ORNL/M-2287

ER009592

Off-Reservation Activities of the DOE Oak Ridge Environmental Restoration Program

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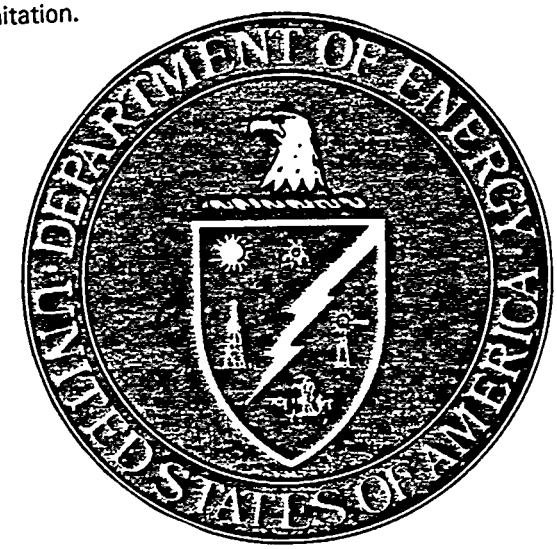

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Briefing for the State of Tennessee Governor's Office

May 30, 1991

#1091

Off-Reservation Activities of the DOE Oak Ridge Environmental Restoration Program

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W. W. Tolbert
B. L. Kimmel

Briefing for
State of Tennessee Governor's Office
May 30, 1991

Prepared by
Martin Marietta Energy Systems, Inc.
Environmental Restoration Program

Prepared for
U.S. Department of Energy
Office of Environmental Restoration and Waste Management
under budget and reporting code EW 20

MARTIN MARIETTA ENERGY SYSTEMS, INC.
managing the
Oak Ridge National Laboratory
Oak Ridge Y-12 Plant
Oak Ridge K-25 Site
Paducah Gaseous Diffusion Plant
under contract DE-AC05-84OR21400
and the
Portsmouth Gaseous Diffusion Plant
under contract DE-AC05-76OR00001
for the
U.S. DEPARTMENT OF ENERGY

U.S. Department of Energy
Oak Ridge Operations Office
Environmental Restoration Program

Briefing for
State of Tennessee Governor's Office
May 30, 1991

Agenda

- Introduction
- CSX railroad site
- Biological monitoring of streams on the Oak Ridge Reservation
- East Fork Poplar Creek
- Clinch River and Watts Bar Reservoir

Agenda

- CSX site history
- Previous investigations
- Current status
- Schedule of activities

CSX Railroad

SITE HISTORY

- Rail siding maintained by CSX Transportation Group and used for transport of materials to ORR facilities
- Low-level radioactive wastes shipped by rail in early 1960s for disposal at ORNL
- Source of contamination suggested to be from leaking concrete casks of ^{137}Cs-bearing animal carcasses

CSX Railroad

PREVIOUS INVESTIGATIONS

- Initial ORNL survey, June 1986, indicated elevated levels of ^{137}Cs at Y-12 Plant sidings
  - Contamination occurs in localized areas
  - Contamination confined within a few meters of track
- ORAU survey, November 1986, provided detailed information on gamma exposure rates
  - ^{137}Cs confined to shallow depths in ballast and soils
  - Stream water and sediment samples typical of background levels in Oak Ridge area

CSX Railroad

PREVIOUS INVESTIGATIONS (cont'd)

- Recent ORNL survey, March and June 1990, assessed remainder of CSX tracks within city limits
  - Additional areas of contamination identified near warehouse district
  - Some adjacent residential properties surveyed with results indicating no elevated ^{137}Cs levels
- Results of all surveys summarized in *Preliminary Assessment of Radiation Doses to the Public from ^{137}Cs Contamination Along Railroad Tracks in Oak Ridge*, Kocher, 1990
  - Primary exposure pathway identified as direct exposure to gamma radiation
  - Risk assessment indicates no significant health risk to the public or to railroad workers from ^{137}Cs exposure

CSX Railroad

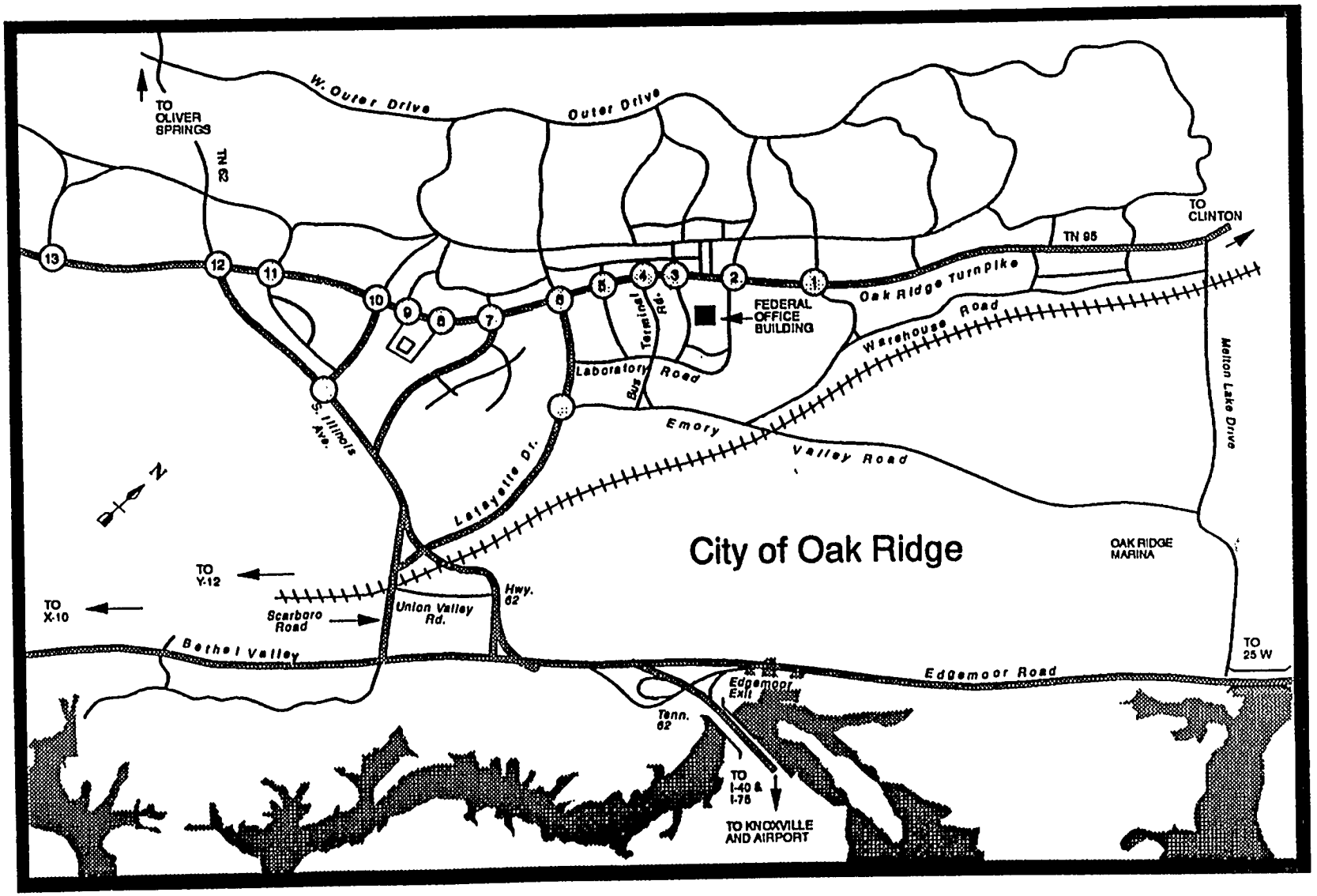
CURRENT STATUS

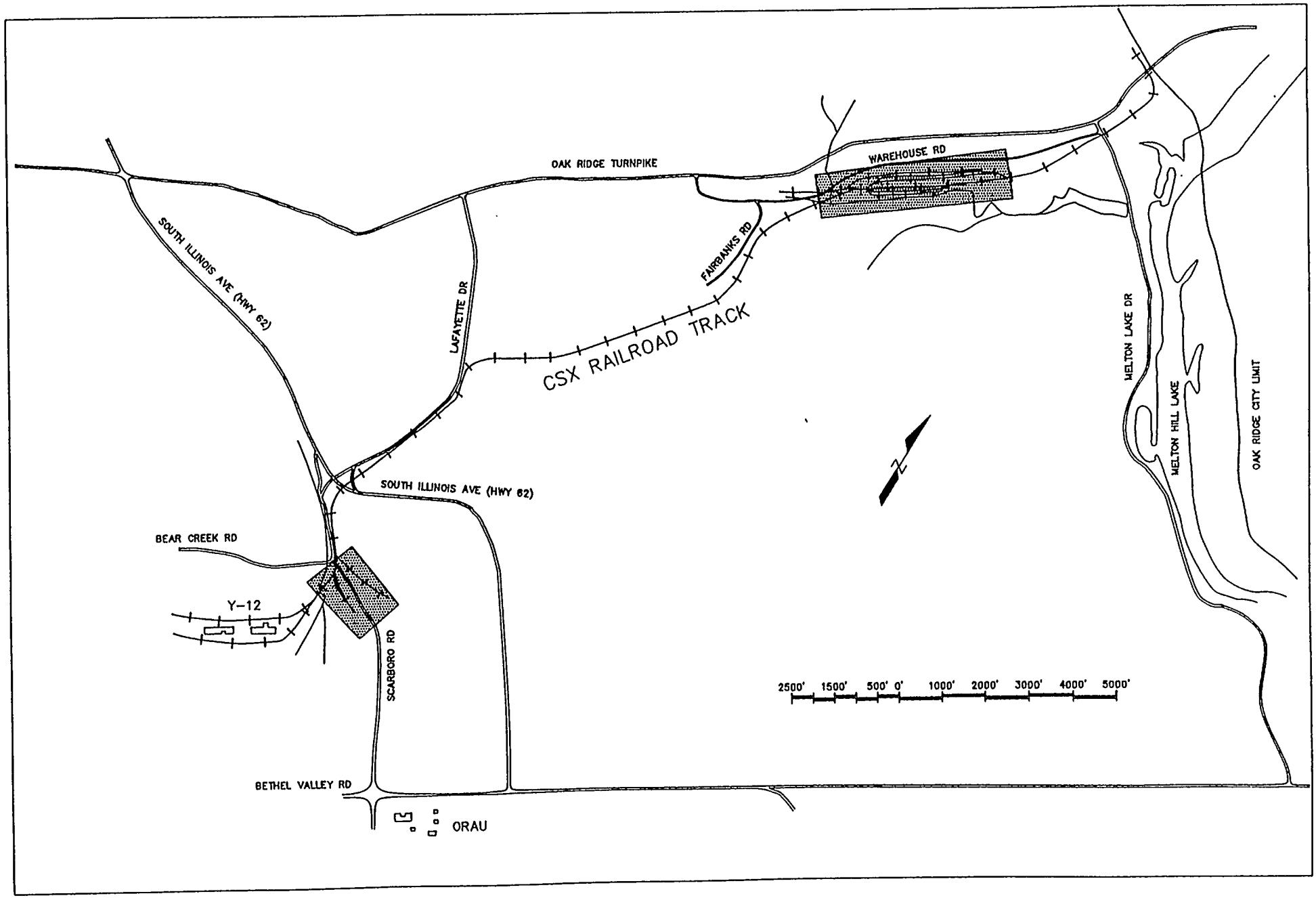
- General public or railroad workers are not likely to exceed annual effective dose equivalents
- Levels of ^{137}Cs exceed NRC and DOE guidelines for unrestricted use by public
- Areas of CSX tracks are unrestricted and accessible by public
- Contaminated material should be removed from public domain
- Remediation of contaminated areas is recommended
- DOE has initiated cleanup process with preparation of a Remedial Investigation work plan

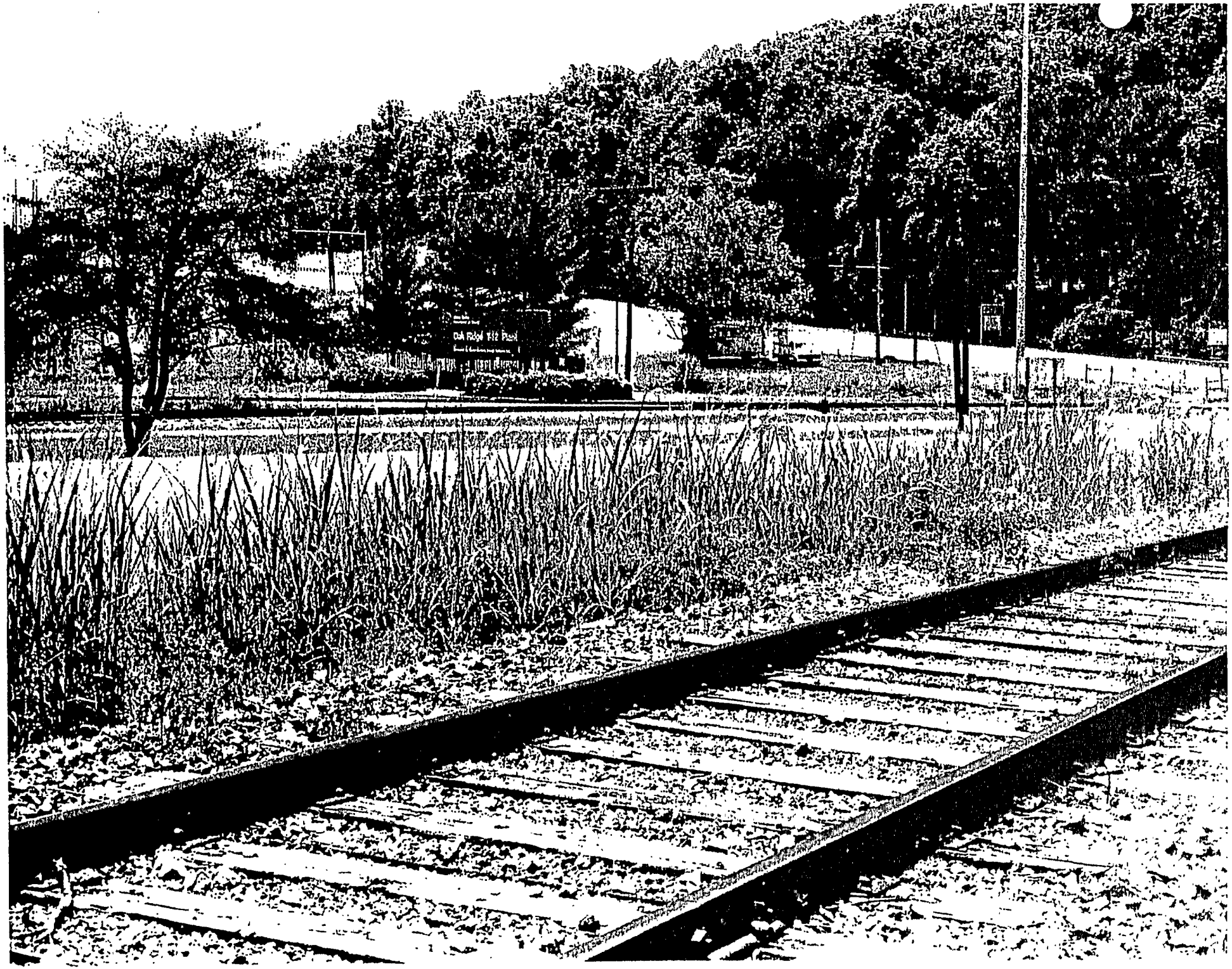
CSX Railroad

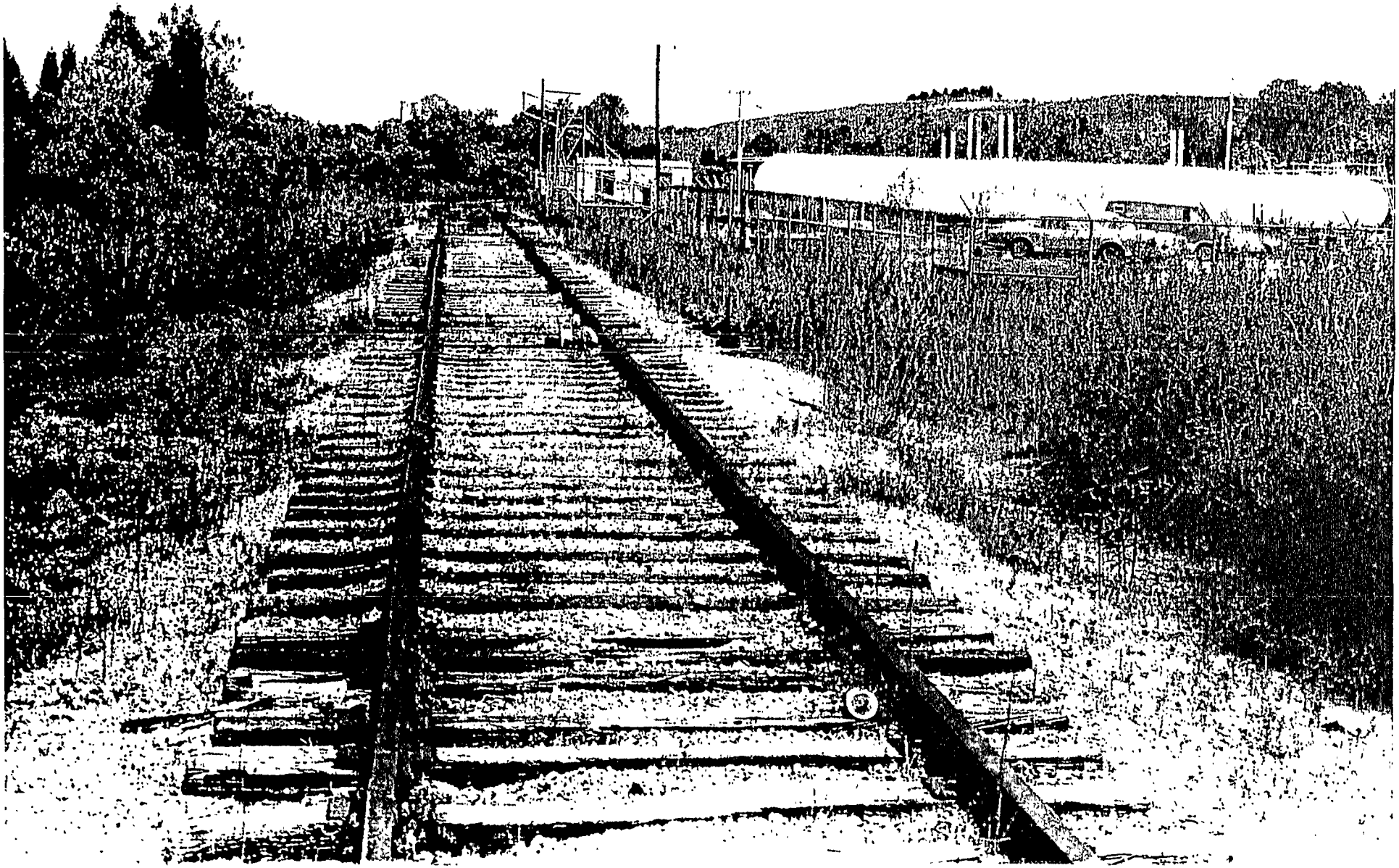
SCHEDULE OF ACTIVITIES

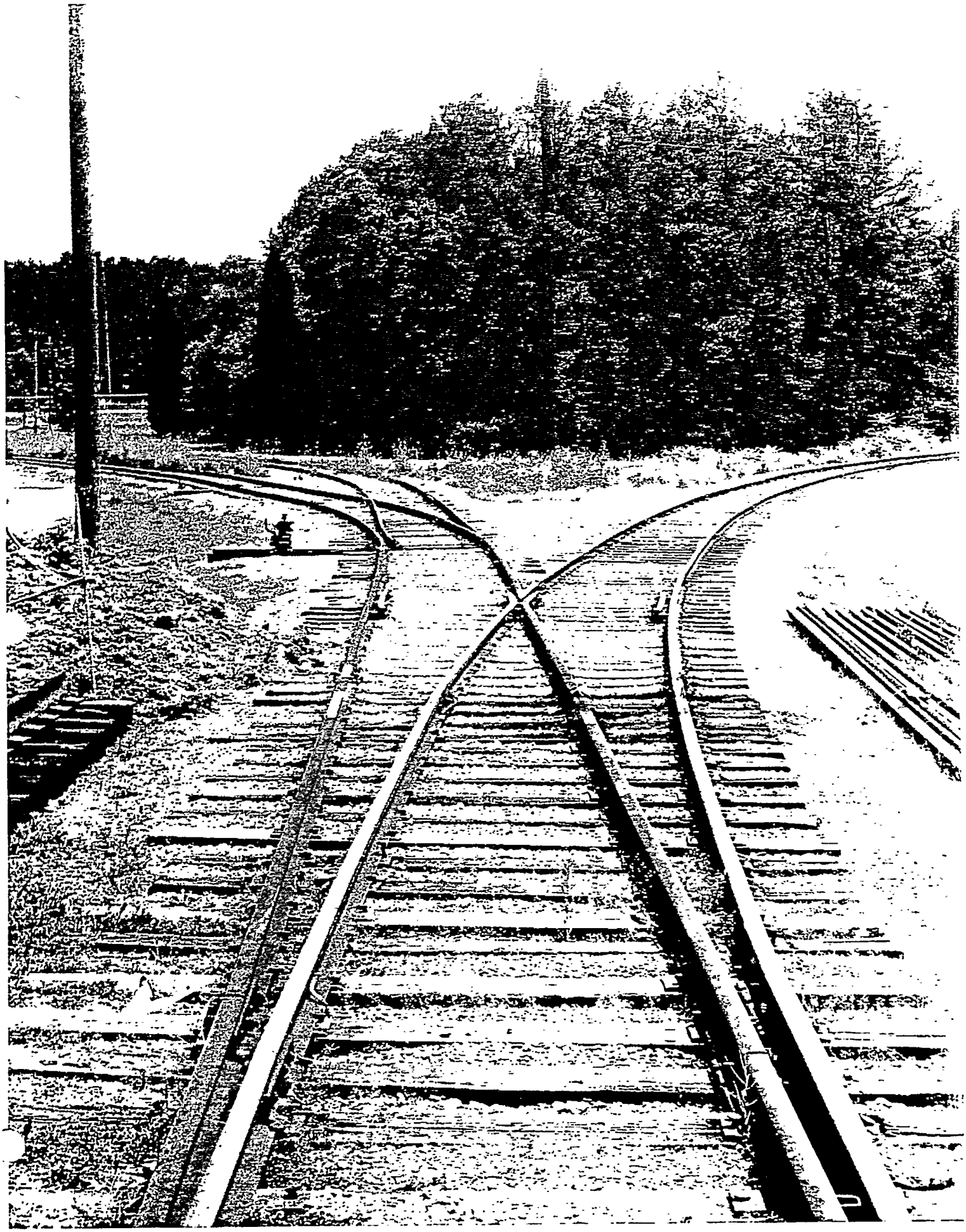
● Kickoff meeting with EPA/TDC	04/25/91
● Draft RI work plan to EPA/TDC	09/13/91
● Initiation of field sampling	10/28/91
● Draft RI/FS/EA report to EPA/TDC	04/10/92
● PRAP submitted for public comment	06/01/92
● Record of Decision	07/31/92
● Remedial action to begin with submittal of ROD	

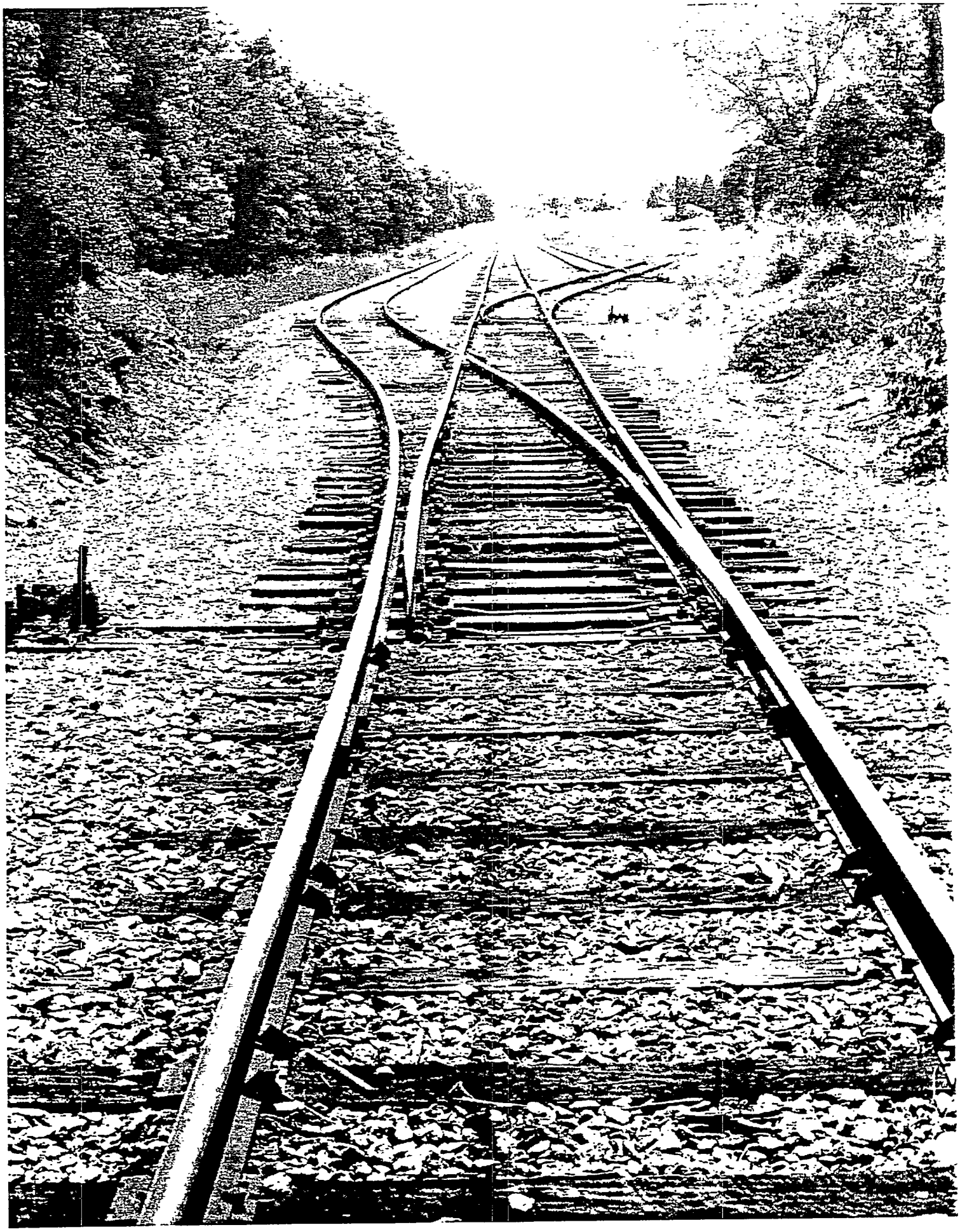

TO OLIVER SPRINGS
TN 62
W. Outer Drive
Outer Drive
TO CLINTON
TN 95
Oak Ridge Turnpike
Warehouse Road
Melton Lake Drive
FEDERAL OFFICE BUILDING
Terminal Rd.
Bus
Laboratory Road
S. Illinois Ave.
Lafayette Dr.
Emory Valley Road
City of Oak Ridge
OAK RIDGE MARINA
N
TO Y-12
TO X-10
Scarboro Road
Union Valley Rd.
Hwy. 62
Bethel Valley
Edgemoor Road
Edgemoor Exit
Tenn. 62
TO 25 W
TO I-40 & I-75
TO KNOXVILLE AND AIRPORT

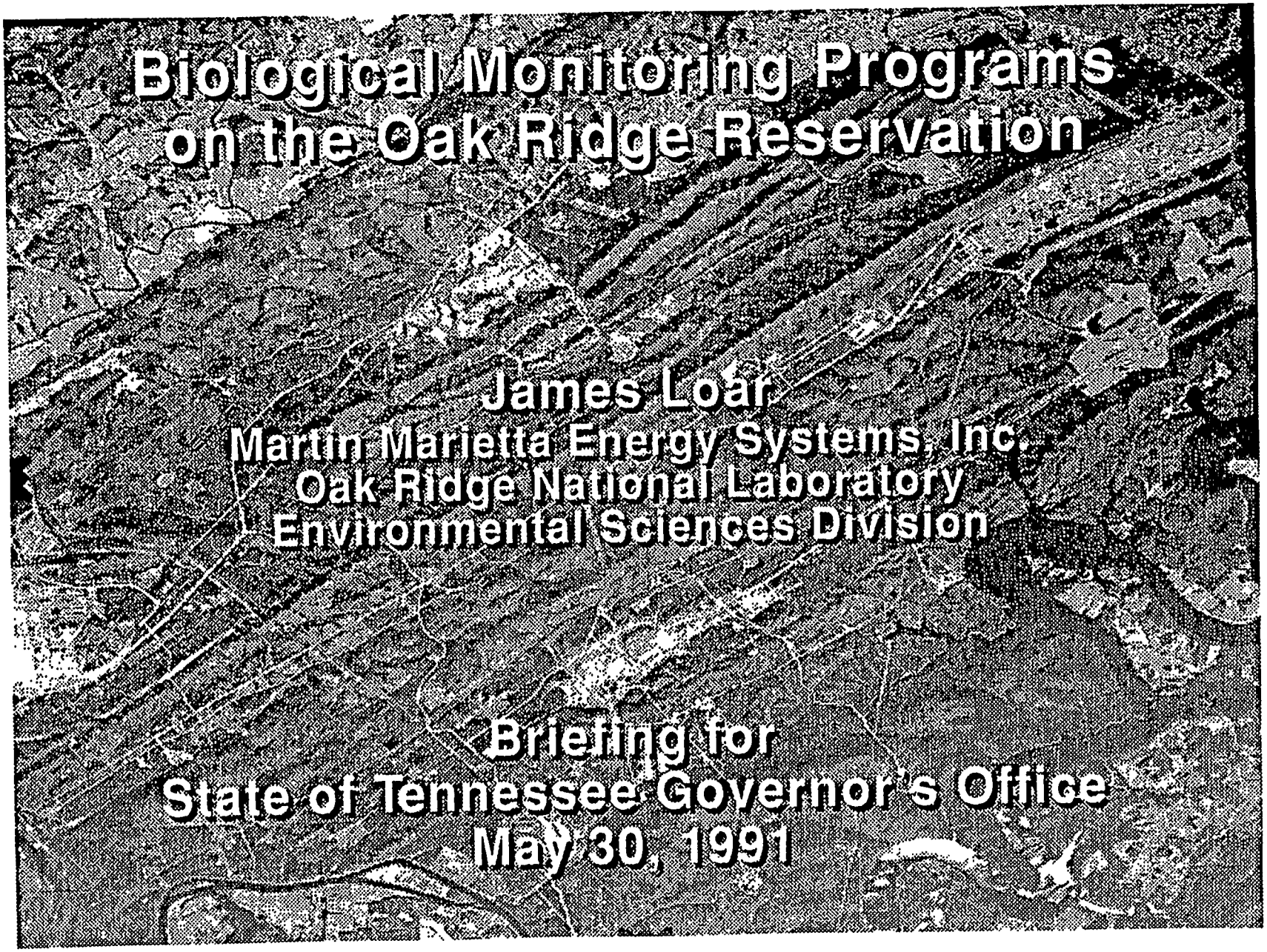

OAK RIDGE TURNPIKE
WAREHOUSE RD
SOUTH ILLINOIS AVE (HWY 62)
FAIRBANKS RD
LAFAYETTE DR
CSX RAILROAD TRACK
WELTON LAKE DR
WELTON HILL LAKE
OAK RIDGE CITY LIMIT
SOUTH ILLINOIS AVE (HWY 62)
BEAR CREEK RD
Y-12
SCARBORO RD
BETHEL VALLEY RD
ORAU
2500' 1500' 500' 0' 1000' 2000' 3000' 4000' 5000'










Biological Monitoring Programs
on the Oak Ridge Reservation
James Loar
Martin Marietta Energy Systems, Inc.
Oak Ridge National Laboratory
Environmental Sciences Division
Briefing for
State of Tennessee Governor's Office
May 30, 1991

Agenda

- Background and history
- Scope of existing programs
  - Objectives
  - Tasks
  - Unique characteristics
- Use of biological monitoring to evaluate remedial actions

History of Biological Monitoring at DOE Oak Ridge Facilities (NPDES Programs)

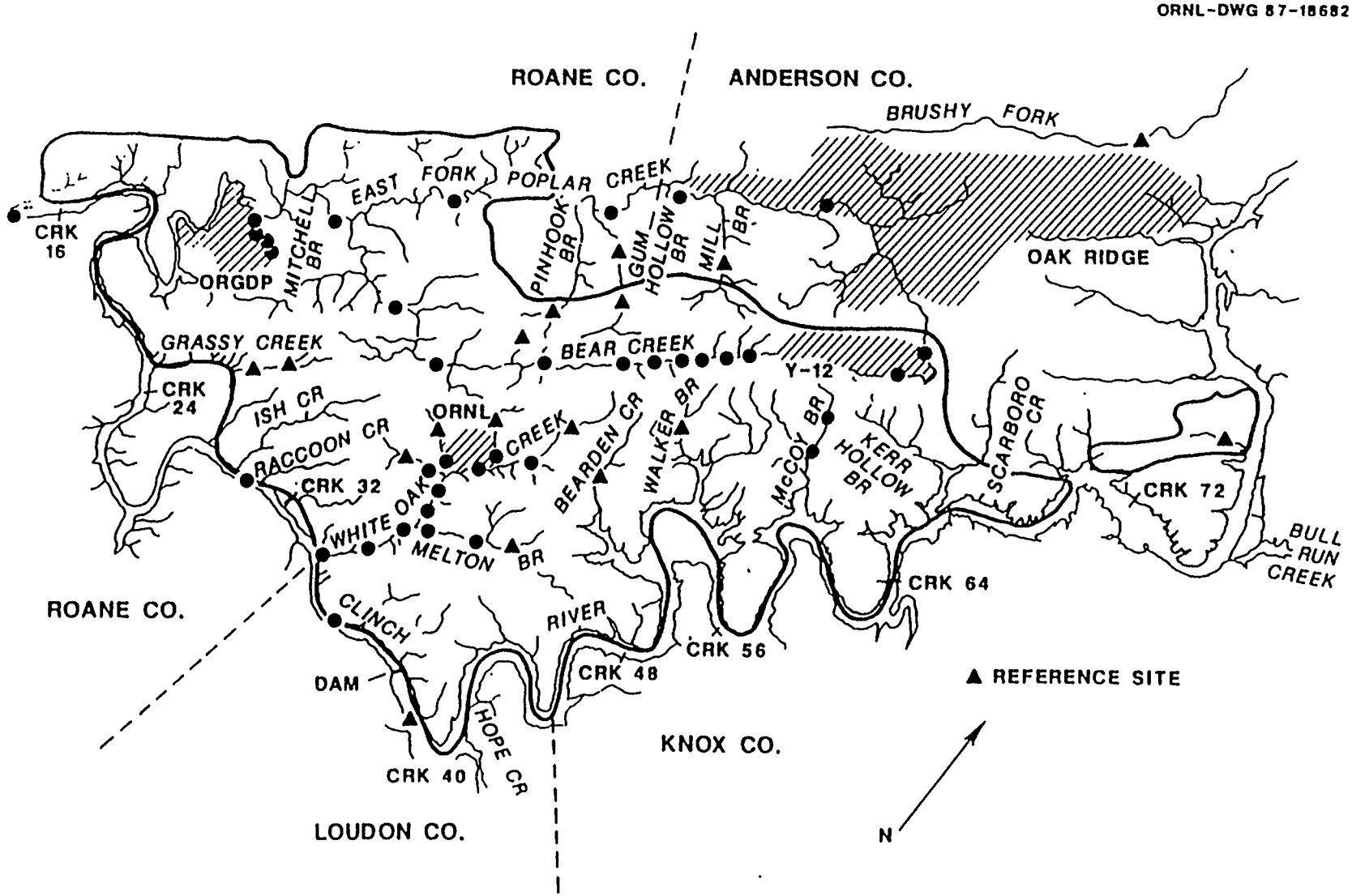
- Facilities could not comply with state water quality standards for the receiving stream
- Insufficient information on plant effluents and high capital costs impacted alternative approaches to compliance
- Biological monitoring approach was selected to provide
  - Alternative mechanism for compliance based upon protection of the classified uses of the receiving stream
  - Framework for establishing interim, less restrictive effluent limits

Summary of Existing Biological Monitoring Programs On the Oak Ridge Reservation (ORR)

Facility	Type of Program[A]	Receiving Stream	Date Monitoring Initiated
Y-12 Plant	ER	Bear Creek	May 1984
Y-12 Plant	NPDES	East Fork Poplar Creek	May 1985
ORNL	NPDES/ER	White Oak Creek Watershed[B]	April 1986
K-25 Site	NPDES	Mitchell Branch	August 1986
Y-12 Plant	ER	McCoy Branch	April 1989

[A] ER = Environmental Restoration; NPDES = National Pollutant Discharge Elimination System.

[B] Includes White Oak Creek and tributaries (Fifth Creek, First Creek, Melton Branch, Northwest Tributary), White Oak Lake, White Oak Creek embayment, and Clinch River.


ORNL-DWG 87-18682
ROANE CO.
ANDERSON CO.
BRUSHY FORK
EAST FORK POPLAR CREEK
CRK 16
ORGDP
MITCHELL BR
PINHOOK BR
GUM HOLLOW BR
MILL BR
OAK RIDGE
GRASSY CREEK
BEAR CREEK
Y-12
CRK 24
ISH CR
ORNL
RACCOON CR
CRK 32
WHITE OAK CREEK
BEARDEN CR
WALKER BR
McCOY BR
KERR HOLLOW BR
SCARBORO CR
CRK 72
BULL RUN CREEK
MELTON BR
CRK 64
ROANE CO.
CLINCH RIVER
CRK 56
CRK 48
DAM
REFERENCE SITE
HOPE CR
KNOX CO.
CRK 40
LOUDON CO.
N

Objectives of the Biological Monitoring Programs

- Determine if the interim NPDES effluent limits protect the classified uses of the receiving stream (e.g., growth and propagation of fish and aquatic life)
- Provide an ecological characterization of the receiving stream
  - To document ecological impacts
  - To identify contaminant sources that adversely affect stream biota
- Monitor ecological recovery during and after implementation of major remedial actions

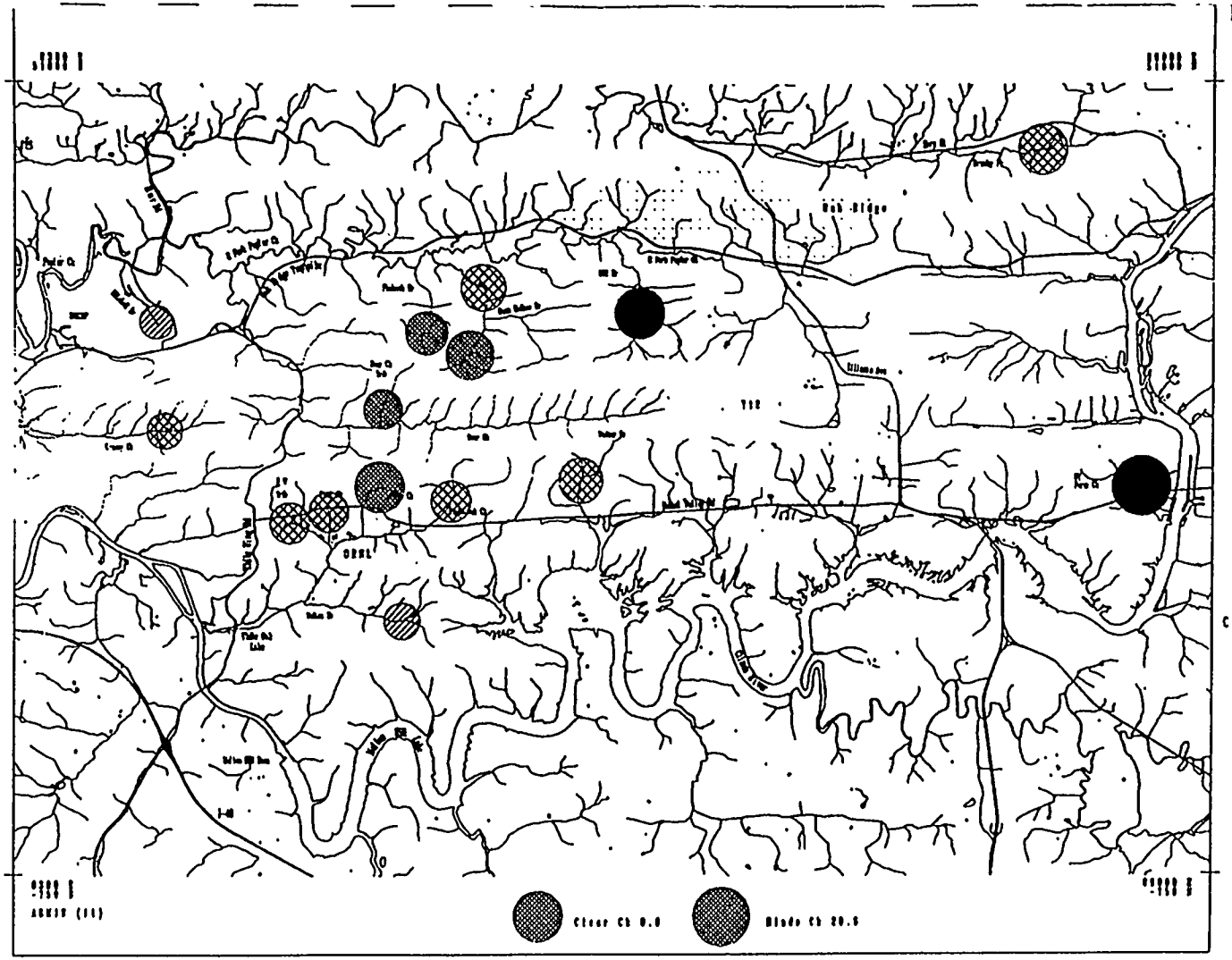
Summary of Biological Monitoring Program Tasks/Subtasks[a]

	ORNL BMAP	Y-12 BMAP	K-25 BMAP	Bear Cr RFI	McCoy Br RFI
Ambient toxicity testing	X	X	X	X	X
Bioaccumulation studies					
Aquatic	X	X	X	X	X
Terrestrial	X				
Bioindicator studies	X	X	X		
Ecological surveys					
Periphyton	X	X			
Benthic invertebrates	X	X	X	X	X
Fish	X	X	X	X	X
Radioecology of WOL	X				

[a]BMAP = Biological Monitoring and Abatement Program; RFI = RCRA Facility Investigation.

Unique Characteristics of ORR Biological Monitoring Programs

- Consist of characterization and investigative phases, in addition to routine monitoring
- Emphasize program flexibility and integration
  - Modify sampling frequencies
  - Integrate results among programs
- Combine conventional biological monitoring procedures with innovative state-of-the-art techniques
- Utilize detailed, written SOPs to assure quality and minimize costs



REFERENCE SITE

TAXON RICHNESS
YEAR 3
Aug 1986-Jul 1987

Number of Taxa per Sample

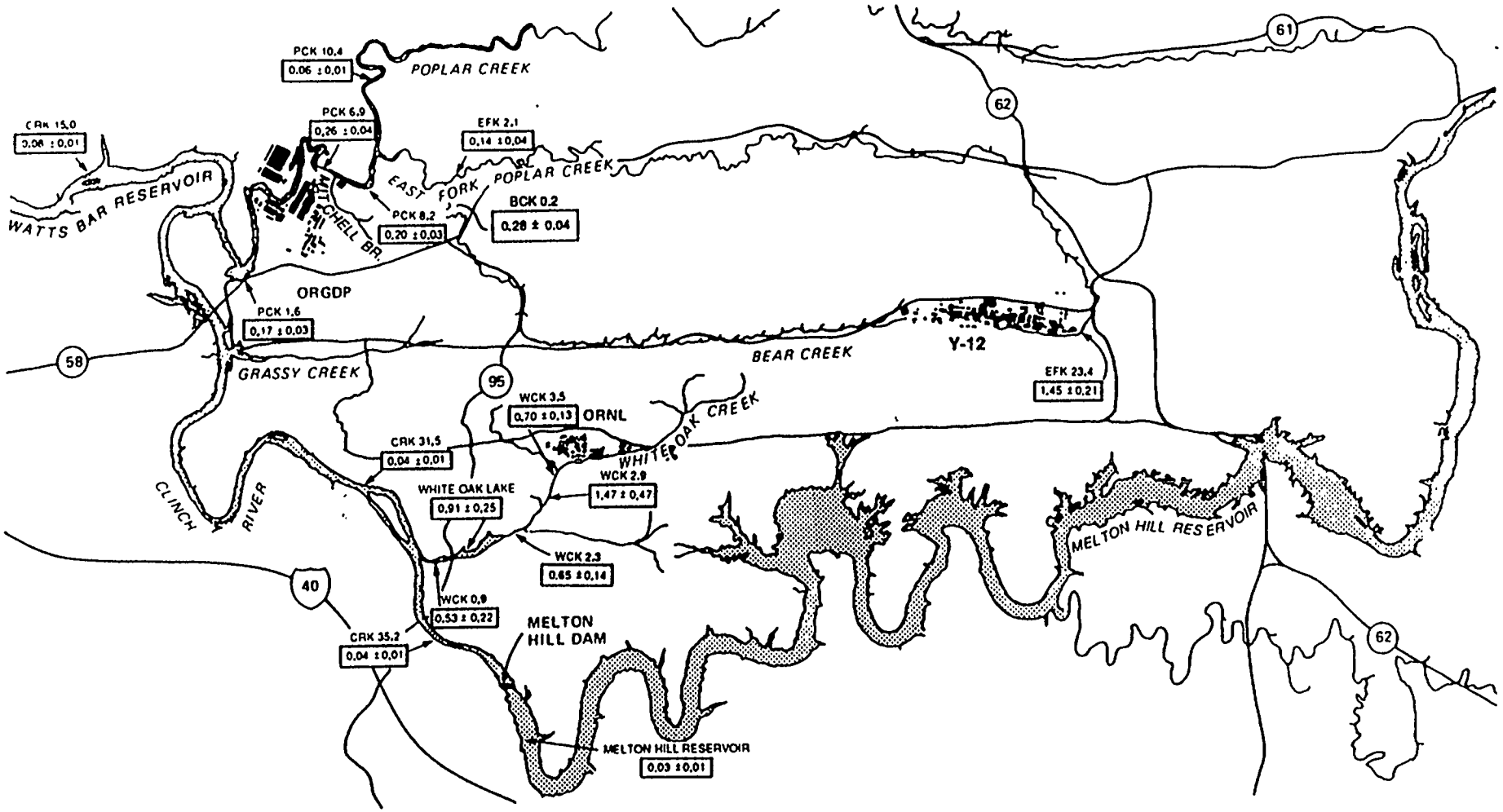
- < 15
- 15.1 - 20.0
- 20.1 - 25.0
- 25.1 - 30.0
- > 30

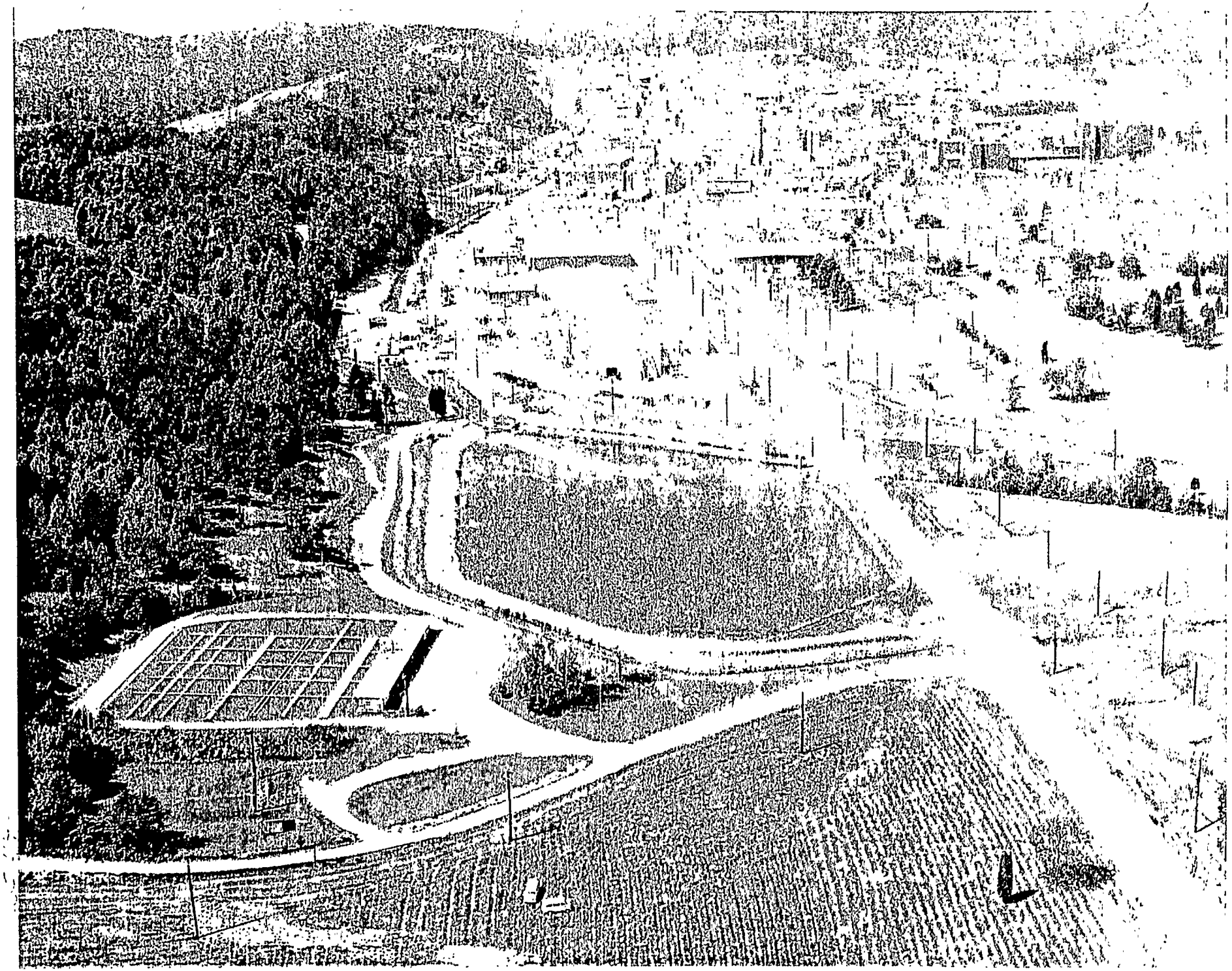
Circle Size Corresponds to Biomass (wet wt) per Sample

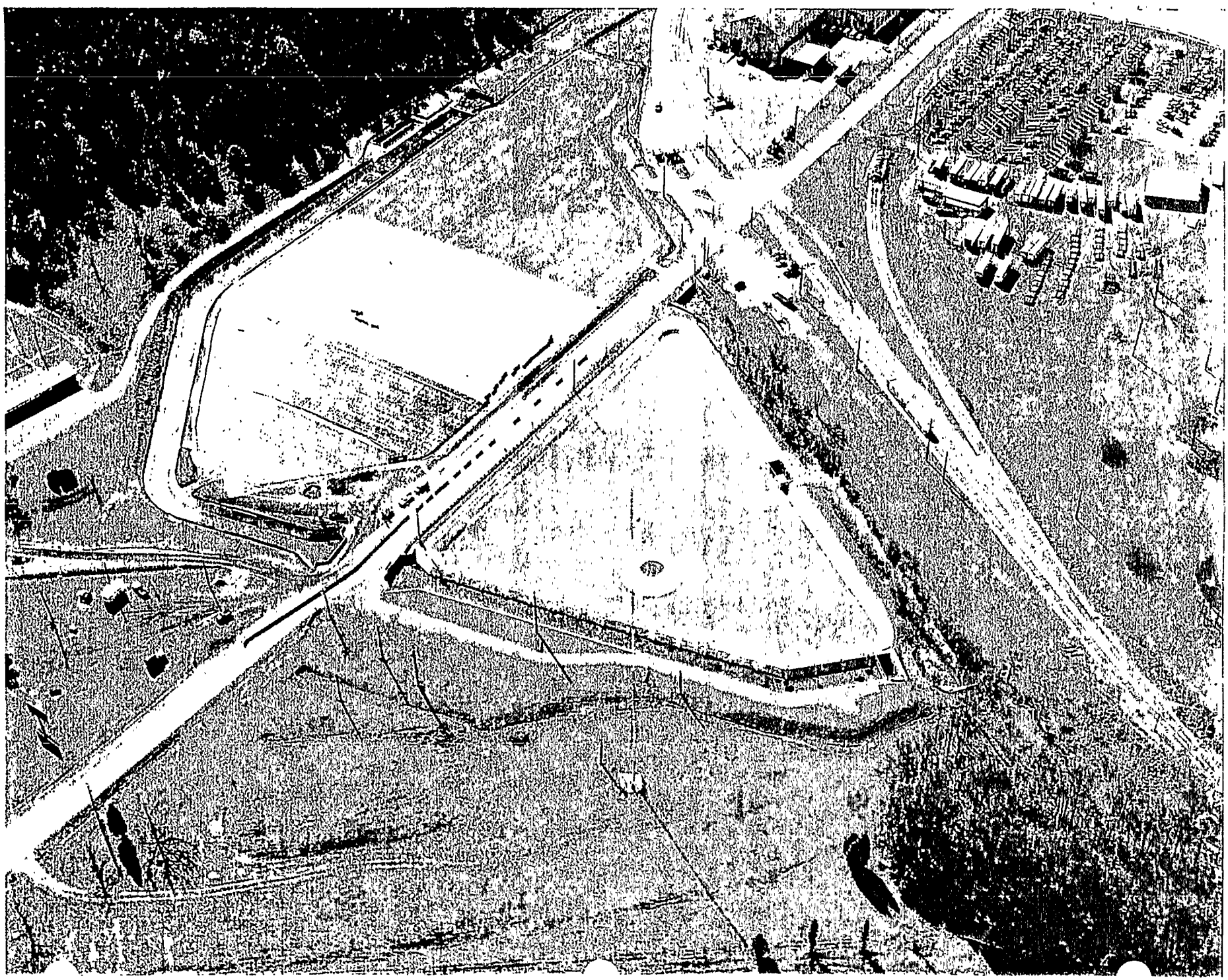
.25g .75g 1.25g

Values are Means for Quarterly Samples: Oct, Jan, Apr, Jul

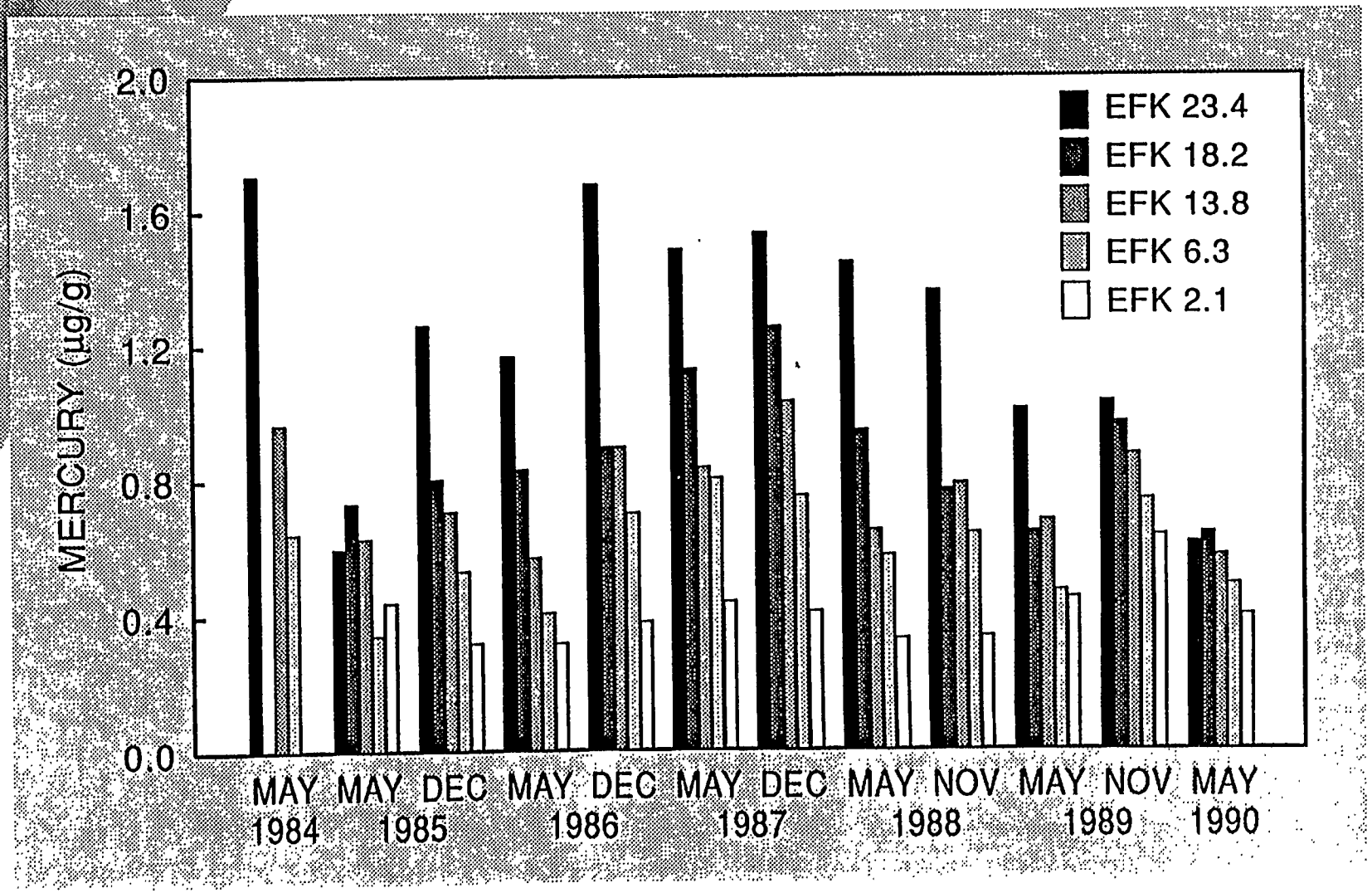
Concentrations of PCBs in Bluegill Sunfish, Fall/Winter 1987-1988



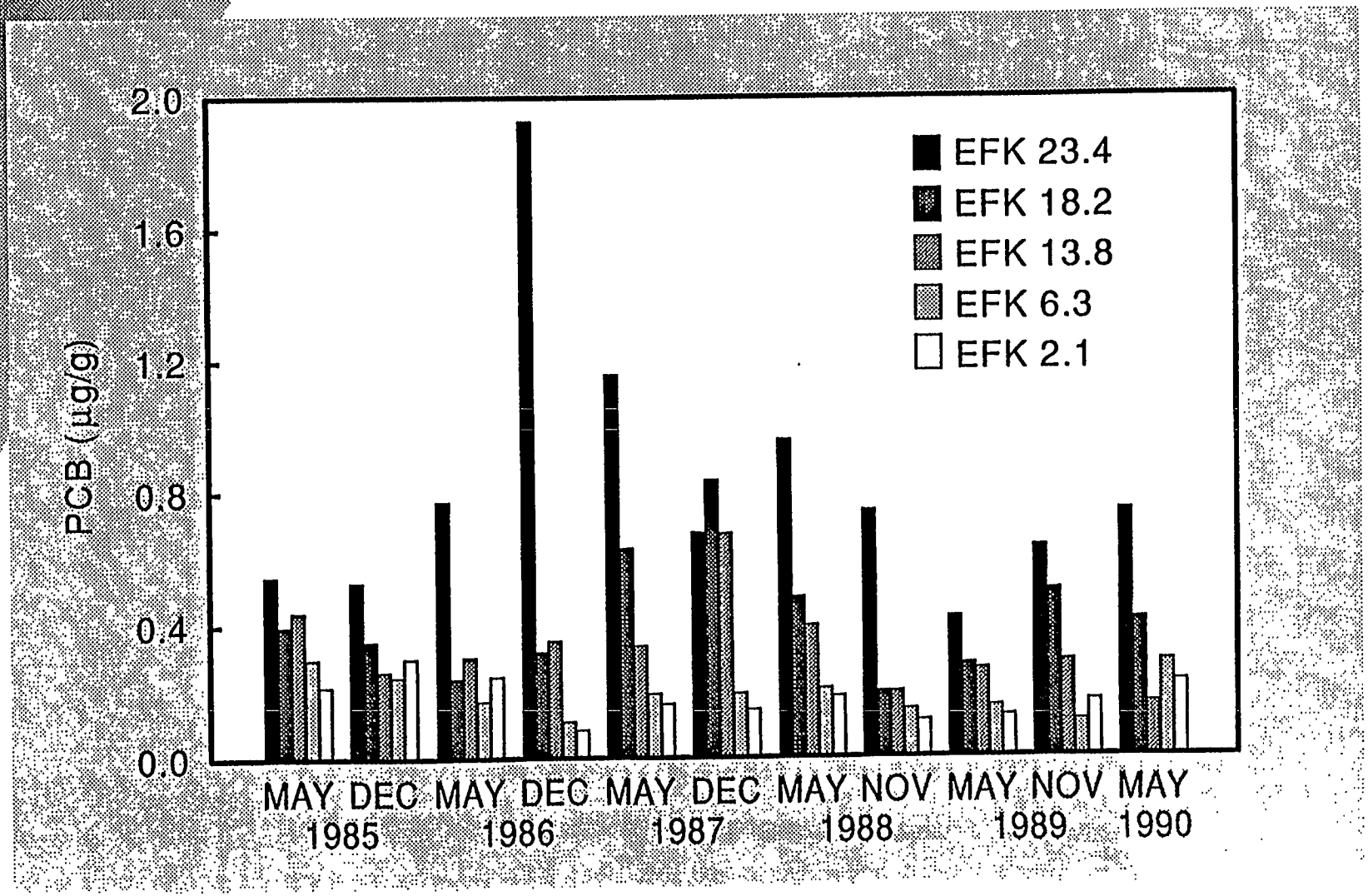


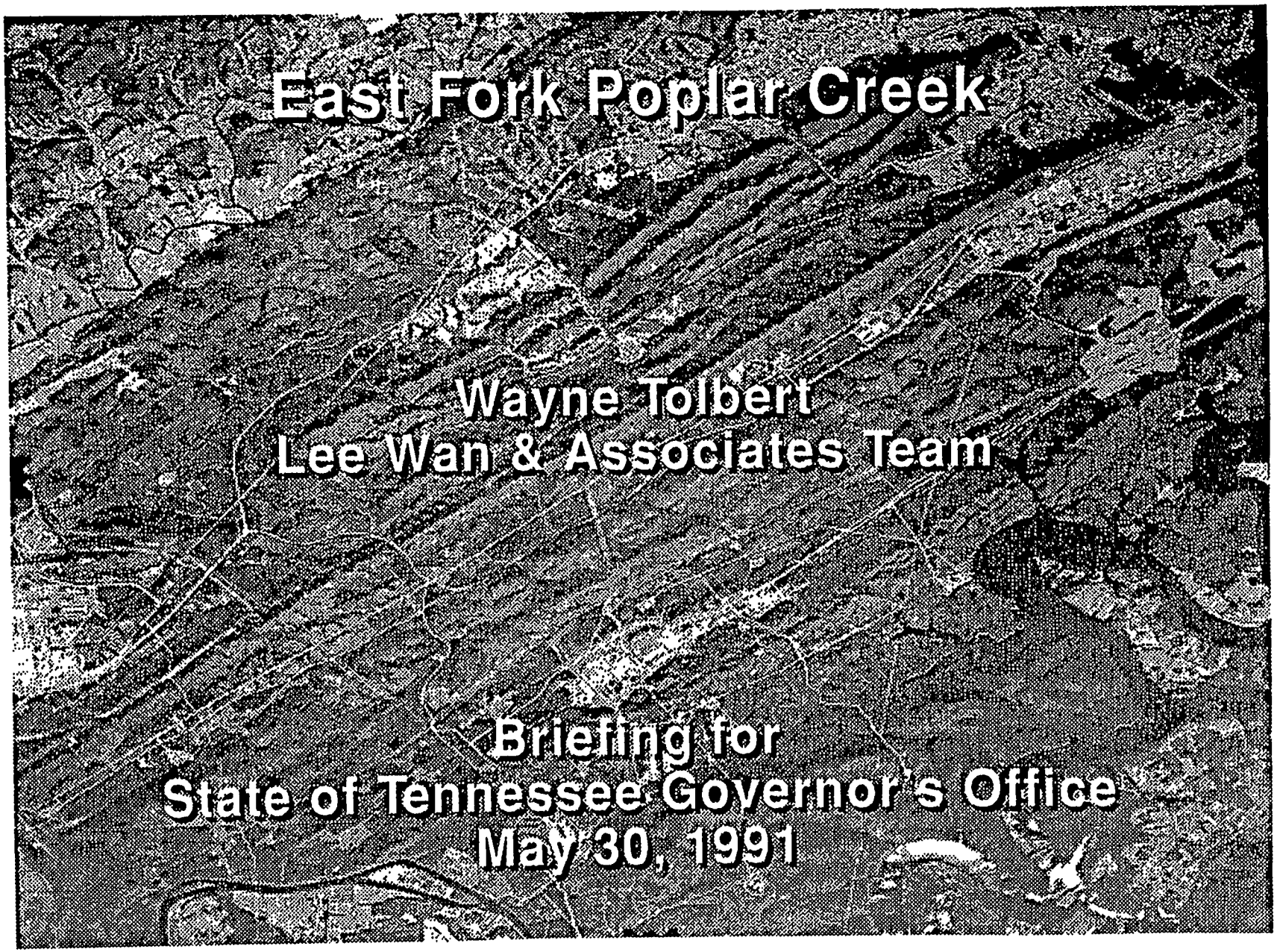


Mercury Concentrations in Sunfish



PCB Concentrations in Sunfish




East Fork Poplar Creek
Wayne Tolbert
Lee Wan & Associates Team
Briefing for
State of Tennessee Governor's Office
May 30, 1991

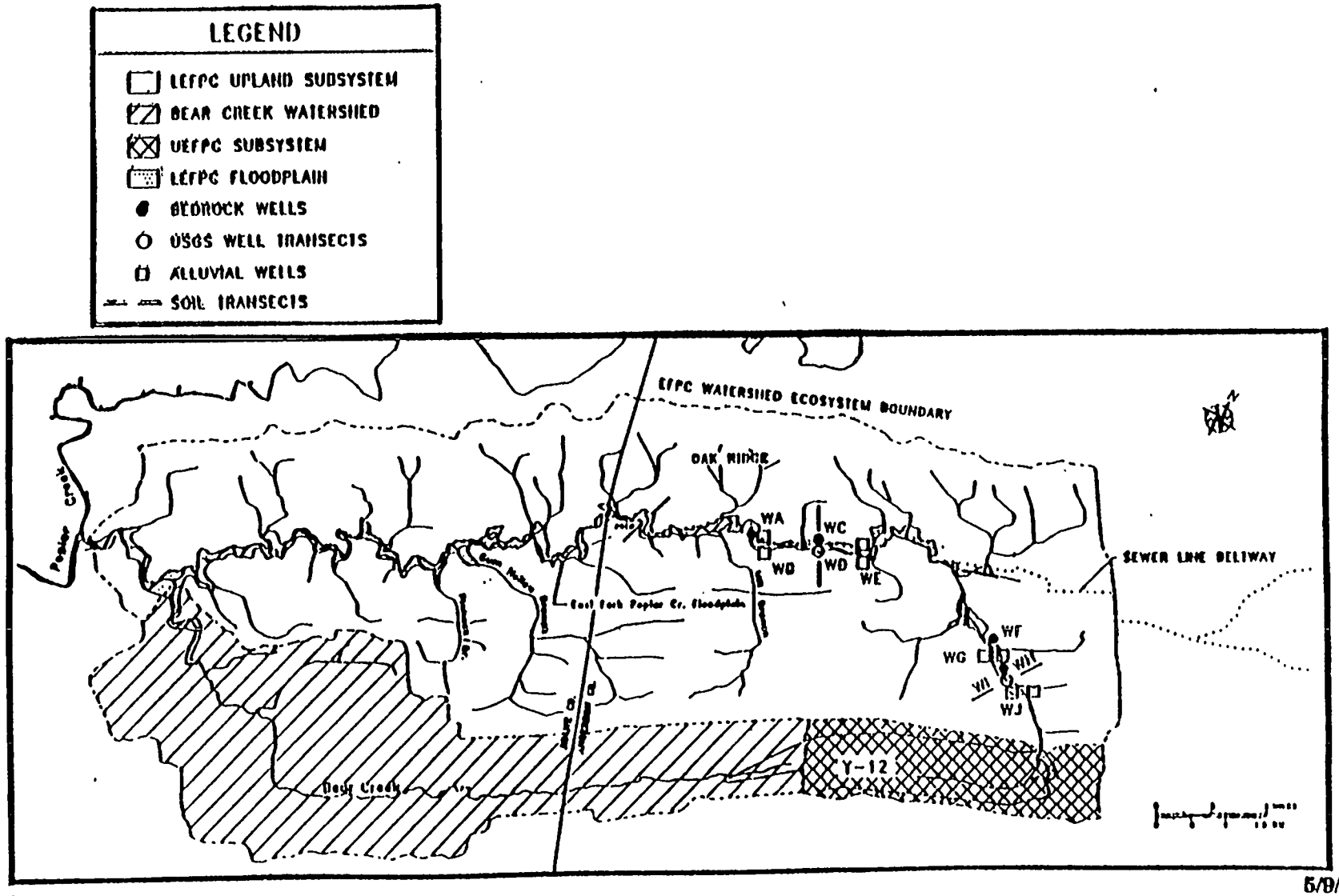
Agenda

- Background
- History
- Scope of LWA team efforts
- Phased sampling approach
- Progress to date
- Schedule

EAST FORK POPLAR CREEK BACKGROUND

- 17-mile stream originating in the center of the Y-12 Plant
- ~600 acres of floodplain
- Stream runs through City of Oak Ridge
- Involves ~250 property owners

EAST FORK POPLAR CREEK PHASE IA SAMPLING SITES



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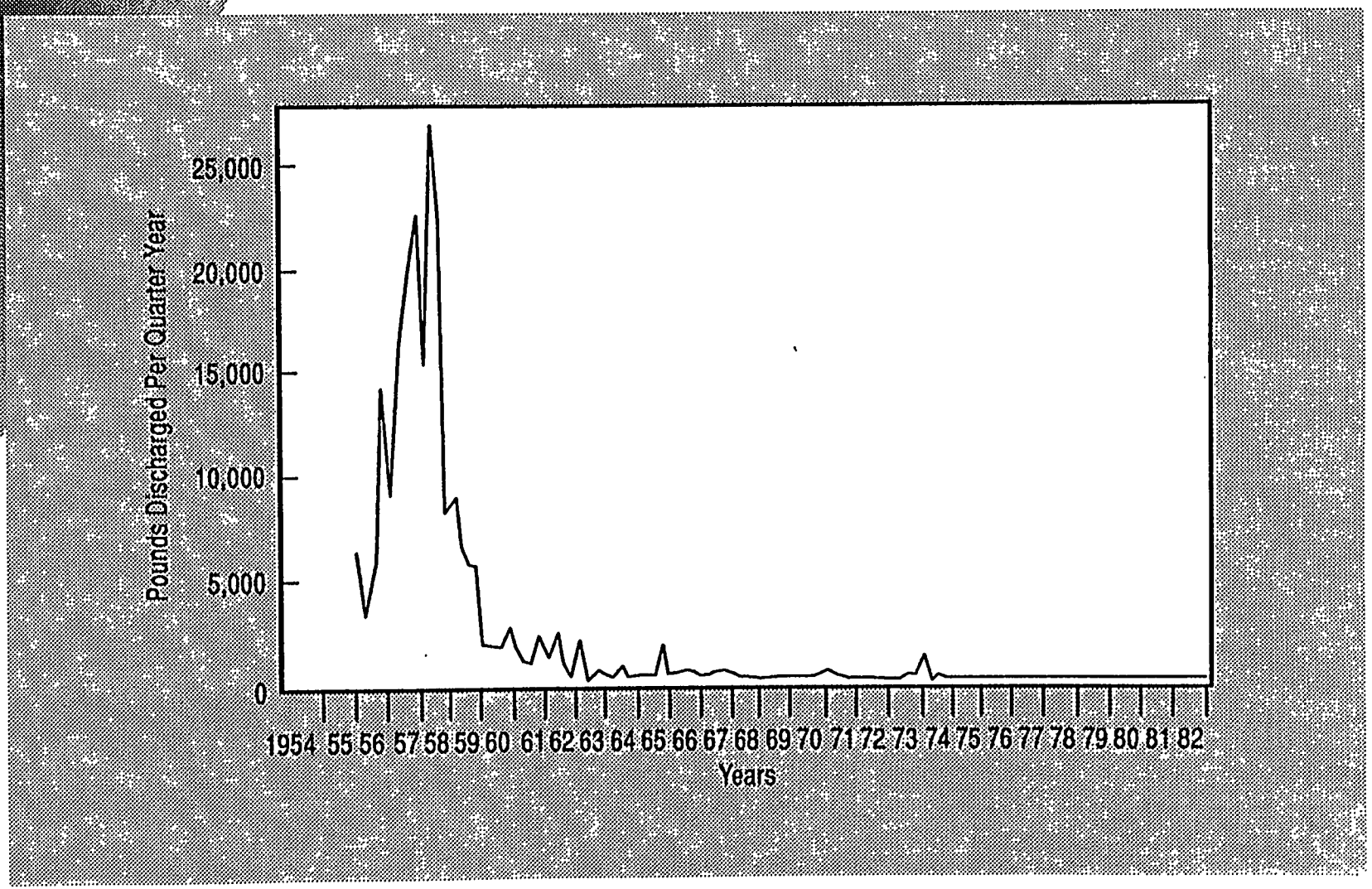
5/9/91

Mercury Concentrations Measured Each Quarter in East Fork Poplar Creek



EAST FORK POPLAR CREEK HISTORICAL PERSPECTIVE

1983 (Summer)

- **Formation of the Oak Ridge Interim Task Group Reporting to EQAB**

1984 (Fall)

- **Removal of Contaminated Soil from a Private Residence**

1987 (November)

- **RFI Work Plan Submitted to TDHE and EPA**

1987 (December)

- **Removal of Contaminated Soil from the Sewer Beltway at the Civic Center**

5/28/91

90-074M/0591

EAST FORK POPLAR CREEK HISTORICAL PERSPECTIVE (continued)

1988 (December)

- **Notice of Intent to Prepare an Environmental Impact Statement for Remediation of East Fork Poplar Creek Floodplain**

1989 (January)

- **Began Negotiations on Tripartite Federal Facilities Agreement Between DOE, EPA, and TDHE in Anticipation of Being Placed on NPL**

1989 (May)

- **Comments on RFI Work Plan Received from EPA and TDHE, Document Revised and Resubmitted**

EAST FORK POPLAR CREEK HISTORICAL PERSPECTIVE (continued)

1989 (October)

- **Removal of Contaminated Soil from Sewer Beltway Along Emory Valley Road**

1989 (November)

- **Federal Facilities Agreement Submitted for Approval to DOE and EPA Headquarters**

1989 (December)

- **Oak Ridge Reservation and Environs Placed on NPL (this changed regulatory picture)**

5/28/91

EAST FORK POPLAR CREEK
HISTORICAL PERSPECTIVE (continued)

1990 (January)

- **LWA Team Tasked to Perform EFPC Remedial Investigation**

1990 (October)

- **Phase 1a Field Work Began**

ENVIRONMENTAL RESTORATION PROGRAM
SCOPE OF WORK
EAST FORK POPLAR CREEK

- Prepare EIS Implementation Plan
- Prepare RI Work Plan
- Conduct Remedial Investigation
- Prepare FS-EIS
- Prepare Remedial Action Plan and ROD
- Participate in Community Relations Plan implementation

EAST FORK POPLAR CREEK REMEDIAL INVESTIGATION

PHASED APPROACH

Phase Ia

EFPC – "Nature" of Contamination

- **ID contaminants of concern**
- **ID levels of concern**
- **ID indicator parameters**
- **ID relationship between particle size and contamination**
- **ID importance of storm event**

No sampling of sewer line beltway

Review and evaluation of historical data

EAST FORK POPLAR CREEK REMEDIAL INVESTIGATION

Phase Ib Approach

- Use indicator contaminants
- Use field screening or rapid laboratory techniques
- Follow-up with lab verification - 5 to 10% full QA
- Statistically - based design - "Hot Spots"

EAST FORK POPLAR CREEK REMEDIAL INVESTIGATION

Phase Ib – "Extent" and Risk

- Monitor fluxes from Lake Reality
- Determine spatial distribution of contaminants in
  - EFPC Floodplain
  - Sewer line beltway
- Characterize body burdens
  - Aquatic flora and fauna
  - Terrestrial flora and fauna
- Characterize human exposures
- Perform wetland and land use surveys

EAST FORK POPLAR CREEK ACCOMPLISHMENTS

- **Draft EIS Implementation Plan** (4/90)
- **Final EIS Implementation Plan** (8/90)
- **Phase 1a Sampling and Analysis Plan Draft, Project-Specific QA Plan and Project Health and Safety Plan** (8/90)
- **Phase 1a Waste Management Plan** (7/90)
- **Phase 1a Sampling** (10/90-present)
  - — soil, wells, sediment, surface water of EFPC
  - — surface water and sediment of 20 tributaries
  - — soil, surface water, and sediment of Hinds Creek (reference stream)
  - — storm water sampling (2 events)

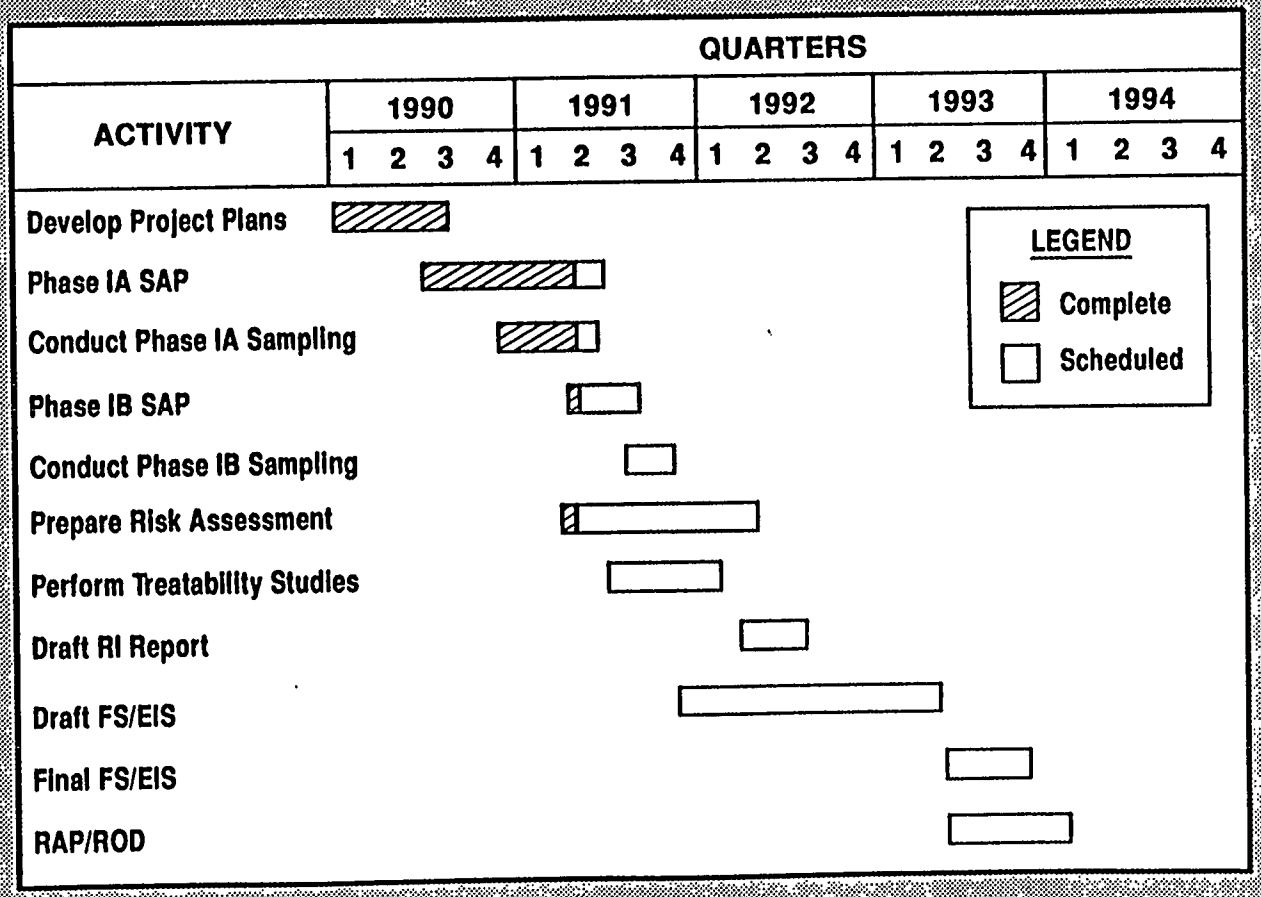
5/28/91

90-074M/0591

EAST FORK POPLAR CREEK ACCOMPLISHMENTS (continued)

- **Phase 1a Data Analysis** **(11/90-present)**
- **Initiation of FS-EIS** **(4/91)**
- **Interactions with property owners and public** **(ongoing)**
- **Interactions with EPA and State of Tennessee** **(ongoing)**

EFPC Schedule



ENVIRONMENTAL RESTORATION PROGRAM SCHEDULE STATUS - EAST FORK POPLAR CREEK

ACTIVITY	TARGET DATE	STATUS
Site Characterization Summary Report to Regulators	02/17/92	Proposed new date*
Draft RI Report to Regulators	10/16/92	Proposed new date*
Draft FS-EIS to Regulators	04/02/93	Proposed new date*
Record of Decision	03/21/94	Proposed new date*

*Schedule rebaselined 3/19/91 for FFA submittal

5/28/91

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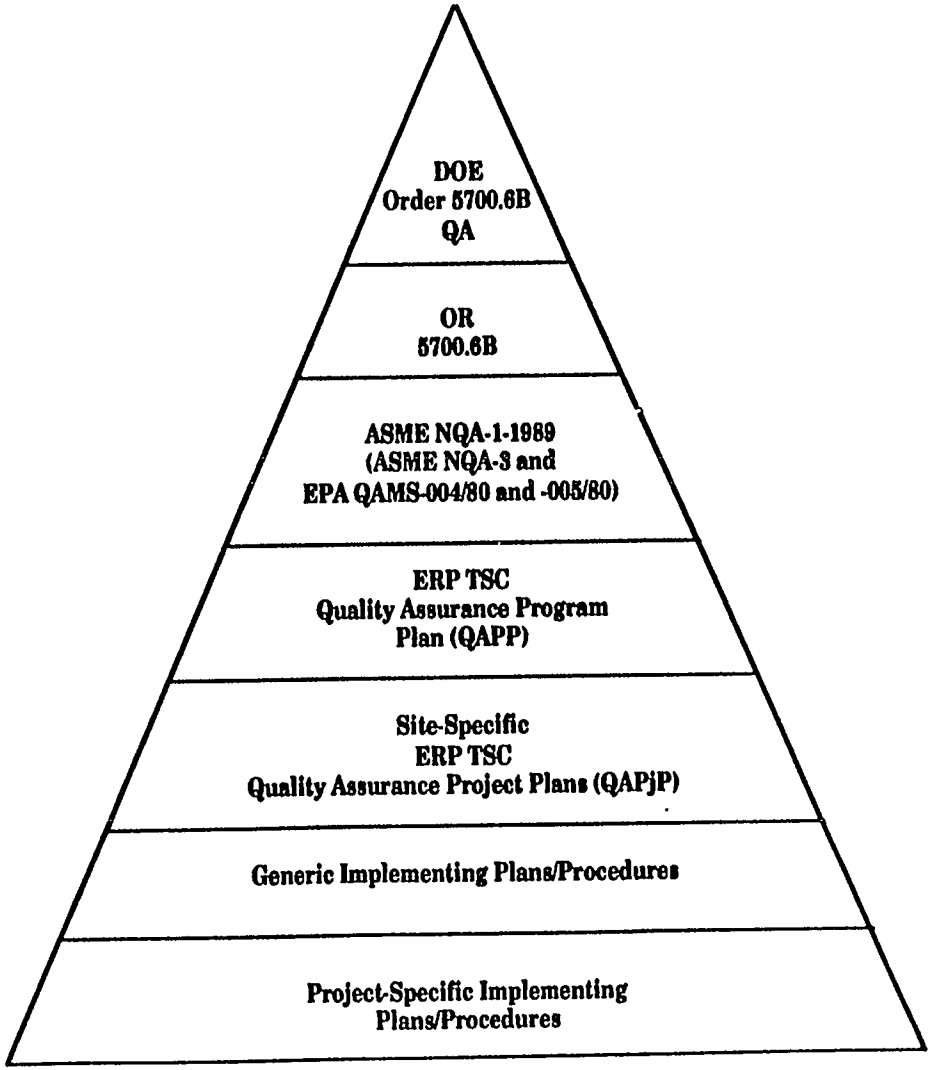
EAST FORK POPLAR CREEK
HIERARCHY OF QA DOCUMENTS



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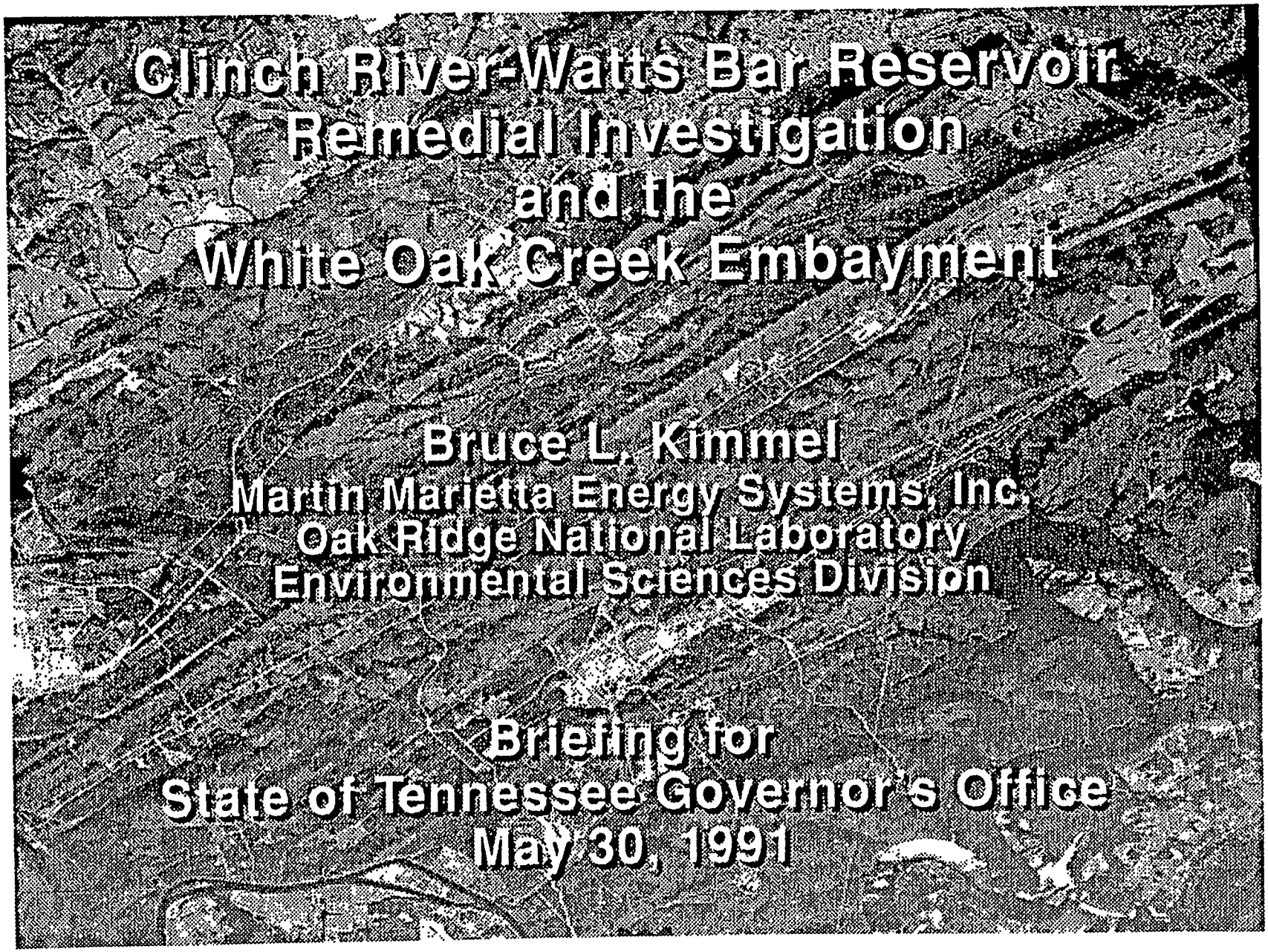

Clinch River-Watts Bar Reservoir
Remedial Investigation
and the
White Oak Creek Embayment
Bruce L. Kimmel
Martin Marietta Energy Systems, Inc.
Oak Ridge National Laboratory
Environmental Sciences Division
Briefing for
State of Tennessee Governor's Office
May 30, 1991

Agenda

- Status of Clinch River and Watts Bar Reservoir RI
  - Review of phased approach
  - Progress to date
  - Next steps and schedule
- Significant developments
  - Interagency working group
  - TVA assistance
  - White Oak Creek Embayment

Purpose/Objectives of Clinch River RI Phases

Scoping Phase

- Use existing historical data to identify potential contaminants of concern
- Risk screening to
  - Immediately identify high-risk situations
  - Identify contaminants for further investigation in Phase 1

Phase-1 Investigation

- Obtain high-quality data to confirm/modify preliminary results from scoping studies
- Focus further (Phase-2) investigation on specific contaminants, sites, pathways

Purpose/Objectives of Clinch River RI Phases (cont'd)

Phase-2 Investigation

- Sampling, analysis, and data integration focused on specific contaminants, sites, pathways
- Continuing risk analysis to further focus investigation
- Identification of potential remediation alternatives
- Risk screening of potential remediation alternatives
- Site-specific sampling, analysis, prediction, risk analysis
- RI report, conclusions, recommendations

Contaminants Identified in Screening Analyses for Further Evaluation in the Clinch River RCRA Facility Investigation

Inorganics	Organics	Radionuclides
Aluminum	Chlordane*	Cesium-137*
Arsenic*	PCB-1254*	Strontium-90*
Antimony*	PCB-1260*	Cobalt-60*
Barium	Vinyl Chloride	Tritium*
Beryllium	Anthracene	Europium-152, 154*
Boron	Benzo(a)anthracene	Americium-241
Cadmium	Chrysene	Plutonium-239
Chromium	DDT	Curium-244
Copper	Fluoranthrene	Uranium-238
Cyanide	Methylene Chloride	Protactinium-234*
Lead*	Phenanthrene	
Lithium	Pyrene	
Manganese	Trans- 1,3-Dichloropropene	
Mercury	Carbon Tetrachloride	
Nickel	Trans- 1,2-Dichloroethene	
Selenium	4,6-Dinitro-ortho-cresol	
Silver	Bis(2-Ethylhexyl)Phthalate	
Thallium*		
Uranium*		
Vanadium		
Zinc		

* Potential high-priority substances identified by nonconservative screening

Contaminants of Concern in Clinch River and Watts Bar Reservoir

- Preliminary Phase-1 Results -
Human Health Risk Screening

Inorganics	Organics	Radionuclides
Arsenic	PCBs*	Cesium-137
Chromium		Cobalt-60
Mercury		
Selenium		
Zinc		

* Potentially high priority contaminant via nonconservative screening, fish ingestion pathway

All other contaminants constitute a risk only by sediment dredging and agriculture pathway

Phase-2 Planning

Approach

- Observational approach/bias for action
- Early identification and screening of potential remediation alternatives
- Progressive focus on contaminants, pathways, and sites of concern

Phase-2 Planning (cont'd)

Major Components

- Progressively focused site characterization effort
- Sources, bioaccumulation of PCBs
- Ecological assessment (risk, toxicity, physiological and reproductive effects, population- and community-level effects)
- Predictive capability for assessing contaminant transport and fate, remobilization, remediation alternatives, risk scenarios
- Preliminary identification and evaluation of potential remediation alternatives

Interagency Working Group on Watts Bar Reservoir Sediment Contamination

Members

- TDC, chair
- EPA-IV
- TVA
- USCOE
- DOE

Purpose

- Examine and evaluate permit applications for activities having potential for disturbing contaminated sediments
- Ensure public safety and minimize remobilization of contaminants

TVA Assistance to DOE Efforts on the Clinch River and Watts Bar Reservoir

- Sampling at public recreation areas and water intakes on Watts Bar, Melton Hill, and Norris reservoirs
- Updating of Watts Bar sediment range cross-sections
- Modeling of water and sediment transport in the Clinch River and Watts Bar Reservoir
- Aerial photography and topographic mapping of White Oak Creek embayment
- Historical review of TVA sediment-disturbing activities

White Oak Creek Embayment

White Oak Creek Embayment

ISSUE

Higher-than-expected levels of ^{137}Cs contamination in near-surface sediments of the White Oak Creek Embayment (WOCE)

White Oak Creek Embayment

CONCERN

The contaminated surface sediments in WOCE are of concern because they are uncontrolled; i.e., the sediments can be readily eroded from the embayment and transported downstream into the Clinch River

White Oak Creek Embayment

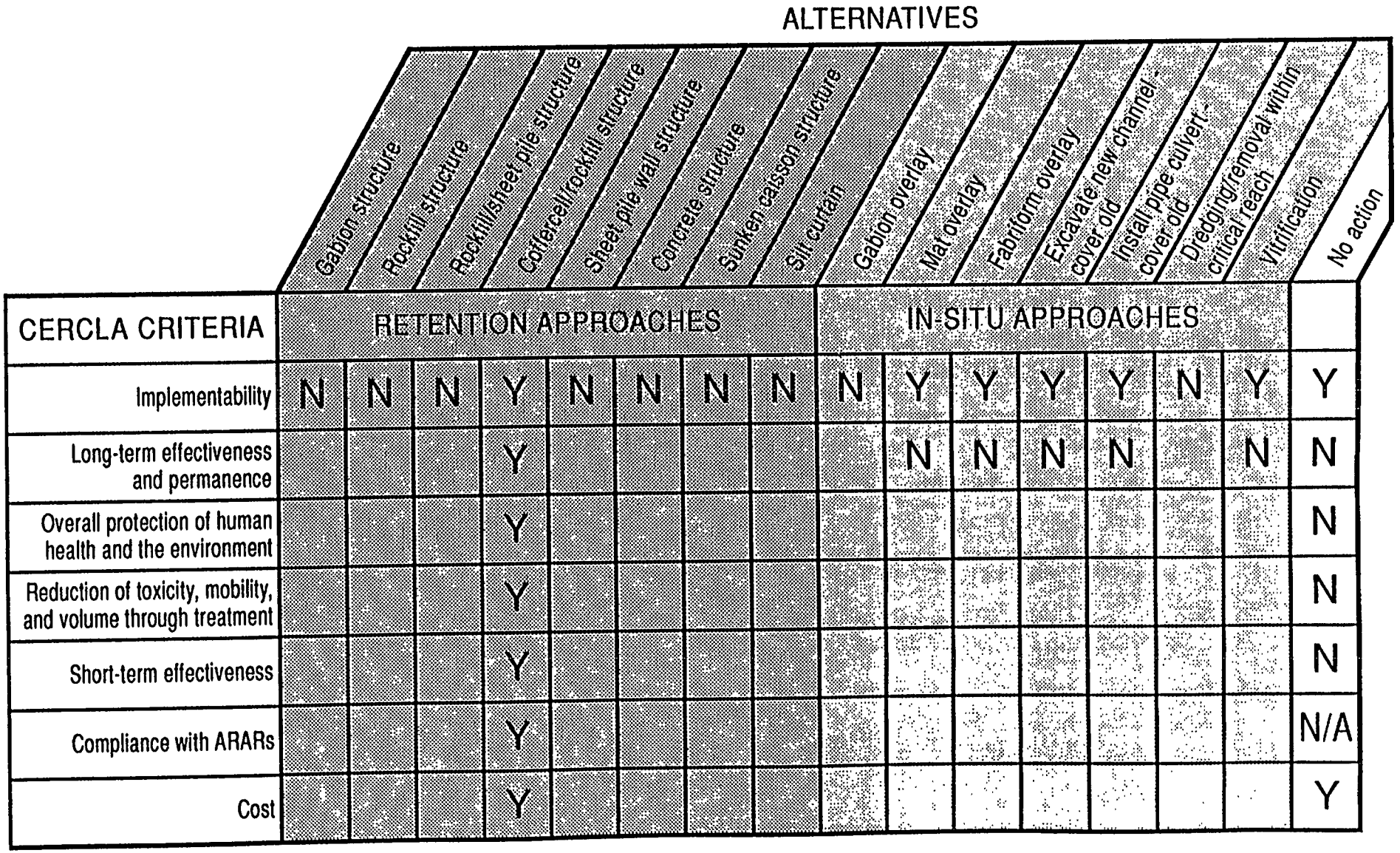
ACTION PLAN

1. Improve restriction of public access to WOCE area
2. Conduct accelerated site characterization and risk assessment efforts on the WOCE area
3. Conduct, in parallel, an assessment of potential interim corrective measures
4. Implement the most appropriate interim corrective measure to control WOCE sediment erosion to prevent transport of contaminated sediments into the Clinch River

Functional Requirements

- 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 WAGs
- 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
- Achieve year-round inundation of WOCE sediments to minimize risk due to direct exposure to contaminated sediment
- Minimize movement of fishes into and out of the WOCE

Evaluation of Alternatives for White Oak Creek Embayment, ORNL



WOCE Project Method of Accomplishment

- **DOE** — Overall project responsibility, direction of prime contractors, NEPA documentation
- **MMES** — Project integration, ES&H oversight, environmental monitoring, design review, Title III, construction support
- **COE** — Alternatives evaluation, design, construction support
- **MK-F** — Construction management, construction contracting

Summary of Analytical Results on WOCE Sediment and Soil

- The sediment (~upper 3 feet) in the stream channel is contaminated, primarily with ^{137}Cs; the underlying soil (~3-12 feet) is uncontaminated
- Chemical analyses of sediment for total concentrations of metals and organics show low organics, some contamination by metals (e.g., Hg, Cr, Pb)
- TCLP results show that extractable/leachable metals are low, well below guidance levels
- Therefore, the problem here is radioactive contamination, predominantly ^{137}Cs

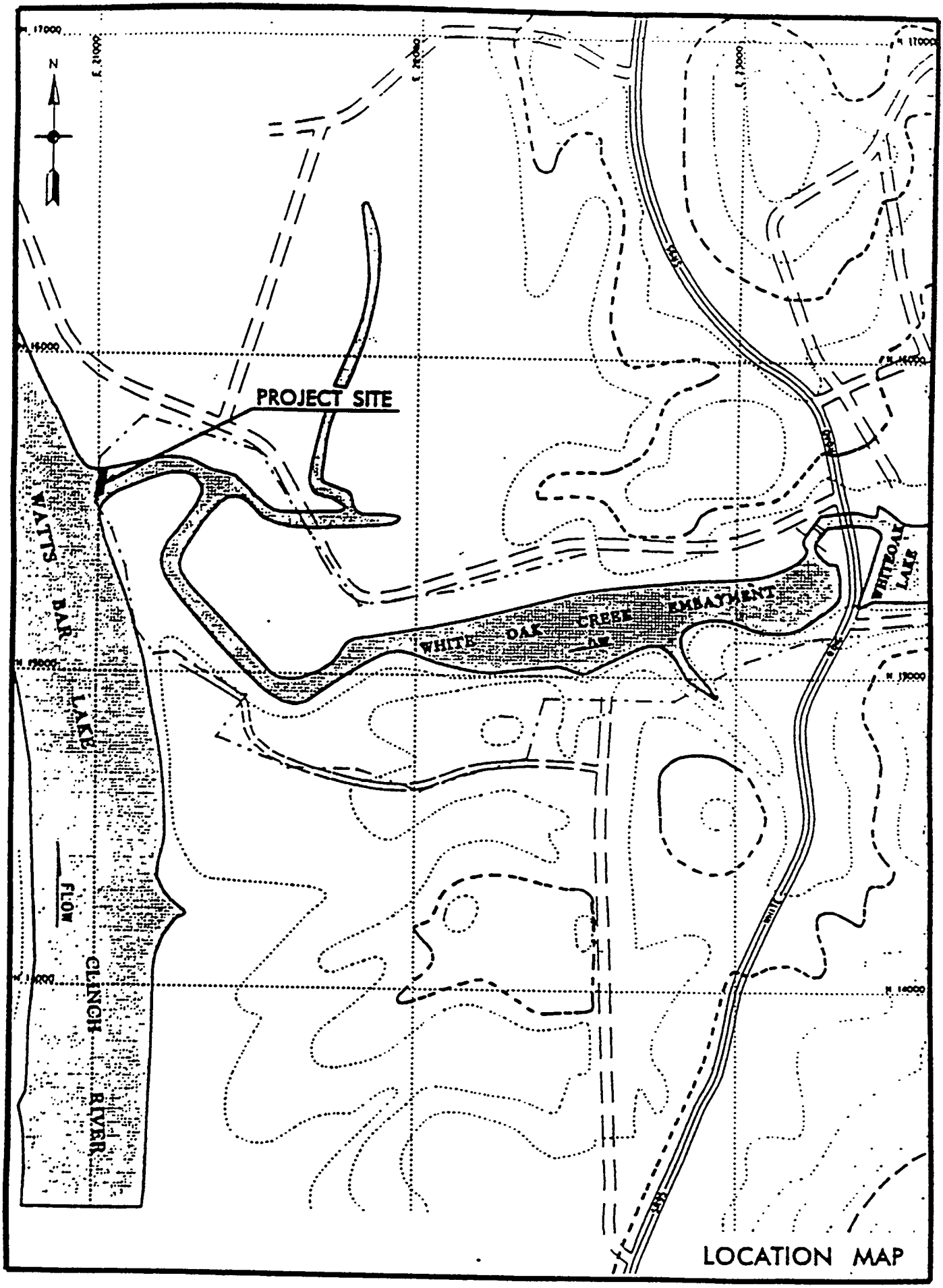
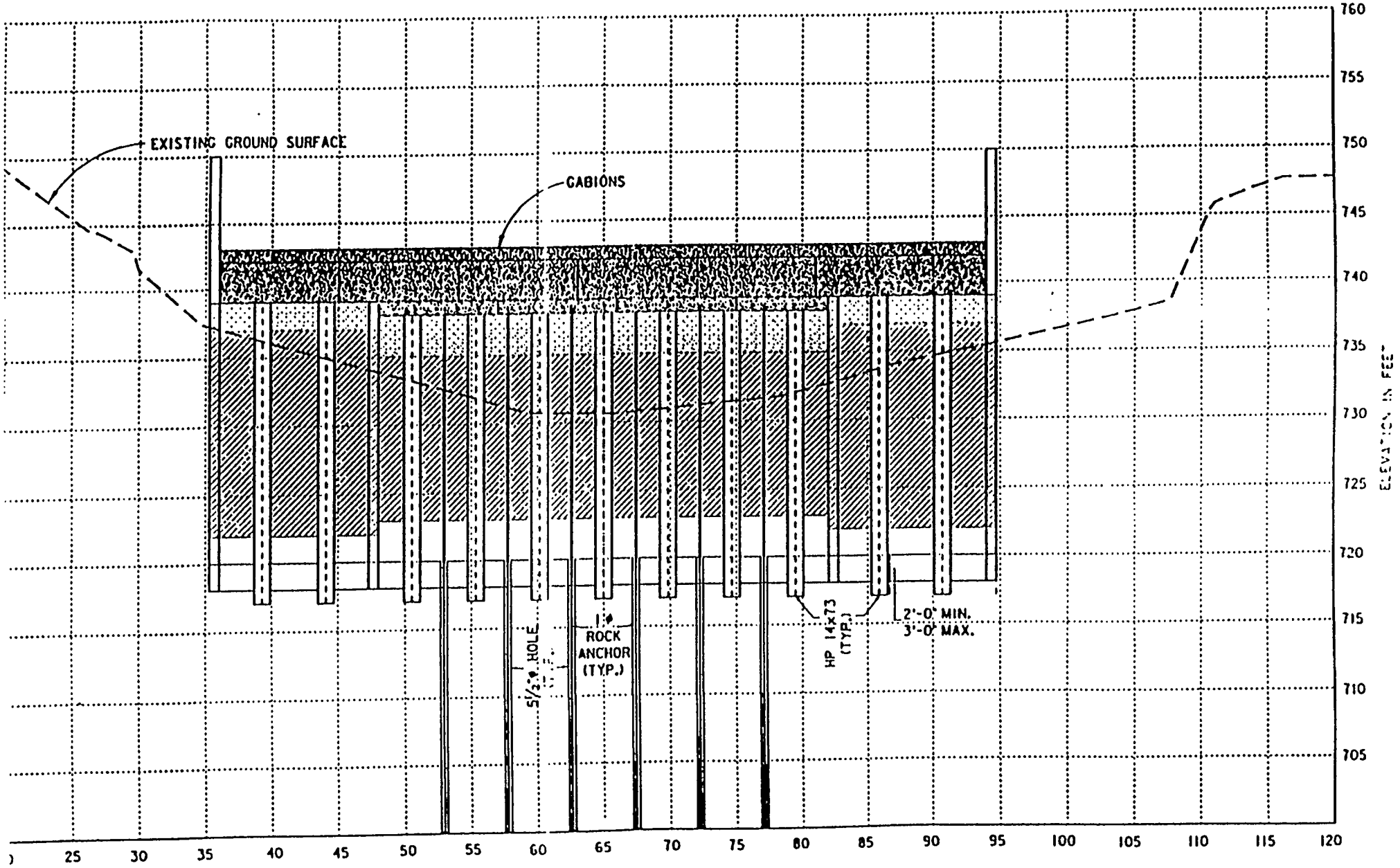
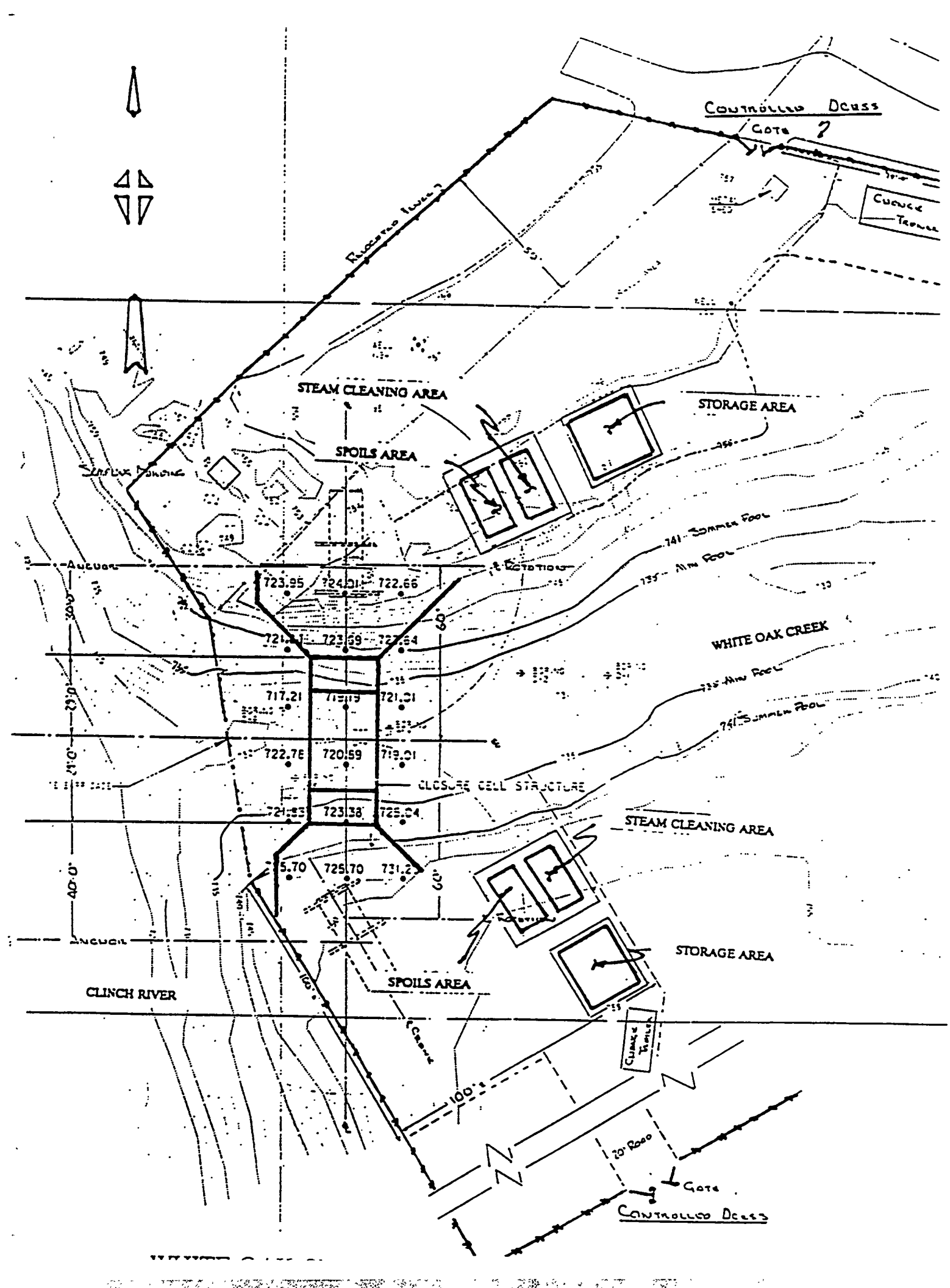
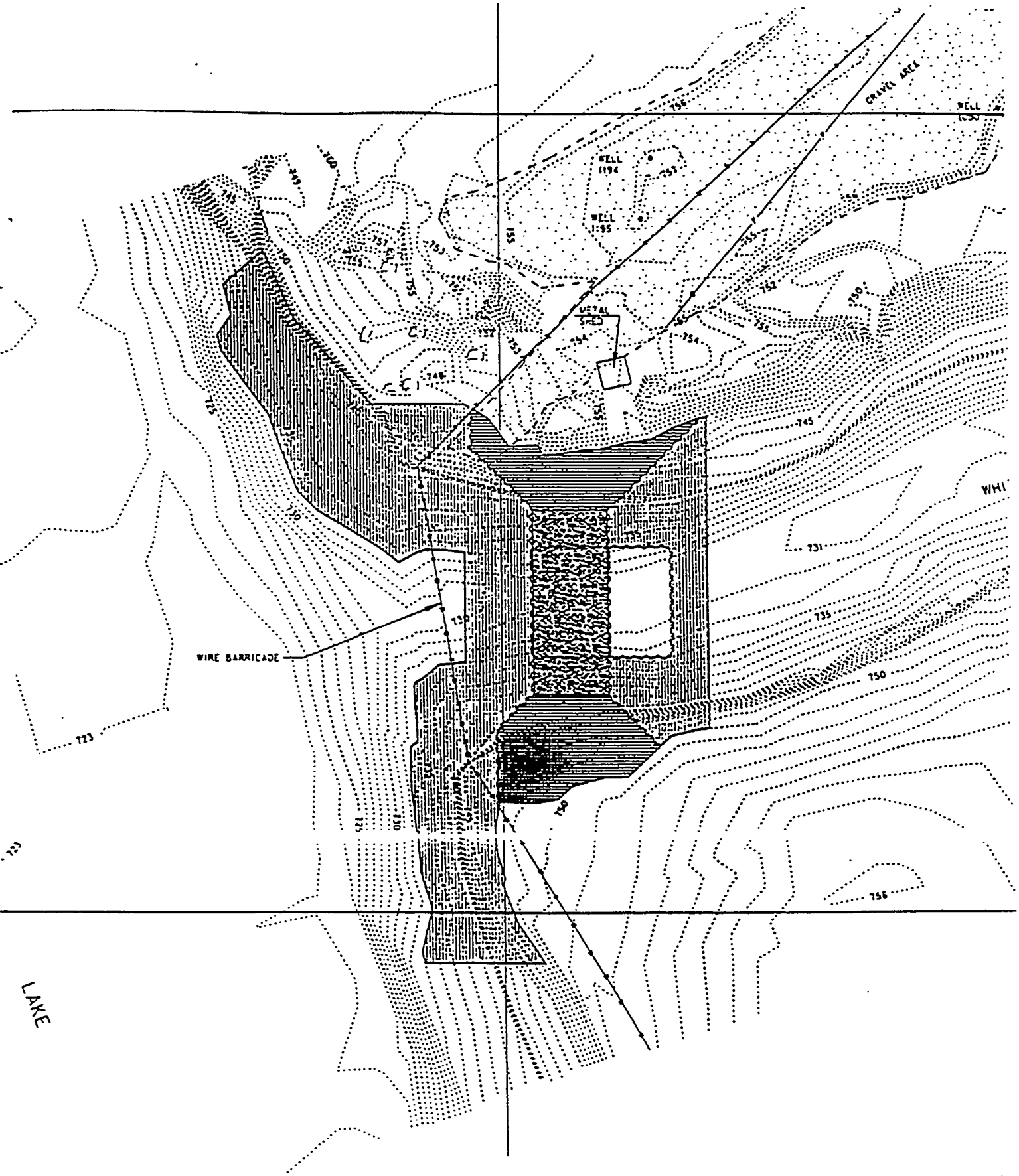

N
PROJECT SITE
WATTS BAR LAKE
CLINCH RIVER
FLOW
WHITE OAK CREEK EMBAYMENT
WHITE OAK LAKE
LOCATION MAP

FIGURE 2



TYPICAL SECTION


CONTROLLED ACCESS
GATE
STEAM CLEANING AREA
STORAGE AREA
SPOILS AREA
WHITE OAK CREEK
CLOSURE CELL STRUCTURE
STEAM CLEANING AREA
STORAGE AREA
SPOILS AREA
CLINCH RIVER
20' ROAD
GATE
CONTROLLED ACCESS


GRAVEL AREA
WELL 1194
WELL 1195
METAL SHED
WIRE BARRICADE
LAKE
756
755
754
753
752
751
750
749
748
745
731
735
730
725
723

WOCE Project Chronology

● WOCE sediment cores obtained	Summer 1990
● Data reveals contamination, occurrence report filed	9/7/90
● Accelerated environmental site characterization effort initiated, continuing	Mid September-
● Restriction of public access to WOCE area improved	Late September
● EPA, TDC, and DOE agree that interim measure should be implemented as a CERCLA removal action	10/17/90
● Alternatives assessment by USCOE initiated	10/26/90
● Geotech site investigation conducted	11/12/90 - 11/21/90
● NEPA documentation submitted to DOE-HQ	Late November
● Alternatives assessment completed; Coffer-Dam recommendation agreed to by DOE, TDC, and EPA	12/17/90

WOCE Project Chronology (cont'd)

● 50% design review completed	1/15/91
● 90% design review completed	2/22/91
● Preconstruction site preparation initiated	3/4/91
● Drawings and specifications certified for construction	3/22/91
● NEPA CX approval received	4/23/91
● Initial construction bids received	4/30/91
● Construction bid to be awarded	~ 5/22/91

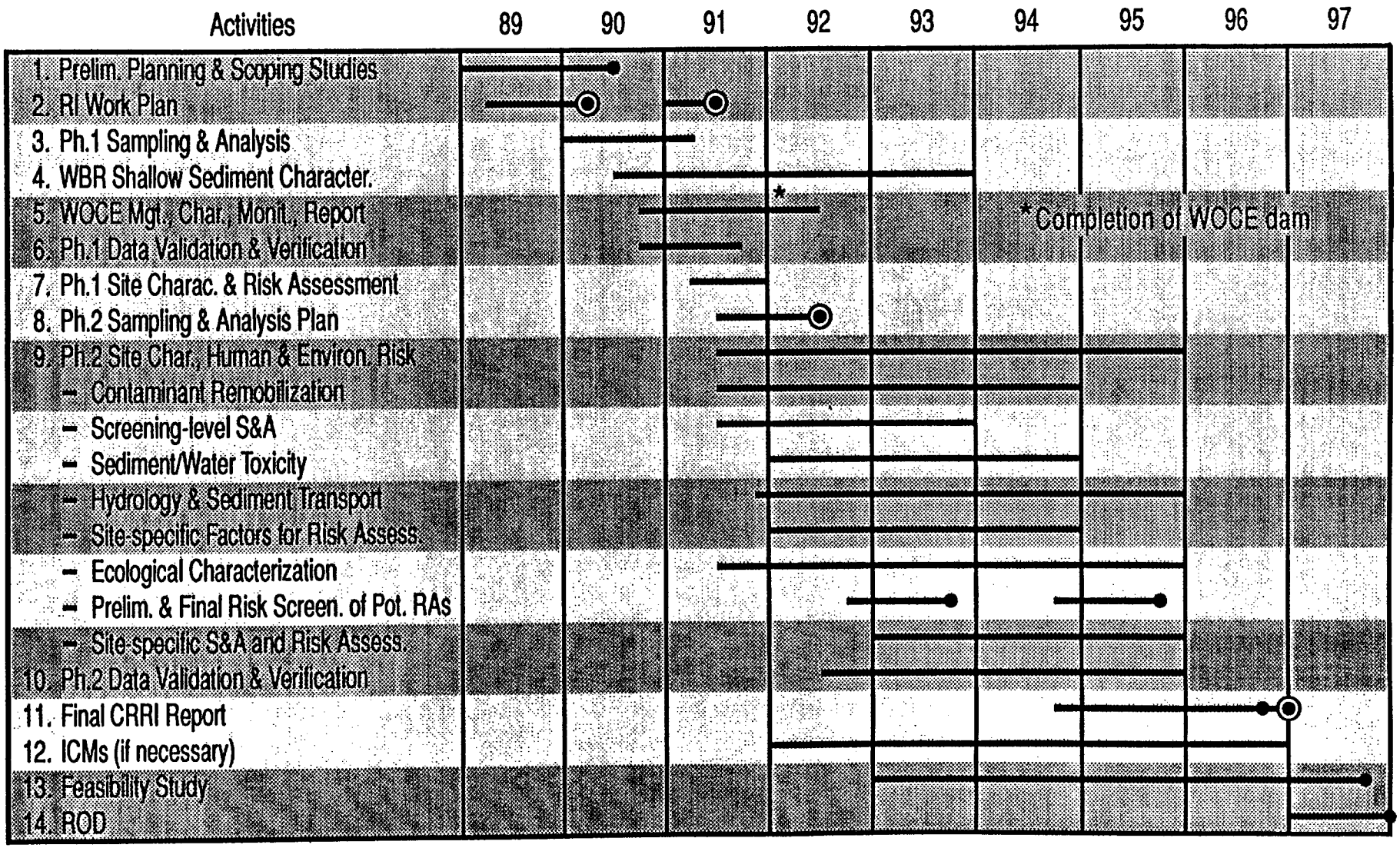
WOCE Target Construction Schedule

● Initial site preparation	03/04/91 - 05/31/91
● Sheet pile installation	06/03/91 - 07/26/91
– Cell closure early July	
● Jet grout testing	07/01/91 - 07/26/91
● Jet grouting	07/26/91 - 09/26/91
● Rock anchor installation	09/16/91 - 09/26/91
● Concrete cap installation	09/26/91 - 10/11/91
● Gabion and rock armor placement	10/11/91 - 12/30/91

Summary

- WOCE corrective measures will
  - Prevent transport of contaminated WOCE sediments onto Clinch River and Watts Bar Reservoir
  - Prevent movement of fish into WOCE
  - Should reduce levels of contamination in Clinch River fish
- Clinch River -- Watts Bar RI proceeding on schedule
  - Phase-1 results providing significant focus regarding contaminants of concern, human-health risk
  - Phase-2 planning in progress
  - Phase-2 S&A plan to be submitted in December 1991

FY 1991 Scope of Work

- Complete regulatory requirements and interfaces; site characterization, ICM design readiness review for WOCE
- Conduct ICM construction and environmental monitoring for WOCE
- Respond to regulator comments on CRRI Work Plan
- Prepare Phase 1 site characterization and risk summaries
- Prepare Phase 2 Sampling and Analysis Plan
- Initiate and coordinate collaborative efforts with TVA
- Continue WBR shallow-sediment characterization
- Conduct additional sediment sampling in Melton Hill Reservoir
- Conduct additional sampling and analysis of fish for PCBs
- Initiate ecological assessment

Off-Site Environmental Restoration Program