	Zinc	0.0025	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	1.14	pCi/L			NA	
TRM570-572	Aluminum	0.229	mg/L		0.087	Y	(b)
	Barium	0.0251	mg/L			NA	
	Beryllium	0.00003	mg/L		0.00053	N	
	Boron	0.0194	mg/L		0.75	N	
	Calcium	22.5	mg/L			NA	
	Chromium	0.00047	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00025	mg/L			NA	
	Copper	0.00097	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.318	mg/L		1	N	
	Lithium	0.0022	mg/L			NA	
	Magnesium	5.16	mg/L			NA	
	Manganese	0.0534	mg/L			NA	

Table 7.3. FY 2000 LWBR surface water screening (continued)

Station	Chemical	Maximum detected result	Units	(a) TWQC Criterion*	(b) EPA Criterion**	Result exceed criteria	Criterion exceeded
TRM570-572	Nickel	0.00049	mg/L	0 1 (d)	0 08771	N	
	Potassium	1.77	mg/L			NA	
	Sodium	8 57	mg/L			NA	
	Strontium	0.0701	mg/L			NA	
	Vanadium	0.00097	mg/L			NA	
	Zinc	0.004	mg/L	0 117 (f)	0.05891	N	
	Uranium-233/234	1.45	pCi/L			NA	
	Uranium-238	1 91	pCi/L			NA	

*TDEC General Water Quality Criteria (d) domestic water supply, (f) fish and aquatic life, (r) recreation
**EPA Region IV Water Management Division Freshwater Water Quality Screening values for Hazardous Waste Sites
EPA = U S Environmental Protection Agency
FY = fiscal year
LWBR = Lower Watts Bar Reservoir
N = No
NA = not applicable
TDEC = Tennessee Department of Environment and Conservation
TRM = Tennessee River mile

Analytical results are presented in Table 7.4 for comparison with sediment screening values The LWBR RI/FS identified cadmium, chromium, mercury, and zinc as chemicals of concern in LWBR sediments FY 2000 sampling results show that zinc exceeded one of the screening criteria at the background monitoring location for LWBR sediments, TRM 570-572 (Table 7.4). At that location, zinc was measured at a concentration of 144 mg/kg, exceeding the EPA screening value of 124 mg/kg At the three downstream locations, the concentration of zinc in sampled sediments ranged from 220 mg/kg to 254 mg/kg. The concentration of cadmium in sediment samples collected at the three downstream monitoring locations ranged from 0.27 mg/kg to 0.43 mg/kg, in each case exceeding the background value of 0.24 mg/kg, but remaining below screening values for this contaminant. Chromium concentrations ranged from 29.6 mg/kg to 34.4 mg/kg at the three downstream sampling locations, exceeding the background concentration of 21 mg/kg and the residential PRG screening value of 23 mg/kg Mercury ranged from 1.2 mg/kg to 1.6 mg/kg, well above the background concentration of 0.09 mg/kg and the screening value of 0.13 mg/kg established by EPA-Region IV.

As shown in Table 7.5, most of the metals and radiological analytes exceeded either background concentrations or at least one of the state or federal screening criteria at the three downstream monitoring locations Although ^{137}Cs is not identified in the ROD for LWBR as a chemical of concern in sediment, it has historically been a contaminant of interest in the Clinch River–Watts Bar Reservoir hydrologic system In FY 2000, ^{137}Cs was not detected at the background sampling location for LWBR monitoring It was, however, measured at concentrations ranging from 3.37 pCi/g to 6.82 pCi/g at downstream sampling locations, exceeding both recreational and residential PRG screening values used in Table 7.5 (2.3 pCi/g and 0 021 pCi/g, respectively). Most of the other radiological constituents also exceeded their respective PRGs

From FY 1997 through FY 2000, two areas within the LWBR OU have been consistently sampled a reach defined by TRM 543-548 and a reach defined by TRM 551-556. Results for the four RI chemicals of concern (the metals cadmium, chromium, mercury, and zinc) and ^{137}Cs for the three years in which sediment samples have been collected (1997, 1999, and 2000) are shown in Fig. 7.2. Measured concentrations of the metals during this timeframe are generally decreasing No pattern for ^{137}Cs is evident With implementation of the combined monitoring plan for LWBR and the CR/PC in FY 2000, contaminants in sediment will be more consistently sampled within the same area of the hydrologic system from year to year. Sediment samples will be collected at the four LWBR monitoring locations noted above for the next four years. Therefore, the magnitude and pattern of contaminants in the overlying sediment layer can be more meaningfully compared and evaluated on an annual basis

Table 7.4. FY 2000 sediment screening results

Station	Chemical	Maximum detected result	Units	(a) Background (TRM570-572)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
TRM530-532	Aluminum	13900	mg/kg	9470				Y	a
	Antimony	0 52	mg/kg	0 32	26	3 1	12	Y	a
	Arsenic	12 5	mg/kg	6 9	31	0 43	7 24	Y	a, c, d
	Barium	178	mg/kg	136	30000	550		Y	a
	Beryllium	1 3	mg/kg	0 95	0 35	0 063		Y	a, b, c
	Boron	1 3	mg/kg	0 83	300000	700		Y	a
	Cadmium	0 27	mg/kg	0 24	6 4	1 4	1	Y	a
	Calcium	2730	mg/kg	2580				Y	a
	Chromium	32 5	mg/kg	21	380	23	52 3	Y	a, c
	Cobalt	18 9	mg/kg	12 8				Y	a
	Copper	33 5	mg/kg	20 2			18 7	Y	a, d
	Iron	39800	mg/kg	26500				Y	a
	Lead	40 7	mg/kg	25 1			30 2	Y	a, d
	Lithium	12 5	mg/kg	8 5				Y	a
	Magnesium	1920	mg/kg	2610				N	
	Manganese	3080	mg/kg	1260	11000	360		Y	a, c
	Mercury	1 5	mg/kg	0 09	130	2 3	0 13	Y	a, d
	Nickel	23 6	mg/kg	13 9	29000	160	15 9	Y	a, d
	Potassium	1310	mg/kg	1370				N	
	Selenium	2 1	mg/kg	1 1	11000	39		Y	a
	Sodium	132	mg/kg	82 4				Y	a
	Strontium	13 1	mg/kg	10	670000	4700		Y	a
	Vanadium	41 9	mg/kg	29	450	55		Y	a
	Zinc	220	mg/kg	140	330000	2300	124	Y	a, d
	Actinium-228	2 29	pCi/g	ND	1 5	0 013		Y	a, b, c
	Bismuth-214	1 13	pCi/g	ND	0 81	0 0072		Y	a, b, c
	Cesium-137	5 14	pCi/g	ND	2 3	0 021		Y	a, b, c
	Cobalt-60	0 46	pCi/g	0 49	0 5	0 0045		Y	c
	Lead-212	1 96	pCi/g	ND	16	0 14		Y	a, c
	Lead-214	1 16	pCi/g	ND	6 9	0 061		Y	a, c
	Potassium-40	13 78	pCi/g	13 87	8	0 071		Y	b, c
	Thallium-208	1 47	pCi/g	ND	0 34	0 003		Y	a, b, c
	Thorium-234	5 19	pCi/g	3	1100	9 9		Y	a
TRM543-548	Aluminum	14200	mg/kg	9470				Y	a
	Arsenic	13 1	mg/kg	6 9	31	0 43	7 24	Y	a, c, d
	Barium	177	mg/kg	136	30000	550		Y	a
	Beryllium	1 4	mg/kg	0 95	0 35	0 063		Y	a, b, c
	Boron	1 3	mg/kg	0 83	300000	700		Y	a
	Cadmium	0 43	mg/kg	0 24	6 4	1 4	1	Y	a
	Calcium	2660	mg/kg	2580				Y	a
	Chromium	34 4	mg/kg	21	380	23	52 3	Y	a, c
	Cobalt	19 2	mg/kg	12 8				Y	a
	Copper	36 2	mg/kg	20 2			18 7	Y	a, d
	Iron	39000	mg/kg	26500				Y	a
	Lead	42 2	mg/kg	25 1			30 2	Y	a, d
	Lithium	13 4	mg/kg	8 5				Y	a
	Magnesium	2100	mg/kg	2610				N	
	Manganese	2040	mg/kg	1260	11000	360		Y	a, c
	Mercury	1 6	mg/kg	0 09	130	2 3	0 13	Y	a, d
	Nickel	25 3	mg/kg	13 9	29000	160	15 9	Y	a, d
	Potassium	1340	mg/kg	1370				N	
	Selenium	2	mg/kg	1 1	11000	39		Y	a
	Sodium	96 1	mg/kg	82 4				Y	a

Table 7.4. FY 2000 sediment screening results (continued)

Station	Chemical	Maximum detected result	Units	(a) Background (TRM570-572)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
TRM543-548	Strontium	12 7	mg/kg	10	670000	4700		Y	a
	Thallium	0 85	mg/kg	ND	25	0 63		Y	a, c
	Vanadium	41 4	mg/kg	29	450	55		Y	a
	Zinc	254	mg/kg	140	330000	2300	124	Y	a, d
	Actinium-228	1 86	pCi/g	ND	1 5	0 013		Y	a, b, c
	Bismuth-214	1 01	pCi/g	ND	0 81	0 0072		Y	a, b, c
	Cesium-137	6 82	pCi/g	ND	2 3	0 021		Y	a, b, c
	Cobalt-60	0 72	pCi/g	0 49	0 5	0 0045		Y	a, b, c
	Lead-212	2 06	pCi/g	ND	16	0 14		Y	a, c
	Lead-214	1 57	pCi/g	ND	6 9	0 061		Y	a, c
	Potassium-40	15 43	pCi/g	13 87	8	0 071		Y	a, b, c
	Thallium-208	1 46	pCi/g	ND	0 34	0 003		Y	a, b, c
	Thorium-234	5 74	pCi/g	3	1100	9 9		Y	a
TRM551-556	Aluminum	12600	mg/kg	9470				Y	a
	Arsenic	11 8	mg/kg	6 9	31	0 43	7 24	Y	a, c, d
	Barium	157	mg/kg	136	30000	550		Y	a
	Beryllium	1 3	mg/kg	0 95	0 35	0 063		Y	a, b, c
	Boron	0 83	mg/kg	0 83	300000	700		N	
	Cadmium	0 35	mg/kg	0 24	6 4	1 4	1	Y	a
	Calcium	2690	mg/kg	2580				Y	a
	Chromium	29.6	mg/kg	21	380	23	52 3	Y	a, c
	Cobalt	18 4	mg/kg	12 8				Y	a
	Copper	34 3	mg/kg	20 2			18 7	Y	a, d
	Iron	35600	mg/kg	26500				Y	a
	Lead	40 5	mg/kg	25 1			30 2	Y	a, d
	Lithium	12	mg/kg	8 5				Y	a
	Magnesium	2040	mg/kg	2610				N	
	Manganese	1880	mg/kg	1260	11000	360		Y	a, c
	Mercury	1 2	mg/kg	0 09	130	2 3	0 13	Y	a, d
	Nickel	24 6	mg/kg	13 9	29000	160	15 9	Y	a, d
	Potassium	1190	mg/kg	1370				N	
	Selenium	2 3	mg/kg	1 1	11000	39		Y	a
	Sodium	121	mg/kg	82 4				Y	a
	Strontium	12 2	mg/kg	10	670000	4700		Y	a
	Thallium	0 85	mg/kg	ND	25	0 63		Y	a,
	Vanadium	37.8	mg/kg	29	450	55		Y	a
	Zinc	221	mg/kg	140	330000	2300	124	Y	a, d
	Actinium-228	1 64	pCi/g	ND	1 5	0 013		Y	a, b, c
	Bismuth-212	1 26	pCi/g	ND	7 3	0 065		Y	a, c
	Bismuth-214	1 2	pCi/g	ND	0 81	0 0072		Y	a, b, c
	Cesium-137	3 37	pCi/g	ND	2 3	0 021		Y	a, b, c
	Lead-212	1 85	pCi/g	ND	16	0 14		Y	a, c
	Lead-214	1 22	pCi/g	ND	6 9	0 061		Y	a, c
	Potassium-40	19 13	pCi/g	13 87	8	0 071		Y	a, b, c
	Thallium-208	1 49	pCi/g	ND	0 34	0 003		Y	a, b, c

EPA = U S Environmental Protection Agency
FY = fiscal year
ND = Not detected above associated reporting level
PRG = preliminary remediation goal
TRM = Tennessee River mile

Table 7.5. Results of chemical analyses of biota sampled in Lower Watts Bar Reservoir

Sample location	Sample medium	Date	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	Aroclor-1254	Aroclor-1260	BHCs	Chlordane	Dieldrin	Endosulfans	Endrins	Heptachlor	Mercury
TRM 530-532	Channel catfish	11/29/99	6.7*	80	20U	2.9*	17U	640	26U	60U	0.4*	24.4*U	31*U	6.6*U	335
	Largemouth bass	11/29/99	20U	1.1*	20U	7U	17U	16*	26U	60U	15U	45U	46U	4.3*U	119
	Striped bass	11/29/99	3.3*	15.4*	19.8U	2.6*U	17U	40	25.7U	59.4U	1.2*	44.5U	4.7*U	5.3*U	130
	Striped bass	1/18/00	8.3*	24	19.8U	6.9U	17U	220	12*U	59.4U	16	14.3*	26.9*U	8.4*U	122
	Channel catfish	6/26/00	6U	9 9	6U		100U	64*		7.2*U	5.8*	6.6*U	6.6*U	1.2*	120
	Largemouth bass	6/26/00	6U	3.3	6U		100U	100U		3.8*U	6U	18U	5*U	22U	103
TRM 560-562	Channel catfish	11/29/99	1.8*	22	20U	2.1*	17U	150	26U	60U	1 0*	19.2*U	16.3*U	3.0*	446
	Largemouth bass	11/29/99	20U	16U	20U	7U	17U	17U	26U	60U	15U	45U	46U	4.5*U	126
	Striped bass	11/29/99	2.7*	23	20U	4.4*	17U	110	6.3*U	60U	3.3*	45U	13.7*U	6.1*	166
TRM 551-556	Channel catfish	6/26/00	6U	25	6U		100U	240		7.9*U	6 5	18U	6.9*U	3*	167
	Largemouth bass	6/26/00	6U	1.2*	6U		100U	100U		12U	6U	18U	3.8*U	22U	190
TRM 570-572	Channel catfish	11/29/99	20U	16U	20U	7U	17U	60	26U	60U	0.5*	45U	46U	4.5*U	124
	Largemouth bass	11/29/99	20U	16U	20U	0.8*	17U	17U	9.4*U	60U	15U	45U	46U	4.8*U	128
	Striped bass	11/29/99	4 5*	40	20U	6.8*	17U	200	6.8*U	60U	4.8*	45U	19*U	10*	199
	Channel catfish	6/26/00	6U	3.2*	6U		27*	100U		4.7*U	2.9*	18U	4.1*U	22U	53.6
	Largemouth bass	6/26/00	6U	1.2*	6U		100U	100U		12U	6U	18U	3.5*U	22U	366

* = Concentration estimated at a level below the detection limit
*U = Concentration calculated by averaging estimated values with half the detection limit
Concentrations in µg/kg
BHC = benzene hexachloride
U = not detected at the concentration stated in the table

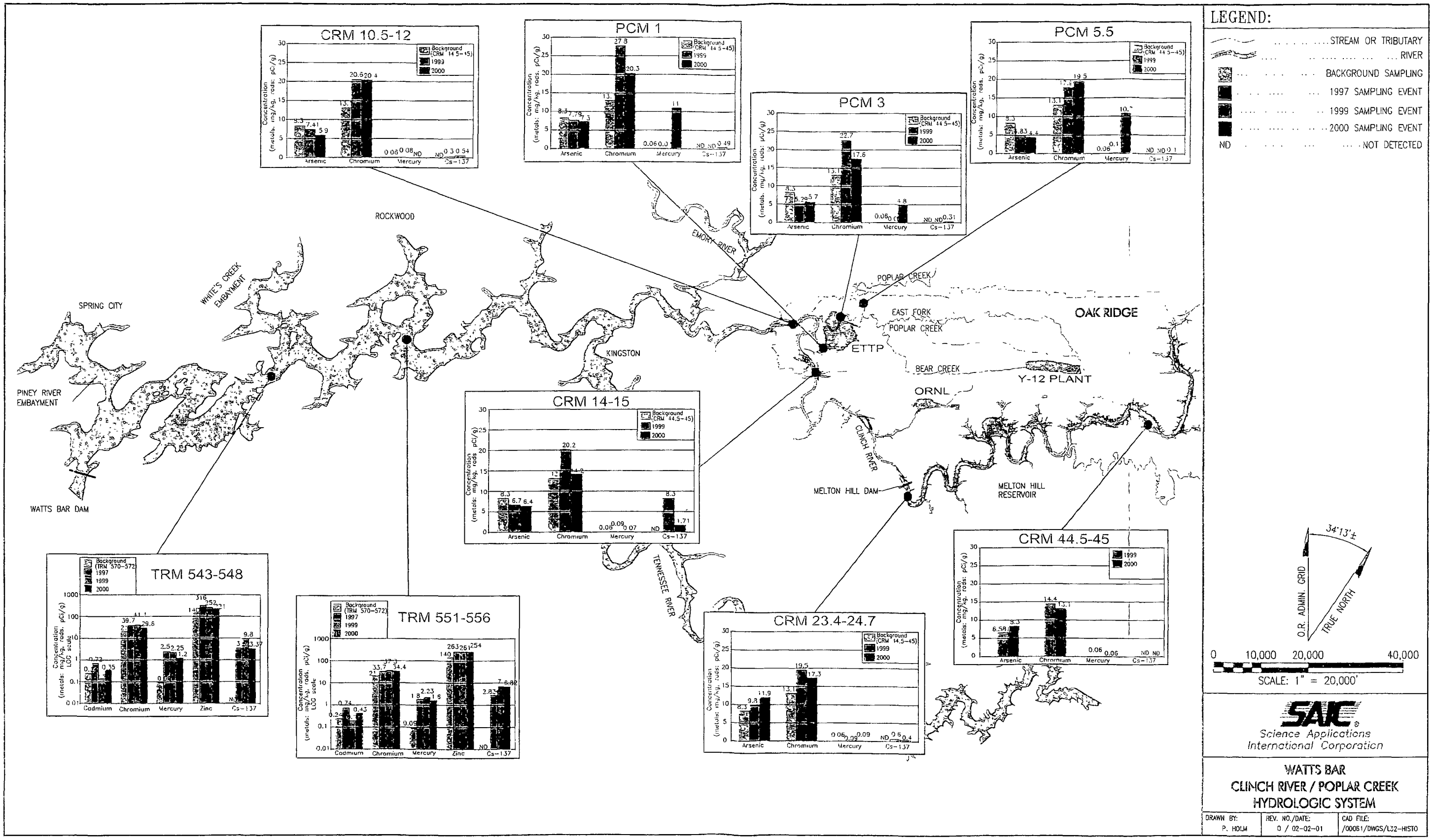


Fig. 7.2. RI contaminants of concern in sediment, 1997-2000.

In conclusion, it appears that shallow, near-shore sediments of the LWBR OU do not present an unacceptable risk to the public Sediments in the main channel of the LWBR do not present a risk to the public if left undisturbed Continued monitoring of LWBR sediments will provide information that can be used to confirm that accumulation of sediment is continuing to isolate the contaminated layer of LWBR sediment In the meantime, existing institutional controls on sediment-disturbing activities should be maintained in order to ensure continued protection of human health.

7.1.4.5 Biota monitoring

Biota Sampling. Biota sampling was done to evaluate potential accumulation of contaminants by fish Striped bass, large mouth bass, and catfish from Watts Bar Lake were sampled at the Watts Bar Dam forebay (TRM 530-532), at TRMs 551-556 and 560-562, and near Kingston above the confluence with the Clinch River (TRM 570-572)

RI chemicals of concern for biota were PCBs, pesticides, arsenic, and mercury (DOE 1995k) In addition to sampling for these chemicals, concentrations of ^{137}Cs, ^{60}Co, and ^{40}K were also measured Table 7 5 presents the analytical results for chemicals in fish and turtles collected in the LWBR In this table, alpha-BHC, beta-BHC, and delta-BHC were combined as benzene hexachlorides (BHCs), chlordane, alpha-chlordane, and gamma-chlordane were combined as chlordane, endosulfan I, endosulfan II, and endosulfan sulfate were combined as endosulfans, endrin and endrin aldehyde were combined as endrins, and heptachlor and heptachlor epoxide were combined as heptachlors Non-detects are reported as the concentration representing the detection limit followed by "U " Concentrations estimated at levels below the detection limits are reported with an asterisk When non-detects and estimated values were combined, the non-detect value was taken to be half the detection limit, and the result was followed by "+U " Table 7 6 shows the results of analyses of fish for ^{137}Cs, ^{60}Co, and ^{40}K

Table 7.6. Frequency of detection and activity of radionuclides in fish in the Lower Watts Bar Reservoir

Location	Tissue	Cs-137 Detection frequency	Cs-137 Activity (pCi/g)	Co-60 Detection frequency	Co-60 Activity (pCi/g)	K-40 Detection frequency	K-40 Activity (pCi/g)
TRM 530-532	Catfish	1/2	0 08*	1/2	0 06*	1/1	3 0
	Largemouth bass	1/3	0 012*	0/3	U	3/3	4 6
	Striped bass	0/3	U	0/3	U	2/2	2 5
TRM 551-556,	Catfish	0/2	U	1/2	0 07*	2/2	2 9
TRM 560-562	Largemouth bass	0/4	U	1/4	0 5*	2/2	3 6
TRM 570-572	Catfish	0/2	U	0/2	U	2/2	3 1
	Largemouth bass	0/3	U	0/3	U	3/3	3 1
	Striped bass	0/1	U	0/1	U	Not reported	

TRM = Tennessee River mile

PCB concentrations in fish in lower Watts Bar Lake ranged from an estimated 16 to 640 μg/kg, both at the Watts Bar Dam forebay The concentrations are well below the Federal Drug Administration limit of 2000 μg/kg for marketability of fish, but all are above the EPA Office of Water health screening level of 10 μg/kg and only 2 of 16 samples had a concentration below that yielding a 10^{-4} risk to humans in the Lower Watts Bar RI/FS (DOE 1995k) Concentrations were observed at TRM 570-572, upstream from the confluence of the Clinch River

Most of the pesticide concentrations were below or near detection limits for all three fish species at all sites

Many of the reported mercury concentrations (54 to 446 μg/kg) for all fish species were in the range of reference streams (60 to 110 μg/kg) (Southworth et al 1994). Concentrations were below the 1 mg/kg limit for marketability of fish. Two of 16 fish samples had a concentration above the Oregon state health screening level of 0.35 mg/kg. Three of 16 samples had concentrations above the upper concentration of 0.24 mg/kg for Lower Watts Bar fish that resulted in a hazard quotient of about 1.5 for children consuming fish in the Lower Watts Bar RI/FS (DOE 1995k).

The maximum concentrations of radionuclides in fish tissue were used to estimate the daily internal radiation dose by using methods published by ORNL Environmental Sciences Division (Sample et al 1997). The maximum dose for all radionuclides, including those that were estimated but below detection limits, was less than 1 mrad/d, whereas a dose of 1 rad/d is considered to be unlikely to cause harm to fish (ICRP 1977, NCRP 1991). The radionuclides that were reported, ^{137}Cs, ^{60}Co, and ^{40}K, are assumed not to bioaccumulate in aquatic biota and do not bioaccumulate in mammals (Baes et al. 1984) Therefore, the internal concentrations of these radionuclides in fish should not be of concern to predators of fish

Risks to humans from consumption of fish in LWB are illustrated in Figure 7.3. Concentrations corresponding to risks reported in the LWB RI/FS (DOE 1995k) were calculated and adjusted as described in Sect. 7.1.4.3. Observed concentrations and one-half the detection limit of non-detected concentrations were compared with those values. Icons representing catfish and bass were given colors indicating the following risk levels. green, cancer risk <1E-06 and hazard quotient (HQ) <1, yellow, cancer risk between 1E-04 and 1E-03 and HQ between 1 and 15, and red, cancer risk >1E-03 and HQ>15 Thus, yellow indicates potential harm in humans to the unlikely circumstance that the very conservative exposure assumptions used in the LWB RI/FS risk assessment (DOE 1995k) actually occur, whereas red indicates a high likelihood of unacceptable risk Figure 7.3 shows that PCBs in catfish from LWBR could be harmful to adults if the catfish are eaten for a lifetime Mercury concentrations in fish both above and below the confluence with the Clinch River could be harmful to children

Review of Lower Watts Bar Risk Issues. The Lower Watts Bar ROD states that ecological risks to benthic organisms and piscivorous wildlife were suggested by the data, but DOE determined that no remedial action is necessary. Monitoring was required to determine that the decision remains valid

The Lower Watts Bar RI/FS reported the following potential ecological risks or hazards to benthic biota and piscivorous wildlife·

- sediment-dwelling invertebrates—concentrations of arsenic, barium, cadmium, iron, lead, manganese, mercury, nickel, silver, zinc, and chlordane may be causing reductions in population size and diversity in the most contaminated sediments; and

- piscivorous wildlife—mercury, selenium, and PCBs in fish tissue were sufficiently high to reduce survival or reproduction of mink, and mercury and zinc concentrations were sufficiently high to reduce survival or reproduction of herons

Risks to piscivores were evaluated by comparing observed concentrations in fish to benchmark values for mink and great blue herons Safe concentrations for consumption of fish contaminated with mercury were stated in the RI/FS to be 60 μg/kg for mink and 27 μg/kg for great blue herons Nearly all of the concentrations observed in the LWBR samples are above those concentrations Mercury concentrations in fish are similar to those found in the RI/FS, indicating that the risks to piscivores from ingestion of fish in the LWBR probably remain about the same

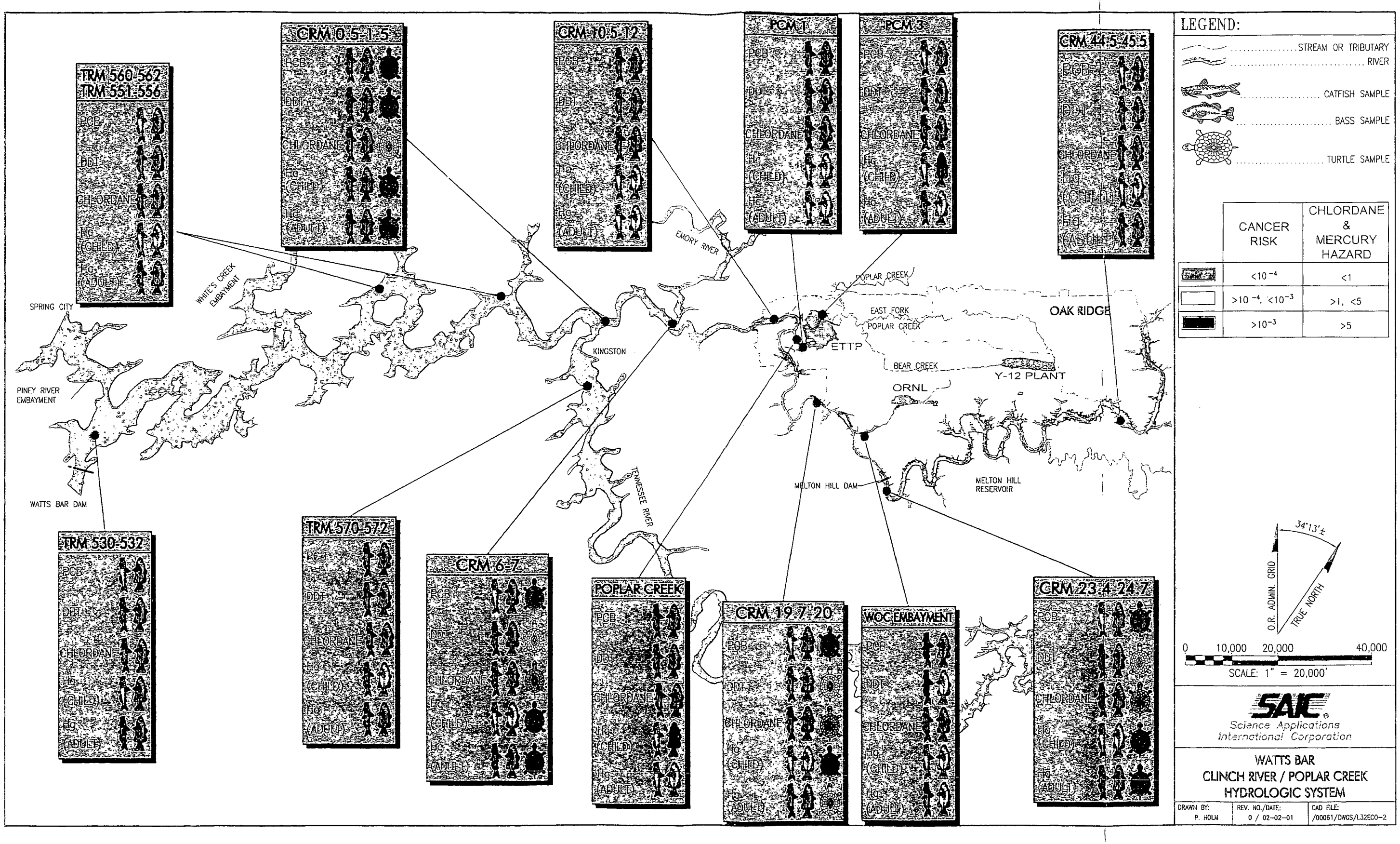


Fig. 7.3. Pictorial summary of health risks from COCs in biota.

Safe concentrations for consumption of fish contaminated with Aroclor were stated in the RI/FS to be 1.0 mg/kg for mink and 7.0 mg/kg for great blue herons. The concentrations observed in the LWBR samples are well below those concentrations. Therefore, risks to piscivores from Aroclor ingested in fish in the LWBR appear to be low. One sample, taken at WOCE, had a concentration above the benchmark for mink but below the benchmark for herons.

Conclusions. There is no indication that aldrin or mercury is now accumulating to levels of concern in fish in the LWBR. Chlordane is below levels of concern from results established in the LWB RI/FS for human health, because the levels of concern are below the reported limits of detection.

Exposure of piscivores to mercury by ingestion of fish remains above toxicity benchmarks in the LWBR In contrast, exposures to PCBs appear not to be of concern for piscivores. Accumulation of ^{137}Cs and ^{60}Co by fish is below levels of concern to predators.

7.1.4.6 Changes in toxicity factors for LWBR contaminants of concern

The LWBR RI/FS identified the following chemicals of concern:

- PCBs, mercury, aldrin, arsenic, and chlordane in fish,
- cadmium, chromium, mercury, and zinc in sediments, and
- manganese in surface water.

Subsequent to completion of the LWBR RI/FS in March 1995, there have been changes in toxicity factors for the following LWBR chemicals of concern PCBs, mercury, arsenic, chlordane, cadmium, chromium, and manganese.

PCBs. A slope factor of 7 7E+00 was used in calculating risk associated with ingestion of fish in the human health risk assessment. A slope factor of 2 0E+00 is currently used, thus, the corresponding risk is decreased accordingly.

Mercury. A chemical of concern associated with ingestion of fish tissue, and ingestion of milk, meat, or vegetables derived from agricultural practices using sediments dredged from LWBR. The oral reference dose for mercury was withdrawn in 1995. An RfD for mercuric chloride can be used to evaluate the hazard associated with mercury This RfD is the same value as the withdrawn inorganic mercury value; thus, there is no change associated with this contaminant of concern

Arsenic. Inhalation slope factor withdrawn in 1997, however, there is no change associated with ingestion of fish tissue.

Chlordane. Oral RfD changed from 6.0E-05 to 5.0E-04 in 1998, thus decreasing hazard associated with ingestion of fish tissue.

Cadmium. Inhalation slope factor withdrawn in 1997, although inhalation unit risk is still available to use in calculation of a slope factor The resulting slope factor is 6 3, compared to the previous (withdrawn) slope factor of 6 1 This has a negligible effect on the risk associated with this contaminant of concern No change has been identified that affects the hazard associated with this contaminant of concern

Chromium. Oral reference dose reduced from 5 0E-03 to 3 0E-03, thereby increasing hazard associated with ingestion of milk or meat derived from farming practices utilizing dredged sediments The

hazard quotient calculated in the RI/FS human health risk assessment for chromium under these exposure scenarios (child) was 1.4 and 1.9, respectively.

Manganese. Oral reference dose increased from 5.0E-03 to 4.6E-02, thus reducing the hazard quotient associated with ingestion of manganese in LWBR waters from 1.1E+00 to 1.2E-01.

7.1.5 Recommendations

- Continue existing institutional controls to reduce exposure to contaminated sediment.
- Continue fish consumption advisories to reduce exposure to contaminants in fish tissue.
- Continue annual monitoring as described in the *Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River Poplar Creek Operable Units at Oak Ridge Reservation.*

7.2 ORAU SOUTH CAMPUS FACILITY REMEDIAL ACTION

- ROD: December 28, 1995
- Field Activities: No Further Action
- RAR: May 1996

7.2.1 Project Description

The Oak Ridge Associated Universities (ORAU) South Campus Facility (SCF) is located southeast of Y-12 at the intersection of Pumphouse Road and Bethel Valley Road (Fig. 7.4). The facility was originally an experimental station where radionuclide effects on animals were studied. Activities and buildings at SCF either supported research on exposed animals or managed those animals before and after exposure to radiation. The SCF included pasture area, several buildings, and wastewater treatment facilities. The site slopes southeast toward the Scarboro Creek embayment, with the topography in the developed northwest corner of the site modified by the installation of roads, buildings, and associated drainage control ditches and storm drain/sewer systems. Riparian wetlands, ranging in width from 5 to 30 ft, flank the entire length of Scarboro Creek at the facility. Emergent and wet meadow wetlands are found at the mouth of Scarboro Creek at the embayment.

The selected remedy for the SCF was no action. The RI/FS, completed in February 1995, concluded that the site posed no unacceptable risk to humans or the environment, provided that groundwater is not used for human consumption. It was anticipated that TCE in groundwater will naturally attenuate and, therefore, no remedial action was considered necessary.

7.2.2 Evaluation of Decision Document Requirements for Performance and Stewardship

7.2.2.1 Goals of decision

The goal of the decision for the SCF was to provide institutional controls that help ensure the site continues to pose no unacceptable risk.

7.2.2.2 Monitoring and stewardship required

The selected remedy at the SCF " .includes periodic sampling to ensure that evaluations completed in support of the RI are accurate and that natural attenuation in the zone of contamination continues as expected" (DOE 1995g). The ROD requires that groundwater samples be collected from monitoring wells MW-19, -43a, -43b, and -43c (these wells were subsequently renamed GW-841, -842, -843, and -844, respectively) and that a surface water sample be collected from a ditch approximately 180 ft downgradient of the MW-43 well cluster (Fig 7.4).

The ROD requires that samples be collected from the five locations once every two years as long as TCE contamination above acceptable levels is present. The ROD stipulated that the first sampling event occur during the rainy season closest to and within two years of the signing of the ROD (December 28, 1995) The ROD also states that "A notice of the contamination will be recorded with respect to the contaminated parcel in Anderson County property records" (DOE 1995g)

The ROD requires that the Five-Year Reviews consider the results of the RI, the quarterly groundwater monitoring program, and the two-year sampling events to assess the rate of TCE degradation

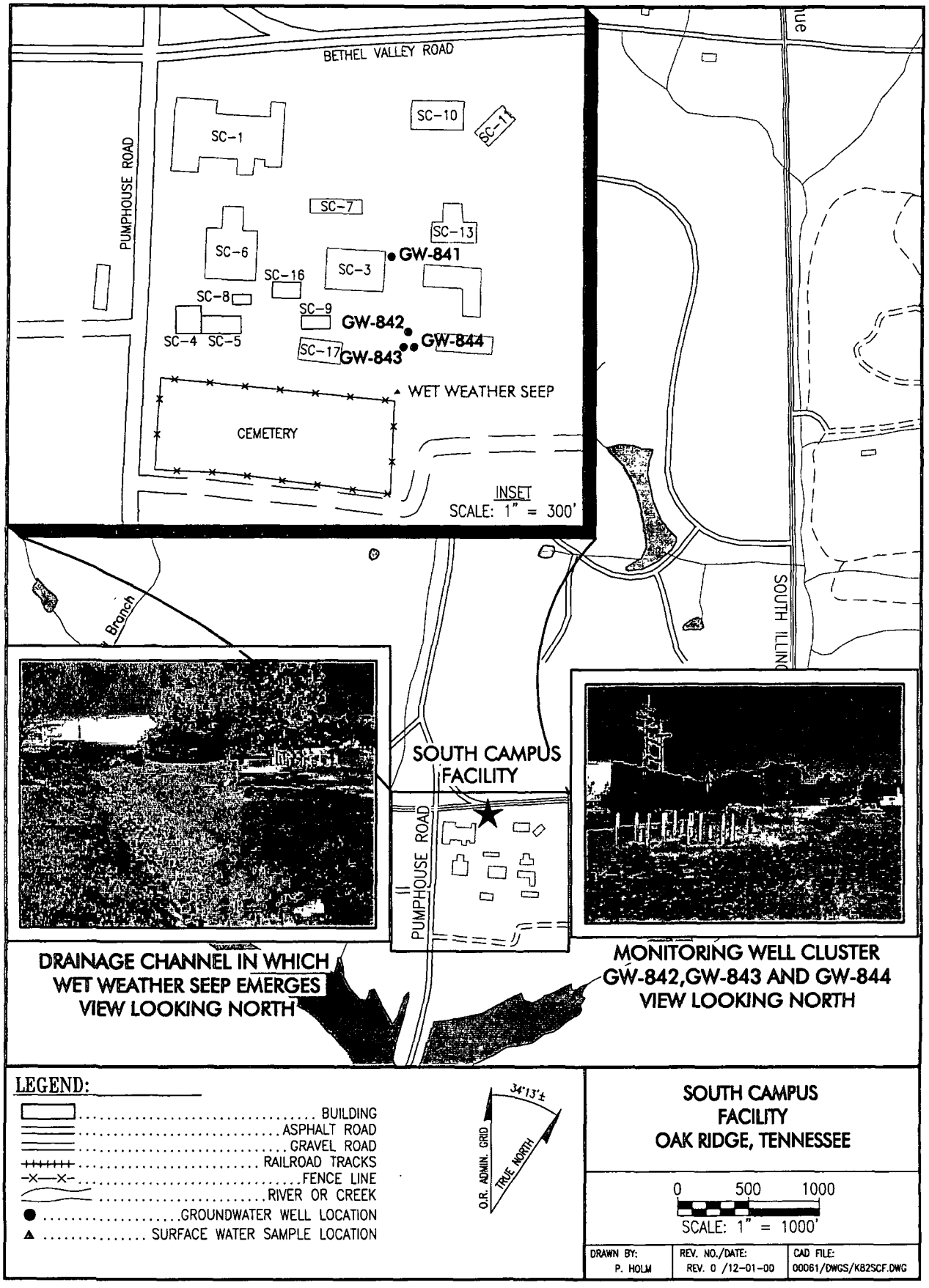


Fig. 7.4. ORAU South Campus Facility location map.

7.2.3 Implementation of Previous Year's Recommendations

No changes were recommended in the 2000 RER.

7.2.4 Evaluation of Performance and Stewardship Data

Table 7.7 provides a summary of the Five-Year Review for the SCF. Details on the activities are provided in the following sections.

7.2.4.1 Groundwater and surface water monitoring

Groundwater and surface water samples are collected biannually from the five locations specified in the ROD. The first round of monitoring samples was collected in February 1997 In accordance with the sampling schedule stipulated in the ROD, these locations were sampled again in February 1999 An additional round of samples was collected in FY 1999 during the August–September timeframe to allow a comparison of wet season and dry season concentrations in order to better document and establish baselines for monitored natural attenuation Groundwater and surface water samples are analyzed for TCE, associated degradation products, and physical and chemical biodegradation indicators Analytical results from FY 1997 and FY 1999 monitoring events are presented in Table 7 8, along with results from the RI and quarterly sampling events

Several positive indicators are present in the post-ROD baseline sampling data for monitored natural attenuation (Table 7 8) Groundwater from the shallow well at the upgradient end of the zone of contamination (GW-841) contains both TCE and its degradation product, cis-1,2-DCE, unequivocal evidence that the TCE is degrading Moreover, the concentration of TCE has decreased from a high of 1200 µg/L during the 1994 sampling event to 290 µg/L in September 1999 Additionally, the concentration of DCE has decreased at this location from a high of 370 µg/L in 1994 to 91 µg/L in September 1999 However, the apparent absence of vinyl chloride, the DCE degradation product, at this well (below detection limits in both 1999 sampling events), and high vinyl chloride detection limits (25 µg/L in February 1999 and 10 µg/L in September 1999), introduces some uncertainty as to whether the DCE is also degrading.

Supporting evidence for DCE degradation is the fact that the downgradient wells typically contain little or no measurable concentrations of this compound GW-842, the shallowest of the downgradient wells, had a DCE concentration of 3 µg/L during the September 1999 sampling event, equivalent to its previous detection in this well in 1994 The TCE concentration in the September 1999 sample from this well was 4 µg/L, down from a high of 10 µg/L in 1994 Vinyl chloride did not occur at concentrations above its detection limit of 10 µg/L in this well during the two 1999 sampling events, down from 10 µg/L in 1993 TCE, DCE, and vinyl chloride occurred in concentrations below their respective detections limits of 5 µg/L, 5 µg/L, and 10 µg/L in the next deepest downgradient monitoring well, GW-843, during both 1999 sampling events. The deepest of the downgradient wells, GW-844, was dry during both 1999 sampling events but the historical data indicate that TCE and vinyl chloride concentrations have decreased from highs of 10 µg/L to below their detection limits (Table 7 8) Because TCE and its degradation products are no longer detectable in the downgradient wells, it is tentatively concluded that degradation of TCE and its daughter products is occurring at upgradient locations in the zone of contamination However, this conclusion must remain tentative until there is a sufficient history of sampling to confirm it

The absence of vinyl chloride from the zone of contamination may be attributable to the fact that conditions are suitable for its aerobic degradation in the upgradient portions of the zone For example,

Table 7.7. ORAU South Campus Facility Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	See Sect 7 2 4 1 for discussion of monitoring results
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	As long as groundwater is not used as a drinking water source, exposure will be prevented and protectiveness of the remedy will be maintained
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	See Sect 7 2 4 2 for evaluation of measures in place to prevent exposure
Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	Yes	No additional actions were deemed necessary
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	N/A	No long-term operating procedures were established in conjunction with the selected remedy
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	"Pursuant to EPA Office of Solid Waste and Emergency Response Directive 9234 2-01/FS-4 (EPA 1994), there are no applicable or relevant and appropriate requirements for a no action alternative" (ROD, pg 2-10)
Have there been any changes in land use or expected land use on or near the site?	No	See Sect 7 2 4 2 for discussion of potential change in land use near the SCF
Have new human health or ecological exposure pathways or receptors been identified?	No	
Have new contaminants or contaminant sources been identified?	No	
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	Yes	Obsolete buildings removed, rip-rap added to drainage ditch to control erosion (Sect 7 2 4 2)
Have there been any changes in the toxicity factors for contaminants of concern?	Yes	Oral slope factor for benzene revised from 2 9E-02 to 5 5E-02, thereby increasing risk from injection pathway by a factor of 1 9
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	COCs do not present an unacceptable risk to wildlife or plants
Is the site located in an area subject to natural disasters?	Yes	Low probability earthquake/tornadoes

ARAR = applicable or relevant and appropriate requirement
COC = contaminant of concern
EPA = U S Environmental Protection Agency
NA = not applicable
ROD = record of decision
SCF = South Campus Facility
TBC = to be considered

Table 7.8. Summary of performance data from ORAU South Campus Facility

Parameter (units)	SCF Seep 02/06/ 1997	SCF Seep 03/03/ 1999	SCF Seep 08/18/ 1999	GW-841[a] 04/06/ 1993	GW-841[a] 11/18/ 1994	GW-841[a] 02/01/ 1995	GW-841[a] 02/06/ 1997	GW-841[a] 02/03/ 1999	GW-841[a] 09/09/ 1999	GW-842[a] 08/18/ 1993	GW-842[a] 11/17/ 1994	GW-842[a] 01/31/ 1995	GW-842[a] 02/05/ 1997	GW-842[a] 02/03/ 1999	GW-842[a] 09/07/ 1999
Alkalinity (mg/L)	N/A	116	(dry)	N/A	N/A	N/A	N/A	244	311	N/A	N/A	N/A	N/A	188	239
Chloride (mg/L)	N/A	0.92	(dry)	N/A	N/A	N/A	N/A	2.4	3.2	N/A	N/A	N/A	N/A	4.5	5.1
Fluoride (mg/L)	N/A	0.1 U	(dry)	N/A	N/A	N/A	N/A	0.19	0.25 U	N/A	N/A	N/A	N/A	0.18	0.18
Nitrate/Nitrite as Nitrogen (mg/L)	N/A	N/A	(dry)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.15
Sulfate (mg/L)	N/A	25	(dry)	N/A	N/A	N/A	N/A	36.3	30.6	N/A	N/A	N/A	N/A	25.3	23.8
Sulfide (mg/L)	N/A	1.2 J	(dry)	N/A	N/A	N/A	N/A	1 U	N/A	N/A	N/A	N/A	N/A	1 U	1 U
Iron (mg/L)	N/A	0.219	(dry)	8.9	N/A	N/A	N/A	0.237 J	N/A	12.5	N/A	N/A	N/A	0.29 J	N/A
Manganese (mg/L)	N/A	0.0171	(dry)	0.374	N/A	N/A	N/A	0.0062	N/A	1.87	N/A	N/A	N/A	0.0076	N/A
Total Organic Carbon (mg/L)	N/A	4.2	(dry)	N/A	N/A	N/A	N/A	1.9	N/A	N/A	N/A	N/A	N/A	1.6	0.51
Benzene (μg/L)	N/A	5 U	(dry)	25	74 U	33 UJ	5 U	12 U	5 U	10	10 U	10 UJ	5 U	5 U	5 U
cis-1,2-Dichloroethene (μg/L)	N/A	5 U	(dry)	N/A	370	N/A	58	87	91	N/A	3 J	N/A	5 U	5 U	3 J
trans-1,2-Dichloroethene (μg/L)	N/A	5 U	(dry)	410	16	N/A	5 U	12 U	2 J	8.2	5 U	N/A	5 U	5 U	5 U
Ethane (μg/L)	N/A	5 UJ	(dry)	N/A	N/A	N/A	N/A	5 U	5 U	N/A	N/A	N/A	N/A	5 U	5 U
Ethylene (μg/L)	N/A	5 UJ	(dry)	N/A	N/A	N/A	N/A	5 U	5 U	N/A	N/A	N/A	N/A	5 U	5 U
Methane (μg/L)	N/A	5 UJ	(dry)	N/A	N/A	N/A	N/A	5 U	5 U	N/A	N/A	N/A	N/A	5 U	78
Trichloroethene (μg/L)	18	5 U	(dry)	388	1200	430	120	360	290 J	5	10	3 J	3 J	1 J	4 J
Vinyl chloride (μg/L)	10 U	10 U	(dry)	25	7 J	33 U	10 U	25 U	10 U	10	10 U	10 U	10 U	10 U	10 U
Dissolved oxygen (mg/L)	10.5	N/A	(dry)	N/A	N/A	N/A	3.5	N/A	2.79	N/A	N/A	N/A	3	N/A	0.51
Redox (mV)	242	N/A	(dry)	N/A	N/A	N/A	241	N/A	202	N/A	N/A	N/A	69	N/A	98
pH (std. Unit)	6.8	N/A	(dry)	N/A	N/A	N/A	6.7	N/A	6.51	N/A	N/A	N/A	7.3	N/A	6.7
Temperature (°C)	7.3	N/A	(dry)	N/A	N/A	N/A	10.6	N/A	22.9	N/A	N/A	N/A	14	N/A	21.3

Table 7.8. Summary of performance data from ORAU South Campus Facility (continued)

Parameter (units)	GW-843[a] 08/18/ 1993	11/16/ 1994	01/31/ 1995	02/05/ 1997	02/03/ 1999	09/08/ 1999	GW-844[a] 08/26/ 1993	01/31/ 1995	02/05/ 1997	02/03/ 1999	08/23/ 1999
Alkalinity (mg/L)	N/A	N/A	N/A	N/A	250	259	N/A	N/A	N/A	(dry)	(dry)
Chloride (mg/L)	N/A	N/A	N/A	N/A	11.6	13.3	N/A	N/A	N/A	(dry)	(dry)
Fluoride (mg/L)	N/A	N/A	N/A	N/A	0.2	0.23	N/A	N/A	N/A	(dry)	(dry)
Nitrate/Nitrite as Nitrogen (mg/L)	N/A	N/A	N/A	N/A	N/A	0.02 U	N/A	N/A	N/A	(dry)	(dry)
Sulfate (mg/L)	N/A	N/A	N/A	N/A	27.9	28.4	N/A	N/A	N/A	(dry)	(dry)
Sulfide (mg/L)	N/A	N/A	N/A	N/A	1 U	1 U	N/A	N/A	N/A	(dry)	(dry)
Iron (mg/L)	0.423	N/A	N/A	N/A	0.556 J	N/A	47	N/A	N/A	(dry)	(dry)
Manganese (mg/L)	0.0125	N/A	N/A	N/A	0.0111	N/A	0.444	N/A	N/A	(dry)	(dry)
Total Organic Carbon (mg/L)	N/A	N/A	N/A	N/A	0.78	0.5 U	N/A	N/A	N/A	(dry)	(dry)
Benzene (μg/L)	10	10 U	10 UJ	5 U	5 U	5 U	12	15 J	6	(dry)	(dry)
cis-1,2-Dichloroethene (μg/L)	N/A	10 U	N/A	5 U	5 U	5 U	N/A	N/A	5 U	(dry)	(dry)
trans-1,2-Dichloroethene (μg/L)	8.2	5 U	N/A	5 U	5 U	5 U	41	N/A	5 U	(dry)	(dry)
Ethane (μg/L)	N/A	N/A	N/A	N/A	5 U	5 U	N/A	N/A	N/A	(dry)	(dry)
Ethylene (μg/L)	N/A	N/A	N/A	N/A	5 U	5 U	N/A	N/A	N/A	(dry)	(dry)
Methane (μg/L)	N/A	N/A	N/A	N/A	5 U	5 U	N/A	N/A	N/A	(dry)	(dry)
Trichloroethene (μg/L)	2	5 U	5 U	5 U	5 U	5 U	10	7 U	5 U	(dry)	(dry)
Vinyl chloride (μg/L)	10	10 U	10 U	10 U	10 U	10 U	10	14 U	10 U	(dry)	(dry)
Dissolved oxygen (mg/L)	N/A	N/A	N/A	1.7	N/A	0.54	N/A	N/A	1.48	(dry)	(dry)
Redox (mV)	N/A	N/A	N/A	94	N/A	-36	N/A	N/A	-260	(dry)	(dry)
pH (std. Unit)	N/A	N/A	N/A	7.8	N/A	7.17	N/A	N/A	11.1	(dry)	(dry)
Temperature (°C)	N/A	N/A	N/A	14.6	N/A	20.6	N/A	N/A	12.9	(dry)	(dry)

[a] These wells are renamed on inclusion into the Y-12 Plant Groundwater Well database and differ from the well names used in the RAR. MW-19 was renamed GW-841, MW-43a was renamed GW-842, MW-43b was renamed GW-843, and MW-43c was renamed GW-844

J = indicates that the value of the constituent was an estimated value

N/A = no analysis

ORAU = Oak Ridge Associated Universities

SCF = South Campus Facility

U = indicates that the constituent was not detected at associated level

dissolved oxygen in the upgradient well, GW-841, although low (2.79 mg/L) is sufficiently high that vinyl chloride could undergo oxidative dechlorination. Similarly, high redox conditions (202 mV) and relatively high sulfate concentrations in samples collected from this well in 1999 (36.3 mg/L and 30.6 mg/L) support the argument that the system is sufficiently aerobic for oxidative dechlorination of vinyl chloride. In contrast, physical and chemical parameters indicate anaerobic conditions that would lead to reductive dechlorination in the downgradient wells (Table 7.8). For example, the dissolved oxygen concentration in the shallowest of the downgradient wells (GW-842) is only 0.51 mg/L and only 0.54 mg/L in the next deepest downgradient well (GW-843). Redox conditions are relatively low in GW-842 (98 mV) and even lower in GW-843 (-36 mV). Sulfate concentrations in these two wells are at near borderline values (~20 mg/L) for reductive chlorination (Table 7.8). Finally, detectable methane in GW-842 (78 μg/L) is strong evidence for conditions conducive to reductive dechlorination.

In conclusion, historical and post-ROD sampling of the wells in the zone of contamination at the SCF provide good baseline compositions against which to compare future data. In addition, preliminary interpretations of the existing data indicate a strong likelihood that TCE and its daughter products are degrading in the subsurface. However, these interpretations are tentative and await a history of sampling results for confirmation

7.2.4.2 Land use

Land use controls were not a component of the no-action remedy for the SCF, however, the area is regularly patrolled, and buildings are physically secured when unoccupied.

Since 1995, a number of obsolete structures have been removed from the SCF area. These changes in physical site conditions include removal of a maintenance/storage shed, a pasture shelter, an isolation barn originally used for surgical recovery, and a small pump house. Riprap was recently added to a drainage ditch in the southern portion of the site to control erosion. A potential change in land use adjacent to the site involves an approximate 20-acre parcel of land immediately east of the SCF The city of Oak Ridge is considering purchase of this parcel for subsequent resale to parties interested in developing the property This constitutes a potential change in land use adjacent to the SCF, but would not appear to impact the remedial decision made for this site.

7.2.5 Recommendations

Since groundwater is not used at the SCF, there continues to be no risk issue to address There is some question on whether complete biodegradation of TCE to chloroethane (the non-toxic final daughter in the TCE degradation chain) is occurring Because of this uncertainty, it is recommended that sampling be conducted annually instead of biannually to better quantify degradation potential at this site

7.3 CLINCH RIVER/POPLAR CREEK REMEDIAL ACTION

- ROD: September 1997
- Field Activities: None
- RAR: February 1999

7.3.1 Project Description

The CR/PC OU includes the sediments and biota in the Watts Bar and Melton Hill Reservoirs from Clinch River Mile (CRM) 0.0 near Kingston, at the confluence of the Clinch and Tennessee rivers, upstream to CRM 43.7, 20.6 river miles upstream of Melton Hill Dam (CRM 23.1) (Fig. 7.5). The OU also includes the Poplar Creek embayment from the mouth of Poplar Creek on the Clinch River at CRM 12.0 upstream to its confluence with East Fork Poplar Creek at Poplar Creek Mile (PCM) 5.5. The Poplar Creek portions of the OU are located within the boundaries of the ORR.

The CR/PC RI identified two primary risks to human health: (1) exposure to mercury, chromium, arsenic, and ^{137}Cs in the deep sediment of the main river channel and (2) exposure to PCBs, chlordane, arsenic, and mercury in fish tissue The ROD indicated that ecological risk in CR/PC was ". not serious enough to warrant an action that would be harmful to the environment in the short-term," therefore, the selected remedy does not address ecological risk. (DOE 1997j). The ROD further indicates that CR/PC surface water will be addressed in a separate ROD following remediation of upstream contaminant sources

The selected remedy for CR/PC uses existing institutional controls to control potential sediment-disturbing activities, fish consumption advisories to reduce exposure to contaminants in fish tissue, annual monitoring to detect changes in CR/PC contaminant levels or mobility, and a survey to confirm effectiveness of fish consumption advisories.

7.3.2 Evaluation of Decision Document Requirements for Performance and Stewardship

7.3.2.1 Goals of decision

The goals of the response action are to protect human health and the environment by (1) limiting exposure to mercury, chromium, arsenic, and ^{137}Cs in the deep sediment of the main river channel and (2) limiting exposure to PCBs, chlordane, arsenic, and mercury in fish tissue

7.3.2.2 Monitoring and stewardship required

Post-ROD monitoring activities described in the ROD include the following

- continuation of monitoring of sediment and fish to determine whether there is a change in the currently calculated risk that would pose a threat to human health or the environment and

- monitoring of turtles to build data on PCB levels in turtle flesh.

The ROD also requires the following·

- continuation of existing institutional controls to control potential sediment-disturbing activities,
- continuation of fish consumption advisories to reduce exposure to contaminants in fish tissue, and
- a survey to confirm effectiveness of fish consumption advisories.

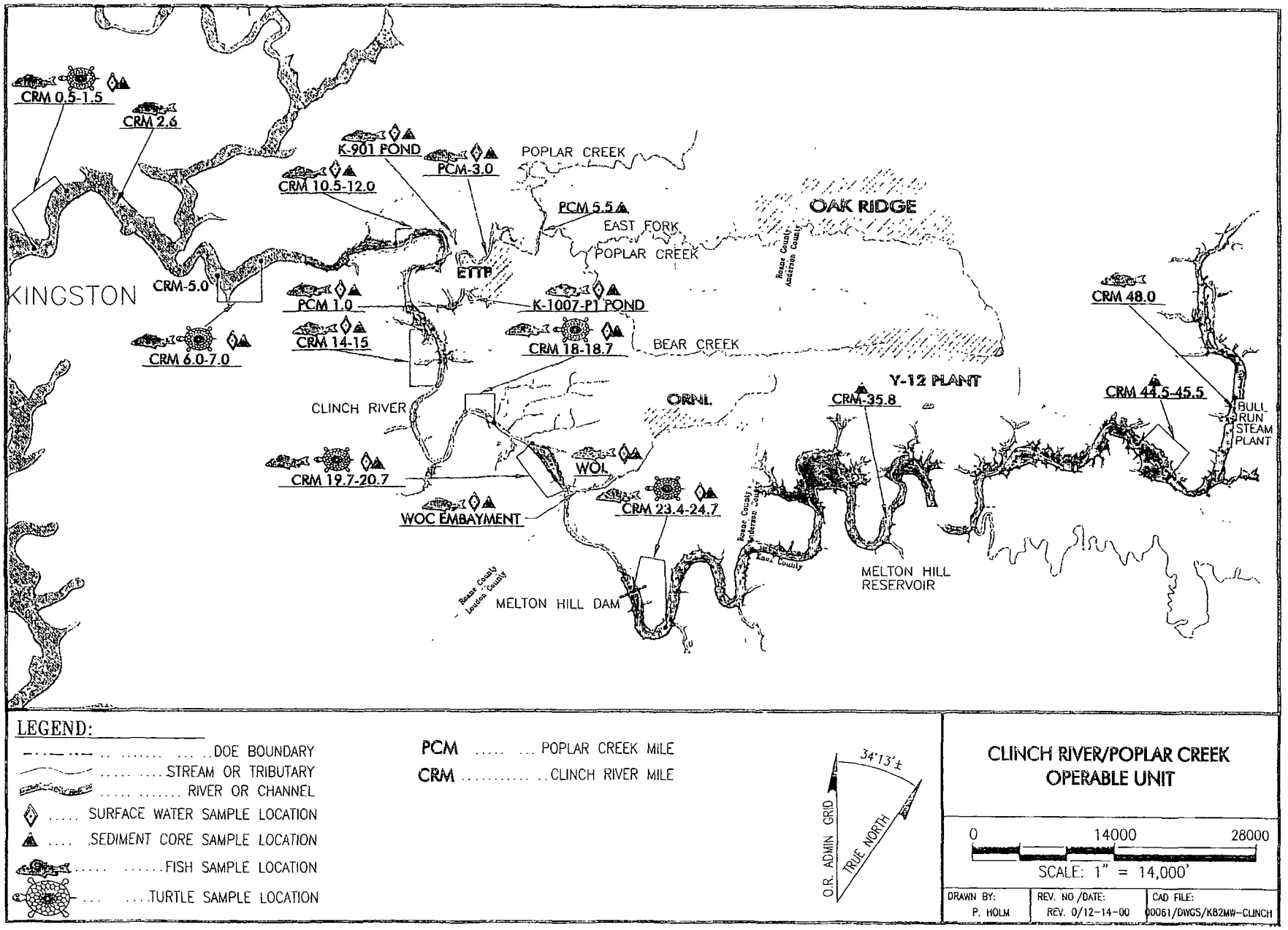


Fig. 7.5. Monitoring locations in the Clinch River/Poplar Creek Operable Unit.

7.3.3 Implementation of Previous Year's Recommendations

The 2000 RER recommended that the *Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River Poplar Creek Operable Units at the Oak Ridge Reservation* be implemented in FY 2000 The combined monitoring plan was implemented as recommended

The premise of the combined monitoring plan is that an integrated monitoring program, addressing the two OUs as a single hydrologic system, will be more technically sound and economically feasible than two separate programs As presented in the combined monitoring plan, the goals of the combined program are as follows

1 Meet the monitoring requirements of the LWBR and CR/PC RODs

2 Supply information that directly addresses the contaminant- and risk-related issues identified in the RI/FSs

3 Provide answers to questions that will continue to be raised by stakeholders

4 Integrate with ongoing WRRP monitoring on the ORR that has been designed to track the effectiveness of the DOE remediation efforts

5 Integrate, to the extent possible, with monitoring programs conducted by other agencies (e g , TWRA, TVA) to take full advantage of existing data and knowledge of the Clinch River-Watts Bar Reservoir system

6 Remain cost-effective in CERCLA monitoring

A detailed description of the monitoring program that brings together the new monitoring requirements and those parts of the previous requirements that were retained is presented in Chap 2 of the combined monitoring plan

7.3.4 Evaluation of Performance and Stewardship Data—Clinch River/Poplar Creek

Table 7 9 provides a summary of the Five-Year Review activities for the CR/PC OU Details on these activities are provided in the following sections

7.3.4.1 Watts Bar Interagency Working Group activities

The WBIWG was established by the Watts Bar Reservoir Permit Coordination Interagency Agreement in 1991 The purpose of the agreement was to establish a procedure for the interagency coordination and review of permitting and other use authorization activities by the USACE, Nashville District, and TVA which could result in the disturbance, resuspension, removal, and/or disposal of contaminated sediments or potentially contaminated sediments in the Watts Bar Reservoir This agreement identifies the cooperative efforts of the DOE, EPA, USACE, Nashville District, TVA, and TDEC

Table 7.9. Clinch River/Poplar Creek Five-Year Review summary

	Question	Response	Notes
A.	**Is the remedy functioning as intended by the decision documents?**		
	Are performance standards being met (or likely to be met?)	Yes	See Sect 7 3 4 for discussion of monitoring results and results of surveys
	Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Advisories remain in place, and applications for dredging or other sediment disturbing activities are reviewed by the WBIWG
	Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	See Sect 7 3 4.2 for discussion of advisories
	Are additional actions, such as removals, that were deemed necessary to ensure that immediate threats were addressed completed?	NA	No additional actions deemed necessary
	Are operating procedures, as implemented, maintaining the effectiveness of response actions?	Yes	Fish consumption advisory procedures are maintained by TDEC
B.	**Are the assumptions used at the time of remedy selection valid?**		
	Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	No	No changes in requirements regarding residual radioactive materials left in place or dose received by the public from all sources of radiation exposure
	Have there been any changes in land use or expected land use on or near the site?	No	Land use categories along shorelines of CR/PC will continue to be agricultural, recreational, residential, and industrial purposes
	Have new human health or ecological exposure pathways or receptors been identified?	Yes	Possible exposure associated with turtle ingestion
	Have new contaminants or contaminant sources been identified?	No	Sample results screened against PRGs (Sect 7 3 4)
	Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	No action was taken
	Have there been any changes in the physical site conditions?	No	No major changes have occurred that impact the hydrology of the CR/PC system
	Have there been any changes in the toxicity factors for contaminants of concern?	Yes	See Sect 7 3 5 for discussion of changes in toxicity factors
	Were there significant changes in the standardized risk assessment methodologies?	No	
C.	**Has any other information come to light that could call into question the protectiveness of the remedy?**		
	Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	NA	Response action does not address ecological risk (ROD, pg 2-7)
	Is the site located in an area subject to natural disasters?	Yes	Flood, low probability of earthquakes or tornadoes

ARAR = applicable or relevant and appropriate requirement
CR = Clinch River
NA = not applicable
PC = Poplar Creek
PRG = preliminary remediation goal
ROD = record of decision
TBC = to be considered
TDEC = Tennessee Department of Environment and Conservation
WBIWG = Watts Bar Interagency Working Group

DOE has recently performed data searches and data collection to support several WBIWG-related activities Tennessee Department of Transportation widening of the Highway 58 bridge across the Clinch River was supported by historical data search and sediment collection and analysis. Sediment samples were collected at the site of a proposed marina at the confluence of the Clinch and Tennessee Rivers Risk assessment and radiological surveying support was provided to the U S Coast Guard to evaluate risk to the crew of the USS Quachita. Current support is being provided to determine whether dredging for navigation at a development on Watts Bar Reservoir will result in excessive risk

7.3.4.2 Fish consumption advisories

One potential threat to human health posed by the CR/PC OU is consumption of certain species of fish. The selected remedy continues fish consumption advisories to reduce exposure to contaminants in fish tissue The TDEC Division of Water Pollution Control currently posts two types of fish consumption advisories at approximately 20 public and private access points surrounding the CR/PC OU A precautionary advisory warns children, pregnant women, and nursing mothers to avoid eating sauger and catfish from the Clinch River arm of the Watts Bar Reservoir All others are warned to limit consumption of those species to 1.2 lbs per month A no-consumption advisory warns the public to avoid eating catfish from Melton Hill, striped bass from the Clinch River arm, or any species from Poplar Creek. A list of advisories is printed in *Tennessee Fishing Regulations* published by the TWRA

In an effort to confirm effectiveness of the fish consumption advisories, a survey of local fishermen was conducted at various fishing locations around the CR/PC OU and the LWBR OU in July and August 2000 The survey form included general questions regarding fish consumption practices and awareness of fish consumption advisories Nearly 80% of survey respondents indicated that their awareness of fish consumption advisories was gained from the signs and postings at public fishing locations Others gained awareness of the advisories through notices in local newspapers or pamphlets Fifty-three percent of the respondents reported that they released all species of fish caught in the reservoir About 25% of the respondents indicated occasional consumption (up to 2 times per month) of catfish or striped bass No information regarding the amount of fish consumed by survey participants is available

7.3.4.3 Surface water monitoring

The 1999 RER reported that data for surface water samples collected at six locations during the summer of 1998 showed that none of the detected analytes exceeded their relevant drinking water standards

Results from samples collected in 1999 show that aluminum exceeded federal water quality screening values for hazardous waste sites at five of six sampled locations Mercury exceeded its federal water quality screening value at one location These data are reported in the 2000 RER.

During FY 2000, surface water samples were collected at the 13 CR/PC OU monitoring locations designated in the *Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River/Poplar Creek Operable Units at Oak Ridge Reservation* Unfiltered water samples were submitted for analysis of metals and uranium Detected analytes were screened against TDEC General Water Quality Criteria and EPA Region IV Water Management Division Freshwater Water Quality Screening Values for Hazardous Waste Sites (Chronic) Analytical results for each monitoring location are presented in Table 7 10 for comparison with water quality screening values Aluminum was found above the EPA Region IV water quality screening value at 9 of the 13 monitoring locations, including the most upstream surface water location, Melton Hill forebay Most other exceedances (11 of a total of 18) of water quality screening

Table 7.10. FY 2000 Clinch River/Poplar Creek surface water screening

Station	Chemical	Result	Units	(a) TWQC criterion*	(b) EPA criterion**	Result exceeded criteria?	Criterion Exceeded
CRM0.5-1.5	Aluminum	0.224	mg/L		0.087	Y	b
	Arsenic	0.00076	mg/L	0.0014 (r)	0.19	N	
	Barium	0.0296	mg/L			NA	
	Beryllium	0.00006	mg/L		0.00053	N	
	Boron	0.0145	mg/L		0.75	N	
	Calcium	14	mg/L			NA	
	Chromium	0 00045	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00051	mg/L			NA	
	Copper	0.0022	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.32	mg/L		1	N	
	Lithium	0.0026	mg/L			NA	
	Magnesium	3.8	mg/L			NA	
	Manganese	0.0568	mg/L			NA	
	Nickel	0.0019	mg/L	0.1(d)	0.08771	N	
	Potassium	1.21	mg/L			NA	
	Sodium	2.35	mg/L			NA	
	Strontium	0.0412	mg/L			NA	
	Vanadium	0.00088	mg/L			NA	
	Zinc	0.0042	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	1.37	pCi/L			NA	
	Uranium-236	1 52	pCi/L			NA	
CRM10.5-12	Aluminum	0.152	mg/L		0.087	Y	b
	Antimony	0.0005	mg/L		0.16	N	
	Arsenic	0.00086	mg/L	0.0014 (r)	0.19	N	
	Barium	0.0296	mg/L			NA	
	Beryllium	0.00004	mg/L		0.00053	N	
	Boron	0.0165	mg/L		0.75	N	
	Calcium	33.2	mg/L			NA	
	Chromium	0.00044	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00032	mg/L			NA	
	Copper	0.0017	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.229	mg/L		1	N	
	Lithium	0.0025	mg/L			NA	
	Magnesium	9 05	mg/L			NA	
	Manganese	0.0382	mg/L			NA	
	Nickel	0.00081	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.66	mg/L			NA	
	Sodium	5.09	mg/L			NA	
	Strontium	0 0798	mg/L			NA	
	Vanadium	0.00089	mg/L			NA	
	Zinc	0.0039	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	2.65	pCi/L			NA	
	Uranium-238	2.68	pCi/L			NA	
CRM14-15	Aluminum	0.166	mg/L		0.087	Y	b
	Antimony	0.00061	mg/L		0.16	N	
	Arsenic	0.00097	mg/L	0.0014 (r)	0.19	N	
	Barium	0.0305	mg/L			NA	
	Beryllium	0.00003	mg/L		0.00053	N	
	Boron	0.0172	mg/L		0 75	N	
	Calcium	34.8	mg/L			NA	

Table 7.10. FY 2000 Clinch River/Poplar Creek surface water screening (continued)

Station	Chemical	Result	Units	(a) TWQC criterion*	(b) EPA criterion**	Result exceeded criteria?	Criterion exceeded
CRM14-15	Chromium	0.00041	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00035	mg/L			NA	
	Copper	0.0012	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.191	mg/L		1	N	
	Lithium	0.0026	mg/L			NA	
	Magnesium	9.43	mg/L			NA	
	Manganese	0.0363	mg/L			NA	
	Nickel	0.00078	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.72	mg/L			NA	
	Sodium	5.23	mg/L			NA	
	Strontium	0.0837	mg/L			NA	
	Vanadium	0.00099	mg/L			NA	
	Zinc	0.0021	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	1.8	pCi/L			NA	
	Uranium-238	1	pCi/L			NA	
CRM18-18.7	Aluminum	0.0542	mg/L		0.087	N	
	Antimony	0.00065	mg/L		0.16	N	
	Barium	0.0295	mg/L			NA	
	Boron	0.0174	mg/L		0.75	N	
	Calcium	31.7	mg/L			NA	
	Chromium	0.00025	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00018	mg/L			NA	
	Copper	0.0013	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.077	mg/L		1	N	
	Lithium	0.0021	mg/L			NA	
	Magnesium	8.41	mg/L			NA	
	Manganese	0.0331	mg/L			NA	
	Nickel	0.00039	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.82	mg/L			NA	
	Sodium	4.25	mg/L			NA	
	Strontium	0.0722	mg/L			NA	
	Vanadium	0.00062	mg/L			NA	
	Zinc	0.0016	mg/L	0.117 (f)	0.05891	N	
	Uranium-238	1.08	pCi/L			NA	
CRM19.7-20	Aluminum	0.0756	mg/L		0.087	N	
	Barium	0.0302	mg/L			NA	
	Boron	0.0178	mg/L		0.75	N	
	Calcium	32.6	mg/L			NA	
	Chromium	0.00038	mg/L	0.016 (f)	0.11732	N	
	Copper	0.0013	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.117	mg/L		1	N	
	Lithium	0.0022	mg/L			NA	
	Magnesium	8.68	mg/L			NA	
	Manganese	0.031	mg/L			NA	
	Nickel	0.00061	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.87	mg/L			NA	
	Sodium	4.36	mg/L			NA	
	Strontium	0.0742	mg/L			NA	
	Vanadium	0.00076	mg/L			NA	
	Zinc	0.002	mg/L	0.117 (f)	0.05891	N	

Table 7.10. FY 2000 Clinch River/Poplar Creek surface water screening (continued)

Station	Chemical	Result	Units	(a) TWQC criterion*	(b) EPA criterion**	Result exceeded criteria?	Criterion exceeded
CRM19.7-20	Uranium-236	0	pCi/L			NA	
CRM23.4-24.7	Aluminum	0.172	mg/L		0.087	Y	b
	Arsenic	0.00085	mg/L	0.0014 (r)	0.19	N	
	Barium	0.0315	mg/L			NA	
	Beryllium	0.00005	mg/L		0.00053	N	
	Boron	0.0187	mg/L		0.75	N	
	Calcium	37.1	mg/L			NA	
	Chromium	0.00053	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00024	mg/L			NA	
	Copper	0.0014	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.19	mg/L		1	N	
	Lead	0.00069	mg/L	0.005 (r)	0.00132	N	
	Lithium	0.0027	mg/L			NA	
	Magnesium	10	mg/L			NA	
	Manganese	0.0359	mg/L			NA	
	Nickel	0.00079	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.94	mg/L			NA	
	Sodium	5.81	mg/L			NA	
	Strontium	0.0926	mg/L			NA	
	Uranium-233/234	4.21	pCi/L			NA	
	Vanadium	0.00098	mg/L			NA	
	Zinc	0.002	mg/L	0.117 (f)	0.05891	N	
CRM6-7	Aluminum	0.0687	mg/L		0.087	N	
	Arsenic	0.0011	mg/L	0.0014 (r)	0.19	N	
	Barium	0.0291	mg/L			NA	
	Boron	0.0186	mg/L		0.75	N	
	Calcium	27.2	mg/L			NA	
	Copper	0.0022	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.0965	mg/L		1	N	
	Lithium	0.0031	mg/L			NA	
	Magnesium	7.2	mg/L			NA	
	Manganese	0.0447	mg/L			NA	
	Nickel	0.00068	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.72	mg/L			NA	
	Sodium	3.98	mg/L			NA	
	Strontium	0.0663	mg/L			NA	
	Vanadium	0.001	mg/L			NA	
	Zinc	0.0019	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	1.12	pCi/L			NA	
K-1007-P1	Aluminum	0.858	mg/L		0.087	Y	b
	Antimony	0.00057	mg/L		0.16	N	
	Arsenic	0.0015	mg/L	0.0014 (r)	0.19	Y	a
	Barium	0.0228	mg/L			NA	
	Beryllium	0.00006	mg/L		0.00053	N	
	Boron	0.0137	mg/L		0 75	N	
	Calcium	18.7	mg/L			NA	
	Chromium	0.0037	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00043	mg/L			NA	
	Copper	0.0021	mg/L	0.0177 (f)	0.00654	N	
	Iron	1.01	mg/L		1	Y	b
	Lead	0.0014	mg/L	0.005 (d)	0.00132	Y	b

Table 7.10. FY 2000 Clinch River/Poplar Creek surface water screening (continued)

Station	Chemical	Result	Units	(a) TWQC criterion*	(b) EPA criterion**	Result exceeded criteria?	Criterion exceeded
K-1007-P1	Lithium	0.002	mg/L			NA	
	Magnesium	4.63	mg/L			NA	
	Manganese	0.0503	mg/L			NA	
	Nickel	0.0032	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.78	mg/L			NA	
	Sodium	1.35	mg/L			NA	
	Strontium	0.0328	mg/L			NA	
	Vanadium	0.0018	mg/L			NA	
	Zinc	0.0092	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	1.02	pCi/L			NA	
K-901 POND	Aluminum	0.399	mg/L		0.087	Y	b
	Antimony	0.0008	mg/L		0.16	N	
	Arsenic	0.0011	mg/L	0.0014 (r)	0.19	N	
	Barium	0.0299	mg/L			NA	
	Beryllium	0.00004	mg/L		0.00053	N	
	Boron	0.0129	mg/L		0.75	N	
	Calcium	33.3	mg/L			NA	
	Chromium	0.0108	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00025	mg/L			NA	
	Copper	0.0014	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.562	mg/L		1	N	
	Lead	0.00091	mg/L	0.005 (r)	0.00132	N	
	Lithium	0.001	mg/L			NA	
	Magnesium	7.57	mg/L			NA	
	Manganese	0.0395	mg/L			NA	
	Nickel	0.00079	mg/L	0.1 (d)	0.08771	N	
	Potassium	1.26	mg/L			NA	
	Sodium	0.884	mg/L			NA	
	Strontium	0.0521	mg/L			NA	
	Vanadium	0.001	mg/L			NA	
	Zinc	0.013	mg/L	0.117 (f)	0.05891	N	
	Uranium-233/234	3.71	pCi/L			NA	
	Uranium-236	1.1	pCi/L			NA	
PCM 1	Aluminum	0.265	mg/L		0.087	Y	b
	Arsenic	0.00098	mg/L	0.0014 (r)	0.19	N	
	Barium	0.0423	mg/L			NA	
	Boron	0.029	mg/L		0.75	N	
	Calcium	35.4	mg/L			NA	
	Chromium	0.00051	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00047	mg/L			NA	
	Copper	0.0015	mg/L	0.0177 (f)	0.00654	N	
	Iron	0.451	mg/L		1	N	
	Lithium	0.0045	mg/L			NA	
	Magnesium	9.19	mg/L			NA	
	Manganese	0.1	mg/L			NA	
	Mercury	0.00008	mg/L	0.00014 (r)	0.000012	Y	b
	Nickel	0.0016	mg/L	0.1 (d)	0.08771	N	
	Potassium	2.17	mg/L			NA	
	Sodium	6.07	mg/L			NA	
	Strontium	0.0765	mg/L			NA	
	Vanadium	0.001	mg/L			NA	

Table 7.10. FY 2000 Clinch River/Poplar Creek surface water screening (continued)

Station	Chemical	Result	Units	(a) TWQC criterion*	(b) EPA criterion**	Result exceeded criteria?	Criterion exceeded
PCM 1	Zinc	0 0052	mg/L	0 117 (f)	0 05891	N	
	Uranium-233/234	1 21	pCi/L			NA	
	Uranium-238	1 46	pCi/L			NA	
PCM 3	Aluminum	0 0762	mg/L		0 087	N	
	Barium	0 0522	mg/L			NA	
	Boron	0 023	mg/L		0 75	N	
	Calcium	34 8	mg/L			NA	
	Chromium	0 00029	mg/L	0 016 (f)	0 11732	N	
	Copper	0 0009	mg/L	0 0177 (f)	0 00654	N	
	Iron	0 195	mg/L		1	N	
	Lithium	0 003	mg/L			NA	
	Magnesium	10 8	mg/L			NA	
	Manganese	0 0687	mg/L			NA	
	Mercury	0 00019	mg/L	0 00014 (r)	0 000012	Y	a, b
	Nickel	0 00098	mg/L	0 1 (d)	0 08771	N	
	Potassium	2 06	mg/L			NA	
	Sodium	5 15	mg/L			NA	
	Strontium	0 0743	mg/L			NA	
	Vanadium	0 00051	mg/L			NA	
	Zinc	0 0032	mg/L	0 117 (f)	0 05891	N	
	Uranium-233/234	1 66	pCi/L			NA	
	Uranium-238	1 2	pCi/L			NA	
WOL	Aluminum	0 173	mg/L		0 087	Y	b
	Antimony	0 0011	mg/L		0 16	N	
	Arsenic	0 0045	mg/L	0 0014 (r)	0 19	Y	a
	Barium	0 0318	mg/L			NA	
	Beryllium	0 00007	mg/L		0 00053	N	
	Boron	0 0263	mg/L		0 75	N	
	Calcium	53 9	mg/L			NA	
	Chromium	0 0032	mg/L	0 016 (f)	0 11732	N	
	Cobalt	0 00031	mg/L			NA	
	Copper	0 0024	mg/L	0 0177 (f)	0 00654	N	
	Iron	0 381	mg/L		1	N	
	Lead	0 0015	mg/L	0 005 (r)	0 00132	Y	b
	Lithium	0 0039	mg/L			NA	
	Magnesium	9 57	mg/L			NA	
	Manganese	0 123	mg/L			NA	
	Mercury	0 0001	mg/L	0 00014 (r)	0 000012	Y	b
	Nickel	0 0011	mg/L	0 1 (d)	0 08771	N	
	Potassium	2 4	mg/L			NA	
	Sodium	10 7	mg/L			NA	
	Strontium	0 103	mg/L			NA	
	Vanadium	0 0016	mg/L			NA	
	Zinc	0 01	mg/L	0 117 (f)	0 05891	N	
	Uranium-233/234	7 51	pCi/L			NA	
	Uranium-238	2 89	pCi/L			NA	
WOCE	Aluminum	0 159	mg/L		0 087	Y	b
	Arsenic	0 00087	mg/L	0 0014 (r)	0 19	N	
	Barium	0 0341	mg/L			NA	
	Boron	0 023	mg/L		0 75	N	
	Calcium	47	mg/L			NA	

Table 7.10. FY 2000 Clinch River/Poplar Creek surface water screening (continued)

Station	Chemical	Result	Units	(a) TWQC criterion*	(b) EPA criterion**	Result exceeded criteria?	Criterion exceeded
WOCE	Chromium	0 0014	mg/L	0.016 (f)	0.11732	N	
	Cobalt	0.00021	mg/L			NA	
	Copper	0.0015	mg/L	0 0177 (f)	0 00654	N	
	Iron	0.256	mg/L		1	N	
	Lead	0 00058	mg/L	0.005 (r)	0 00132	N	
	Lithium	0 0029	mg/L			NA	
	Magnesium	8.21	mg/L			NA	
	Manganese	0 0942	mg/L			NA	
	Mercury	0.00008	mg/L	0.00014 (r)	0 000012	Y	b
	Nickel	0 00085	mg/L	0.1 (d)	0 08771	N	
	Potassium	2 14	mg/L			NA	
	Sodium	9 52	mg/L			NA	
	Strontium	0 0908	mg/L			NA	
	Vanadium	0.0011	mg/L			NA	
	Zinc	0 0049	mg/L	0 117 (f)	0 05891	N	
	Uranium-233/234	9 56	pCi/L			NA	
	Uranium-238	2 82	pCi/L			NA	

*TDEC General Water Quality Criteria (d) domestic water supply, (f) fish and aquatic life, (r) recreation
**EPA Region IV Water Management Division Freshwater Water Quality Screening values for Hazardous Waste Sites
CRM = Clinch River mile
EPA = U S Environmental Protection Agency
FY = fiscal year
NA = not applicable
PCM = Poplar Creek mile
TDEC = Tennessee Department of Environment and Conservation
WOCE = White Oak Creek Embayment
WOL = White Oak Lake

values, including criteria for arsenic, iron, lead, and mercury, occurred in surface water bodies associated directly with ETTP (i.e., K-901 Pond and K-1007-P1 Pond) and ORNL (i.e., White Oak Lake and WOCE). Mercury also exceeded screening criteria at two monitoring locations along Poplar Creek, downstream of surface water discharges related to ETTP.

Because most of the contaminants of concern in the Watts Bar/Clinch River hydrologic system are particle-reactive materials (i e., PCBs/pesticides, metals, most radionuclides), the surface water component of the monitoring program included analysis of suspended particulate matter samples in FY 2000 Analysis of suspended particulate matter filtered from water may allow improved analyses and more informative results for important particle-reactive contaminants, primarily radionuclides and metals. Determining contaminant levels associated with suspended particulate matter may provide a means of obtaining a more direct and meaningful analysis of contaminants entering the foodweb.

Particulate samples were collected at the same locations where surface water samples were collected in LWBR. Each particulate sample was obtained by passing a volume of water across a filter and accumulating the suspended particulate matter on the filter. The particulate sample was forwarded to the analytical laboratory and the particulate matter was then analyzed for metals, pesticides, PCBs, and radiological constituents.

There were no pesticides or PCBs detected in the particulate samples from LWBR. A number of metals were detected, as expected Interpretation of the particulate sample results continues and recommendations regarding this type of sampling will be provided in the future.

7.3.4.4 Sediment monitoring

The first post-ROD sediment samples were collected throughout the CR/PC OU in 1999. Sediment samples were collected at 12 locations and analyzed for metals and ^{137}Cs. Metals were detected in 8 of the 12 samples. Cesium-137 was detected in 7 of the 12 samples. These data are reported in the 2000 RER.

The Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River/Poplar Creek Operable Units identified 16 monitoring locations for collection of sediment samples associated with the CR/PC OU. These monitoring locations included CRM 44.5–45.5 (Solway Bridge area), CRM 35.8 (McCoy Branch), and PCM 5.5 along Poplar Creek in addition to the 13 surface water monitoring locations identified in Sect. 7.3.4.3. During FY 2000, sediment samples could not be collected at two of the designated monitoring locations, CRM 18-18.7 and CRM 19.7-20.7.

The sediment samples were submitted for analysis of metals and radiological constituents. Detected analytes were screened against DOE-ORO residential PRGs (risk level of 1.0E-06 and an HI level of 0.1), recreational PRGs (risk level of 1.0E-06 and an HI level of 0.1), and EPA Region IV Water Management Division Sediment Screening Values for Hazardous Waste Sites. It should be noted that the PRGs listed here are typically used as a screening tool in the scoping phase of the RI/FS process or concurrently during RI/FS activities. They do not indicate specific cleanup goals for this remedial action. They are included in this comparison because the TDEC DOE Oversight Division compares sediment data collected under its annual independent environmental monitoring program to DOE-ORO recreational PRGs. Residential PRGs are included in this screening to provide a comparison against a range of screening values derived from the same source.

Analytical results are presented in Table 7.11 for comparison with sediment screening values The CR/PC RI identified arsenic, chromium, mercury and ^{137}Cs as contaminants of concern in CR/PC sediments FY 2000 sampling results show that arsenic in sediment exceeded the residential PRG and slightly exceeded the EPA screening value at the background monitoring location for CR/PC sediments, CRM 44.5-45 (vicinity of Solway Bridge) At that location, arsenic was measured at a concentration of 8.3 mg/kg, exceeding the residential PRG of 0.43 mg/kg (although well below the recreational PRG of 31 mg/kg) and the EPA screening value of 7.24 mg/kg. Arsenic results from other CR/PC monitoring locations ranged from 2.6 mg/kg (White Oak Lake) to 22 mg/kg (K-901 Pond). Arsenic exceeded the background concentration at less than one-half of the sampled locations. Chromium was present in sediment at a concentration of 13.1 mg/kg at the background monitoring location. Chromium results from all but one downstream sampling location (CRM 6-7) exceeded the background value. At CRM 6-7, chromium was measured at 11.1 mg/kg Results from other locations ranged from 14.2 mg/kg (CRM 14-15) to 1660 mg/kg (K-901 Pond). The result from K-901 Pond is high with respect to the other results in this data set, the next highest chromium result is 58 4 mg/kg. While a few exceedances do occur, Table 7.11 indicates that FY 2000 chromium levels are below the residential PRG screening value, a conservative screening criterion Mercury was present in sediment collected at the background monitoring location at a concentration of 0.06 mg/kg but was not detected above its associated reporting level at four of the downstream monitoring locations (CRM 10.5-12, K-901 Pond, White Oak Lake, and WOCE). Mercury results range from 0.07 mg/kg at CRM 14-15 to 11.0 mg/kg at PCM 1. Mercury exceeded the EPA screening value of 0.13 mg/kg at five of the sampled locations and exceeded the residential PRG of 2.3 mg/kg at three locations. There were no exceedances of the recreational PRG (130 mg/kg). The maximum concentration of ^{137}Cs (81 72 pCi/g) was measured in the sediment sample collected from White Oak Lake. Cesium-137 was not detected at the background monitoring location or the next downstream monitoring location at CRM 35.8 (McCoy Branch) or in sediment collected from the WOCE. Cesium-137 was present above the residential PRG (0 021 pCi/L) at most of the downstream monitoring locations, and exceeded the recreational PRG of 2 3 pCi/L at four locations. As shown in Table 7.11, results obtained from downstream monitoring locations for most analytes exceeded either background concentrations or at least one of the state or federal screening criteria

Table 7.11. FY 2000 Clinch River/Poplar Creek sediment screening

Station	Chemical	Maximum detected result	Units	(a) Background (CRM44.5-45)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
CRM0 5-1 5	Aluminum	9180	mg/kg	66400				N	
	Arsenic	16	mg/kg	8 3	31	0 43	7 24	Y	a, c, d
	Barium	126	mg/kg	123	30000	550		Y	a
	Beryllium	1 1	mg/kg	0 8	0 35	0 063		Y	a, b, c
	Boron	2	mg/kg	2 3	300000	700		N	
	Cadmium	0 24	mg/kg	0 12	6 4	1 4	1	Y	a
	Calcium	3040	mg/kg	5230				N	
	Chromium	17 8	mg/kg	13 1	380	23	52 3	Y	a
	Cobalt	17 4	mg/kg	14 5				Y	a
	Copper	41 7	mg/kg	32 2			18 7	Y	a, d
	Iron	25100	mg/kg	20700				Y	a
	Lead	25 8	mg/kg	28 4			30 2	N	
	Lithium	11 2	mg/kg	8 5				Y	a
	Magnesium	1730	mg/kg	2450				N	
	Manganese	2120	mg/kg	4380	11000	360		Y	c
	Mercury	2 1	mg/kg	0 06	130	2 3	0 13	Y	a, d
	Nickel	25 2	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	1020	mg/kg	880				Y	a
	Selenium	1 6	mg/kg	1 2	11000	39		Y	a
	Sodium	85 4	mg/kg	101				N	
	Strontium	12 6	mg/kg	12 5	670000	4700		Y	a
	Vanadium	26 7	mg/kg	20 2	450	55		Y	a
	Zinc	101	mg/kg	81 2	330000	2300	124	Y	a
	Americium-241	5 27	pCi/g	15 21	250	2 2		Y	c
	Cesium-137	4 15	pCi/g	ND	2 3	0 021		Y	a, b, c
	Cobalt-57	1 87	pCi/g	6 24	24	0 21		Y	c
	Cobalt-60	3 04	pCi/g	10 74	0 5	0 0045		Y	b, c
	Potassium-40	14 68	pCi/g	14 1	8	0 071		Y	a, b, c
	Thorium-234	20 46	pCi/g	41 45	1100	9 9		Y	c
CRM10 5-12	Aluminum	12100	mg/kg	66400				N	
	Antimony	0 3	mg/kg	ND	26	3 1	12	N	a
	Arsenic	5 9	mg/kg	8 3	31	0 43	7 24	Y	c
	Barium	108	mg/kg	123	30000	550		N	
	Beryllium	0 82	mg/kg	0 8	0 35	0 063		Y	a, b, c
	Boron	6 4	mg/kg	2 3	300000	700		Y	a
	Cadmium	0 62	mg/kg	0 12	6 4	1 4	1	Y	a
	Calcium	2860	mg/kg	5230				N	
	Chromium	20 4	mg/kg	13 1	380	23	52 3	Y	a
	Cobalt	13 9	mg/kg	14 5				N	
	Copper	21 8	mg/kg	32 2			18 7	Y	d
	Iron	20500	mg/kg	20700				N	
	Lead	19	mg/kg	28 4			30 2	N	
	Lithium	17 8	mg/kg	8 5				Y	a
	Magnesium	2060	mg/kg	2450				N	
	Manganese	855	mg/kg	4380	11000	360		Y	c
	Nickel	24 7	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	1790	mg/kg	880				Y	a
	Silver	0 14	mg/kg	ND	5100	39	2	N	a
	Sodium	78 1	mg/kg	101				N	
	Strontium	14 5	mg/kg	12 5	670000	4700		Y	a
	Vanadium	20 2	mg/kg	20 2	450	55		N	
	Zinc	95 3	mg/kg	81 2	330000	2300	124	Y	a
	Cesium-137	0 54	pCi/g	ND	2 3	0 021		Y	c

Table 7.11. FY 2000 Clinch River/Poplar Creek sediment screening (continued)

Station	Chemical	Maximum detected result	Units	(a) Background (CRM44.5-45)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
CRM10.5-12	Potassium-40	12.59	pCi/g	14.1	8	0.071		Y	b, c
CRM14-15	Aluminum	7120	mg/kg	66400				N	
	Arsenic	6 4	mg/kg	8.3	31	0 43	7.24	Y	c
	Barium	111	mg/kg	123	30000	550		N	
	Beryllium	0.76	mg/kg	0.8	0.35	0 063		Y	b, c
	Boron	1.5	mg/kg	2.3	300000	700		N	
	Cadmium	0.05	mg/kg	0.12	6 4	1 4	1	N	
	Calcium	5120	mg/kg	5230				N	
	Chromium	14.2	mg/kg	13.1	380	23	52.3	Y	a
	Cobalt	13.3	mg/kg	14.5				N	
	Copper	13.3	mg/kg	32.2			18.7	N	
	Iron	19000	mg/kg	20700				N	
	Lead	25	mg/kg	28 4			30.2	N	
	Lithium	6 7	mg/kg	8.5				N	
	Magnesium	1930	mg/kg	2450				N	
	Manganese	2440	mg/kg	4380	11000	360		Y	c
	Mercury	0.07	mg/kg	0.06	130	2.3	0 13	Y	a
	Nickel	14	mg/kg	18.8	29000	160	15.9	N	
	Potassium	907	mg/kg	880				Y	a
	Selenium	0 84	mg/kg	1.2	11000	39		N	
	Sodium	50	mg/kg	101				N	
	Strontium	10.3	mg/kg	12.5	670000	4700		N	
	Vanadium	20.5	mg/kg	20.2	450	55		Y	a
	Zinc	54	mg/kg	81.2	330000	2300	124	N	
	Cesium-137	1.71	pCi/g	ND	2.3	0.021		Y	a, c
	Potassium-40	13.38	pCi/g	14.1	8	0.071		Y	b, c
CRM23 4-24.7	Aluminum	10100	mg/kg	66400				N	
	Arsenic	11.9	mg/kg	8 3	31	0 43	7.24	Y	a, c, d
	Barium	148	mg/kg	123	30000	550		Y	a
	Beryllium	1.1	mg/kg	0.8	0.35	0.063		Y	a, b, c
	Boron	3	mg/kg	2.3	300000	700		Y	a
	Calcium	7400	mg/kg	5230				Y	a
	Chromium	17.3	mg/kg	13.1	380	23	52.3	Y	a
	Cobalt	16 6	mg/kg	14 5				Y	a
	Copper	39 7	mg/kg	32.2			18 7	Y	a, d
	Iron	28400	mg/kg	20700				Y	a
	Lead	35 8	mg/kg	28 4			30.2	Y	a, d
	Lithium	12	mg/kg	8.5				Y	a
	Magnesium	2120	mg/kg	2450				N	
	Manganese	4120	mg/kg	4380	11000	360		Y	c
	Mercury	0.09	mg/kg	0.06	130	2.3	0 13	Y	a
	Nickel	23 6	mg/kg	18.8	29000	160	15 9	Y	a, d
	Potassium	1220	mg/kg	880				Y	a
	Selenium	2 1	mg/kg	1.2	11000	39		Y	a
CRM35 8	Aluminum	8380	mg/kg	66400				N	
	Arsenic	10.6	mg/kg	8.3	31	0 43	7.24	Y	a, c, d
	Barium	142	mg/kg	123	30000	550		Y	a
	Beryllium	0 91	mg/kg	0 8	0.35	0.063		Y	a, b, c
	Boron	1 8	mg/kg	2.3	300000	700		N	
	Cadmium	0 15	mg/kg	0 12	6 4	1.4	1	Y	a
	Calcium	8130	mg/kg	5230				Y	a
	Chromium	15.7	mg/kg	13.1	380	23	52.3	Y	a
	Cobalt	16 3	mg/kg	14.5				Y	a
	Copper	42 7	mg/kg	32.2			18 7	Y	a, d
	Iron	24800	mg/kg	20700				Y	a
	Lead	31.8	mg/kg	28.4			30 2	Y	a, d

Table 7.11. FY 2000 Clinch River/Poplar Creek sediment screening (continued)

Station	Chemical	Maximum detected result	Units	(a) Background (CRM44.5-45)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
CRM35.8	Lithium	10 3	mg/kg	8 5				Y	a
	Magnesium	2270	mg/kg	2450				N	
	Manganese	4510	mg/kg	4380	11000	360		Y	a, c
	Mercury	0 08	mg/kg	0 06	130	2 3	0 13	Y	a
	Nickel	21 5	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	1020	mg/kg	880				Y	a
	Selenium	1 8	mg/kg	1 2	11000	39		Y	a
	Sodium	86 1	mg/kg	101				N	
	Strontium	13 5	mg/kg	12 5	670000	4700		Y	a
	Vanadium	25 1	mg/kg	20 2	450	55		Y	a
	Zinc	89 2	mg/kg	81 2	330000	2300	124	Y	a
	Americium-241	4 95	pCi/g	15 21	250	2 2		Y	c
	Cobalt-57	1 19	pCi/g	6 24	24	0 21		Y	c
	Cobalt-60	1 94	pCi/g	10 74	0 5	0 0045		Y	b, c
	Potassium-40	17 63	pCi/g	14 1	8	0 071		Y	a, b, c
	Thorium-234	16 88	pCi/g	41 45	1100	9 9		Y	c
CRM6-7	Aluminum	4300	mg/kg	66400				N	
	Arsenic	6 8	mg/kg	8 3	31	0 43	7 24	Y	c
	Barium	65 9	mg/kg	123	30000	550		N	
	Beryllium	0 51	mg/kg	0 8	0 35	0 063		Y	b, c
	Boron	1 2	mg/kg	2 3	300000	700		N	
	Cadmium	0 09	mg/kg	0 12	6 4	1 4	1	N	
	Calcium	3450	mg/kg	5230				N	
	Chromium	11 1	mg/kg	13 1	380	23	52 3	N	
	Cobalt	9 2	mg/kg	14 5				N	
	Copper	13 6	mg/kg	32 2			18 7	N	
	Iron	13700	mg/kg	20700				N	
	Lead	14 2	mg/kg	28 4			30 2	N	
	Lithium	5 2	mg/kg	8 5				N	
	Magnesium	1630	mg/kg	2450				N	
	Manganese	1560	mg/kg	4380	11000	360		Y	c
	Mercury	1 6	mg/kg	0 06	130	2 3	0 13	Y	a, d
	Nickel	12 5	mg/kg	18 8	29000	160	15 9	N	
	Potassium	575	mg/kg	880				N	
	Selenium	0 8	mg/kg	1 2	11000	39		N	
	Sodium	76 4	mg/kg	101				N	
	Strontium	7 3	mg/kg	12 5	670000	4700		N	
	Vanadium	12 8	mg/kg	20 2	450	55		N	
	Zinc	46 7	mg/kg	81 2	330000	2300	124	N	
	Americium-241	2 34	pCi/g	15 21	250	2 2		Y	c
	Cesium-137	4 54	pCi/g	ND	2 3	0 021		Y	a, b, c
	Cobalt-57	0 96	pCi/g	6 24	24	0 21		Y	c
	Cobalt-60	1 74	pCi/g	10 74	0 5	0 0045		Y	b, c
	Potassium-40	13 49	pCi/g	14 1	8	0 071		Y	b, c
	Thorium-234	7 62	pCi/g	41 45	1100	9 9		N	
K-1007-P1	Aluminum	23800	mg/kg	66400				N	
	Arsenic	8 1	mg/kg	8 3	31	0 43	7 24	Y	c, d
	Barium	124	mg/kg	123	30000	550		Y	a
	Beryllium	1 2	mg/kg	0 8	0 35	0 063		Y	a, b, c
	Boron	8 3	mg/kg	2 3	300000	700		Y	a
	Cadmium	3 1	mg/kg	0 12	6 4	1 4	1	Y	a, c, d
	Calcium	22700	mg/kg	5230				Y	a
	Chromium	283	mg/kg	13 1	380	23	52 3	Y	a, c, d
	Cobalt	13 8	mg/kg	14 5				N	
	Copper	91 3	mg/kg	32 2			18 7	Y	a, d
	Iron	33700	mg/kg	20700				Y	a
	Lead	77	mg/kg	28 4			30 2	Y	a, d

Table 7.11. FY 2000 Clinch River/Poplar Creek sediment screening (continued)

Station	Chemical	Maximum detected result	Units	(a) Background (CRM44.5-45)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
K-1007-P1	Lithium	36	mg/kg	8 5				Y	a
	Magnesium	4720	mg/kg	2450				Y	a
	Manganese	712	mg/kg	4380	11000	360		Y	c
	Nickel	141	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	3010	mg/kg	880				Y	a
	Sodium	112	mg/kg	101				Y	a
	Strontium	28 4	mg/kg	12 5	670000	4700		Y	a
	Vanadium	35 5	mg/kg	20 2	450	55		Y	a
	Zinc	383	mg/kg	81 2	330000	2300	124	Y	a, d
	Actinium-228	1 71	pCi/g	ND	1 5	0 013		Y	a, b, c
	Bismuth-214	1 13	pCi/g	ND	0 81	0 0072		Y	a, b, c
	Cesium-137	1 05	pCi/g	ND	2 3	0 021		Y	a, c
	Lead-212	1 66	pCi/g	ND	16	0 14		Y	a, c
	Lead-214	0 66	pCi/g	ND	6 9	0 061		Y	a, c
	Potassium-40	19 24	pCi/g	14 1	8	0 071		Y	a, b, c
	Thallium-208	1 32	pCi/g	ND	0 34	0 003		Y	a, b, c
	Thorium-234	4 61	pCi/g	41 45	1100	9 9		N	
K-901 POND	Aluminum	10500	mg/kg	66400				N	
	Arsenic	22	mg/kg	8 3	31	0 43	7 24	Y	a, c, d
	Barium	128	mg/kg	123	30000	550		Y	a
	Beryllium	0 45	mg/kg	0 8	0 35	0 063		Y	b, c
	Boron	8 9	mg/kg	2 3	300000	700		Y	a
	Cadmium	0 77	mg/kg	0 12	6 4	1 4	1	Y	a
	Calcium	213000	mg/kg	5230				Y	a
	Chromium	1660	mg/kg	13 1	380	23	52 3	Y	a, b, c, d
	Cobalt	7 1	mg/kg	14 5				N	
	Copper	46 5	mg/kg	32 2			18 7	Y	a, d
	Iron	18300	mg/kg	20700				N	
	Lead	25 3	mg/kg	28 4			30 2	N	
	Lithium	19 5	mg/kg	8 5				Y	a
	Magnesium	5950	mg/kg	2450				Y	a
	Manganese	708	mg/kg	4380	11000	360		Y	c
	Nickel	18 9	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	1850	mg/kg	880				Y	a
	Silver	0 22	mg/kg	ND	5100	39	2	N	a
	Sodium	207	mg/kg	101				Y	a
	Strontium	167	mg/kg	12 5	670000	4700		Y	a
	Vanadium	16 3	mg/kg	20 2	450	55		N	
	Zinc	854	mg/kg	81 2	330000	2300	124	Y	a, d
	Cesium-137	4 55	pCi/g	ND	2 3	0 021		Y	a, b, c
	Potassium-40	7 95	pCi/g	14 1	8	0 071		Y	c
	Thorium-234	4 67	pCi/g	41 45	1100	9 9		N	
PCM 1	Aluminum	8230	mg/kg	66400				N	
	Arsenic	7 3	mg/kg	8 3	31	0 43	7 24	Y	c, d
	Barium	102	mg/kg	123	30000	550		N	
	Beryllium	0 93	mg/kg	0 8	0 35	0 063		Y	a, b, c
	Boron	2 2	mg/kg	2 3	300000	700		N	
	Cadmium	0 52	mg/kg	0 12	6 4	1 4	1	Y	a
	Calcium	2640	mg/kg	5230				N	
	Chromium	20 3	mg/kg	13 1	380	23	52 3	Y	a
	Cobalt	15 3	mg/kg	14 5				Y	a
	Copper	25	mg/kg	32 2			18 7	Y	d
	Iron	22700	mg/kg	20700				Y	a
	Lead	21 4	mg/kg	28 4			30 2	N	
	Lithium	11 7	mg/kg	8 5				Y	a
	Magnesium	1850	mg/kg	2450				N	
	Manganese	754	mg/kg	4380	11000	360		Y	c

Table 7.11. FY 2000 Clinch River/Poplar Creek sediment screening (continued)

Station	Chemical	Maximum detected result	Units	(a) Background (CRM44.5-45)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
PCM 1.	Mercury	11	mg/kg	0 06	130	2 3	0 13	Y	a, c, d
	Nickel	28 9	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	1070	mg/kg	880				Y	a
	Selenium	1 6	mg/kg	1 2	11000	39		Y	a
	Silver	0 43	mg/kg	ND	5100	39	2	N	a
	Sodium	66 9	mg/kg	101				N	
	Strontium	11 1	mg/kg	12 5	670000	4700		N	
	Vanadium	18 6	mg/kg	20 2	450	55		N	
	Zinc	104	mg/kg	81 2	330000	2300	124	Y	a
	Americium-241	1 37	pCi/g	15 21	250	2 2		N	
	Cesium-137	0 49	pCi/g	ND	2 3	0 021		Y	a, c
	Cobalt-57	0 85	pCi/g	6 24	24	0 21		Y	c
	Cobalt-60	1 4	pCi/g	10 74	0 5	0 0045		Y	b, c
	Potassium-40	11 58	pCi/g	14 1	8	0 071		Y	b, c
	Thorium-234	7 4	pCi/g	41 45	1100	9 9		N	
PCM 3	Aluminum	7270	mg/kg	66400				N	
	Arsenic	5 7	mg/kg	8 3	31	0 43	7 24	Y	c
	Barium	99 9	mg/kg	123	30000	550		N	
	Beryllium	0 83	mg/kg	0 8	0 35	0 063		Y	a, b, c
	Boron	2 2	mg/kg	2 3	300000	700		N	
	Cadmium	0 57	mg/kg	0 12	6 4	1 4	1	Y	a
	Calcium	3220	mg/kg	5230				N	
	Chromium	17 6	mg/kg	13 1	380	23	52 3	Y	a
	Cobalt	16 2	mg/kg	14 5				Y	a
	Copper	22 2	mg/kg	32 2			18 7	Y	d
	Iron	21200	mg/kg	20700				Y	a
	Lead	19 3	mg/kg	28 4			30 2	N	
	Lithium	9 9	mg/kg	8 5				Y	a
	Magnesium	1790	mg/kg	2450				N	
	Manganese	1060	mg/kg	4380	11000	360		Y	c
	Mercury	4 8	mg/kg	0 06	130	2 3	0 13	Y	a, c, d
	Nickel	27 3	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	940	mg/kg	880				Y	a
	Selenium	1 5	mg/kg	1 2	11000	39		Y	a
	Silver	0 27	mg/kg	ND	5100	39	2	N	a
	Sodium	81 7	mg/kg	101				N	
	Strontium	9 5	mg/kg	12 5	670000	4700		N	
	Vanadium	16 1	mg/kg	20 2	450	55		N	
	Zinc	106	mg/kg	81 2	330000	2300	124	Y	a
	Americium-241	1 19	pCi/g	15 21	250	2 2		N	
	Cesium-137	0 31	pCi/g	ND	2 3	0 021		Y	a, c
	Cobalt-57	0 34	pCi/g	6 24	24	0 21		Y	c
	Cobalt-60	0 66	pCi/g	10 74	0 5	0 0045		Y	b, c
	Potassium-40	11 55	pCi/g	14 1	8	0 071		Y	b, c
	Thorium-234	6 48	pCi/g	41 45	1100	9 9		N	
PCM5 5	Aluminum	2970	mg/kg	66400				N	
	Arsenic	4 4	mg/kg	8 3	31	0 43	7 24	Y	c
	Barium	42 7	mg/kg	123	30000	550		N	
	Beryllium	0 49	mg/kg	0 8	0 35	0 063		Y	b, c
	Boron	3 4	mg/kg	2 3	300000	700		Y	a
	Cadmium	0 28	mg/kg	0 12	6 4	1 4	1	Y	a
	Calcium	1120	mg/kg	5230				N	
	Chromium	19 5	mg/kg	13 1	380	23	52 3	Y	a
	Cobalt	9 2	mg/kg	14 5				N	
	Copper	12 7	mg/kg	32 2			18 7	N	

Table 7.11. FY 2000 Clinch River/Poplar Creek sediment screening (continued)

Station	Chemical	Maximum detected result	Units	(a) Background (CRM44.5-45)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
PCM5 5	Iron	11700	mg/kg	20700				N	
	Lead	11 1	mg/kg	28 4				N	
	Lithium	4	mg/kg	8 5			30 2	N	
	Magnesium	631	mg/kg	2450				N	
	Manganese	356	mg/kg	4380	11000	360		N	
	Mercury	10 7	mg/kg	0 06	130	2 3	0 13	Y	a, c, d
	Nickel	17 5	mg/kg	18 8	29000	160	15 9	Y	d
	Potassium	478	mg/kg	880				N	
	Selenium	0 9	mg/kg	1 2	11000	39		N	
	Silver	0 12	mg/kg	ND	5100	39	2	N	a
	Sodium	57 6	mg/kg	101				N	
	Strontium	7 1	mg/kg	12 5	670000	4700		N	
	Thallium	0 45	mg/kg	ND	25	0 63		N	a
	Vanadium	9 9	mg/kg	20 2	450	55		N	
	Zinc	40 8	mg/kg	81 2	330000	2300	124	N	
	Cesium-137	0 1	pCi/g	ND	2 3	0 021		Y	a, c
	Potassium-40	3 46	pCi/g	14 1	8	0 071		Y	c
WOL	Aluminum	10800	mg/kg	66400				N	
	Arsenic	2 6	mg/kg	8 3	31	0 43	7 24	Y	c
	Barium	93 7	mg/kg	123	30000	550		N	
	Beryllium	0 83	mg/kg	0 8	0 35	0 063		Y	a, b, c
	Boron	4 3	mg/kg	2 3	300000	700		Y	a
	Cadmium	0 2	mg/kg	0 12	6 4	1 4	1	Y	a
	Calcium	36300	mg/kg	5230				Y	a
	Chromium	42 4	mg/kg	13 1	380	23	52 3	Y	a, c
	Cobalt	13 6	mg/kg	14 5				N	
	Copper	23 5	mg/kg	32 2			18 7	Y	d
	Iron	24100	mg/kg	20700				Y	a
	Lead	36 6	mg/kg	28 4			30 2	Y	a, d
	Lithium	17 7	mg/kg	8 5				Y	a
	Magnesium	11400	mg/kg	2450				Y	a
	Manganese	390	mg/kg	4380	11000	360		Y	c
	Nickel	32 1	mg/kg	18 8	29000	160	15 9	Y	a, d
	Potassium	2780	mg/kg	880				Y	a
	Silver	0 16	mg/kg	ND	5100	39	2	N	a
	Sodium	129	mg/kg	101				Y	a
	Strontium	34 9	mg/kg	12 5	670000	4700		Y	a
	Thallium	0 95	mg/kg	ND	25	0 63		Y	a, c
	Vanadium	17 6	mg/kg	20 2	450	55		N	
	Zinc	200	mg/kg	81 2	330000	2300	124	Y	a, d
	Cesium-134	0 19	pCi/g	ND	0 83	0 0074		Y	a, c
	Cesium-137	81 72	pCi/g	ND	2 3	0 021		Y	a, b, c
	Cobalt-60	1 98	pCi/g	10 74	0 5	0 0045		Y	b, c
	Lead-212	0 57	pCi/g	ND	16	0 14		Y	a, c
	Potassium-40	18 01	pCi/g	14 1	8	0 071		Y	a, b, c
	Thallium-208	0 76	pCi/g	ND	0 34	0 003		Y	a, b, c
WOCE	Aluminum	9510	mg/kg	66400				N	
	Arsenic	5 1	mg/kg	8 3	31	0 43	7 24	Y	c
	Barium	104	mg/kg	123	30000	550		N	
	Beryllium	0 76	mg/kg	0 8	0 35	0 063		Y	b, c
	Boron	4 4	mg/kg	2 3	300000	700		Y	a

Table 7.11. FY 2000 Clinch River/Poplar Creek sediment screening (continued)

Station	Chemical	Maximum detected result	Units	(a) Background (CRM44.5-45)	(b) Recreational PRG	(c) Residential PRG	(d) EPA criterion	Max exceeds criterion	Criterion exceeded
	Cadmium	0 5	mg/kg	0 12	6 4	1 4	1	Y	a
WOCE	Calcium	4510	mg/kg	5230				N	
	Chromium	58 3	mg/kg	13 1	380	23	52 3	Y	a, c, d
	Cobalt	9 9	mg/kg	14 5				N	
	Copper	27	mg/kg	32 2			18 7	Y	d
	Iron	21000	mg/kg	20700				Y	a
	Lead	24 5	mg/kg	28 4			30 2	N	
	Lithium	7 8	mg/kg	8 5				N	
	Magnesium	1730	mg/kg	2450				N	
	Manganese	793	mg/kg	4380	11000	360		Y	c
	Nickel	15	mg/kg	18 8	29000	160	15 9	N	
	Potassium	994	mg/kg	880				Y	a
	Silver	2	mg/kg	ND	5100	39	2	N	a
	Sodium	108	mg/kg	101				Y	a
	Strontium	10 9	mg/kg	12 5	670000	4700		N	
	Vanadium	17 6	mg/kg	20 2	450	55		N	
	Zinc	137	mg/kg	81 2	330000	2300	124	Y	a, d

CRM = Clinch River mile
EPA = U S Environmental Protection Agency
FY = fiscal year
ND = Not detected above associated reporting level
PCM = Poplar Creek mile
PRG = preliminary remediation goal
WOCE = White Oak Creek Embayment
WOL = White Oak Lake

Post-ROD sediment sampling in CR/PC began in FY 1999 In the past 2 years, seven areas have been consistently sampled CRM 44 5-45 (Solway Bridge), CRM 23 4-24 7 (Melton Hill forebay area), CRM 14-15 (vicinity of ETTP water intake), CRM 10 5-12 (Poplar Creek North/Brashear Island), PCM 1, PCM 3, and PCM 5.5 Results obtained in FY 1999 and FY 2000 for the four RI contaminants of concern (arsenic, chromium, mercury, and ^{137}Cs) are shown in Fig 7.2. Trends are difficult to determine with limited data from only 2 years of sampling at these locations, although it is noted that chromium concentrations at each location decreased slightly from 1999 to 2000 Concentrations of mercury in sediment samples collected from the three Poplar Creek monitoring locations increased dramatically from 1999 to 2000. At the Clinch River monitoring locations, mercury concentrations remained stable or decreased slightly. Cesium-137 data are too limited for even preliminary assessments With implementation of the combined monitoring plan for LWBR and the Clinch River/Poplar Creek in FY 2000, contaminants in sediment will be more consistently sampled within the same areas of the hydrologic system from year to year Sediment samples will be collected from the same 16 areas in CR/PC over the next four years Therefore the magnitude and pattern of contaminants in the overlying sediment layer can be more meaningfully compared and evaluated on an annual basis

Conclusion. The CR/PC ROD notes that if deep-water sediments are left in place, they do not pose a risk to human health because no exposure pathway exists Continued monitoring of CR/PC sediments will provide information that can be used to confirm that accumulation of sediment is continuing to isolate the contaminated layer of CR/PC sediment In the meantime, existing institutional controls on sediment disturbing activities should be maintained in order to ensure continued protection to public health

Also, as noted in Sect 7.3 4 2, DOE provided risk assessment and radiological surveying support to the U.S Coast Guard to evaluate risk to the crew of a U S Coast Guard vessel performing maintenance on channel marker buoys (aids to navigation) in the Clinch River and Watts Bar Reservoir in the vicinity of the DOE-ORR Potential radiation exposures to U S Coast Guard personnel who may potentially come into contact with sediments containing residual radioactive materials during maintenance of navigational marker buoys were evaluated The work was conducted in September and October 1999

Typical maintenance activities include pulling up buoy anchors to inspect for damage or corrosion, making repairs as needed, and relocating them to the correct coordinate locations A total of 14 navigational markers, positioned along the Clinch River from CRM 0 0 to CRM 20 8, were brought onboard for inspection In each case, DOE contractor personnel collected measurements of radiation levels (beta-gamma activity and gamma contact dose rate) from river sediments on anchors, chains, and fittings Measurements were also collected from a large metal beam used to hold the vessel in a fixed position, as well as from gloves, life jackets, and clothing worn by U S Coast Guard personnel In all cases, no indication of radioactivity above natural background levels was observed The contact dose rate was observed to remain at background levels (approximately 0 01 to 0 03 mrem/hr) at all times In addition to these on-site measurements, swipe samples were collected from each marker anchor for laboratory analysis All results were found to be within the range of natural background activity Alpha activity was found to marginally exceed instrument detection levels for only one of the 16 samples, and beta-gamma activity for only 3 of 16 samples

Thus, the field and analytical information collected during this activity indicate that sediments from the Clinch River in the vicinity of the DOE-ORO do not present a hazard to U S Coast Guard personnel conducting inspection and maintenance activities for navigational markers, and that any radiation exposures to these personnel would be negligibly small (i e , four to five orders of magnitude below that from natural background radiation)

7.3.4.5 Biota monitoring

Biota Sampling. Biota sampling was done to evaluate potential accumulation of contaminants by fish and turtles. Striped bass, large mouth bass, and catfish were sampled in the Clinch River system at the following locations:

- CRM 0.5-1.5 (Kingston City Park)
- CRM 2.6 (Kingston steam plant effluent)
- CRM 6 or 6-7 (Near Young Creek)
- CRM 10 or 10.5-12 (Brashear Island, immediately downstream of Poplar Creek)
- CR Poplar Creek (Confluence with Clinch River)
- PCM 1
- PCM 3
- CRM 14-15 (ETTP water intake)
- CRM 18-18.7 (Grubb Island)
- CRM 19.7-20 (Jones Island)
- White Oak Lake
- White Oak Embayment
- CRM 23.4-24.7 (Melton Hill Dam forebay)
- McCoy Branch Embayment
- Solway Bridge
- CRM 48 (Bull Run steam plant)

RI chemicals of concern for biota were PCBs, pesticides, and mercury (DOE 1997j). In addition to sampling for these chemicals, concentrations of ^{137}Cs, which is of human health concern in CR/PC sediments, were measured, as were ^{60}Co and ^{40}K. Table 7 12 presents the analytical results for chemicals in fish and turtles collected in the Clinch River system. In this table, alpha-BHC, beta-BHC, and delta-BHC were combined as BHCs; chlordane, alpha-chlordane, and gamma-chlordane were combined as chlordane, endosulfan I, endosulfan II, and endosulfan sulfate were combined as endosulfans, endrin and endrin aldehyde were combined as endrins, and heptachlor and heptachlor epoxide were combined as heptachlors. Non-detects are reported as the concentration representing the detection limit followed by "U." Concentrations estimated at levels below the detection limits are reported with an asterisk. When non-detects and estimated values were combined, the non-detect value was taken to be half the detection limit, and the result was followed by "*U."

Table 7.13 shows the results of analyses of fish for ^{137}Cs, ^{60}Co, and ^{40}K, and Table 7.14 shows the results of analyses of turtles for the same radionuclides

PCB concentrations in fish in the Clinch River system ranged from 24 μg/kg to a maximum of 5800 μg/kg, which was observed at the WOCE Except for that location, the concentrations are well below the Federal Drug Administration limit of 2000 μg/kg for marketability of fish, but all, including the sites upstream of the ORR, are above the EPA Office of Water health screening level of 10 μg/kg PCB concentrations above 200 μg/kg were observed only at CRM 2.6 and CRM 6, and these levels were not observed consistently at different collection times

Most of the pesticide concentrations were below or near detection limits for all three fish species at all sites. However, almost all pesticides analyzed were elevated in a channel catfish at CRM 6-7 (12/6/00), and DDE was elevated in a catfish sample at CRM 6 (11/30/99) The location of these samples may indicate a non-point-source contribution of pesticides to the Clinch River.

Table 7.12. Results of chemical analyses of biota sampled in the Clinch River system

Sample location	Sample medium	Date	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	Aroclor-1254	Aroclor-1260	BHCs	Chlordane	Dieldrin	Endosulfans	Endrins	Heptachlor	Mercury
CRM 0 5-1 5 (Kingston City Park)	Channel catfish	6/26/00	6U	0 94*	6U		100U	100U		12U	0 85*	18U	3 8*U	22U	81
	Largemouth bass	6/26/00	6U	2 2*	6U		100U	80*		4 8*U	0 62*	6 8*U	4 1*U	22U	369
	Turtle muscle	9/11/00	600U	600U	600U		1000U	1000U		1200U	600U	1800U	1200U	2200U	173
	Turtle liver	9/11/00	1500U	700*U	1500U		24,667U	18,333*U		3000U	697U	4500U	2843U	8400U	2347
	Turtle fat	9/11/00	5 9U	1910	5 9U		**	224,000		5 9U	1220	14 8U	11 8U	513	23 6
CRM 2 6 (Kingston steam plant effluent)	Striped bass	01/18/00	6 7*	30	19 6U	6 9U	83U	280	3 1*U	58 8U	19*	23 7*U	30 5*	8 1*U	127
CRM 6	Channel catfish	11/30/99	3 7*	43	20U	4 1*	17U	310	8 8*U	60U	3 5*	25*U	28*U	7 2*	242
	Largemouth bass	11/30/99	20U	2 1*	20U	1 2*	17U	24	9 7*U	60U	15U	45U	9 2*U	91*	378
	Striped bass	11/30/99	2*	17	20U	3 4*	17U	120		60U	2 4*	45U	13 8*U	5 4*	301
CRM 6-7 (Young Creek)	Channel catfish	6/26/00	30U	4 5*	60		100U	100U		36U	6 5*	90U	60U	110U	136
	Largemouth bass	6/26/00	6U	2 5*	6U		100U	100U		12U	0 7*	18U	4 2*U	22U	651
	Turtle muscle	9/11/00	600U	600U	600U		1000U	1000U		1200U	600U	1800U	1200U	2200U	339
	Turtle liver	9/11/00	1400U	1400U	1400U		23,333U	20,333*U		2800U	1400U	4200U	2800U	5133U	4565
	Turtle fat	9/11/00	4 8U	272	4 8U		**	130,050		4 8U	63	12 1U	9 7U	125	42 8
CRM 10	Channel catfish	11/29/00	19 8U	9*	19 8U	1*	17U	170	25 7U	59 4U	14 8U	19 6*U	15 8U	4 4*U	718
	Largemouth bass	11/29/00	20U	2 4*	20U	7U	17U	58	17 6*	60U	15U	16 7*U	16U	1*	916
	Striped bass	11/29/00	1 6*	16	20U	1 *6	17U	98	9 1*U	60U	1 8*	45U	16U	4 *	182
CRM 10 5-12 (Brashear Island)	Channel catfish	6/26/00	6U	2 9*	6U		100U	62*		6 6*U	6 2	18U	5 4*U	22	375
	Largemouth bass	6/26/00	6U	2 2*	6U		100U	91*		4 2*U	2 1*	6 9*U	2 6*	1 5*	841
CR Poplar Creek	Channel catfish	11/30/00	19 8U	8 7*	19 8U	0 9*	17U	120	9 4*U	59 4U	0 7*	18 8*U	15 6*U	1 6*	563
	Largemouth bass	11/30/00	20U	2 6*	20U	0 6*	17U	69	22 1*U	60U	4 0*U	9 0*U	12 2*U	1 7*	832
	Striped bass	11/30/00	0 8*	7 4*	14 6	1 9*	12U	76	6 6*U	43 8U	0 6*	32 9U	15 3*	3 7*	737
PCM 1	Channel catfish	6/26/00	6U	3 9*	6U		100U	95*		11 9*U	6 4	7 8*U	6 9*U	4 2*	606
	Largemouth bass	6/26/00	6U	0 7*	6U		18*	100U		12U	0 8*	18U	12U	22U	592
PCM 3	Channel catfish	6/26/00	6U	5 3*	6U		100U	140		7*U	4 4*	8 6*U	10 3*U	3 2*	394
	Largemouth bass	6/26/00	6U	0 7*	6U		100U	100U		4 1*U	1 2*	18U	4 1*U	22U	1240

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Table 7.12. Results of chemical analyses of biota sampled in the Clinch River system (continued)

Sample location	Sample medium	Date	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	Aroclor-1254	Aroclor-1260	BHCs	Chlordane	Dieldrin	Endosulfans	Endrins	Heptachlor	Mercury
CRM 14-15 (ETTP water intake)	Channel catfish	6/26/00	6U	12	6U		100U	140		8 3*U	4 6*	7 6*U	10 1*U	2 2	185
	Largemouth bass	6/26/00	6U	1 5*	6U		100U	100U		3 2*	1 5*	18U	12U	2 1	155
CRM 18-18 7 (Grubb Island)	Channel catfish	6/26/00	6U	10	6U		100U	130		10 4*U	7 8	18U	6 4*U	2 8*	339
	Turtle muscle	9/12/00	600U	600U	600U		1000U	1000U		1200U	600U	1800U	1200U	2200U	298
	Turtle liver	9/12/00	420U	420U	420U		10,000U	6267*U		840U	420U	1043*U	840*U	1540*U	3161
	Turtle fat	9/12/00	4 8U	135	4 8U		**	56,933		4 8U	129	12 1U	9 7U	54	36
CRM 19 7-20	Channel catfish	6/26/00	6U	3 9*	6U		100U	180		7 7*U	4 6*	6 8*U	4 0*	0 7*	191
	Largemouth bass	6/26/00	6U	2 3*	6U		70*	100U		5 9*U	2 1*	14 6*U	4 3*	2 2*	159
	Turtle muscle	9/12/00	600U	600U	600U		4000U	4000U		1200U	600U	1800U	600U	2200U	190
	Turtle liver	9/12/00	687U	220*U	687U		11,333U	9033*U		1373U	223*U	2060U	987U	906U	1130
	Turtle fat	9/12/00	4 9U	668	4 9U		**	89,800		4 8U	213	12 0U	9 8U	81	30 4
	Turtle composite	9/12/00	4 9U	282	4 9U		**	44,567		4 8U	163	12 1U	9 7U	137	682
White Oak Lake	Largemouth bass	6/26/00	6U	6U	6U		100U	190		12U	5 4*	5 8*U	22 2*U	4 8*	445
White Oak Embayment	Channel catfish	6/26/00	6U	9 9	6U		2600	3200		14*U	28	32*U	50*U	20*	210
	Largemouth bass	6/26/00	6U	1 4*	6U		100U	97*		12U	6U	18U	7 6*U	1 2*	426
CRM 23 4-24 7 (Melton Hill Dam forebay)	Channel catfish	6/26/00	6U	12	6U		100U	160		22 2	12	15*U	9 6*U	1 8*U	211
	Largemouth bass	6/26/00	6U	1 5*	46		100U	100U		12U	1 2*	7 2*U	12U	22U	158
	Turtle muscle	9/12/00	600U	600U	600U		10,000U	10,000U		1200U	600U	1800U	1200U	2200U	151
	Turtle liver	9/12/00	707U	286*	707U		11,667U	13,633*U		1413U	293*U	2120U	1010*U	966*U	3347
	Turtle fat	9/12/00	5 0U	85 6	5 0U		**	110,567		5 0U	70	12 5U	10 1U	23 1	35 6
	Turtle composite	9/12/00	4 8U	83 5	4 8U		**	12,100		4 8U	11	12 0U	9 6U	62 1	975
McCoy Branch Embayment	Channel catfish	11/29/99	20U	1 6*	20U	7U	17U	32	26U	60U	15U	15 9*U	10*U	4 4*U	162
	Largemouth bass	11/29/99	20U	0 6*	20U	7U	17U	17U	9 2*U	60U	15U	45U	46U	4 7*U	84 6

Table 7.12. Results of chemical analyses of biota sampled in the Clinch River system (continued)

Sample location	Sample medium	Date	4,4'-DDD	4,4'-DDE	4,4'-DDT	Aldrin	Aroclor-1254	Aroclor-1260	BHCs	Chlordane	Dieldrin	Endosulfans	Endrins	Heptachlor	Mercury
Solway Bridge	Channel catfish	11/29/99	1 4*	29	19 8U	6 9U	84U	670	6 2*	59 4U	0.5*	44.5U	51.9*U	6.2*U	252
	Largemouth bass	11/29/99	20U	0 54*	20U	7U	17U	17U	17 8*U	60U	15U	45U	46U	4 4*U	84 6
	Striped bass	11/29/99	1*	7.3*	19 8U	6.9U	17U	60	7 6*	59.4U	1.2*	16 4*U	10 7*U	2.6*	152
CRM 48 (Bull Run steam plant effluent)	Striped bass	01/18/00	2 8*	11*	20U	7U	17U	110	3 9*U	60U	6.8*	16 4*U	22*U	6 8*U	71 8

* = Concentration estimated at a level below the detection limit
*U = Concentration calculated by averaging estimated values with half the detection limit
Concentrations in µg/kg
CRM = Clinch River mile
ETTP = East Tennessee Technology Park
PCM = Poplar Creek mile
U = not detected at the concentration stated in the table

Table 7.13. Frequency of detection and activity of radionuclides in fish in the Clinch River system

Location	Tissue	Cs-137		Co-60		K-40	
		Detection frequency	Activity (pCi/g)	Detection frequency	Activity (pCi/g)	Detection frequency	Activity (pCi/g)
CRM 0.5-1.5	Catfish	0/1	0.06*	0/1	U	0/1	U
	Largemouth bass	0/1	U	0/1	U	1/1	2.7
CRM 2.6	Striped bass	0/1	U	0/1	U	1/1	3.6
CRM 6	Catfish	0/1	U	0/1	U	1/1	3.5
	Largemouth bass	0/1	U	0/1	U	1/1	3.8
	Striped bass	0/1	U	1/1	0.04*	1/1	3.3
CRM 6-7	Catfish	0/1	U	0/1	U	1/1	2.1*
	Largemouth bass	0/1	U	0/1	U	1/1	2.0
CRM 10.5-12	Catfish	0/1	U	1/1	0.07*	1/1	2.7*
	Largemouth bass	1/1	0.06*	1/1	0.02*	1/1	2.9
PCM 1	Catfish	0/1	U	0/1	U	1/1	1.7*
	Largemouth bass	0/1	U	0/1	U	1/1	2.1
PCM 3	Catfish	0/1	U	0/1	U	1/1	2.0*
	Largemouth bass	0/1	U	0/1	U	1/1	2.8
CRM 14-15	Catfish	0/1	U	0/1	U	1/1	2.9
	Largemouth bass	0/1	U	0/1	U	1/1	3.8
CRM 18-18.7	Catfish	0/1	U	0/1	U	1/1	2.2
CRM 19-19.7	Catfish	0/1	U	0/1	U	0/1	U
	Largemouth bass	1/1	0.6	0/1	U	1/1	3.8
White Oak Lake	Largemouth bass	1/1	5.4	0/1	U	1/1	2.5
White Oak Embayment	Catfish	1/1	3.1	0/2	U	1/1	3.0
	Largemouth bass	1/1	6.6	0/2	U	1/1	5 7
	Striped bass	0/1	U	0/1	U	Not reported	
CRM 23.4-24.7	Catfish	0/1	U	0/1	U	1/1	2 4
	Largemouth bass	0/1	U	0/1	U	1/1	3.4
McCoy Embayment	Catfish	0/1	U	0/1	1/1	Not reported	
	Largemouth bass	0/1	U	0/1	U	Not reported	
	Striped bass	0/1	U	1/1	0.05*	1/1	3.1
Solway Bridge	Catfish	0/1	U	0/1	U	1/1	2.5
	Largemouth bass	0/1	U	0/1	U	1/1	5.3
	Striped bass	0/1	U	0/1	U	1/1	3.3
CRM 48.0	Striped bass	0/1	U	0/1	U	1/1	2.4

U = not detected at the concentration stated in the table
* = Concentration estimated at a level below the detection limit
*U = Concentration calculated by averaging estimated values with half the detection limit
CRM = Clinch River mile
PCM = Poplar Creek mile

Table 7.14. Concentrations of radionuclides in turtle tissue

Location	Tissue	Cs-137 Detection frequency	Cs-137 Activity (pCi/g)	Co-60 Detection frequency	Co-60 Activity (pCi/g)	K-40 Detection frequency	K-40 Activity (pCi/g)
CRM 0 5-1 5	Muscle	1/3	0 15*	0/3	U	1/1	5 4*
	Liver	0/3	U	0/3	U	1/1	5 6*
	Fat	0/3	U	0/3	U	Not reported	
	Composite	0/1	U	0/1	U	1/1	3 7*
CRM 6-7	Muscle	0/3	U	0/3	U	2/3	3 7*
	Liver	0/3	U	0/3	U	Not reported	
	Fat	0/3	U	1/3	0 11*	1/3	0 9*
	Composite	0/1	U	0/1	U	1/1	2 3
CRM 18-18 7	Muscle	1/3	0 08*	0/3	U	3/3	1 7*
	Liver	0/3	U	0/3	U	Not reported	
	Fat	1/3	0 12*	0/3	U	2/3	1 3*
	Composite	1/1	0 11*	0/1	U	1/1	2 1*
CRM 19 7-20	Muscle	1/3	0 06*	0/3	U	3/3	1 79*
	Liver	1/3	0 05*	1/3	0 67*	Not reported	
	Fat	0/3	U	0/3	U	0/2	U
	Composite	0/2	U	0/2	U	2/2	2 8
CRM 23 4-24	Muscle	1/3	0 09*	0/3	U	3/3	2 7
	Liver	0/3	U	0/3	U	Not reported	
	Fat	1/3	0 18*	0/3	U	0/3	U
	Composite	0/1	U	1/1	0 03*	1/1	1 9

U = not detected at the concentration stated in the table
* = Concentration estimated at a level below the detection limit
*U = Concentration calculated by averaging estimated values with half the detection limit
CRM = Clinch River mile

Many of the reported mercury concentrations (81 to 1240 μg/kg) for all fish species were in the range of reference streams (60 to 110 μg/kg) (Southworth et al 1994) Except for one sample at PCM 3, concentrations were below 1 mg/kg (1000 μg/kg) for marketability of fish An important source of risk from mercury is to fetuses from maternal ingestion of mercury in fish A pregnant woman of 62 kg who eats fish at the rate that EPA's Exposure Factors Handbook (EPA 1997c) suggests for the general population (6 6 g/d) should not eat a fish diet whose average mercury concentration is above 940 μg/kg fresh weight One of 36 fish sampled had a concentration above 940 μg/kg, suggesting that a fish diet would not exceed the RfD For consumption of fish at a rate typical of recreational fishers who eat their catch (14 2 g/d), the limit would be 435 μg/kg (exceeded by 11 of 36 fish sampled) The RfD would likely be exceeded if the diet were restricted to Poplar Creek and a few miles downstream of its confluence with the Clinch River In contrast, the Oak Ridge Dose Reconstruction Project (TDH 1999) reported that most fetuses whose mothers were light consumers of fish (8 g/d or less) probably received doses above the RfD from Clinch River/Poplar Creek fish from 1956 through 1962 Fetuses whose mothers were moderate consumers (8 to 24 g/d) probably received doses above the RfD from Clinch River/Poplar Creek fish from 1953 through 1976 Fetuses whose mothers were heavy consumers (24 to 60 g/d) nearly all received doses above the RfD from 1953 through 1973 In the data of Table 7 12, 18 of 36 samples exceeded the RfD at a consumption rate of 24 g/d, and 32 of 36 samples exceeded the RfD at a consumption rate of 60 g/d

Calculations done for the LWB risk assessment indicate that a concentration of 158 μg/kg corresponds to an HQ of 1 for children, therefore, this appears to be a more conservative point of comparison than the RfD for pregnant women

Nearly all the fish samples from Poplar Creek and the Clinch River just downstream of the Poplar Creek confluence had concentrations above the upper concentration of 158 μg/kg for LWBR fish that resulted in a hazard quotient of about 1 for children consuming fish in the LWBR Bar RI/FS (DOE 1995k). About two-thirds of the other samples had concentrations above 158 μg/kg.

Historical information from this and other sites indicates that turtles may bioaccumulate PCBs to a greater degree than do fish. To better evaluate this, limited turtle monitoring was conducted in FY 2000 and combined with previously collected TDEC data. Three samples were analyzed from each of five Clinch River sites. Results for muscle, liver, fat, and composited tissues are presented in Table 7.14. The results are difficult to analyze because of high detection limits. Pesticides were not detected in muscle tissue. Aroclor-1260, 4,4'-DDE, dieldrin, and heptachlor were reported in all turtle fat and turtle composite tissue samples. All reported Aroclor concentrations were above the U.S. Food and Drug Administration action level for marketability of fish of 2 mg total PCBs/kg tissue (2000 μg/kg). Neither DDT nor DDD was reported above detection limits, but the reported DDE values may represent DDT and its breakdown products. All DDE concentrations reported as detected or estimated in turtle tissue were above the Food and Drug Administration action level of 5 mg/kg for fish tissue. Dieldrin concentrations reported in turtle tissue were all above the Food and Drug Administration action level of 0.3 mg/kg (300 μg/kg) for fish tissue. Heptachlor epoxide concentrations reported in turtle tissue were all above the Food and Drug Administration action level of 0.3 mg/kg (300 μg/kg) for fish tissue. Mercury concentrations in turtle muscle, fat, and composite tissue were below the Food and Drug Administration limit for marketability of fish, but the average concentrations in liver at all sites were above the Food and Drug Administration limit Mercury in muscle varied little among samples at the same site, but concentrations in liver usually varied by a factor of ten or more at the same site.

The maximum concentrations of radionuclides in fish tissue were used to estimate the daily internal radiation dose by using methods published by ORNL Environmental Sciences Division (BJC 1998d). The maximum dose for all radionuclides, including those that were estimated but below detection limits, was less than 1 mrad/d, whereas a dose of 1 rad/d (1000 mrad/d) is considered to be unlikely to cause harm to fish (NCRP 1991). The radionuclides that were reported, ^{137}Cs, ^{60}Co, and ^{40}K, are assumed not to bioaccumulate in aquatic biota and do not bioaccumulate in mammals. Therefore, the internal concentrations of these radionuclides in fish should not be of concern to predators of fish.

The maximum concentrations of radionuclides in turtle tissue were used to estimate the daily internal radiation dose by using methods published by ORNL Environmental Sciences Division. The maximum dose for all radionuclides, including those that were estimated but below detection limits, was less than 1 mrad/d, whereas a dose of 0.1 rad/d (100 mrad/d) is considered to be unlikely to cause harm to mammals (ICRP 1977) Turtles are not likely to be more sensitive to radiation than mammals. Therefore, internal radiation doses to turtles appear to be of no concern. The radionuclides that were reported, ^{137}Cs, ^{60}Co, and ^{40}K, do not bioaccumulate in mammalian tissue Therefore, the internal concentrations of these radionuclides in turtles should not be of concern to predators of turtles. No trend in accumulation could be demonstrated for ^{137}Cs and ^{60}Co, because no samples had concentrations above the detection limits. Concentrations were generally below detection limits for ^{40}K, but estimated concentrations were higher at CRM 0.5-1.5 and CRM 6-7 than at the other sites.

Risks to humans from consumption of fish in CR/PC, as indicated by the data in Table 7.12, are illustrated in Figure 7.3. Concentrations corresponding to risks reported in the LWB RI/FS (DOE 1995k) were calculated and adjusted as described in Sect. 7.1.4.3. Observed concentrations and one-half the detection limit of non-detected concentrations were compared with these values. Icons representing catfish and bass were given colors indicating the following risk levels: green, cancer risk <1E-06 and HQ<1; yellow, cancer risk between 1E-04 and 1E-03 and HQ between 1 and 15, and red, cancer risk >1E-03 and HQ>15 Thus, yellow indicates potential harm to humans in the unlikely circumstance that

the very conservative exposure assumptions used in the LWB RI/FS risk assessment (DOE 1995k) actually occur, whereas red indicates a high likelihood of unacceptable risk. Figure 7.3 shows that consumption of turtles at the same rate as the fish consumption rate used in the LWB RI (DOE 1995k) is likely to cause lifetime cancer risks >1E-03 throughout the CR/PC system. Consumption of turtle liver would result in HQs above 5. Fish in PC and in CR for several kilometers downstream of PC had mercury concentrations that would result in HQs >1.

Sources of Contaminants. White Oak Creek appears to be a source of PCBs into the Clinch River, as indicated by fish bioaccumulation. The spatial distribution of PCB concentrations does not indicate clearly any other specific source of the PCBs in fish in the Clinch River System. However, estimated PCB concentrations in turtle liver were reported more frequently with distance upstream, and the Melton Hill forebay sample (CRM 23.4-24) had the highest estimated concentration of any sample. Poplar Creek appears to be an ongoing source of mercury in fish, but most of the fish with elevated mercury concentrations appear in or near Poplar Creek itself. Mercury in turtle liver was highest at CRM 6-7, downstream of the Poplar Creek confluence. There are increased concentrations of ^{40}K in turtles downstream of ETTP, but concentrations are too low to justify identifying that reach as having ^{40}K sources

The concentrations of all four pesticide/PCB analytes detected in turtle fat were highest at CRM 0.5-1.5. Samples taken farther upstream had lower concentrations that did not show a consistent pattern with location, except that the pesticides generally had their lowest concentrations at the Melton Hill Dam forebay (CRM 23 4-24) Aroclor concentrations at CRM 18-18.7 and CRM 19 7-20 were somewhat lower than at the Melton Hill Dam forebay (CRM 23.4-24). The pattern of concentrations suggests that there are many sources of pesticides and PCBs in the Clinch River, including sources upstream of the ORR. Discharges downstream of the Poplar Creek confluence may also be a significant source of pesticides and PCBs.

Accumulation of Contaminants by Turtles. Reported concentrations of contaminants in turtles were evaluated to determine whether turtles accumulate contaminants more than fish. The turtle fat and composite tissue samples were analyzed at a different laboratory from the turtle muscle and liver samples, and the detection limits were different, so a comparison of detected and non-detected values is not useful. It is clear, however, that reported values of Aroclor-1260, 4,4'-DDE, dieldrin, and heptachlor in turtle fat are, with some exceptions, higher than concentrations in catfish and bass DDE and dieldrin concentrations in turtle tissue were about 6 to 7 times the concentration in bass at the Melton Hill Dam forebay (CRM 23 4-24), and ranged up to more than 1000 times the concentration in catfish and bass at the Kingston City Park (CRM 0 5-1.5) Heptachlor concentrations in turtle fat were higher than concentrations in fish except at the Melton Hill Dam forebay (CRM 23 4-24), where the catfish sample had about the same concentration as turtle fat. However, at this location, the turtle composite tissue sample had a higher heptachlor concentration than the fish samples. Aroclor-1260 concentrations in turtle fat were two to nine times the concentrations in composite tissue from the same location, and the concentrations in turtle fat ranged from about 400 times the concentration in fish at CRM 18-18.7 to about 2000 times the concentration in fish at CRM 0.5-1.5 Mercury concentrations in turtle muscle were similar to the concentrations in fish muscle at the same sites. However, it appears that mercury and PCB concentrations in turtle liver are higher than in fish muscle at the same sites Specifically, average mercury concentrations in liver were about tenfold higher than the average concentrations in muscle.

The distribution of mercury among muscle, fat, and liver was determined The results are shown in Table 7.15. Concentrations in fat were from 12% to 24% of the concentrations in the corresponding muscle tissues, and the concentrations in liver were sixfold to 22-fold higher than concentrations in muscle. Therefore, it appears that fat discriminates against mercury relative to muscle, whereas liver accumulates mercury to a much higher degree than muscle.

Table 7.15. Average concentrations (μg/kg) of mercury in turtle tissues

Location	Tissue		
	Muscle	Fat	Liver
CRM 0.5-1.5	173	24	2347
CRM 6-7	339	43	4565
CRM 18-18.7	298	36	3161
CRM 19.7-20	190	30	1130
CRM 23 4-24.7	151	36	3347

CRM = Clinch River mile

An attempt was made to determine whether PCB concentrations in turtle muscle had changed with time. Table 7.16 presents the concentrations in turtle muscle and fat reported by TDEC at Clinch River locations in 1997 and the concentrations observed in FY 2000 at nearby locations. Concentrations of Aroclor 1260 in catfish muscle are also presented for comparison. Table 7.16 shows that Aroclor-1260 concentrations in turtles were orders of magnitude higher in the FY 2000 samples than in the TDEC samples. Concentrations in muscle are all below the Food and Drug Administration guideline for fish of 2 mg/kg.

Table 7.16. Aroclor-1260 concentrations in turtle and catfish tissues

Location	Data source	Aroclor-1260 concentrations in turtles (mg/kg)		Aroclor-1260 concentrations in catfish (mg/kg)
		Muscle	Fat	
CRM 0 1-1.5	FY 2000	ND at 1 0	224	0 1
CRM 2.5	TDEC 1997	0 076	4.18	N/A
CRM 6-7	FY 2000	ND at 1 0	130	0 1
CRM 10	TDEC 1997	0 076	1.02	N/A
CRM 18-18 7	FY 2000	ND at 1 0	57	0.17

CRM = Clinch River mile
FY = fiscal year
N/A = not available
ND = not detected
TDEC = Tennessee Department of Environment and Conservation

Concentrations of Aroclor-1260 in catfish are also shown for comparison. The concentrations observed in FY 2000 are well below the concentrations reported by TDEC for the years 1991 and 1992 Detection limits for PCB concentrations in turtle muscle are above the concentrations in catfish tissue, so a comparison cannot be made. However, concentrations in turtle fat (Table 7.16) and in composite turtle tissue (Table 7.14) are much higher than in catfish tissue. Aroclor concentrations in Clinch River catfish are similar to the concentrations observed in LWBR (Sect. 7.1.4.5). Concentrations in catfish from the Clinch River and tributaries averaged 0.13 mg/kg, whereas the concentrations in catfish from the LWBR averaged about 0.15 mg/kg.

Conclusions. There is no indication that aldrin or mercury is now accumulating to levels of concern in fish in the lower CR/PC Chlordane is below levels of concern for human health, established from results in the LWB RI/FS. Lifetime cancer risk from ingestion of PCB in fish is estimated to be >1E-04 at many locations throughout the CR/PC system, and estimated risks from the consumption of PCB in turtles are mostly 1E-03.

Exposure of piscivores to mercury by ingestion of fish remains above toxicity benchmarks in the Clinch River system. Exposures to PCBs appear to be of concern for piscivores only in the vicinity of the WOCE. Accumulation of ^{137}Cs and ^{60}Co by fish and turtles is below levels of concern to predators.

Evaluation of the bioaccumulation of pesticides, PCBs, mercury, and radionuclides by turtles showed that pesticides and PCBs accumulate in fat much more than they do in fish tissue, and it is likely that PCBs are bioaccumulated in turtle liver. Mercury does not bioaccumulate more in muscle tissue than in fish muscle, but concentrations in liver are about tenfold higher and above limits for marketability of fish Radionuclides were not detected above detection limits, but estimated values did not show any evident difference in accumulation between muscle and liver. Activities in fat were similar to those in muscle. Activities in turtle tissue were similar to those in fish tissue at the same site

7.3.5 Changes in Toxicity Factors for CR/PC Contaminants of Concern

The CR/PC RI/FS identified the following contaminants of concern:

- PCBs, mercury, arsenic, and chlordane in fish, and
- Chromium, mercury, arsenic, and ^{137}Cs in sediments

Subsequent to completion of the CR/PC RI/FS there have been changes in toxicity factors for the following CR/PC contaminants of concern: PCBs, mercury, arsenic, chlordane, and chromium.

PCBs. A slope factor of 7.7E+00 was used in calculating risk associated with ingestion of fish in the human health risk assessment. A slope factor of 2.0E+00 is currently used, thus, the corresponding risk is decreased accordingly.

Mercury. This is contaminant of concern associated with ingestion of fish tissue, and ingestion of milk, meat, or vegetables produced on sediments dredged from CR/PC The oral RfD for mercury was withdrawn in 1995 A reference dose for mercuric chloride can be used to evaluate the hazard associated with mercury This RfD is the same value as the withdrawn inorganic mercury value, thus, there is no change associated with this contaminant of concern

Arsenic. The inhalation slope factor was withdrawn in 1997, however, there is no change associated with ingestion of fish tissue or ingestion of vegetables, milk, or meat produced on sediments dredged from CR/PC

Chlordane. The oral RfD changed from 6 0E-05 to 5.0E-04 in 1998, thus, decreasing the hazard associated with ingestion of fish tissue

Chromium. The oral RfD was reduced from 5 0E-03 to 3 0E-03, thereby, increasing the hazard associated with ingestion of vegetables, milk, or meat produced on dredged sediments

7.3.6 Recommendations

- Continue existing institutional controls to control potential sediment-disturbing activities
- Continue existing fish consumption advisories to reduce exposure to contaminants in fish tissue.
- Continue annual monitoring as described in the Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River Poplar Creek Operable Units

7.4 LOWER EAST FORK POPLAR CREEK REMEDIAL ACTION

- ROD: August 1995
- Field Activities Complete: October 1997
- RAR: June 2000

7.4.1 Project Description

The Lower East Fork Poplar Creek (LEFPC) OU includes the soil, sediment, and groundwater in the 100-year floodplain along LEFPC and the Sewer Line Beltway. The OU begins at the outfall at Lake Reality and ends at the confluence of LEFPC and Poplar Creek (Fig. 7.6) The site includes portions of the ORR, along with commercial, agricultural, residential, and other areas within the city of Oak Ridge.

The LEFPC floodplain downstream of Y-12 became contaminated from mercury and other contaminant releases that occurred since the 1950s. The RI report and the Proposed Plan identified two primary areas of the floodplain that required excavation. The process for identifying these areas required extensive technical, regulatory, and public input regarding three primary issues. (1) the concentration of mercury that would be considered health-protective, (2) the cost of remediation, and (3) land-owner wishes. The RI report concluded that the Sewer Line Beltway soils presented no significant risk.

A risk assessment process was used to define a 400-ppm mercury cleanup level for the floodplain soils. This level was based on a conservative future land use of children playing in the soils and the bioavailability of the site-specific form of mercury (mercuric sulfide) in LEFPC. Based on the low bioavailability of mercuric sulfide, the cleanup levels increased from the original remediation goal of 50 ppm to 400 ppm

The selected remedy for LEFPC used excavation of floodplain soils with mercury concentrations >400 ppm, confirmatory sampling in the excavated areas to ensure all mercury concentrations above 400 ppm have been removed, backfilling the excavated areas with clean borrow soil and vegetating appropriately, and monitoring to ensure the effectiveness of the remediation The remedial action was implemented in two phases. Phase I was performed in the spring and summer of 1996. From July 8 to September 14, 1996, about 5560 loose yd^3 of mercury-contaminated soils (> 400 ppm mercury) were removed from the floodplain near the National Oceanographic and Atmospheric Administration site (Fig. 7.6). Phase II was performed from March 3 to October 24, 1997. During Phase II, about 39,200 loose yd^3 of mercury-contaminated soils (>400 ppm mercury) were removed from the floodplain near the National Oceanic and Atmospheric Administration (NOAA) site and the Bruner site (Fig. 7 6) In both phases, soils were taken to the Y-12 Industrial Landfill V for disposal in accordance with the TDEC Special Waste Approval (TDEC 1996a). During both phases, several pockets of elevated radiologically contaminated soils (>250 cpm gross beta-gamma) were located. These soils were excavated, placed in containers, and stored at ETTP

Two modifications were made to the site restoration activities in response to site conditions and storm events: (1) the wetland restoration was modified to remove only 6 in of topsoil and (2) several island areas and sections of creek bank where large quantities of river rock were deposited during a 50-year storm event were restored

The RAR for LEFPC (DOE 2000f) provides a description of all measures taken during the remedial activities to comply with action-specific ARARs.

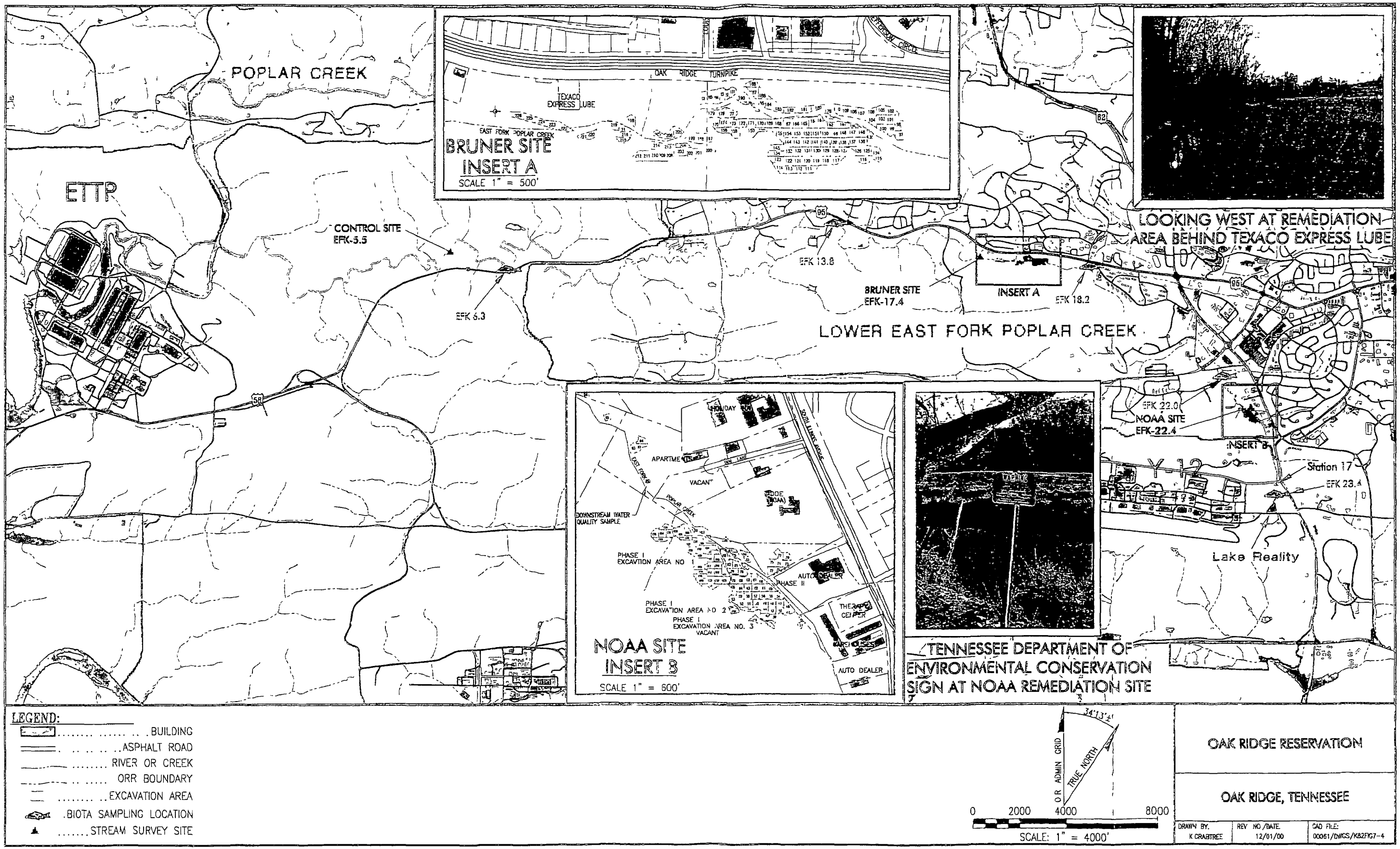

Fig. 7.6. Monitoring locations for Lower East Fork Poplar Creek.

7.4.2 Evaluation of Decision Document Requirements for Performance and Stewardship

7.4.2.1 Goals of decision

The goal of this decision is to minimize the risk to human health and the environment from mercury-contaminated soil in the LEFPC floodplain by excavating and disposing of identified floodplain soils contaminated above the remediation goal of 400 ppm mercury (DOE 1995f).

7.4.2.2 Monitoring and stewardship required

Post-remediation monitoring to address the effectiveness of the LEFPC remedy is described in the RAR (DOE 2000f). The recommended routine annual monitoring includes the following.

- continuous monitoring of mercury input into LEFPC at Station 17 (outfall of Lake Reality) to evaluate the magnitude of continued mercury fluxes from UEFPC to LEFPC. (Since this type of monitoring is currently conducted in conjunction with on-site efforts to reduce mercury flux leaving Y-12, no additional field work is required to obtain mercury data at Station 17.),

- an annual stream channel/floodplain survey to track significant changes in the sediment depositional patterns in the streambed, and

- an annual survey of land use in the area of the Dean Stallings Ford automobile dealership parking lot to verify that the land use has not changed since the issuance of the *East Fork Poplar Creek–Sewer Line Beltway Remedial Investigation Report*.

A Five-Year Review is required to evaluate whether the selected remedy remains protective. The major issue addressed by the Five-Year Review will be any uncertainty associated with the protectiveness of the 400 ppm limit as it relates to (1) changes in land use or mercury redeposition, or (2) bioaccumulation of mercury through the food chain. Monitoring activities in preparation for the Five-Year Review include the following

- vegetation surveys to verify restoration of wetlands in the remediation areas,

- a survey to verify baseline land use assumptions related to groundwater use along LEFPC,

- floodplain soil sampling in areas where redeposition has occurred to evaluate mercury concentrations in "new" sediment/soil deposition areas, and

- body burden and bioaccumulation sampling to determine if uptake of mercury through the food chain is acceptable

The RAR also indicates that if a significant flood event occurs that results in release of mercury from Y-12 at historical levels or if significant scouring of contaminated sediment occurs, then sampling may be conducted prior to the Five-Year Review.

7.4.3 Implementation of Previous Year's Recommendations

The RAR for LEFPC has been finalized as recommended in the 2000 RER

7.4.4 Evaluation of performance and stewardship data

Table 7.17 provides a summary of the Five-Year Review for LEFPC Detail on these activities is provided in the following sections.

7.4.4.1 LEFPC confirmatory sampling

Extensive confirmatory sampling was performed throughout both phases of remediation to ensure that all soils in the excavation areas exceeding the 400 ppm mercury performance standard were removed During Phase I, a total of 146 confirmatory soil samples was taken in the 36 excavation confirmation units (ECUs). All samples collected from 16- to 32-in. intervals were <400 ppm except for samples collected from ECU 11.1 (1105 ppm) and ECU 21:1 (651 ppm) The area surrounding these two locations was excavated to 32 in. bgs Additional confirmatory samples were collected at both locations from 32 to 48 in. bgs to ensure the affected areas had been excavated sufficiently The results for both samples were well below the cleanup criteria Twenty-five percent of the Phase I sample was split with an independent verification contractor The verification contractor identified one sample from ECU 021 as being above the 400 ppm. As indicated above, this area was further excavated to 32 in bgs

After mercury-contaminated soils were excavated, project personnel reviewed the radiological survey data that had been collected during the excavation and identified additional soil that required removal (approximately 170 loose yd^3)

During Phase II, 877 confirmatory samples were collected in 190 ECUs Most excavation areas were <400 ppm from 16 to 32 in bgs, however, levels >400 ppm were detected at 49 locations At these locations, samples were collected from 32 to 48 in. bgs All but three were <400 ppm At these three locations, soils were excavated until the "black layer," which was considered likely to contain elevated levels of mercury contamination, was completely removed Elevated radiological surveys required that about 39,200 additional loose yd^3 be removed.

7.4.4.2 Additional LEFPC floodplain soil sampling

In September 2000, EPA Region IV collected floodplain soil samples at the NOAA site to determine if a July 1997 flood event resulted in release of mercury from Y-12 and recontamination of LEFPC floodplain soil Samples were collected at 26 LEFPC RI ECUs and analyzed for mercury and methyl mercury There were no results above the cleanup standard of 400 ppm EPA concluded that the flood event did not have an adverse impact on the LEFPC remediation area

7.4.4.3 FY 2000 land use survey

A land use survey along LEFPC was performed in 1993 during the Feasibility Study for the East Fork Poplar Creek–Sewer Line Beltway (DOE 1994d) The results of that land use survey serve as the baseline land use condition for the LEFPC remedial action The land use categories identified during the survey included residential, agricultural, commercial, and open land use

A new land use survey was performed in 2000 as required under the RAR for the LEFPC project in order to verify baseline land use conditions along the creek The land use categories identified during the 1993 survey were used for updating current and proposed land use along the creek

Table 7.17. Lower East Fork Poplar Creek Five-Year Review summary

Question	Response	Notes
A. Is the remedy functioning as intended by the decision documents?		
Are performance standards being met (or likely to be met?)	Yes	See Sect 7 4 4 for summaries of confirmatory sampling conducted during remediation, annual monitoring results, and results of surveys and sampling performed in support of the 5-year review
Are there problems with the remedy that could lead to remedy failure or suggest that protectiveness is at risk?	No	Contaminated material above levels of concern were removed, continued protectiveness is assessed through long-term monitoring
Are the land use controls (fencing, security guards, etc) in place and preventing exposure?	Yes	See Sect 7 4 4 3, FY 2000 Land Use Survey
Are additional actions, such as removals that were deemed necessary to ensure that immediate threats were addressed completed?	N/A	Early actions along LEFPC occurred during the early 1980s to address potential risk near the Oak Ridge Civic Center and at Y-12 New Hope Pond
Are operating procedures, as implemented, maintaining the effectiveness of response actions?	N/A	No long-term operating procedures are required to support this decision
B. Are the assumptions used at the time of remedy selection valid?		
Have there been changes in the standards identified as ARARs in the ROD, newly promulgated standards and/or changes in TBCs that could call into question the protectiveness of the remedy?	Yes	MCLs are included as ARARs, new MCLs have been developed for radionuclides, no pathway to groundwater currently exists
Have there been any changes in land use or expected land use on or near the site?	Yes	See Sect 7 4 4 3, FY 2000 Land Use Survey
Have new human health or ecological exposure pathways or receptors been identified?	No	Previously identified pathway must be re-evaluated (Sect 7 4 4 4)
Have new contaminants or contaminant sources been identified?	No	
Were there any unexpected toxic byproducts of the remedy not addressed by the decision documents?	No	
Have there been any changes in the physical site conditions?	Yes	See Sect 7 4 4 3, FY 2000 Land Use Survey
Have there been any changes in the toxicity factors for contaminants of concern?	No	See Sect 7 4 4 4
Were there significant changes in the standardized risk assessment methodologies?	No	
C. Has any other information come to light that could call into question the protectiveness of the remedy?		
Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?	Yes	See Sect 7 4 4 5, Ecological Risk Activities
Is the site located in an area subject to natural disasters?	Yes	Site lies within the 500-year floodplain, low probability of earthquakes and tornadoes

ARAR = applicable or relevant and appropriate requirement
FY = fiscal year
LEFPC = Lower East Fork Poplar Creek
MCL = maximum contaminant level
NA = not applicable
ROD = record of decision
TBC = to be considered

East Fork Poplar Creek flows north along South Illinois Avenue after exiting DOE property at they Y-12 boundary Land use along this stretch of the creek has changed little since the previous survey, with the exception of the construction of the City of Oak Ridge Commercial Services building in a previously vacant area next to the Hopkins-Strang Ball Park The parcel upon which the new building has been constructed was previously considered open land use, but now would be considered commercial This is presented on Land Use Map–Segment 1 (Fig 7 7)

The stretch of East Fork Poplar Creek that flows along South Illinois Avenue is predominantly surrounded by commercial properties on the east and open areas to the west Residential areas are also encountered along this stretch There have been no changes in land use designation in this area, as indicated on Land Use Map–Segment 2 (Fig 7 8)

East Fork Poplar Creek intersects the Oak Ridge Turnpike and crosses to the north side of the road before taking a western turn [Land Use Map–Segment 3 (Fig 7 9)] The land use is a combination of residential and commercial, including a YWCA and a National Guard Armory Robertsville Junior High School has been converted to Robertsville Middle School The land use for this parcel (#273) does not change, however, it should be noted that the students now attending the school represent a slightly younger age group The Jefferson Tennis Courts (parcel #410) are now occupied by Girls Inc ® a national non-profit youth organization The land use for parcel #410 has been changed from residential to commercial No other land use changes have been identified for this segment of the creek

East Fork Poplar Creek then curves south and crosses the Oak Ridge Turnpike before beginning a westerly path along the south side of the road Much of the vacant open land use area and formerly agricultural land use area have been developed into residential use area In addition, Parcel 343, formerly considered a residential land use, has been developed commercially These land use changes are presented on Land Use Maps–Segments 4–10 (Figs 7 10 through 7 16)

As East Fork Poplar Creek turns northwest and crosses the Oak Ridge Turnpike again, it enters into DOE property, as indicated in Land Use Maps–Segments 11–15 (Figs 7 17 through 7 21) Horizon Center is a new business and industrial park under development on the eastern end of the DOE property There are seven major development sites ranging form 11 to 148 acres in size, encompassing a total of 426 acres Only one site has been leased and is currently occupied by Theragenics Corporation (Figs 7 19 and 7 20) No other land use changes have been identified for these portions of the creek Surveyed property boundaries of this new development were not available at the time of the Five-Year Review land use survey This will be updated during the next survey

In addition to surveying land use, a review of potential groundwater use was performed Contact with officials at the City of Oak Ridge indicated that no new water wells for human or livestock use have been constructed in the LEFPC floodplain since finalization of the ROD The city has an established municipal water supply system that serves all residences and commercial establishments in or near the LEFPC floodplain

Current State of Tennessee regulations require that groundwater wells for water consumption be permitted by TDEC's Division of Water Supply Contact with officials at the Division of Water Supply in Nashville indicated that there are no water wells in the LEFPC floodplain permitted by the state

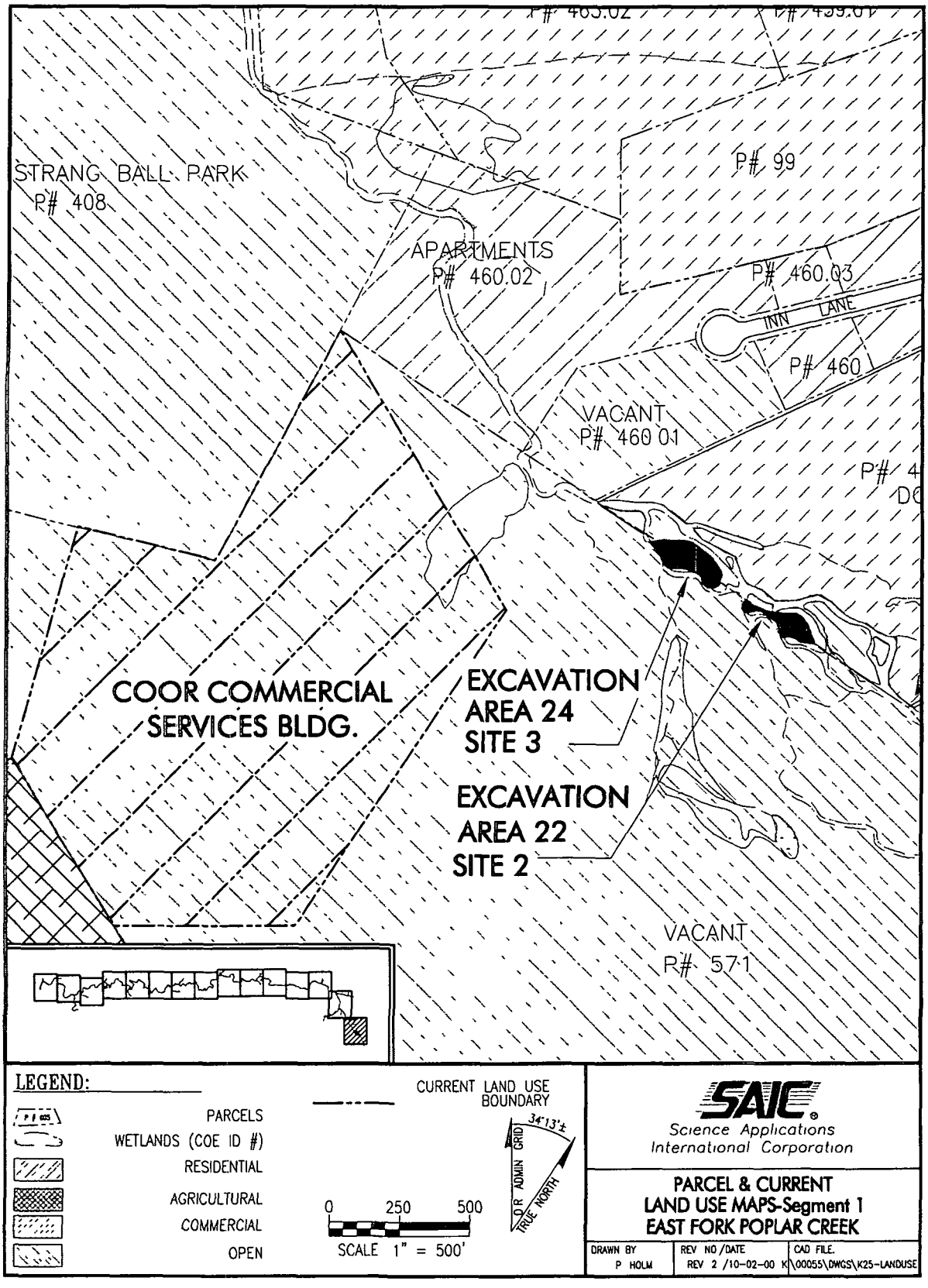

Fig. 7.7. Land use map—Segment 1

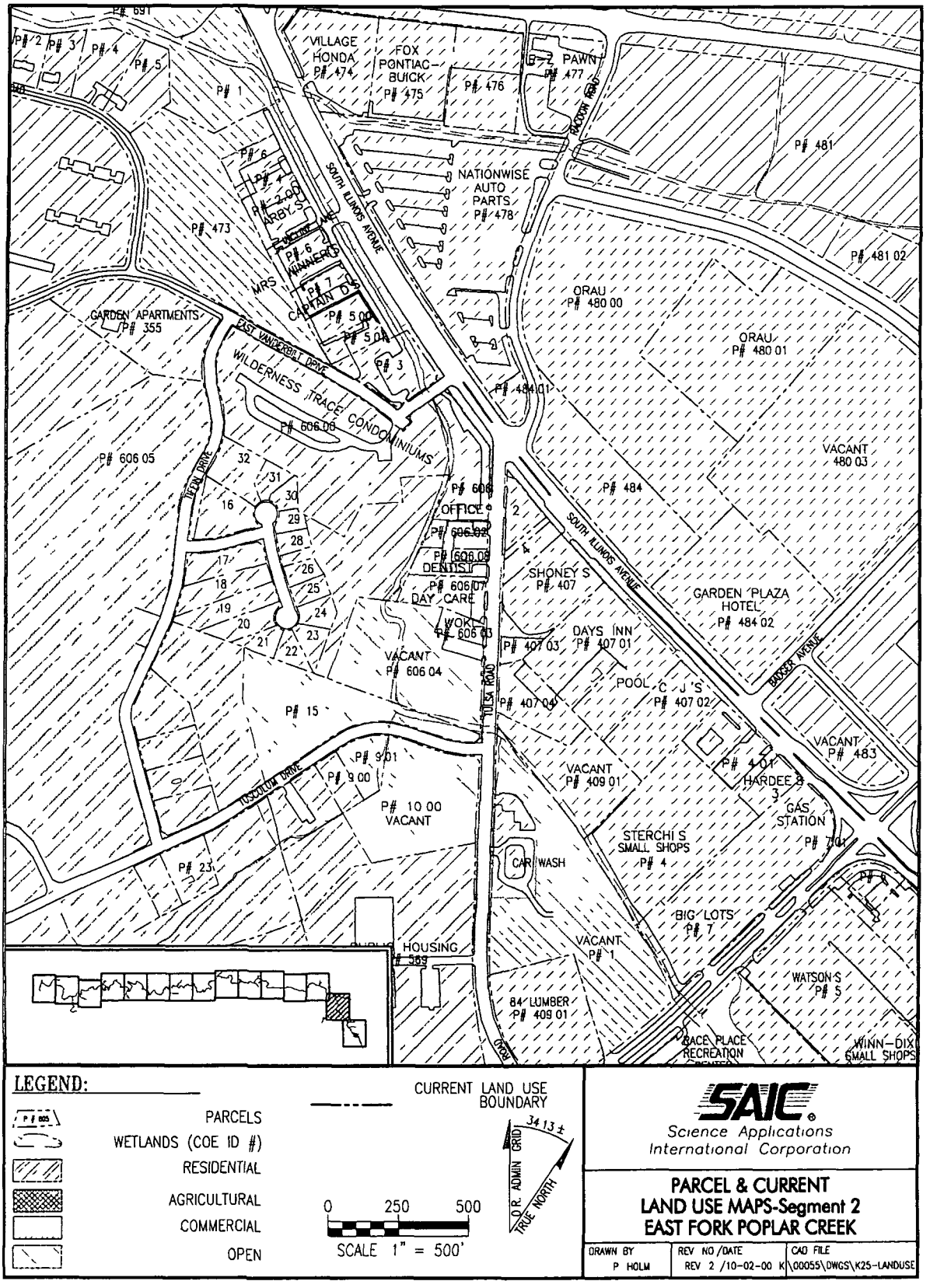

Fig. 7.8. Land use map—Segment 2.

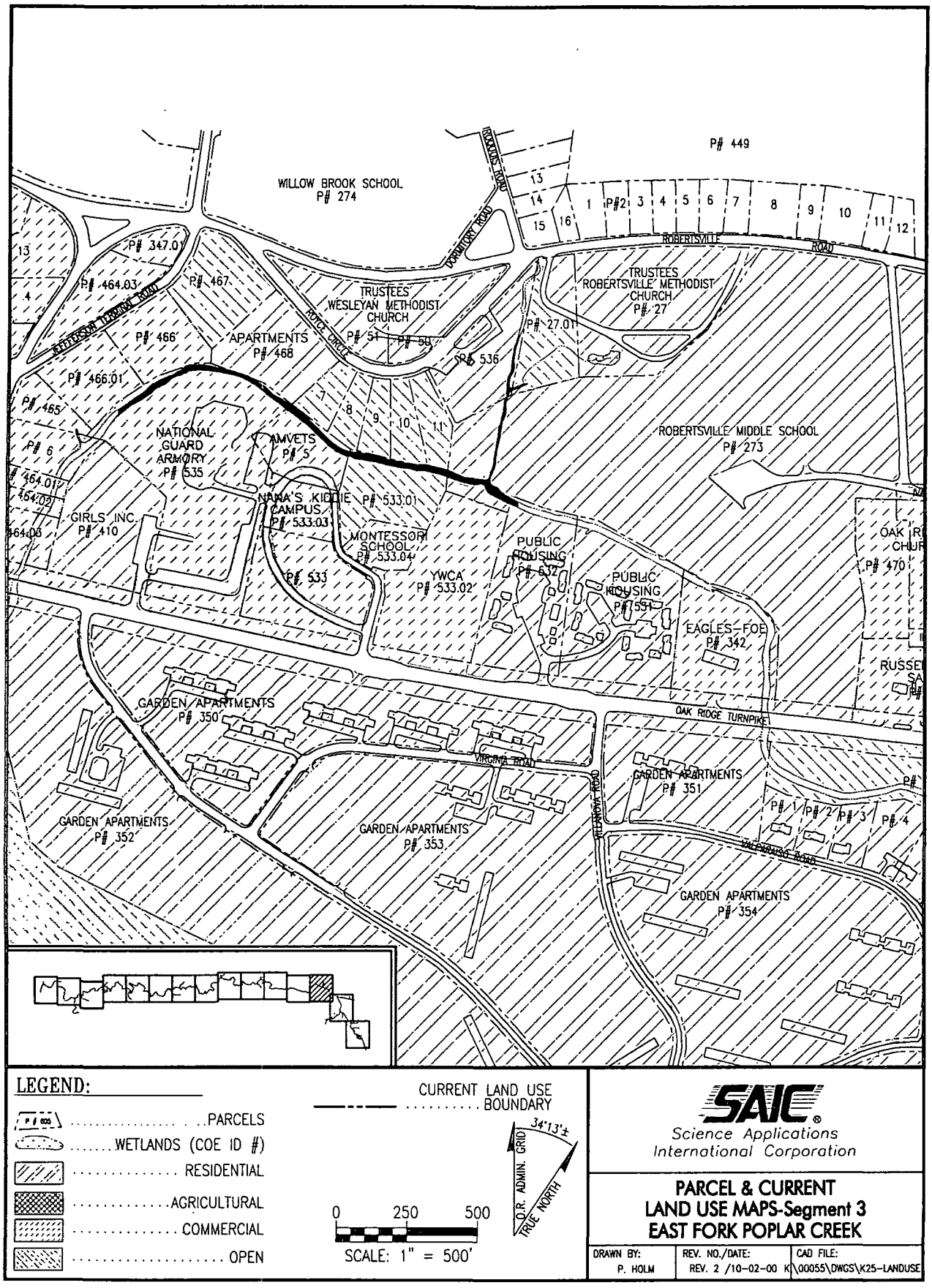

Fig. 7.9. Land use map—Segment 3

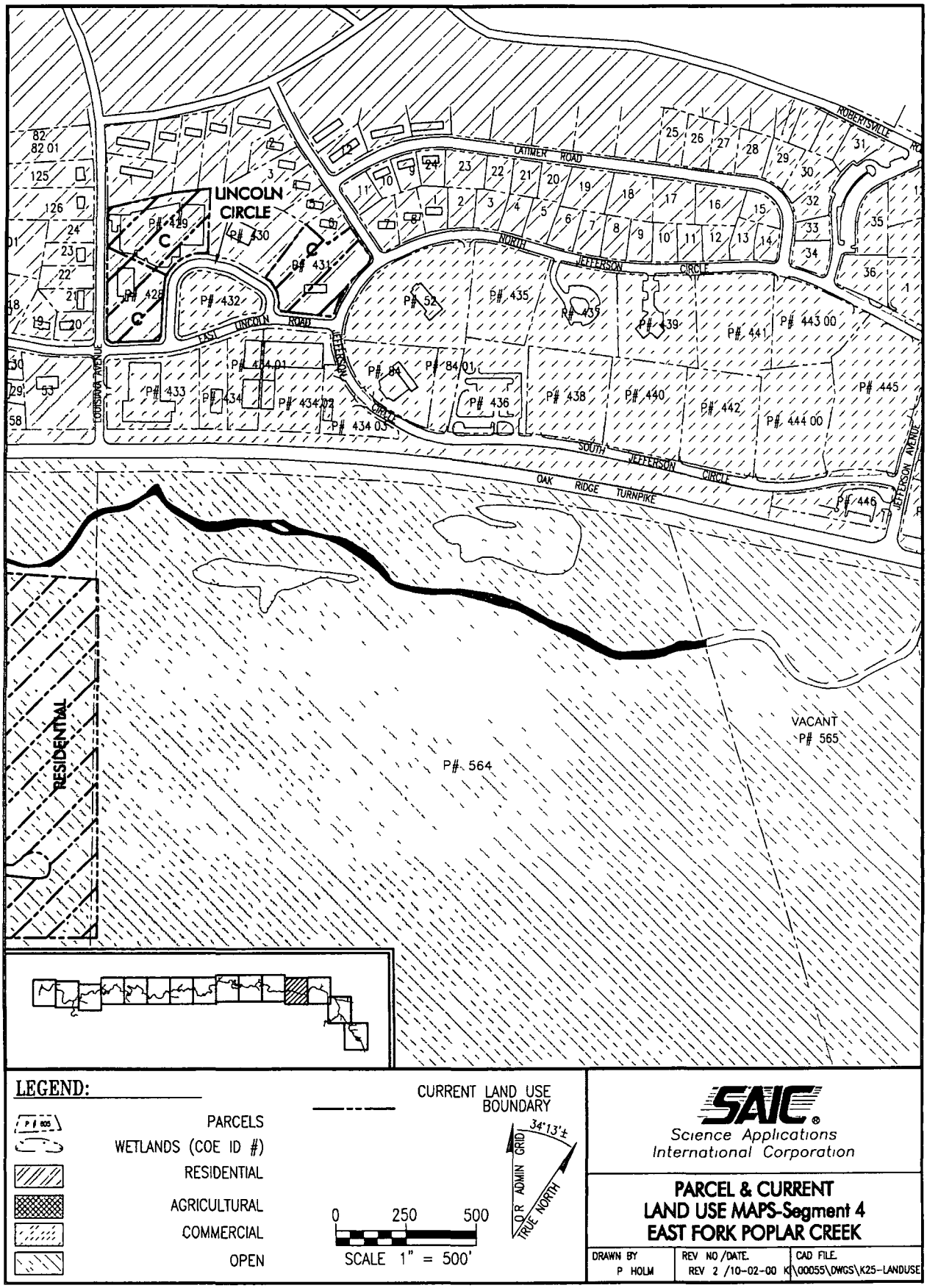

Fig. 7.10. Land use map—Segment 4.

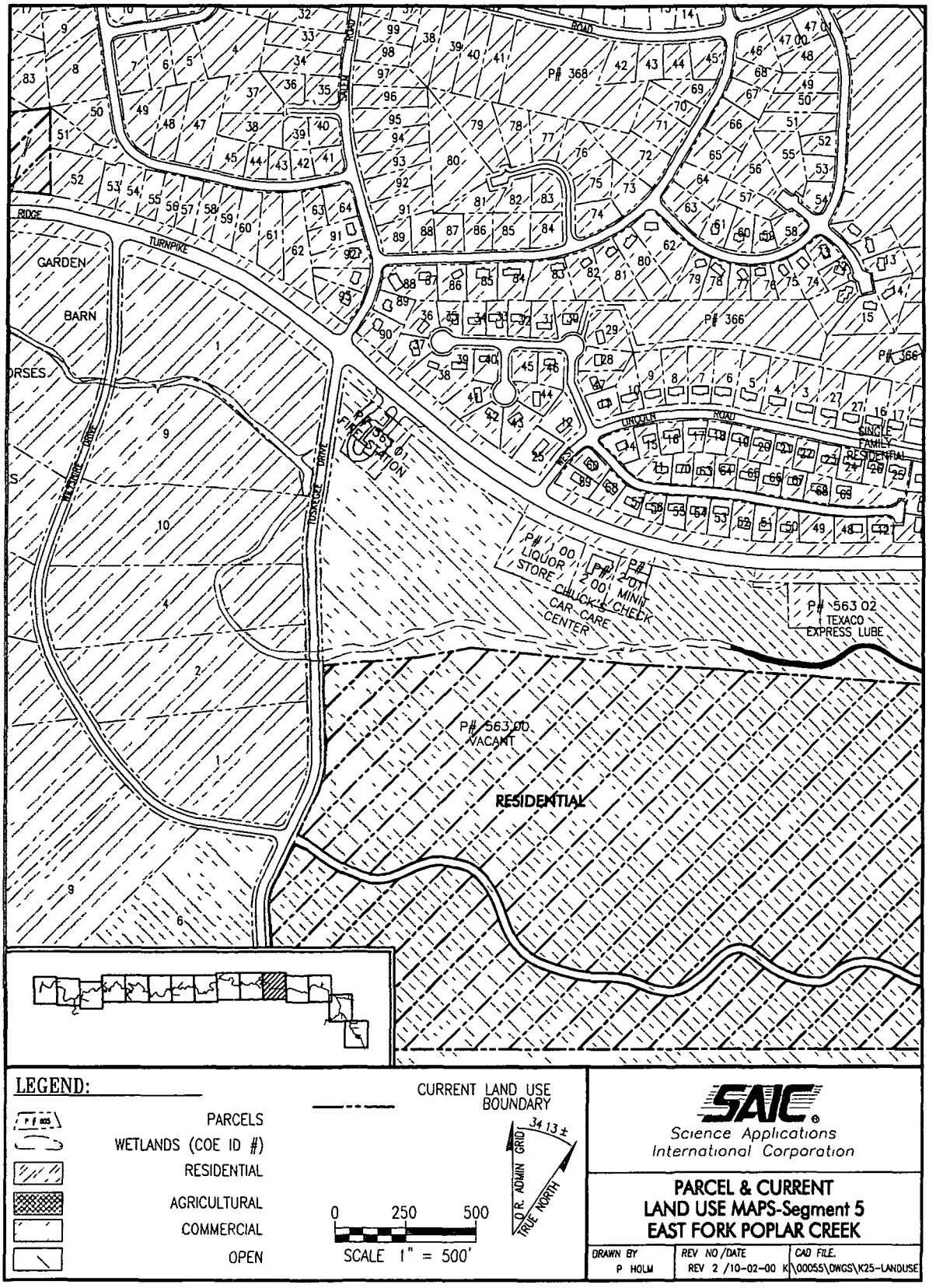

Fig. 7.11. Land use map—Segment 5.

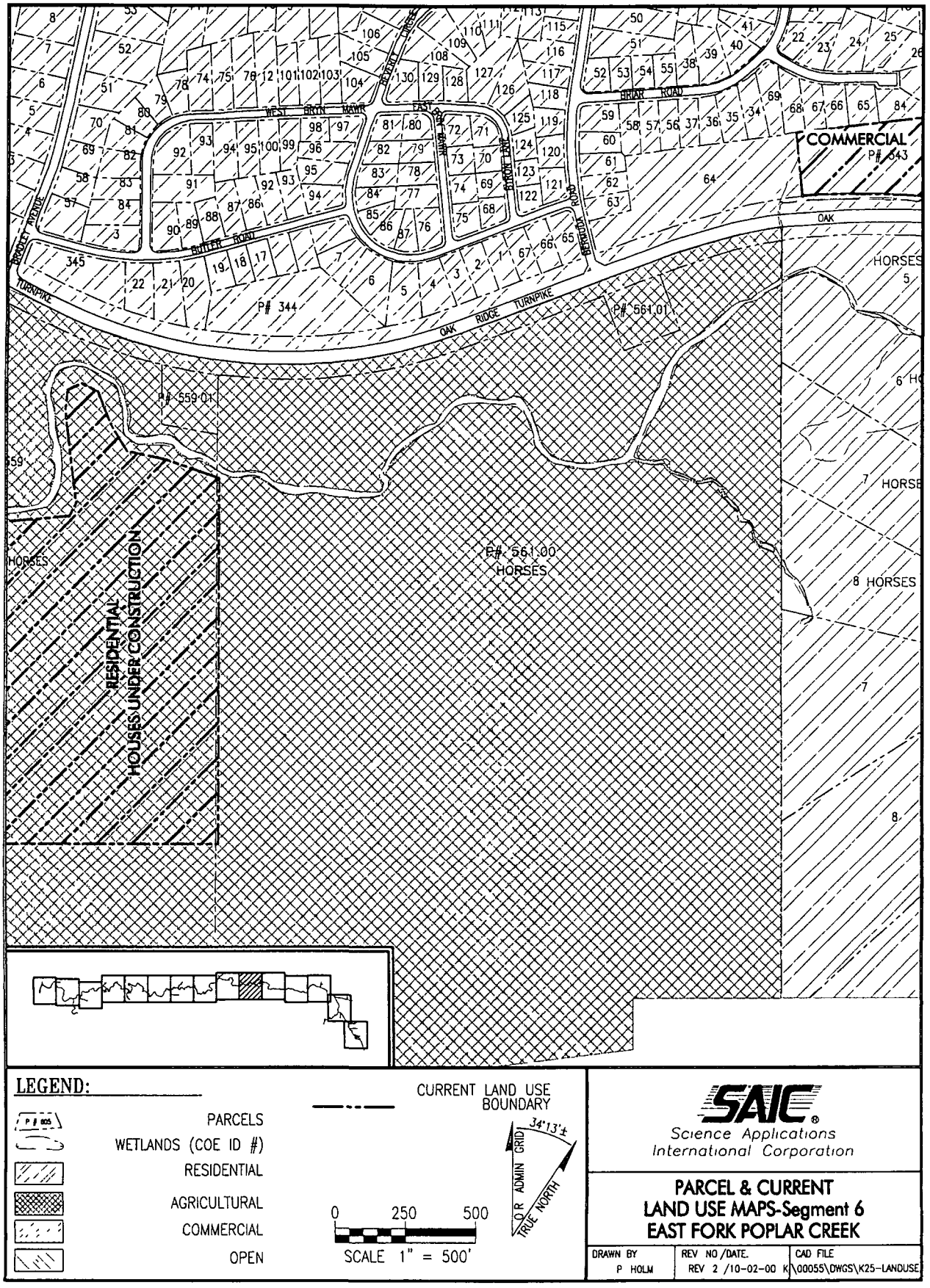

Fig. 7.12. Land use map—Segment 6.

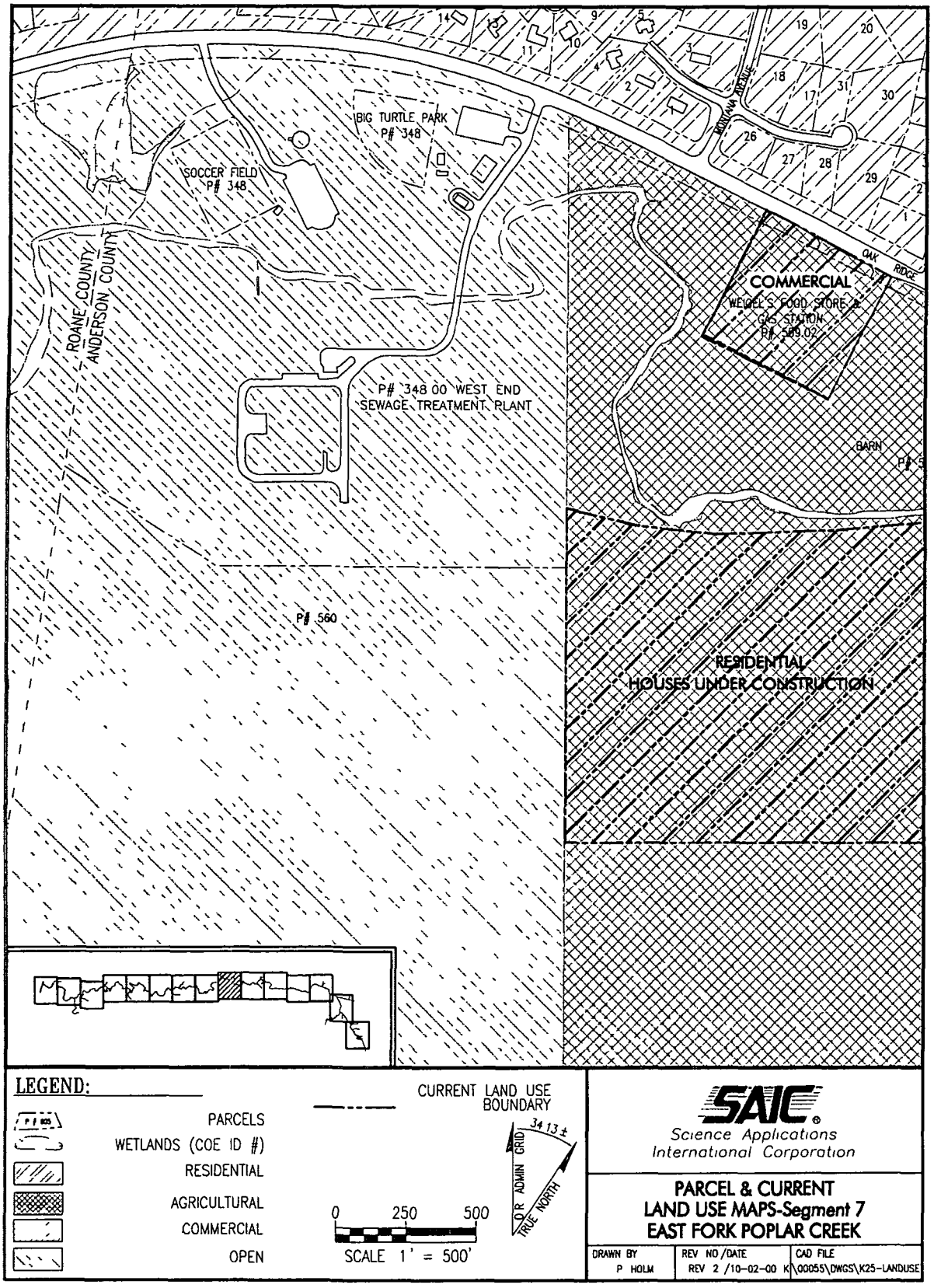

Fig. 7.13. Land use map—Segment 7.

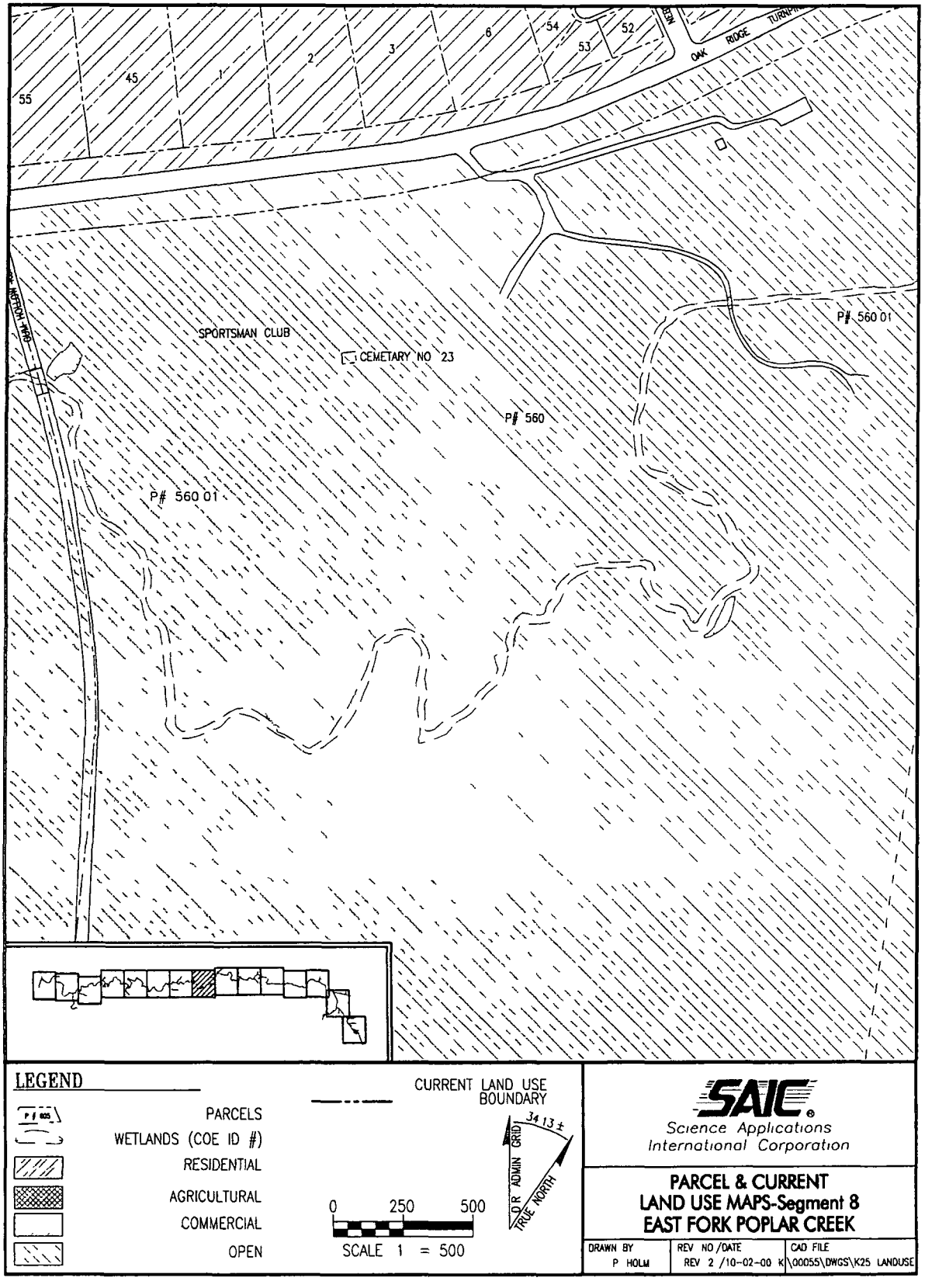

Fig. 7.14. Land use map—Segment 8.

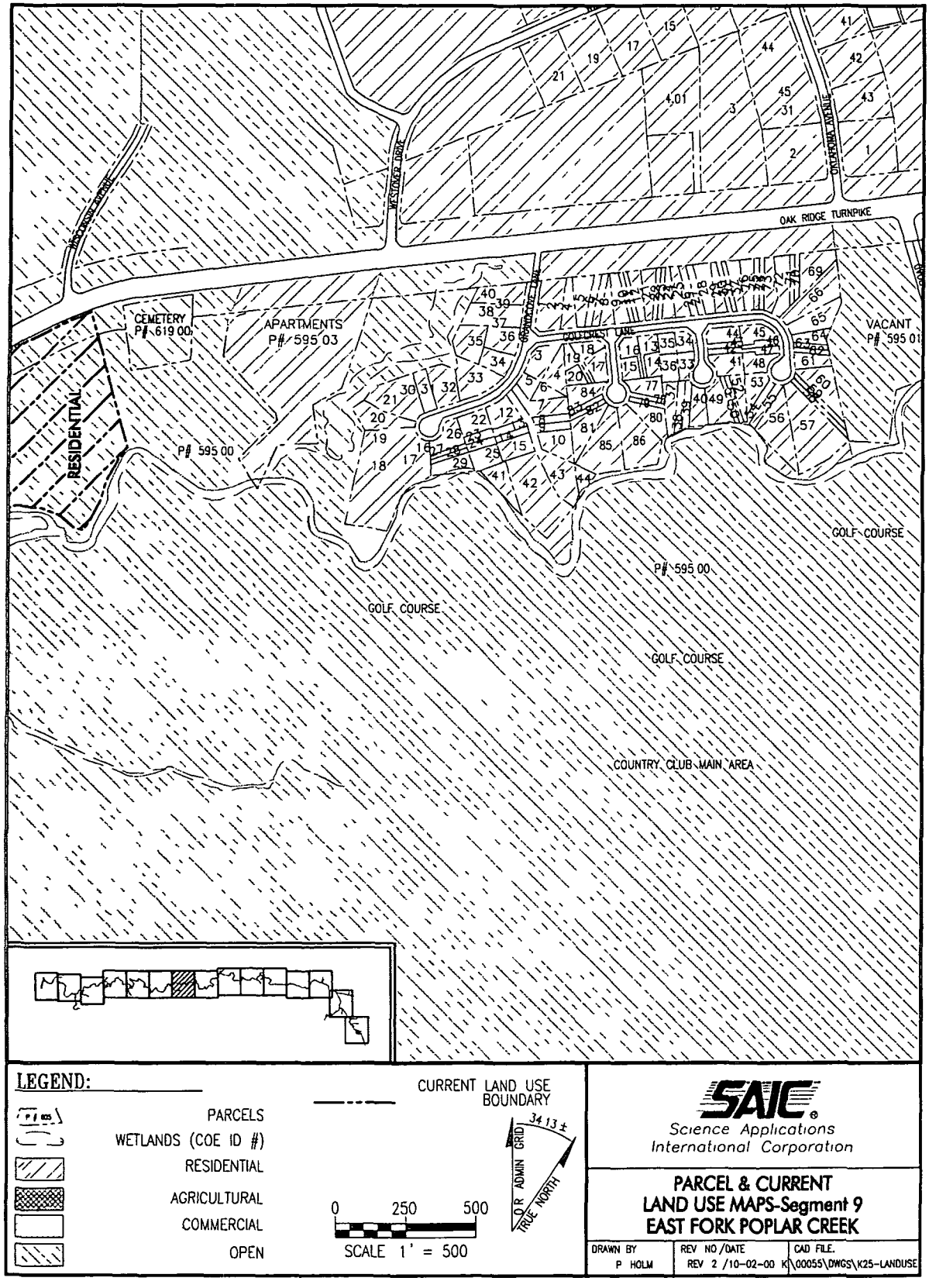

Fig. 7.15. Land use map—Segment 9.

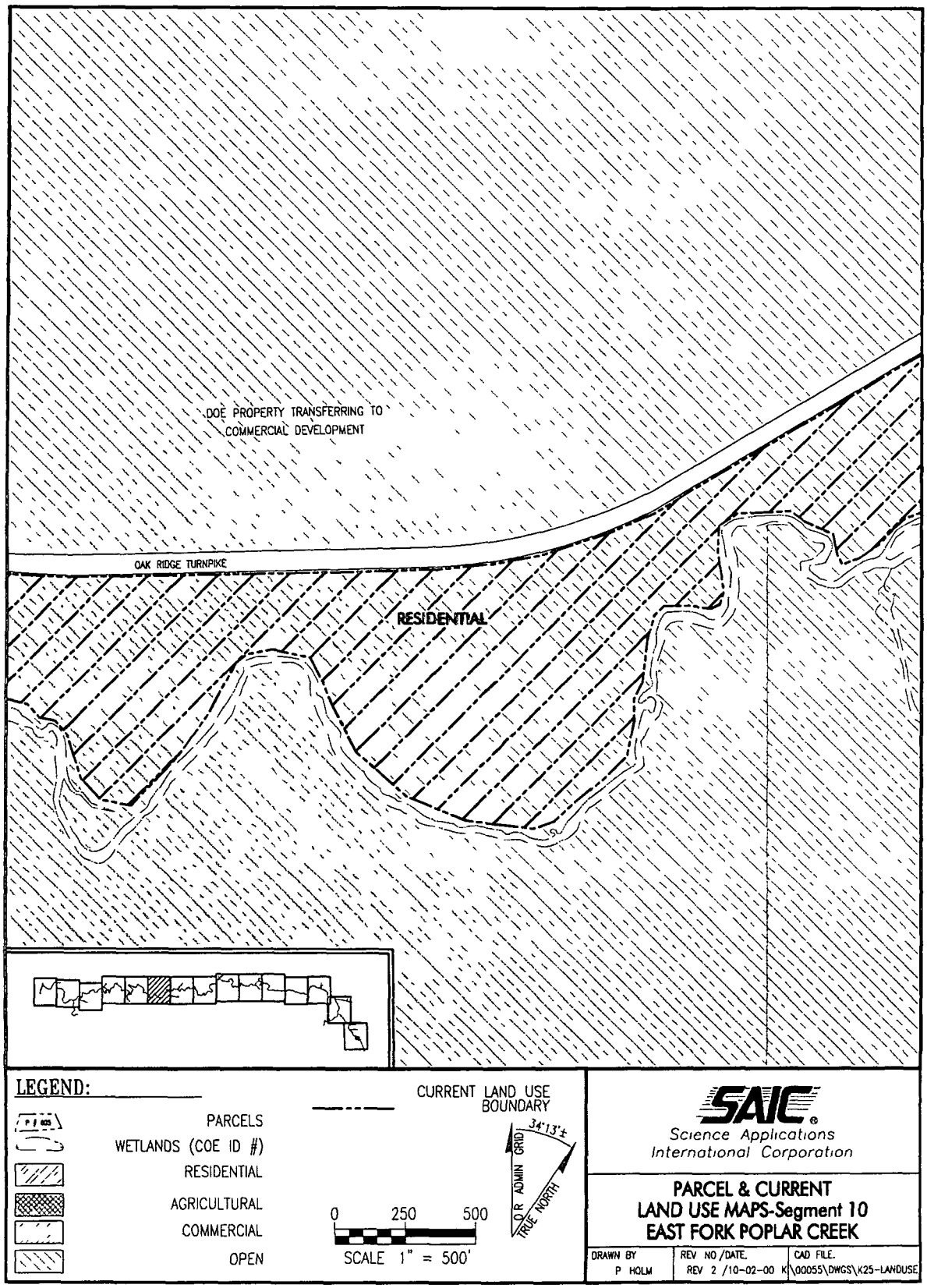

Fig. 7.16. Land use map—Segment 10.

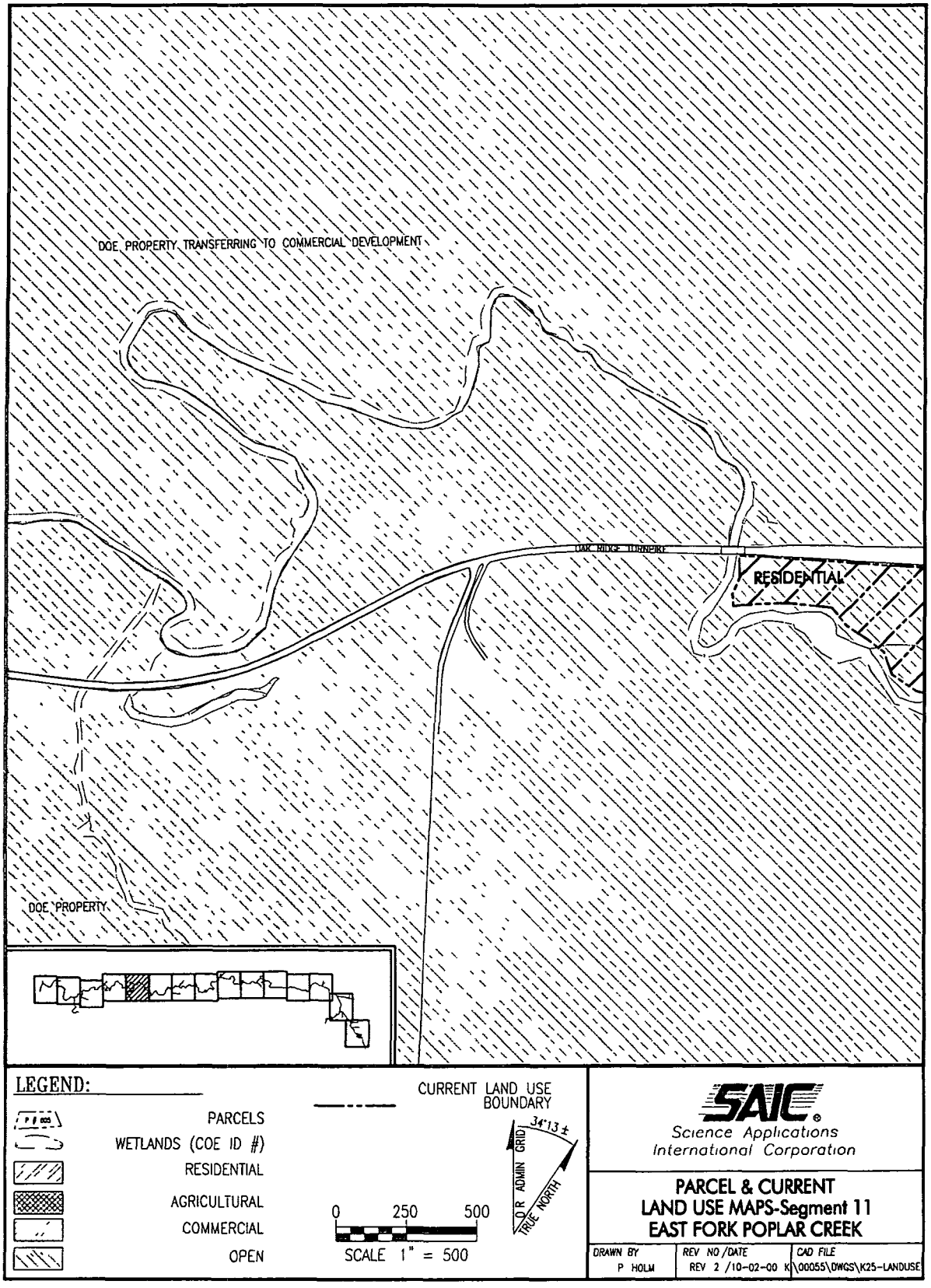

Fig. 7.17. Land use map—Segment 11.

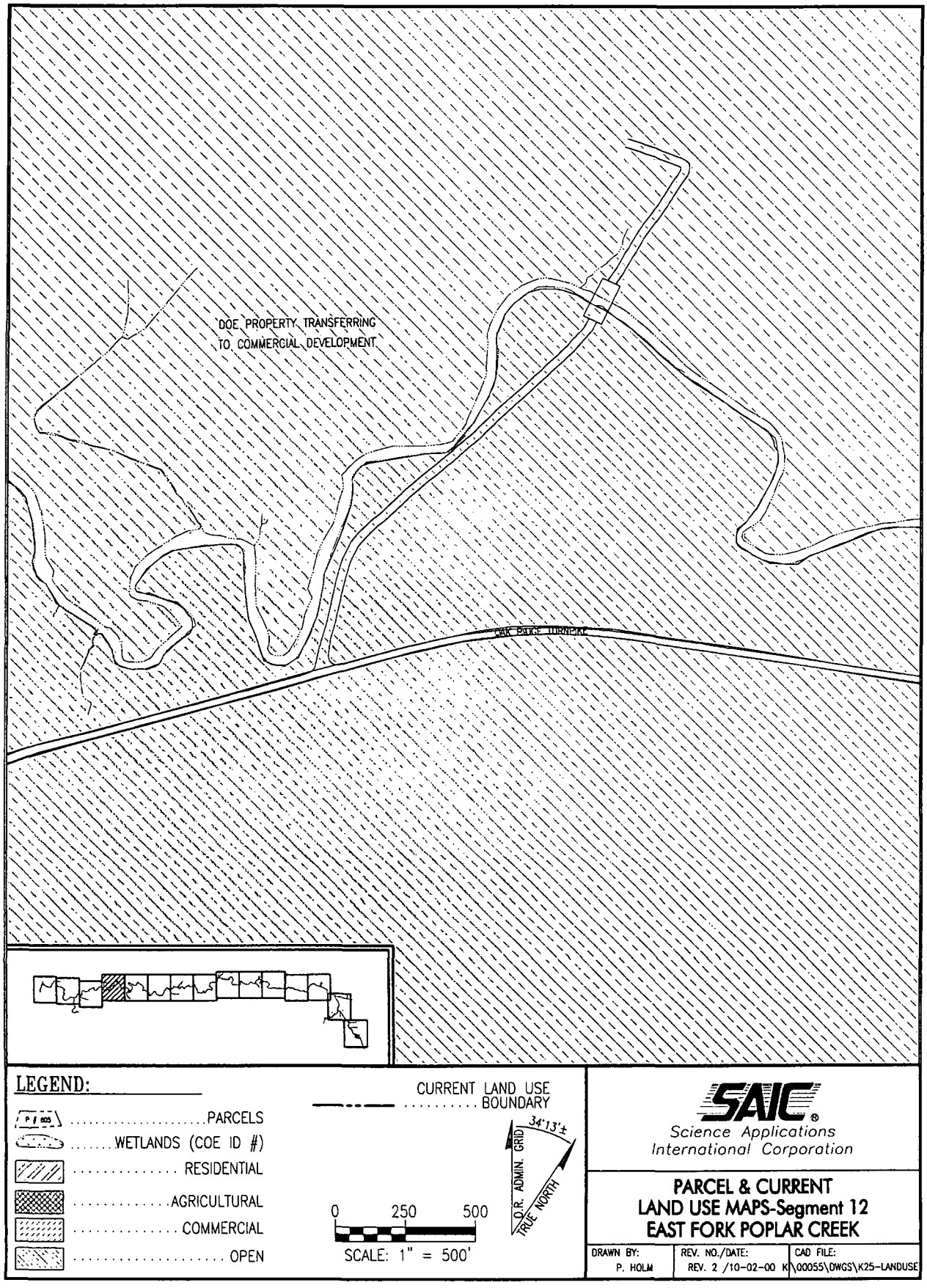

Fig. 7.18. Land Use Map–Segment 12.

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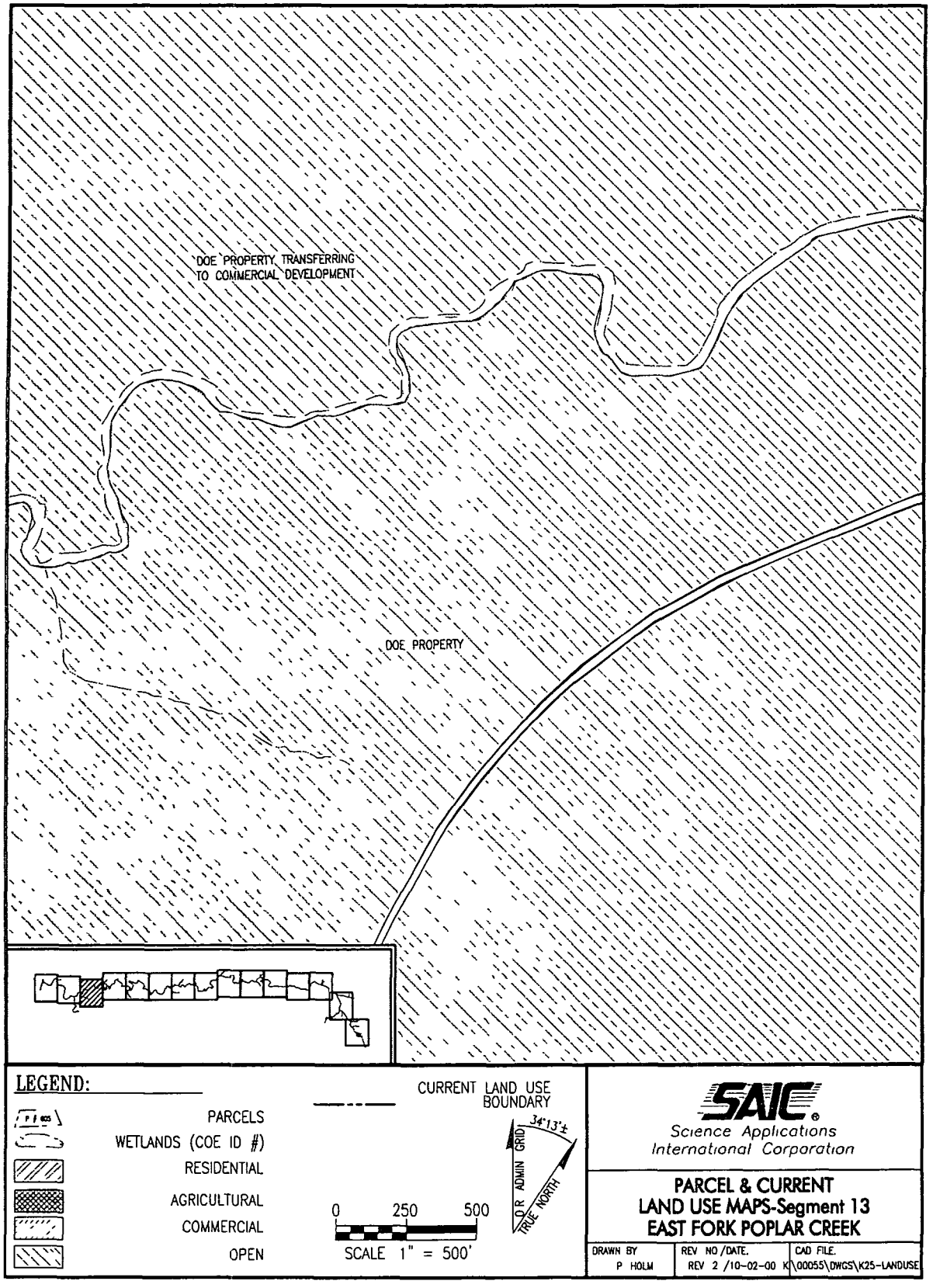

Fig. 7.19. Land use map—Segment 13.

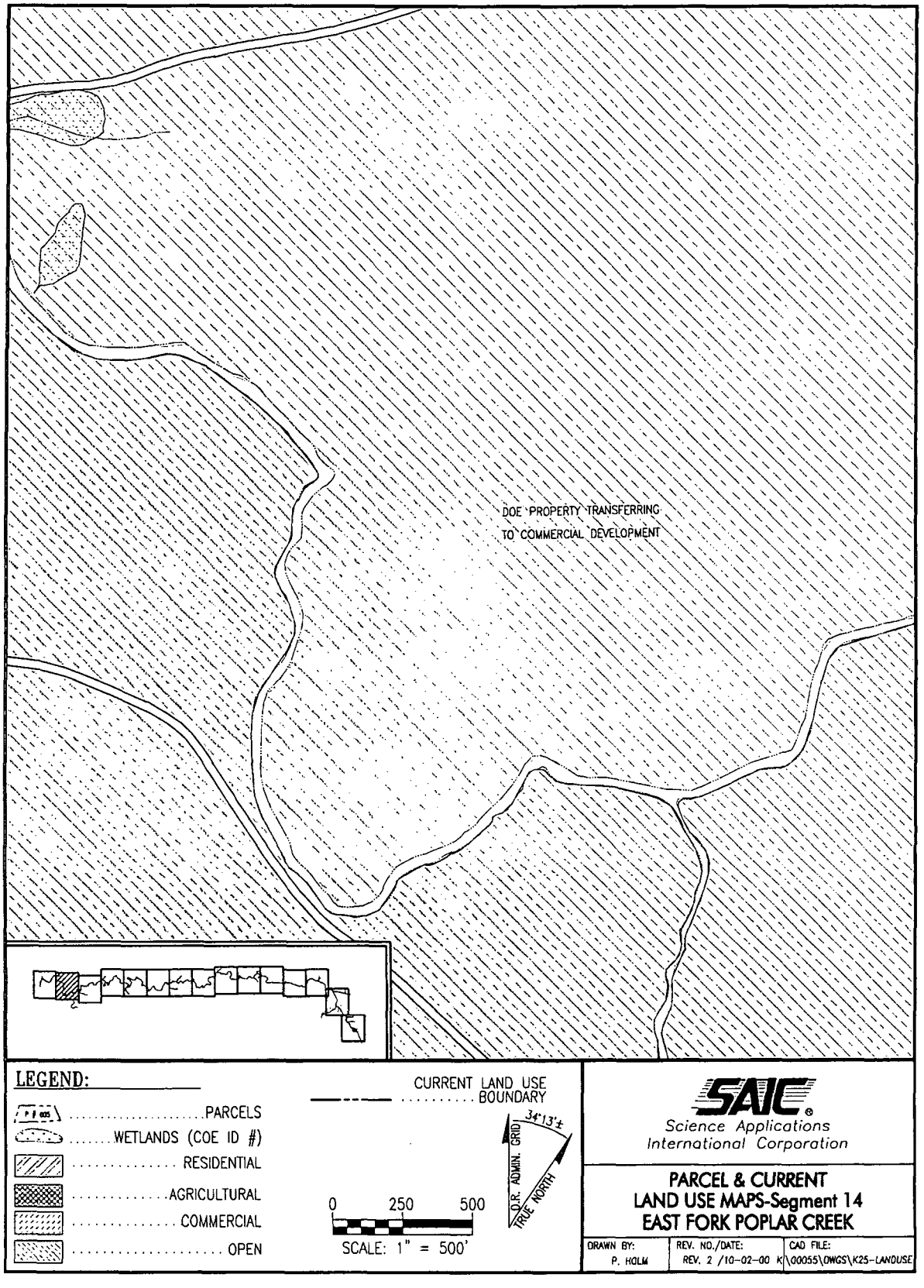

Fig. 7.20. Land use map—Segment 14.

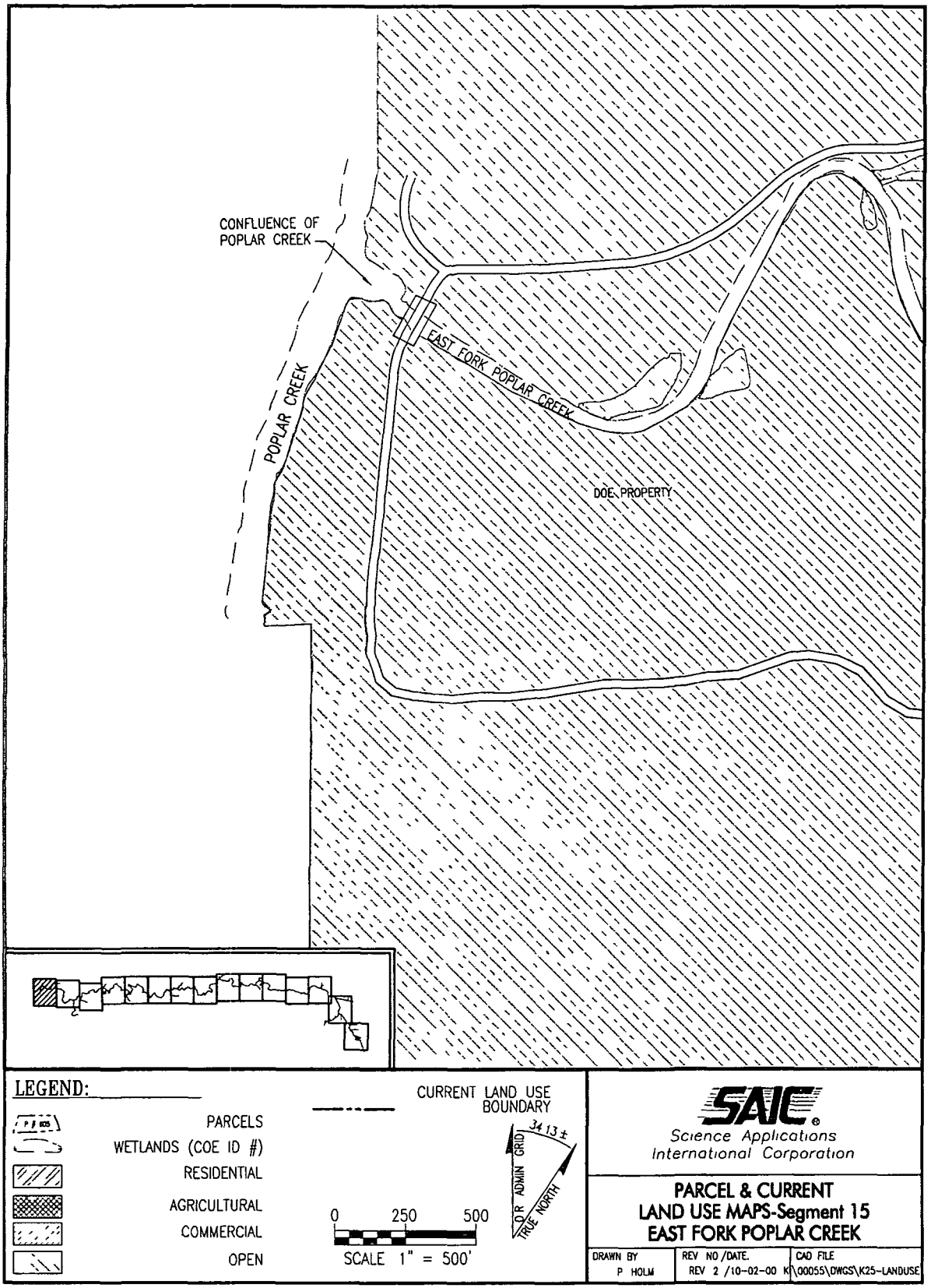

Fig. 7.21. Land use map—Segment 15.

7.4.4.4 FY 2000 wetlands vegetation survey

Lower East Fork Poplar Creek Wetland Mitigation Survey. A vegetation survey was conducted at each of the three wetland mitigation sites on August 21, 2000, as indicated on the land use map, Segment 1 (Fig. 7.7). The vegetation survey consisted of a thorough walkover of each site. A list of the most common species was made during the walkover survey In order to determine mitigation goals, the list of species at each site was compared to the wetland indicator status rating in the list of wetland plants for the southeastern United States (Reed 1988). As specified in the RAR (DOE 2000f), a predominance of plants with a wetland indicator status of obligate and facultative wetland was assumed to be sufficient evidence to determine if the wetland mitigation was successful or not. No intrusive sampling of soils was conducted; however, field indicators of wetland hydrology were noted at each site Wildlife usage at each site was also noted. Table 7.18 lists the most common plants at each site and their wetland indicator status. Copies of field data forms are also included.

Mitigation site 1 (Excavation area 16) is the largest of the mitigation sites, it also has the greatest biological diversity. A total of 36 plants were common at Mitigation site 1 (Table 7.18). Common plants at the site include 12 obligate plants, 20 facultative wetland plants, 3 facultative plants, and 1 facultative upland plant Field indicators of wetland hydrology included inundation, saturated soils, and drainage patterns in wetlands. Mitigation site 1 is currently functioning as a wetland; most of the plants present at the site are obligate and facultative wetland species, and there are positive field indicators of wetland hydrology.

Mitigation site 2 (Excavation area 22) is located on a small island in East Fork Poplar Creek A total of 16 plants were common at Mitigation site 2 (Table 7.18) Common plants at the site include eight obligate plants, seven facultative wetland plants, and one facultative upland plant. Field indicators of wetland hydrology included drift lines and drainage patterns in wetlands Mitigation site 2 is currently functioning as a wetland; most of the plants present at the site are obligate and facultative wetland species, and there are positive field indicators of wetland hydrology

Mitigation site 3 (Excavation area 24) is located on an old island in East Fork Poplar Creek Soon after construction, the creek channel around the north side of the island filled in during a storm event and the site is no longer an island A total of 18 plants were common at Mitigation site 3 (Table 7 18) Common plants at the site include 3 obligate plants, 11 facultative wetland plants, 2 facultative plants, and 2 facultative upland plants Field indicators of wetland hydrology included drift lines and drainage patterns in wetlands Mitigation site 3 is only functioning marginally as a wetland; however, most of the plants present at the site are obligate and facultative wetland species, and there are positive field indicators of wetland hydrology

In general, all three wetland mitigation sites are heavily vegetated, and the majority of plant species at each site consists of hydrophytic (obligate or facultative wetland) plants Wetland mitigation has been most successful at Mitigation sites 1 and 2, however, Mitigation site 3 is dominated by hydrophytic plants and also has positive field indicators of wetland hydrology All three sites are dominated by herbaceous species, but each site contains a relatively diverse mixture of woody plants (shrubs and trees) As ecological succession proceeds over time, bottomland hardwood forest communities should eventually develop at each site A number of animals that frequent wetland habitats were also observed at all three sites Animals observed during the site visit included fish, frogs (bull frog and green frog), turtles (red eared sliders), snakes, and birds (belted kingfisher and Canada geese)

and calculation of risk-based cleanup ...
of the ROD IRIS published revised toxicity information for inorganic mercury as mercuric chloride in May 1995 The oral RfD currently available in IRIS is 0.00003 mg/kg-day Inorganic mercury is currently classified as a group C carcinogen, however, no cancer slope factor is available No new toxicity data for mercury have become available since the ROD that would result in increased risk associated with the risk-based cleanup level of 400 ppm in floodplain soil identified in the ROD

Table 7.18. Wetland plant list: Wetland mitigation sites 1, 2, and 3 (Excavation areas 16, 22, and 24)

Common name	Scientific name	Wetland indicator status: Southeast region *	Mitigation site 1	Mitigation site 2	Mitigation site 3
ash, green	*Fraxinus pennsylvanica*	FACW	X		
beggar-ticks, devil's	*Bidens frondosa*	FACW	X	X	X
boxelder	*Acer negundo*	FACW	X	X	X
bugleweed, Virginia	*Lycopus virginicus*	OBL	X	X	X

The reduced bioavailability of mercury in East Fork Poplar Creek floodplain compared to the mercuric chloride used in the toxicity evaluation was measured experimentally using East Fork Poplar Creek floodplain soils No new information has become available to supercede the site-specific value used

Available toxicity information for other contaminants of potential concern in East Fork Poplar Creek media was also evaluated to determine whether new data have become available that could result in another chemical driving remediation. The RfDs (oral or inhalation) currently available in IRIS are higher (i e , lower toxicity) for three contaminants of potential concern (manganese, 2-butanone, carbon disulfide) than the values available at the time of the ROD The oral RfD for beryllium currently published by IRIS (2.00E-03) is slightly lower than the value used at the time of the ROD (5 00E-03), indicating a slight increase in the estimated toxicity of this chemical However, this change is too small to impact the conclusions of the ROD.

The cancer slope factors (oral or inhalation) for non-radionuclide contaminants of potential concern currently available in IRIS are lower (i.e , lower toxicity) for four contaminants of potential concern (arsenic, Aroclors, benzo(k)fluoranthene, chrysene) than the values available at the time of the ROD The screening factors have not increased (i e , higher toxicity) for any of the contaminants of potential concern, and no new screening factors have become available The cancer slope factors for radionuclide contaminants of potential concern currently available in HEAST differ slightly from those available at the time of the ROD, however, these differences are not large enough to impact the results of the risk assessment Based on this evaluation, the estimated cancer risks summarized in the ROD have not changed, therefore, no change in the remediation levels is appropriate

Exposure Assessment Assumptions. As indicated in Sect 7 4 4 2, there have been several land use changes along LEFPC from 1993 to 2000 Of primary interest for the Five-Year Review are locations where land use changes could result in different and, more importantly, more conservative receptor and exposure assumptions than were used to make the remediation decisions for the floodplain soils Along this line, this discussion will focus on areas where land use changed from a more restrictive to a less restrictive condition (e g , from industrial to residential)

As a reminder, the land use scenarios and soil exposure pathways that were evaluated in the LEFPC RI/FS and used in the ROD are summarized in Table 7 19

Table 7.19. Land use scenarios in the LEFPC baseline risk assessment

Land use	Soil exposure pathways
Residential	Dermal, incidental ingestion, ingestion of homegrown produce
Agricultural	Dermal, incidental ingestion, ingestion of homegrown produce, ingestion of beef and milk
Commercial	None (evaluates groundwater exposures)
Open	Dermal, incidental ingestion (characterized by shortened frequencies of exposure than residential land use)

LEFPC = Lower East Fork Poplar Creek

Based on the FY 2000 survey results, the following land use changes and associated risk issues occurred

Segment 1—Open to Commercial,
Segment 2—None,
Segment 3—None

Segment 4—None,
Segment 5—Open to Residential,
Segment 6—Agricultural to Residential,
Segment 7—Agricultural to Residential,
Segment 8—None,
Segment 9—Open to Residential (small potion of segment changed),
Segment 10—Open to Residential,
Segment 11—Open to Residential (small potion of segment changed),
Segment 12—Open to Commercial,
Segment 13—Open to Commercial,
Segment 14—Open to Commercial, and
Segment 15—Open to Commercial.

Land use in Segments 5, 6, 7, 9, 10 and 11 changed to residential Since the Remedial Goal Objective (RGO) for all segments of LEFPC was based on the scenario of future potential residential land use, the fact that land use has changed to residential may not be of concern.

The child ingestion scenario was selected as the creek-wide basis of the RGO Additional exposure scenarios, primarily the food chain exposure pathways (e.g. meat and vegetable ingestion), were identified as potential risk issues but were discounted in the final decision. These pathways were identified as a potential risk because animals and plants may bioaccumulate mercury and other COCs. Recent regulatory guidance quantifying these pathways has been developed and is provided in "Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities" (EPA 1999a), and the 1997 Exposure Factors Handbook (EPA 1997).

The combination of several issues, including the change in land use, the greater potential for residential gardening, and the new guidance may warrant additional evaluation of the residential gardening scenario.

7.4.4.6 Ecological Monitoring

Biota sampling in LEFPC and its floodplain had the purposes of (1) determining whether mercury mobilized from the floodplain soil as a consequence of remediation caused an increase in bioaccumulation of mercury by fish in LEFPC, and (2) addressing the uncertainty that the lower limit mercury concentration of 400 mg/kg that was required for remediation is protective of ecological receptors.

Fish Sampling. The purpose of post-remediation biota sampling in LEFPC was to determine whether remedial activities in the LEFPC floodplain had caused an increase in mercury concentrations in fish. These results were initially published in the FY 2000 RER. Sunfish and stonerollers were sampled in April 1999 at EFK 23 4 (the Y-12 outfall), EFK 20.2, EFK 18.2 (above and below a remediation site), EFK 13.8, EFK 6.3 (also above and below a remediation site), and a reference site at Hinds Creek Concentrations in redbreast sunfish were highest at EFK 20.0, decreasing with distance downstream (Fig 7.22). In both cases, mercury concentrations in sunfish were about 20% lower downstream of the remediation site as compared to upstream of the site, implying that the remediation sites were not sources of mercury exposure to sunfish

Total mercury concentrations in stonerollers were about 50% lower at EFK 18.2 than at EFK 20 0, but about 50% higher at EFK 6 3 than at EFK 13.8. The fraction of methyl mercury in stonerollers showed a distinct gradient, steadily increasing from 6% at EFK 23.4 to 85% at EFK 6 3 (Fig. 7 23) Because stonerollers occupy a low trophic level, the fraction of methyl mercury in their tissues likely reflects the distribution of methyl mercury in surface water and sediment. Newly deposited sediment or

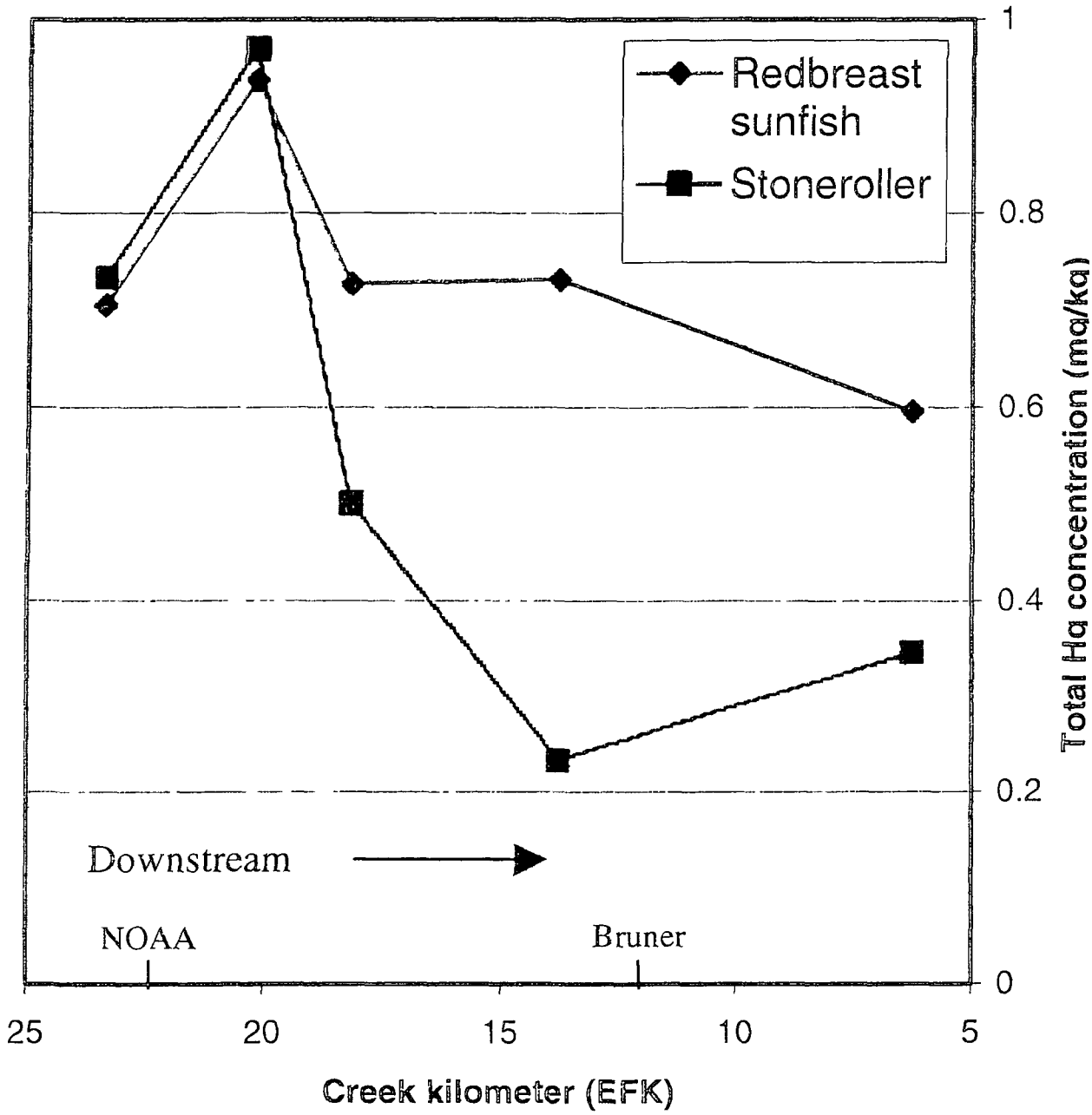

Fig. 7.22. Total mercury concentrations in redbreast sunfish and stonerollers in LEFPC.

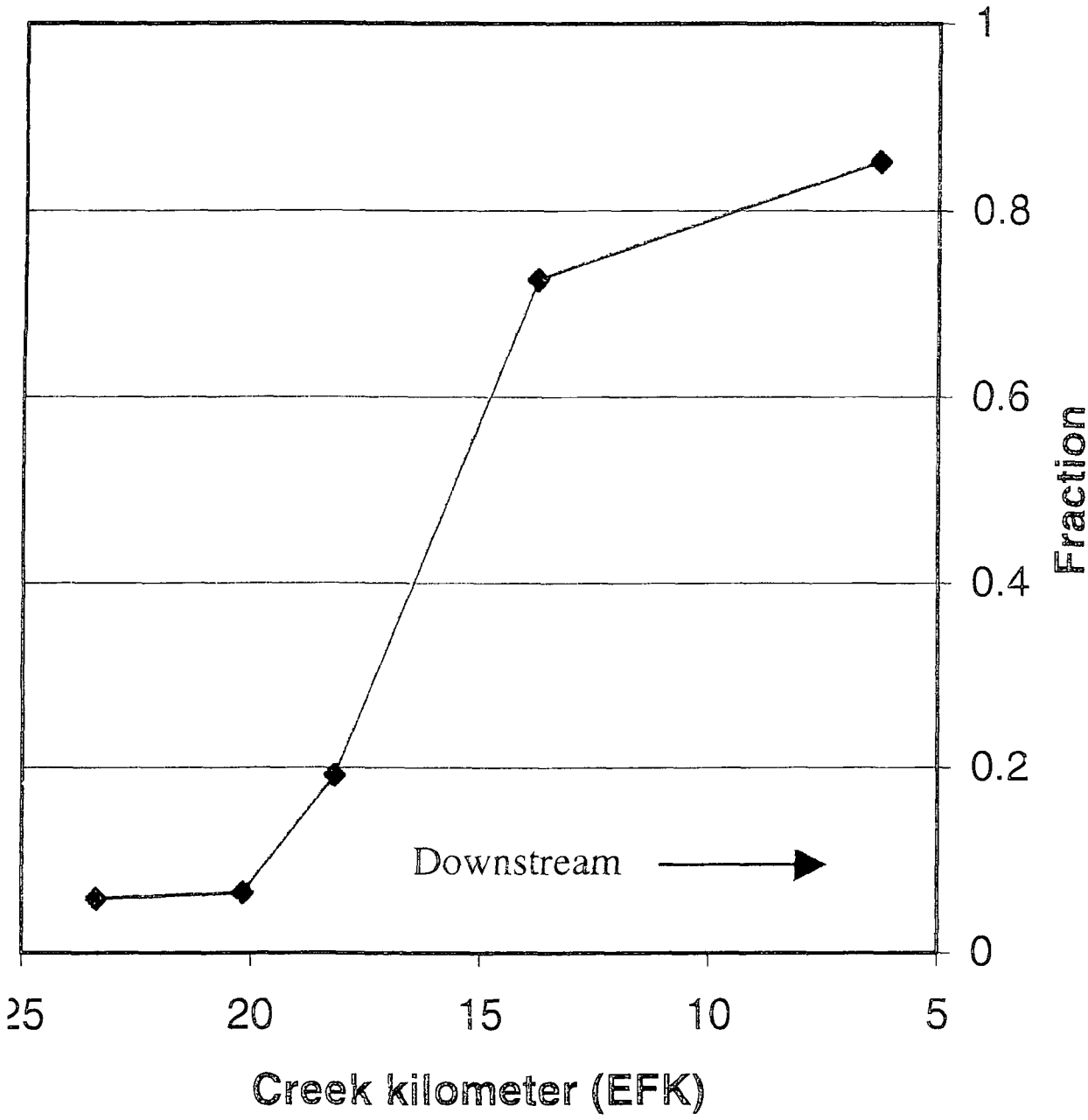

Fig. 7.23. Fraction of total mercury as methyl mercury in stonerollers.

soluble mercury leached from the remediation sites would have very low methyl mercury content Therefore, the increasing fraction of methyl mercury downstream of each remediation site probably indicates that the remediation sites are not sources of mercury exposure to stonerollers Furthermore, the continual drop in total mercury concentrations with distance downstream (Fig 7 22) follows a historic trend documented by the BMAP for East Fork Poplar Creek and implies that the principal source of mercury contamination to LEFPC fish is ongoing releases from Y-12 A gradual decrease in mercury concentrations at EFK 23 4 suggests that the impact of releases from Y-12 continues to fall

Terrestrial Biota Sampling. Terrestrial biota were sampled in the LEFPC floodplain before and after remediation to evaluate the effectiveness of remediation Earthworms and starling eggs and nestlings were sampled, and starling reproductive success was evaluated at remediation sites near EFK 22 6 and EFK 17 3, at two sites where soil mercury concentrations were moderately elevated but below the remediation goal of 400 mg/kg Typical concentrations of total mercury are reported to be 80 to 1100 ng/g in plant-eating insects and 30 to 350 ng/g in terrestrial birds, concentrations in earthworms are likely to be higher than in plant-eating insects because earthworms ingest large quantities of soil The ranges of total mercury concentrations in post-remediation samples from the LEFPC floodplain were 220 to 2700 ng/g in earthworms and 110 to 494 ng/g in starlings The Post-remediation Monitoring Program Baseline Report (ORNL 1998) states that in the preremediation studies, earthworms at all sites except TN EFK 22 6, had lower total mercury and higher methyl mercury concentrations than the soil from which they were taken, and starling eggs and nestlings had lower total mercury and higher methyl mercury concentrations than the earthworms from the same locations (Table 7 20) The relatively low mercury concentrations in starling tissue at TN EFK 22 6 were interpreted as a consequence of there being little suitable foraging habitat in the contaminated area In FY 2000, total mercury and methyl mercury concentrations were much reduced from the preremediation levels in all samples except starling muscle at TN EFK 22 6 Because mercury concentrations decreased at unremediated sites and the reference sites, the data do not show conclusively that remediation was effective in reducing mercury exposures of both primary producers (earthworms) and predators (starlings) However, the ratios of total mercury concentrations in earthworms relative to the Jackson Farm went from 5 g and 2 g at TN EFK 22 6 and TN EFK 17 3, respectively, to <1 0 g, suggesting a reduction at TN EFK 22 6 and TN EFK 47 3 The fraction of methyl mercury in earthworm tissue ranged from 1% to 2% of total mercury in the LEFPC samples The fraction of methyl mercury in starling tissue decreased slightly, from 70% to 80% in pre-remediation samples to 35% to 50% in post-remediation samples However, the fraction of methyl mercury measured in reference samples also decreased

Studies of starling reproduction were done to evaluate the effects of exposure to LEFPC conditions Starlings are reported typically to lay four to six eggs per brood In comparison, the average numbers of eggs reported in the LEFPC study ranged from 4 7 to 5 4, within the typical range No effect of site (and, therefore, mercury concentration) on reproductive success and nestling weight was observed in pre-remediation studies This study showed that although bioaccumulation of methyl mercury was occurring through the food chain in the LEFPC floodplain, no effect on population parameters for starlings, the surrogate for bird populations, was detected at preremediation concentrations The apparently reduced post-remediation concentrations are even less likely to have a deleterious effect on predator populations

Toxicity data for mercury were derived from published feeding studies in which ionic mercury or methyl mercury was fed to small mammals and birds Chronic exposure of mink to ionic mercury at 7 4 mg/kg (7400 ng/g) had no deleterious effect on reproduction (Aulerich et al 1974), and chronic exposure of Japanese quail to ionic mercury to 4 mg/kg (4000 ng/g) in the diet did not—but 8 mg/kg (ng/g) in the diet did—have an adverse effect on reproduction (Hill and Schaffner 1976) These dietary concentrations are above the ionic mercury concentrations in starling muscle both before and after

Table 7.20. Mercury concentrations in biota in the LEFPC floodplain[a]

Site Name	Sampling Location	Date	Earthworms		Starling muscle		Starling eggs	
			Hg	MeHg	Hg	MeHg	Hg	MeHg
NOAA[b]	Site 2	1991	33,200	No data	3,500[c]	No data	No data	No data
	TNEFK22.6	1996	81,949	1,544	194	140	No data	No data
	TNEFK22.6	2000	2,693	48	134	65	137	128
Bruner Site[d]	Site 3	1991	28,500	No data	No data	No data	No data	No data
	TNEFK17.3	1996	30,078	585	No data	No data	No data	No data
	TNEFK17.3	2000	2,070	35	No data	No data	No data	No data
Jackson Farm[e]		1991	No data	No data	No data	No data	No data	No data
	TNEFK14.0	1996	18,487	144	494	335	434	240
	TNEFK14.0	2000	2,792	42	78	37	34	34
Country Club[f]	Site 4	1991	24,600	No data	3,500c	No data	No data	No data
	TNEFK10.0	1996	12,580	177	500	403	630	385
	TNEFK10.0	2000	222	5 4	110	38	20	18
Reference[g]	Mill Branch	1991	<300	No data	No data	No data	No data	No data
	TFREELSBD1	1996	833	49	66	31	72	38
	TFREELSBD1	2000	25	0 32	13	3	5 4	3 3

[a] All values are in ng/g TFREELSBD1 = Terrestrial (site) near Freels bend (reference site), TNEFK = Terrestrial (site) near East Fork Poplar Creek kilometer
[b] Preremediation mercury concentration Total, 284 mg/kg, Methyl mercury, 0 078 mg/kg
[c] Values for adult Carolina wren tissue
[d] Preremediation mercury concentration Total, 997 mg/kg, Methyl mercury, 0 022 mg/kg
[e] Preremediation mercury concentration Total, 71 mg/kg, Methyl mercury, 0 026 mg/kg
[f] Preremediation mercury concentration Total, 54 mg/kg, Methyl mercury, 0 014 mg/kg
[g] Preremediation mercury concentration Total, 1 5 mg/kg, Methyl mercury, 0 003 mg/kg
LEFPC = Lower East Fork Poplar Creek
NOAA = National Oceanic and Atmospheric Administration

remediation. In a chronic feeding study of mink, a diet containing 1 1 mg methyl mercury/kg (1100 ng/g) had no deleterious effect, but a diet of 1.8 mg/kg (1800 ng/g) did have adverse effects (mortality, weight loss, or behavioral abnormalities) (Wobeser et al. 1976). Adverse effects to mallard ducks resulted from exposure to a diet at a single concentration of 0.5 mg/kg (500 ng/g) (Heinz 1979). These concentrations are well above the observed methyl mercury concentrations in starlings both before and after remediation and also in earthworms at all sites after remediation

In summary, post-remediation concentrations of ionic mercury and methyl mercury in earthworms and starlings are reduced compared to preremediation concentrations. Exposure to floodplain contaminants has not had a discernible adverse effect on reproduction by starlings, which show evidence of mercury accumulation above reference levels. Concentrations of ionic mercury and methyl mercury in biota that can serve as food for predators are below concentrations that have been shown to be toxic in laboratory studies. Therefore, it appears unlikely that dietary exposure to mercury species in LEFPC by ingestion of contaminated food could cause any deleterious effects to ecological populations.

7.4.4.7 Stream stability monitoring

An annual survey to measure any changes in the LEFPC stream channel and floodplain is being performed as described in the RAR. There are two primary objectives of this study. The first is to evaluate whether erosion of potentially mercury-bearing sediments is occurring in the floodplain of LEFPC. The second objective is to identify areas where sediment is being deposited in the channel and floodplain of

LEFPC. Areas where sediment deposition is occurring will be sampled at a later date in support of the CERCLA Five-Year Review in 2006.

The scope of this study includes detailed surveys at three locations along LEFPC (Fig. 7.6). The locations include the two sites where remedial action activities occurred, the NOAA and Bruner sites, and a third control site on the ED-1 parcel. At these locations, detailed measurements of the existing stream channel and floodplain are being made on an annual basis using monumented cross-sections. Bank pins have been installed in the stream bank and scour chains have been driven into the floodplain and channel and are being monitored for erosion and deposition. These activities began in 2000 and will continue for five years on an annual basis.

7.4.5 Recommendations

- Compile available information on the bioaccumulation of LEFPC mercury species and provide stakeholders with recommendations to address possible risk issues by July 2001.

8. RECOMMENDATIONS SUMMARY

This section provides a summary of recommendations made within the FY 2001 RER for proposed adjustments in the post-decision monitoring activities associated with completed ORR CERCLA actions. Several recommendations have also been made regarding monitoring or operational changes to the selected remedy. Separate notification will be sent to regulatory agencies regarding the changes summarized below.

8.1 CONCLUSIONS OF THE FIVE-YEAR REVIEW

The first CERCLA remediation decision on the ORR was initiated as a Tc RmA in November 1990 to address releases of contaminated sediments from the WOCE to the Clinch River. This was closely followed in 1991 by the first CERCLA ROD, for the UNC Site Remedial Action. Ten years later, the DOE has completed a total of 35 CERCAL actions, with 16 additional actions in progress. Of the 35 competed actions, 16 were initiated by RODs, and 19 were initiated as smaller-scale removal actions.

The effectiveness of each of these actions has been evaluated on a site-by-site basis and presented in this Reservation-wide Five-Year Review. These evaluations indicate that either by active treatment and/or removal, or by maintenance of land use controls, all actions have resulted in increased protectiveness to human and ecological receptors.

In all, actions have been initiated to address the highest priority risk sites first. Most of the contamination on the ORR lies within DOE-controlled property to which the general public has no access. However, over time, contaminants migrated from the DOE areas to adjacent public areas. Figure 8.1 shows the migration pathways for waterborne contaminants that originate at the three DOE facilities. CERCLA decisions have been implemented in all portions of the hydrologic regime depicted in Fig. 8.1 that lie outside of the DOE-controlled area: LWBR, CR/PC, and LEFPC. In addition, major actions occurred to reduce the most prominent releases to off-property areas (e.g., erection of an SRS at the WOCE to stop releases of sediment-bound ^{137}Cs to the Clinch River). Additional prominent actions in this regard were initiated either prior to the development of the CERCLA FFA or outside the auspices of CERCLA and thus are not discussed in this report. These include the development of Lake Reality in UEFPC and various actions within UEFPC to reduce mercury in Y-12 Plant effluent.

Next, actions occurred within the DOE property to address the major sources contributing to ongoing off-property releases. Examples of this include the two major source areas for releases of ^{90}Sr to the Clinch River: the Corehole 8 Plume action in Bethel Valley and the Seeps C and D treatment actions in Melton Valley. At the same time, DOE addressed sites near the DOE property boundary, even if these sites were found to have low risk potential (e.g., the K-1007 and K-901 Ponds at ETTP, the ^{137}Cs Burial Plots at ORNL, and volatile organic groundwater plumes in Union Valley).

In addition, several source areas within the DOE area have been addressed over time because of on-site worker protection issues (e.g., several building D&D efforts), operations logistics (e.g., the Abandoned Nitric Acid Pipeline in UEFPC), high future risk potential (e.g., the Gunite Tanks in Bethel Valley), or because they coincided with RCRA efforts (e.g., Kerr Hollow Quarry in the UEFPC administrative watershed). In one case, a major effort to characterize CERCLA releases in conjunction with a RCRA effort resulted in the decision to "defer" a decision at the ORNL WAG 6 site.

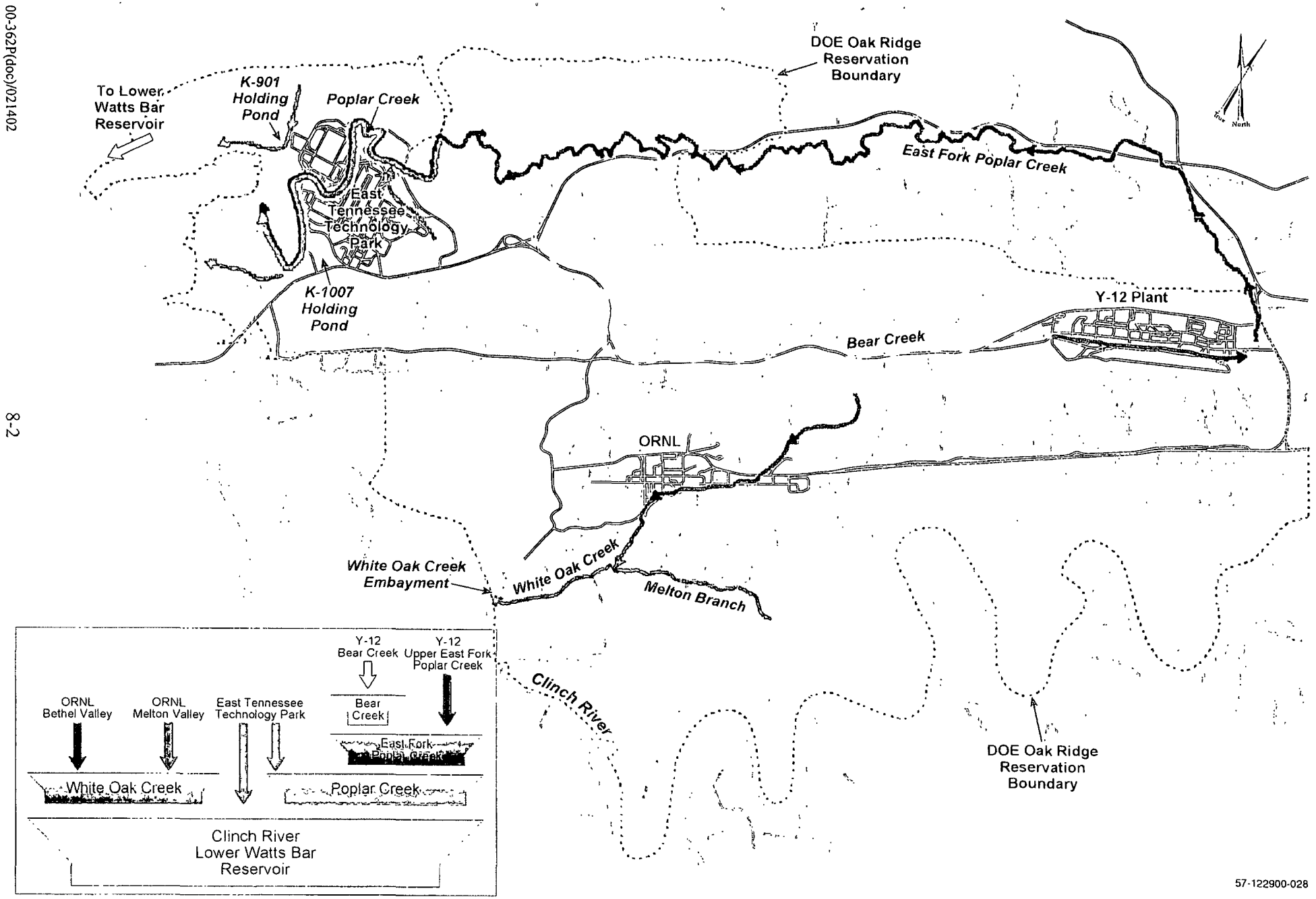

Fig. 8.1. Migration pathw[illegible]r waterborne contaminants.

New decisions on the ORR have been developed to address remediation so that watershed goals are identified and accomplished by an optimal combination of actions at various source areas within the watershed These decisions have been deemed "ROD for Interim Action" or "ROD for Phase I Activities" primarily because of the uncertainties associated with implementing such large-scale decisions The first two watershed RODs were signed in FY 2000

Provided in the following sections are the conclusions and recommendations for each of the 35 completed CERCLA actions that were included in this Reservation-wide Five-Year Review

8.2 EAST TENNESSEE TECHNOLOGY PARK

K-1417-A and K-1417-B Drum Storage Yards Interim Remedial Action

The purpose of this interim action was to "prevent or mitigate the imminent threat of release of contaminants from the sludges to the surrounding environment and to minimize the threat top human health " An additional goal was to manage the sludges in compliance with the requirements of RCRA Removal of the liquids from the sludges, repair of the stabilized sludge drums, and removal of all the drums from the Drum Storage Yards eliminated the chronic release of contaminants from leaking drums as well as the potential for a large release of sludge It also eliminated the threat to human health from drums toppling over The action was completed in 1994, and the goals of the decision have been met There are no wastes remaining from the original action, and no monitoring or stewardship requirements specified in the decision documents

K-1070 Operable Unit SW-31 Spring Interim Remedial Action

The goal of this interim action was to "quickly reduce the migration of contaminants and degradation of the environment " The objective of the interim remedial action for SW-31 Spring was "simply to terminate the direct discharge of contaminants to surface waters by intercepting and routing contaminated waters for treatment [air stripping and treatment at the CNF] prior to discharge to surface waters via a NPDES-permitted outfall The contaminants found in the SW-31 spring are amenable to removal by proven physical/chemical treatment technologies " The action as described in the decision document has been completed, and the goals of the remedy have been met

K-1407-B/C Ponds Remedial Action

The 1407-B/C Ponds remedial action was completed in 1995 The goal of this remedial action was to "reduce potential threats to human health and the environment posed by residual metal, radiological, and volatile organic compound (VOC) contamination within the K-1407-B/C Ponds " Major components of the selected remedy included placement of clean soil and rock fill for isolation and shielding, maintenance of institutional controls, and groundwater monitoring to assess performance of the action and to develop information for use in reviewing the effectiveness of the remedy

The action has been completed, and the goals of the decision have been met Based on the monitoring results for UNW-003, UNW-009, and MIK 0 39, no significant change in groundwater quality is apparent VOCs, which are present in groundwater upgradient of the K-1407-B Pond, are the primary groundwater contaminants in this area of the ETTP The remedial action for the K-1407-B/C Ponds was a source removal, which did not address groundwater beneath the former ponds Subsequent to this action, a groundwater collection system, which has a requirement for performance monitoring, has been installed downgradient of the K-1407-B Pond

WAG 1 Tank WG-14 Time-Critical Removal Action—Liquid Removal

The TC RmA for the WC-14 tanks was performed in 1995 and, subsequently, the remaining sludge was removed and the tank grouted in place. The goal of the initial action was simply to remove liquid to prevent overflow until the tank could be stabilized. The TC RmA was successful at accomplishing this goal but is moot in light of the fact that the tank has been grouted.

WAG 1 Tank WC-14 Time-Critical Removal Action—Sludge Removal

The TC RmA for liquid in the WC-14 tank was performed in 1995 and, in February 1998, the remaining sludge was removed and the tank grouted in place. The goal of the initial action was to stabilize the tank, thus mitigating risk to human health and the environment. The action was successful at accomplishing this goal.

Waste Evaporator Facility Removal Action

The Removal Action for the Waste Evaporator Facility was completed in 1996. The goal of the action was to "effectively mitigate the external radiation exposure pathway and remove the chemical contaminants that could affect workers and hypothetical adult trespassers" by the removal of the above-grade portion of Bldg. 3506. The completion of this action meets the stated goal. The source material has been removed and there are no post-action monitoring or stewardship goals stated in the decision documents.

Building 3001 Canal Removal Action

The removal action was completed in 1997 and meets the stated goals to "reduce or eliminate potential future risk to human health and the environment and to reduce surveillance and maintenance cost of this canal." There are no postaction monitoring requirements other than to conduct S&M inspections of the canal.

8.4 MELTON VALLEY WATERSHED

White Oak Creek Embayment Time-Critical Removal Action

The WOCE action was performed more than 10 years ago to inundate ^{137}Cs-contaminated sediments and to prevent them from migrating into the Clinch River. This removal action has been successful at accomplishing this goal. A final action for the embayment sediments will be included in a future ROD for ORNL boundary sites. At this time, it is recommended that the continuous monitoring of embayment water levels be discontinued, since many years of data have indicated that the water levels in the embayment remain significantly above the contaminated sediments. The information is costly to gather and is rarely reviewed. Periodic surveillance should be continued, including surveillance immediately after heavy storms.

It is recommended that the WOCE action continue to be tracked through the annual RER and subject to further Reservation-wide Five-Year Review cycles until the time that additional actions are determined for the embayment.

WAG 5 Seep C Removal Action

The zeolite treatment unit routinely meets the goal of the AM. Based on historical data and site interviews, the system is not effective if/when the zeolites became clogged with iron. Monthly sampling of the unit helps to identify if iron clogging occurs. In general, the Seep C system collects as much as 2 to 3 Ci/month that would otherwise migrate to and across White Oak Dam For this reason, the unit should remain active until a final action is implemented for SWSA 5.

Seep C is an operating treatment unit and as such should continue to be tracked in the RER. Flow-composite samples and grab sampling should be used to continue to track the effectiveness of the unit. If possible, the waste management and WRRP projects should attempt to collect and share influent-effluent sample results in a timely manner to avoid duplication of effort. The site should continue to be included in the annual RER and evaluated in future Reservation-wide Five-Year Review cycles.

WAG 5 Seep D Removal Action

Based on monitoring data collected since the Seep D system was brought on line in early 1995, the treatment unit has achieved the AM goal of >90% treatment efficiency. However, ^{90}Sr continues to bypass the collection system and migrate downstream to White Oak Dam Because the unit continues to capture almost a curie of ^{90}Sr that would otherwise migrate to White Oak Dam, the system should remain operating until a final action is implemented for the SWSA 5 trenches.

As with the Seep C unit, it is recommended that monthly grab samples from the upstream and downstream locations be collected until such a time that baseline information is needed for future actions at SWSA 5.

If possible, the waste management and WRRP projects should attempt to collect and share influent–effluent sample results to avoid duplication of effort. In addition, an effort should be made to determine if automated process controls can be designed to avoid the daily inspections currently performed The site should continue to be included in the annual RER and evaluated in future Reservation-wide Five-Year Review cycles.

WAG 4 Seeps Removal Action

The WAG 4 seeps action has been effective at reducing ^{90}Sr inputs to White Oak Creek but may not have achieved the goal of a 35% reduction within three years. Releases from the grouted trench areas have decreased significantly, but this reduction is less clear on a larger scale.

As indicated by the difficulty in using the pre- and post-action data, the use of the C-Q method and the collection of grab data and total flow data at all WAG 4 locations should be closely re-evaluated prior to developing the WRRP Sampling and Analysis Plan for FY 2002.

No further recommendations are made for this site, since larger-scale actions are occurring at SWSA 4 under the new Melton Valley ROD process (see Sect. 4 11). This site will continue to be reported in the annual RER and included in future Reservation-wide Five-Year Review cycles

WAG 13 Cesium Plots Interim Remedial Action

The WAG 13 Cesium Plots interim remedial action was performed more than 6 years ago to remove ^{137}Cs-contaminated soils and, by maintaining the existing fencing, to mitigate the threat from gamma radiation to human health or the environment This remedial action has been successful at accomplishing

this goal A final action for the Cesium Plots will be included in a future ROD for ORNL boundary sites. Until that time, the fence around the Cesium Plots must be maintained. Maintenance should take place immediately of the portion of fencing that is in need of repair. At this time, there is no monitoring conducted.

8.5 BEAR CREEK VALLEY WATERSHED

White Wing Scrap Yard Surface Debris Interim Remedial Action

With the removal of surface debris in 1994, the stated goals of the decision have been met. The current fencing and S&M operating procedures, conducted as best management practice, are maintaining the effectiveness of the remedy and mitigating risk to the public. It is recommended that the controls and S&M activities be included in an addendum to the ROD. This site will continue to be evaluated in the annual RER and the Reservation-wide Five-Year Review cycle

Spoil Area 1 and SY-200 Yard (BCV OU-2) Remedial Action

Current site access controls and deed restrictions serve to meet the goals of the decision, which were to mitigate risks to human health and the environment from exposure to contaminated soil and sediment This site will continue to be evaluated in the annual RER and the Reservation-wide Five-Year Review cycle

8.6 UPPER EAST FORK POPLAR CREEK WATERSHED

United Nuclear Corporation Disposal Site Remedial Action

Evaluation of groundwater monitoring data over the past five years shows that the primary goal of the action, preventing migration of mobile contaminants to groundwater in excess of drinking water standards, has been achieved to date. In light of continuing increases in gross beta activity observed in well GW-205, analyses for a comprehensive suite of radioisotopes (including, but not limited to, uranium and daughter products, ^{99}Tc, and $^{226/228}$Ra) are recommended in FY 2001 for this well to attempt to identify the potential cause No other changes in the monitoring and stewardship program are recommended This site should continue to be included in the annual RER, and the site should be evaluated as part of the Reservation-wide Five-Year Review cycle.

Mercury Tanks Interim Remedial Action

The Mercury Tanks were emptied and mercury-contaminated sediment removed in 1993 Two of the three tanks were abandoned in place, and stormwater from the third was redirected to the Y-12 Central Mercury Treatment Facility The stormwater system completely bypasses the mercury tanks, which meets the stated goals of the decision There are no post-remedial action stewardship or monitoring requirements that apply to the Mercury Tanks

Plating Shop Container Areas Remedial Action

The conclusion of the ROD for this site was that the total excess cancer risk is below the EPA-established range of concern, and noncarcinogenic health effects are below the threshold for potential concern A No Further Action Recommendation was made in 1992. There are no post-remedial action stewardship or monitoring requirements that apply to the Plating Shop Container Areas

Abandoned Nitric Acid Pipeline Remedial Action (UEFPC OU 2)

A No Further Action designation was assigned to this site in 1994, indicating that the Abandoned Nitric Acid Pipeline site poses no undue risk to human health or to the environment. There are no post-remedial action stewardship or monitoring requirements that apply.

Kerr Hollow Quarry Remedial Action

The site was closed under RCRA in 1996, with closure activities deemed protective of human health and the environment. A No Further Action designation was assigned under CERCLA Available data from Outfall 301 have not indicated substantial potential ecological impacts related to surface water contaminant concentrations at Outfall 301. Barium in Outfall 301 discharges, however, has exceeded chronic ecological PRGs during the past three sampling events No statistically significant releases of contaminants to groundwater have been documented On the basis of the Five-Year Review, the remedial action for Kerr Hollow Quarry remains effective Given that (1) potential effects related to disturbance of sediment in the quarry floor during closure have had 7 years to dissipate, (2) no observable barium concentration trend is evident, and (3) barium concentrations at Outfall 301 are less than those observed in an ORR reference stream, the presence of barium at the observed concentrations likely reflects ambient conditions. In consideration of the evaluation of Outfall 301 data and frequent lack of flow, continued monitoring of the outfall is not anticipated to show ecological impacts to surface water A recommendation to discontinue sampling of the outfall is made

Kerr Hollow Quarry should continue to be included in the annual RER and evaluated in further Reservation-wide Five-Year Reviews

Filled Coal Ash Pond/Upper McCoy Branch Remedial Action

Evaluation of existing data for the FCAP area indicates that the selected remedy has been effective in meeting the stated goals of the decision to minimize the migration of contaminants into surface water, to minimize direct contact of humans and animals with the ash, to reduce the potential for future failure of the dam, and to preserve the local habitat in the long term The site should continue to be included in the annual RER and be subject to further evaluations in the Reservation-wide Five-Year Review

Building 9201-4 (Alpha 4) Exterior Process Piping Removal Action

The stated goal of the removal action was to "reduce the risk that a mercury release poses to human health and the environment " The piping has been removed and is stored in a secured area, and the goals of the decision have been met There are no post-remedial action stewardship or monitoring requirements that apply.

UEFPC Watershed Interim ROD Union Valley Remedial Action

The goals of the institutional controls interim remedy were to ensure that public health is protected while final actions are being developed and implemented In addition, they were to identify and, if necessary, prohibit future activities with a potential to accelerate the rate of contaminant migration from the UEFPC characterization area or increase the extent of the contaminant plume. Based on the review, the administrative requirements of the IROD remain effective for protection of public health There are no monitoring requirements stipulated in the decision documents for the Union Valley IROD, however, decision documents for the Y-12 Plant East End VOC Plume remedial action (Sect 6 12) specify sampling of wells GW-169 and GW-170 in Union Valley as part of performance monitoring With the startup of the Y-12 Plant East End VOC Plume remedial action in October 2000, it is recommended that

all future monitoring within Union Valley be addressed in annual RER and future Reservation-wide Five-Year Reviews as part of the performance assessment for the East End VOC Plume Action

Lead Source Removal at the Former YS-860 Firing Ranges Removal Action

The goals of the Firing Range lead source removal were twofold. to protect human health and the environment from a source of lead contamination, and to achieve a risk-based cleanup level of 1400 ppm lead in soil based on a recreational scenario. The action was completed in 1998, and confirmatory sampling indicated the goals of the action had been met. There are no post-remedial action stewardship or monitoring requirements that apply.

Y-12 Plant 9822 Sediment Basin and Building 81-10 Sump Removal Action

The 9822 Sediment Basin and Building 81-10 Sump removal action was completed in 1998. This removal met the stated goals "to reduce the health and environmental risks associated with the release of contaminants from the 9822 Sediment Basin and Building 81-10 Sump " The sources of mercury and PCB contamination have been removed, and there are no post-remedial action stewardship or monitoring requirements that apply

8.7 OFF-SITE LOCATIONS

Lower Watts Bar Reservoir Remedial Action

The goal of the selected remedy for the LWBR remedial action is to protect human health and the environment by reducing exposure to contaminated sediment, reducing exposure to contaminants in fish tissue, and detecting changes in LWBR contaminant levels or mobility Institutional controls are currently used to review activities that could result in the disturbance, resuspension, removal and/or disposal of contaminated sediments or potentially contaminated sediments in the Watts Bar Reservoir Fish consumption advisories are printed in the *Tennessee Fishing Regulations* published by TWRA. Surface water, sediment, and biota samples are collected and analyzed annually to help identify and assess potential changes in LWBR contaminant levels and mobility. This monitoring is conducted as described in DOE's *Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River Poplar Creek Operable Units at the Oak Ridge Reservation*, published in September 1999

Since the ROD for LWBR requires that monitoring " . be continued to determine whether there is a change in the currently calculated risk that would pose a threat to human health and/or the environment," it is important that a systematic, repeatable approach be used in evaluating the annual monitoring data. In order to establish a systematic approach, it is recommended that the stakeholders (1) agree on representative background values for comparison with annual LWBR (and CR/PC) monitoring data to help distinguish ORR-related contaminants from contaminants not related to the ORR and (2) establish a protocol. including the proper risk-based screening criterion, for screening the annual monitoring data This action should continue to be included in the annual RER, and evaluated in future Reservation-wide Five-Year reviews

Oak Ridge Associated Universities South Campus Facility Remedial Action

The selected remedy for SCF was no action. The RI/FS concluded that the site poses no unacceptable risk to humans or the environment, provided groundwater is not used for human consumption It was anticipated that TCE in groundwater will naturally attenuate and, therefore, no remedial action was considered necessary The goal of the decision was to provide institutional controls that help ensure the

site continues to pose no unacceptable risk In addition to institutional controls, the ROD required that groundwater samples be collected biannually as long as TCE contamination above acceptable levels is present

Since groundwater is not used at the SCF, there continues to be no risk issue to address Based on results of groundwater monitoring conducted to date, there is some question regarding whether complete biodegradation of TCE to chloroethane (the non-toxic final daughter in the TCE degradation chain) is occurring Because of this uncertainty, it is recommended that sampling be conducted annually instead of biannually to better quantify degradation potential at this site This action should continue to be included in the annual RER and evaluated in future Reservation-wide Five-Year reviews

Clinch River/Poplar Creek Remedial Action

The goal of the selected remedy for the CR/PC remedial action is to protect human health and the environment by (1) limiting exposure to mercury, chromium, arsenic, and ^{137}Cs in the deep sediment of the main river channel and (2) limiting exposure to PCBs, chlordane, arsenic, and mercury in fish tissue Institutional controls are currently used to review activities that could result in the disturbance, resuspension, removal and/or disposal of contaminated sediments or potentially contaminated sediments in the CR/PC hydrologic system Fish consumption advisories are printed in the *Tennessee Fishing Regulations* published by TWRA Surface water, sediment, and biota samples are collected and analyzed annually to help identify and assess potential changes in CR/PC contaminant levels and mobility This monitoring is conducted as described in DOE's *Combined Monitoring Plan for the Lower Watts Bar Reservoir and Clinch River Poplar Creek Operable Units at the Oak Ridge Reservation*, published in September 1999

As for the ROD for LWBR, it is important that a systematic, repeatable approach be used in evaluating annual monitoring data In order to establish a systematic approach, it is recommended that the stakeholders (1) agree on representative background values for comparison with annual CR/PC monitoring data to help distinguish ORR-related contaminants from contaminants not related to the ORR and (2) establish a protocol, including the proper risk-based screening criterion, for screening of the annual monitoring data This action should continue to be included in the annual RER and evaluated in future Reservation-wide Five-Year reviews

Lower East Fork Poplar Creek Remedial Action

The goal of the LEFPC remedial action was to minimize the risk to human health, specifically via the child ingestion pathway, by excavating floodplain soils contaminated with mercury at levels greater than 400 ppm The RAR required both annual monitoring and specific monitoring to perform the Five-Year Review Specific monitoring for this review included a land use survey, a wetlands survey, a survey of changes in the creek channel and biota sampling Based on evaluation of these data is appears that biota in LEFPC are recovering over time, as indicated by reduced mercury concentrations in earthworms and starlings Biota monitoring will be performed again along LEFPC in FY 2005 in preparation for the 2006 Five-Year Review

The land use survey indicated that several areas along the creek have changed from open or agricultural land use to residential land use At the time of the ROD there was no residential land use along the creek south of Oak Ridge Turnpike Because of this change, and because of new guidance from the regulators, there may need to be additional evaluation of the pathways associated with residential gardening

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2001 Remediation Effectiveness Report/CERCLA Five-Year Review for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge, Tennessee

Appendix A – Site Visits

DOE/OR/01-1941&D2/R1

2001 Remediation Effectiveness Report/CERCLA Five-Year Review for the U.S. Department of Energy Oak Ridge Reservation, Oak Ridge, Tennessee

Appendix A – Site Visits

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BECHTEL JACOBS COMPANY LLC
managing the
Environmental Management Activities at the
East Tennessee Technology Park
Oak Ridge Y-12 Plant
Oak Ridge National Laboratory
Paducah Gaseous Diffusion Plant
Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-98OR22700
for the
U.S. DEPARTMENT OF ENERGY

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2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-1417-A and K-1417-B Drum Storage Yards

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-1417-A and K-1417-B Drum Storage Yards

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Per the Decision Documents, the Remedy was: This source control interim action was conducted to prevent or mitigate the imminent threat of release of contaminants from the sludges to the surrounding environment and to minimize the threat to human health. An additional goal of this interim action was to assure that the sludges are managed in compliance with the requirements of RCRA. Removal of the liquids from the sludges, repair of the stabilized sludge drums, and removal of all the drums from the drum storage yards will eliminate the chronic release of contaminants from leaking drums as well as the potential for a large release of sludge. Subsequent actions will address the final disposition of the sludges.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other (describe) IROD actions complete; site closed under RCRA All subsequent actions to be managed under RCRA

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:
   Although stewardship requirements are not specified in the Decision Documents, the facilities are located within the security fence of the ETTP and are surrounded by an additional interior fence.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
   Weekly drive-by inspections are conducted and the records maintained in the on-site FMSIT offices.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:
   Raw wastes have been repackaged and properly stored prior to treatment and disposal, and stabilized wastes have been placed in permitted storage pending disposal. Drum storage yards have been closed under RCRA. No ongoing operating procedures.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site K-1417-A and K-1417-B Drum Storage Yards

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

   The yards are currently being used by a DOE subcontractor for storage of materials generated from the decontamination activities in Bldg. K-1420.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? NA Up to date? NA

   Are Maintenance Logs readily available? NA Up to date? NA

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? NA Up to date? NA

   Are Inspection Reports readily available? NA Up to date? NA

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   The yards are surrounded by a secondary fence within the ETTP Security fence and the gates are locked unless workers are present to move equipment into or out of the yards.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
   Although there have been no changes in land use, there have been changes to activities conducted at the yards. Currently the yards are controlled by a DOE subcontractor who is using the yards for storage of materials and equipment related to the decontamination activities at Bldg. K-1420.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-1417-A and K-1417-B Drum Storage Yards

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:
   Currently, the yards are used for storage of materials and equipment associated with the decontamination of Bldg. K-1420.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The site is completely fenced with only three access gates from the main plant area of the ETTP. Two of the three gates were locked at the time of the site visit. Signs on the gates indicate no unauthorized access. Additional signs, erected during the period of drum storage, are present warning of the presence of hazardous materials. The asphalt pads appear to be in relatively good condition. Runoff from the yards is generally diverted to storm drain outfalls discharging to the north side of Mitchell Branch. Two large rubberized canvas (RUBB) tents used during the repackaging of the sludges remain on the yards. Material and equipment associated with the decontamination of Bldg. K-1420 are currently being stored on the pads. The materials are stored in large-volume, trailer-type containers.

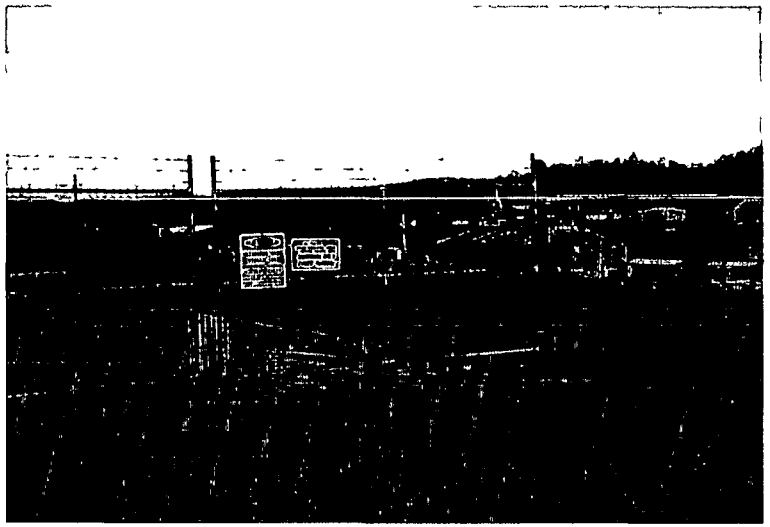
Photographs (following page)
K1417AB1: Northwest enterance to K-1417-A/B Drum Storage Yards
K1417AB2: K-1417-A DSY showing equipment and equipment/material storage
K1417AB3: East end of K-1417-A DSY showing remaining tent, equipment storage, warning sign
K1417AB4: West end of K-1417-B DSY with storage trailers

Signatures:

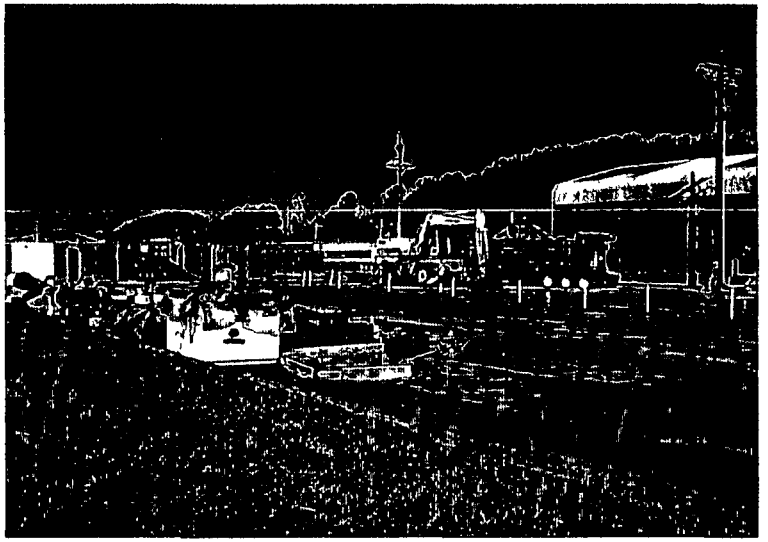
Interviewer _____

Site Personnel _____

K-1417 A and B Drum Storage Yards



K1417AB1



K1417AB3

K1417AB2

K1417AB4

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-1070 Operable Unit SW-31 Spring

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-1070 Operable Unit SW-31 Spring

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Tommy Bowers, BJC (CNF Manager), 576-2629; Deron Hendron, Radian International (CNF Engineer), 241-4987

Per the Decision Documents, the Remedy was: The selected remedy was to terminate the direct discharge of contaminants to surface waters by intercepting and routing contaminated waters for treatment (air stripping and treatment at the CNF prior to discharge to surface waters via a NPDES-permitted outfall). The contaminants found in the SW-31 spring are amenable to removal by proven physical/chemical treatment technologies. The goal of this interim action was to quickly reduce the migration of contaminants and degradation of the environment.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other (describe) *Monitoring of the SW-31 effluent is conducted by CNF as part of their normal operations.*

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:
   CNF conducts daily inspections of the SW-31 collection system.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
   CNF conducts daily inspections of the SW-31 collection system to ensure the system is operating properly and to perform maintenance as needed. Activity records are maintained at CNF.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:
   CNF maintains operation of the system.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site K-1070 Operable Unit SW-31 Spring

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Tommy Bowers, BJC (CNF Manager), 576-2629; Deron Hendron, Radian International (CNF Engineer), 241-4987

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? Yes Up to date? Yes

   Are Maintenance Logs readily available? Yes Up to date? Yes

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? NA Up to date? NA

   Are Inspection Reports readily available? Yes Up to date? Yes

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   The SW-31 is located within the security fence of the ETTP, and the collection sump and transfer building are surrounded by a secondary fence.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
   The ETTP has been, and will continue to be in the future, used for industrial purposes.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-1070 Operable Unit SW-31 Spring

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Tommy Bowers, BJC (CNF Manager), 576-2629; Deron Hendron, Radian International (CNF Engineer), 241-4987

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:
   The K-1070-C/D Groundwater Collection System was installed upgradient of the former SW-31 Spring location. The effluent from the K-1070-C/D collection system is also piped, after first discharging to an oil/water separator, to the SW-31 sump where the effluent from both systems commingles. From the sump the effluent is transferred to CNF.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

   The area of the original spring location is grass-covered with no signs of additional seepage. The collection sump and transfer building are completely surrounded by a fence and the gates are locked at all times unless workers are present. Signs are present indicating the contact person and phone number for information and access to the facility. The SW-31 facility is clean and appears to be well maintained.

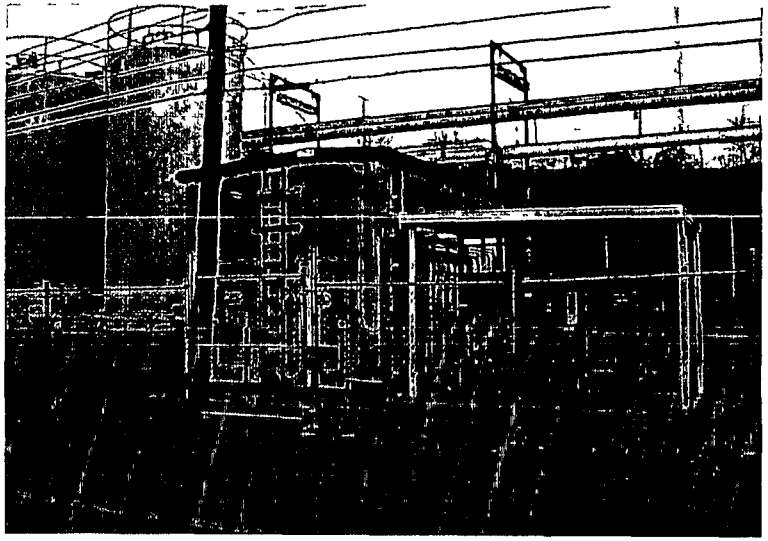
Photographs (following page):
SW-31Spring1: SW-31 Spring control building and storage tanks showing fence and signs
SW-31Spring2: SW-31 Spring control building and storage tanks
SW-31Spring3: SW-31 collection sump and K-1070-C/D oil/water separator with SW-31 control building in background

Signatures:

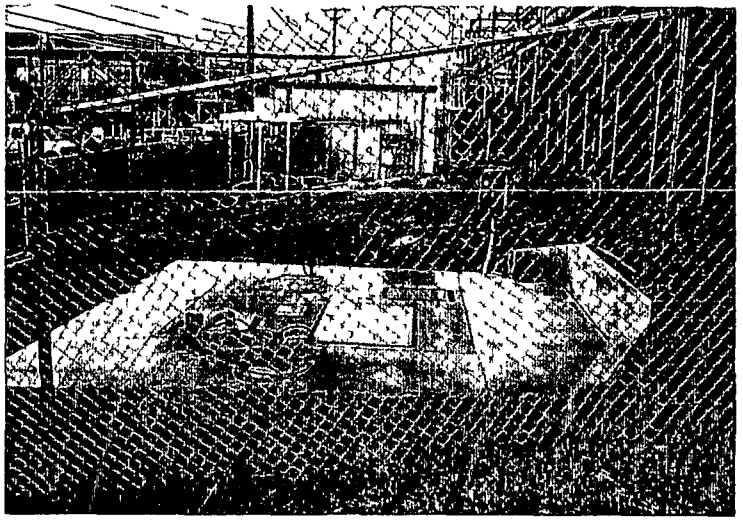
Interviewer _____

Site Personnel _____

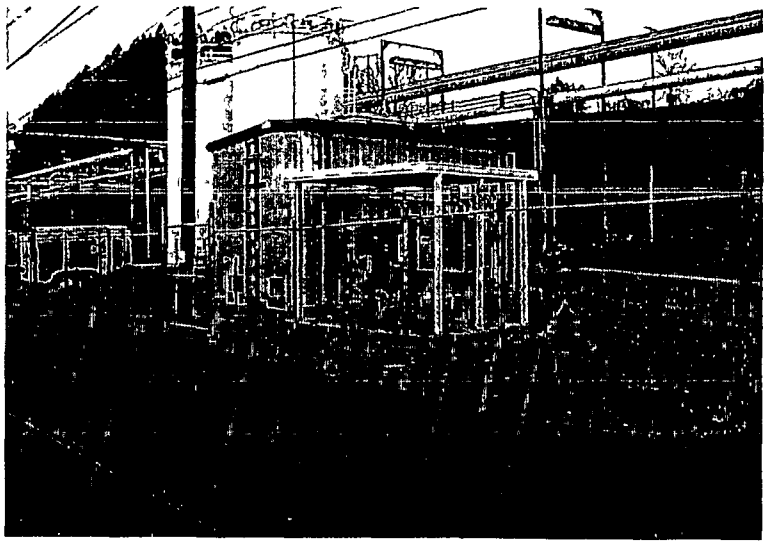
K-1070 OU Sw-31 Spring



SW-31Spring1



SW-31Spring3



SW-31Spring2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-1407-B and C Ponds Remedial Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-1407-B and C Ponds Remedial Action

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Per the Decision Documents, the Remedy was: The selected remedial action for the K-1407 B Holding Pond and the K-1407-C Retention Basin was a source removal action to reduce potential threats to human health and the environment posed by residual metal, radiological, and volatile organic compound (VOC) contamination within the K-1407-B/C Ponds. Major components of the selected remedy include:

- Placement of clean soil and rock fill for isolation and shielding,
- Maintenance of institutional controls, and
- Groundwater monitoring to assess performance of the action and to develop information for use in reviewing the effectiveness of the remedy.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☒ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☒ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:
   The Decision Documents require periodic inspections and surveillance, maintenance, and access and activity controls for the former ponds.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   Inspections of the ponds are conducted weekly to verify conditions and identify potential problems. An annual inspection is conducted to verify the effectiveness of the routine surveillance and maintenance activities. Inspection records are maintained at the on-site FMSIT offices.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site K-1407-B and C Ponds Remedial Action

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Interview (continued)

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:
   There are no operating procedures other than the periodic inspections for the K-1407-B/C Ponds.

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? NA Up to date? NA

   Are Maintenance Logs readily available? NA Up to date? NA

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? Yes Up to date? Yes

   Are Inspection Reports readily available? Yes Up to date? Yes

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   The K-1407-B/C Ponds are within the Security fence of the ETTP. A valid DOE badge or visitors pass is required for access.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
   The ETTP has, and will in the future, be used for industrial purposes.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-1407-B and C PondsRemedial Action

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

The Mitchell Branch Groundwater Collection System has been installed downgradient of the K-1407-B Pond. The collection system began operation in 1998 and includes 29 recovery wells, most of which are located between the former pond and Mitchell Branch, and an interceptor trench west of the former pond.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

   The former ponds are located near the Central Neutralization Facility. A fence has been erected around the CNF and encloses the D&D faciliites to the west of CNF and south of the former K-1407-B Pond. The caps on both of the former K-1407-B/C Ponds are raised above the surrounding grade and are grass-covered. Perimeter drainage ditches around the Ponds are gravel-lined to prevent erosion. There are no signs of significant erosion of the caps and both appear to be adequately maintained.

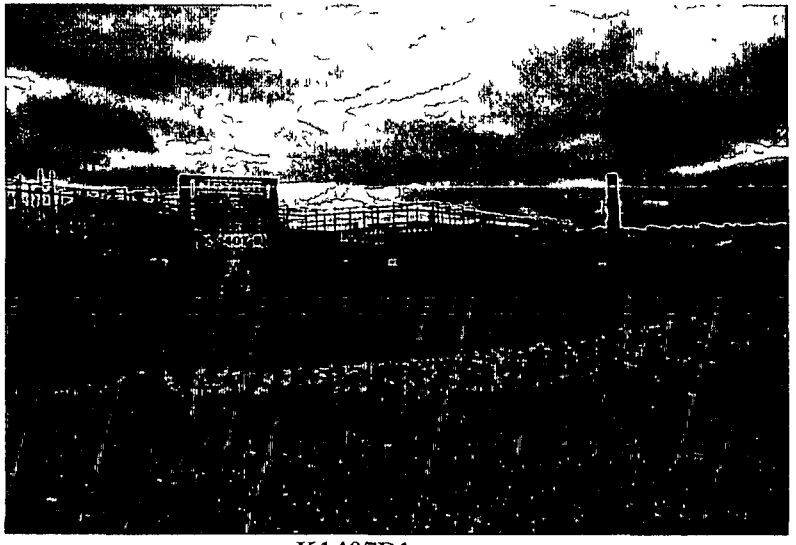
Photographs (following page):
K1407B1: K-1407-B Pond looking southeast, rip-rap lined perimeter ditch in foreground
K1407B2: K-1407-B Pond looking east, CNF in distance
K1407C1: K-1407-C Pond looking north with Mitchell Branch in foreground
K1407C2: K-1407-C Pond looking west, K-25 building in distance

Signatures:

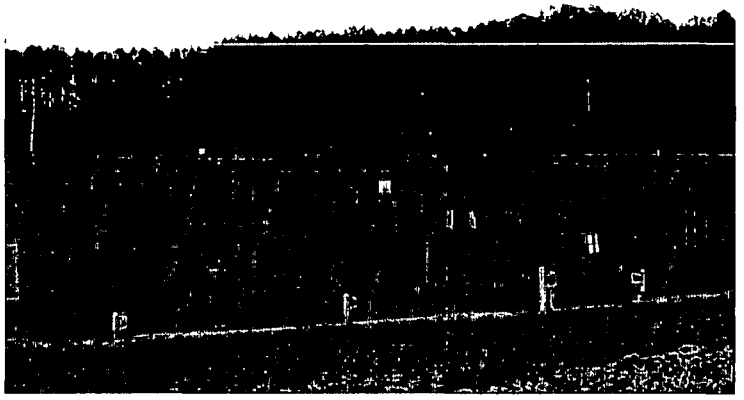
Interviewer _____

Site Personnel _____

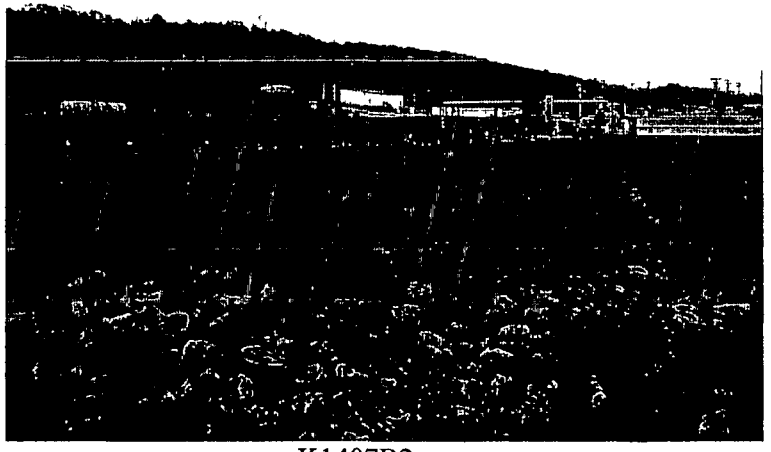
K-1407-B and C Ponds



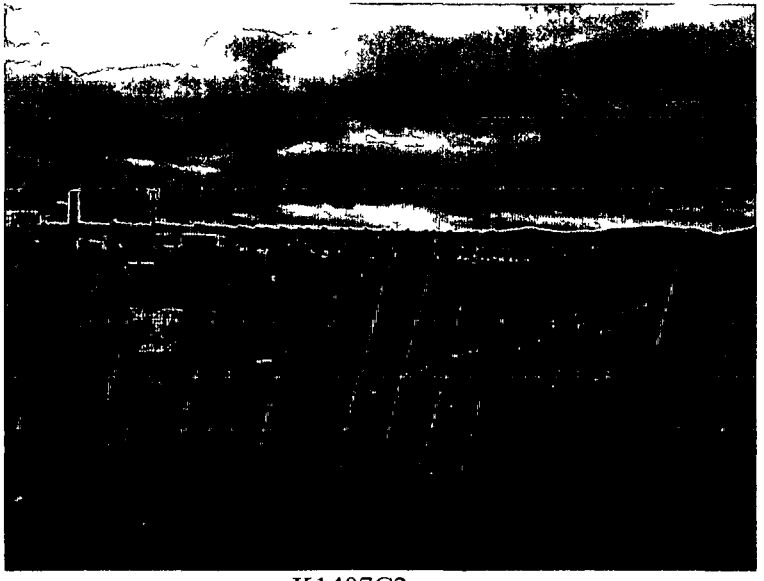
K1407B1



K1407C1



K1407B2



K1407C2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-1070-C/D and Mitchell Branch Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-1070-C/D and Mitchell Branch Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Tommy Bowers, BJC, CNF Manger, 576-2629; Deron Hendron, Radian International, CNF Engineer, 241-4987

Per the Decision Documents, the Remedy was: Installation of a groundwater collection system to capture contaminated groundwater and treatment of the captured water at the Central Neutralization Facility. Objectives of these actions were to capture groundwater in the unconsolidated zone south of Mitchell Branch and in the area south and west of K-1070-C/D Burial Grounds and treat the water to reduce volatile organic compounds and other contaminants to acceptable levels before discharge, thereby mitigating plume growth in these areas and reducing contaminant flux from shallow groundwater into surface water.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☒ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes: *Although the decision documents do not specify stewardship requirements, both the Mitchell Branch and K-1070-C/D systems are inspected daily due to their potential impacts on operations at the CNF.*

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
   Notes: *CNF personnel conduct daily rounds of the Mitchell Branch and K-1070-C/D systems to check pump operation and perform maintenance as needed. These activities are documented in Round Sheets maintained at CNF.*

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☒ No ☐ NA ☐
   Notes:
   Problems have been experienced with operation of all seven of the Recovery Sump Pumps, installed in the trench segments of the recovery systems, since system operations began in 1998. These problems have included periodic failure and/or plugging of the Recovery Sump Pumps resulting in extended downtime for individual pumps while maintenance is performed. Periodic maintenance has been performed in an effort to keep the pumps operational, and adjustments to increase the pumping rates have been performed. However, due to the rapid

Name of Site K-1070-C/D and Mitchell Branch Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Tommy Bowers, BJC, CNF Manger, 576-2629; Deron Hendron, Radian International, CNF Engineer, 241-4987

A. Interview (continued)

deterioration of pump performance following maintenance, the system continues to perform ineffectively. Additionally, equipment failure has also been experienced with components of the recovery well system pumps located along a portion of Mitchell Branch. This portion of the system consists of 29 recovery wells equipped with pneumatic pumps. Air lines associated with these pumps have begun to degrade where exposed above ground, and ruptures/failures have occurred. Steps are being taken by Bechtel Jacobs Company to evaluate system performance and develop potential options for improved operation of the systems.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☒ NA ☐
   Notes: *Declines in total flow from the collection systems over the past year and indications that contaminant concentrations downgradient of the systems are unchanged or may be increasing suggest the extraction systems are inefficient or ineffective.*

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes: *Although unexpected toxic by-products have not been encountered, it was noted by CNF that iron fouling of the coalescing tubes in the oil/water separator may impair separator operation at times. This condition is being monitored by CNF personnel.*

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? Yes Up to date? Yes.

   Are Maintenance Logs readily available? Yes Up to date? No.

   Notes: *A set of as-constructed drawings is available at the CNF; however, a set of drawings containing redlines indicating field changes to the original design are not available. Maintenance logs are maintained at CNF.*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? Yes Up to date? Yes

   Are Inspection Reports readily available? Yes Up to date? Yes.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-1070-C/D and Mitchell Branch Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Tommy Bowers, BJC, CNF Manger, 576-2629; Deron Hendron, Radian International, CNF Engineer, 241-4987

Documentation (continued)

Notes: *Groundwater monitoring records are maintained by the Water Resources Restoration Program and are available in OREIS. CNF maintains results of the effluent monitoring conducted at both of the respective oil/water separators, which collect the discharge from the systems prior to conveyance to CNF. Inspection reports are maintained at CNF.*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   With the exception of the approximately 250-ft western segment of the trench adjacent to Mitchell Branch, the collection systems are located within the fenced security zone of the ETTP, which requires a valid badge or visitor's pass for access. The western trench segment is patrolled by Park Security personnel.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
   The ETTP has, and will in the future, be used for industrial purposes.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The K-1070-C/D collection system is located on the western slope of the K-1070-C/D Burial Ground. The trench transects the northern portion of the K-1414 Garage area, which is completely paved, and then turns northward paralleling Avenue D through a grass-covered area west of K-1070-C/D. The grass-covered portion is mowed and no fencing surrounds the collection system and associated Recovery Sump Pump enclosures. The Mitchell Branch system parallels Mitchell Branch from the area of CNF westward to the railroad spur adjacent to Portal 5. The trench stops at the railroad and begins again on the west side of the railroad bed. This western trench segment extends beneath the Portal 5 access road and ends opposite the area

Name of Site K-1070-C/D and Mitchell Branch Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Tommy Bowers, BJC, CNF Manger, 576-2629; Deron Hendron, Radian International, CNF Engineer, 241-4987

where Mitchell Branch turns northward towards Poplar Creek. The grass-covered portions of the system are mowed routinely. The reach of Mitchell Branch opposite the recovery wells was lined with an impermeable geomembrane and geotextile fabric to prevent the drawing of water from Mitchell Branch by the recovery wells. Articulating concrete blocks were placed on top of the geomembrane and geotextile layers to form the channel and to protect the geosynthetics. Much of the original pea gravel used to fill the gaps between the concrete blocks has been washed out during storm surges. Sediment, which has replaced the gravel, has allowed natural vegetation to return to the banks of this reach of Mitchell Branch.

Photographs (following pages):
MitchellBranch1: Mitchell Branch recovery well network looking east, CNF in background
MitchellBranch2: Mitchell Branch recovery wells, looking west, trench segment begins near transfer station (tan structure) in distance
MitchellBranch3: Mitchell Branch groundwater collection system transfer station
MitchellBranch4: New asphalt patch indicates path of K-1070-C/D collection trench across the K-1414 Garage area, looking east
MitchellBranch5: K-1070-C/D groundwater collection system looking north with recovery sump pump enclosure (RS-08) in foreground
MtichellBranch6: View to west of path of Mitchell Branch interceptor trench, recovery sump enclosures RS-04 in foreground and RS-03 and RS-02 in background

Signatures:

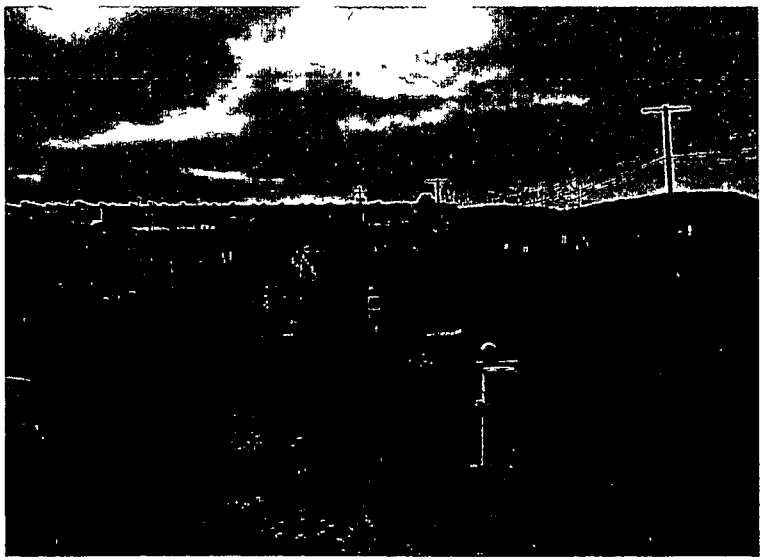
Interviewer _____

Site Personnel _____

K-1070-C/D and Mitchell Branch Interceptor Trench

MitchellBranch1

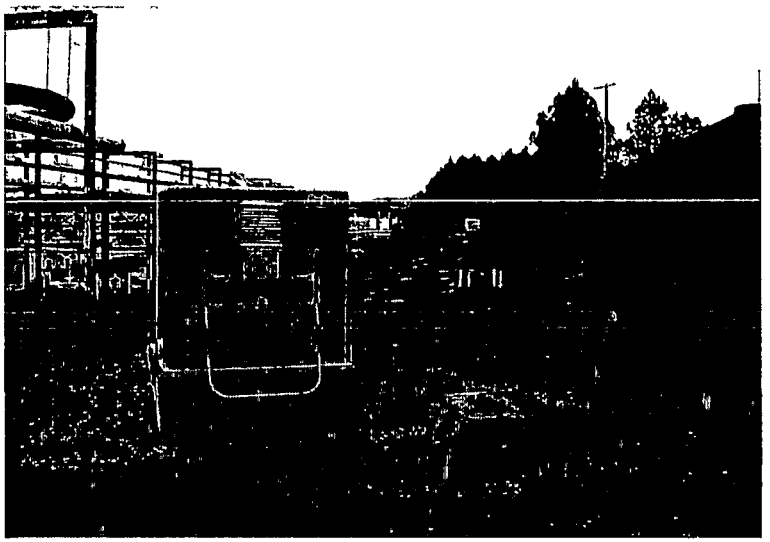
MitchellBranch3



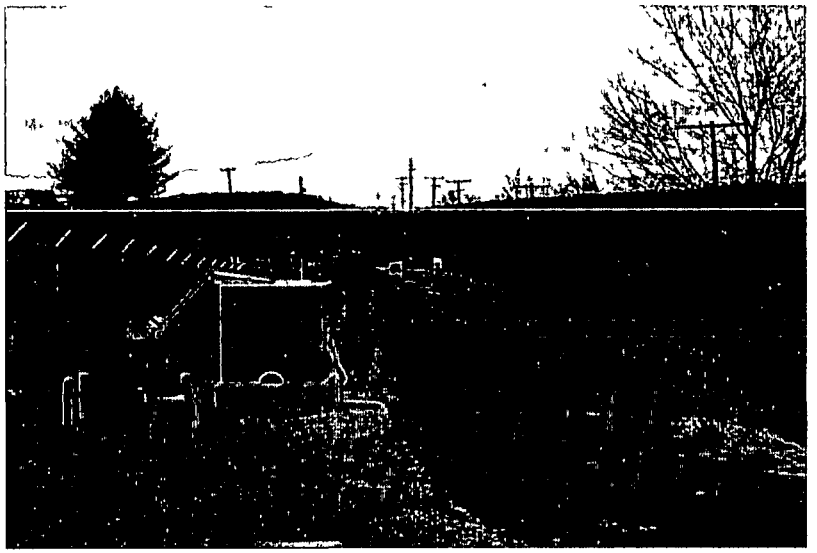
MitchellBranch2

MitchellBranch4

K-1070-C/D and Mitchell Branch Interceptor Trench



MitchellBranch5



MitchellBranch6

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-901 Pond Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-901 Pond Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Mike Coffey, ENSAFE/CDM, Environmental Compliance, 482-1066

Per the Decision Documents, the Remedy was: The Removal Action included the termination of fish and disposal in a fish disposal cell, draining of the pond, and removal and disposal of gas cylinders and other hazardous material containers and metal debris from the K-901 Pond. The purpose of this action is to reduce risk by removing gas cylinders and other hazardous material containers and metal debris from the pond and removing the pathways for ingestion of polychlorinated biphenyl (PCB) contaminated fish from the ponds by humans or piscivorous wildlife. Two objectives for the K-901 Pond were identified in the Action Memorandum:

- Mitigate current and future human health risk from ingestion of fish contaminated with PCBs to $< 1 \times 10^{-4}$ at the K-901-A Holding Pond, and
- Mitigate and control future ecological risk from PCBs to populations of piscivorous wildlife through ingestion of fish from the K-901-A Holding Pond.

Post-Action Monitoring Includes: (check all that apply)

☐ No Further Action
☐ Inspections
☐ Groundwater Monitoring
☐ Air Monitoring
☐ Groundwater pump and treat
☐ Surface Water Monitoring
☐ Surface water collection and treatment
☒ Other (describe) *Biological monitoring*

Stewardship Requirements Include (check all that apply)

☒ NA
☐ Deed Restrictions
☐ Physical Access Controls (fencing, etc)
☐ Institutional Access Controls (Badges, TLDs, etc.)
☐ Posting of signs
☐ S&M Inspections
☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes: *Stewardship requirements are not specified in the Decision Documents.*

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   The Facilities Maintenance, Surveillance, Inspection, and Testing Services (FMSIT) subcontractor conducts weekly surveillances of the pond, which include identification and repair of flood damage, verification that signs are present and visible, and maintenance of the weir at the pond outfall to the Clinch River. Surveillance records are maintained at the on-site ETTP FMSIT offices.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☒ No ☐ NA ☐

Name of Site K-901 Pond Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Mike Coffey, ENSAFE/CDM, Environmental Compliance, 482-1066

Interview (continued)

3. Notes: *The Removal Action included fish removal from the pond to mitigate current and future human health and ecological risks from ingestion of the fish. However, despite the removal of the fish in 1997, fish reportedly occupy the pond again. Thus, the potential for a complete pathway via fish ingestion is available. No additional actions have been taken.*

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☒ NA ☐
   Notes:
   Operating procedures consist of weekly surveillances of the pond. A return of the fish population to the pond was not considered in the removal action.

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒

   Notes:
   No chemical remedial treatment methods were employed.

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? NA Up to date? NA

   Are Maintenance Logs readily available? NA Up to date? NA

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? NA Up to date? NA

   Are Inspection Reports readily available? NA Up to date? NA

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   There is a fence and gate preventing public access to the K-901 Pond from the West Perimeter Road. However, there are no fences preventing public access to the pond from the Clinch River. Signs are posted and surveillance is conducted by Protective Services.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-901 Pond Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Mike Coffey, ENSAFE/CDM, Environmental Compliance, 482-1066

C. Visual Survey (con't):

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
   No land-use restrictions are specified in the Decision Documents. Site remains in government control.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The K-901 Pond is located west of West Perimeter Road on the western border of the ETTP. The pond is elongated north-south and the area surrounding the pond is largely wooded. The north and south arms of the pond are occupied by marshes containing a thick growth of water-tolerant trees and scrub growth. Access to the pond from the east is restricted by bar gates across roads leading to the pond off of West Perimeter Road; however, there are no significant impediments to access from the Clinch River. The pond receives natural surface water flow, primarily from the north; spring discharge; surface runoff from the surrounding area; and storm drain discharge from the K-31/33 area of the ETTP. Two concrete and earthen barriers, approximately 75 ft apart, located at the outfall to the Clinch River at the western edge of the pond, serve to confine the pond. Discharge from the pond is through a corrugated metal pipe directly to the Clinch River. During high pond water level periods, some water discharges through seepage to drainage ditches to the south towards Poplar Creek. The disposal cell used for the fish removed from the pond is located in a wooded area along the western side of the pond and is covered with a healthy stand of grass.

The FMSIT subcontractor conducts weekly surveillances of the pond and maintenance of the weir at the pond outfall to the Clinch River. Surveillance records are maintained at the on-site ETTP FMSIT offices.

The Removal Action included fish removal from the pond to mitigate current and future human health and ecological risks from ingestion of the fish. However, despite the removal of the fish in 1997, the pond has been re-populated by fish. Thus, the potential for a complete pathway via fish ingestion is available. No additional actions at the pond have been taken.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 4

Name of Site K-901 Pond Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Mike Coffey, ENSAFE/CDM, Environmental Compliance, 482-1066

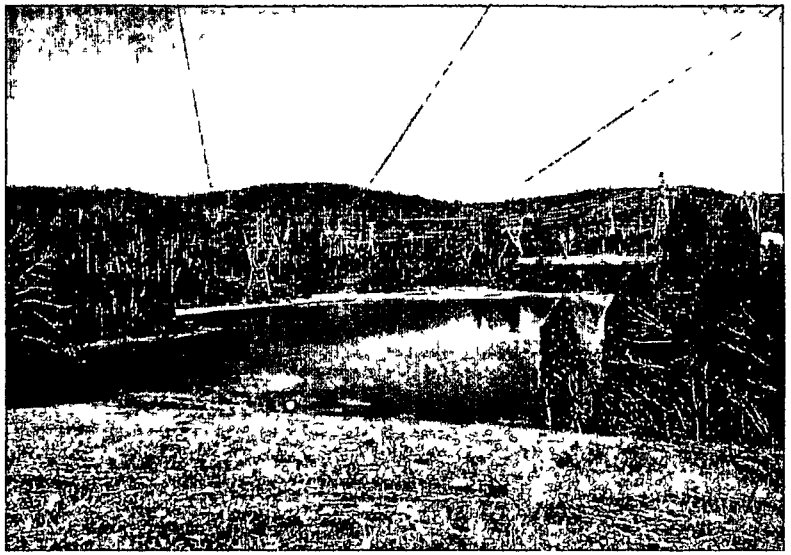
Photographs (following pages):
K902A1: K-901-A Pond looking north
K901A2: K-901A Pond at outfall looking east with warning sign and remnants of beaver dam in distance
K901A3: Western edge of K-901-A Pond with monitoring wells
K901A4: K-901-A Pond looking southeast
K901A5: View OF Former fish disposal cell for K-901-A Pond Removal Action
K901A6: K-901-A Pond structure with Clinch River in distance
K901A7: K-901-A Pond outfall to Clinch River

Signatures:

Interviewer _____

Site Personnel _____

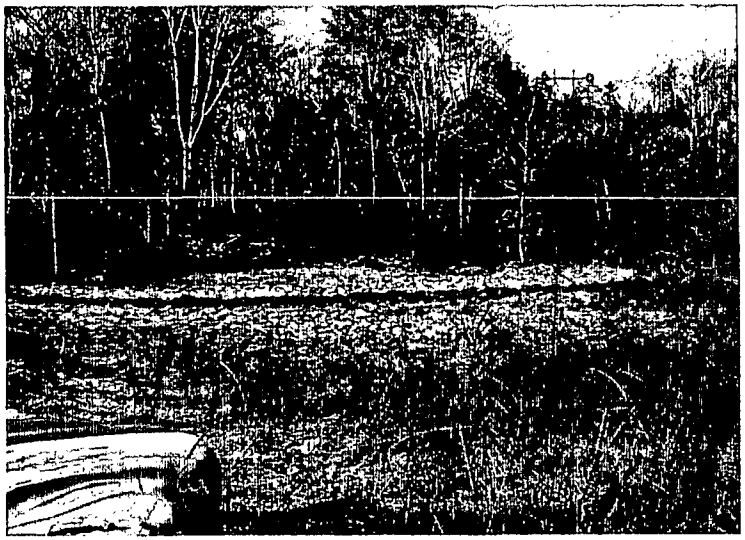
K-901-A Pond



K901A1

K901A3

K-901-A Pond



K901A5

K901A7

K901A6

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-1401 and K-1420 Sumps Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-1401 and K-1420 Sumps Removal Action

Date(s) of Visit 12/12/00 and 12/20/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone John Hicks, Decon and Recovery Services, Building Operator, 574-8175; Ken Skinner, BJC, EWQP Manager, 241-1193; and Gary Harold, Decon and Recovery Services, Manager, 241-0993

Per the Decision Documents, the Remedy was: This time-critical removal action consisted of collecting and piping contaminated groundwater from the sumps to the Central Neutralization Facility (CNF), a wastewater treatment facility at the ETTP. The treated wastewater would then be discharged directly to the Clinch River. The purpose of this action was to reduce the risk to human health and the environment by preventing contaminated groundwater in the sumps from entering nearby surface waters.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☒ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:
   Although the decision documents do not specify stewardship requirements, both the K-1401 and K-1420 systems are inspected daily due to their potential impacts on operations at the CNF.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
   Notes:
   CNF personnel conduct daily rounds of the Mitchell Branch and K-1070-C/D systems to check pump operation and perform maintenance as needed. These activities are documented in Round Sheets maintained at CNF.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:
   CNF maintains operation of the system.

Name of Site K-1401 and K-1420 Sumps Removal Action

Date(s) of Visit 12/12/00 and 12/20/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone John Hicks, Decon and Recovery Services, Building Operator, 574-8175; Ken Skinner, BJC, EWQP Manager, 241-1193; and Gary Harold, Decon and Recovery Services, Manager, 241-0993

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? Yes Up to date? Yes.

   Are Maintenance Logs readily available? Yes Up to date? Yes.

   Notes: *The O&M manual and construction drawings are available at the CNF. Maintenance logs are also maintained by CNF.*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? Yes Up to date? Yes

   Are Inspection Reports readily available? Yes Up to date? Yes.

   Notes: *CNF maintains results of the effluent monitoring conducted at both of the sumps prior to conveyance to CNF. Inspection reports are also maintained at CNF.*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes: *The sumps are located within the fenced security zone of the ETTP, which requires a valid badge or visitors pass for access. Additional authorization is required to access the basement areas of these two buildings. Access doors to the basement of K-1401 are locked at all times. The basement of Bldg. 1420 is a high-contamination area, which requires anti-C clothing and respirator for access.*

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes: *Bldg. K-1401 is currently occupied by several lessee companies and Bldg. 1420 is undergoing decontamination by DRS.*

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-1401 and K-1420 Sumps Removal Action

Date(s) of Visit 12/12/00 and 12/20/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone John Hicks, Decon and Recovery Services, Building Operator, 574-8175; Ken Skinner, BJC, EWQP Manager, 241-1193; and Gary Harold, Decon and Recovery Services, Manager, 241-0993

C. Visual Survey (con't):

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The basements of both buildings require prior approval by the building operators for access, and both require anti-C clothing and ingress and egress through boundary control stations. Due to the aged appearance of most of the appurtenances in the basements, the newer appearance of the sump pumps and associated piping is quite conspicuous. The sump pumps appear to be well-maintained and in good operating condition.

Photographs (following page):
K1420Sumps1: Sump pump system in basement of Building K-1420
K1420Sumps2: Building 1420 sump cover and associated piping
K1420Sumps3: Piping and control valves for K-1420 sump
K1420Sumps4: Emergency backup air-diaphragm pump for K-1420 sump

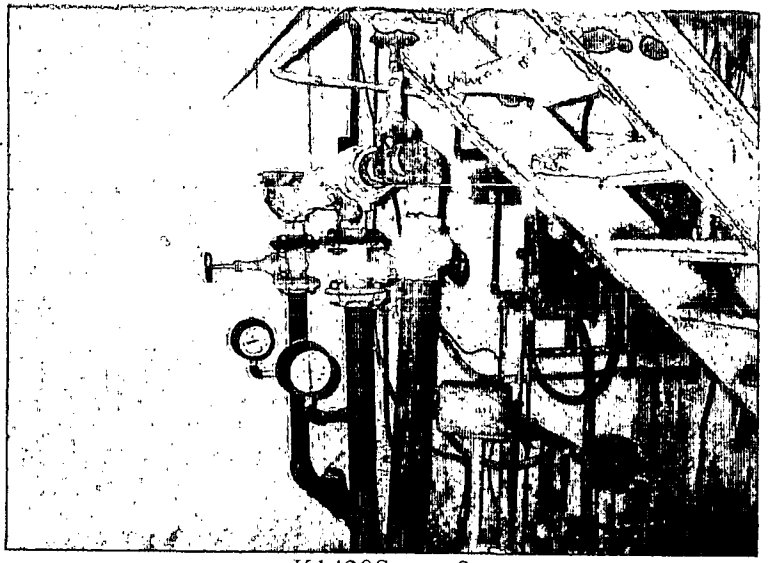
Signatures:

Interviewer _____

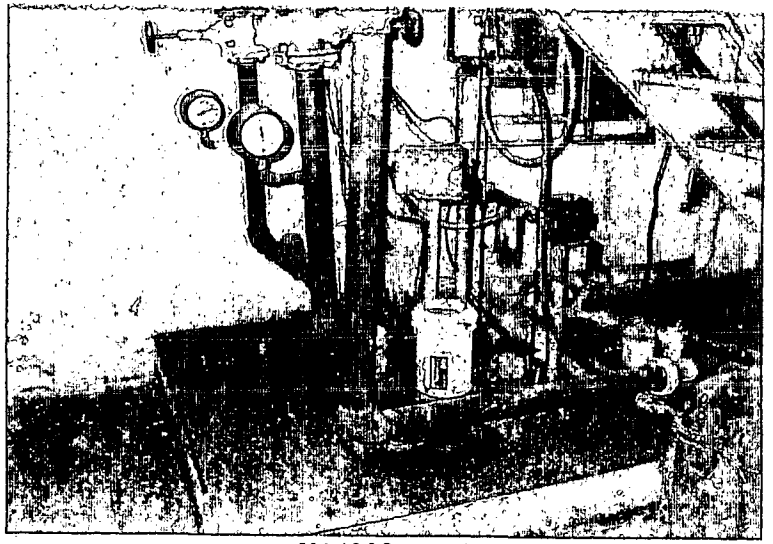
Site Personnel _____

K-1401 and K-1420 Sumps

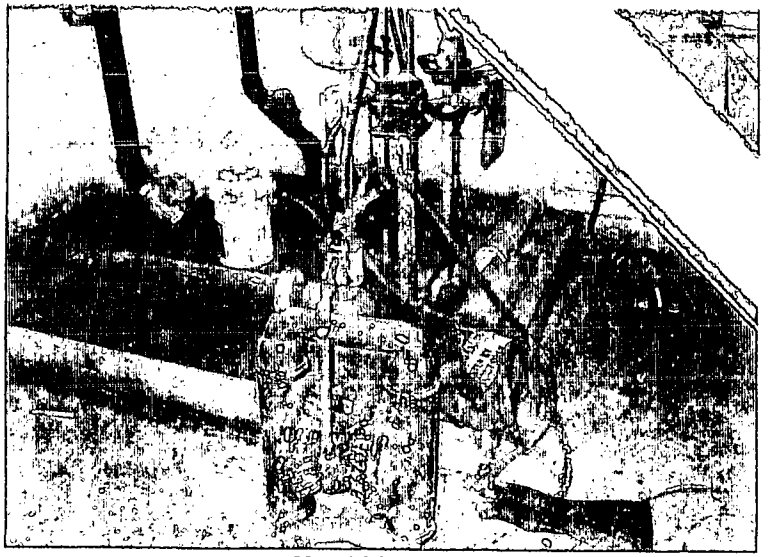
K1420Sumps1



K1420Sumpa3



K1420Sumps2



K1420Sumps4

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-25 Auxilliary Facilities Group I Buildings Demolition

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-25 Auxilliary Facilities Group I Buildings Demolition

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Per the Decision Documents, the Remedy was: The action selected was to dismantle the five Group I non-process facilities to reduce the potential health and environmental hazards caused by the uncontrolled release of contaminated dust, process wastes, equipment, building surfaces, and construction materials.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:
   The Action Memorandum does not specify stewardship requirements; however, the facilities are located within the security fence of the ETTP.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   At a minimum, annual inspections of the former facility locations are conducted and other non-routine inspections are also performed. Records are maintained at the PSS.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:
   There are no ongoing operating procedures associated with the Removal Action.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site K-25 Auxilliary Facilities Group I Buildings Demolition

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

6. Additional site-specific questions and concerns:

   None noted

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:

   No land-use controls are specified in the Decision Documents. The location of the former K-724 and K-725 buildings is within the security fence surrounding the Powerhouse facilities and the former K-1031, K-1131, and K-141 buildings are within the limited access area of the ETTP.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

   The ETTP has been, and will continue in the future, to be used for industrial purposes.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-25 Auxilliary Facilities Group I Buildings Demolition

Date(s) of Visit 11/17/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Lisa Shipe, ENSAFE/CDM, Environmental Compliance, 482-1065

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

   The location of the former K-724 and K-725 buildings is within the security fence surrounding the Powerhouse facilities, and the K-1031, K-1131, and K-1410 buildings are within the limited access area of the ETTP. Access to the Powerhouse area is restricted by several gates that remained locked unless workers are present in the Powerhouse area. The Powerhouse area is patrolled by ETTP Security. Access to the limited area of the ETTP requires passage through two guard portals and a DOE L clearance. The remaining concrete slabs of the former K-724 and K-725 buildings are surrounded by paved and gravel roads with isolated grass-covered areas. The slabs of the former K-1131, K-1031, and K-1410 buildings have been paved over with asphalt to prevent the potential mobilization of radiological contamination by weathering processes.

Photographs (following pages):

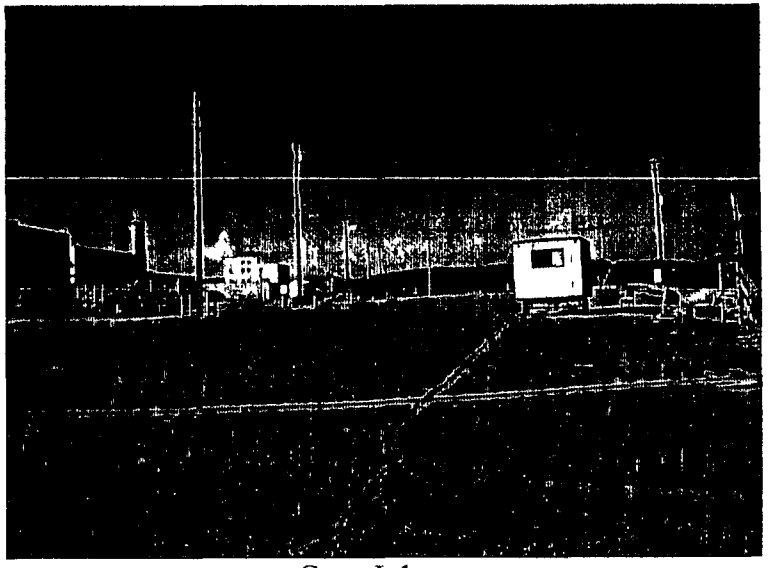
GroupI_1: Location of former K-1131 Building
GroupI_2: Location of former K-724 Building showing remaining slab
GroupI_3: Concrete slab of former K-725 Building

Signatures:

Interviewer _____

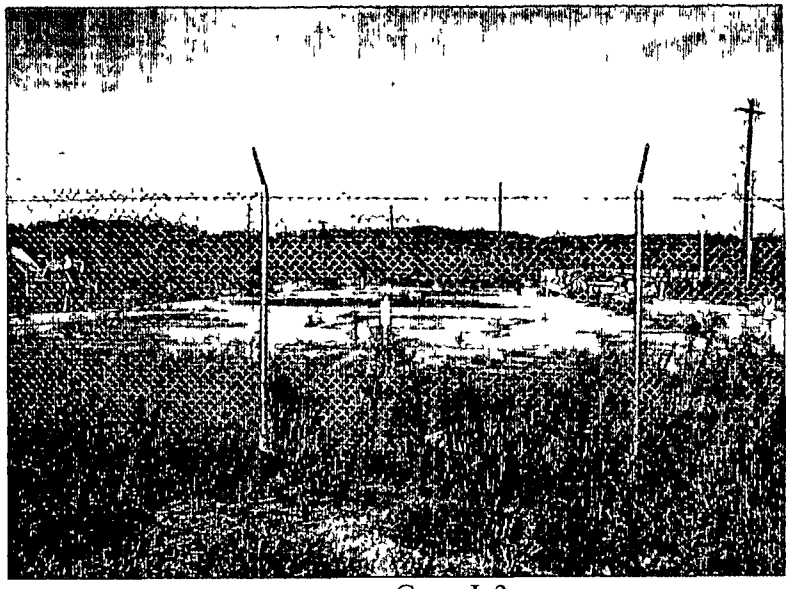
Site Personnel _____

Group I Buildings



GroupI_1

GroupI_2



GroupI_3

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

K-1007-P Ponds Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site K-1007-P Ponds Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Mike Coffey, ENSAFE/CDM, Environmental Compliance, 482-1066

Per the Decision Documents, the Remedy was: The Removal Action included the termination of fish in the pond, draining of the pond, and removal and disposal of gas cylinders and other hazardous material containers and metal debris from the K-1007-P1 Pond. Two objectives for the K-1007-P1 Pond were identified in the Action Memorandum:

- Mitigate current and future human health risk from ingestion of fish contaminated with PCBs to $< 1 \times 10^{-4}$ at the K-1007-P1 Pond, and
- Mitigate and control future ecological risk from PCBs to populations of piscivorous wildlife through ingestion of fish from the K-1007-P1 Pond.

However, fish termination was not accomplished during the action as it was determined that Administrative Controls would sufficiently address the human health risk from fish ingestion. Further action was deferred until sediment contamination can be addressed in future decision documents.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other (describe) *Biological monitoring*

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:
   Although stewardship requirements are not specified in the Decision Documents, Administrative Controls (sign postings and Security patrols) were cited as being adequate to mitigate the human health risk; thus, providing justification for not terminating the fish and draining the pond as described in the Action Memorandum.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

The Facilities Maintenance, Surveillance, Inspection, and Testing Services (FMSIT) subcontractor conducts weekly surveillances of the pond, which include identification and repair of flood damage, verification that signs are present and visible, and maintenance of the weir at the pond outfall to Poplar Creek. Annual drive-by inspections are also conducted. Records are maintained at the on-site at the ETTP FMSIT offices.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site K-1007-P Ponds Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Mike Coffey, ENSAFE/CDM, Environmental Compliance, 482-1066

Interview (continued)

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☒ No ☐ NA ☐
   Notes:
   The fish were not removed from the pond; thus, the future ecological risk to piscivorous wildlife was not addressed.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:
Operating procedures associated with the Removal Action consist of posting of signs and weekly surveillances of the ponds.

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:
   No chemical remedial treatment methods were employed.

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? NA Up to date? NA

   Are Maintenance Logs readily available? NA Up to date? NA

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? NA Up to date? NA

   Are Inspection Reports readily available? NA Up to date? NA

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   There is no fence preventing public access at the K-1007-P1 Pond. However, signs stating "No fishing or water contact" are posted around the pond and the pond is within view of the Security guards at Portals 2, 4, and 11.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site K-1007-P Ponds Removal Action

Date(s) of Visit 10/30/00

Interviewer, title, phone C. Allen Motley, SAIC, Geologist, 481-4607

Site Personnel, title, phone Mike Coffey, ENSAFE/CDM, Environmental Compliance, 482-1066

C. Visual Survey (con't):

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
   No land-use restrictions are specified in the Decision Documents. The land remains under government control.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

   Access to the pond is not restricted; however, sign postings warning of no fishing or water contact are present and visible. The grass-covered areas surrounding the east, west, and north areas of the pond appear to receive routine mowing. In general, trees occupy the south side of the pond. There is no visual evidence of waste materials in the pond.

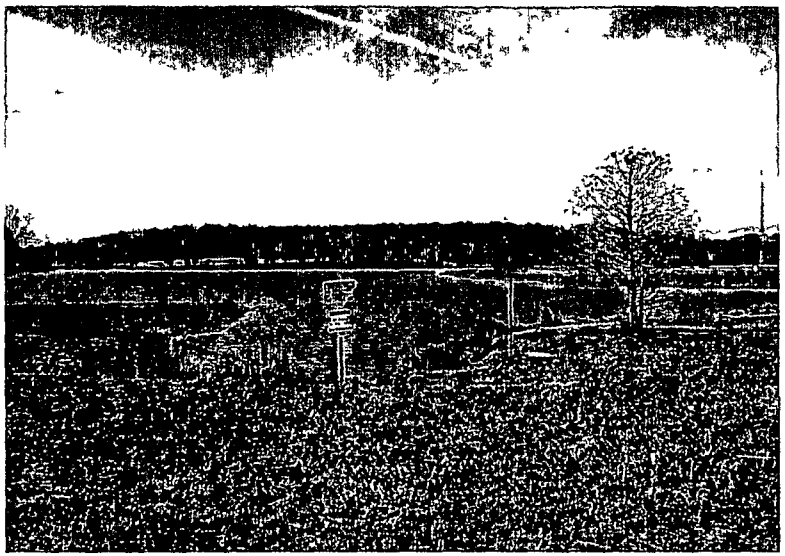
   Photographs (following page):

   K1007Ponds1: K-1007-P1 Pond looking west
   K1007Ponds2: View of north arm of K-1007-P1 Pond with warning sign
   K1007Ponds3: K-1007-P1 Pond looking east with ETTP in background
   K1007Ponds4: View of K-1007-P1 Pond weir structure looking east

Signatures:

Interviewer _____

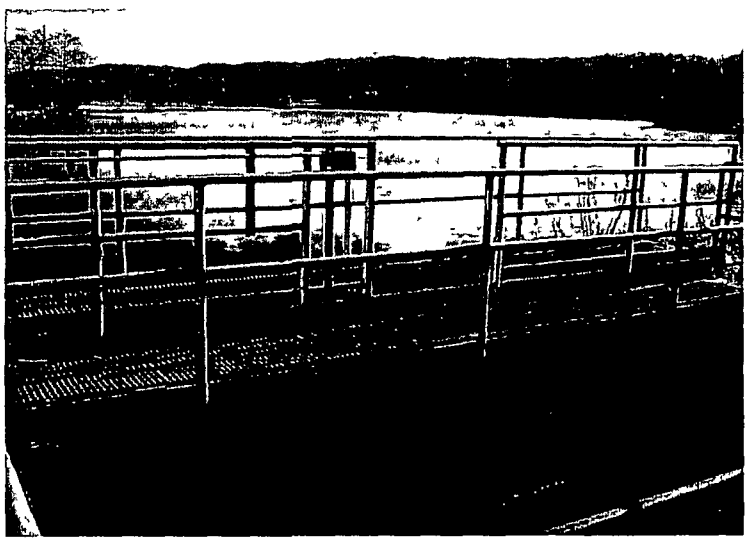
K-1007 Ponds



K1007Ponds1

K1007Ponds3

K1007Ponds2



K1007Ponds4

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

WAG 1 Corehole 8 Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site WAG 1 Corehole 8 Removal Action (AM Nov. 1994; RAR July 1995)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Per the Decision Documents, the Remedy was: to install a groundwater collection and transmission system to collect groundwater containing ^{90}Sr before it discharged to First Creek, and replacement of two inoperative basins with porous sumps. The third basin remained operational but was modified so that groundwater entered a porous sump beneath the basin while the basin itself was sealed to prevent groundwater infiltration. Collected groundwater is piped to the ORNL Process Waste Treatment Plant for treatment and discharged through an existing NPDES outfall. In 1997, IWQP monitoring of surface water in First Creek identified elevated levels of ^{90}Sr and ^{233}U. Additional sampling identified two unlined storm sewer manholes as the conduit for the contamination. In 1998, an additional groundwater interceptor trench was installed that connects to the Corehole 8 trench. This trench provides additional contamination release control until the final remedy is implemented to address source control.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☒ Groundwater collect & treat
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes: *No stewardship requirements were specified in the Action Memorandum.*

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
Waste Management Federal Systems liquid waste division is in charge of operations and inspections. S&M grounds inspections are not performed. MDM takes environmental samples.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☒ No ☐ NA ☐
   Notes: *The remedy does not address/capture the entire plume (See section A-6). Therefore, additional CERCLA actions are being put in place to address the larger problem.*

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site WAG 1 Corehole 8 Removal Action (AM Nov. 1994; RAR July 1995)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

1) Collector pipe hit during excavation; had to be repaired.

2) In 1997, to check for new "fingers" of plume, LMES monitored for Sr-90 and alpha at transects along First Creek and found U-isotopes associated with the Corehole 8 Plume

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *Yes (in RAR)* Up to date? *Yes*

   Are Maintenance Logs readily available? No Up to date? NA

   Maintenance logs not available for inspection at time of site visit.

2. Monitoring and Inspection Records:

   Are Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

Site subject to access controls (badge, fence). Signs clearly in place; control systems automated if pump goes down. Also, plume is located underground, no exposure routes via land.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

Site is within ORNL Physical Plant, therefore, no changes likely.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site WAG 1 Corehole 8 Removal Action (AM Nov. 1994; RAR July 1995)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Steam line installed near system; had to ensure integrity of treatment system.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Site is clean and well marked

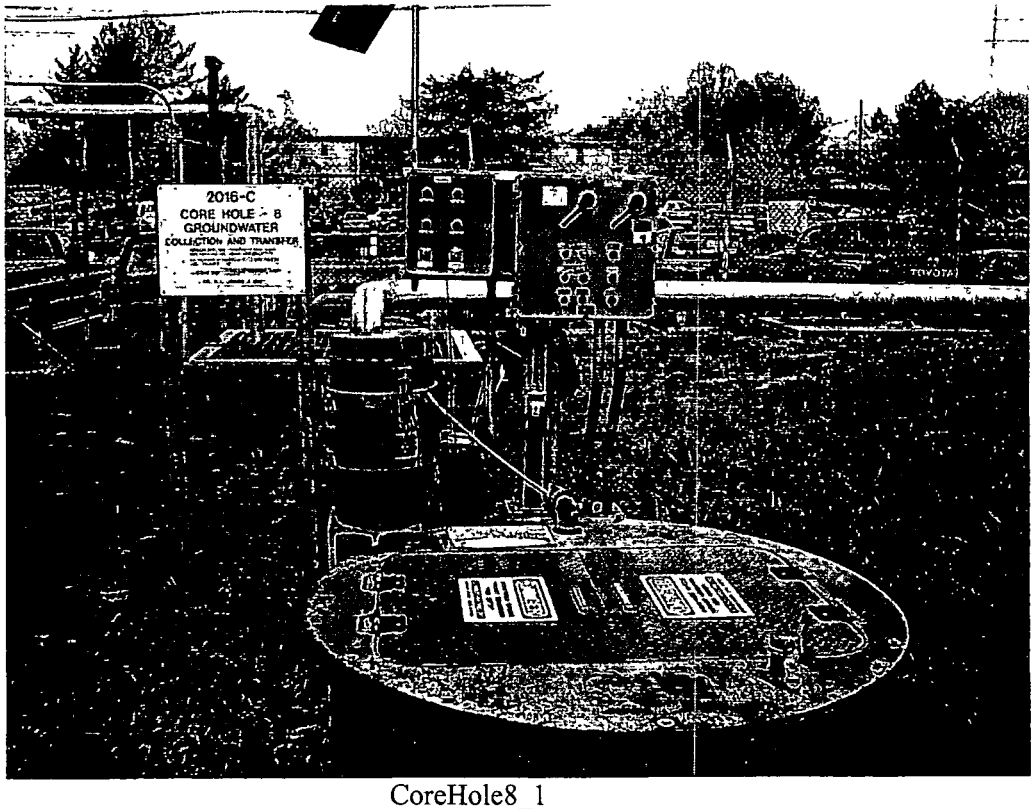
Photograph (next page)
CoheHole 8_1: Main CoreHole 8 plume treatment control area. Pump system is in foreground with control panel and sampling system to rear.

Signatures:

Interviewer _____

Site personnel _____

Corehole 8 Plume



CoreHole8_1

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

WAG 1 Tank WC-14 – Liquid Removal

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site WAG1 Tank WC-14 – Liquid Removal (AM Feb. 1995, RAR July 1995)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Per the Decision Documents, the Remedy was: to remove enough liquid to lower the total volume of waste in the tank to approximately 10 % of the tank's capacity. The aqueous phase contained elevated levels of beta/gamma emitters, primarily Cs-137 and Sr-90, and trace levels of a PCB. The liquid was pumped into metal containers filled with absorbent material such that the liquids were absorbed completely and free-draining liquids were eliminated. The containers are stored in the tumulus in SWSA 6.

Post-Action Monitoring Includes: (check all that apply) (Superceded by Sludge Removal Action)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other (describe) *monitor level of contents in tank WC-14 until tank is remediated*

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:

No stewardship requirements specified in decision document. After removal of sludge from bottom of tank (see following action), tank was grouted in place.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Only general Plant-wide grounds S&M as needed.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

Removal action – no ongoing operating procedures.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site WAG1 Tank WC-14 – Liquid Removal (AM Feb. 1995, RAR July 1995)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:
No chemical treatment in selected remedy.

6. Additional site-specific questions and concerns:

None

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
Site is within general ORNL facility fencing and, as such, a valid badge or visitors pass is required for access.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site WAG1 Tank WC-14 – Liquid Removal (AM Feb. 1995, RAR July 1995)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Subsequent to this action, the sludge was pumped from the tank and the tank grouted in place.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Tank WC-14 is one of several underground tanks located in area between 5th street and Bldg. 3587 The photograph on the following page shows the grassy area covering the entire WC-10 Tank Farm (Tanks WC-10 to WC-17) and Bldg. 3587 in the background. The action is complete on tank WC-14 and a second CERCLA action is in progress on the other tanks in this area.

Signatures:

Interviewer _____

Site personnel _____

Tank WC-14 Removal Action

Tank WC-14 is buried underneath the grassy area in front of Building 3587

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

WAG 1 Tank WC-14 – Sludge Removal

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Tank WC-14 - Sludge Removal (AM Feb. 1995; RAR Nov. 1998)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Per the Decision Documents, the Remedy was: the removal of 80 gal of dewatered sludge from the tank on February 17, 1998 and grouting of the tank on March 4, 1998. The removed de-watered sludge was contained in two partially filled 55-gal drums, placed in a concrete cask, and stored in the ORNL Transuranic Waste Storage Facility, Building 7883.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action (source removal)
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:

No stewardship requirements specified in decision documents. Source removal – tank grouted in place.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Only general Plant-wide grounds S&M as needed.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

Removal action – no ongoing operating procedures.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Tank WC-14 - Sludge Removal (AM Feb. 1995; RAR Nov. 1998)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:
No chemical treatment in selected remedy.

6. Additional site-specific questions and concerns:

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
Site is within general ORNL facility fencing and as such, a valid badge or visitors pass is required for access.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Tank WC-14 - Sludge Removal (AM Feb. 1995; RAR Nov. 1998)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Tank WC-14 is one of several underground tanks located in area between 5th street and Bldg. 3587. The photograph on the following page shows the grassy area covering the entire WC-10 Tank Farm (Tanks WC-10 to WC-17) and Bldg. 3587 in the background. The action is complete on tank WC-14, and a second CERCLA action is in progress on the other tanks in this area.

Signatures:

Interviewer _____

Site personnel _____

Tank WC-14 Removal Action

Tank WC-14 is buried underneath grassy area in front of Building 3587

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Waste Evaporator Facility Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Waste Evaporator Facility Removal Action – Sludge Removal (AM July, 1995; RAR July, 1996)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Per the Decision Documents, the Remedy was: dismantling of the above-ground portion of the Waste Evaporator Facility, removal of rainwater accumulated in the cell, removal of accumulated cell sediment, and removal of mercury/radiologically contaminated soils from the floor of the gallery crawlspace. The work areas were backfilled to grade with clean soil, and the sampling and disposal of soil and rubble was completed according to the project requirements.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action (source removal)
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:

No stewardship requirements were specified in the decision documents.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Building has been removed – site undergoes only general plant-wide grounds S&M as needed.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

Building removed – no ongoing operating procedures in place.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Waste Evaporator Facility Removal Action – Sludge Removal (AM July, 1995; RAR July, 1996)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:
No chemical treatment in the selected remedy.

6. Additional site-specific questions and concerns:

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:
Building has been removed and footprint filled in with clean soil, however, site is within general ORNL facility fencing.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Waste Evaporator Facility Removal Action – Sludge Removal (AM July, 1995; RAR July, 1996)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

The Site is currently occupied by several Rubb buildings being used in conjunction with the Gunnite and Associated Tanks remedial action.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Building has been D&D'd; basement was filled in with clean fill soil.

Photographs (following page)
WEF1: View looking east toward Building 3525 across the former site of the Waste Evaporator Facility. Facility has been removed above grade and is currently an equipment lay-down area for Gunnite and Associated Tanks (GAAT) remediation work. Large rubber tent (RUBB building) stand on exact spot of former WEF.

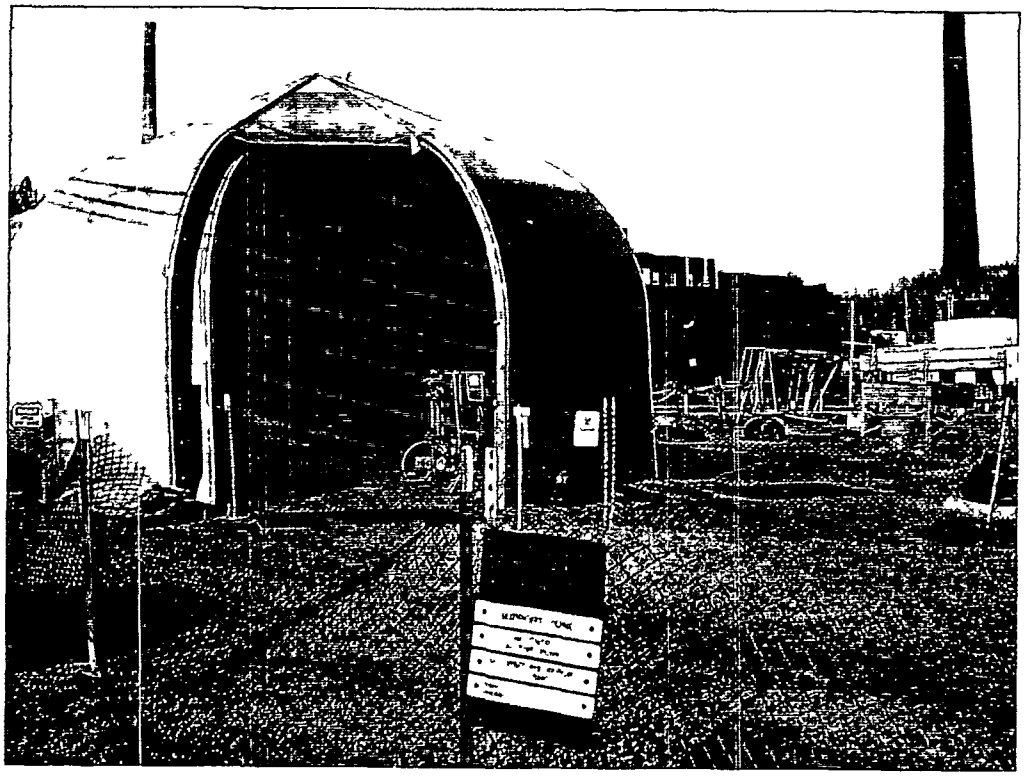
WEF2: Same as above, closer view of inside of RUBB building

Signatures:

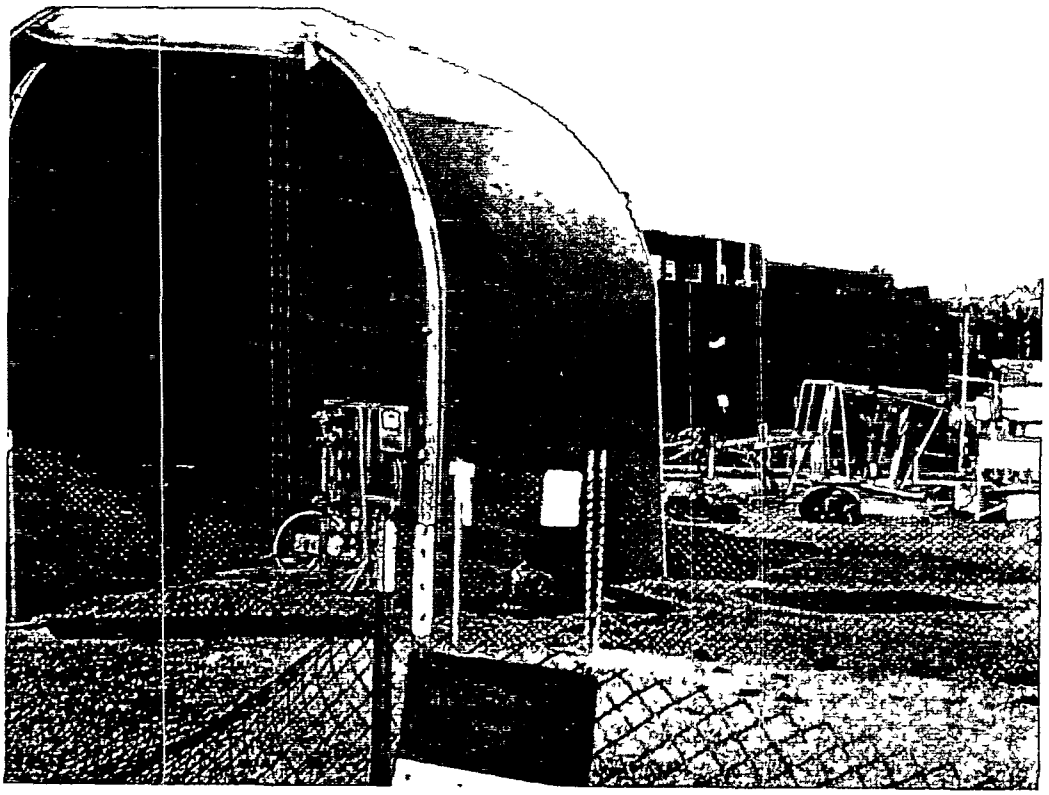
Interviewer _____

Site personnel _____

Waste Evaporator Facility



WEF1



WEF2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Building 3001 Canal Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Building 3001 Canal Removal Action (AM Nov. 1996; RAR May 1997)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762;

Bratati Lynn, BJC, 241-1346

Per the Decision Documents, the Remedy was: to replace the shielding protection provided by water with a specific grout formulation (controlled, low-strength material, or CLSM). Water in the canal was displaced by a low-strength grout in April 1997. The grout is a stable shielding material for residual contamination that also eliminates further leakage and hydraulic transport. After the canal area was cleared of miscellaneous materials, the canal and vault walls were painted to isolate contact-smearable contamination.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action (source removal)
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☒ Institutional Access Controls (Badges, TLDs, etc.)
- ☒ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

Building 3001 is within fenced area of ORNL requiring valid badge or visitor pass for access. Signs are clearly posted, and inspections conducted and documented regularly.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Weekly inspections of painted surfaces and to document that there is no water on the canal floor and that there is negative pressure in the containment duct. Inspections are documented on check sheets, and are submitted to the facility manager for review and retention. They are filed by date of inspection rather than by facility.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

Contamination fixed in place and access restricted. Area is inspected weekly.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Building 3001 Canal Removal Action (AM Nov. 1996; RAR May 1997)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762;

Bratati Lynn, BJC, 241-1346

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?

Yes ☐ No ☐ NA ☒

Notes:

Treatment did not involve chemical remedy.

6. Additional site-specific questions and concerns:

** Note – the site has both a "Contamination Area" and a "Radiological Area" posting.*

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

Are As-Builts readily available? *Yes* Up to date? *Yes*

Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?

Yes ☒ No ☐ NA ☐

Notes:

Badge required for access to building, and door to canal is kept locked at all times.

2. Have there been any changes in land use or expected land use on or near the site?

Yes ☐ No ☒

Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Building 3001 Canal Removal Action (AM Nov. 1996; RAR May 1997)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762;

Bratati Lynn, BJC, 241-1346

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

BJC will eventually turn building over to UT-Batelle after decontamination of rad sources in reactor. The building will be a Visitor Center. There is some uncertainty as to whether BJC will maintain control of the canal area.

Photographs (next page)

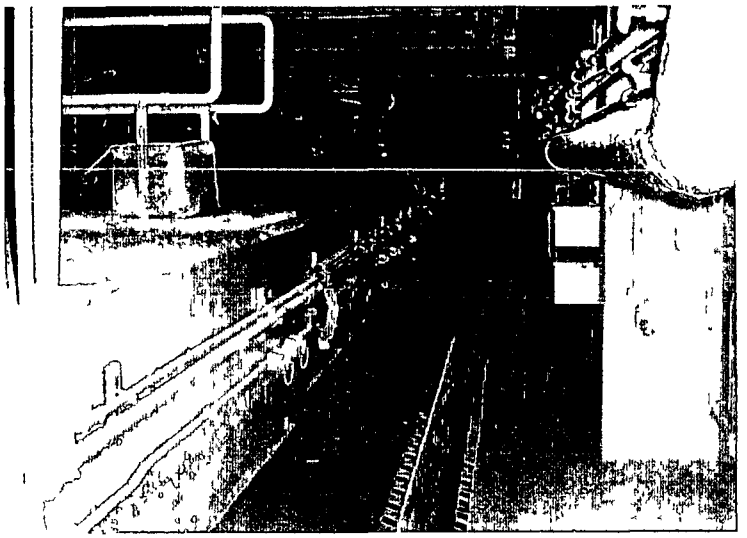
3001Canal1: View of Building 3001 Canal looking south. Canal is grout-filled and the entire structure painted to isolate contact-smearable contamination.
3001Canal2: Building 3001 Canal as it makes 90 degree turn towards Building 3019.
3001Canal3: Building 3001 Canal looking west towards Building 3019.

Signatures:

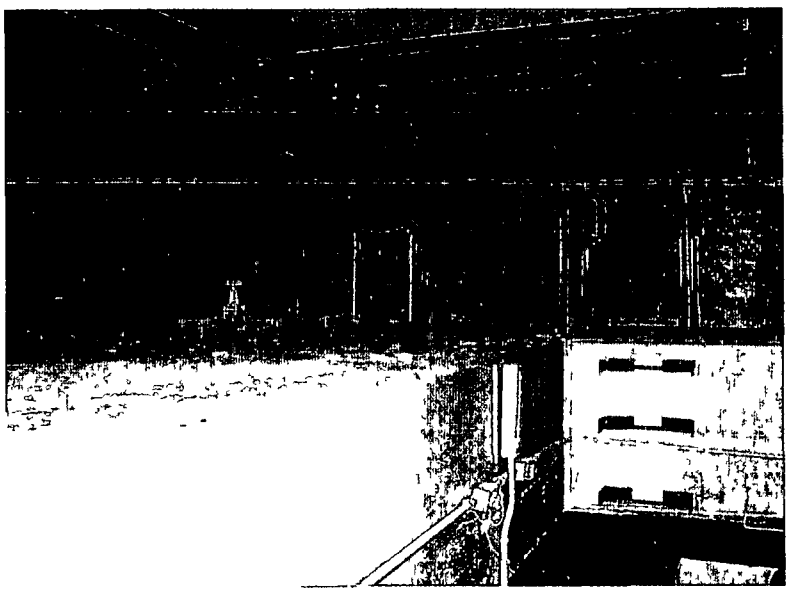
Interviewer _____

Site personnel _____

Building 3001 Canal



3001Canal1



3001Canal2

3001Canal3

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

White Oak Creek Embayment

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site White Oak Creek Embayment (T-CRA Sept. 1992)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Per the Decision Documents, the Remedy was: the construction of a sediment retention structure (SRS) at the mouth of White Oak Creek to contain the sediments in lower White Oak Creek Embayment and minimize transport off-site to the Clinch River and Watts Bar Reservoir.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring (water levels)
- ☐ Surface water collection and treatment
- ☒ Other – Sediment cores every 5 years (2001 on)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☒ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

Physical access limited by locked gate and fence, and signs posted. Possible physical access via the Clinch River. Signs posted on Sediment Retention Structure along river.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Visual survey of sediment trap structure. Full inspection every 6 months at White Oak Dam at 749 ft – stability survey. System is in place to inspect White Oak Dam (WOD) integrity during heavy storm events.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☒ No ☐ NA ☐
   Notes:

Structure was built ~ 8" too high and was acting as a mini-dam. There was not enough elevation difference between the SRS and WOD, so there were problems at WOD. The top 8" of gravel layer was removed in 1999. Also, water levels in the river can change 2 to 3 ft in minutes due to releases at Melton Hill Dam. In low water the sediments are exposed, and water will move into embayment and redeposit sediments. Every 1 to 2 years White Oak Creek overflows the sediment retention structure during big storm events.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☒ NA ☐

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site White Oak Creek Embayment

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Interview (continued)

4.(continued) Notes:

The porous media of the SRS is not very porous anymore. It has become clogged with sediments, debris, and plants, and tends to act more as a dam than as a screen.

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?

Yes ☐ No ☒ NA ☐

Notes:

6. Additional site-specific questions and concerns:

Embayment sediment cores were collected for the first Five-Year Review published in 1996; none were collected for the current Five-Year Review.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

Are As-Builts readily available? *Yes* Up to date? *See A-3*

Are Maintenance Logs readily available? *Yes* Up to date? *Yes*

2. Monitoring and Inspection Records:

Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?

Yes ☒ No ☐ NA ☐

Notes:

However, it is possible to access the embayment (and White Oak Dam upstream) from a boat in the lake. According to the Facility Manager, fishermen have been observed in the Clinch River adjacent to the SRS.

2. Have there been any changes in land use or expected land use on or near the site?

Yes ☐ No ☒

Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site White Oak Creek Embayment

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

As indicated in A3 and below, the SRS has been slightly modified from its original form.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Structure was built ~ 8" too high. When problems occurred at WOD there wasn't enough elevation difference between dam and SRS, so about 8" of rock was removed last year(1999).

The porous media (gravel and boulders) ares clogged with sediment, therefore act more as dam than as sieve.

Fishermen have been observed tied up to SRS fishing, right next to posted signs about contamination.

Photographs (following page)

WOCE1: View standing over SRS (bottom left corner of photograph) looking toward the Clinch River.

WOCE2: View from the SRS looking up White Oak Creek in the direction of WOD (not visible in photograph)

Signatures:

Interviewer _____

Site Personnel _____

White Oak Creek Embayment

WOCE1

WOCE2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

WAG 5 Seep C

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site WAG 5 Seep C

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Per the Decision Documents, the Remedy was: Groundwater collection and treatment: a french drain collects groundwater and routes it by gravity flow to a treatment unit in which zeolite-filled drums sorb ^{90}Sr via ion exchange. The sole objective of the removal action is to reduce the release of ^{90}Sr to Melton Branch and, hence, off-site. Treated groundwater is discharged to Melton Branch without regard for other contaminants that may be present.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☒ Groundwater collect & treat
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes: *Limited access (fencing, signs identifying site and Facility Manager)*

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Yes, weekly S&M inspections by Waste Management Federal Services, and monthly water sampling of influent and effluent.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☒ No ☐ NA ☐
   Notes: *Iron clogs up zeolite in upper portion of drums, and drums are changed out at least once a year. Influent flow meter was down for about 6 months. Squirrel chewed cable on sampling device. Both are repaired and functioning currently.*

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes: *Currently system is operating at 90% efficiency for captured water. Not all contaminated discharge from the SWSA 5 trenches is captured, thus additional CERCLA is planned Data for FY 2000 had gaps (see A-3 above).*

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site WAG 5 Seep C

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☒ No ☐ NA ☐
   Notes:

Iron clogs the zeolite medium; this is only an issue when addressing disposal of used zeolite columns.

6. Additional site-specific questions and concerns:

None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *No* Up to date? *NA*

   As-Built documents not made available at the time of the site visit.

   Are Maintenance Logs readily available? *Yes* Up to date? *Yes*

2. Monitoring and Inspection Records:

   Are Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site WAG 5 Seep C

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Site is clean and well maintained. It appeared that the zeolite drums were in the process of being changed out, as is done annually. Site was well marked and adequately fenced.

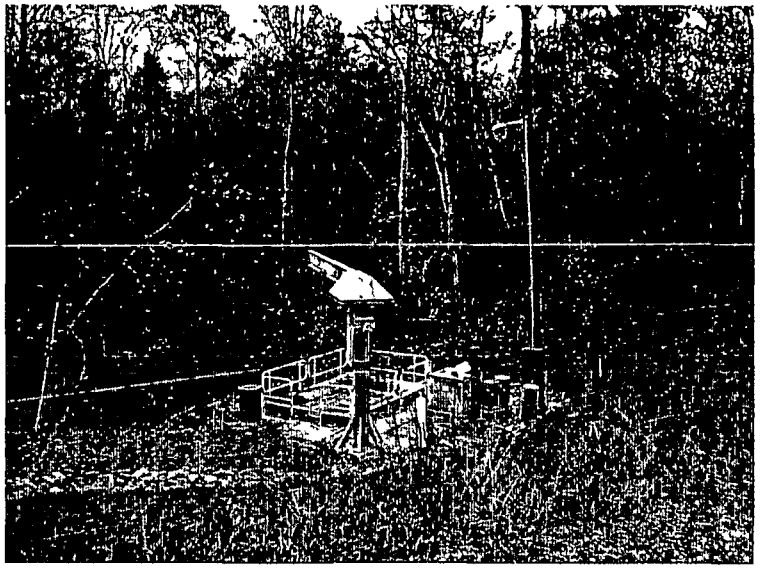
Photographs (following page)
WAG5C1: View of groundwater collection system looking east toward creek (Melton Branch)
WAG5C2: View of collection system with posted signs in foreground
WAG5C3: Equipment on-site for changing out zeolite cells in treatment system

Signatures:

Interviewer _____

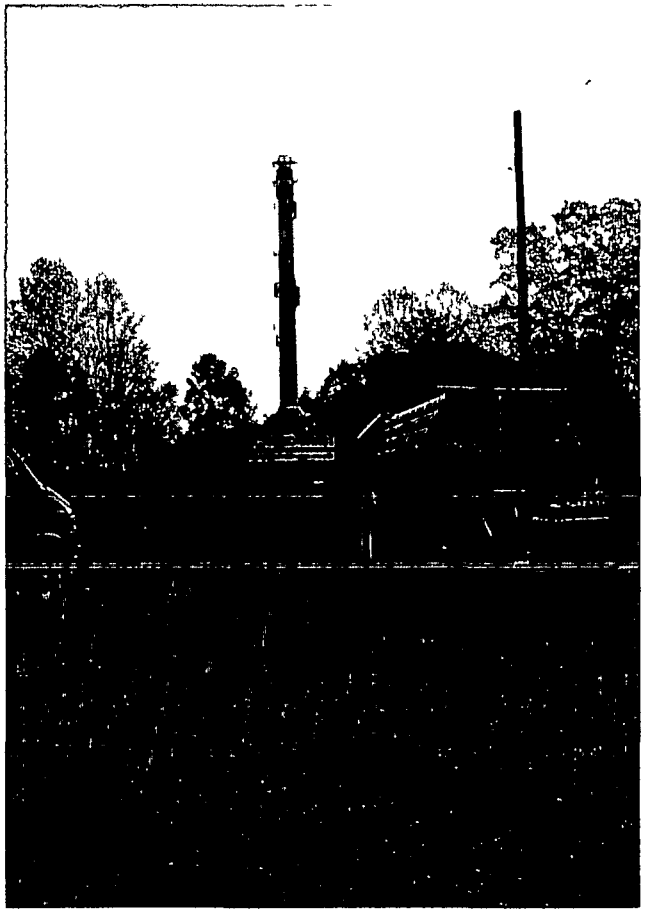
Site Personnel _____

WAG 5 Seep C



WAG5C1

WAG5C2



WAG3C3

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

WAG 5 Seep D

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site WAG 5 Seep D (AM July 1994, PCR June 1995)

Date(s) of Visit October 27. ,2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Per the Decision Documents, the Remedy was: Groundwater collection and treatment: Groundwater is collected from the bed of Melton Branch and pumped through a series of ion-exchange columns filled with zeolite for treatment. The objective of the removal action is to reduce the release of ^{90}Sr into Melton Branch and consequently off-site over White Oak Dam. Treated water is returned to Melton Branch without regard for other contaminants that may be present.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☒ Groundwater collect & treat
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☒ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

WMFS inspects unit daily, and takes monthly influent, effluent samples. Zeolite columns changed every 2 to 3 months, with column 1 taken out, column 2 moved to column 1 spot, and new column put in column 2 spot. Flow is then reversed every time columns changed out.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

Minor incidents such as tree falling on powerline, and cylinder developing a crack and leaking, but all quickly repaired with no long-term consequences. Iron clogging not the problem as in Seep C.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes: *Active pump system operates without problems. Zeolite treatment unit achieves > 90% treatment efficiency.*

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site WAG 5 Seep D

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

Additional automated controls could reduce need for daily inspection and help optimize operations.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *No* Up to date? *NA*

   As-Built documents not made available at the time of the site visit.

   Are Maintenance Logs readily available? *Yes* Up to date? *Yes*

2. Monitoring and Inspection Records:

   Are Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:
   Adjacent to site is construction for Foster Wheeler new TRU Waste Treatment Facility. New road leads from Highway 95 to area near TRU Facility and Seep D Area.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site WAG 5 Seep D

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

All contamination in Seep D is coming from fracture in bedrock below creek. The remedy includes an inverted box with concrete floor constructed with pump. When water in the box reaches a certain level, the pump kicks in and sends water across the creek to treatment unit.

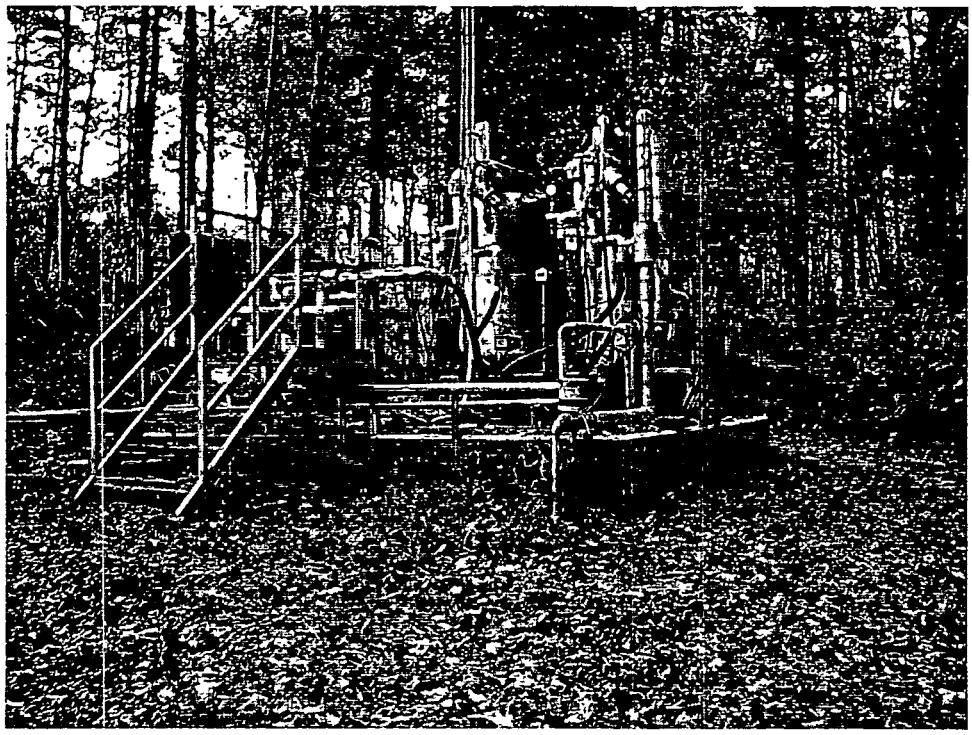
Photographs (following page)
WAG5D1: View from edge of creek looking toward treatment unit.
WAG5D2: View from treatment looking toward creek. Note signs on edge of creek.

Signatures:

Interviewer _____

Site Personnel _____

WAG 5 Seep D



WAG5D1

WAG5D2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

WAG 4 Seeps Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Wag 4 Seeps Removal Action (AM Feb. 1996, RAR Aug. 1997)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Per the Decision Documents, the Remedy was: stabilization of burial trenches by grouting. Many burial trenches at SWSA 4 are inundated, and affected groundwater discharges to an ephemeral stream, which flows to White Oak Creek. Site investigations showed that most of the ^{90}Sr releases occur at two seeps (4 & 6), from parts of four upgradient trenches. To improve the physical stability and reduce the hydraulic conductivity of the trenches, a variety of grouts were injected using a low-pressure permeation technology.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☒ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☒ Institutional Access Controls (Badges, TLDs, etc.)
- ☒ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

Site is clean, well-maintained, and well posted with signs. Site is enclosed by locked fence.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Yes.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:
   Performance data indicate action is close to achieving 35% reduction in ^{90}Sr releases at seeps below grouted trenches.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Wag 4 Seeps Removal Action

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *Yes* Up to date? *Yes*

2. Monitoring and Inspection Records:

   Are Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

Fencing, rad roped areas

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Wag 4 Seeps Removal Action

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Access controls, primarily fencing, is well maintained. Signs indicate Facility Manager contact and site identification.

The WAG 4 MS1 station, a primary monitoring location, is scheduled to be moved down the tributary as part of additional CERCLA action at SWSA 4. This will make comparisons to pre-seeps remediation releases more difficult.

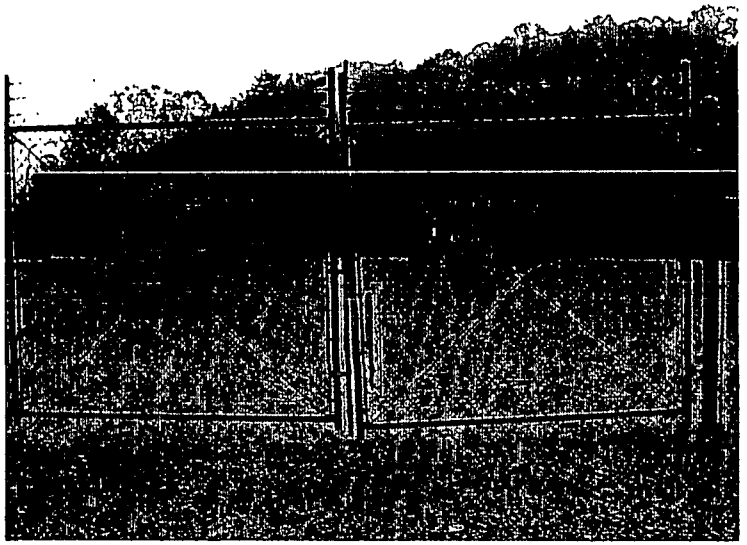
Photographs (following page)
WAG4Seep1: Entrance gate on south side of access road showing clear signage. Gate is kept locked at all times but was unlocked at time of photograph for access to area.
WAG4Seep2: View from just inside fence gate towards the grouted area of WAG 4 trenches (light gray area in center of photograph)
WAG4Seep3: View of grouted trench area – pipes sticking up are grout injection ports.

Signatures:

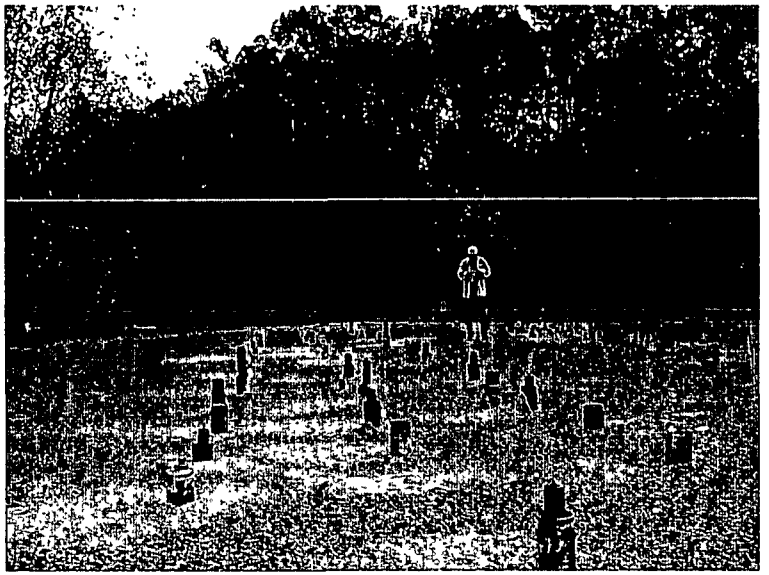
Interviewer _____

Site Personnel _____

WAG 4 Seeps



WAG4Seep1



WAG4Seep3

WAG4Seep2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

WAG 13 Cesium Plots

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site WAG 13 Cesium Plots (IROD Sept. 1992, IRAPCR July 1994)

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Per the Decision Documents, the Remedy was: excavation of ^{137}Cs-contaminated soil until residual contamination was ≤120 pCi/g, containerization of the excavated soil in steel boxes designed for the storage of low-level radioactive waste, transport of the excavated soil to WAG 6 low-level waste silos by truck, and placement of a permeable liner in each excavated plot and backfill with clean compacted fill material and a topsoil layer.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes: *Access to area is restricted, however, the fence needs some repair – during the site visit it was observed that the barbed wire at the top of the fence has been cut in at least one place; 2 or 3 gates along river side are locked and posted with signage indicating "Soil Contamination Area", Facility Manager and phone number listed.*

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

WMFS conducts monthly inspections to check fence, signs, locks, etc. OEP performs rad surveys as needed; last one posted February 1999

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes: *Two years ago, LMES rad survey found a "hot spot" outside of fence between the western end of the site and the Clinch River – possibly from old debris in area. LMES excavated the soil down to 7 ft bgs, and surveyed all up and down river to make sure occurrence was isolated. There is annual compliance monitoring to check dose rates at the river. Floodplain gets saturated during the wet season.*

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Source removal action—no ongoing operations.

Name of Site WAG 13 Cesium Plots

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

Site is along-side the Clinch River, separated only by ~50 yards. There are no access controls preventing public from accessing the site fence from the river. Site will be further addressed as part of planned boundary sites decisions.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
Fence needs repair.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
Carbon Dioxide column test site (ORNL project) adjacent to WAG 13. Site remains in government control.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site WAG 13 Cesium Plots

Date(s) of Visit October 27, 2000

Interviewer, title, phone Samantha Pack, SAIC, RER Project Manager, 481-8750

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762; Steve Nolan, BJC, Facility Manager, 574-0139

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Area immediately around plots is fenced and patrolled at night (no access controls during the day to areas around the fence).

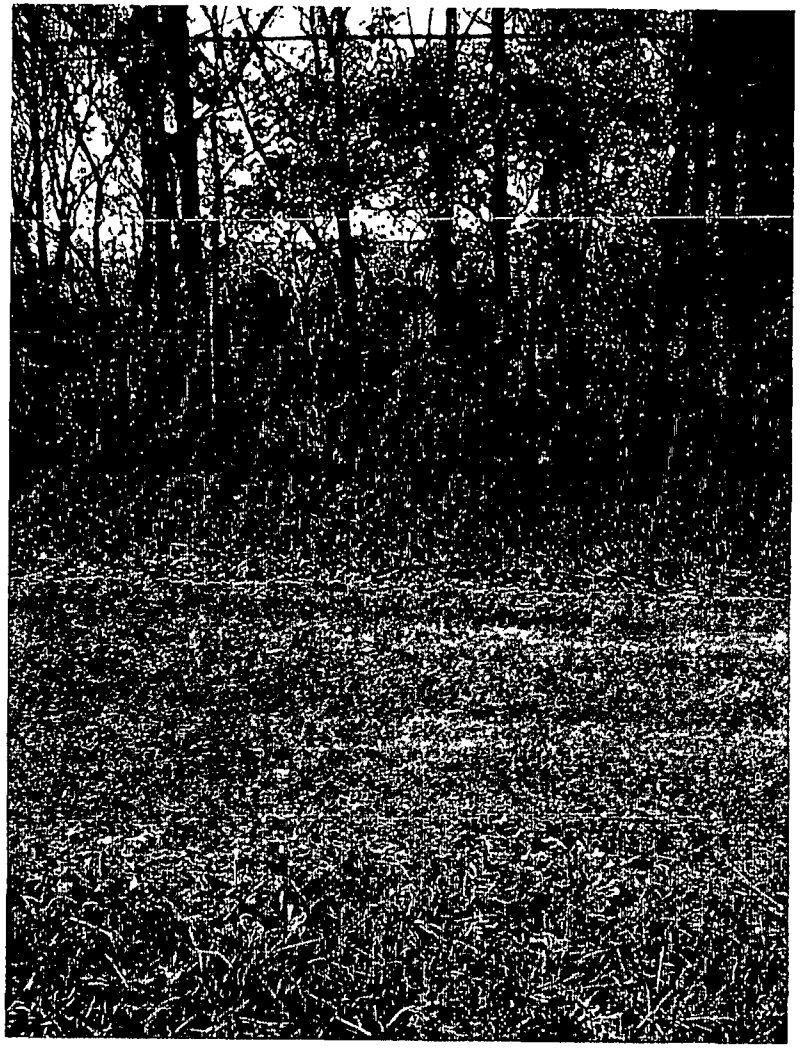
Photographs (following pages)
CsPlots1: View from fence at Cs Plots looking south towards the Clinch River, which is directly behind tree line
CsPlots4: View along access road looking northwest. Clinch River is on left, Cs Plots on right
CsPlots2: View of fence surrounding Cs Plots showing cut barbed wire at top
CsPlots3: View of locked fence gate with warning signs
CsPlots5: Close up of signage on fence identifying site manager and warnings.

Signatures:

Interviewer _____

Site Personnel _____

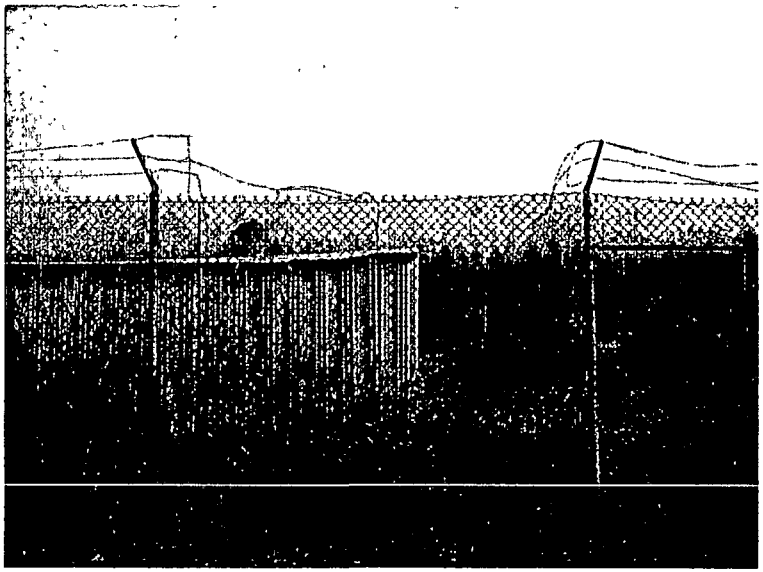
WAG 13 Cesium Plots



CsPlots1

CsPlots4

WAG 13 Cesium Plots



CsPlots2

CsPlots5

CsPlots3

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Old Hydrofracture Facility Tanks

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Old Hydrofracture Facility Tanks (AM Sept., 1996, RmAR Sept., 1998

Date(s) of Visit December 12, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Per the Decision Documents, the Remedy was: to remove radioactive and hazardous supernatant and sludge from 5 underground LLLW tanks. The waste was removed by sluicing and pumping, and transferred to interim storage in the Melton Valley Storage Tanks. Tanks were grouted in place in the summer of 2000.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Site is still under S&M maintenance. Exact schedule and documentation of surveillances was unknown at time of site visit.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

Source has been removed, no ongoing operating procedures.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Old Hydrofracture Facility Tanks (AM Sept., 1996, RmAR Sept., 1998

Date(s) of Visit December 12, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:
Chemical treatment was not part of the selected remedy.

6. Additional site-specific questions and concerns:

None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
Land use controls were not specified in the decision documents, however, one must pass through gated fence (requiring valid badge) to access the site.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Old Hydrofracture Facility Tanks (AM Sept., 1996, RmAR Sept., 1998

Date(s) of Visit December 12, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Dick Ketelle, BJC, XWQP Project Manager, 574-5762

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Tanks were filled with grout this past summer (2000) and thus the action is complete.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The tanks can be located on the gravel pad by the presence of the access ports (brown circular plates with lugs sticking up out of them – see photographs). Two tanks are located on the upper portion of the gravel pad, which is currently covered with abandoned equipment left by CDM. The remaining three tanks are located behind this main pad area.

Photographs:

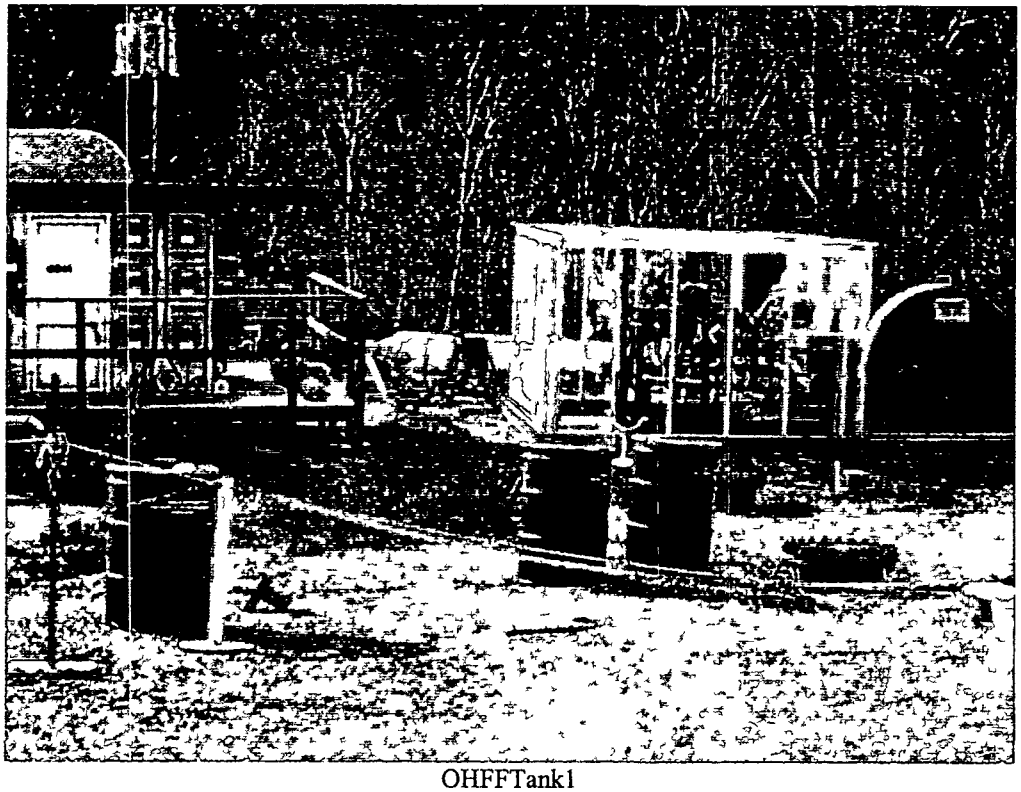
OHFFTank1: Main pad area showing 2 tanks. Tank axis is left-right across the photograph. Remaining tanks are located behind the equipment shown on the gravel pad.
OHFFTank2: Main pad area showing tanks, as above. Equipment on pad was left by CDM after completing the remediation (sluicing and pumping of tank contents).

Signatures:

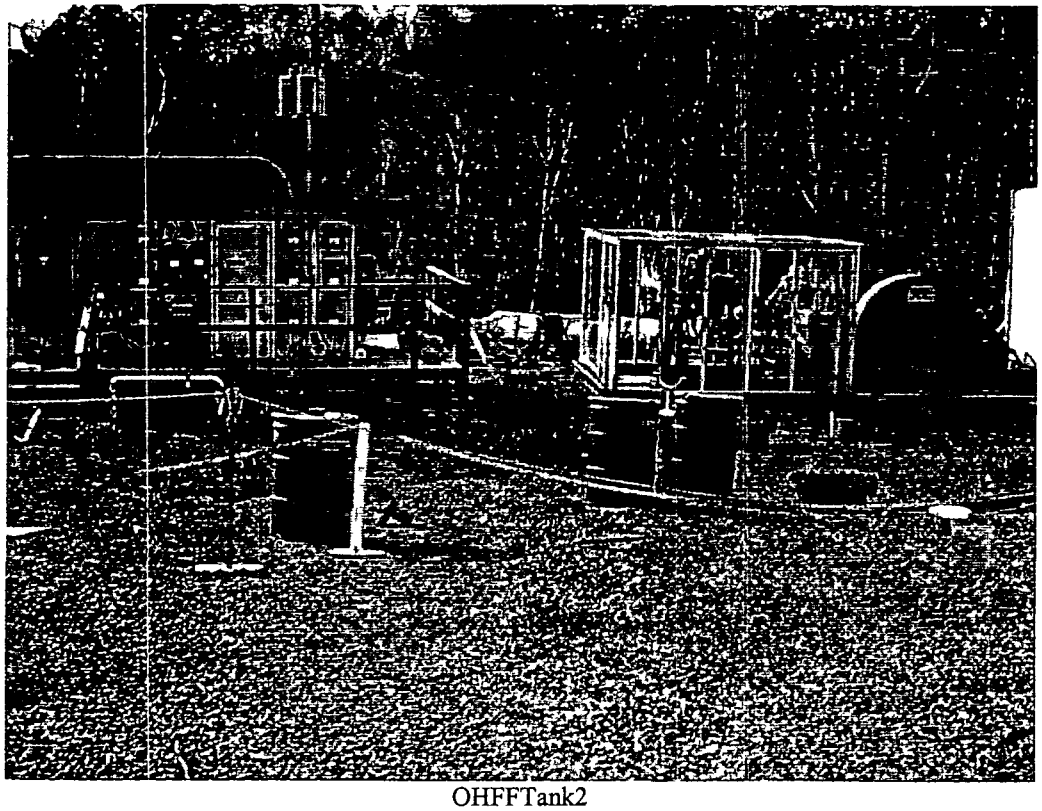
Interviewer _____

Site Personnel _____

Old Hydrofracture Facility (OHFF) Tanks



OHFFTank1



OHFFTank2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

White Wing Scrap Yard

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site: White Wing Scrap Yard (IROD, September 1992)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: Collection and containerization of surface debris, transportation of collected debris to WAG 6 at ORNL for disposal, and re-planting of all areas disturbed during debris removal. Goals of the action are to reduce further environmental degradation by eliminating the potential source (surface debris), reduce the risk associated with investigation and S&M activities.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1.. Are Stewardship requirements specified in the Decision Document (see above) being met?
Yes ☐ No ☐ NA ☒
Notes:
No stewardship requirements are specified in the decision document, however, the entire boundary of the site is fenced and signs are posted on the fencing identifying the site and directing inquires to Greg Wayland.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Yes. Surveillance & maintenance visits occur on a quarterly basis and inspections are made each month. The ROD does not stipulate any form of surveillance activities so these are performed as a best management practice and in response to DOE orders. These activities are documented in inspection reports that are available in the Site Manager's office and sent to the DMC at the end of each FY.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
Yes ☐ No ☒ NA ☐
Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
Yes ☒ No ☐ NA ☐
Notes:

Name of Site: White Wing Scrap Yard (IROD, September 1992)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

   Note that the surveillance and maintenance schedule may vary depending on the weather and the thickness of vegetation. A complete inspection of the fence line may not be possible during some time periods in the summer when vegetation is too thick and heat index too high

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *See Notes*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

Notes: Groundwater monitoring is not a requirement of the remedy, however, all previous groundwater monitoring data from this site are available through OREIS.

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

   The entire boundary of the site is fenced and signs are posted on the fencing identifying the site and directing inquires to Greg Wayland.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:
   This area has been opened up to public access for the purposes of hunting during 3 weekends each year. The fence prevents direct exposure to the site.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site: White Wing Scrap Yard (IROD, September 1992)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☒ No ☐
   Notes:
   Public access provides additional potential exposure pathways not considered by the original remedy. Access controls and the surveillance and maintenance activities have mitigated these potential exposure pathways. The site is completely fenced preventing public access. These controls and the surveillance and maintenance activities should be included in the ROD.

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The White Wing Scrap Yard is a densely wooded area covering approximately 30 acres. The site is located north of Bear Creek and south of the East Fork Poplar Creek floodplain. The topography at the site is gently rolling hills and two tributaries to Bear Creek run through the site. The perimeter of White Wing Scrap Yard is completely surrounded by a fence. A section of one of the tributaries downstream of the site is also enclosed by a fence. The access road ("Hot Yard Road") runs down the middle of the site. On either side there are occasional clearings. Two groundwater wells are located at the east end of the site.

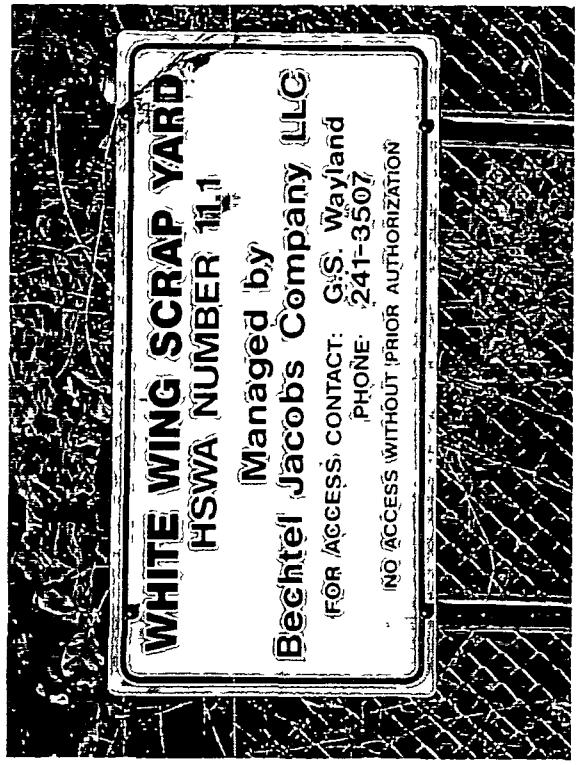
Photographs (next page):
WWSY1: Hot Yard Road looking South from the entrance to WWSY
WWSY2: Example of an cleared area on the East side of Hot Yard Road
WWSY3: Sign at entrance to WWSY
WWSY4: Locked gate at entrance to WWSY

Signatures:

Interviewer _____

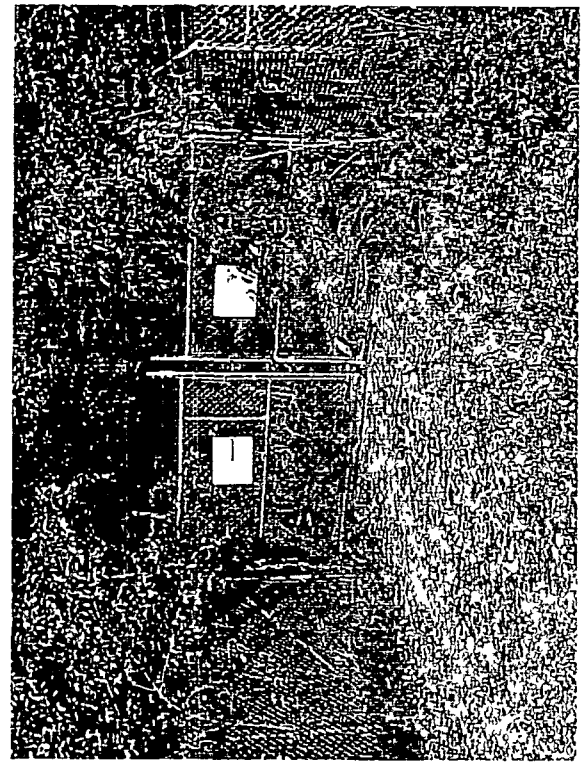
Site Personnel _____

WWSY1



WWSY3

WWSY2



WWSY4

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Spoil Area 1 (BCV OU 2)

00-362P(doc)/021402

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site: Spoil Area 1 (BCV OU 2) (ROD, September 1996)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: Maintenance of physical barriers to limit access to the site; future deed restrictions to (1) restrict construction at this site, (2) incorporate indoor radon mitigative measures in accordance with EPA guidelines for any future structures built on the site, and (3) prohibit waste intrusion to mitigate direct exposure; periodic physical surveillance of the soil cover and other features of the site (i.e. vegetated bank decending to Bear Creek at SY-200) and maintenance or repair, as required.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☒ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☒ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☒ S&M Inspections
- ☒ Other – Maintenance of vegetated soil cover

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:
   This site is located within the fenced security zone of the Y-12 Plant and as such, a valid badge or visitors pass is required for access.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   Yes. Surveillance & maintenance visits occur on a quarterly basis. In addition, inspections are made each month as a best management practice. These activities are documented in inspection reports that are available in the Site Manager's office and sent to the DMC at the end of each fiscal year.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:
   A seep is located on the north side of SP-1 and was identified by the RI. This seep presents a hazard to tractors mowing the steep bank of the SP-1 site from the potential for the tractors to slip on the wet soil. Rip rap has been added to the seep to promote drainage and minimize the area of moist soil.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

Name of Site: Spoil Area 1 (BCV OU 2) (ROD, September 1996)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

   None

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *See Notes*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

Notes: groundwater monitoring is not required as part of the remedy and is not currently conducted, however, monitoring was conducted as part of the RI and those data are available through OREIS

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   Site is located within the fenced security zone of the Y-12 Plant, and as such a valid badge or visitors pass is required for access. Signs are located around the site indicating that no subsurface work should be carried out at the site and identifying Greg Wayland as the contact. A locked gate on the vehicle access road prevents unauthorized vehicle access to the top of the cap.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site: Spoil Area 1 (BCV OU 2) (ROD, September 1996)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The site is a hill with steep banks located south of Old Bear Creek Road on the flank of Chestnut Ridge. The whole site is covered with mowed grass. There are no fences surrounding the site. There are signs (see photographs) located on each side indicating that this is a former site in the remediation program, that prior permission is required before working on the site, and identifying Greg Wayland as the site custodian. There is no sign of erosion of the cap. The road providing access to the top of the cap has a locked gate preventing unauthorized access. Two groundwater wells are located at the crest of the SP-1 cap.

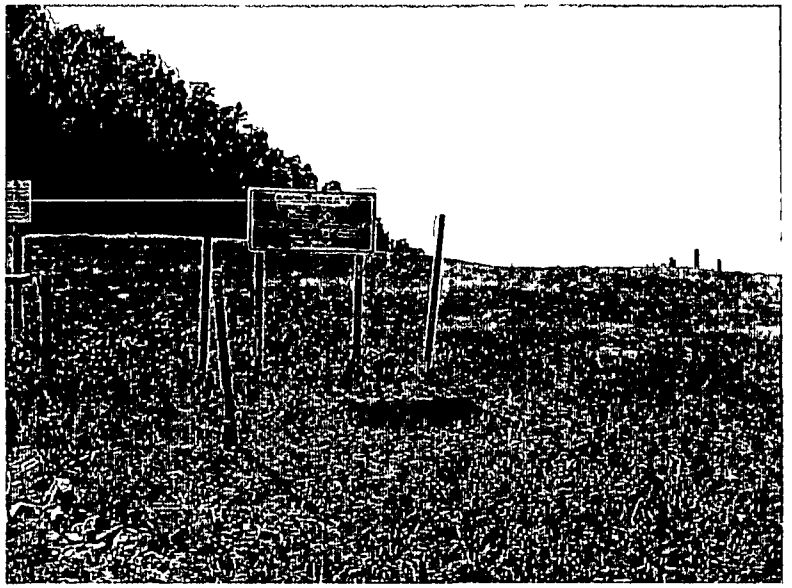
Photographs (next page)
SA11: Sign at Spoil Area 1 at the vehicle entrance.
SA12: Top of Spoil Area 1 cap looking NE, Well GW-314 in the foreground, GW-315 to rear
SA13: Top of Spoil Area 1 cap looking NE
SA14: Top of Spoil Area 1 cap looking NE, Wells GW-314 and GW-313 in the foreground

Signatures:

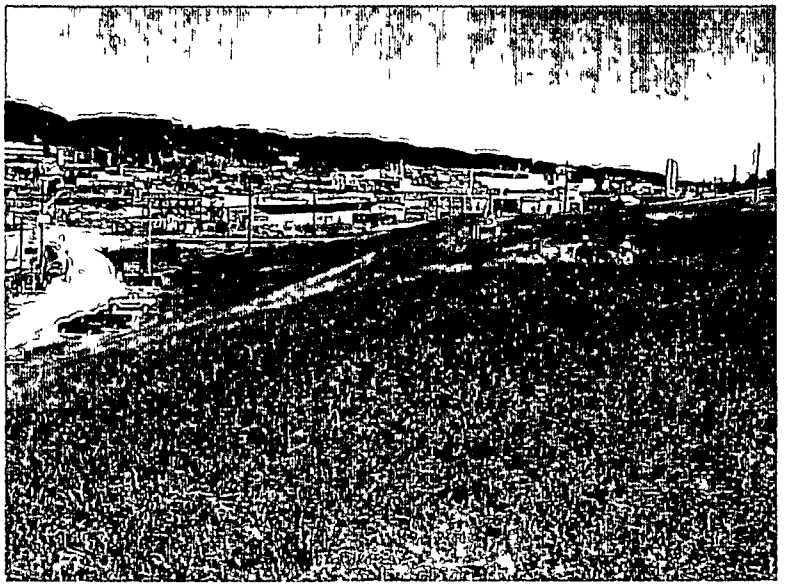
Interviewer _____

Site Personnel _____

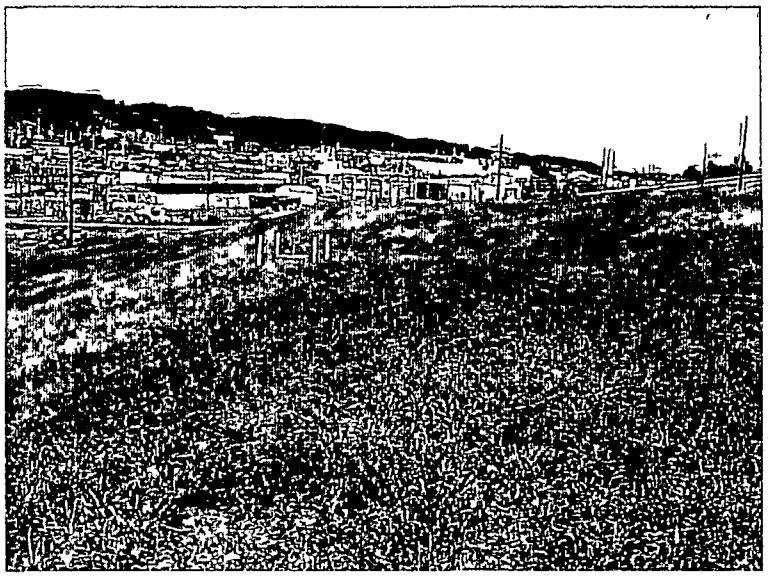
SPOIL AREA 1



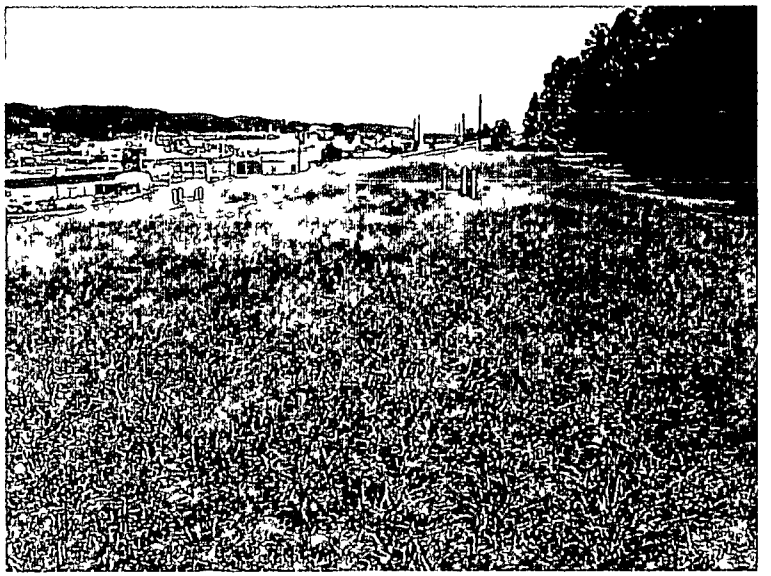
SA11



SA13



SA12



SA14

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

SY-200 Yard (BCV OU 2)

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site: SY-200 Yard (BCV OU 2) (ROD, September 1996)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: Maintenance of physical barriers to limit access to the site; future deed restrictions to (1) restrict construction at this site, (2) incorporate indoor radon mitigative measures in accordance with EPA guidelines for any future structures built on the site, and (3) prohibit waste intrusion to mitigate direct exposure; periodic physical surveillance of the soil cover and other features of the site (i.e. vegetated bank decending to Bear Creek at SY-200) and maintenance or repair, as required.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☒ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☒ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☒ S&M Inspections
- ☒ Other – Maintaining vegetated soil cover

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

   This site is located within the fenced security zone of the Y-12 Plant and as such, a valid badge or visitors pass is required for access.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
   Yes. Surveillance & maintenance visits occur on a quarterly basis. In addition, inspections are made each month as a best management practice. These activities are documented in inspection reports that are available in the Site Manager's office and sent to the DMC at the end of each Fiscal Year.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☒ No ☐ NA ☐
   Notes:
   Difficulty establishing and maintaining vegetative cover - approximately 6 in. top soil was added to the site to promote growth of plant cover.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

Name of Site: SY-200 Yard (BCV OU 2) (ROD, September 1996)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   - Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

   None

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *Yes* Up to date? *See Notes.*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

Notes: groundwater monitoring is not required as part of the remedy and is not currently conducted, however, monitoring was conducted as part of the RI and those data are available through OREIS.

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

The site is within the fenced security zone of the Y-12 Plant, and a valid badge or visitors pass is required for access. Signs are located around the site indicating that no subsurface work should be carried out at the site and identifying Greg Wayland as the contact. There is also one sign providing a map of the site.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:

A section of the SY-200 yard on the south side was overlain with a portion of Old Bear Creek Road after the road was relocated. A gravel parking lot covers approximately the eastern quarter of the SY-200 yard. Neither of these changes results in changes to the exposure pathways at the site.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site: SY-200 Yard (BCV OU 2) (ROD, September 1996)

Date(s) of Visit: October 12, 2000

Interviewer, title, phone: Duncan Moss, SAIC, Senior Scientist, 481-4752

Site Personnel, title, phone: Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐

   Notes: See Visual Survey question # 2 (above). Also refer to attached photographs.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The site is a level area located between Old Bear Creek Road and Bear Creek. The portions of the site that are not covered with the parking lot (located at the east end of the site) are covered with mowed grass. There are no fences surrounding the site. There are signs (see attached photographs) located on each side indicating that this is a former site in the remediation program, that prior permission is required before working on the site, and identifying Greg Wayland as the site custodian. The bank down to Bear Creek on the north side of the side is covered with Rip Rap and heavily vegetated. There is no sign of erosion. Two groundwater wells are located at the west end of the site.

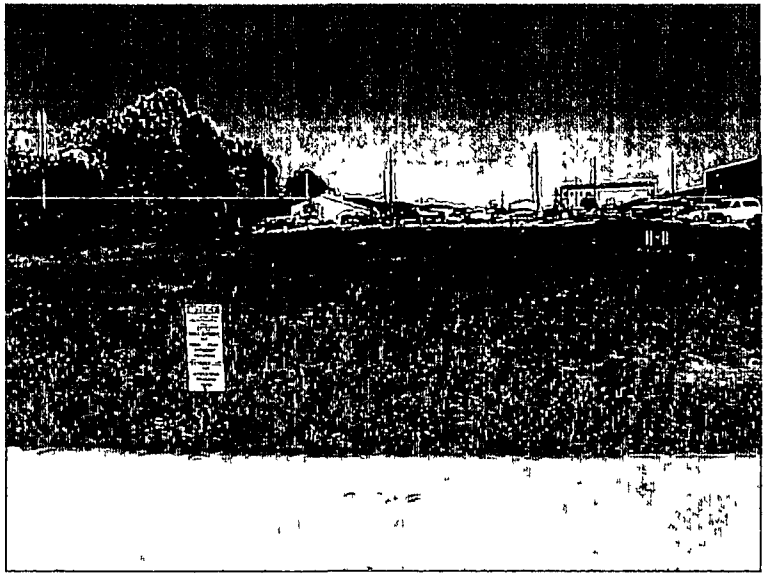
Photographs (next page)
SY2001: SY-200 Facing NE. The parking lot covering part of SY-200 is in the background, Old Bear Creek Road on the right side and Bear Creek on the left side of the photograph
SY2002: Sign at SY-200 Yard
SY003: SY-200 facing SW from the parking lot.

Signatures:

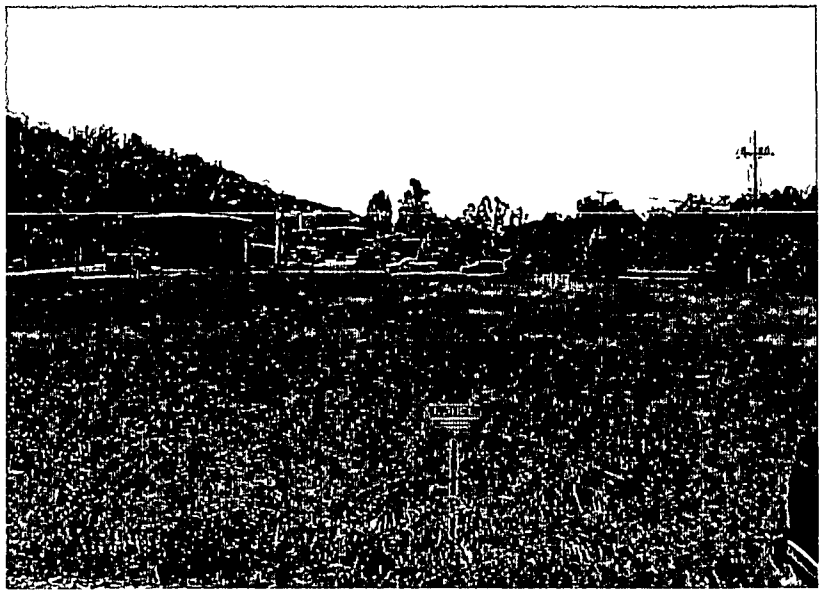
Interviewer _____

Site Personnel _____

SY-200 YARD



SY2001



SY2003

SY2002

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

UNC Site

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site UNC Site (ROD, June 1991; Postconstruction Report, June 1993)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: The construction of a multilayer cover system, surveillance and maintenance of the cap, and groundwater monitoring of the 1.3-acre landfill located near the crest of Chestnut Ridge south of the Y-12 Plant.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☒ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☒ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

   Cover maintenance and inspection is all that was specified.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
   Yes - Quarterly cap inspections documented on inspection forms. Monthly BMP inspections. Cap inspections are also conducted following heavy (i.e., 25 yr intensity) rainfall events.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

   No issues noted. Bechtel Jacobs has recently worked to improve the quality of the vegetative cover on the cap using a seed drill.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

   Well GW-205 has shown elevated gross beta; however, no corresponding increase in Sr-89/90 was noted. Additional evaluation to be done in the FY01 RER.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site UNC Site

Date(s) of Visit October 13, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

   No chemical treatment remedial methods were employed.

6. Additional site-specific questions and concerns:

   None noted other than elevated beta measurements in well GW-205.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *Contained in post-construction report* Up to date? *Yes*

   Are Maintenance Logs readily available? *Yes* Up to date? *Yes*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

   Although not specified in Decision Documents, site is within the Y-12 Plant Property Protection Area and is, therefore, restricted access.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site UNC Site

Date(s) of Visit October 13, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

   Reference item A.3 regarding improved vegetative cover.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

   Open, grass-covered area, gently sloped. The majority of the cap is sloped to the west and south. Riprap drainage controls at northwest corner of the site at the intersection of UNC Site access road and South Patrol Road. A drainage swale oriented east-west exists along the northern edge of the unit and directs flow toward the west.

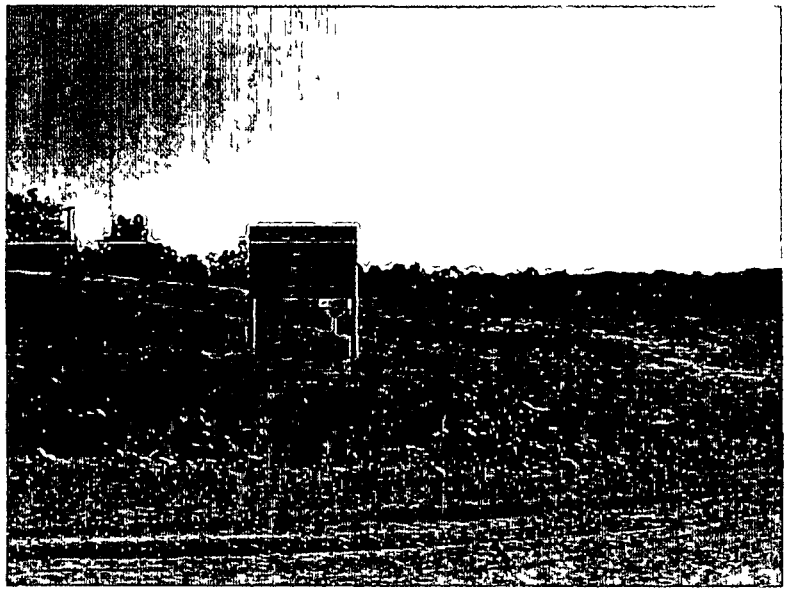
   Photographs (following page)
   UNC1: View of the UNC site from the northwest corner, looking east. Note drainage controls in the foreground
   UNC2: View of the UNC site looking northeast
   UNC3: View of the UNC site looking north
   UNC4: View of the UNC site looking northeast. Note warning sign in foreground and drainage swale to left of the sign

Signatures:

Interviewer _____

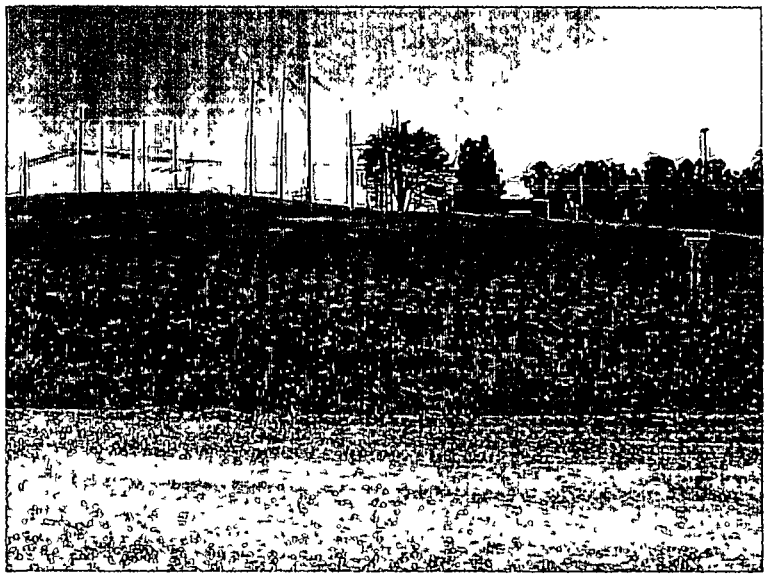
Site Personnel _____

UNC SITE

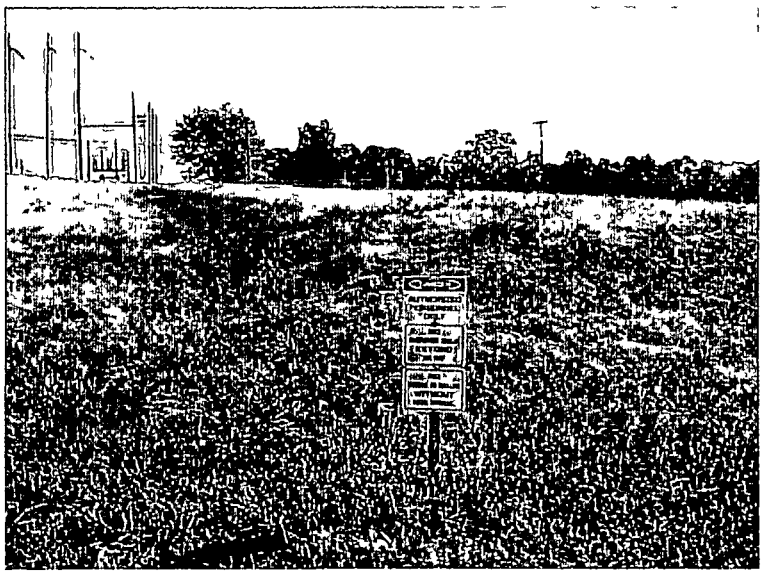


UNC1

UNC3



UNC2



UNC4

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Mercury Tanks

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Mercury Tanks (IROD, September 1991; PCR, September 1993)

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager

Per the Decision Documents, the Remedy was: The interim remedial objective was to remove mercury-contaminated sediment from active tanks and to prevent elemental mercury from entering the storm sewer system. Upon completion of the interim action, Tank 2101-U was abandoned in place. Tank 2104-U was removed from service on November 3, 1996. Tank 2100-U was drained and inspected in November 1995. No accumulation of sediments or sludges was noted at that time. Discharge through Tank 2100-U was redirected to the Y-12 Plant Central Mercury Treatment Facility in November 1996. With this change, the Y-12 Plant storm water collection system completely bypasses the mercury tanks.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA (source removed)
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:

   No further action decision following completion of the interim action.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   No post-remedial action S&M requirements apply. However, the pumping system in Tank 2100-U, which serves as a collection and pumping station for building sumps in 9201-4 and 9201-5, undergoes regular inspection and maintenance.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

Name of Site Mercury Tanks

Date(s) of Visit October 26, 2000 09:24

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager

Interview (continued)

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

   No chemical remedial treatment methods were employed.

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc.) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:
   No land use control specified. The site is within the industrialized portion of the Plant and is within the Y-12 Plant Protected (high security) Area.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:
   Building 9201-5 is scheduled to transition to EM in CY 2003 or 2004.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Mercury Tanks

Date(s) of Visit October 26, 2000 09:24

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Tanks 2101-U and 2104-U are high-strength concrete sumps. A valve pit (approx. 6 ft deep and 4 ft square) covered with a metal grate projects off to the north side of both tanks. On Tank 2104-U an additional valve pit (approx. 2 feet square) projects off of the south side of the tank. Valve pits in Tank 2104-U contain approx. 3 feet of standing rainwater. The tops of the concrete sumps project approximately 3 feet above grade. Entry points are capped with steel plates. A defunct combustible gas indicator and pump body is present on top of 2101-U.

Tank 2100-U is also a concrete sump similar in design to 2101-U and 2104-U, but is routinely maintained as a collection and pumping point for sump discharges from 9201-4 and 9201-5. The top of Tank 2100-U is nearly flush with grade. Pump heads and control panels are located on top of the tank.

Photographs (following pages)
Tank2104U1: View of Tank 2104-U looking south. Note valve pit in the foreground.
Tank2104U2: View of Tank 2104-U looking southeast
Tank 2101U1: View of Tank 2101-U looking southwest
Tank2101U2: View of Tank 2101-U looking south. Note valve pit with T-handles at northwest corner and former vapor monitoring system control panel
Tank2100U1: View of Tank 2100-U looking southeast. Concrete tank cover is at grade
Tank2100U2: View of Tank 2100-U looking south. Note pump heads and control box at north end of the tank

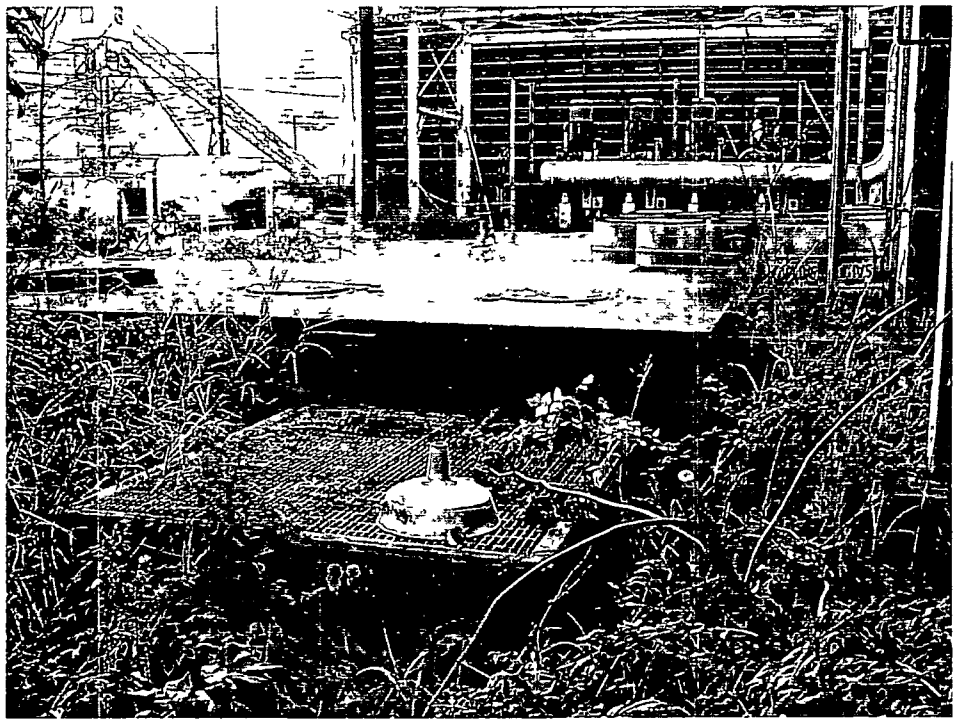
Signatures:

Interviewer _____

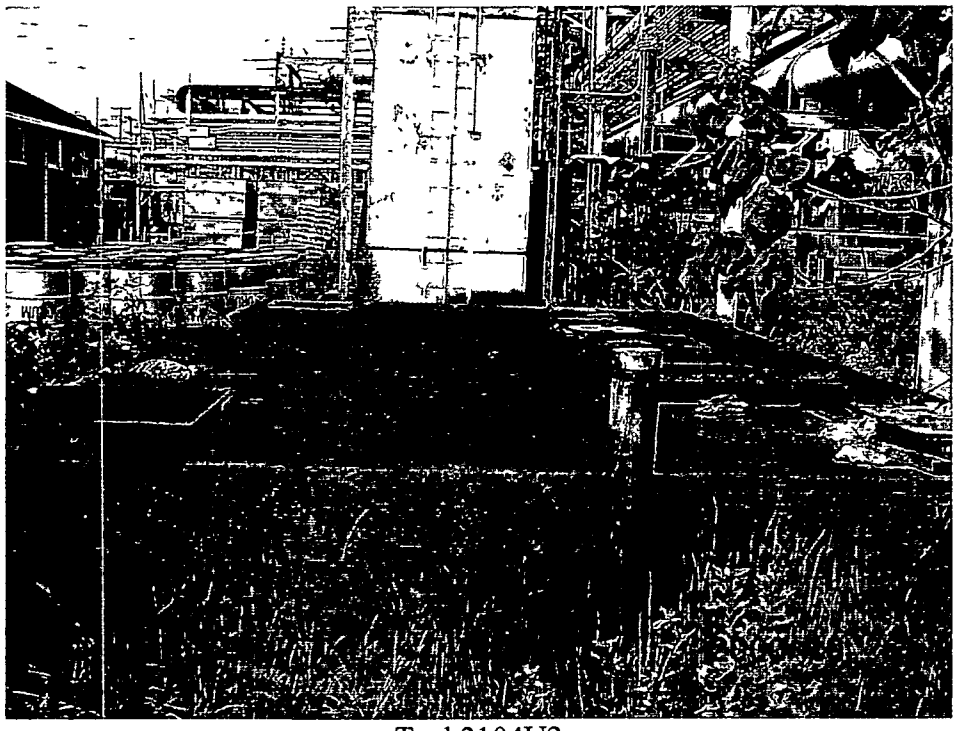
Site Personnel _____

_____

Mercury Tanks – Tank 2104-U

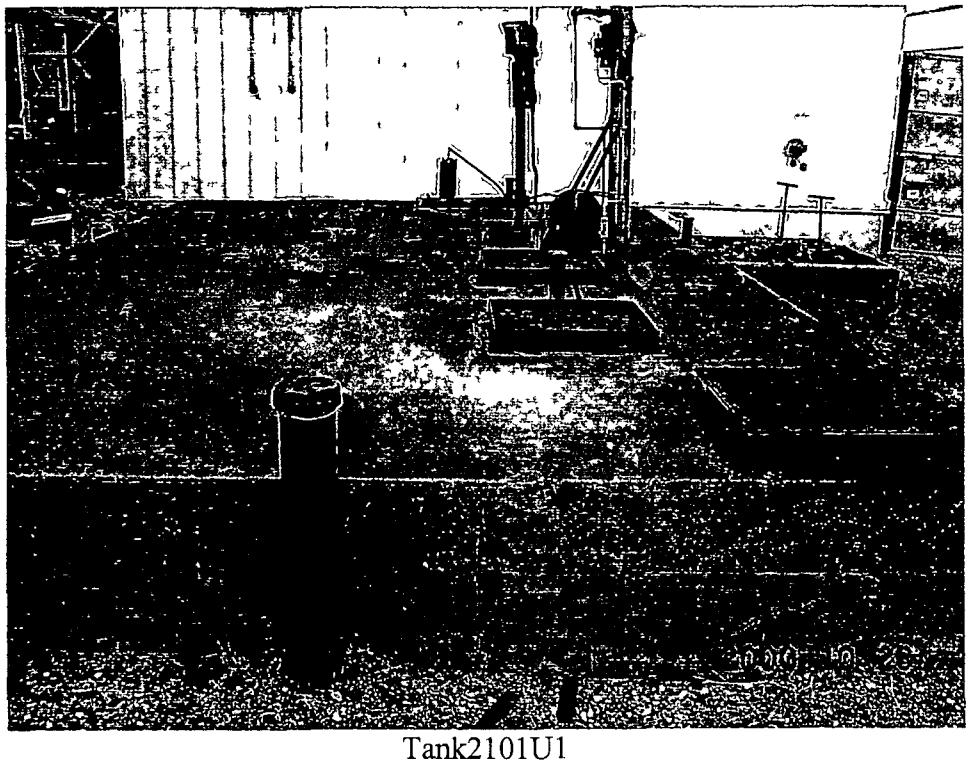


Tank2104U1

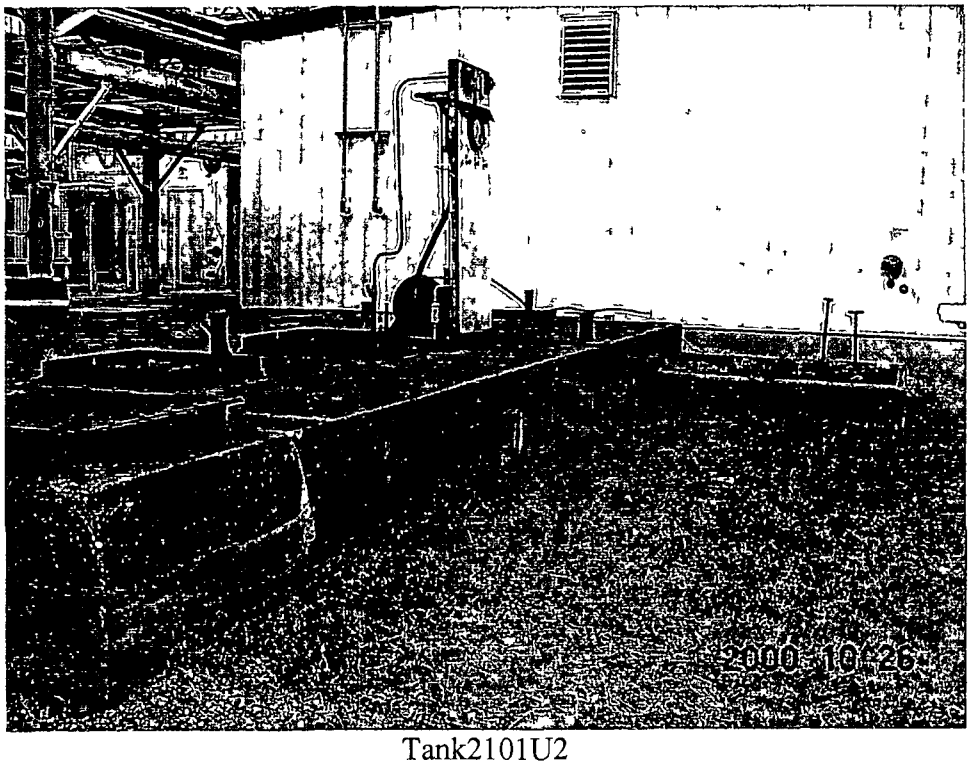


Tank2104U2

Mercury Tanks – Tank 2101-U



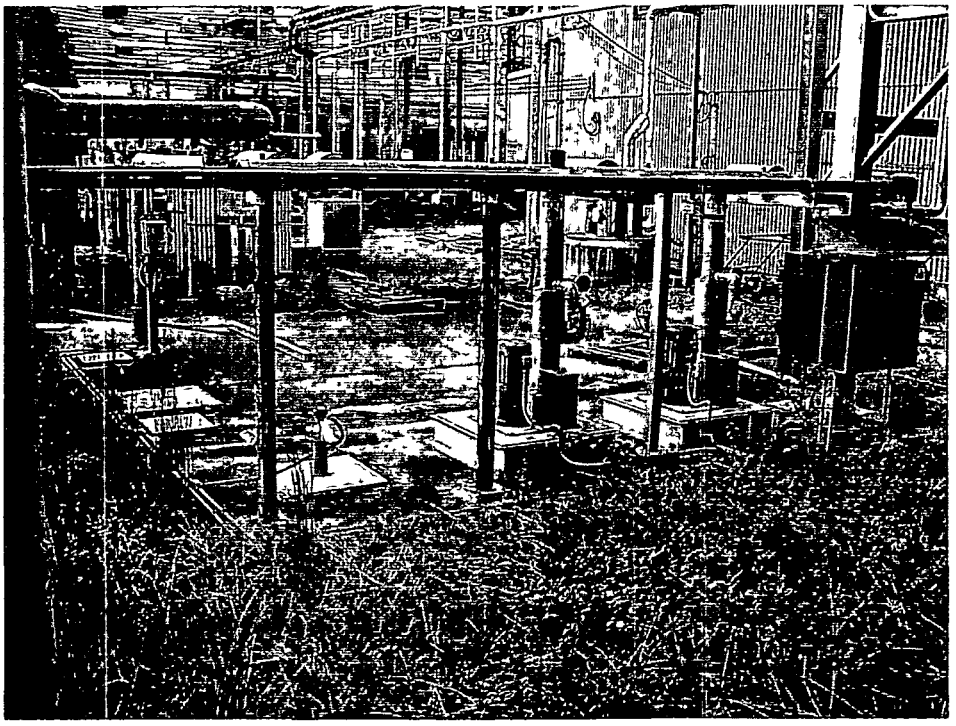
Tank2101U1



Tank2101U2

Mercury Tanks - Tank 2100-U

Tank2100U1



Tank2100U2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Plating Shop Container Areas

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Plating Shop Container Areas (ROD, July 1992)

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

Per the Decision Documents, the Remedy was: Under the most conservative risk scenario developed in the RI, total cancer risk was well below the EPA risk range, and noncarcinogenic health effects were well below the threshold for concern. A No Further Action decision was recommended by DOE in 1992. The ROD codifying the No Further Action decision was issued September 30, 1992.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA -NFA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:

   No further action decision following completion of the interim action. The Plating Shop and the northern and eastern former container storage areas are under Lockheed Martin Energy Systems ownership.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   No post-remedial action S&M requirements apply. The eastern plating shop container storage area is currently fenced and used to store waste material from the Building 9212 complex. The southern half of the unit is designated as a radiological management area (RMA). The RMA must be managed and maintained according to radiological control protocols.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

Name of Site Plating Shop Container Areas

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

Interview (continued)

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

   No chemical remedial treatment methods were employed.

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc.) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:

No land use control specified by the ROD. The site is within the industrialized portion of the Plant and is within the Y-12 Plant Protected (high security) Area. The site is surrounded by fencing that is gated and locked. The southern half of the unit is a designated RMA with entry restricted to personnel with RadWorker I or II training (see item A2).

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Plating Shop Container Areas

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

C. Visual Survey (continued)

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:
   Eastern container storage area is fenced, gated, and locked and used for storage of non-RCRA, non-radiological and radiological wastes. Wastes are contained within B-25 boxes and one land/sea container.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

   See Items A.2 , C.1, and C.2.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

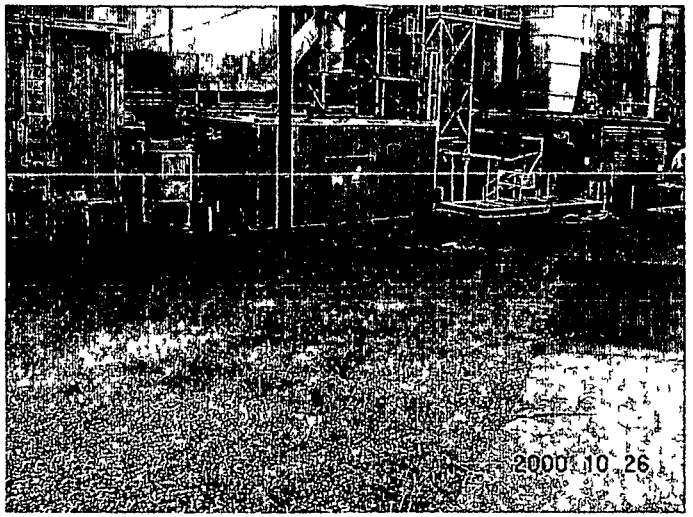
See Items A.2 , C.1, and C.2. The eastern former container storage area is gravel covered. A portion of the covers of two B-25 boxes were unfastened. The former container storage area north of the Plating Shop was not delineated in any fashion nor was marked by signs; this area is also gravel covered.
Photographs (next page):
Platingshop1: view of former Plating Shop Container Area (S-334) looking south toward Bldg. 9401-2
Platingshop2: view of former Plating Shop Container Area east of Bldg. 9401-2 (S-351), looking south
Platingshop3: view of former Plating Shop Container Area east of Bldg. 9401-2 (S-351), looking southeast

Signatures:

Interviewer _____

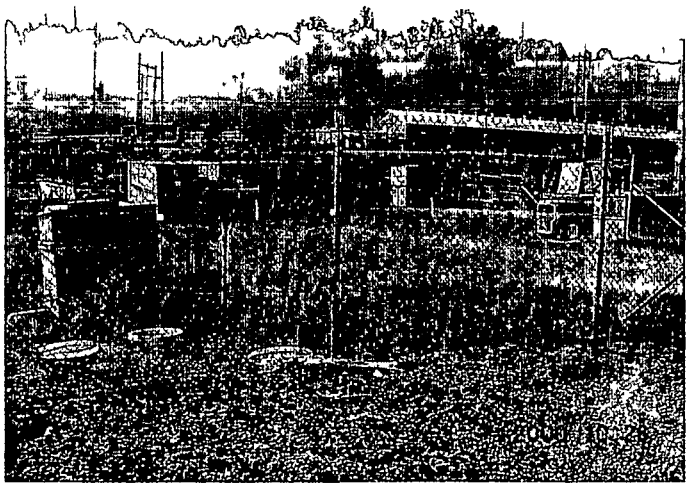
Site Personnel _____

Plating Shop



Platingshop1

Platingshop3



Platingshop2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Abandoned Nitric Acid Pipeline

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Abandoned Nitric Acid Pipeline (ANAP) (ROD, July, 1994)

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

Per the Decision Documents, the Remedy was: The baseline risk assessment conducted in association with the RI indicated that conditions related to the pipeline posed minimal threats to human health and the environment. DOE proposed a No Further Action decision. The ROD codifying the decision was issued September 12, 1994.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:

   No further action decision following completion of the RI. Lockheed Martin Energy Systems holds landlord responsibilities for areas under which ANAP is located.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   No post-remedial action S&M requirements apply.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Abandoned Nitric Acid Pipeline (ANAP)

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

Interview (continued)

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

   No chemical remedial treatment methods were employed.

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc.) in place and preventing exposure?
   Yes No NA
   Notes:

No land use control specified. The ANAP is within the industrialized portion of the Plant and is entirely within the Y-12 Plant Property Protection Area. That portion of the ANAP west of Portal 33 is within the Y-12 Plant Protected (high security) Area.

Name of Site Abandoned Nitric Acid Pipeline

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

C. Visual Survey (Continued)

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:

   Surface land use is currently unchanged. A new Highly Enriched Uranium Facility may be installed north of Building 9201-4 and the ANAP; however, this activity will not directly affect the line itself.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

   The ANAP is within the industrialized area of the Y-12 Plant.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

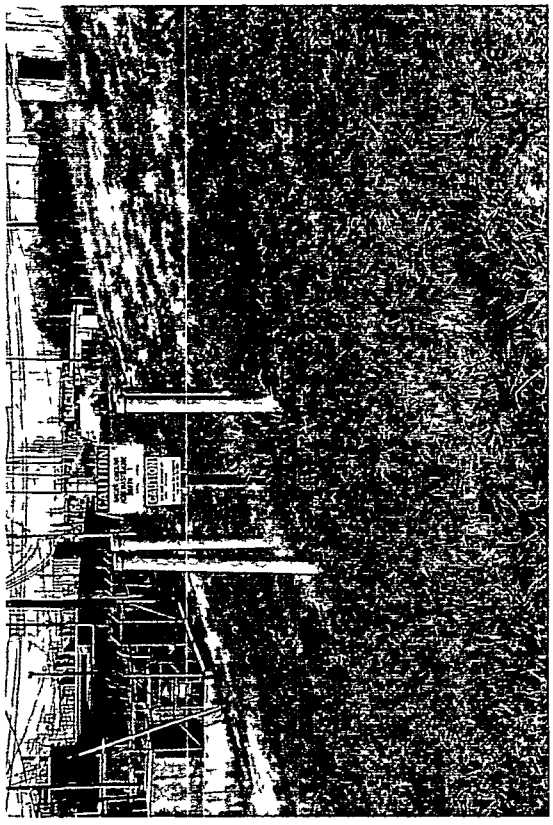
The ANAP is underground and is not visible. The trace of the line is periodically marked with caution signs warning of its location. Signs observed and reference photographs taken at the following points:
ANAP1: view to the west at the south side of Building 9103
ANAP2: view to the west immediately west of the Building 9103 (marker in foreground).
ANAP3: view west near the Salvage Yard (southwest of Buildings 9983-71 and –72)
ANAP4: view of the ANAP trace from the former termination point at the S-3 Pond with a view to the east.

Signatures:

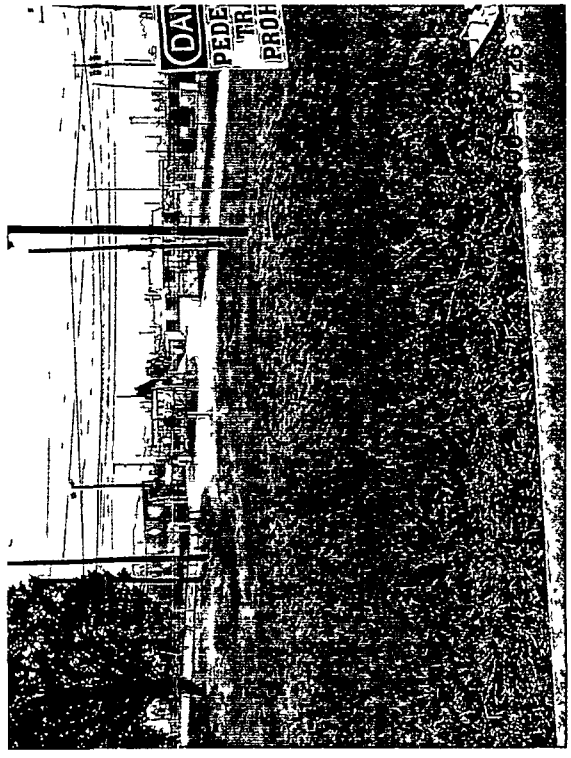
Interviewer _____

Site Personnel _____

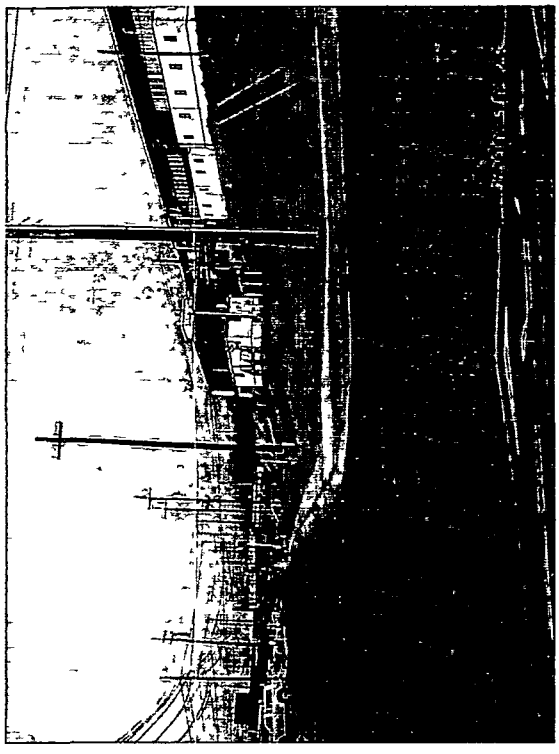
ANAP



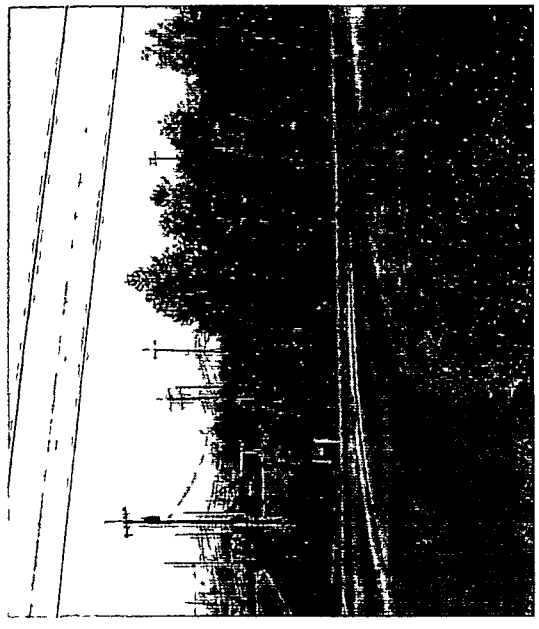
ANAP2



ANAP 4



ANAP1



ANAP 3

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Kerr Hollow Site

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Kerr Hollow Site (ROD, Sept. 1995)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: Kerr Hollow Quarry was closed according to RCRA regulatory guidance. Restricted access provides the necessary protection of human health and the environment. Therefore, a No Further Action determination was proposed for the site in 1995 and accepted by EPA and TDEC in an ROD approved shortly before the site was added to the Chestnut Ridge RCRA Post-Closure Permit.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action (ROD)
- ☐ Inspections
- ☒ Groundwater Monitoring (RCRA PCP)
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring (Best Mgt. Practice)
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☒ Deed Restrictions (RCRA PCP)
- ☒ Physical Access Controls (fencing, etc)
- ☒ Institutional Access Controls (Badges, TLDs, etc.)
- ☒ Posting of signs (RCRA PCP)
- ☒ S&M Inspections (RCRA PCP)
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

   Area is fenced and signs are clearly posted. Inspections are documented (see item 2 below).

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   Yes. Quarterly and monthly inspections of fencing and monitoring systems as a BMP. Annual RCRA Compliance Evaluation Inspection by TDEC. All inspections are documented.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

   Sporadic, low levels of VOCs (carbon tetrachloride and PCE) have been noted in two wells (GW-142 and GW-144) since 1993, but no MCLs have been exceeded, and no statistically significant indication of a release has occurred at site.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒ (NFA)
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Kerr Hollow Site (ROD, Sept. 1995)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

   No chemical treatment remedial methods were employed.

6. Additional site-specific questions and concerns:

   No concerns noted other than sporadic VOC detects in monitoring wells GW-142 and GW-144. No observed trends in detection monitoring data.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *Yes* Up to date? *Yes*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

   Two fence structures present. An outer, barbed wire fence, not designed for exclusion, and an inner 6-ft chain link security fence. Gate on outer fence was unlocked at time of site visit.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

   City of Oak Ridge sewage sludge land application is still ongoing north and west of KHQ.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Kerr Hollow Site

Date(s) of Visit October 13, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

   Outfall 301 was dry at the time of the site visit. The quarry water level was down about 4 feet relative to wet season levels. Storage containers (B-25 boxes) and flotation pontoons were located on-site and marked as an RMA. These items are scheduled for imminent removal per Bechtel Jacobs Company representatives. Rad areas are marked on the former Sonsub operating pad and near the quarry shore.

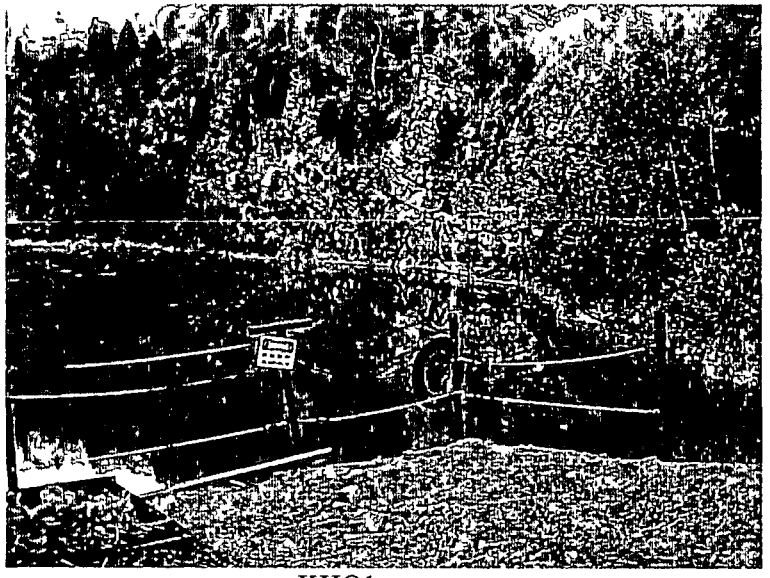
   Photographs (following page)
   KHQ1: View of Kerr Hollow Quarry from the south end, looking north
   KHQ2: View of Kerr Hollow Quarry from the south end of the quarry looking west
   KHQ3: View of Outfall 301 from south end of quarry looking southwest
   KHQ4: View of Kerr Hollow Quarry Entrance – note fence and signs

Signatures:

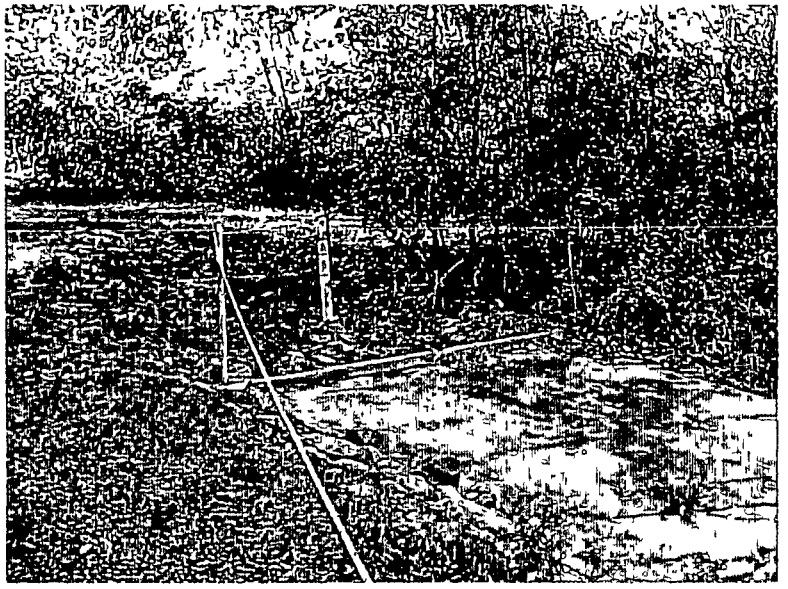
Interviewer _____

Site Personnel _____

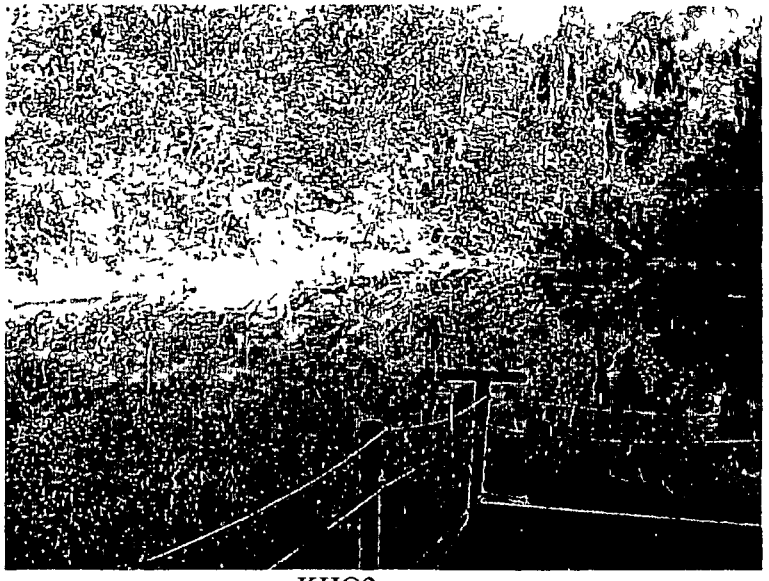
KERR HOLLOW QUARRY



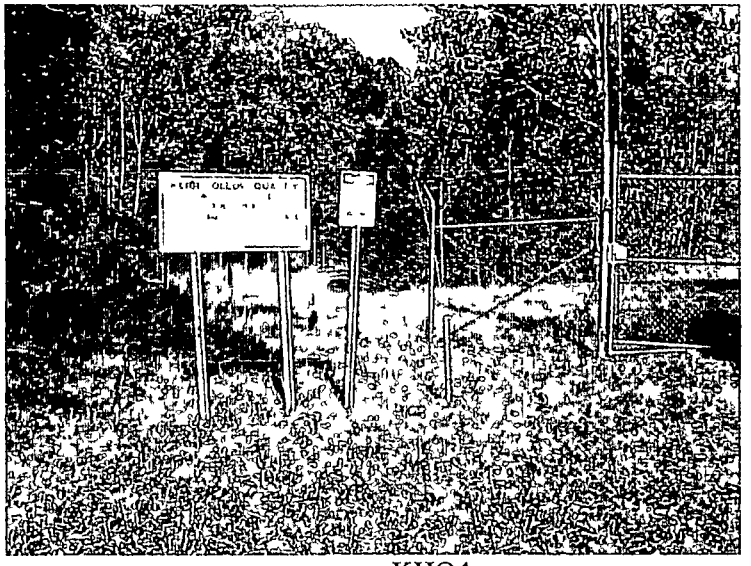
KHQ1



KHQ3



KHQ2



KHQ4

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Filled Coal Ash Pond

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Filled Coal Ash Pond (FCAP) (ROD, January 1996; RAR, May 1997)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: to raise the crest of the dam, reinforce the face of the dam, install a subsurface drain, remove large trees from the face of the dam, repair the emergency spillway (including removing the steep slope to the east of the spillway), construct a settling basin and oxygenation weir at the foot of the dam, and replace a small wetland downstream of the settling basin.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☒ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☒ Surface water collection and treatment (passive)
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☒ Deed Restrictions
- ☒ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☒ Other – Dam improvements & stabilization

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:
   Area is surrounded by fence, and regularly inspected; noted improvements were made to the dam, and the wetland and ecological resources are thriving.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   Quarterly inspections, with monthly inspections as part of BMP. Records maintained in SM's office and sent to DMC at the end of each FY.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:
   It has taken a while to establish vegetation on down stream face of dam, but seems to be adequate currently.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:
   Monitoring results indicate 5 – 10x reduction in arsenic (from coal ash) in wetlands effluent.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Filled Coal Ash Pond (FCAP)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☒ NA ☐
   Notes:

6. Additional site-specific questions and concerns:

Biomonitoring data collected in McCoy Branch and Melton Hill Lake – not required by decision document but related to this action.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA* .

   Are Maintenance Logs readily available? *Yes* Up to date? *Yes* .

2. Monitoring and Inspection Records:

   Are Surface Water Monitoring Records readily available? *Yes* Up to date? *Yes* .

   Are Inspection Reports readily available? *Yes* Up to date? *Yes* .

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:

   Area is fenced, and signs are posted.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

   Reservation-wide game hunts nearby several times a year, but "NO HUNTING" signs posted at site.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Filled Coal Ash Pond (FCAP)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Area behind dam has mostly filled in with ash and is covered in evergreen trees. Spillway constructed of concrete pillow runs along the side of the site perpendicular to the dam to convey overflow during storm events. Slope of dam is vegetation covered presently, so the previous problem with erosion of the cherty soil has been eliminated. At the toe of the slope is a small settling basin where influent water samples are taken, effluent samples are taken on the other side of a small but extremely well established wetland. Creek (McCoy Branch) then winds off site.

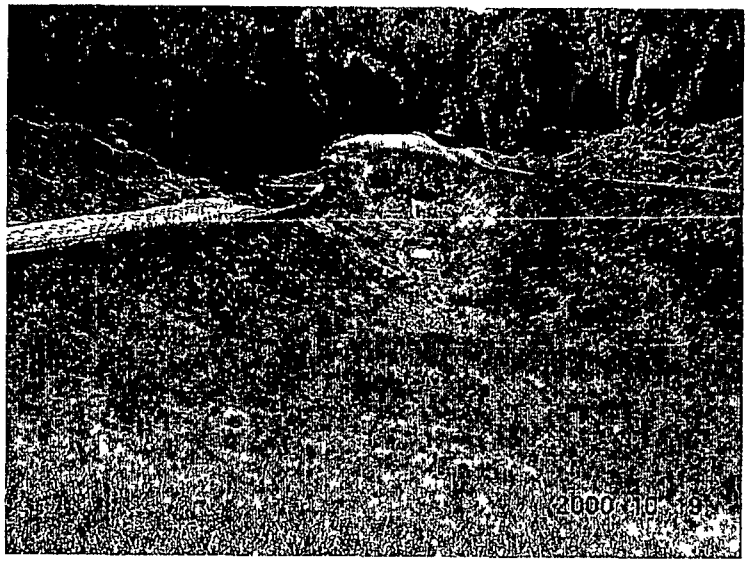
Photographs (following pages)
FCAP1: View from crest of dam looking southeast towards settling basin and wetland
FCAP2: View looking west across southern end of FCAP site. Wetland area is just left of center of photo
FCAP3: View looking west across northern end of FCAP site. Actual coal ash pond is filled- in and tree-covered (trees on right center edge of photo)
FCAP4: View of sign at entrance to FCAP site
FCAP5: View from wetlands (foreground) looking northwest up slope of dam
FCAP6: View looking east across wetlands towards MCK 2.0
FCAP7: View from crest of dam looking southeast towards settling basin and wetland

Signatures:

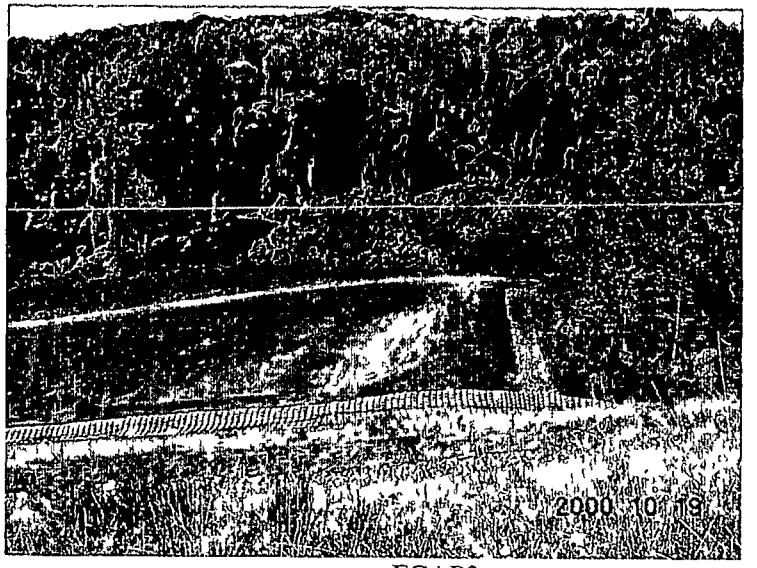
Interviewer _____

Site Personnel _____

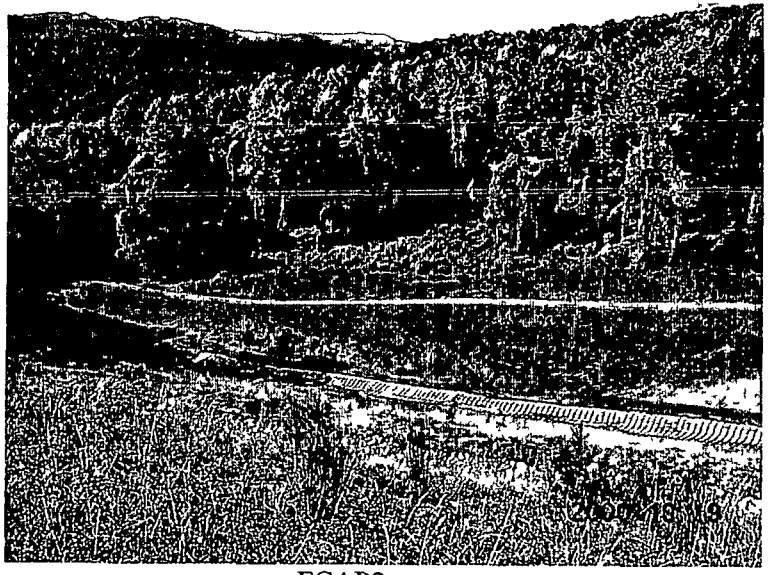
FILLED COAL ASH POND (FCAP)



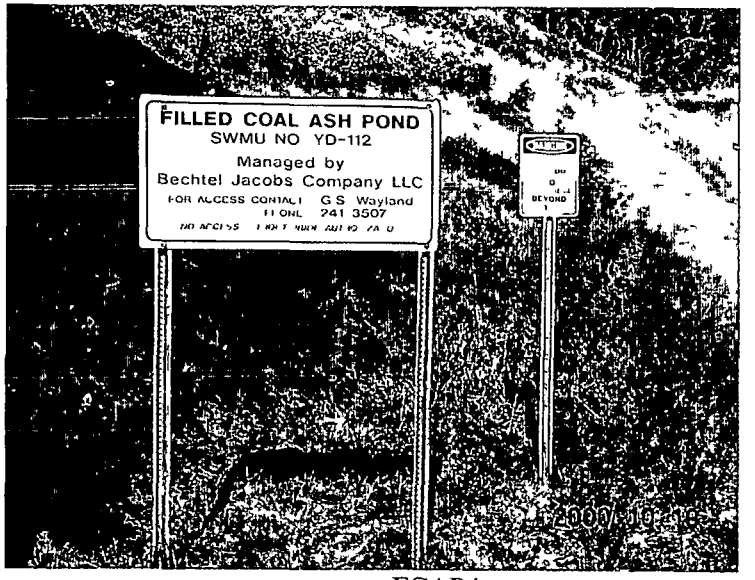
FCAP1



FCAP3

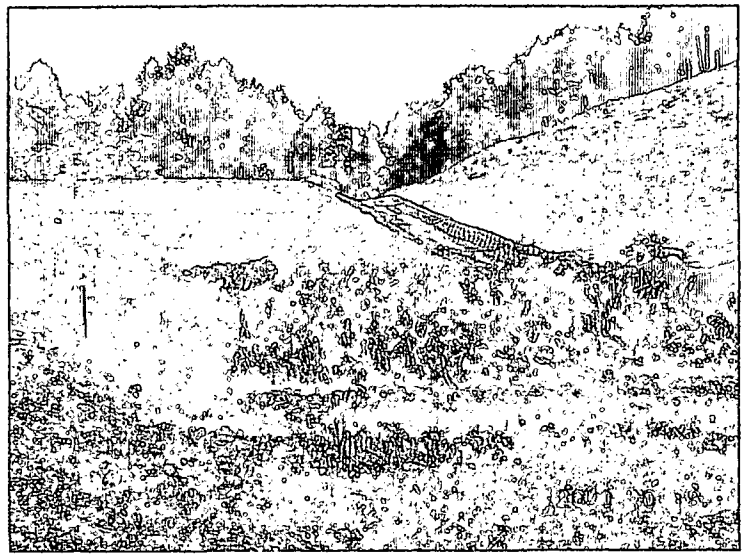


FCAP2

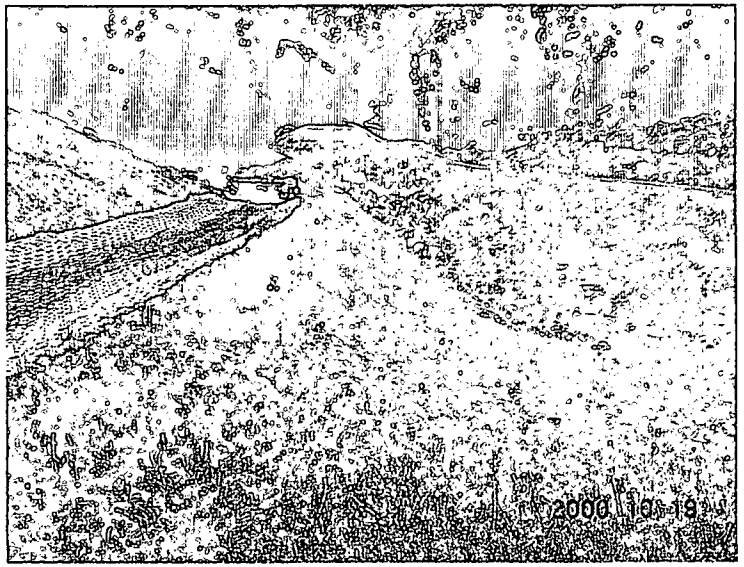


FCAP4

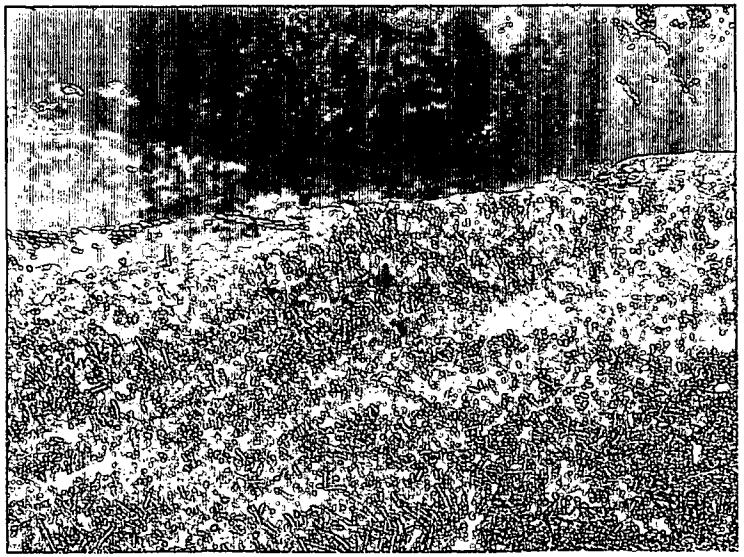
FILLED COAL ASH POND (FCAP) – continued



FCAP5



FCAP7



FCAP6

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Building 9201-4 (Alpha 4) Exterior Process Piping Removal Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Building 9201-4 (Alpha 4) Exterior Process Piping Removal Action (AM, Fenruary 1997; RAR, October 1997))

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

Per the Decision Documents, the Remedy was: The removal action included the mercury feed and hydrogen lines located exterior to Alpha 4. The removal action was begun on June 13, 1997 and completed on June 30, 1997. The exterior process piping was cut into lenghts of 20 feet or less. Mercury was collected from pipe cuts. The ends of the cut sections of piping were capped and placed in the basement floor of Alpha 4. Asbestos pipe insulation was removed and disposed of in the Y-12 Plant industrial landfill. No post removal action monitoring or stewardship requirements were specified in the Action Memorandum or the Removal Action Report.

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☒ NA (Source Removal)
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:

   No further action following completion of the removal action.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   No post-remedial action S&M requirements apply. However, a daily visual inspection is made of Alpha 4, including the basement area, to inspect for fluid or mercury leaks from process piping inside the building. Mercury vapor monitoring is routinely conducted within the building.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Building 9201-4 (Alpha 4) Exterior Process Piping Removal Action

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

Interview (continued)

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

   No chemical remedial treatment methods were employed.

6. Additional site-specific questions and concerns:

   None noted.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc.) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:

   No land use controls specified by the decision documents. The stored piping is secured within the basement of Alpha 4, which is access controlled (locked doors and limited access control). Alpha 4 itself is within the Y-12 Plant Protected (high security) Area.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Building 9201-4 (Alpha 4) Exterior Process Piping Removal Action

Date(s) of Visit October 26, 2000

Interviewer, title, phone Kevin Jago, SAIC, Senior Scientist, 481-4614

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507; Don Sparkman, BJC, 9201-4 Area Manager, 574-3464

Visual Survey (continued)

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

   Building 9201-4 is scheduled for D&D in CY 2008.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Piping is stored on the basement floor in Alpha 4. The storage site is in a classified, former process area. The inside of Alpha 4 is designated as a HAZWOPER site; therefore, the building is access controlled. A portion of the piping is stored directly on the basement floor; another portion is stored on wooden pallets. The storage area is demarcated by flagging. Pipe insulation has been removed and the ends of the pipe section are covered with either plastic plugs or taped closed with plastic covers.

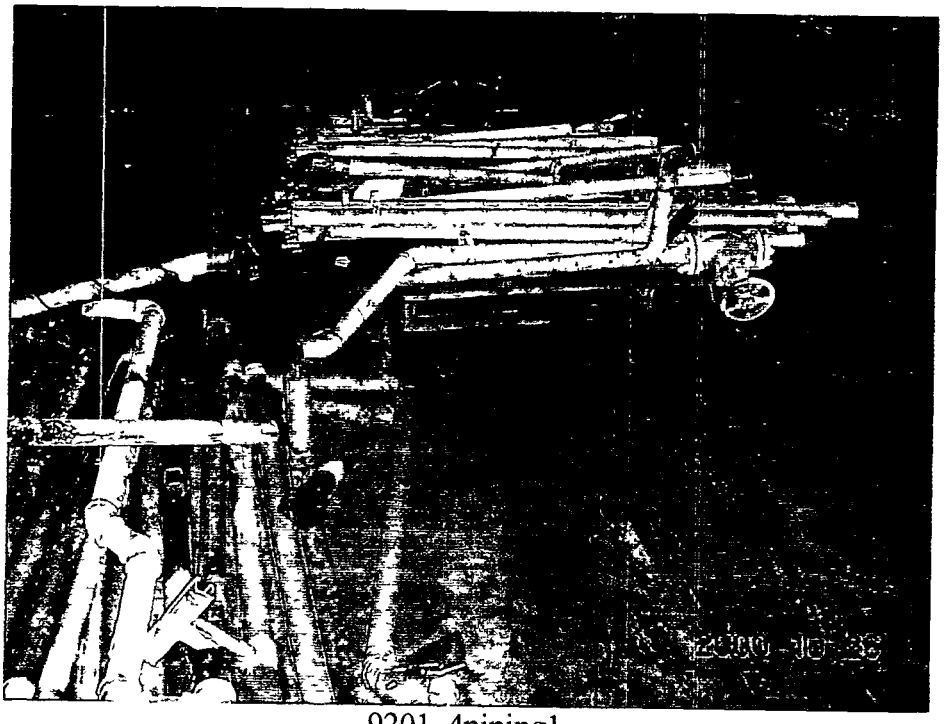
Photographs (following page)
9201_4piping1: View 1, Exterior Piping storage area, Building 9201-4 basement
9201_4piping2: View2, Exterior Piping storage area, Building 9201-4 basement

Signatures:

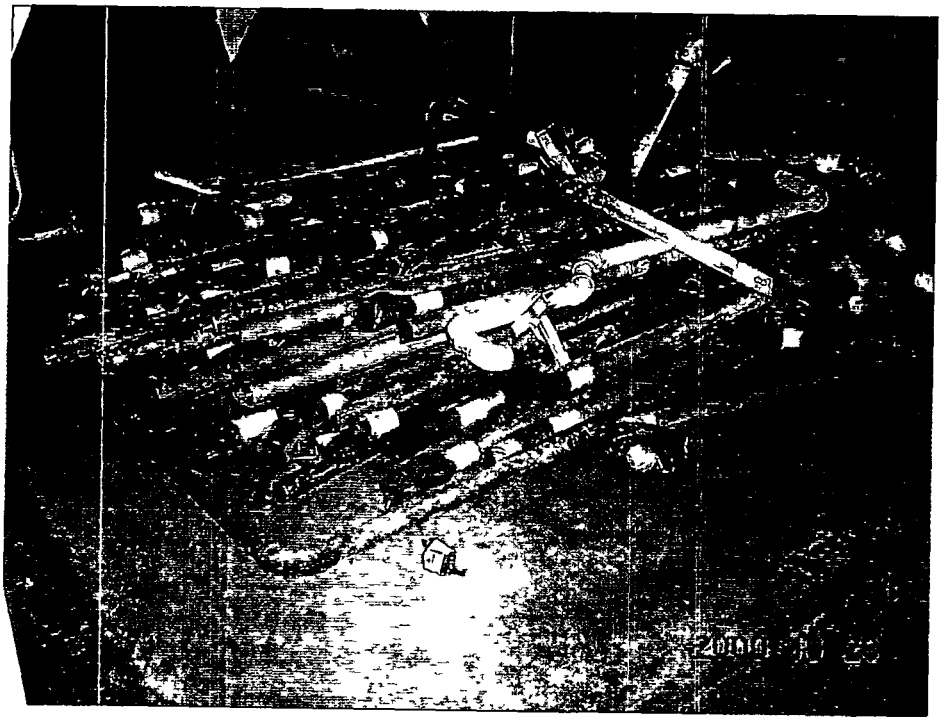
Interviewer _____

Site Personnel _____

Building 9201-4 Exterior Piping



9201_4piping1



9201_4piping2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Union Valley Interim Action

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Union Valley Interim Action (ROD for Interim Action, April, 1997)

Date(s) of Visit December 11, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Bill Teer, BJC, 576-0102

Per the Decision Documents, the Remedy was: Controls to be instituted by DOE during the term of this IROD including: establishing license agreements between DOE and all affected property owners within the interim remedial action boundary that require property owners to notify DOE 90 days before extraction or use of groundwater is proposed; conducting annual title searches to determine whether any affected property changed ownership and verify that any new owner has been notified of the provisions of the license agreement; notifying affected property owners and the city of Oak Ridge to remind them of their obligations under the agreement; surveying owners by telephone to determine whether any new groundwater wells have been constructed or planned, or if there are any new uses for surface water; and notifying licensed well drillers in Tennessee of the license agreements and their terms.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☒ Other (license agreements & notification, title searches, phone surveys)

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

Each year, letters are sent to all land owners reminding them of their obligations under the license agreement to notify DOE of property transfer or planned groundwater wells. This letter is followed up with a telephone call. Letters are also sent to every drilling contractor within the state of Tennessee. Records of all correspondence are kept by BJC and sent to DOE.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

Not applicable.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

Occasionally there have been property transfers without notification of DOE, but property transfer records are checked annually and when this is discovered, the new owners have been notified of the license agreements.

Name of Site Union Valley Interim Action (ROD for Interim Action, April, 1997)

Date(s) of Visit December 11, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Bill Teer, BJC, 576-0102

Interview (continued)

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:

There are no operating procedures, per se, but the remedy appears to be effective.

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

There was no chemical treatment as a part of the remedy.

6. Additional site-specific questions and concerns:

None

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:

"Site" consists of property owned privately or by the city of Oak Ridge or the State (TDOT and UT Arboretum). The contamination is confined to groundwater, and there is little chance of exposure as it is not used for drinking water.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:

Property sold by the city of Oak Ridge to TDOT for the widening of Kerr Hollow Road.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Union Valley Interim Action (ROD for Interim Action, April, 1997)

Date(s) of Visit December 11, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Bill Teer, BJC, 576-0102

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Kerr Hollow Road was widened during the summer and fall of 2000.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

There are four main property owners of lands within the Union Valley ROD for interim remedial action site: private property, state-owned property (TDOT and UT Arboretum), and the city of Oak Ridge. S&M activities are not performed, nor is there any monitoring performed related directly to this action (there are environmental samples collected within the Union Valley Watershed which are used for the WRRP Exit Pathway evaluation, but they are not required by the decision documents for this particular action).

Photographs (following page)
UnionValley1: View from UT Arboretum looking Northwest up Kerr Hollow Road (also known as South Illinois Ave). Road was recently widened from 2 to 4 lanes by TDOT.
UnionValley2: Same view as above, telephoto x2.5

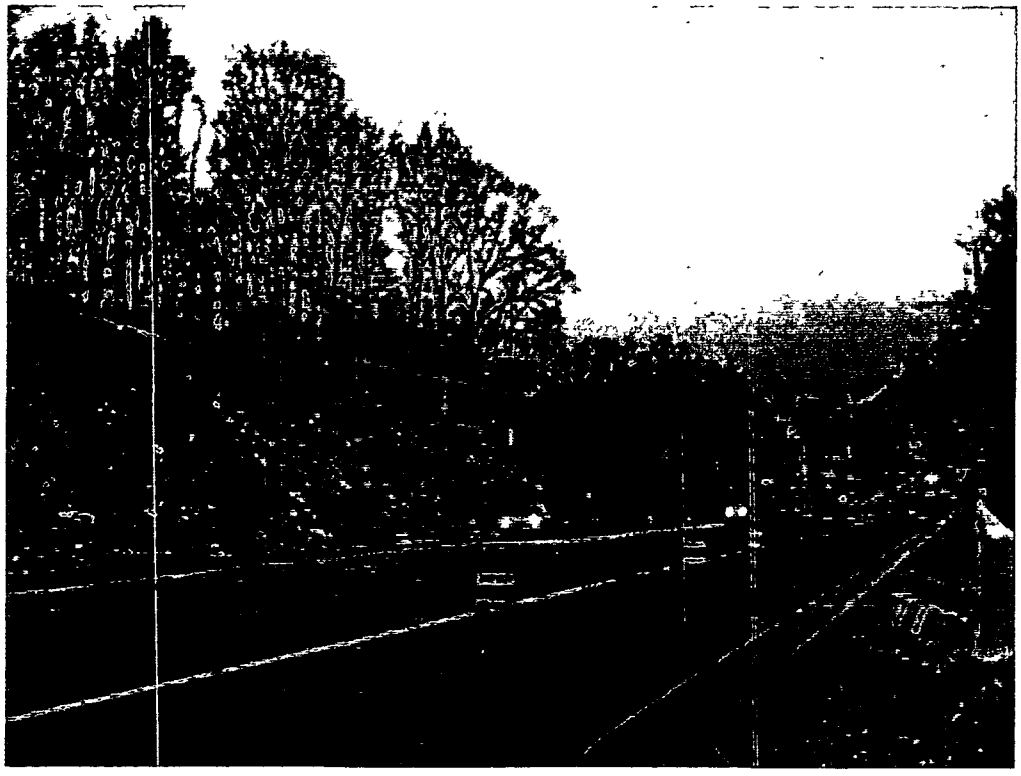
Signatures:

Interviewer _____

Site Personnel _____

Union Valley

UnionValley1



UnionValley2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

YS-860 Firing Range

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site YS-860 Firing Range (AM, August 1997)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: the removal of bullets and lead-contaminated soil in the target areas of the two former firing ranges. 846 yd^3 of lead-contaminated soils were excavated and transported off-site to an approved facility. Nonhazardous wastes incidental to the removal of contaminated soils including trees and brush, asphalt, and concrete were disposed of at the Y-12 Plant Construction/Demolition Landfill VI. After excavation and removal of contaminated soils, verification sampling was conducted to confirm that the requirements of the AM were met (risk-based cleanup concentration of 1,400 μg/g lead in soil).

Post-Action Monitoring Includes: (check all that apply)

- ☒ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other - long term monitoring deferred to UEFPC watershed ROD

Stewardship Requirements Include (check all that apply)

- ☒ NA (Source removal)
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:
   None specified in the Action Memorandum.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?
   Maintenance only for mowing and to maintain vegetation cover, on an as-need basis. Activities are documented in logbooks in SM's office, filed each year at the DMC.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☐ NA ☒
   Notes:
   Control of site has reverted back to Y-12 Plant.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:
   Source removal—no ongoing operations.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site YS-860 Firing Range

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

6. Additional site-specific questions and concerns:

None

B. Documentation (answer yes, no, or NA): *(NA to all)*

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:

Source removed, so no exposure potential, but site is within Y-12 Perimeter fence.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site YS-860 Firing Range

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Construction of East End VOC treatment facility on eastern end of Firing Range.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Site is currently a level, open, grassy field with a grass-covered berm at the north side of the site.

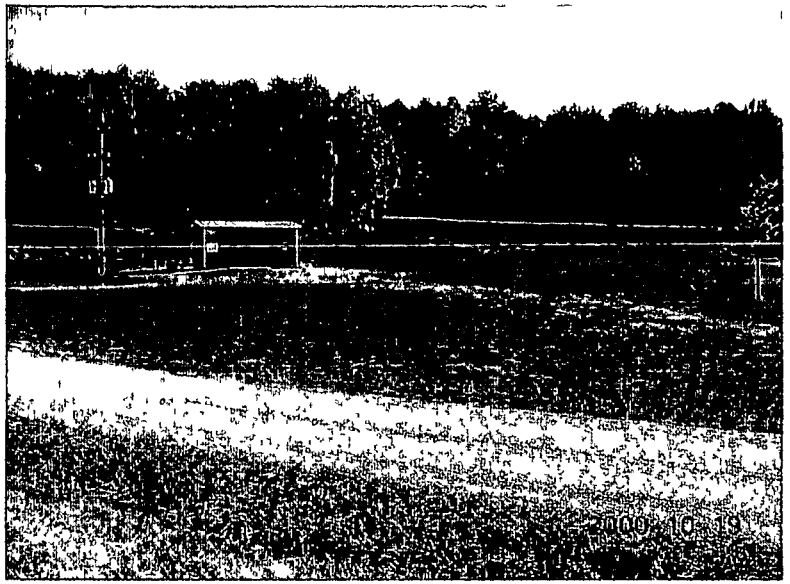
Photographs (following page)
FiringRng1: View of the former firing range looking towards the south. Building in the photo is Building 9422-22, which houses the East End VOC Plume treatment facility
FiringRng2: View of former firing range. Note grass covered berm in front of tree line to rear of photo
FiringRng3: View of former firing range looking towards the southeast. Building 9422-22 is on left side of photo
FiringRng4: Another view of flat grassy field with grass-covered berm in background

Signatures:

Interviewer _____

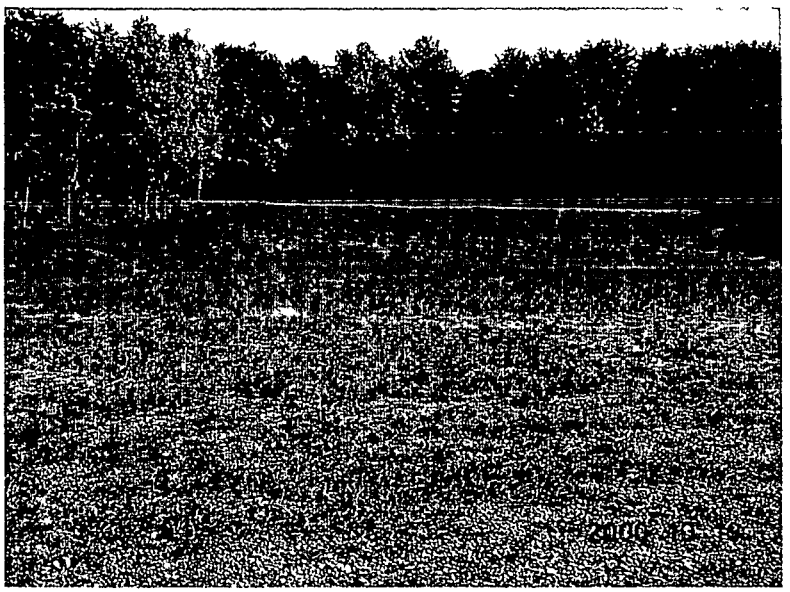
Site Personnel _____

Y-12 FIRING RANGE



FiringRng1

FiringRng3



FiringRng2

FiringRng4

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

9822 Sediment Basin

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site 9822 Sediment Basin (AM, May, 1998, RAR, October 1998)

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Per the Decision Documents, the Remedy was: The removal of the liquid from the basin and building sump with filtration and transfer of the liquid to the Y-12 Plant Groundwater Treatment Facility; removal and stabilization of the sediment; disposal of the sediment pursuant to the criteria in DOE Order 5400.5 at a chemical waste disposal facility permitted under the TSCA of 1976 (as amended); rinsing of the interior walls of the basin and the building sump, treatment of the rinsate, and plugging of the connecting drain line; and demolition of the basin walls and placement of fill in the basin and building sump.

Post-Action Monitoring Includes: (check all that apply).

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☐ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other – deferred to UEFPC Watershed ROD

Stewardship Requirements Include (check all that apply)

- ☒ NA (Source removed)
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☐ No ☐ NA ☒
   Notes:
   No requirements specified. Action was originally done under RMPE then brought under CERCLA. The site is under the control of the Y-12 Utilities Group – Hydrogen Yard.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

   No inspections related to the specific site that BJC representative was aware of. Former basin has been removed and hole backfilled with gravel. Site is within the fenced boundary of the Hydrogen Yard.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☐ No ☐ NA ☒
   Notes:
   Source removal—no ongoing operations.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site 9822 Sediment Basin

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

6. Additional site-specific questions and concerns:

None

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA* .

   Are Maintenance Logs readily available? *NA* Up to date? *NA* .

2. Monitoring and Inspection Records:

   Are Groundwater Monitoring Records readily available? *NA* Up to date? *NA*

   Are Inspection Reports readily available? *NA* Up to date? *NA* .

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☒ No ☐ NA ☐
   Notes:
   Site is located within the Y-12 perimeter fence.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site 9822 Sediment Basin

Date(s) of Visit October 13, 2000

Interviewer, title, phone Sally Absher, SAIC, Geologist, 481-4645

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258; Greg Wayland, BJC, 241-3507

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☐ NA ☒
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☐ No ☒
   Notes:

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

Gravel covered pad, fenced locally as part of the Hydrogen Yard and located just outside the PIDAS corridor but within the Plant Perimeter Fence.

Photographs (following page)
9822basin1: View of former sediment basin looking northeast toward Building 9204-3. PIDAS corridor runs immediately behind former basin
9822basin2: View of former sediment basin looking northwest

Signatures:

Interviewer _____

Site Personnel _____

9288 SEDIMENT BASIN

9822basin1

9822basin2

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Lower Watts Bar Reservoir OU

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Lower Watts Bar Reservoir OU

Date(s) of Visit December, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, WRRP Project Manager, 241-5258

Per the Decision Documents, the Remedy was: Continue existing institutional controls to reduce exposure to contaminated sediment, fish consumption advisories to reduce exposure to contaminants in fish tissue, and annual monitoring to detect changes in LWBR contaminant levels or mobility.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other (describe) *sediment and fish sampling, particulate sampling in conjunction with water sampling*

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, etc.)
- ☒ Posting of signs *(TDEC posts signs)*
- ☐ S&M Inspections
- ☒ Other *TWRA issues fish consumption advisories. DOE participates in WBIWG*

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

State of Tennessee is maintaining fish consumption advisories and postings at popular fishing locations. Watts Bar Interagency Working Group functions to oversee potential sediment-disturbing activities.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

None specified in the decision documents.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

Fish consumption advisory procedures are maintained by TDEC to ensure protection of public health. Controls on sediment-disturbing activities are defined in Rules of the Tennessee Department of Environment and Conservation, Chapter 1200-4-7, "Aquatic Resource Alteration Permit Process," Section 26A of the Tennessee Valley Authority Act of 1933, and Section 10 of the Rivers and Harnors Act of 1910 (COE Authority).

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Lower Watts Bar Reservoir OU

Date(s) of Visit December, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, WRRP Project Manager, 241-5258

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:

Chemical treatment was not a part of the selected remedy.

6. Additional site-specific questions and concerns:

None.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

   Notes: *WRRP maintains monitoring records. Sampling results are available in DataWizard and are also maintained in OREIS.*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:

Land use controls, per se, are not a component of this response action, however, institutional controls over dredging of deep channel sediments or other sediment-disturbing activities are maintained by the WGIWG, which includes DOE, TDEC, EPA, TVA, and COE.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:

The LWBR OU extends 38 miles from TRM 567.5 to 529.9. Land use categories along LWBR OU include residential, agricultural, industrial, and recreational. Although identifying specific land use changes along the OU is beyond the scope of this site visit, it is likely that some changes have occurred since the ROD. Broad land use categories along the OU, however, are not likely to have changed.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Lower Watts Bar Reservoir OU

Date(s) of Visit December, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, WRRP Project Manager, 241-5258

Visual Survey (continued)

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

Exposure pathways would remain the same.

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Likely, although none specific were identified in the site visit. See also C2.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The LWBR OU extends approximately 38 miles from TRM 529.9 at Watts Bar Dam upstream to TRM 567.5 at the mouth of the Clinch River. There are 20 recreational parks within the Watts Bar area and 27 commercial recreational facilities, including marinas, resorts, and golf courses. Of these commercial facilities, 22 are located within the LWBR OU. The reservoir provides swimming, boating, skiing, and fishing opportunities to the resident populations in the vicinity of the reservoir as well as persons from outside the OU area.

Signatures:

Interviewer _____

Site personnel _____

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

South Campus Facility

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site South Campus Facility (ROD, Dec. 1995)

Date(s) of Visit November 30, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258

Per the Decision Documents, the Remedy was: No Action Alternative, which includes periodic sampling to ensure that natural attenuation in the zone of contamination continues as expected. In addition a statement will be placed in the property title to notify owners of the contamination.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☒ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☐ Other (describe)

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☒ Deed Restrictions (notification)
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, TLDs, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☐ Other

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes: *Notification of property owners has been added to deed.*

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

No S&M specified in the decision document, however, the SCF buildings and grounds are well maintained and a number of obsolete facilities have been removed under the purview of the EH&S program.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐

Notes: *Monitoring to date indicates natural attenuation is continuing as expected. No long-term operating procedures were established in conjunction with the selected remedy.*

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes: *No chemical treatment remedial methods were employed. No action decision for this site is based on natural attenuation of the TCE.*

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site South Campus Facility (ROD, Dec. 1995)

Date(s) of Visit November 30, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258

Interview (continued)

6. Additional site-specific questions and concerns:

None

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? NA Up to date? NA

   Are Maintenance Logs readily available? NA Up to date? NA

2. Monitoring and Inspection Records:

   Are Surface and Groundwater Monitoring Records readily available? Yes Up to date? Yes

   Are Inspection Reports readily available? NA Up to date? NA

WRRP maintains groundwater and surface water monitoring records. Sampling results are available via DataWizard and are also maintained in OREIS.

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:

Land use controls were not a component of the no-action remedy for SCF. However, the area is regularly patrolled and buildings are physically secured when unoccupied.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☐ No ☒
   Notes:

The Director of Facilities Management (Rac Cox) for the SCF noted that the City of Oak Ridge City Council has considered purchase of approximately 19 acres immediately east of SCF for subsequent resale to parties interested in developing the property. This is a potential change in land use adjacent to the facility but would not appear to impact the decision made at the facility.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes: *The decision at the SCF addresses the TCE contaminated soil and groundwater east and south of Building SC-3. This area is not included in the ~19 acre plot of land noted in the previous response.*

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site South Campus Facility (ROD, Dec. 1995)

Date(s) of Visit November 30, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, Project Manager, 241-5258

Visual Survey (continued)

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Rip-rap was added to the drainage ditch below Building SC-3 in the fall of 2000 to control erosion. NOTE: the placement of rip-rap in the drainage ditch south of Building SC-3 may create an obstruction to sampling the seep which has been sampled as part of the SCF monitoring activities specified in the decision document. The sampling team will need to develop an alternative method of collecting the seep sample. Several other buildings have been removed/D&D'd as indicated on the attached listing.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The site is well maintained. In addition to general site maintenance, the Facilities Mangement organization has implemented a number of actions to characterize, and decontaminate if necessary, certain structures. Other structures have been removed as noted on the attached list. According to Rac Cox, Director of Facilities Management, these actions were funded by HQ DOE as EH&S program activities. NEPA related documents, e.g. CX's, were prepared prior to implementing the actions.

Photographs (following pages)

Southcampus4: View looking north of groundwater monitoring well cluster GW-842, -843, and –844. Well GW-841, which is approximately 170 ft north of the well cluster, can also be seen in the background. These wells are located in the area of TCE-contaminated soil and groundwater at SCF. Building SC-3 can be seen to the west of GW-841.

Southcampus1: View looking north along the drainage channel where seep water samples are collected to determine whether unacceptable concentrations of TCE are migrating in to the Scarboro Creek Embayment, which lies approximately 650 ft. south of this location. Monitoring well cluster GW-842, -843, and –844 can be seen to the right. The south side of Building SC-3 can also be seen NNW of this location.

Signatures:

Interviewer _____

Site personnel _____

ORISE Scarboro Operations Site (Formerly South Campus)

Environmental and Facility Activities 1995 – 2000

- Radiological cleanup of Nutrition Barn pad and paving site 1996
- Removal of SC-17 (maintenance shed) 1995
- Removed buildings and disposed of top ground soil and droppings in SC-18 (Twin Barns) 1997
- Pump house at ponds removed 1995
- Decontaminated and removed SC-11 piping and septic tank
- D & D of SC-11 (Isolation Barn) and removal 1996
- Decontaminated and removed pad behind SC-14. 1996
- Removed 1,000 gal SS tank, two contaminated concrete tanks from SC-5 pit, remove pit building 1996
- Removed hot piping (inner pipe) fro, SC-2 to SC-5 tanks. 1995
- Mapped all underground piping and septic tanks. 1996
- Characterized six septic tanks, decontaminated one, and removed all six. 1998
- Disposed of all loose contaminated items in SC-2, SC-5, and SC-12 1997-99
- Characterized SC-2, SC-5, and SC-12. 1999
- Removed all contamination areas in SC-15. 2000
- Added erosion control to ditch below SC-3. 2000

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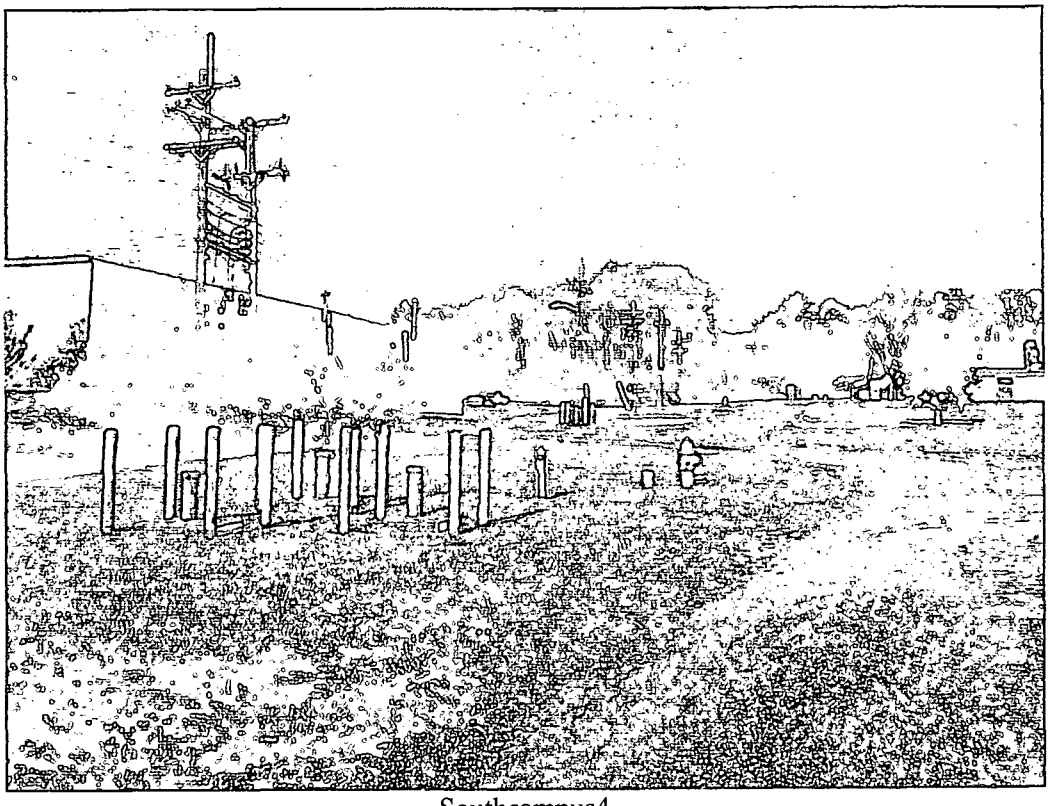
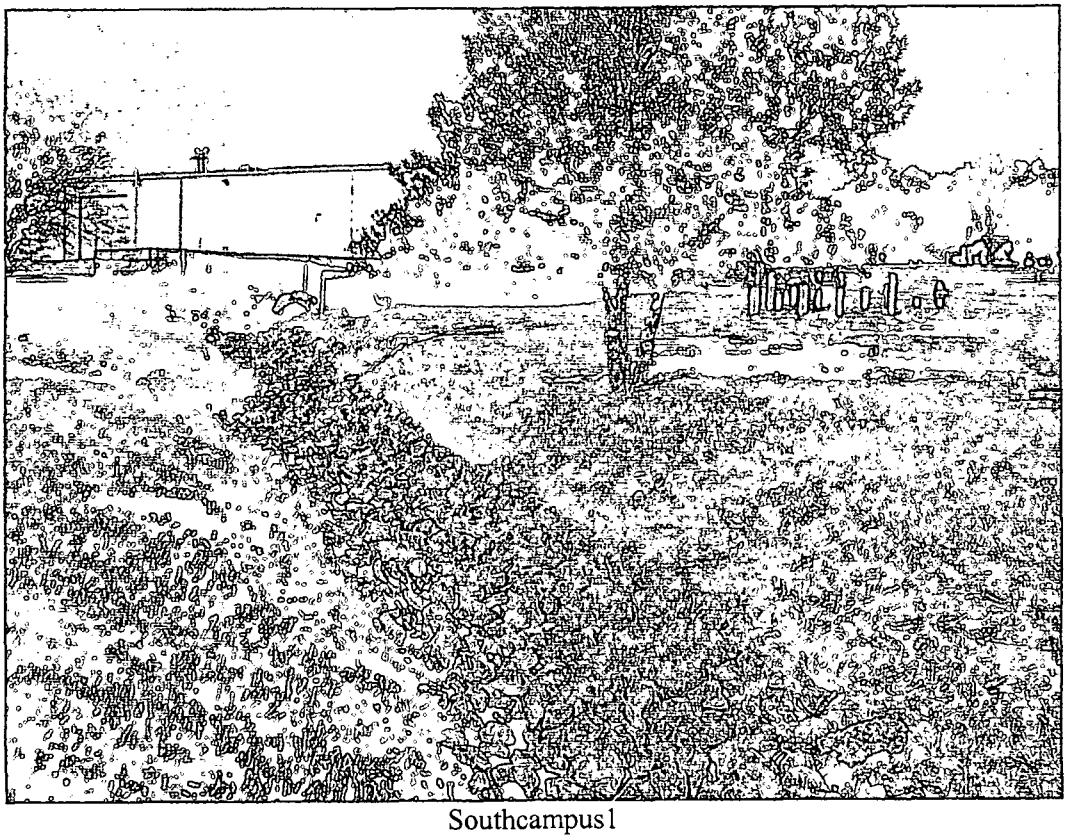
South Campus Facility



Southcampus4



Southcampus1

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Clinch River/Poplar Creek OU

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Clinch River/Poplar Creek OU

Date(s) of Visit December, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, WRRP Program Manager, 241-5258

Per the Decision Documents, the Remedy was: Continue existing institutional controls to mitigate potential sediment-disturbing activities; fish consumption advisories to reduce exposure to contaminants in fish tissue; annual monitoring to detect changes in CR/PC contaminant levels or mobility; survey to confirm effectiveness of fish consumption advisories.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other (describe) *sediment, turtle, and fish sampling and particulate sampling in conjunction with surface water sampling*

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, etc.)
- ☒ Posting of signs *(TDEC posts & maintains signs)*
- ☐ S&M Inspections
- ☒ Other *Fish consumption advisories issued by TWPA DOE participates in interagency agreement with TDEC, EPA, TVA, and COE.*

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

State of Tennessee is maintaining fish consumption advisories and postings at popular fishing locations. State and federal stakeholders participate in interagency agreement to oversee and control potential sediment-disturbing activities.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

None defined in CR/PC decision documents.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

Procedure for review of potential sediment disturbing operations in CR, below Melton Hill Dam, and including Poplar Creek, is maintained through IAWG. Fish consumption advisory procedures are maintained by TDEC to ensure protection of public health. Controls on sediment-disturbing activities are defined in Rules of the Tennessee Department of Environment and Conservation, Chapter 1200-4-7,

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Clinch River/Poplar Creek OU

Date(s) of Visit December, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, WRRP Program Manager, 241-5258

Interview (continued)

4. (Con't) *"Aquatic Resource Alteration Permit Process," Section 26A of the Tennessee Valley Authority Act of 1933, and Section 10 of the Rivers and Harnors Act of 1910 (COE Authority).*

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:
Chemical treatment was not part of the selected remedy.

6. Additional site-specific questions and concerns:

None

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

   Notes: *WRRP maintains monitoring records. Sampling results are available in DataWizard and are also maintained in OREIS.*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:
Land use controls are not specified in the ROD, however, IAWG reviews requests for projects such as construction of beaches, boat ramps, docks, marinas, buoy anchors, fences, fish attractors, pump stations, culverts, etc., for their potential to disturb sediment.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:
The CR/PC OU extends from Clinch River mile 0.0 at the confluence of the Clinch and Tennessee Rivers upstream, to CRM 44 near the Solway Bridge, and includes Poplar Creek from the creek mouth at CRM 12 upstream to its confluence with EFPC at PCM 5.5. Land use along the Clinch River is primarily agricultural and residential in the valleys and woodland on the ridges. Identifying specific land use

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 3

Name of Site Clinch River/Poplar Creek OU

Date(s) of Visit December, 2000

Interviewer, title, phone Butch Will, SAIC, Senior Engineer, 481-4762

Site Personnel, title, phone Steve Haase, BJC, WRRP Program Manager, 241-5258

Visual Survey (continued)

changes along the Clinch River and Poplar Creek is beyond the scope of this site visit, however, it is likely that some changes have occurred. Broad land use categories along the OU are not likely to have changed.

3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

Exposure pathways are the same as those evaluated in the RI/FS.

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

It is highly likely that changes in physical site conditions have occurred at scattered locations along the CR/PC OU, although none have been identified in conjunction with this site visit. See also C2.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

The CR/PC OU is large, extending almost 34 miles from the mouth of the Clinch River at Kingston, TN, to the upstream limit of the ORR at Clinch River mile 43.7 near the city of Oak Ridge. It includes the Poplar Creek embayment of Watts Bar Reservoir from the creek's mouth at CRM 12.0 upstream to its confluence with East Fork Poplar Creek at Poplar Creek mile 5.5. In addition to providing swimming, boating, skiing, and fishing opportunities, uses of the Clinch River include industrial water supply and potable water supply (city of Oak Ridge, west Knox County Utility District, and ETTP).

Signatures:

Interviewer _____

Site personnel _____

2001 RER/CERCLA FIVE-YEAR REVIEW
SITE VISIT/SITE MANAGER INTERVIEW FORM

Lower East Fork Poplar Creek

2001 RER 5 Year Review Site Visit/Site Manager Interview Form

Name of Site Lower East Fork Poplar Creek

Date(s) of Visit August 21, September, and December 8, 2000

Interviewer, title, phone Jimmy Groton, SAIC, Env. Scientist, Samantha Pack, SAIC, Sr. Risk Scientist; Jennifer Godsey, SAIC, Risk Scientist, and Butch Will, SAIC, Senior Engineer

Site Personnel, title, phone Steve Haase, BJC, WRRP Program Manager, 241-5258

Per the Decision Documents, the Remedy was: Excavation of mercury-contaminated soil at NOAA site and Bruner site, performing confirmatory sampling, backfilling and revegetating excavated areas, and monitoring.

Post-Action Monitoring Includes: (check all that apply)

- ☐ No Further Action
- ☐ Inspections
- ☐ Groundwater Monitoring
- ☐ Air Monitoring
- ☐ Groundwater pump and treat
- ☒ Surface Water Monitoring
- ☐ Surface water collection and treatment
- ☒ Other (describe) *annual stream channel survey, land use survey, biota sampling, floodplain soil sampling (FY2005), wetland mitigation survey*

Stewardship Requirements Include (check all that apply)

- ☐ NA
- ☐ Deed Restrictions
- ☐ Physical Access Controls (fencing, etc)
- ☐ Institutional Access Controls (Badges, etc.)
- ☐ Posting of signs
- ☐ S&M Inspections
- ☒ Other *annual land use survey and periodic well survey records to detect residential use of GW*

A. Interview:

1. Are Stewardship requirements specified in the Decision Document (see above) being met?
   Yes ☒ No ☐ NA ☐
   Notes:

Land use and well surveys conducted in FY2000 and a report prepared. Information included in the report is presented in 2001 RER/Five Year Review document. Posting of signs not a requirement of the ROD but is under the purview of the State of Tennessee.

2. Does the site undergo surveillance and maintenance on a regular schedule? If so, what is the schedule? Are these activities documented?

No routine S&M activities defined for this action.

3. Is the Site Manager aware of any problems with the remedy? What solutions have been applied?
   Yes ☐ No ☒ NA ☐
   Notes:

Potential problem associated with changes in land use. See section C2.

4. Are operating procedures, as implemented, maintaining the effectiveness of response actions?
   Yes ☒ No ☐ NA ☐
   Notes:

No specific operating procedures defined for this response action, however, monitoring and surveys required under the ROD will ensure effectiveness is maintained.

2001 RER 5 Year Review Site Visit/Site Manager Interview Form – Page 2

Name of Site Lower East Fork Poplar Creek

Date(s) of Visit August 21, September, and December 8, 2000

Interviewer, title, phone Jimmy Groton, SAIC, Env. Scientist, Samantha Pack, SAIC, Sr. Risk Scientist; Jennifer Godsey, SAIC, Risk Scientist, and Butch Will, SAIC, Senior Engineer

Site Personnel, title, phone Steve Haase, BJC, WRRP Program Manager, 241-5258

Interview (continued)

5. Were there any unexpected toxic by-products of the remedy not addressed by the decision documents?
   Yes ☐ No ☐ NA ☒
   Notes:
Chemical treatment was not a part of the selected remedy.

6. Additional site-specific questions and concerns:

None.

B. Documentation (answer yes, no, or NA):

1. O&M Manual and As-Builts:

   Are As-Builts readily available? *NA* Up to date? *NA*

   Are Maintenance Logs readily available? *NA* Up to date? *NA*

2. Monitoring and Inspection Records:

   Are Monitoring Records readily available? *Yes* Up to date? *Yes*

   Are Inspection Reports readily available? *NA* Up to date? *NA*

   Notes: *WRRP maintains monitoring records. Sampling results are available in DataWizard and are also maintained in OREIS.*

C. Visual Survey:

1. Are land use controls (fencing, security guards, etc) in place and preventing exposure?
   Yes ☐ No ☐ NA ☒
   Notes:
Land use controls are not specified under the ROD; however, warning signs are posted at various locations along LEFPC. These signs are under the purview of the State of Tennessee.

2. Have there been any changes in land use or expected land use on or near the site?
   Yes ☒ No ☐
   Notes:
Changes in land use from open or agricultural to residential have occurred along LEFPC. .

Name of Site Lower East Fork Poplar Creek

Date(s) of Visit August 21, September, and December 8, 2000

Interviewer, title, phone Jimmy Groton, SAIC, Env. Scientist, Samantha Pack, SAIC, Sr. Risk Scientist; Jennifer Godsey, SAIC, Risk Scientist, and Butch Will, SAIC, Senior Engineer

Site Personnel, title, phone Steve Haase, BJC, WRRP Program Manager, 241-5258

Visual Survey (continued)

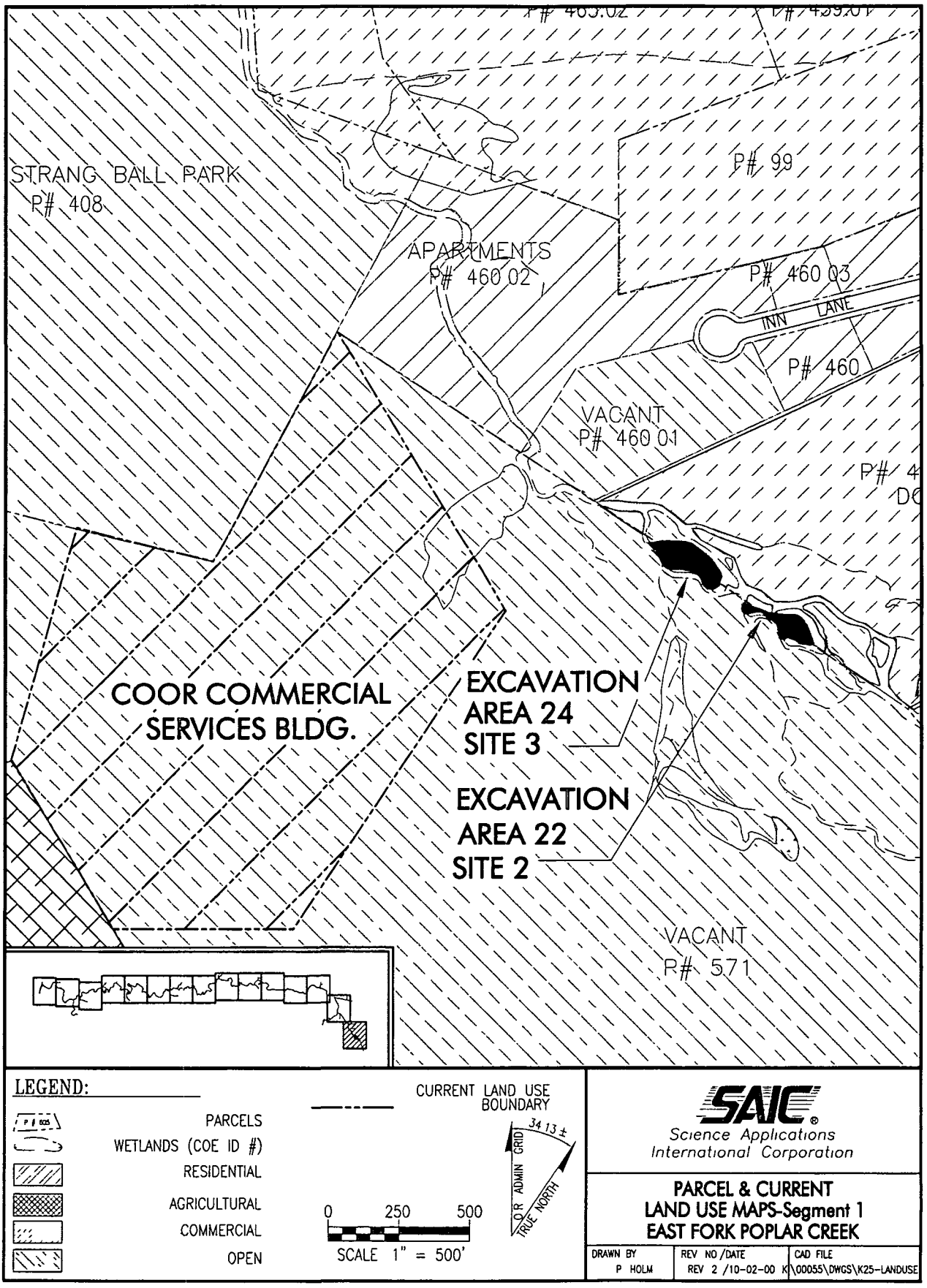
3. If yes, do these changes result in potential new exposure pathways (ecological or human health)?
   Yes ☐ No ☒ NA ☐
   Notes:

4. Have there been any changes in the physical site conditions?
   Yes ☒ No ☐
   Notes:

Commercial development on previously open land (Segment 1). Residences have been constructed on formerly vacant open land and agricultural land (Segments 4 through 10). Details are presented in the 2001 RER/Five Year Review document.

5. Briefly describe the physical appearance of the site, including presence or absence of site access controls, condition of surface water conveyances, evidence of S&M activities (mowing, inspections), presence of waste material remaining or appearing on the site, etc. Attach photographs if allowable and relevant.

See attached Land Use Survey, Wetland Mitigation Survey, and photographs.


STRANG BALL PARK
P# 408
APARTMENTS
P# 460 02
P# 99
P# 460 03
INN LANE
P# 460
VACANT
P# 460 01
COOR COMMERCIAL
SERVICES BLDG.
EXCAVATION
AREA 24
SITE 3
EXCAVATION
AREA 22
SITE 2
VACANT
P# 571
LEGEND:
PARCELS
WETLANDS (COE ID #)
RESIDENTIAL
AGRICULTURAL
COMMERCIAL
OPEN
CURRENT LAND USE
BOUNDARY
0 250 500
SCALE 1" = 500'
34 13 ±
OR ADMIN GRID
TRUE NORTH
SAIC
Science Applications
International Corporation
PARCEL & CURRENT
LAND USE MAPS-Segment 1
EAST FORK POPLAR CREEK
DRAWN BY
P HOLM
REV NO /DATE
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CAD FILE
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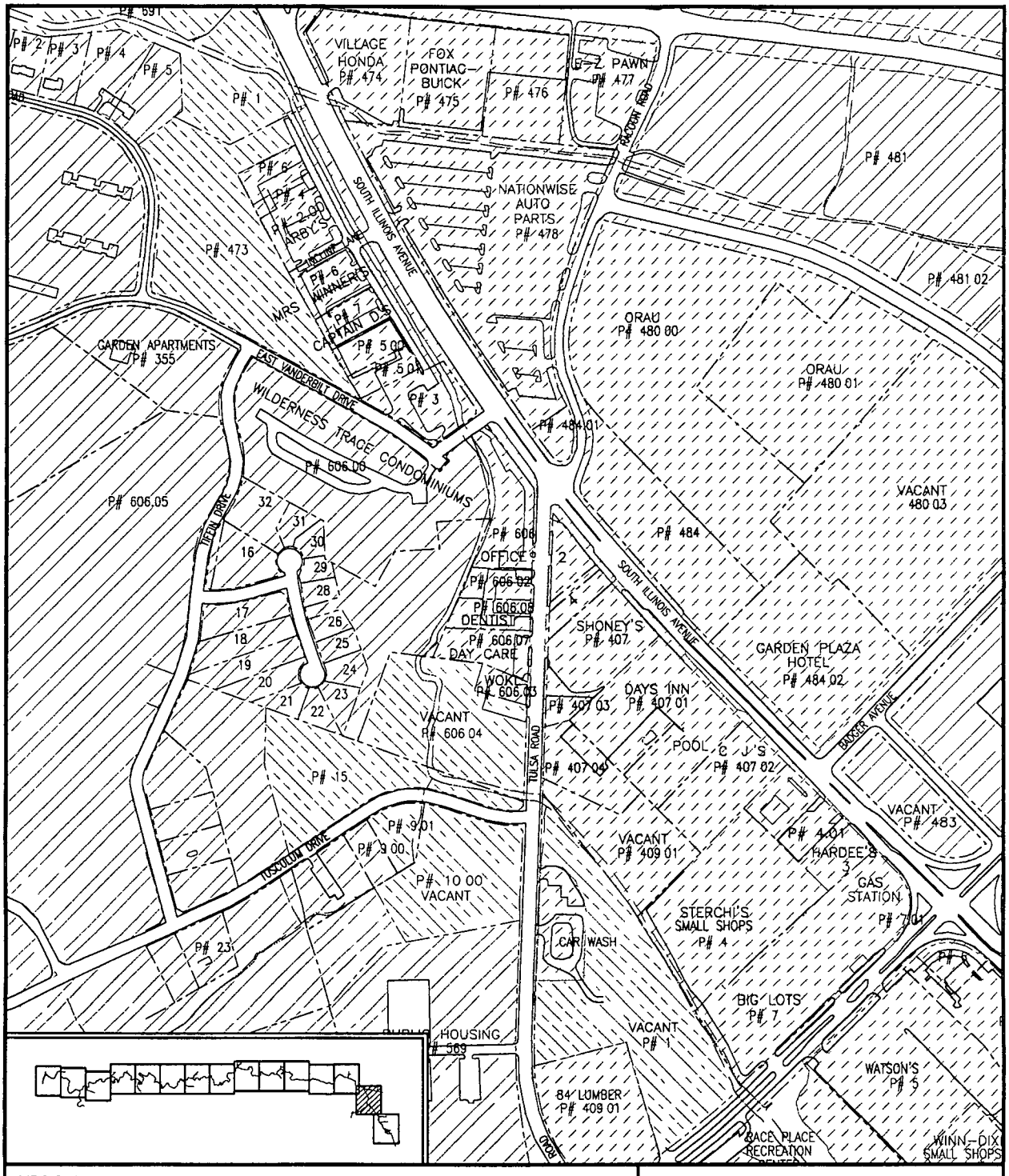

LEGEND:

- P # 605 — PARCELS
- WETLANDS (COE ID #)
- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL
- OPEN

CURRENT LAND USE BOUNDARY

0 250 500

SCALE 1" = 500'

34°13'± OR ADMIN GRID TRUE NORTH

SAIC® Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 2 EAST FORK POPLAR CREEK

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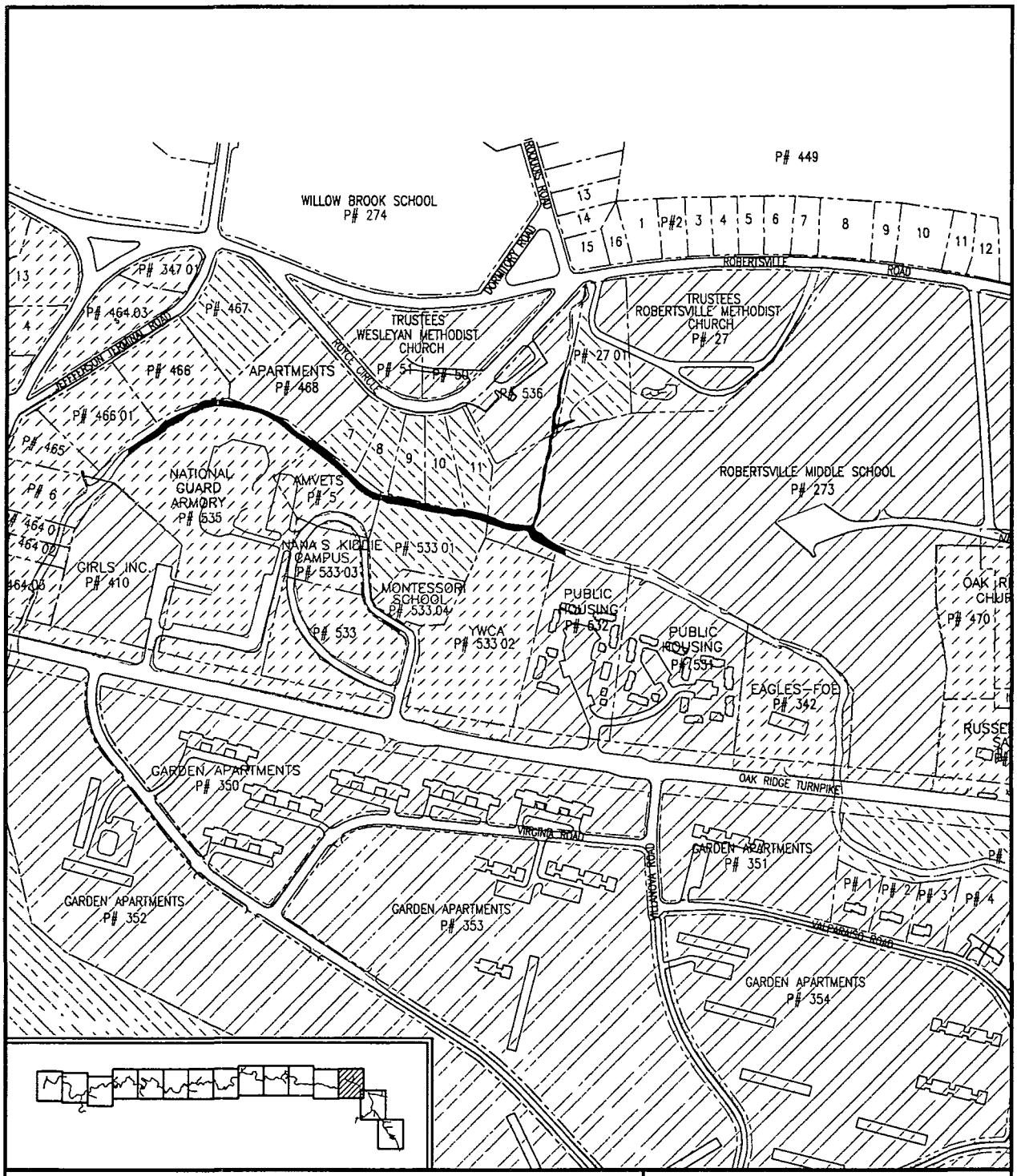

LEGEND:

- PARCELS
- WETLANDS (COE ID #)
- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL
- OPEN

CURRENT LAND USE BOUNDARY

0 250 500

SCALE 1" = 500'

34 13 ± OR ADMIN GRID

TRUE NORTH

SAIC®
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 3
EAST FORK POPLAR CREEK

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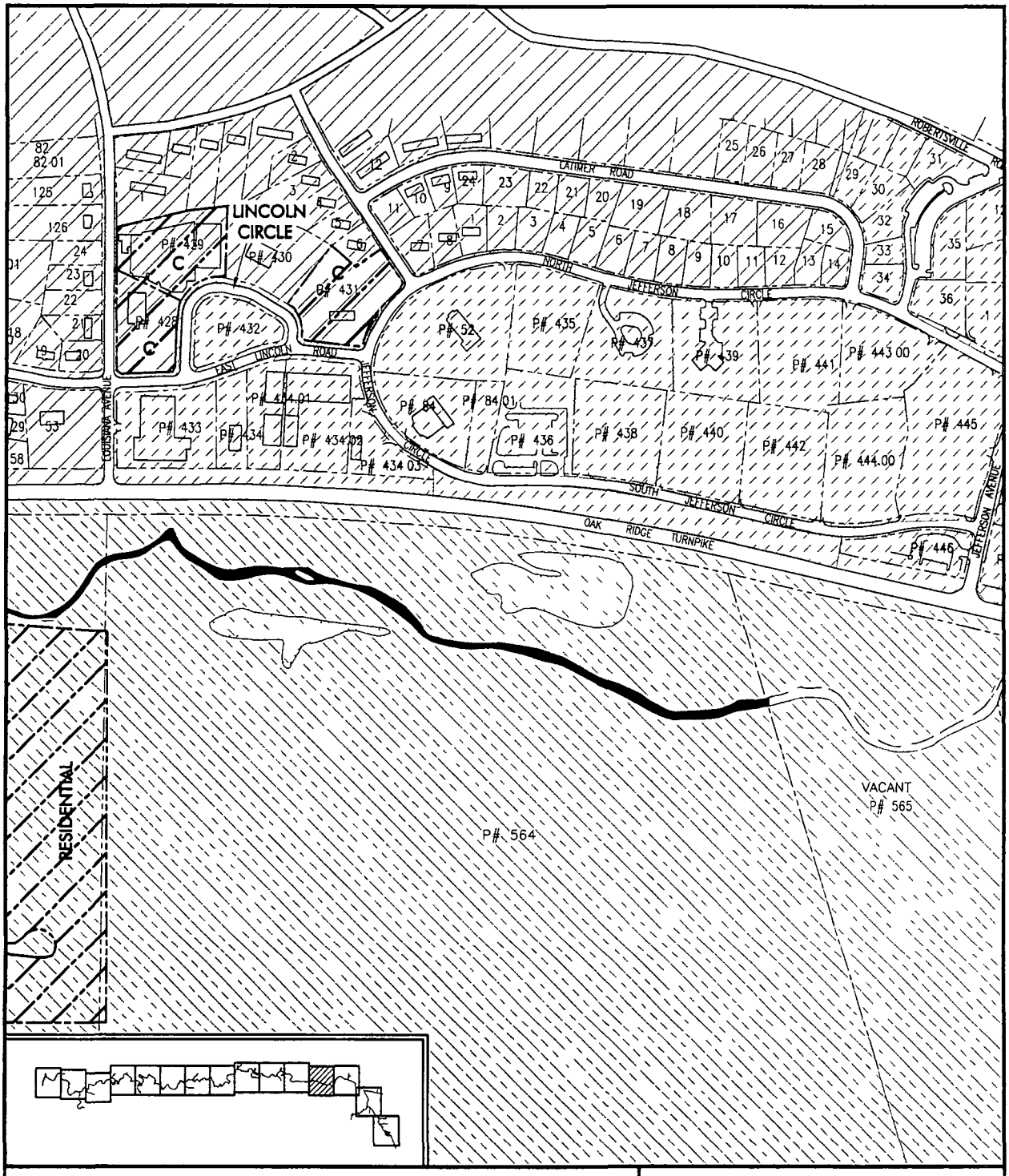

LEGEND:

PARCELS

WETLANDS (COE ID #)

RESIDENTIAL

AGRICULTURAL

COMMERCIAL

OPEN

CURRENT LAND USE BOUNDARY

34°13 ± O R ADMIN GRID TRUE NORTH

0 250 500

SCALE 1" = 500'

SAIC®
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 4 EAST FORK POPLAR CREEK

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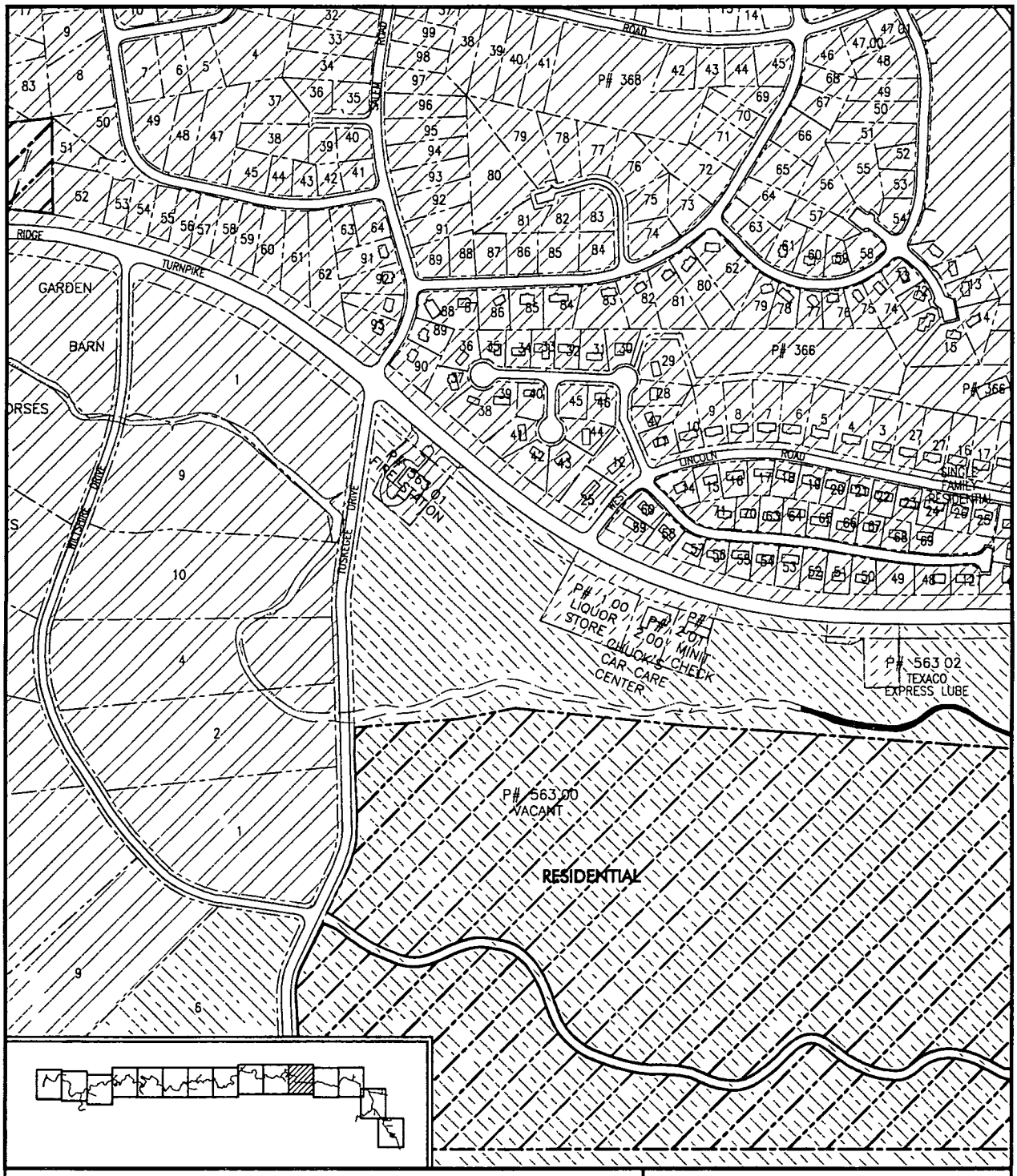
P HOLM	REV 2 /10-02-00	K:\00055\DWGS\K25-LANDUSE



LEGEND:

PARCELS

WETLANDS (COE ID #)

RESIDENTIAL

AGRICULTURAL

COMMERCIAL

OPEN

CURRENT LAND USE BOUNDARY

0 250 500

SCALE 1" = 500'

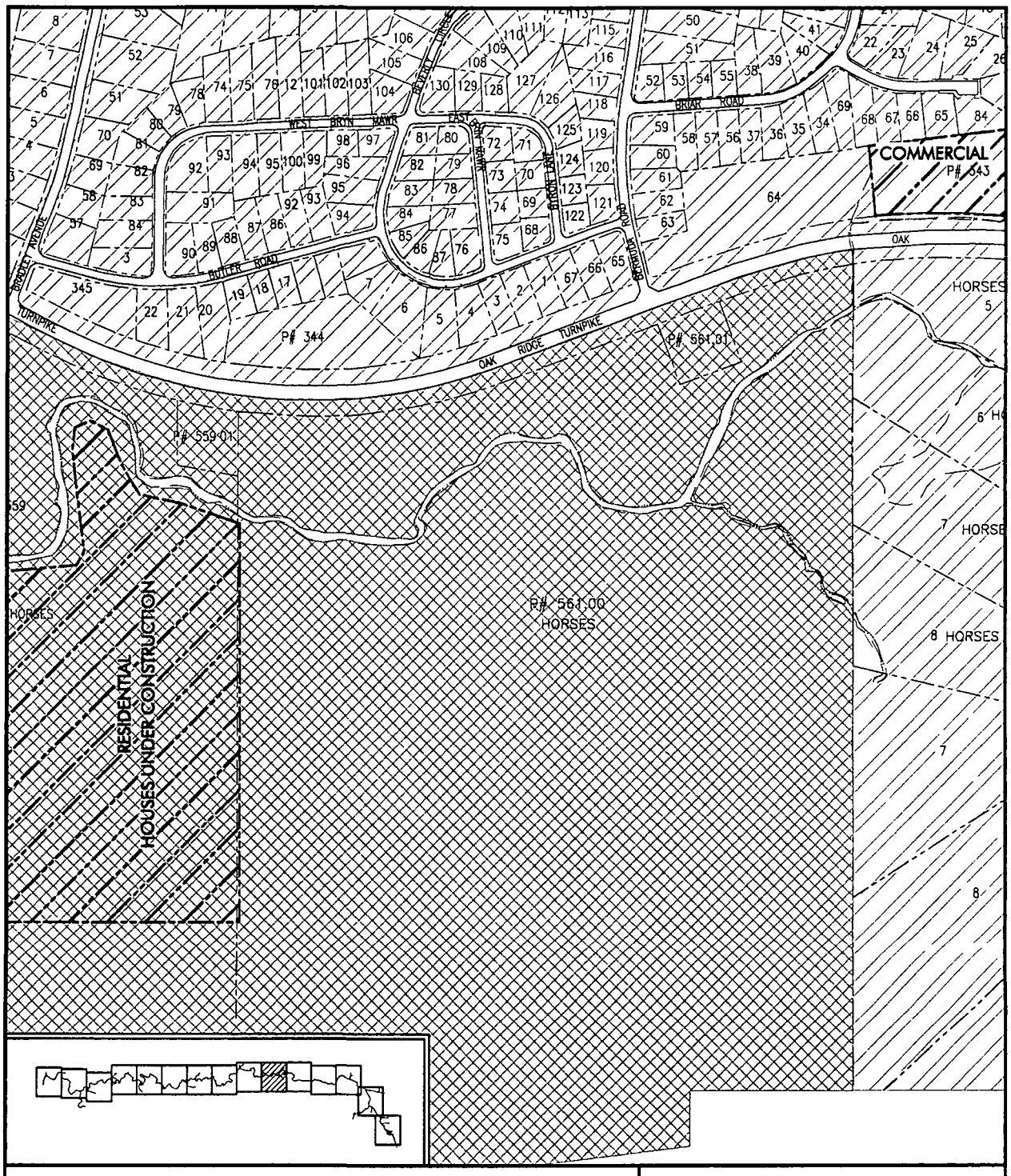
34°13'± OR ADMIN GRID

TRUE NORTH

SAIC®
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 5 EAST FORK POPLAR CREEK

DRAWN BY	REV NO /DATE	CAD FILE
P HOLM	REV 2 /10-02-00	K:\00055\DWGS\K25-LANDUSE



LEGEND:

PARCELS

WETLANDS (COE ID #)

RESIDENTIAL

AGRICULTURAL

COMMERCIAL

OPEN

CURRENT LAND USE BOUNDARY

0 250 500

SCALE 1" = 500'

34 13 ±

OR ADMIN GRID

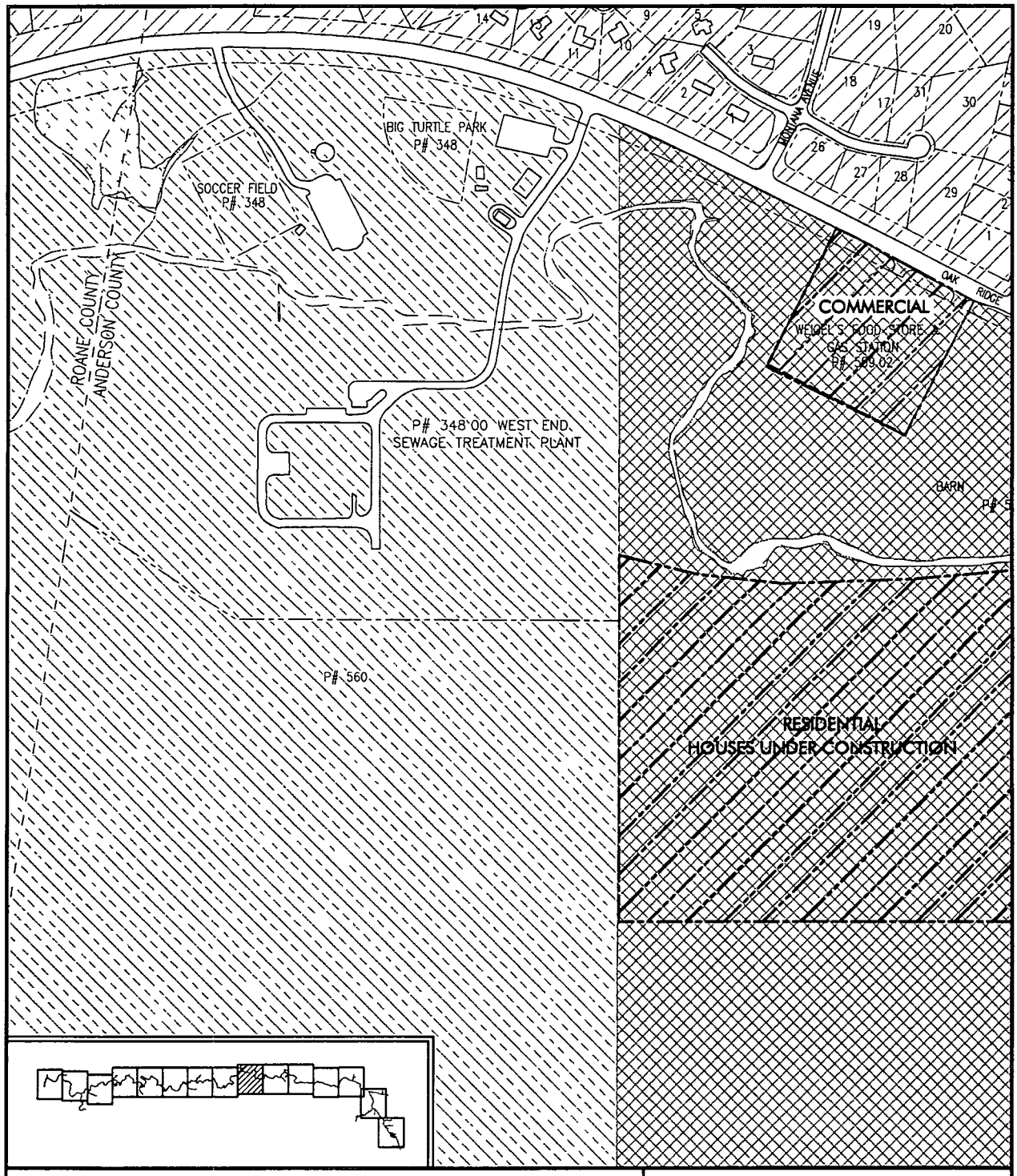
TRUE NORTH

SAIC®

Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 6 EAST FORK POPLAR CREEK

DRAWN BY	REV NO/DATE	CAD FILE
P HOLM	REV 2 /10-02-00	K:\00055\DWGS\K25-LANDUSE



LEGEND:

- PARCELS
- WETLANDS (COE ID #)
- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL
- OPEN

CURRENT LAND USE BOUNDARY

0 250 500

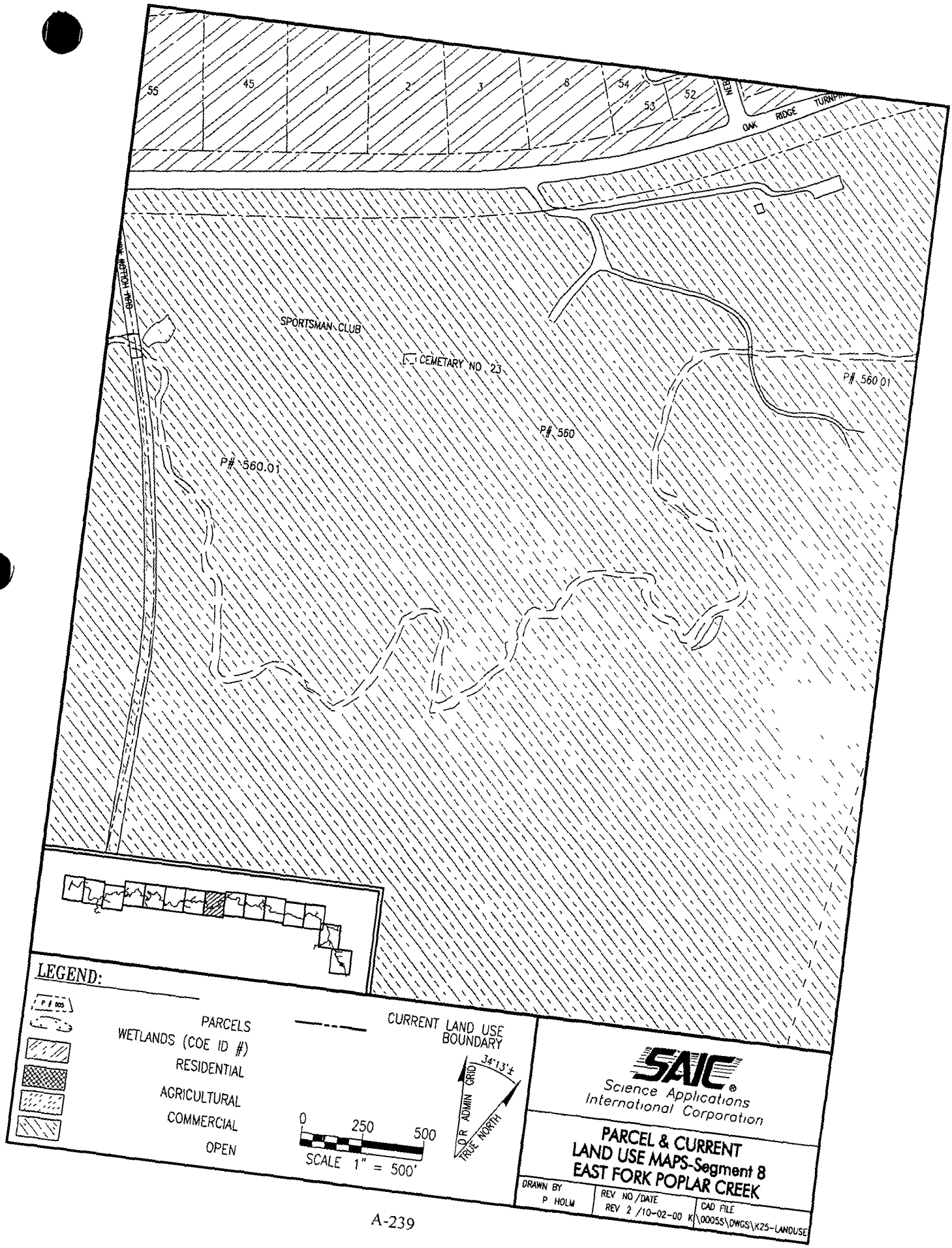
SCALE 1" = 500'

34°13'± OR ADMIN GRID TRUE NORTH

SAIC®
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 7 EAST FORK POPLAR CREEK

DRAWN BY	REV NO/DATE.	CAD FILE
P HOLM	REV 2 /10-02-00 K	\00055\DWGS\K25-LANDUSE


55
45
1
2
3
6
54
53
52
OAK RIDGE TURNPIKE
SPORTSMAN CLUB
CEMETARY NO. 23
P# 560.01
P# 560
P# 560.01
LEGEND:
PARCELS
WETLANDS (COE ID #)
RESIDENTIAL
AGRICULTURAL
COMMERCIAL
OPEN
CURRENT LAND USE BOUNDARY
0 250 500
SCALE 1" = 500'
34°13'±
O.R. ADMIN GRID
TRUE NORTH
SAIC
Science Applications International Corporation
PARCEL & CURRENT LAND USE MAPS-Segment 8
EAST FORK POPLAR CREEK
DRAWN BY
P HOLM
REV NO /DATE
REV 2 /10-02-00 K
CAD FILE
\00055\DWGS\K25-LANDUSE

LEGEND:

- PARCELS
- WETLANDS (COE ID #)
- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL
- OPEN

CURRENT LAND USE BOUNDARY

0 250 500

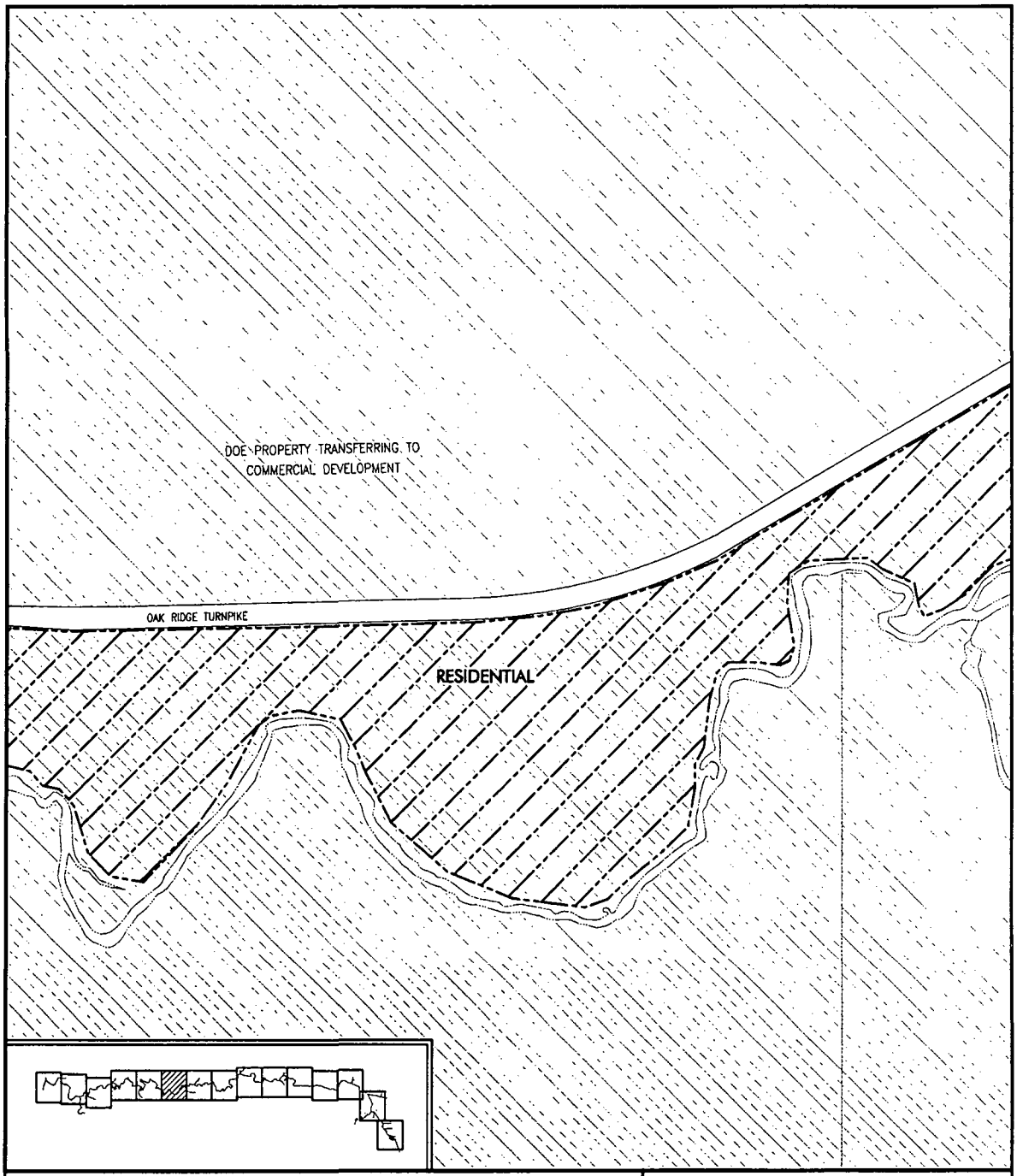
SCALE 1" = 500'

34°13'± O.R. ADMIN GRID TRUE NORTH

SAIC®
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 9 EAST FORK POPLAR CREEK

DRAWN BY	REV NO/DATE	CAD FILE
P HOLM	REV 2 /10-02-00	K:\00055\DWGS\K25-LANDUSE



LEGEND:

- PARCELS
- WETLANDS (COE ID #)
- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL
- OPEN

CURRENT LAND USE BOUNDARY

0 250 500

SCALE: 1" = 500'

34°13'± O.R. ADMIN. GRID TRUE NORTH

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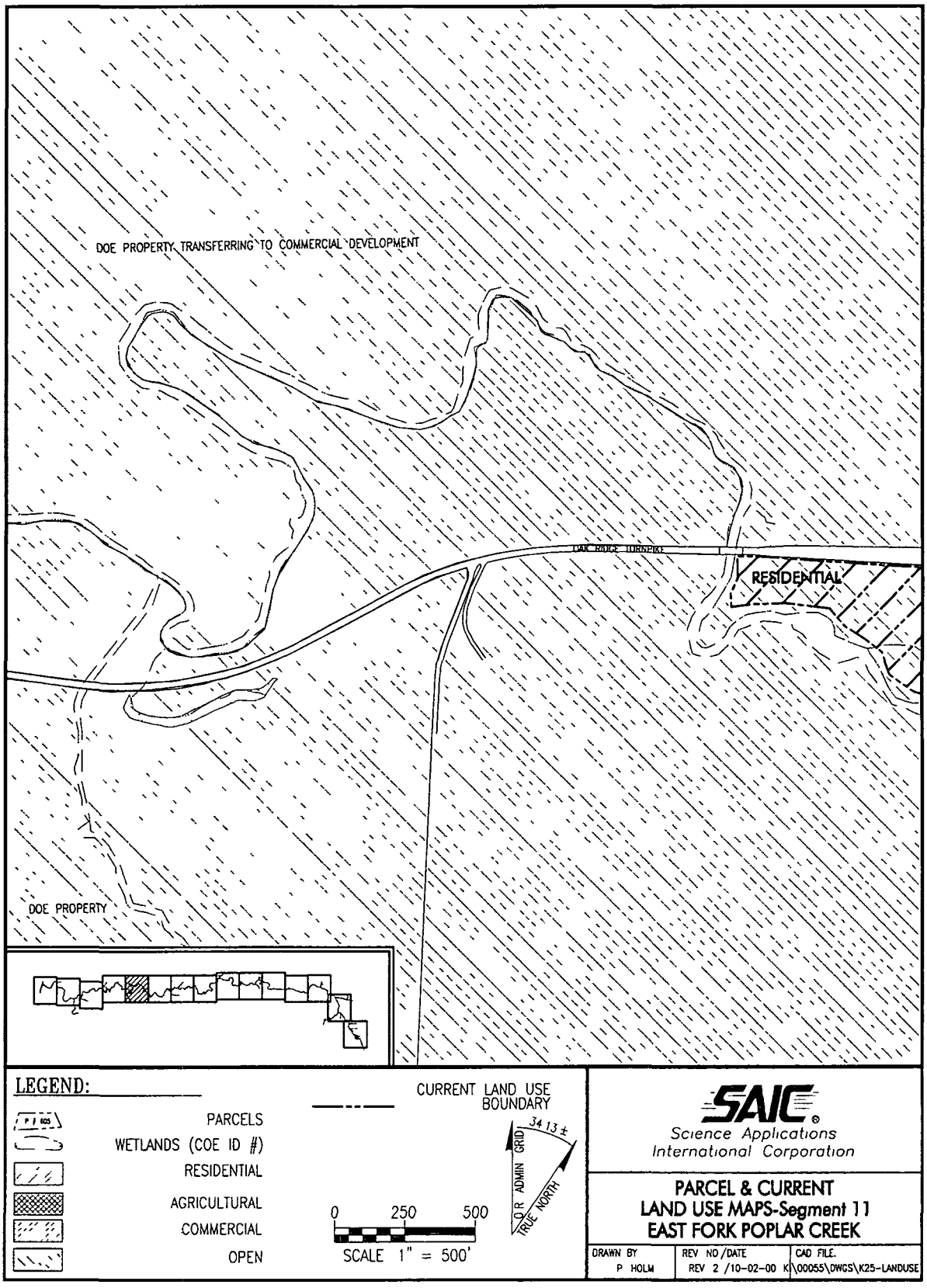
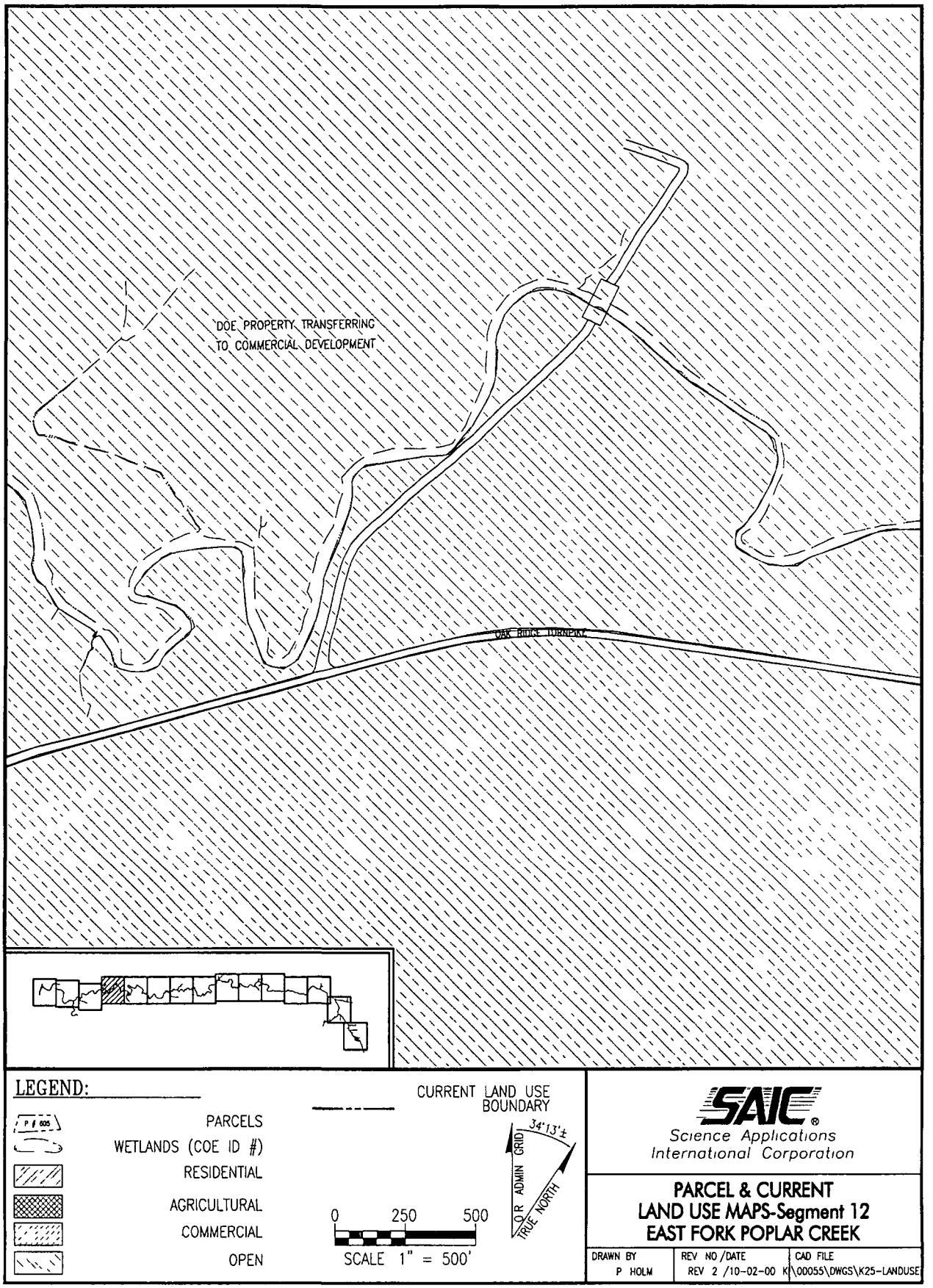
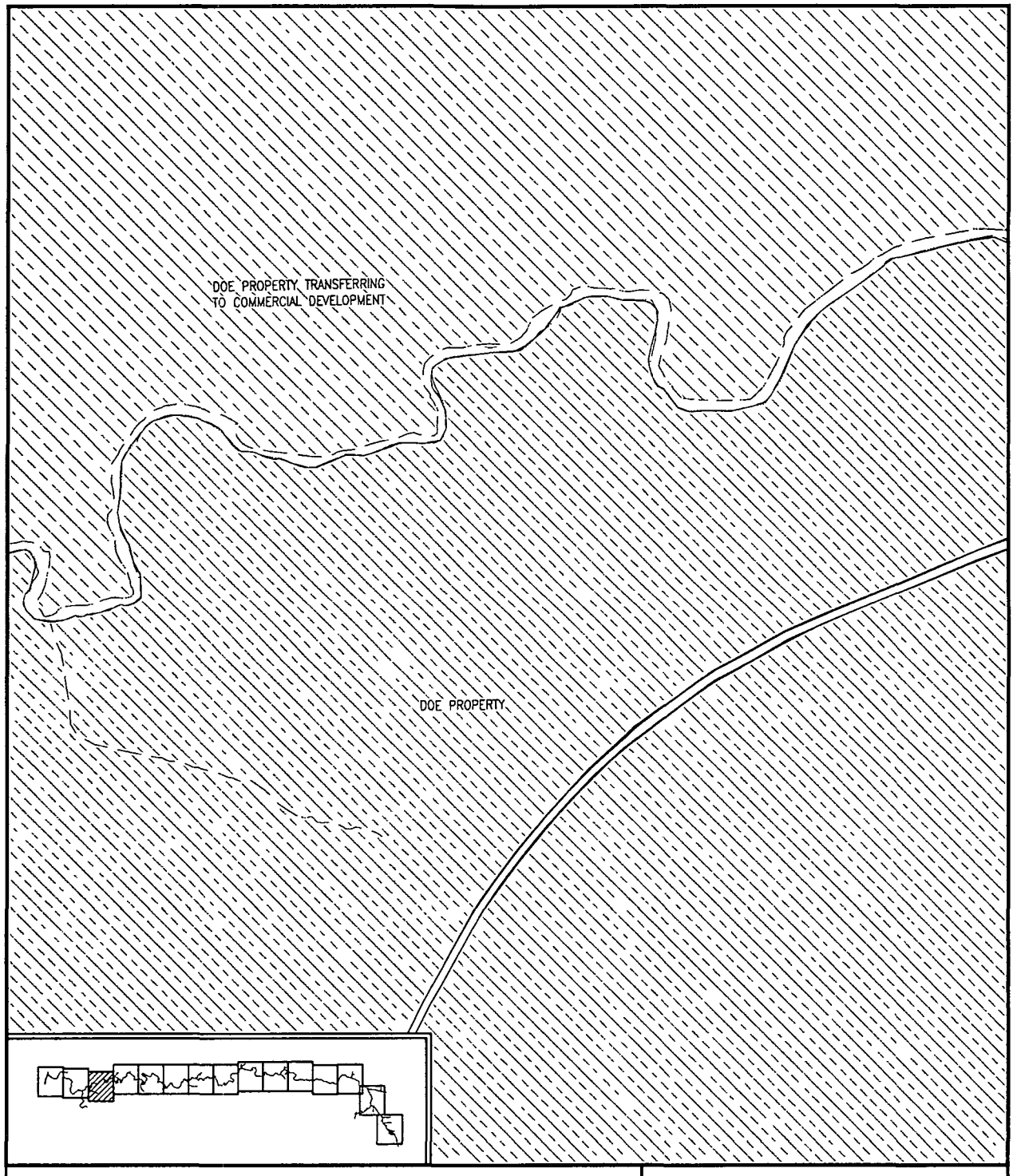
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 10 EAST FORK POPLAR CREEK

DRAWN BY:	REV. NO./DATE:	CAD FILE:
P. HOLM	REV. 2 /10-02-00 K	\00055\DWGS\K25-LANDUSE


DOE PROPERTY TRANSFERRING TO COMMERCIAL DEVELOPMENT
OAK RIDGE TURNPIKE
RESIDENTIAL
DOE PROPERTY
LEGEND:
PARCELS
WETLANDS (COE ID #)
RESIDENTIAL
AGRICULTURAL
COMMERCIAL
OPEN
CURRENT LAND USE BOUNDARY
0 250 500
SCALE 1" = 500'
34 13 ±
OR ADMIN GRID
TRUE NORTH
SAIC
Science Applications International Corporation
PARCEL & CURRENT
LAND USE MAPS-Segment 11
EAST FORK POPLAR CREEK
DRAWN BY
P HOLM
REV NO/DATE
REV 2 /10-02-00
CAD FILE.
K:\00055\DWGS\K25-LANDUSE


DOE PROPERTY TRANSFERRING
TO COMMERCIAL DEVELOPMENT
OAK RIDGE TURNPIKE
LEGEND:
PARCELS
WETLANDS (COE ID #)
RESIDENTIAL
AGRICULTURAL
COMMERCIAL
OPEN
CURRENT LAND USE BOUNDARY
0 250 500
SCALE 1" = 500'
34°13'±
OR ADMIN GRID
TRUE NORTH
SAIC
Science Applications International Corporation
PARCEL & CURRENT
LAND USE MAPS-Segment 12
EAST FORK POPLAR CREEK
DRAWN BY
P HOLM
REV NO /DATE
REV 2 /10-02-00
CAD FILE
K:\00055\DWGS\K25-LANDUSE



LEGEND:

PARCELS

WETLANDS (COE ID #)

RESIDENTIAL

AGRICULTURAL

COMMERCIAL

OPEN

CURRENT LAND USE BOUNDARY

0 250 500

SCALE 1" = 500'

34 13'±

O R ADMIN GRID

TRUE NORTH

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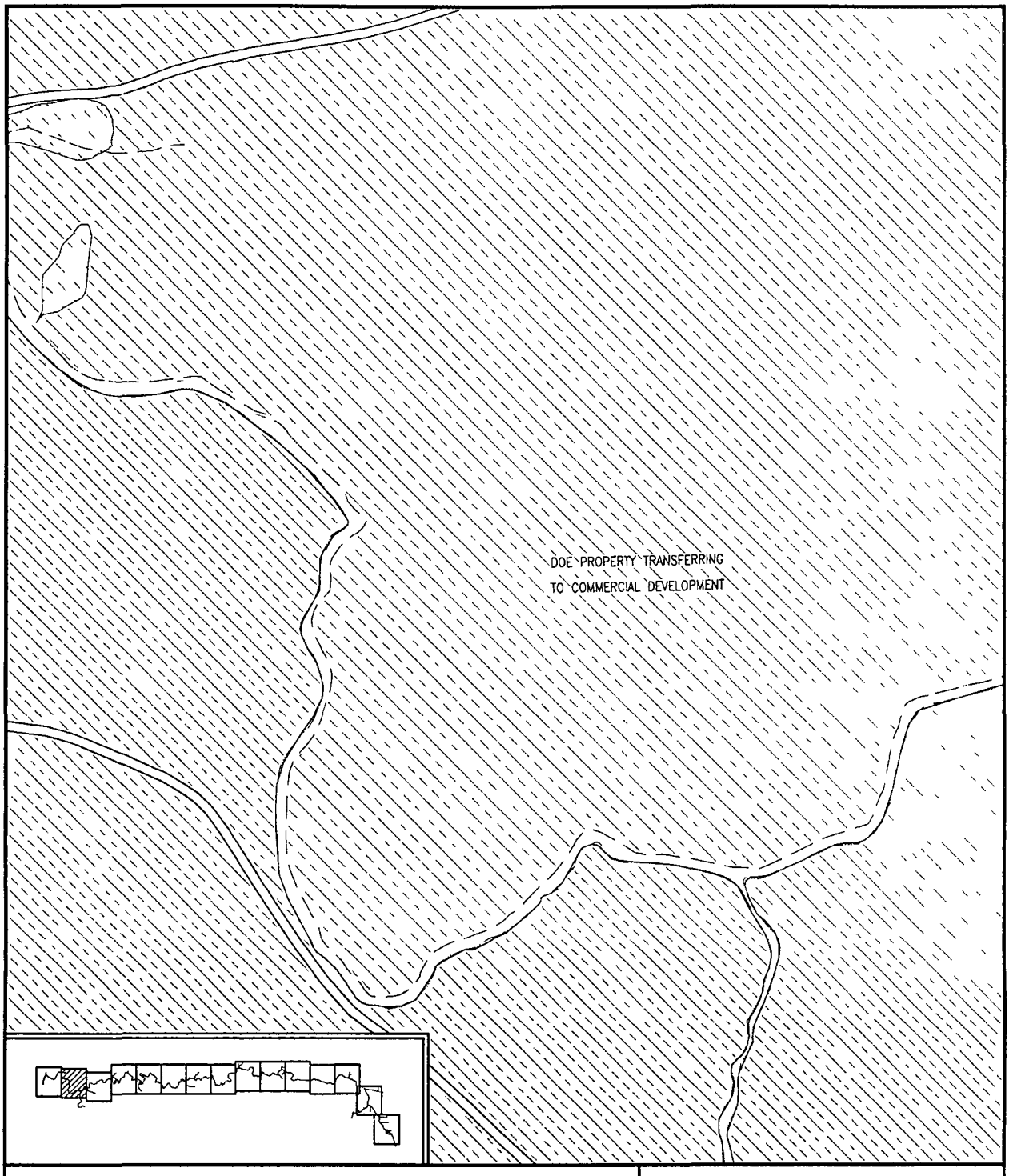
PARCEL & CURRENT LAND USE MAPS-Segment 13 EAST FORK POPLAR CREEK

DRAWN BY	REV NO/DATE	CAD FILE
P HOLM	REV 2 /10-02-00 K	\00055\DWGS\K25-LANDUSE



LEGEND:

- PARCELS
- WETLANDS (COE ID #)
- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL
- OPEN

CURRENT LAND USE BOUNDARY

0 250 500

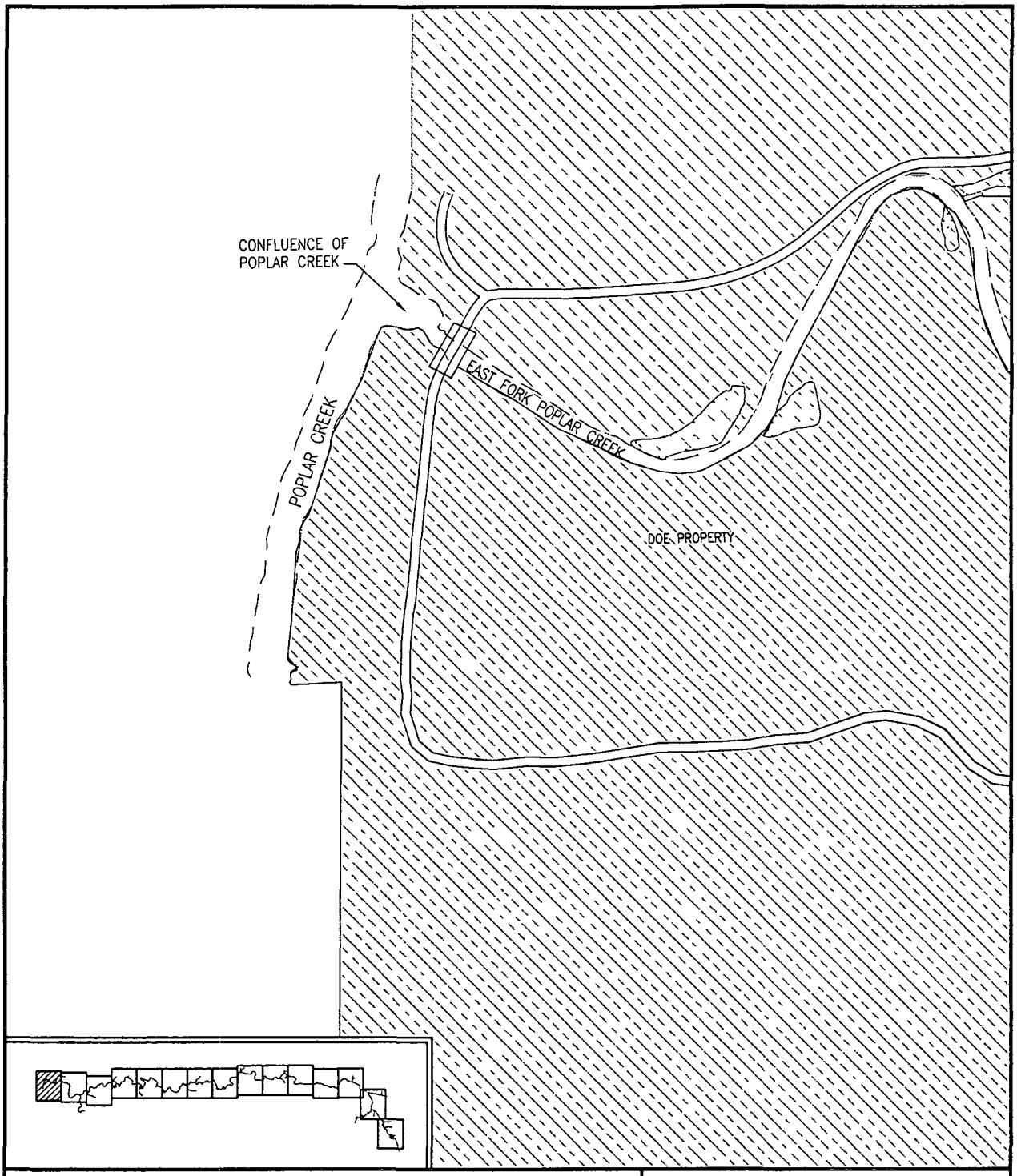
SCALE 1" = 500'

34°13'± OR ADMIN GRID TRUE NORTH

SAIC®
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 14 EAST FORK POPLAR CREEK

DRAWN BY	REV NO/DATE	CAD FILE
P HOLM	REV 2 /10-02-00 K	\00055\DWGS\K25-LANDUSE



LEGEND:

PARCELS
WETLANDS (COE ID #)
RESIDENTIAL
AGRICULTURAL
COMMERCIAL
OPEN

CURRENT LAND USE BOUNDARY

0 250 500
SCALE 1" = 500'

34°13'± O.R. ADMIN GRID
TRUE NORTH

SAIC®
Science Applications International Corporation

PARCEL & CURRENT LAND USE MAPS-Segment 15 EAST FORK POPLAR CREEK

DRAWN BY	REV NO/DATE	CAD FILE
P HOLM	REV 2 /10-02-00 K	\00055\DWGS\K25-LANDUSE