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ENVIRONMENTAL RESTORATION PROGRAM

Baseline Report for Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

Volume 1: Text

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Environmental Restoration Division
ORNL Environmental Restoration Program

Baseline Report for Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee

Volume 1: Text

Date Issued–September 1992

Compiled by
Ebasco Services Incorporated
Oak Ridge, Tennessee
under subcontract 910027.01

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Oak Ridge, Tennessee 37831-6285
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ER-44A	9/16/92
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TABLE OF CONTENTS

Page

LIST OF FIGURES xxix
LIST OF TABLES xxxviii
ACRONYMS xliii
ACKNOWLEDGEMENTS xlvii

EXECUTIVE SUMMARY ES-1

1.0 WAG 1 INTRODUCTION 1-1

1.1 PURPOSE OF REPORT 1-1

1.2 BACKGROUND 1-6

1.3 REGULATORY REQUIREMENTS 1-22
1.3.1 Oak Ridge National Laboratory Regulatory History 1-22
1.3.2 Regulatory Drivers 1-23
1.3.3 Regulatory Strategy 1-25

2.0 PROJECT SCOPE 2-1

2.1 DESCRIPTION 2-1
2.1.1 Background 2-1
2.1.2 General Site Description 2-2
2.1.2.1 Physiography and Topography 2-2
2.1.2.2 Geology 2-2
2.1.2.3 Seismic Activity 2-4
2.1.2.4 Soils 2-4
2.1.2.5 Surface Water 2-5
2.1.2.6 Groundwater 2-5
2.1.2.7 Biota 2-8
2.1.3 Release Sites 2-8
2.1.4 Operable Units and Solid Waste Management Units 2-28
2.1.4.1 North and South Tank Farms and Tanks TH-4 and W-11 Operable Unit - OU1 2-31
2.1.4.2 Surface Impoundments Operable Unit - OU2 2-32
2.1.4.3 Underground Piping and Storm Drain Operable Unit - OU3 . . 2-34
2.1.4.4 Groundwater Operable Unit - OU4 2-34
2.1.4.5 White Oak Creek Flood Plan Soils and Sediments Operable Unit - OU5 2-34
2.1.4.6 Solid Waste Storage Area 1 Operable Unit - OU6 2-34
2.1.4.7 Solid Waste Storage Area 2 Operable Unit - OU7 2-35

TABLE OF CONTENTS
(continued)

Page

2.1.4.8 Waste Pile Operable Unit - OU8 2-36
2.1.4.9 Contaminated Soils Operable Unit - OU9 2-36
2.1.4.10 Steel Tank Systems Operable Unit - OU10 2-37

2.2 APPROACH 2-39

2.3 METHOD OF ACCOMPLISHMENT 2-41
2.3.1 United States Department of Energy - Oak Ridge Field Office 2-42
2.3.2 Martin Marietta Energy Systems, Inc. 2-42
2.3.3 Remedial Investigation Subcontractor 2-42
2.3.4 Feasibility Study Contractor 2-42
2.3.5 Remedial Design Architect-Engineer Contractor 2-44
2.3.6 Remedial Action Construction Manager 2-44

2.4 WORK BREAKDOWN STRUCTURE 2-44

2.5 TECHNOLOGY NEEDS 2-44

3.0 WAG 1 PROJECT MANAGEMENT 3-1

3.1 SCOPE AND ASSUMPTIONS 3-1
3.1.1 Project Integration 3-1
3.1.1.1 Martin Marietta Energy Systems, Inc. Project Management . . . 3-1
3.1.1.2 General Project Support 3-1
3.1.1.3 Baseline Design Report/System Requirement Document 3-5

3.2 RISKS AND UNCERTAINTIES 3-5

3.3 INTERFACES 3-6

4.0 WAG 1 SUPPORT FACILITIES 4-1

4.1 SCOPE AND ASSUMPTIONS 4-1
4.1.1 Support Facilities Design 4-1
4.1.1.1 Title I and Title II Design 4-1
4.1.2 Support Facilities Construction 4-7
4.1.2.1 Construction Oversight 4-7
4.1.2.2 Personnel Decontamination Facility 4-7
4.1.2.3 Equipment Decontamination Facility 4-7
4.1.2.4 Parking and Staging Facility, Roads, and Gates 4-8

TABLE OF CONTENTS
(continued)

Page

4.1.2.5 Grout Mixing and Pumping Facility 4-8
4.1.2.6 Support Activities 4-8
4.1.2.7 D&D Personnel Decontamination Facility 4-8
4.1.2.8 D&D Equipment Decontamination Facility and Grout Facility 4-11
4.1.2.9 New Consolidation Area 4-11
4.1.3 NEPA Activities 4-14
4.1.3.1 Categorical Exclusion 4-14

4.1.4 Monitoring During Construction 4-14
4.1.4.1 Monitoring Plan 4-14
4.1.4.2 Monitoring During Construction 4-14

4.2 RISKS AND UNCERTAINTIES 4-14

5.0 WAG 1 EARLY ACTION GUNITE TANKS 5-1

5.1 SCOPE AND ASSUMPTIONS 5-1

5.2 PLANNING 5-1
5.2.1 Action Plan 5-1
5.2.2 Investigation/Feasibility/Requirements 5-5
5.2.3 Support Documentation 5-5

5.3 DESIGN/PROCEDURES 5-5
5.3.1 Design/Procedures 5-5

5.4 IMPLEMENTATION 5-6
5.4.1 Integration 5-6
5.4.2 Implementation 5-6

5.5 EARLY ACTION REPORT 5-9
5.5.1 Early Action Report 5-9

5.6 EARLY ACTION OVERSIGHT 5-9
5.6.1 Early Action Oversight 5-9

5.7 RISKS AND UNCERTAINTIES 5-10

5.8 INTERFACES 5-10

TABLE OF CONTENTS (continued)

Page

6.0 WAG 1 EARLY ACTION TANK CONTENTS REMOVAL/INTERIM ACTION . 6-1

6.1 SCOPE AND ASSUMPTIONS 6-1

6.2 PLANNING 6-1
6.2.1 Action Plan 6-1
6.2.2 Investigation/Feasibility/Requirements 6-5
6.2.3 Support Documentation 6-5

6.3 DESIGN/PROCEDURES 6-5
6.3.1 Design/Procedures 6-5

6.4 IMPLEMENTATION 6-6
6.4.1 Integration 6-6
6.4.2 Implementation 6-6

6.5 EARLY ACTION REPORT 6-6
6.5.1 Early Action Report 6-6

6.6 EARLY ACTION OVERSIGHT 6-7
6.6.1 Early Action Oversight 6-7

6.7 RISKS AND UNCERTAINTIES 6-7

6.8 INTERFACES 6-7

7.0 WAG 1 EARLY ACTION GROUNDWATER MONITORING INTERIM ACTION 7-1

7.1 SCOPE AND ASSUMPTIONS 7-1

7.2 PLANNING 7-1
7.2.1 Action Plan 7-1
7.2.2 Investigation/Feasibility/Requirements 7-5
7.2.3 Support Documentation 7-5

7.3 DESIGN/PROCEDURES 7-5
7.3.1 Design/Procedures 7-5

TABLE OF CONTENTS
(continued)

Page

7.4 IMPLEMENTATION 7-5
7.4.1 Integration 7-5
7.4.2 Implementation 7-6

7.5 EARLY ACTION REPORT 7-6
7.5.1 Early Action Report 7-6

7.6 EARLY ACTION OVERSIGHT 7-6
7.6.1 Early Action Oversight 7-6

7.7 RISKS AND UNCERTAINTIES 7-6

7.8 INTERFACES 7-7

8.0 WAG 1 EARLY ACTION INACTIVE LOW-LEVEL RADIOACTIVE WASTE TANK SYSTEMS 8-1

8.1 SCOPE AND ASSUMPTIONS 8-1

9.0. WAG 1 EARLY ACTION GUNITE TANKS ROBOTICS INTERIM ACTION . . . 9-1

9.1 SCOPE AND ASSUMPTIONS 9-1

9.2 PLANNING 9-5
9.2.1 Action Plan 9-5
9.2.2 Investigation/Feasibility/Requirements 9-5
9.2.3 Support Documentation 9-5

9.3 DESIGN/PROCEDURES 9-6
9.3.1 Design/Procedures 9-6

9.4 IMPLEMENTATION 9-6
9.4.1 Integration 9-6
9.4.2 Implementation 9-7

9.5 EARLY ACTION REPORT 9-8
9.5.1 Early Action Report 9-8

9.6 EARLY ACTION OVERSIGHT 9-9
9.6.1 Early Action Oversight 9-9

TABLE OF CONTENTS
(continued)

Page

9.7 RISKS AND UNCERTAINTIES 9-9

9.8 INTERFACES 9-10

10.0 WAG 1 EARLY ACTION CORE HOLE EIGHT INTERIM ACTION 10-1

10.1 SCOPE AND ASSUMPTIONS 10-1

10.2 PLANNING 10-1
10.2.1 Action Plan 10-1
10.2.2 Investigation/Feasibility/Requirements 10-5
10.2.3 Support Documentation 10-5

10.3 DESIGN/PROCEDURES 10-5
10.3.1 Design/Procedures 10-5

10.4 IMPLEMENTATION 10-6
10.4.1 Integration 10-6
10.4.2 Implementation 10-6

10.5 EARLY ACTION REPORT 10-7
10.5.1 Early Action Report 10-7

10.6 EARLY ACTION OVERSIGHT 10-7
10.6.1 Early Action Oversight 10-7

10.7 RISKS AND UNCERTAINTIES 10-8

10.8 INTERFACES 10-8

11.0. WAG 1 EARLY ACTION BOUNDARY INTERCEPTION 11-1

11.1 SCOPE AND ASSUMPTIONS 11-1

11.2 PLANNING 11-1
11.2.1 Action Plan 11-1
11.2.2 Investigation/Feasibility/Requirements 11-5
11.2.3 Support Documentation 11-5

TABLE OF CONTENTS
(continued)

Page

11.3 DESIGN/PROCEDURES 11-5
11.3.1 Design/Procedures 11-5

11.4 IMPLEMENTATION 11-6
11.4.1 Integration 11-6
11.4.2 Implementation 11-6

11.5 EARLY ACTION REPORT 11-8
11.5.1 Early Action Report 11-8

11.6 EARLY ACTION OVERSIGHT 11-8
11.6.1 Early Action Oversight 11-8

11.7 RISKS AND UNCERTAINTIES 11-8

11.8 INTERFACES 11-8

12.0 WAG 1 EARLY ACTION WHITE OAK CREEK INTERIM ACTION 12-1

12.1 SCOPE AND ASSUMPTIONS 12-1

12.2 PLANNING 12-1
12.2.1 Action Plan 12-1
12.2.2 Investigation/Feasibility/Requirements 12-5
12.2.3 Support Documentation 12-5

12.3 DESIGN/PROCEDURES 12-5
12.3.1 Design/Procedures 12-5

12.4 IMPLEMENTATION 12-6
12.4.1 Integration 12-6
12.4.2 Implementation 12-6

12.5 EARLY ACTION REPORT 12-7
12.5.1 Early Action Report 12-7

12.6 EARLY ACTION OVERSIGHT 12-7
12.6.1 Early Action Oversight 12-7

12.7 RISKS AND UNCERTAINTIES 12-7

TABLE OF CONTENTS
(continued)

Page

12.8 INTERFACES 12-8

13.0 WAG 1 PHASE I REMEDIAL INVESTIGATION 13-1

13.1 SCOPE AND ASSUMPTIONS 13-1

13.2 PHASE I REMEDIAL INVESTIGATION REPORT 13-1
13.2.1 Nonintrusive Surveys 13-1
13.2.2 Groundwater Investigation 13-1
13.2.3 Surface Water and Sediment Investigations 13-1
13.2.4 Soils Investigation 13-1
13.2.5 Baseline Risk Assessment 13-5
13.2.6 Environmental Engineering 13-5
13.2.7 Remedial Investigation Report 13-5
13.2.8 Alternatives Screening 13-5
13.2.9 Operable Unit Coordination 13-5
13.2.10 Remedial Investigation Oversight Activities 13-6

13.3 RISKS AND UNCERTAINTIES 13-6

13.4 INTERFACES 13-6

14.0 WAG 1 NORTH AND SOUTH TANK FARMS AND TANKS TH-4 AND W-11 OPERABLE UNIT 14-1

14.1 PHASE II REMEDIAL INVESTIGATION 14-1
14.1.1 Scope and Assumptions 14-1
14.1.2 Operable Unit Specific Remedial Investigation Work Plan 14-8
14.1.2.1 Planning 14-8
14.1.3 Operable Unit Specific Remedial Investigation Report 14-8
14.1.3.1 Nonintrusive Surveys 14-8
14.1.3.2 Groundwater Investigation 14-8
14.1.3.3 Surface Water and Sediment Investigation 14-9
14.1.3.4 Soils Investigation 14-9
14.1.3.5 Baseline Risk Assessment 14-9
14.1.3.6 Environmental Engineering 14-9
14.1.3.7 Remedial Investigation Report 14-9
14.1.3.8 Alternatives Screening 14-9
14.1.3.9 Operable Unit Coordination 14-9
14.1.3.10 Remedial Investigation Oversight Activities 14-10

TABLE OF CONTENTS (continued)

Page

14.1.4 Risks and Uncertainties 14-11
14.1.5 Interfaces 14-11

14.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 14-11
14.2.1 Scope and Assumptions 14-12
14.2.2 Feasibility Study Report 14-16
14.2.2.1 Technology Screening Activities 14-17
14.2.2.2 Alternatives Development and Analysis 14-17
14.2.2.3 NEPA Environmental Activities 14-17
14.2.2.4 Feasibility Study Development 14-17
14.2.2.5 Feasibility Study Operable Unit Coordination 14-18
14.2.2.6 Treatability Studies 14-18
14.2.2.7 Feasibility Study Oversight Activities 14-18
14.2.3 Proposed Plan 14-19
14.2.3.1 Proposed Plan Development 14-19
14.2.3.2 Proposed Plan Oversight Activities 14-19
14.2.4 Interim Record of Decision 14-20
14.2.4.1 Interim Record of Decision Development 14-20
14.2.4.2 Interim Record of Decision Oversight Activities 14-20
14.2.5 Risks and Uncertainties 14-20
14.2.6 Interfaces 14-21

14.3 REMEDIAL DESIGN 14-21
14.3.1 Scope and Assumptions 14-21
14.3.2 Remedial Design Work Plan 14-25
14.3.2.1 Remedial Design Work Plan 14-25
14.3.2.2 Engineering Studies 14-25
14.3.2.3 Remedial Design Work Plan Oversight Activities 14-27
14.3.3 Remedial Design Report 14-27
14.3.3.1 Remedial Design Report Phase I Title I 14-27
14.3.3.2 Remedial Design Report Phase I Title II Design 14-27
14.3.3.3 Remedial Design Report Phase II Title I Design 14-28
14.3.3.4 Remedial Design Report Phase II Title II 14-28
14.3.3.5 Remedial Design Oversight Activities 14-29
14.3.4 Risks and Uncertainties 14-29
14.3.5 Interfaces 14-30

TABLE OF CONTENTS
(continued)

Page

14.4 REMEDIAL ACTION 14-30
14.4.1 Scope and Assumptions 14-31
14.4.2 Remedial Action Work Plan 14-31
14.4.2.1 Remedial Action Work Plan 14-31
14.4.2.2 Remedial Action Work Plan Oversight Activities 14-31
14.4.3 Remedial Action Activities 14-31
14.4.3.1 Remedial Action Integration 14-35
14.4.3.2 North Tank Farm Remediation Phase I 14-35
14.4.3.3 North Tank Farm Remediation Phase II 14-39
14.4.3.4 South Tank Farm Remediation 14-47
14.4.3.5 TH-4 and W-11 Tank Remediation 14-51
14.4.3.6 Support Activities 14-56
14.4.4 Post Construction 14-56
14.4.4.1 Post Construction Report 14-56
14.4.5 Monitoring During Remedial Action 14-57
14.4.5.1 Monitoring Plan 14-57
14.4.5.2 Environmental Monitoring Program During Remedial Action 14-57
14.4.6 Verification 14-57
14.4.6.1 Five-Year Review Plan 14-57
14.4.6.2 Five-Year Monitoring 14-57
14.4.6.3 Five-Year Plan Assessment 14-58
14.4.7 Risks and Uncertainties 14-58
14.4.8 Interfaces 14-59
14.4.9 Contingent Action 14-60

15.0 WAG 1 SURFACE IMPOUNDMENTS OPERABLE UNIT 15-1

15.1 PHASE II REMEDIAL INVESTIGATION 15-1
15.1.1 Scope and Assumptions 15-1
15.1.2 Operable Unit Specific Remedial Investigation Work Plan 15-1
15.1.2.1 Planning 15-1
15.1.3 Operable Unit Specific RI Report 15-8
15.1.3.1 Nonintrusive Surveys 15-8
15.1.3.2 Groundwater Investigation 15-8
15.1.3.3 Surface Water and Sediment Investigation 15-8
15.1.3.4 Soil Investigation 15-8
15.1.3.5 Baseline Risks Assessment 15-8
15.1.3.6 Environmental Engineering 15-9
15.1.3.7 Remedial Investigation Report 15-9

TABLE OF CONTENTS (continued)

Page

15.1.3.8 Alternatives Screening 15-9
15.1.3.9 Operable Unit Coordination 15-10
15.1.3.10 Remedial Investigation Oversight Activities 15-11
15.1.4 Risks and Uncertainties 15-11
15.1.5 Interfaces 15-11

15.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 15-12
15.2.1 Scope and Assumptions 15-12
15.2.2 Feasibility Study Report 15-16
15.2.2.1 Technology Screening Activities 15-17
15.2.2.2 Alternatives Development and Analysis 15-17
15.2.2.3 NEPA Environmental Activities 15-18
15.2.2.4 Feasibility Study Development 15-18
15.2.2.5 Feasibility Study Operable Unit Coordination 15-19
15.2.2.6 Treatability Studies 15-19
15.2.2.7 Feasibility Study Oversight Activities 15-19
15.2.3 Proposed Plan 15-20
15.2.3.1 Proposed Plan Development 15-20
15.2.3.2 Proposed Plan Oversight Activities 15-20
15.2.4 Interim Record of Decision 15-21
15.2.4.1 Interim Record of Decision Development 15-21
15.2.4.2 Interim Record of Decision Oversight Activities 15-21
15.2.5 Risks and Uncertainties 15-21
15.2.6 Interfaces 15-22

15.3 REMEDIAL DESIGN 15-23
15.3.1 Scope and Assumptions 15-23
15.3.2 Remedial Design Work Plan 15-23
15.3.2.1 Remedial Design Work Plan 15-23
15.3.2.2 Engineering Studies 15-28
15.3.2.3 Remedial Design Work Plan Oversight Activities 15-28
15.3.3 Remedial Design Report 15-28
15.3.3.1 Title I Design 15-28
15.3.3.2 Title II Design 15-29
15.3.3.3 Remedial Design Oversight Activities 15-29
15.3.4 Risks and Uncertainties 15-30
15.3.5 Interfaces 15-30

TABLE OF CONTENTS (continued)

Page

15.4 REMEDIAL ACTION 15-31
15.4.1 Scope and Assumptions 15-31
15.4.2 Remedial Action Work Plan 15-31
15.4.2.1 Remedial Action Work Plan 15-31
15.4.2.2 Remedial Action Work Plan Oversight Activities 15-35
15.4.3 Remedial Action 15-35
15.4.3.1 Remedial Action Integration 15-35
15.4.3.2 Surface Impoundments Remediation 15-35
15.4.3.3 Support Activities 15-36
15.4.4 Post Construction 15-38
15.4.4.1 Post Construction Report 15-38
15.4.5 Monitoring During Remedial Action 15-38
15.4.5.1 Monitoring Plan 15-38
15.4.5.2 Monitoring During Remedial Action 15-38
15.4.6 Verification 15-39
15.4.6.1 Five-Year Review Plan 15-39
15.4.6.2 Five-Year Monitoring 15-39
15.4.6.3 Five-Year Plan Assessment 15-39
15.4.7 Risks and Uncertainties 15-39
15.4.8 Interfaces 15-40
15.4.9 Contingent Action 15-41

16.0 WAG 1 UNDERGROUND PIPING AND STORM DRAIN OPERABLE UNIT . . 16-1

16.1 PHASE II REMEDIAL INVESTIGATION 16-1
16.1.1 Scope and Assumptions 16-1
16.1.2 Operable Unit Specific Remedial Investigation Work Plan 16-8
16.1.2.1 Planning 16-8
16.1.3 Operable Unit Specific Remedial Investigation Report 16-9
16.1.3.1 Nonintrusive Surveys 16-9
16.1.3.2 Groundwater Investigation 16-9
16.1.3.3 Surface Water and Sediment Investigations 16-10
16.1.3.4 Soils Investigation 16-11
16.1.3.5 Baseline Risk Assessment 16-11
16.1.3.6 Environmental Engineering 16-11
16.1.3.7 Remedial Investigation Report 16-12
16.1.3.8 Alternatives Screening 16-12
16.1.3.9 Operable Unit Coordination 16-13
16.1.3.10 Remedial Investigation Oversight Activities 16-14
16.1.4 Risks and Uncertainties 16-14

TABLE OF CONTENTS
(continued)

Page

16.1.5 Interfaces 16-15

16.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 16-15
16.2.1 Scope and Assumptions 16-19
16.2.2 Feasibility Study Report 16-20
16.2.2.1 Technology Screening Activities 16-20
16.2.2.2 Alternatives Development and Analysis 16-20
16.2.2.3 NEPA Environmental Activities 16-21
16.2.2.4 Feasibility Study Development 16-21
16.2.2.5 Feasibility Study Operable Unit Coordination 16-22
16.2.2.6 Treatability Studies 16-22
16.2.2.7 Feasibility Study Oversight Activities 16-22
16.2.3 Proposed Plan 16-23
16.2.3.1 Proposed Plan Development 16-23
16.2.3.2 Proposed Plan Oversight Activities 16-23
16.2.4 Interim Record of Decision 16-23
16.2.4.1 Interim Record of Decision Development 16-23
16.2.4.2 Interim Record of Decision Oversight Activities 16-24
16.2.5 Risks and Uncertainties 16-24
16.2.6 Interfaces 16-24

16.3 REMEDIAL DESIGN 16-25
16.3.1 Scope and Assumptions 16-25
16.3.2 Remedial Design Work Plan 16-25
16.3.2.1 Remedial Design Work Plan 16-25
16.3.2.2 Engineering Studies 16-30
16.3.2.3 Remedial Design Work Plan Oversight Activities 16-30
16.3.3 Remedial Design Report 16-30
16.3.3.1 Title I Design 16-30
16.3.3.2 Title II Design 16-30
16.3.3.3 Remedial Design Oversight Activities 16-31
16.3.4 Risks and Uncertainties 16-31
16.3.5 Interfaces 16-32

16.4 REMEDIAL ACTION 16-32
16.4.1 Scope and Assumptions 16-36
16.4.2 Remedial Action Work Plan 16-36
16.4.2.1 Remedial Action Work Plan 16-36
16.4.2.2 Remedial Action Work Plan Oversight Activities 16-36

TABLE OF CONTENTS
(continued)

Page

16.4.3 Remedial Action Activities 16-36
16.4.3.1 Remedial Action Integration 16-36
16.4.3.2 Underground Piping and Storm Drain Remediation 16-37
16.4.3.3 Support Activities 16-39
16.4.4 Post Construction 16-39
16.4.4.1 Post Construction Report 16-39
16.4.5 Monitoring During Remedial Action 16-40
16.4.5.1 Monitoring Plan 16-40
16.4.5.2 Environmental Monitoring Program During Remedial Action 16-40
16.4.6 Verification 16-40
16.4.6.1 Five-Year Review Plan 16-40
16.4.6.2 Five-Year Monitoring 16-40
16.4.6.3 Five-Year Plan Assessment 16-41
16.4.7 Risks and Uncertainties 16-41
16.4.8 Interfaces 16-41
16.4.9 Contingent Action 16-42

17.0 WAG 1 GROUNDWATER OPERABLE UNIT 17-1

17.1 PHASE II REMEDIAL INVESTIGATION 17-1
17.1.1 Scope and Assumptions 17-1
17.1.2 Operable Unit Specific Remedial Investigation Work Plan 17-8
17.1.2.1 Planning 17-8
17.1.3 Operable Unit Specific Remedial Investigation Report 17-8
17.1.3.1 Nonintrusive Surveys 17-8
17.1.3.2 Groundwater Investigation 17-9
17.1.3.3 Surface Water and Sediment Investigations 17-10
17.1.3.4 Soils Investigation 17-11
17.1.3.5 Baseline Risk Assessment 17-11
17.1.3.6 Environmental Engineering 17-12
17.1.3.7 Remedial Investigation Report 17-12
17.1.3.8 Alternatives Screening 17-13
17.1.3.9 Operable Unit Coordination 17-14
17.1.3.10 Remedial Investigation Oversight Activities 17-14
17.1.4 Risks and Uncertainties 17-15
17.1.5 Interfaces 17-15

TABLE OF CONTENTS (continued)

Page

17.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 17-16
17.2.1 Scope and Assumptions 17-16
17.2.2 Feasibility Study Report 17-20
17.2.2.1 Feasibility Study Technology Screening Activities 17-20
17.2.2.2 Alternatives Development and Analysis 17-21
17.2.2.3 NEPA Environmental Activities 17-21
17.2.2.4 Feasibility Study Development 17-22
17.2.2.5 Feasibility Study Operable Unit Coordination 17-22
17.2.2.6 Treatability Studies 17-22
17.2.2.7 Feasibility Study Oversight Activities 17-22
17.2.3 Proposed Plan 17-23
17.2.3.1 Proposed Plan Development 17-23
17.2.3.2 Proposed Plan Oversight Activities 17-23
17.2.4 Interim Record of Decision 17-24
17.2.4.1 Interim Record of Decision Development 17-24
17.2.4.2 Interim Record of Decision Oversight Activities 17-24
17.2.5 Risks and Uncertainties 17-24
17.2.6 Interfaces 17-25

17.3 REMEDIAL DESIGN 17-25
17.3.1 Scope and Assumptions 17-25
17.3.2 Remedial Design Work Plan 17-29
17.3.2.1 Remedial Design Work Plan 17-29
17.3.2.2 Engineering Studies 17-29
17.3.2.3 Remedial Design Work Plan Oversight Activities 17-29
17.3.3 Remedial Design Report 17-31
17.3.3.1 Title I Design 17-31
17.3.3.2 Title II Design 17-31
17.3.3.3 Remedial Design Oversight Activities 17-31
17.3.4 Risks and Uncertainties 17-32
17.3.5 Interfaces 17-32

17.4 REMEDIAL ACTION 17-33
17.4.1 Scope and Assumptions 17-33
17.4.2 Remedial Action Work Plan 17-33
17.4.2.1 Remedial Action Work Plan 17-33
17.4.2.2 Remedial Action Work Plan Oversight Activities 17-37

TABLE OF CONTENTS
(continued)

Page

17.4.3 Remedial Action 17-37
17.4.3.1 Remedial Action Integration 17-37
17.4.3.2 Groundwater Remediation 17-37
17.4.3.3 Support Activities 17-38
17.4.4 Post Construction 17-38
17.4.4.1 Post Construction Report 17-38
17.4.5 Monitoring During Remedial Action 17-39
17.4.5.1 Monitoring Plan 17-39
17.4.5.2 Environmental Monitoring Program During Remedial Action 17-39
17.4.6 Verification 17-39
17.4.6.1 Five-Year Review Plan 17-39
17.4.6.2 Five-Year Monitoring 17-40
17.4.6.3 Five-Year Plan Assessment 17-40
17.4.7 Risks and Uncertainties 17-40
17.4.8 Interfaces 17-41
17.4.9 Contingent Action 17-41

18.0 WAG 1 WHITE OAK CREEK FLOOD PLAIN SOILS AND SEDIMENTS OPERABLE UNIT 18-1

18.1 PHASE II REMEDIAL INVESTIGATION 18-1
18.1.1 Scope and Assumptions 18-1
18.1.2 Operable Unit Specific Remedial Investigation Work Plan 18-8
18.1.2.1 Planning 18-8
18.1.3 Operable Unit Specific Remedial Investigation Report 18-8
18.1.3.1 Nonintrusive Surveys 18-8
18.1.3.2 Groundwater Investigation 18-8
18.1.3.3 Surface Water and Sediment Investigations 18-9
18.1.3.4 Soils Investigation 18-9
18.1.3.5 Baseline Risk Assessment 18-10
18.1.3.6 Environmental Engineering Analysis 18-10
18.1.3.7 Remedial Investigation Report 18-11
18.1.3.8 Alternatives Screening 18-11
18.1.3.9 Operable Unit Coordination 18-12
18.1.3.10 Remedial Investigation Oversight Activities 18-12
18.1.4 Risks and Uncertainties 18-13
18.1.5 Interfaces 18-13

TABLE OF CONTENTS (continued)

Page

18.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 18-14
18.2.1 Scope and Assumptions 18-14
18.2.2 Feasibility Study Report 18-18
18.2.2.1 Technology Screening Activities 18-18
18.2.2.2 Alternatives Development and Analysis 18-19
18.2.2.3 NEPA Environmental Activities 18-19
18.2.2.4 Feasibility Study Development 18-20
18.2.2.5 Feasibility Study Operable Unit Coordination 18-20
18.2.2.6 Treatability Studies 18-20
18.2.2.7 Feasibility Study Oversight Activities 18-20
18.2.3 Proposed Plan 18-21
18.2.3.1 Proposed Plan Development 18-21
18.2.3.2 Proposed Plan Oversight Activities 18-21
18.2.4 Interim Record of Decision 18-22
18.2.4.1 Interim Record of Decision Development 18-22
18.2.4.2 Interim Record of Decision Oversight Activities 18-22
18.2.5 Risks and Uncertainties 18-22
18.2.6 Interfaces 18-23

18.3 REMEDIAL DESIGN 18-23
18.3.1 Scope and Assumptions 18-27
18.3.2 Remedial Design Work Plan 18-27
18.3.2.1 Remedial Design Work Plan 18-27
18.3.2.2 Engineering Studies 18-27
18.3.2.3 Remedial Design Work Plan Oversight Activities 18-27
18.3.3 Remedial Design Report 18-29
18.3.3.1 Title I Design 18-29
18.3.3.2 Title II Design 18-29
18.3.3.3 Remedial Design Oversight Activities 18-30
18.3.4 Risks and Uncertainties 18-30
18.3.5 Interfaces 18-30

18.4 REMEDIAL ACTION 18-31
18.4.1 Scope and Assumptions 18-31
18.4.2 Remedial Action Work Plan 18-31
18.4.2.1 Remedial Action Work Plan 18-31
18.4.2.2 Remedial Action Work Plan Oversight Activities 18-35
18.4.3 Remedial Action Activities 18-35
18.4.3.1 Remedial Action Integration 18-35

TABLE OF CONTENTS
(continued)

Page

18.4.3.2 White Oak Creek Flood Plain Soils and Sediments Remediation 18-35
18.4.3.3 Support Activities 18-36
18.4.4 Post Construction 18-36
18.4.4.1 Post Construction Report 18-36
18.4.5 Monitoring During Remedial Action 18-36
18.4.5.1 Monitoring Plan 18-36
18.4.5.2 Monitoring During Remedial Action 18-37
18.4.6 Verification 18-37
18.4.6.1 Five-Year Review Plan 18-37
18.4.6.2 Five-Year Monitoring 18-37
18.4.6.3 Five-Year Plan Assessment 18-37
18.4.7 Risks and Uncertainties 18-38
18.4.8 Interfaces 18-38
18.4.9 Contingent Action 18-39

19.0 WAG 1 SOLID WASTE STORAGE AREA 1 OPERABLE UNIT 19-1

19.1 PHASE II REMEDIAL INVESTIGATION 19-1
19.1.1 Scope and Assumptions 19-1
19.1.2 Operable Unit Specific Remedial Investigation Work Plan 19-1
19.1.2.1 Planning 19-1
19.1.3 Operable Unit Specific Remedial Investigation Report 19-8
19.1.3.1 Nonintrusive Surveys 19-8
19.1.3.2 Groundwater Investigation 19-8
19.1.3.3 Surface Water and Sediment Investigations 19-9
19.1.3.4 Soils Investigation 19-10
19.1.3.5 Baseline Risk Assessment 19-10
19.1.3.6 Environmental Engineering 19-10
19.1.3.7 Remedial Investigation Report 19-11
19.1.3.8 Alternatives Screening 19-12
19.1.3.9 Operable Unit Coordination 19-12
19.1.3.10 Remedial Investigation Oversight Activities 19-13
19.1.4 Risks and Uncertainties 19-13
19.1.5 Interfaces 19-13
19.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 19-14
19.2.1 Scope and Assumptions 19-14
19.2.2 Feasibility Study Report 19-19
19.2.2.1 Technology Screening Activities 19-19

TABLE OF CONTENTS
(continued)

Page

19.2.2.2 Alternatives Development and Analysis 19-20
19.2.2.3 NEPA Environmental Activities 19-20
19.2.2.4 Feasibility Study Development 19-20
19.2.2.5 Feasibility Study Operable Unit Coordination 19-21
19.2.2.6 Treatability Studies 19-21
19.2.2.7 Feasibility Study Oversight Activities 19-21
19.2.3 Proposed Plan 19-22
19.2.3.1 Proposed Plan Development 19-22
19.2.3.2 Proposed Plan Oversight Activities 19-22
19.2.4 Interim Record of Decision 19-22
19.2.4.1 Interim Record of Decision Development 19-22
19.2.4.2 Interim Record of Decision Oversight Activities 19-23
19.2.5 Risks and Uncertainties 19-23
19.2.6 Interfaces 19-23

19.3 REMEDIAL DESIGN 19-24
19.3.1 Scope and Assumptions 19-24
19.3.2 Remedial Design Work Plan 19-24
19.3.2.1 Remedial Design Work Plan 19-24
19.3.2.2 Engineering Studies 19-29
19.3.2.3 Remedial Design Work Plan Oversight Activities 19-29
19.3.3 Remedial Design Report 19-29
19.3.3.1 Title I Design 19-29
19.3.3.2 Title II Design 19-29
19.3.3.3 Remedial Design Oversight Activities 19-30
19.3.4 Risks and Uncertainties 19-30
19.3.5 Interfaces 19-31

19.4 REMEDIAL ACTION 19-31
19.4.1 Scope and Assumptions 19-35
19.4.2 Remedial Action Work Plan 19-35
19.4.2.1 Remedial Action Work Plan 19-35
19.4.2.2 Remedial Action Work Plan Oversight Activities 19-35
19.4.3 Remedial Action Activities 19-35
19.4.3.1 Remedial Action Integration 19-35
19.4.3.2 Solid Waste Storage Area 1 Remediation 19-36
19.4.3.3 Support Activities 19-36
19.4.4 Post Construction 19-38
19.4.4.1 Post Construction Report 19-38

TABLE OF CONTENTS
(continued)

Page

19.4.5 Monitoring During Remedial Action 19-38
19.4.5.1 Monitoring Plan 19-38
19.4.5.2 Monitoring During Remedial Action 19-38
19.4.6 Verification 19-39
19.4.6.1 Five-Year Review Plan 19-39
19.4.6.2 Five-Year Monitoring 19-39
19.4.6.3 Five-Year Plan Assessment 19-39
19.4.7 Risks and Uncertainties 19-39
19.4.8 Interfaces 19-40
19.4.9 Contingent Actions 19-41

20.0 WAG 1 SOLID WASTE STORAGE AREA 2 OPERABLE UNIT 20-1

20.1 PHASE II REMEDIAL INVESTIGATION 20-1
20.1.1 Scope and Assumptions 20-1
20.1.2 Operable Unit Specific Remedial Investigation Work Plan 20-1
20.1.2.1 Planning 20-1
20.1.3 Operable Unit Specific Remedial Investigation Report 20-8
20.1.3.1 Nonintrusive Surveys 20-8
20.1.3.2 Groundwater Investigation 20-8
20.1.3.3 Surface Water and Sediment Investigations 20-8
20.1.3.4 Soils Investigation 20-8
20.1.3.5 Baseline Risk Assessment 20-9
20.1.3.6 Environmental Engineering 20-9
20.1.3.7 Remedial Investigation Report 20-10
20.1.3.8 Alternatives Screening 20-10
20.1.3.9 Operable Unit Coordination 20-10
20.1.3.10 Remedial Investigation Oversight Activities 20-11
20.1.4 Risks and Uncertainties 20-11
20.1.5 Interfaces 20-12

20.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 20-12
20.2.1 Scope and Assumptions 20-16
20.2.2 Feasibility Study Report 20-17
20.2.2.1 Technology Screening Activities 20-17
20.2.2.2 Alternatives Development and Analysis 20-17
20.2.2.3 NEPA Environmental Activities 20-17
20.2.2.4 Feasibility Study Development 20-17
20.2.2.5 Feasibility Study Operable Unit Coordination 20-18

TABLE OF CONTENTS
(continued)

Page

20.2.2.6 Treatability Studies 20-18
20.2.2.7 Feasibility Study Oversight Activities 20-18
20.2.3 Proposed Plan 20-19
20.2.3.1 Proposed Plan Development 20-19
20.2.3.2 Proposed Plan Oversight Activities 20-19
20.2.4 Interim Record of Decision 20-19
20.2.4.1 Interim Record of Decision Development 20-19
20.2.4.2 Interim Record of Decision Oversight Activities 20-19
20.2.5 Risks and Uncertainties 20-20
20.2.6 Interfaces 20-20
20.2.7 Contingent Action 20-21

21.0 WAG 1 WASTE PILE OPERABLE UNIT 21-1

21.1 PHASE II REMEDIAL INVESTIGATION 21-1
21.1.1 Scope and Assumptions 21-1
21.1.2 Operable Unit Specific Remedial Investigation Work Plan 21-1
21.1.2.1 Planning 21-1
21.1.3 Operable Unit Specific Remedial Investigation Report 21-8
21.1.3.1 Nonintrusive Surveys 21-8
21.1.3.2 Groundwater Investigation 21-8
21.1.3.3 Surface Water and Sediment Investigations 21-8
21.1.3.4 Soils Investigation 21-8
21.1.3.5 Baseline Risk Assessment 21-9
21.1.3.6 Environmental Engineering 21-9
21.1.3.7 Remedial Investigation Report 21-10
21.1.3.8 Alternatives Screening 21-10
21.1.3.9 Operable Unit Coordination 21-10
21.1.3.10 Remedial Investigation Oversight Activities 21-11
21.1.4 Risks and Uncertainties 21-11
21.1.5 Interfaces 21-12

21.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 21-12
21.2.1 Scope and Assumptions 21-16
21.2.2 Feasibility Study Report 21-16
21.2.2.1 Technology Screening Activities 21-17
21.2.2.2 Alternatives Development and Analysis 21-17
21.2.2.3 NEPA Environmental Activities 21-17
21.2.2.4 Feasibility Study Development 21-17

TABLE OF CONTENTS
(continued)

Page

21.2.2.5 Feasibility Study Operable Unit Coordination 21-17
21.2.2.6 Treatability Studies 21-17
21.2.2.7 Feasibility Study Oversight Activities 21-17
21.2.3 Proposed Plan 21-18
21.2.3.1 Proposed Plan Development 21-18
21.2.3.2 Proposed Plan Oversight Activities 21-18
21.2.4 Interim Record of Decision 21-19
21.2.4.1 Interim Record of Decision Development 21-19
21.2.4.2 Interim Record of Decision Oversight Activities 21-19
21.2.5 Risks and Uncertainties 21-19
21.2.6 Interfaces 21-20
21.2.7 Contingent Action 21-20

22.0 WAG 1 CONTAMINATED SOILS OPERABLE UNIT 22-1

22.1 PHASE II REMEDIAL INVESTIGATION 22-1
22.1.1 Scope and Assumptions 22-1
22.1.2 Operable Unit Specific Remedial Investigation Work Plan 22-8
22.1.2.1 Planning 22-8
22.1.3 Operable Unit Specific Remedial Investigation Report 22-8
22.1.3.1 Nonintrusive Surveys 22-8
22.1.3.2 Groundwater Investigation 22-9
22.1.3.3 Surface Water and Sediment Investigations 22-9
22.1.3.4 Soils Investigation 22-9
22.1.3.5 Baseline Risk Assessment 22-9
22.1.3.6 Environmental Engineering 22-10
22.1.3.7 Remedial Investigation Report 22-10
22.1.3.8 Alternatives Screening 22-11
22.1.3.9 Operable Unit Coordination 22-11
22.1.3.10 Remedial Investigation Oversight Activities 22-12
22.1.4 Risks and Uncertainties 22-12
22.1.5 Interfaces 22-13

22.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 22-13
22.2.1 Scope and Assumptions 22-17
22.2.2 Feasibility Study Report 22-18
22.2.2.1 Technology Screening Activities 22-18
22.2.2.2 Alternatives Development and Analysis 22-18
22.2.2.3 NEPA Environmental Activities 22-19

TABLE OF CONTENTS
(continued)

Page

22.2.2.4 Feasibility Study Development 22-19
22.2.2.5 Feasibility Study Operable Unit Coordination 22-20
22.2.2.6 Treatability Studies 22-20
22.2.2.7 Feasibility Study Oversight Activities 22-20
22.2.3 Proposed Plan 22-21
22.2.3.1 Proposed Plan Development 22-21
22.2.3.2 Proposed Plan Oversight Activities 22-21
22.2.4 Interim Record of Decision 22-22
22.2.4.1 Interim Record of Decision Development 22-22
22.2.4.2 Interim Record of Decision Oversight Activities 22-22
22.2.5 Risks and Uncertainties 22-22
22.2.6 Interfaces 22-23

22.3 REMEDIAL DESIGN 22-23
22.3.1 Scope and Assumptions 22-23
22.3.2 Remedial Design Work Plan 22-27
22.3.2.1 Remedial Design Work Plan 22-27
22.3.2.2 Engineering Studies 22-27
22.3.2.3 Remedial Design Work Plan Oversight Activities 22-27
22.3.3 Remedial Design Report 22-27
22.3.3.1 Title I Design 22-27
22.3.3.2 Title II Design 22-29
22.3.3.3 Remedial Design Oversight Activities 22-29
22.3.4 Risks and Uncertainties 22-29
22.3.5 Interfaces 22-30

22.4 REMEDIAL ACTION 22-31
22.4.1 Scope and Assumptions 22-31
22.4.2 Remedial Action Work Plan 22-31
22.4.2.1 Remedial Action Work Plan 22-31
22.4.2.2 Remedial Action Work Plan Oversight Activities 22-31
22.4.3 Remedial Action 22-31
22.4.3.1 Remedial Action Integration 22-31
22.4.3.2 Soils in 3000 Watershed 22-35
22.4.3.3 Soils in Isotope Circle Area 22-35
22.4.3.4 Soils from Mercury Spills 22-36
22.4.3.5 Miscellaneous Contaminated Soils 22-36
22.4.3.6 Support Activities 22-37
22.4.4 Post Construction 22-37
22.4.4.1 Post Construction Report 22-37

TABLE OF CONTENTS
(continued)

Page

22.4.5 Monitoring During Remedial Action 22-37
22.4.5.1 Monitoring Plan 22-37
22.4.5.2 Monitoring During Remedial Action 22-38
22.4.6 Verification 22-38
22.4.6.1 Five-Year Review Plan 22-38
22.4.6.2 Five-Year Monitoring 22-38
22.4.6.3 Five-Year Plan Assessment 22-38
22.4.7 Risks and Uncertainties 22-39
22.4.8 Interfaces 22-40
22.4.9 Contingent Action 22-41

23.0 WAG 1 STEEL TANK SYSTEMS OPERABLE UNIT 23-1

23.1 PHASE II REMEDIAL INVESTIGATION 23-1
23.1.1 Scope and Assumptions 23-1
23.1.2 Operable Unit Specific Remedial Investigation Work Plan 23-1
23.1.2.1 Planning 23-1
23.1.3 Operable Unit Specific Remedial Investigation Report 23-1
23.1.3.1 Nonintrusive Surveys 23-8
23.1.3.2 Groundwater Investigation 23-8
23.1.3.3 Surface Water and Sediment Investigations 23-8
23.1.3.4 Soils Investigation 23-8
23.1.3.5 Baseline Risk Assessment 23-8
23.1.3.6 Environmental Engineering 23-8
23.1.3.7 Remedial Investigation Report 23-8
23.1.3.8 Alternatives Screening 23-9
23.1.3.9 Operable Unit Coordination 23-9
23.1.3.10 Remedial Investigation Oversight Activities 23-10
23.1.4 Risks and Uncertainties 23-10
23.1.5 Interfaces 23-10

23.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION 23-11
23.2.1 Scope and Assumptions 23-11
23.2.2 Feasibility Study Report 23-15
23.2.2.1 Technology Screening Activities 23-16
23.2.2.2 Alternatives Development and Analysis 23-16
23.2.2.3 NEPA Environmental Activities 23-16
23.2.2.4 Feasibility Study Development 23-17
23.2.2.5 Feasibility Study Operable Unit Coordination 23-17

TABLE OF CONTENTS
(continued)

Page

23.2.2.6 Feasibility Study Oversight Activities 23-17
23.2.3 Proposed Plan 23-18
23.2.3.1 Proposed Plan Development 23-18
23.2.3.2 Proposed Plan Oversight Activities 23-18
23.2.4 Interim Record of Decision 23-18
23.2.4.1 Interim Record of Decision Development 23-18
23.2.4.2 Interim Record of Decision Oversight Activities 23-19
23.2.5 Risks and Uncertainties 23-19
23.2.6 Interfaces 23-20

23.3 REMEDIAL DESIGN 23-21
23.3.1 Scope and Assumptions 23-21
23.3.2 Remedial Design Work Plan 23-21
23.3.2.1 Remedial Design Work Plan 23-21
23.3.2.2 Engineering Studies 23-21
23.3.2.3 Remedial Design Work Plan Oversight Activities 23-25
23.3.3 Remedial Design Report 23-25
23.3.3.1 Title I Design 23-25
23.3.3.2 Title II Design 23-25
23.3.3.3 Remedial Design Oversight Activities 23-27
23.3.4 Risks and Uncertainties 23-27
23.3.5 Interfaces 23-28

23.4 REMEDIAL ACTION 23-28
23.4.1 Scope and Assumptions 23-29
23.4.2 Remedial Action Work Plan 23-29
23.4.2.1 Remedial Action Work Plan 23-29
23.4.2.2 Remedial Action Work Plan Oversight Activities 23-29
23.4.3 Remedial Action 23-29
23.4.3.1 Remedial Action Integration 23-29
23.4.3.2 Steel Tank Systems Remediation 23-33
23.4.3.3 Support Activities 23-34
23.4.4 Post Construction 23-35
23.4.4.1 Post Construction Report 23-35
23.4.5 Monitoring During Remedial Action 23-35
23.4.5.1 Monitoring Plan 23-35
23.4.5.2 Monitoring During Remedial Action 23-35
23.4.6 Verification 23-36
23.4.6.1 Five-Year Review Plan 23-36
23.4.6.2 Five-Year Monitoring 23-36

TABLE OF CONTENTS
(continued)

Page

23.4.6.3 Five-Year Plan Assessment 23-36
23.4.7 Risks and Uncertainties 23-36
23.4.8 Interfaces 23-37
23.4.9 Contingent Action 23-38

24.0 WAG 1 GUNITE TANK CLOSURE 24-1

24.1 SCOPE AND ASSUMPTIONS 24-1
24.1.1 Support Facilities Design 24-1
24.1.1.1 Title I and Title II Design 24-1
24.1.2 Gunite Tank Closure Construction 24-5
24.1.2.1 Construction Oversight 24-5
24.1.2.2 Construction of Tank Closure 24-5
24.1.2.3 Support Activities 24-6
24.1.3 NEPA Activities 24-6
24.1.3.1 Categorical Exclusion 24-6
24.1.4 Monitoring During Construction 24-6
24.1.4.1 Monitoring Plan 24-6
24.1.4.2 Monitoring During Construction 24-6
24.2 RISKS AND UNCERTAINTIES 24-7

25.0 WAG 1 PROCESS WASTE TREATMENT PLANT SURGE CAPACITY UPGRADE 25-1

25.1 SCOPE AND ASSUMPTIONS 25-1

25.2 PLANNING 25-1

25.3 DESIGN 25-1

25.4 IMPLEMENTATION 25-3
25.4.1 Integration 25-3
25.4.2 Implementation 25-3

25.5 OVERSIGHT 25-3

25.6 RISKS AND UNCERTAINTIES 25-3

25.7 INTERFACES 25-4

TABLE OF CONTENTS
(continued)

Page

26.0 WAG 1 RISKS AND UNCERTAINTIES SUMMARY 26-1

26.1 CONTINGENCY IN THE ESTIMATE 26-1

26.2 COST CONTINGENCY ANALYSIS 26-1

26.3 RISKS AND UNCERTAINTIES 26-2

27.0 WAG 1 SCHEDULE SUMMARY 27-1

28.0 WAG 1 COSTS ASSESSMENT SUMMARY 28-1

29.0 REFERENCES 29-1

LIST OF FIGURES

Page

Fig. ES.1 WAG 1 Summary Level Work Breakdown Structure. ES-3

Fig. ES.2 WAG 1 Summary Schedule. ES-6

Fig. 1.1 Oak Ridge Reservation. 1-2

Fig. 1.2 ORNL Waste Area Groupings. 1-3

Fig. 1.3 Comparison of CERCLA Process, Phases of Typical Engineering Project, Types of Estimates, and Baseline Report Update. 1-4

Fig. 1.4 ORNL ER Program Baseline Process. 1-7

Fig. 1.5 Life Cycle Costing Workshop Process. 1-8

Fig. 2.1 Geologic Cross Section through Main Plant Area. *Source:* BNI, 1989 2-3

Fig. 2.2 Location Map of ORNL Streams. 2-6

Fig. 2.3 WAG 1 Solid Waste Management Units. 2-29

Fig. 2.4 ORR Environmental Restoration Organization. 2-43

Fig. 2.5 WAG 1 Work Breakdown Structure. 2-45

Fig. 3.1 Project Integration Work Breakdown Structure. 3-2

Fig. 3.2 Project Integration Summary Level Schedule 3-3

Fig. 4.1 Support Facilities Work Breakdown Structure. 4-2

Fig. 4.2 Support Facilities Summary Level Schedule 4-3

Fig. 4.3 Grout Facilities Summary Level Schedule. 4-4

Fig. 4.4 Grout Mixing and Pumping Facility. 4-9

Fig. 4.5 Homogenization Blending System for Grout Mixing and Pumping Facility. . . 4-10

Fig. 4.6 Typical Cross Section through New Consolidation Area. 4-12

LIST OF FIGURES
(continued)

Page

Fig. 4.7 Consolidation Area Covered with Multilayer Cap. 4-13

Fig. 5.1 Gunite Tanks Early Action Work Breakdown Structure 5-2

Fig. 5.2 Gunite Tanks Early Action Summary Level Schedule. 5-3

Fig. 5.3 Equipment Support Bridge System for the North Tank Farm. 5-8

Fig. 6.1 Tank Contents Removal Early Action Work Breakdown Structure. 6-2

Fig. 6.2 Tank Contents Removal Early Action Summary Level Schedule. 6-3

Fig. 7.1 Groundwater Monitoring Early Action Work Breakdown Structure. 7-2

Fig. 7.2 Groundwater Monitoring Early Action Summary Level Schedule. 7-3

Fig. 9.1 Gunite Tanks Robotics Early Action Work Breakdown Structure. 9-2

Fig. 9.2 Gunite Tanks Robotics Early Action Summary Level Schedule. 9-3

Fig. 10.1 Core Hole Eight Early Action Work Breakdown Structure. 10-2

Fig. 10.2 Core Hole Eight Early Action Summary Level Schedule. 10-3

Fig. 11.1 Boundary Interception Early Action Work Breakdown Structure. 11-2

Fig. 11.2 Boundary Interception Early Action Summary Level Schedule. 11-3

Fig. 12.1 White Oak Creek Early Action Work Breakdown Structure. 12-2

Fig. 12.2 White Oak Creek Early Action Summary Level Schedule. 12-3

Fig. 13.1 Phase I Remedial Investigation Work Breakdown Structure. 13-2

Fig. 13.2 Phase I Remedial Investigation Summary Level Schedule. 13-3

Fig. 14.1 Tank Farm OU Work Breakdown Structure. 14-2

Fig. 14.2 Tank Farm OU Summary Level Schedule. 14-3

LIST OF FIGURES
(continued)

Page

Fig. 14.3 Tank Farm OU RI Work Breakdown Structure. 14-5

Fig. 14.4 Tank Farm OU RI Summary Level Schedule. 14-6

Fig. 14.5 Tank Farm OU FS/PP/IROD Work Breakdown Structure. 14-13

Fig. 14.6 Tank Farm OU FS/PP/IROD Summary Level Schedule. 14-14

Fig. 14.7 Tank Farm OU RD Work Breakdown Structure 14-22

Fig. 14.8 Tank Farm OU RD Summary Level Schedule. 14-23

Fig. 14.9 Tank Farm OU Phase I Schedule Logic 14-26

Fig. 14.10 Tank Farm OU RA Work Breakdown Structure. 14-32

Fig. 14.11 Tank Farm OU Summary Level RA Schedule. 14-33

Fig. 14.12 North Tank Farm Location. 14-36

Fig. 14.13 Typical Equipment Support Bridge for Gunite Tanks. 14-37

Fig. 14.14 Setup for Pumping Supernatant from Tank. 14-40

Fig. 14.15 Setup for Detaching Solids from Tank Bottom and Coarse Size-Reduction of Solids. 14-42

Fig. 14.16 Setup for Intermediate Size-Reduction of Solids. 14-43

Fig. 14.17 Setup to Decontaminate Inside of Tank. 14-44

Fig. 14.18 Setup for Final Size-Reduction of Solids and Mixing. 14-45

Fig. 14.19 North Tank Farm Enclosure. 14-46

Fig. 14.20 South Tank Farm Enclosure. 14-49

Fig. 14.21 Enclosure for Tank TH-4. 14-53

Fig. 14.22 Tank Arrangement and Setup for Tank W-11. 14-55

LIST OF FIGURES
(continued)

Page

Fig. 15.1 Surface Impoundments OU Work Breakdown Structure. 15-2

Fig. 15.2 Surface Impoundments OU Summary Level Schedule. 15-3

Fig. 15.3 Surface Impoundments OU RI Work Breakdown Structure. 15-5

Fig. 15.4 Surface Impoundments OU RI Summary Level Schedule. 15-6

Fig. 15.5 Surface Impoundments OU FS/PP/IROD Work Breakdown Structure. 15-13

Fig. 15.6 Surface Impoundments OU FS/PP/IROD Summary Level Schedule. 15-14

Fig. 15.7 Surface Impoundments RD Work Breakdown Structure. 15-24

Fig. 15.8 Surface Impoundments RD Summary Level Schedule. 15-25

Fig. 15.9 Surface Impoundments OU Phase I Schedule Logic. 15-27

Fig. 15.10 Surface Impoundments OU RA Work Breakdown Structure. 15-32

Fig. 15.11 Surface Impoundments OU RA Summary Level Schedule. 15-33

Fig. 15.12 Typical Cross Section of Multilayer Cap. 15-37

Fig. 16.1 WAG 1 Underground Piping and Storm Drains OU Work Breakdown Structure. 16-2

Fig. 16.2 WAG 1 Underground Piping and Storm Drains OU Summary Level Schedule. 16-3

Fig. 16.3 Underground Piping and Storm Drains RI Work Breakdown Structure 16-5

Fig. 16.4 Underground Piping and Storm Drains OU RI Summary Level Schedule. . . . 16-6

Fig. 16.5 Underground Piping and Storm Drains FS/PP/IROD Work Breakdown Structure 16-16

Fig. 16.6 Underground Piping and Storm Drains FS/PP/IROD Summary Level Schedule. 16-17

LIST OF FIGURES
(continued)

Page

Fig. 16.7 Underground Piping and Storm Drains RD Work Breakdown Structure. . . . 16-26

Fig. 16.8 Underground Piping and Storm Drains RD Summary Level Schedule 16-27

Fig. 16.9 Underground Piping and Storm Drains Phase I Schedule Logic. 16-29

Fig. 16.10 Underground Piping and Storm Drains RA Work Breakdown Structure 16-33

Fig. 16.11 Underground Piping and Storm Drains RA Summary Level Schedule 16-34

Fig. 17.1 Groundwater OU Work Breakdown Structure. 17-2

Fig. 17.2 Groundwater OU Summary Level Schedule. 17-3

Fig. 17.3 Groundwater OU RI Work Breakdown Structure. 17-5

Fig. 17.4 Groundwater OU RI Summary Level Schedule. 17-6

Fig. 17.5 Groundwater OU FS/PP/IROD Work Breakdown Structure. 17-17

Fig. 17.6 Groundwater OU FS/PP/IROD Summary Level Schedule. 17-18

Fig. 17.7 Groundwater OU RD Work Breakdown Structure. 17-26

Fig. 17.8 Groundwater OU RD Summary Level Schedule. 17-27

Fig. 17.9 Groundwater OU Phase I Schedule Logic. 17-30

Fig. 17.10 Groundwater OU RA Work Breakdown Structure. 17-34

Fig. 17.11 Groundwater OU RA Summary Level Schedule. 17-35

Fig. 18.1 White Oak Creek Flood Plain Soils and Sediments OU Work Breakdown Structure. 18-2

Fig. 18.2 White Oak Creek Flood Plain Soils and Sediment OU Summary Level Schedule. 18-3

Fig. 18.3 White Oak Creek Flood Plain Soils and Sediments OU RI Work Breakdown Structure. 18-5

LIST OF FIGURES
(continued)

Page

Fig. 18.4 White Oak Creek Flood Plains Soils and Sediments OU RI Summary Level Schedule. 18-6

Fig. 18.5 White Oak Creek Flood Plain Soils and Sediments OU FS/PP/IROD Work Breakdown Structure. 18-15

Fig. 18.6 White Oak Creek Flood Plain Soils and Sediments OU FS/PP/IROD Summary Level Schedule. 18-16

Fig. 18.7 White Oak Creek Flood Plain Soils and Sediments OU RD Work Breakdown Structure 18-24

Fig. 18.8 White Oak Creek Flood Plain Soils and Sediments OU RD Summary Level Schedule. 18-25

Fig. 18.9 White Oak Creek Flood Plain Soils and Sediments OU Phase I Schedule Logic. 18-28

Fig. 18.10 White Oak Creek Flood Plain Soils and Sediments OU RA Work Breakdown Structure. 18-32

Fig. 18.11 White Oak Creek Flood Plain Soils and Sediments OU RA Summary Level Schedule. 18-33

Fig. 19.1 SWSA 1 OU Work Breakdown Structure. 19-2

Fig. 19.2 SWSA 1 OU Summary Level Schedule. 19-3

Fig. 19.3 SWSA 1 OU RI Work Breakdown Structure. 19-5

Fig. 19.4 SWSA 1 OU RI Summary Level Schedule. 19-6

Fig. 19.5 SWSA 1 OU FS/PP/IROD Work Breakdown Structure. 19-15

Fig. 19.6 SWSA 1 OU FS/PP/IROD Summary Level Schedule. 19-16

Fig. 19.7 SWSA 1 OU RD Work Breakdown Structure. 19-25

Fig. 19.8 SWSA 1 OU RD Summary Level Schedule. 19-26

LIST OF FIGURES
(continued)

Page

Fig. 19.9 SWSA 1 OU Phase I Schedule Logic. 19-28

Fig. 19.10 SWSA 1 OU RA Work Breakdown Structure. 19-32

Fig. 19.11 SWSA 1 OU RA Summary Level Schedule. 19-33

Fig. 19.12 SWSA 1 Multilayer Cap. 19-37

Fig. 20.1 SWSA 2 OU Work Breakdown Structure. 20-2

Fig. 20.2 SWSA 2 OU Summary Level Schedule. 20-3

Fig. 20.3 SWSA 2 OU RI Work Breakdown Structure. 20-5

Fig. 20.4 SWSA 2 OU RI Summary Level Schedule. 20-6

Fig. 20.5 SWSA 2 OU FS/PP/IROD Work Breakdown Structure. 20-13

Fig. 20.6 SWSA 2 OU FS/PP/IROD Summary Level Schedule. 20-14

Fig. 21.1 Waste Pile OU Work Breakdown Structure 21-2

Fig. 21.2 Waste Pile OU Summary Level Schedule. 21-3

Fig. 21.3 Waste Pile OU RI Work Breakdown Structure 21-5

Fig. 21.4 Waste Pile OU RI Summary Level Schedule. 21-6

Fig. 21.5 Waste Pile OU FS/PP/IROD Work Breakdown Structure. 21-13

Fig. 21.6 Waste Pile OU FS/PP/IROD Summary Level Schedule. 21-14

Fig. 22.1 Contaminated Soils OU Work Breakdown Structure. 22-2

Fig. 22.2 Contaminated Soils OU Summary Level Schedule. 22-3

Fig. 22.3 Contaminated Soils OU RI Work Breakdown Structure 22-5

Fig. 22.4 Contaminated Soils OU RI Summary Level Schedule. 22-6

LIST OF FIGURES
(continued)

Page

Fig. 22.5 Contaminated Soils OU FS/PP/IROD Work Breakdown Structure. 22-14

Fig. 22.6 Contaminated Soils OU FS/PP/IROD Summary Level Schedule. 22-15

Fig. 22.7 Contaminated Soils OU RD Work Breakdown Structure. 22-24

Fig. 22.8 Contaminated Soils OU RD Summary Level Schedule. 22-25

Fig. 22.9 Contaminated Soils OU Phase I Schedule Logic. 22-28

Fig. 22.10 Contaminated Soils OU RA Work Breakdown Structure. 22-32

Fig. 22.11 Contaminated Soils OU RA Summary Level Schedule. 22-33

Fig. 23.1 Steel Tanks OU Work Breakdown Structure. 23-2

Fig. 23.2 Steel Tanks OU Summary Level Schedule. 23-3

Fig. 23.3 Steel Tanks OU RI Work Breakdown Structure. 23-5

Fig. 22.4 Steel Tanks OU RI Summary Level Schedule. 23-6

Fig. 23.5 Steel Tanks OU FS/PP/IROD Work Breakdown Structure. 23-12

Fig. 23.6 Steel Tanks OU FS/PP/IROD Summary Level Schedule. 23-13

Fig. 23.7 Steel Tanks OU RD Work Breakdown Structure. 23-22

Fig. 23.8 Steel Tanks OU RD Summary Level Schedule. 23-23

Fig. 23.9 Steel Tanks Phase I Schedule Logic. 23-26

Fig. 23.10 Steel Tanks OU RA Work Breakdown Structure. 23-30

Fig. 23.11 Steel Tanks OU RA Summary Level Schedule. 23-31

Fig. 24.1 Gunite Tank Closure Work Breakdown Structure 24-2

Fig. 24.2 Gunite Tank Closure Summary Level Schedule 24-3

LIST OF FIGURES
(continued)

Page

Fig. 25.1 PWTP Surge Capacity Upgrade Work Breakdown Structure. 25-2

Fig. 27.1 WAG 1 Summary Schedule. 27-2

Fig. 27.2 Accelerated Review Cycle. 27-25

LIST OF TABLES

Page

Table ES.1 WAG 1 Milestones Summary ES-9

Table ES.2 Overall WAG 1 Baseline Cost Assessment ES-10

Table 1.1 Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: Removal Actions 1-9

Table 1.2 Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: In Situ Actions 1-11

Table 1.3 Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: Tank Management 1-13

Table 1.4 Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: Offsite Disposal 1-15

Table 1.5 Summary of Data Needs for WAG 1 Operable Unit 1D: Surface Impoundments 1-16

Table 1.6 Summary of Data Needs for WAG 1 Operable Unit 1E: Groundwater 1-17

Table 1.7 Summary of Data Needs for WAG 1 Operable Unit 1F: Pipelines and Storm Drains 1-18

Table 1.8 Summary of Data Needs for WAG 1 Operable Unit 1G: White Oak Creek Flood Plain Soils 1-18

Table 1.9 Summary of Data Needs for WAG 1 Operable Unit 1H: SWSA 1, 2, and Waste Pit 1-19

Table 1.10 Summary of Data Needs for WAG 1 Operable Unit 1I: Contaminated Soils 1-20

Table 1.11 Summary of Data Needs for WAG 1 Operable Unit 1J: Empty Steel Tanks 1-21

Table 1.12 WAG 1 Regulatory Drivers 1-24

Table 2.1 WAG 1 Solid Waste Management Unit List 2-10

Table 3.1 WAG 1 Project Management Cost Assessment 3-4

Table 4.1 WAG 1 Support Facilities 01 Cost Assessment 4-5

Table 4.2 WAG 1 Support Facilities 02 Cost Assessment 4-6

Table 5.1 WAG 1 Early Action 01 Cost Assessment 5-4

Table 6.1 WAG 1 Early Action 02 Cost Assessment 6-4

Table 7.1 WAG 1 Early Action 03 Cost Assessment 7-4

Table 9.1 WAG 1 Early Action 04 Cost Assessment 9-4

Table 10.1 WAG 1 Early Action 05 Cost Assessment 10-4

Table 11.1 WAG 1 Early Action 06 Cost Assessment 11-4

Table 12.1 WAG 1 Early Action 07 Cost Assessment 12-4

Table 13.1 WAG 1 Phase I Remedial Investigation Cost Assessment 13-4

Table 14.1 WAG 1 Oper. Unit 01 Baseline Cost Assessment 14-4

Table 14.2 WAG 1 Oper. Unit 01 RI Cost Assessment 14-7

Table 14.3 WAG 1 Oper. Unit 01 FS/PP/IROD Cost Assessment 14-15

Table 14.4 WAG 1 Oper. Unit 01 RD Cost Assessment 14-24

Table 14.5 WAG 1 Oper. Unit 01 RA Cost Assessment 14-34

Table 15.1 WAG 1 Oper. Unit 02 Baseline Cost Assessment 15-4

Table 15.2 WAG 1 Oper. Unit 02 RI Cost Assessment 15-7

Table 15.3 WAG 1 Oper. Unit 02 FS/PP/IROD Cost Assessment 15-15

Table 15.4 WAG 1 Oper. Unit 02 RD Cost Assessment 15-26

Table 15.5 WAG 1 Oper. Unit 02 RA Cost Assessment 15-34

Table 16.1 WAG 1 Oper. Unit 03 Baseline Cost Assessment 16-4

LIST OF TABLES
(continued)

Page

Table 16.2 WAG 1 Oper. Unit 03 RI Cost Assessment 16-7

Table 16.3 WAG 1 Oper. Unit 03 FS/PP/IROD Cost Assessment 16-18

Table 16.4 WAG 1 Oper. Unit 03 RD Cost Assessment 16-28

Table 16.5 WAG 1 Oper. Unit 03 RA Cost Assessment 16-35

Table 17.1 WAG 1 Oper. Unit 04 Baseline Cost Assessment 17-4

Table 17.2 WAG 1 Oper. Unit 04 RI Cost Assessment 17-7

Table 17.3 WAG 1 Oper. Unit 04 FS/PP/IROD Cost Assessment 17-19

Table 17.4 WAG 1 Oper. Unit 04 RD Cost Assessment 17-28

Table 17.5 WAG 1 Oper. Unit 04 RA Cost Assessment 17-36

Table 18.1 WAG 1 Oper. Unit 05 Baseline Cost Assessment 18-4

Table 18.2 WAG 1 Oper. Unit 05 RI Cost Assessment 18-7

Table 18.3 WAG 1 Oper. Unit 05 FS/PP/IROD Cost Assessment 18-17

Table 18.4 WAG 1 Oper. Unit 05 RD Cost Assessment 18-26

Table 18.5 WAG 1 Oper. Unit 05 RA Cost Assessment 18-34

Table 19.1 WAG 1 Oper. Unit 06 Baseline Cost Assessment 19-4

Table 19.2 WAG 1 Oper. Unit 06 RI Cost Assessment 19-7

Table 19.3 WAG 1 Oper. Unit 06 FS/PP/IROD Cost Assessment 19-17

Table 19.4 WAG 1 Oper. Unit 06 RD Cost Assessment 19-27

Table 19.5 WAG 1 Oper. Unit 06 RA Cost Assessment 19-34

Table 20.1 WAG 1 Oper. Unit 07 Baseline Cost Assessment 20-4

LIST OF TABLES
(continued)

Page

Table 20.2 WAG 1 Oper. Unit 07 RI Cost Assessment 20-7

Table 20.3 WAG 1 Oper. Unit 07 FS/PP/IROD Cost Assessment 20-15

Table 21.1 WAG 1 Oper. Unit 08 Baseline Cost Assessment 21-4

Table 21.2 WAG 1 Oper. Unit 08 RI Cost Assessment 21-7

Table 21.3 WAG 1 Oper. Unit 08 FS/PP/IROD Cost Assessment 21-15

Table 22.1 WAG 1 Oper. Unit 09 Baseline Cost Assessment 22-4

Table 22.2 WAG 1 Oper. Unit 09 RI Cost Assessment 22-7

Table 22.3 WAG 1 Oper. Unit 09 FS/PP/IROD Cost Assessment 22-16

Table 22.4 WAG 1 Oper. Unit 09 RD Cost Assessment 22-26

Table 22.5 WAG 1 Oper. Unit 09 RA Cost Assessment 22-34

Table 23.1 WAG 1 Oper. Unit 10 Baseline Cost Assessment 23-4

Table 23.2 WAG 1 Oper. Unit 10 RI Cost Assessment 23-7

Table 23.3 WAG 1 Oper. Unit 10 FS/PP/IROD Cost Assessment 23-14

Table 23.4 WAG 1 Oper. Unit 10 RD Cost Assessment 23-24

Table 23.5 WAG 1 Oper. Unit 10 RA Cost Assessment 23-32

Table 24.1 WAG 1 Gunite Tank Closures 24-4

Table 28.1 Overall WAG 1 Baseline Cost Assessment 28-2

Table 28.2 WAG 1 AES Phase/Participant Summary Unescalated Dollars ($1000s) 28-3

LIST OF TABLES
(continued)

Page

Table 28.3 Early Action - Program Integration and Engineering - Construction Cost % 28-13

Table 28.4 Operable Unit - Program Integration and Engineering - Construction Cost % 28-14

ACRONYMS

ADS	Activity Data Sheets
A-E	Architect-Engineer
AEC	Atomic Energy Commission
AES	Automated Estimating System
ALARA	As Low as Reasonably Achievable
ARARs	Applicable or Relevant and Appropriate Requirements
BDR	Baseline Design Report
BNI	Bechtel National, Inc.
CDR	Conceptual Design Report
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFC	Certified for Construction
CFR	Code of Federal Regulations
Ci	Curie
CWBS	Contract Work Breakdown Structure
CYWPs	Current Year Work Plans
D&D	Decontamination and Decommissioning
DOE	The United States Department of Energy
DOE-HQ	DOE Headquarters
DOE-OR	DOE Field Office - Oak Ridge
DOT	Department of Transportation
DQOs	Data Quality Objectives
EA	Environmental Assessment
EIS	Environmental Impact Statement
EM	DOE-HQ Environmental Restoration Program
EPA	The United States Environmental Protection Agency
ER	Environmental Restoration Program
ERDS	Environmental Review and Documentation Section
ES&H	Environment, Safety, and Health
FFA	Federal Facilities Agreement
FONSI	Finding of No Significant Impact
FPD	Fission Product Development Laboratory
FR	Federal Register
FS	Feasibility Study
FS/EA	Feasibility Study/Environmental Assessment

ACRONYMS
(continued)

FS/PP/IROD	Feasibility Study/Proposed Plan/Interim Record of Decision
FY	Fiscal Year
GET	General Employee Training
GPA	GPA General Plant Administration
GPS	General Plant Services
HDPE	High-Density Polyethylene
HEPA	High-Efficiency Particulate Air
HVAC	Heating, Ventilating, and Air Conditioning
IROD	Interim Record of Decision
kVa	Kilovolt Ampere
kW	Kilowatt
LLLW	Low-Level Liquid Radioactive Waste
LLW	Low-Level Radioactive Waste
MMES	Martin Marietta Energy Systems, Inc.
mrem/h	Millirem per Hour
nCi/g	nanoCuries per gram
NEPA	National Environmental Policy Act
NESHAPs	National Emissions Standards for Hazardous Air Pollutants
NFA	no further action
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
NRWTP	Nonradiological Waste Treatment Plant
OD	Outer diameter
ORAU	Oak Ridge Associated Universities
ORNL	The Oak Ridge National Laboratory
ORR	Oak Ridge Reservation
OSHA	Occupational Safety and Health Act
OU	Operable Unit
PA	Preliminary Assessment
PA/SI	Preliminary Assessment/Site Investigation
PEIS	Programmatic Environmental Impact Statement

ACRONYMS
(continued)

PP	Proposed Plan
PPE	Personnel Protective Equipment
PSWBS	Project Summary Work Breakdown Structure
PVC	Polyvinyl Chloride
PWTP	Process Waste Treatment Plant
QA	Quality Assurance
QC	Quality Control
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act
RD	Remedial Design
RD/RA	Remedial Design/Remedial Action
RFIs	RCRA Facility Investigations
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCSR	Site Characterization Summary Report
SI	Site Investigation
SRD	System Requirements Document
SWMU	Solid Waste Management Unit
SWSA	Solid Waste Storage Area
TAG	Technical Advisory Group
TAL	Total Analyte List
TBC	To-Be-Considered Guidance
TCF	Technical Complexity Factor
TCL	Target Compound List
TDEC	Tennessee Department of Environment and Conservation
TDHE	Tennessee Department of Health and Environment
TM	Technical Memorandum
TRU	Transuranic
TSD	Transport, Storage, and Disposal
USRADS	United States Ultrasonic Ranging and Data System

ACRONYMS
(continued)

WAG	Waste Area Grouping
WBS	Work Breakdown Structure
WHPP	Waste Handling and Packaging Plant
WIPP	Waste Isolation Pilot Plant
WTP	Waste Treatment Plant

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EXECUTIVE SUMMARY

The purpose of this Oak Ridge National Laboratory (ORNL) Environmental Restoration (ER) Program Baseline Report is to provide a detailed plan for remediation of release sites that have the potential to adversely impact human health and the environment at Waste Area Grouping (WAG) 1, which is located within ORNL main plant area. The ORNL Resource Conservation and Recovery Act (RCRA) Facilities Assessment (ORNL, 1987) identified 167 Solid Waste Management Units (SWMUs) located within WAG 1. The ER Program has responsibility for management of remedial action activities associated with a portion of those SWMUs that are included in the ER Baseline. The SWMUs included in the ER baseline are grouped into ten Operable Units (OUs) that include underground steel and gunite tanks, surface impoundments, underground pipelines, a portion of White Oak Creek adjacent to the main plant area, former and suspected burial grounds, contaminated soils and shallow groundwater, and a number of inactive underground steel tanks located throughout the main plant area.

The primary function of the WAG 1 Baseline Report is to serve as a resource planning tool. The WAG 1 Baseline Report includes all phases of remediation activities consistent with the Federal Facility Agreement (FFA) and will be used in the development of Activity Data Sheets (ADSs), Current Year Work Plans (CYWPs), and similar documents for which the basis for cost and schedule must be rigorously documented. The WAG 1 Baseline Report is a "living" document that will be revised periodically through a change control procedure. Changes in programmatic funding, United States Department of Energy (DOE) policy, regulatory requirements, ER Program remediation priorities, and similar items will require timely adjustments. Changes to scope, cost, and schedule will be documented with the same rigor as the base case. As the WAG 1 project progresses from planning to implementation, the Baseline Report will become a project management tool evolving into the Baseline Design Report (BDR). An annual Baseline Summary Report will summarize all 21 WAG Baseline Reports and will document the current ORNL ER Program strategy.

This Baseline Report develops the technical scope, cost assessment, and integrated schedule for remediation of WAG 1 in accordance with the requirements of DOE (EM-40) *Draft Guidance for the Development of Environmental Restoration Program Baseline Reports* (November 22, 1991). The potential remedial actions and contingent actions were initially identified for ten operable units (OUs) in the WAG 1 Observational Approach Workshop in October 1991. The Observational Approach is a method endorsed by the United States Environmental Protection Agency (EPA) for developing remediation scenarios based on data sufficiency instead of data completeness. During preparation of this Baseline Report, however, an in-depth review of existing information revealed different conditions for which other approaches were more appropriate. Therefore, the remediation approach was modified in certain cases.

The scope of environmental restoration identified for WAG 1 in this Baseline Report includes seven Early Actions in addition to the ten OUs, as well as construction of support facilities required for implementation of remedial actions. The description of this scope of work; associated assumptions, risks and uncertainties; method of accomplishment; and schedule and cost assessment

are organized and presented in the following four summary elements: Project Management, Support Facilities, Early Actions, and OU Remediation. Fig. ES.1 presents the Work Breakdown Structure (WBS) summary for these elements and associated remediation phases.

Project Management includes such activities as independent certification, project integration, maintenance of the Baseline Report, technical review, engineering support, and development of overall WAG 1 project plans.

Support Facilities covers the design, construction, operation, and decommission of facilities (e.g., parking, personnel and equipment decontamination facilities and grout mixing and pumping facility) required to support the selected remedial actions.

The Early Actions proposed for WAG 1 are intended to accelerate the cleanup process [i.e., depending upon the final remedial alternative(s) selected] by controlling further releases of contamination to the environment and construction of infrastructure and/or procurement of equipment required to support remediation. They will be completed in the following five phases: (1) Planning, (2) Investigation/Feasibility or Treatability Study, (3) Design Procedures, (4) Implementation, and (5) Report. A brief description of each Early Action is provided below.

Early Action 1 is the construction of enclosure buildings equipped with overhead cranes to house remedial action activities for the tank farms located within WAG 1 and of a piping system to facilitate the eventual removal of standing water within the tanks before remediation is begun.

Early Action 2 includes the plugging of existing piping in order to control further inleakage and the removal of liquid from nine underground tanks located throughout WAG 1.

Early Action 3 is the installation new groundwater monitoring wells within WAG 1 to provide additional information regarding groundwater flow and quality and to characterize further groundwater movement through, out, and away from WAG 1.

Early Action 4 consists of the engineering development for treatability studies and the development of robotics capability for remediation of tanks containing radioactive waste located within the Tank Farm OU.

Early Action 5 involves the construction of an underground trench in order to capture, collect, and treat contaminated shallow groundwater as an interim action until the overall strategy for remediating shallow groundwater within WAG 1 is implemented.

Early Action 6 involves the construction of systems to intercept, collect, and treat contaminated groundwater that is infiltrating existing underground pipes and/or pipe trenches, which will continue until the strategy for migration of groundwater through these underground pipelines is implemented.

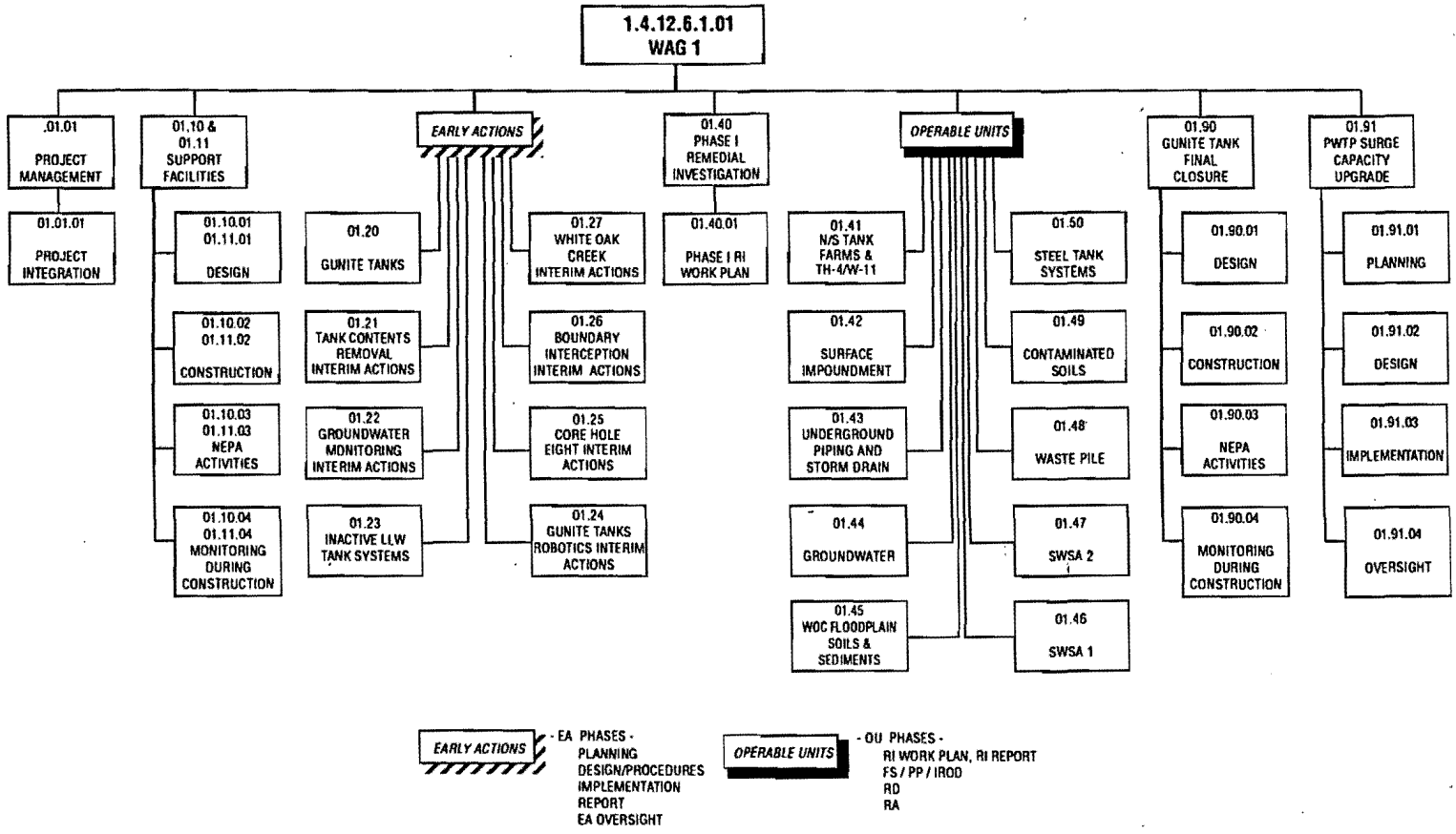


Fig. ES.1. WAG 1 Summary Level Work Breakdown Structure.

Early Action 7 consists of the removal and temporary stabilization of mercury-contaminated sediments in White Oak Creek flood plain to prevent further downstream migration.

The IRODs for remediation of the operable units (OUs) will be completed according to the established phases of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as outlined below. Three key schedule decisions had to be implemented for the Tank Farm OU so that construction may be started within 15 months of the signing of the IROD: (1) accelerated agency review cycles, (2) division of Remedial Design (RD) and Remedial Action (RA) activities between a Phase I Fast Track effort and a subsequent Phase II scope, and (3) preliminary work on RD/RA activities that would be initiated "at risk" (i.e., before final agency approvals were received on previous submittals). The remaining OUs have the same schedule decisions, except the RD/RA activities are not divided into two phases; however in some cases engineering design and procurement of equipment may be initiated at risk. The CERCLA process as applied to the WAG 1 OUs is as follows:

- Remedial Investigation — Includes completing nonintrusive surveys; groundwater, surface water, sediment, and soils investigations; a baseline risk assessment; alternatives screening; and a Remedial Investigation (RI) Report.

- Feasibility Study — Includes the screening of remedial technologies, developing and analyzing remedial alternatives, preparing National Environmental Policy Act (NEPA) documentation activities, and preparing a Feasibility Study/Environmental Assessment (FS/EA) report.

- Proposed Plan — Includes developing the Proposed Plan (PP), attending and preparing for public meetings, and responding to comments.

- IROD — Includes completing the application for an IROD.

- RD Efforts — Include engineering studies, Title I and Title II design, and Phase I Fast Track and Phase II Design Reports (for OU1 only).

- RA Activities — Include Phase I Fast Track and Phase II RA activities for OU1, as well as remedial activities for the remaining OUs. A brief description of each OU follows.

Operable Unit 1 consists of the underground steel and gunite tanks associated with the tank farms located in the center of the ORNL main plant area. Phase I involves the removal of liquids and tank decontamination/closure for those tanks only containing liquids. Phase II for the remaining tanks involves the removal of liquids overlying the sludges, in-place treatment of sludges using solidification with portland cement based grout, and tank closure. The RAs for both phases will be conducted remotely using robotics to minimize the occupational radiation exposure dose to workers.

Operable Unit 2 includes the four surface impoundments located at the south end of the main plant area. The proposed action is in-place treatment using an auger-type mixing device suspended from an overhead crane to mix portland cement based grout with the sludges, followed by capping.

Operable Unit 3 includes the underground piping, pipe trenches, and storm drains. As additional outfalls or pipelines crossing the WAG boundary are identified, measures will be taken to intercept, collect, and treat contaminated groundwater as a continuation of Early Action 6.

Operable Unit 4 is the contaminated shallow groundwater underlying WAG 1. The proposed RA will extend the collection of contaminated groundwater from sources identified in Early Action 5 to other sources established in the RI Report.

Operable Unit 5 encompases the contaminated soil and sediments in the portion of White Oak Creek located in WAG 1. As a follow-on activity to Early Action 7, the proposed RA includes additional measures to provide permanent reduction of contaminant migration off-WAG.

Operable Unit 6 is the Solid Waste Storage Area (SWSA) 1 burial facility for which construction of a slurry wall and cap is proposed.

Assumptions were made in the cost assessments for Operable Units 7 (SWSA 2) and 8 (Waste Pile) that the IRODs approved by EPA would specify no further action (NFA), so no costs were included in the ER baseline for remedial action.

Operable Unit 9 contains all the contaminated soils underlying various portions of WAG 1. The remediation costs include removal and treatment of mercury-contaminated soils at an offsite facility, in-place treatment of other contaminated soils, and construction of a cap.

Operable Unit 10 contains the remaining underground steel tanks located throughout the main plant area which must be properly characterized and then closed.

Fig. ES.2 and Table ES.1 summarize all elements and phases of WAG 1 remediation activities for the next 27 years, including project management milestones and primary regulatory milestones. Table ES.2 presents the baseline costs by fiscal year (FY) for each of the remediation elements along with the costs for General Plant Administration/General Plant Services (GPA/GPS) contingency, contingent actions, and risks and uncertainties. These costs total $917,714,000.

The WAG 1 Baseline Report is comprised of four volumes. Volume 1 describes all elements and phases of remedial activities in specific chapters and sections and includes figures and tables as required to document the assumptions for planning and implementing the proposed actions. Volumes 2, 3, and 4 contain the following five appendices: Appendix A (WBS Dictionary), Appendix B (Schedule Details), Appendix C (Cost Assessment Details), Appendix D (Waste Management), Appendix E (Infrastructure Requirements - to be added in FY 1993), and Appendix F (TCF Methodology).

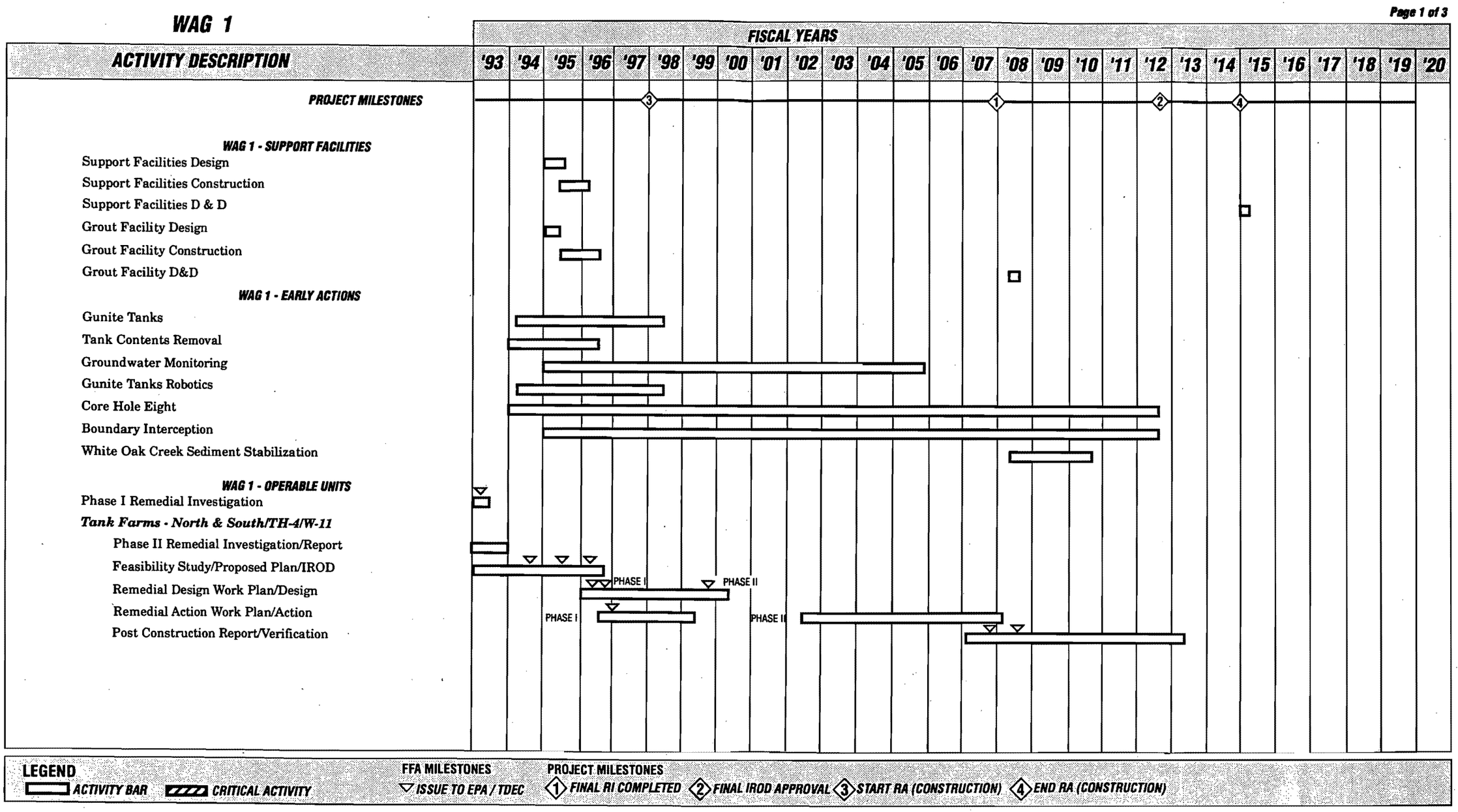


Fig. ES.2. WAG 1 Summary Schedule.

PASTE-UP SIDE
LASER PLUS
HAMMERMILL LASER

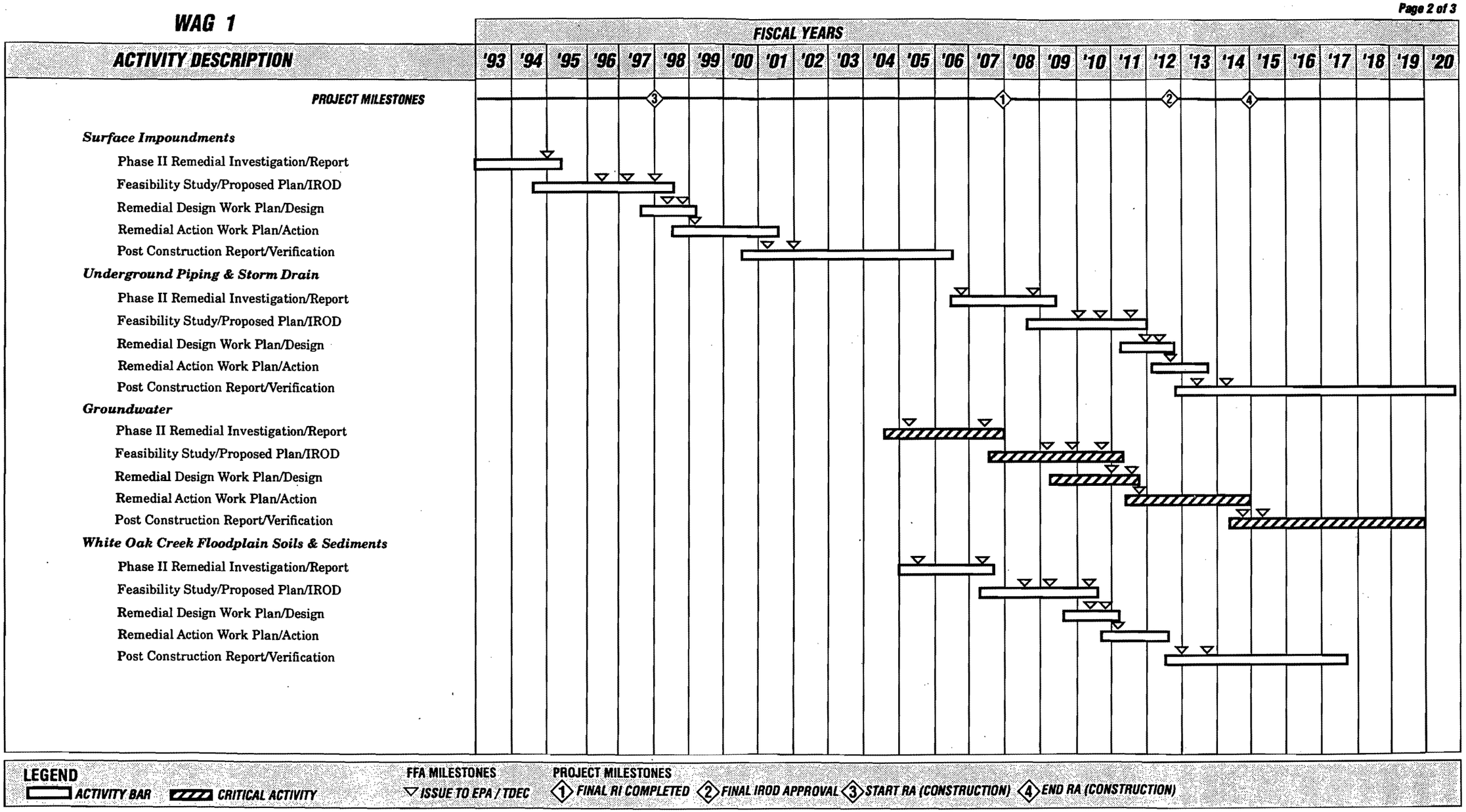


Fig. ES.2. WAG 1 Summary Schedule (continued).

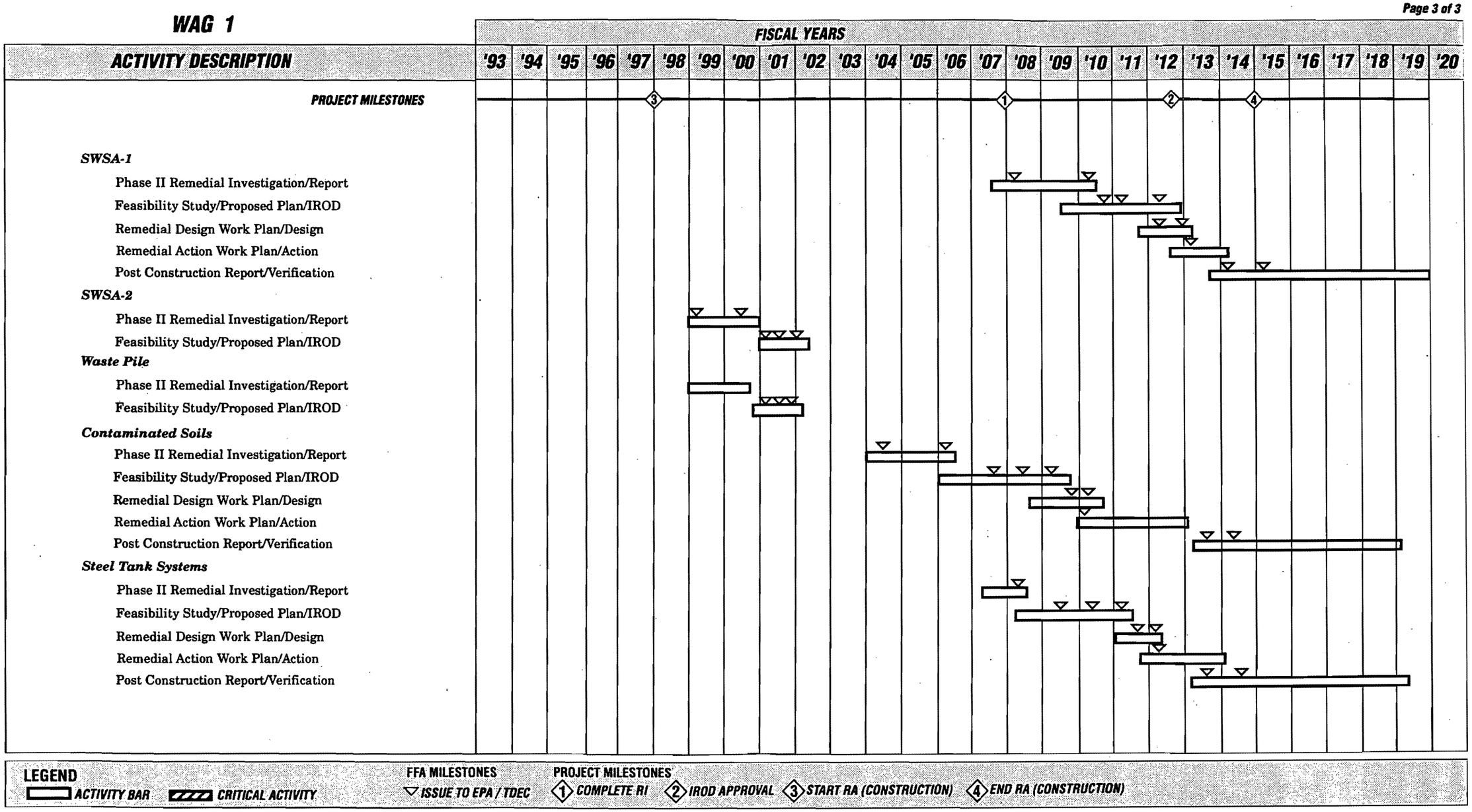


Fig. ES.2. WAG 1 Summary Schedule (continued).

TABLE ES.1. WAG 1 Milestones Summary

PROJECT MANAGEMENT MILESTONES	OU 1	OU2	OU3	OU4	OU5	OU6	OU7	OU8	OU9	OU10
• Complete Remedial Investigation	SEP 1993	JAN 1995	JAN 2009	OCT 2007	AUG 2007	APR 2010	SEP 2000	AUG 2000	MAY 2006	SEP 2008
• Interim Record of Decision	JUN 1996	MAR 1998	SEP 2011	OCT 2010	APR 2010	APR 2012	JAN 2002	JAN 2002	JUN 2009	APR 2011
• Start of Remedial Action	SEP 1997	MAY 1999	NOV 2012	JAN 2012	JUN 2011	JUL 2013	N/A	N/A	AUG 2010	JUL 2012
• End of Remedial Action	NOV 2007	APR 2001	JUL 2013	OCT 2014	FEB 2012	JUL 2014	N/A	N/A	OCT 2013	OCT 2013
PRIMARY REGULATORY MILESTONES										
• Remedial Investigation Work Plan Supplement	DEC 1992	N/A	DEC 2006	APR 2005	JUL 2005	MAY 2008	DEC 1998	DEC 1998	JUL 2004	N/A
• Remedial Investigation Report	N/A	JAN 1995	JAN 2009	OCT 2007	AUG 2007	APR 2010	SEP 2000	AUG 2000	MAY 2006	SEP 2008
• Feasibility Study Report	DEC 1994	AUG 1996	MAR 2010	APR 2009	SEP 2008	OCT 2010	MAY 2001	APR 2001	NOV 2007	OCT 2009
• Proposed (Remedial Action) Plan	SEP 1995	JUN 1997	DEC 2010	JAN 2010	JUL 2009	JUL 2011	AUG 2001	JUL 2001	AUG 2008	JUL 2010
• Interim Record of Decision	JUN 1996	MAR 1998	SEP 2011	OCT 2010	APR 2010	APR 2012	JAN 2002	JAN 2002	JUN 2009	APR 2011
• Remedial Design Work Plan	OCT 1996	JUL 1998	FEB 2012	MAR 2011	SEP 2010	SEP 2012	N/A	N/A	OCT 2009	SEP 2011
• Remedial Design Report	NOV 1996[1]	DEC 1998[1]	JUN 2012	AUG 2011	JAN 2011	FEB 2013	N/A	N/A	MAR 2010	FEB 2012
• Remedial Action Work Plan	MAR 1997	APRIL 1999	OCT 2012	DEC 2011	MAY 2011	JUN 2013	N/A	N/A	JUL 2012	MAY 2012
• Remedial Design Report	MAR 2000[2]	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
• Post Construction Report	OCT 2008	MAR 2002	JUN 2014	SEP 2015	DEC 2012	MAY 2015	N/A	N/A	SEP 2014	SEP 2014
• Five Year Review Plan	NOV 2007	APR 2001	JUL 2013	OCT 2014	FEB 2012	JUL 2014	N/A	N/A	OCT 2013	OCT 2013

[1] **PHASE I**
[2] **PHASE II**

TABLE ES.2
Overall WAG 1 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																												
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Project Integration	1,423	1,444	1,669	2,047	2,537	3,180	3,892	4,700	5,570	6,457	7,192	7,600	7,663	7,462	6,953	5,966	4,958	4,295	3,768	3,139	2,253	1,658	385	0	0	0	0	0	96,211
Support Facilities 01	0	0	7,672	6,395	195	344	520	732	957	1,195	1,444	1,696	1,932	2,090	2,136	2,055	1,865	1,595	1,270	817	381	123	619	0	0	0	0	0	36,033
Support Facilities 02	0	0	876	7,402	0	0	0	0	0	0	0	0	0	0	0	217	0	0	0	0	0	0	0	0	0	0	0	0	8,495
Early Action 01	0	340	3,603	6,120	8,999	1,057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20,119
Early Action 02	0	218	1,780	3,449	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,446
Early Action 03	0	0	753	844	1,080	2,059	3,186	4,325	5,123	4,901	3,759	1,968	710	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,707
Early Action 04	0	197	6,764	12,028	21,042	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40,038
Early Action 05	0	178	417	61	116	183	266	354	446	538	628	692	707	670	587	475	330	158	47	44	0	0	0	0	0	0	0	0	6,898
Early Action 06	0	0	404	1,428	144	284	453	650	859	1,087	1,310	1,501	1,597	1,552	1,384	1,137	817	392	112	60	0	0	0	0	0	0	0	0	15,172
Early Action 07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	276	1,827	3,891	0	0	0	0	0	0	0	0	0	0	5,995
Phase I Remed. Investig.	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54
Operable Unit 01	3,157	1,188	897	3,602	1,174	4,213	2,463	902	792	2,572	6,838	3,676	4,862	4,213	1,674	221	312	564	539	270	176	0	0	0	0	0	0	0	44,306
Operable Unit 02	289	1,086	2,114	3,109	374	1,798	814	3,177	2,300	168	351	643	494	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,046
Operable Unit 03	0	0	0	0	0	0	0	0	0	0	0	0	0	2,218	5,135	4,041	1,950	547	1,939	2,218	8,480	475	411	411	411	596	0	0	28,834
Operable Unit 04	0	0	0	0	0	0	0	0	0	0	0	334	4,353	6,910	4,701	1,832	616	1,633	2,493	1,080	4,022	3,695	723	411	411	411	699	0	34,325
Operable Unit 05	0	0	0	0	0	0	0	0	0	0	0	0	742	1,365	1,941	906	334	1,861	3,347	3,583	433	411	411	411	390	0	0	0	16,136
Operable Unit 06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	312	1,512	2,385	1,817	451	781	790	3,180	393	329	329	329	534	0	13,142
Operable Unit 07	0	0	0	0	0	0	1,174	1,193	938	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,367
Operable Unit 08	0	0	0	0	0	0	1,526	1,968	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,542
Operable Unit 09	0	0	0	0	0	0	0	0	0	0	0	1,140	2,840	2,909	772	364	22,340	8,667	15,262	20,909	28,743	3,310	411	411	411	555	144	0	109,189
Operable Unit 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	550	1,471	856	334	1,827	971	3,990	726	313	313	313	313	367	0	12,347
Gunite Tank Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,406	7,638	12,950	47,808	42,530	6,237	537	0	0	123,106
PWTP Surge Capacity Upgrade	0	2,193	1,140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,333
SUBTOTALS	4,924	6,844	28,090	46,484	35,661	13,125	14,295	18,002	17,032	16,979	21,523	19,249	25,901	29,718	26,146	20,472	38,592	25,752	31,056	39,279	56,906	26,529	51,474	44,818	8,504	2,742	1,744	0	671,841
Contingency	1,302	1,222	7,008	13,935	11,346	4,092	4,354	5,512	5,237	5,212	6,521	5,886	8,228	9,610	8,382	6,389	13,865	8,675	10,471	13,346	19,250	8,316	15,518	13,561	2,674	942	571	0	211,426
SUBTOTALS	6,225	8,065	35,098	60,419	47,007	17,217	18,649	23,514	22,270	22,191	28,044	25,135	34,129	39,329	34,528	26,861	52,457	34,427	41,527	52,625	76,155	34,845	66,993	58,379	11,178	3,684	2,316	0	883,268
Contingent Action																													34,447
TOTAL																													917,714

1.0 WAG 1 INTRODUCTION

Oak Ridge National Laboratory (ORNL) is one of three major facilities (Fig. 1.1) located in Oak Ridge, Tennessee, operated for the United States Department of Energy (DOE) by Martin Marietta Energy Systems, Inc. (MMES). Waste Area Grouping (WAG) 1 is located within the main plant area at ORNL (Fig. 1.2).

WAG 1 contains a number of inactive facilities and active facilities where ongoing research programs are being conducted. The Environmental Restoration (ER) Program currently includes a number of inactive facilities and release sites that include gunite and steel tanks containing Liquid Low-Level Radioactive Waste (LLRW), surface impoundments, former land burial sites, underground pipelines, contaminated shallow groundwater, contaminated soils, and a portion of White Oak Creek. Contaminants that have been identified are radionuclides, organic compounds, and metals, but the specific nature and extent of contamination is undefined. Because of the potential threat to human health and the environment by hazardous and radioactive wastes in WAG 1, it has been included in the ORNL ER Program.

The following sections outline the purpose and scope of this report and describe the regulatory requirements assumed in developing the baseline cost assessment and the schedule for environmental restoration of WAG 1.

1.1 PURPOSE OF REPORT

The purpose of this Baseline Report is to describe the currently planned remedial activities, the associated assumptions, risks and uncertainties, method of accomplishment, and schedule and cost assessment for integration into the ORNL ER Program planning and management process.

The Baseline Report will be reviewed and revised annually or at designated times during the planning and early phases of the project. Fig. 1.3 presents a comparison of the phases of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process, the phases of a typical engineering project, the types of estimates appropriate for each phase, and the designated times when the Baseline Report will be revised. Obviously, as the project matures, the level of detail and refinement of the cost assessment will increase. In the early phases assumptions are made that will be replaced by design criteria in the later phases.

The WAG 1 Baseline Report comprises three volumes. Volume 1 contains the main text of the report, providing information about WAG 1, descriptions of the scope of work, associated assumptions, risks and uncertainties, and schedule and cost assessment for the phases of remediation. Volumes 2, 3, and 4 are composed of five appendices that contain the detailed backup for various components of the Baseline Report.

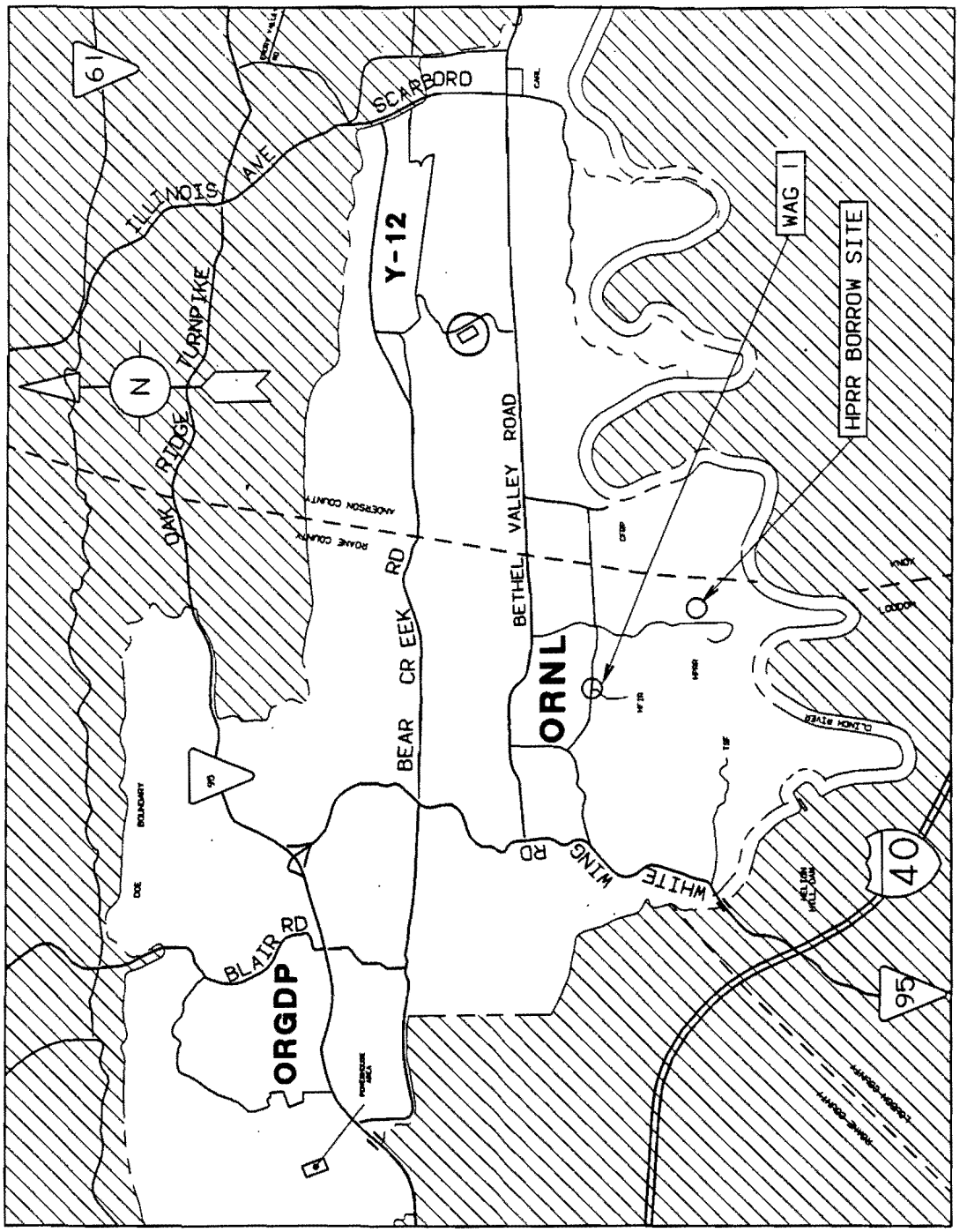


Fig. 1.1. Oak Ridge Reservation.

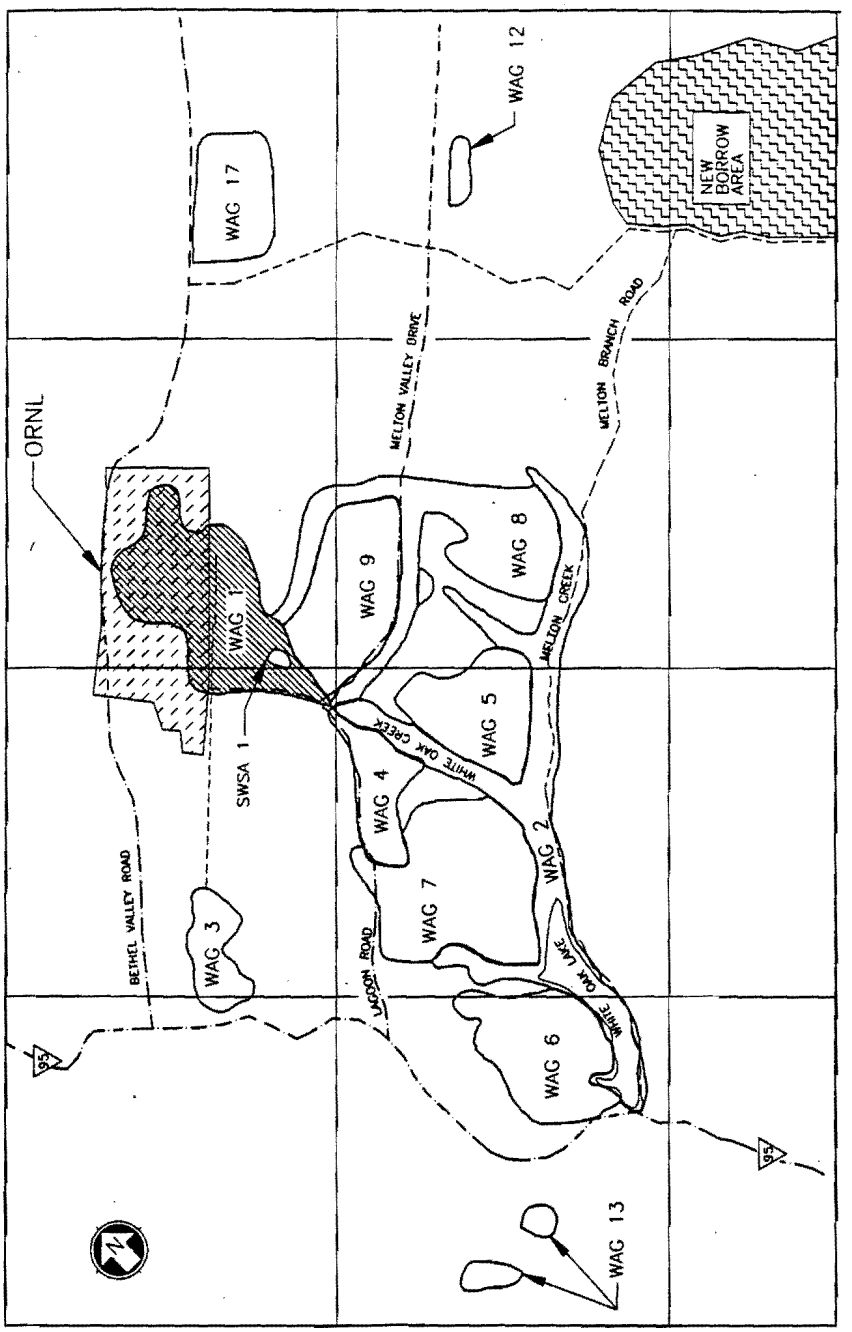


Fig. 1.2. ORNL Waste Area Groupings.

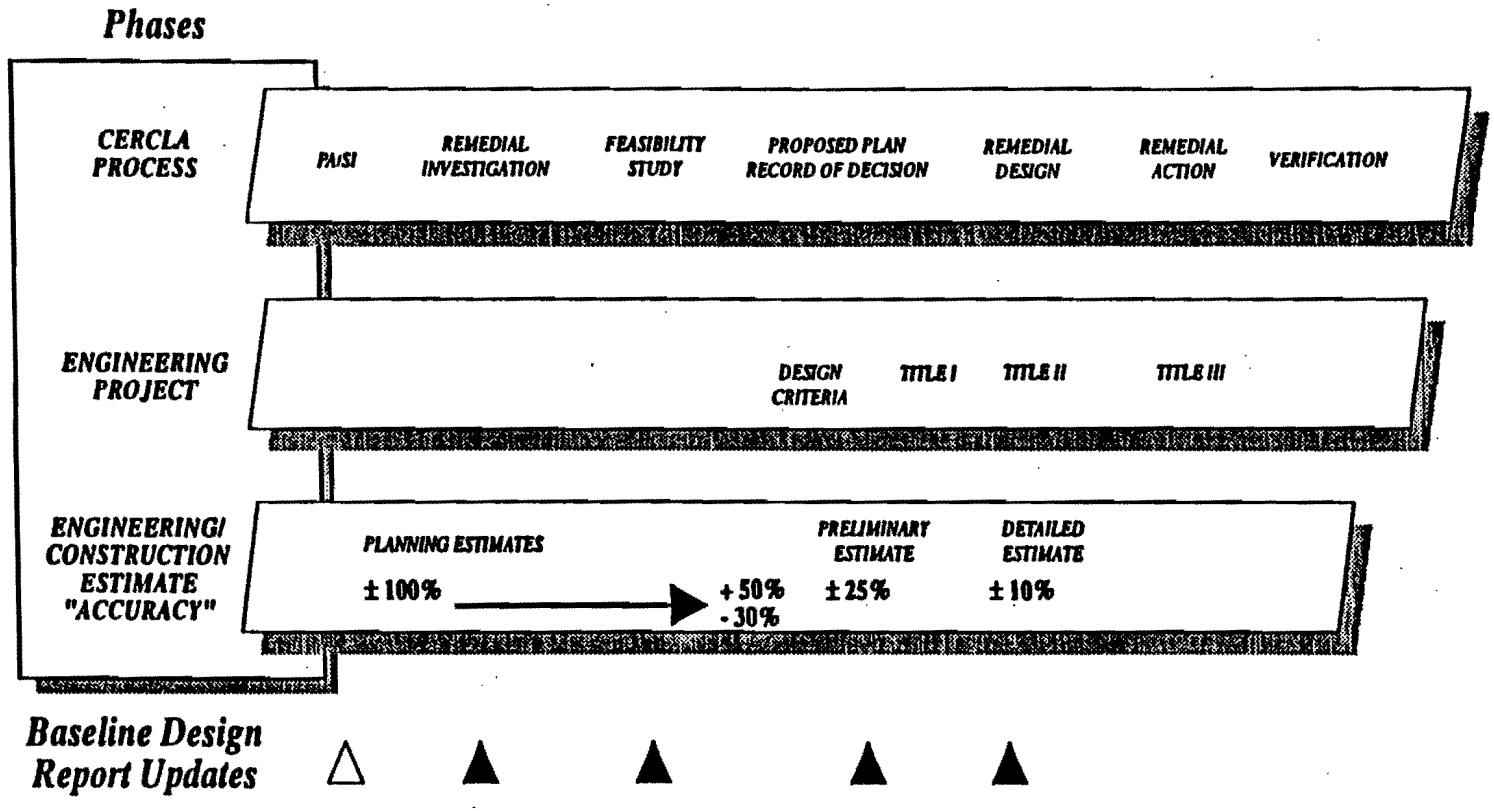


Fig. 1.3. Comparison of CERCLA Process, Phases of Typical Engineering Project, Types of Estimates, and Baseline Report Update.

This introduction chapter provides background information on the observational approach used for developing remediation scenarios and the regulatory requirements that apply to the remediation of release sites in WAG 1.

Chapter 2.0 provides a brief summary of background information for WAG 1 including descriptions of the current conditions, release sites, and the overall scope of work for remediation of WAG 1, specifically outlining the proposed approach and method of accomplishment.

The next 23 chapters contain the scope, associated assumptions, risks and uncertainties, interfaces, schedule, and cost assessment for the summary elements identified for WAG 1. Chapter 3.0 presents the scope, associated assumptions, risks and uncertainties, and interfaces for Project Integration efforts required by MMES for project management and by subcontractors for general project support. Chapter 4.0 describes the design tasks, permitting requirements, construction activities, operation, monitoring, and decontamination and decommissioning (D&D) efforts for the support facilities required to implement remedial actions. Chapters 5.0 through 12.0 discuss the Early Actions proposed for WAG 1. Chapter 13.0 describes Phase I Remedial Investigation (RI) activities for WAG 1. Chapters 14.0 through 23.0 contain the descriptions of the Phase II RI, the Feasibility Study/Proposed Plan/Interim Record of Decision (FS/PP/IROD), Remedial Design (RD), and Remedial Action (RA) activities for remediation of the ten operable units (OUs). Both a proposed action based on expected conditions, and a contingent action, as applicable, are identified. Chapter 25.0 discusses activities associated with final closure of the gunite tanks in the Tank Farm OU that contain sludge. Chapter 26.0 provides a brief discussion of a proposed surge capacity upgrade for the Process Waste Treatment Plant (PWTP).

The remaining four chapters contain supporting documentation for the baseline report. Chapter 26.0 presents a summary of the risks and uncertainties associated with WAG 1 remediation efforts including the development of a contingency analysis based on uncertainties and unforeseen unpredictable conditions. Chapter 27.0 outlines key assumptions and presents the summary schedule for WAG 1 based on a detailed network logic schedule, which is prepared for each phase of remediation. Chapter 28.0 summarizes the WAG 1 baseline cost assessment and lists the typical assumptions used to estimate construction costs. References used in the development of this report are listed in Chapter 29.0.

Appendix A presents the proposed Work Breakdown Structure (WBS) Dictionary which defines the objective, scope, deliverables, and participants for each WBS element identified for the WAG 1 remediation efforts. Appendix B contains the detailed schedules for all phases of remediation for each WBS element identified. Appendix C contains the Phase/Participant Report, Cost Schedule Report, five Automated Estimating System (AES) Summary Reports, Contingency Report, and the Detail Report. Appendix D provides information concerning the types of waste generated during each remedial activity, approximate generation dates, and final disposition of the waste. Appendix E will be provided in FY 1993 and will contain a discussion of infrastructure requirements needed to support remediation of WAG 1. Appendix F presents the Technical

Complexity Factor (TCF) used in assessing costs for various Remedial Investigation/Feasibility Study (RI/FS) activities.

1.2 BACKGROUND

As part of the DOE Headquarters (DOE-HQ) ER Program, the ORNL ER Program has been tasked by DOE Order 4700.1 to develop a long-range plan for remediation of areas or facilities contaminated by past activities, including waste disposal. This plan will develop an integrated technical scope, schedule, and cost assessment baseline for all activities required to complete environmental restoration over the lifetime of the program. All assumptions used to develop the scope, schedule, and cost assessment are documented sufficiently to validate the plan, explain variances, and justify changes as the plan is implemented. The ORNL plan is intended to include all phases of remediation activities from Preliminary Assessment/Site Investigation (PA/SI) through RA and monitoring and verification consistent with the Federal Facility Agreement (FFA) for all WAGs as well as other activities, such as site characterization and program management. The plan will reflect program priorities and include all DOE participating contractors and subcontractors and will be used to support preparation of program documents such as Activity Data Sheets (ADSs), Element of Cost Sheets, Current Year Work Plans (CYWPs), and budgets. It will also be used as a tool to evaluate impacts of changing priorities and funding. The plan will vary in level of refinement (e.g., year one versus out years) and will incorporate quantitative and qualitative uncertainties associated with the estimates of scope, schedule, and cost assessment. The plan will be a "living" document, which is revised on an annual basis. Fig. 1.4 summarizes the approach and sequence of activities for development of the ER Program long-range plan.

A Life Cycle Costing Workshop was conducted in October 1991 using the Observational Approach to develop remediation scenarios for WAG 1 (Fig. 1.5). The remediation scenarios developed for each remedial grouping and presented as general response actions, expected conditions and potential deviations were identified in Tables 1.1 through 1.11. Potential deviations were addressed by contingent actions.

The Life Cycle Costing Workshop remediation scenarios were prepared based on certain assumptions about site conditions and the nature and extent of contamination known at that time. The workshop identified ten OUs, but no Early Actions were identified in the workshop. However, during preparation of this report, decisions were made to (1) reorganize the OUs so that the three OUs identified for the North Tank Farm, South Tank Farm, and TH-4/W-11 were combined into one OU and the combined OU for SWSA 1, 2, and Waste Pile was separated into three OUs, (2) modify several of the proposed RAs in light of new information about the applicability of remediation technologies, and (3) separate out discrete components of several Remedial Actions as Early Actions to facilitate scheduling and funding.

Several RAs were identified for the Tank Farm OU but only one (grout/cement sludge) was selected for baseline estimating purposes. The contingent action identified in the workshop was to

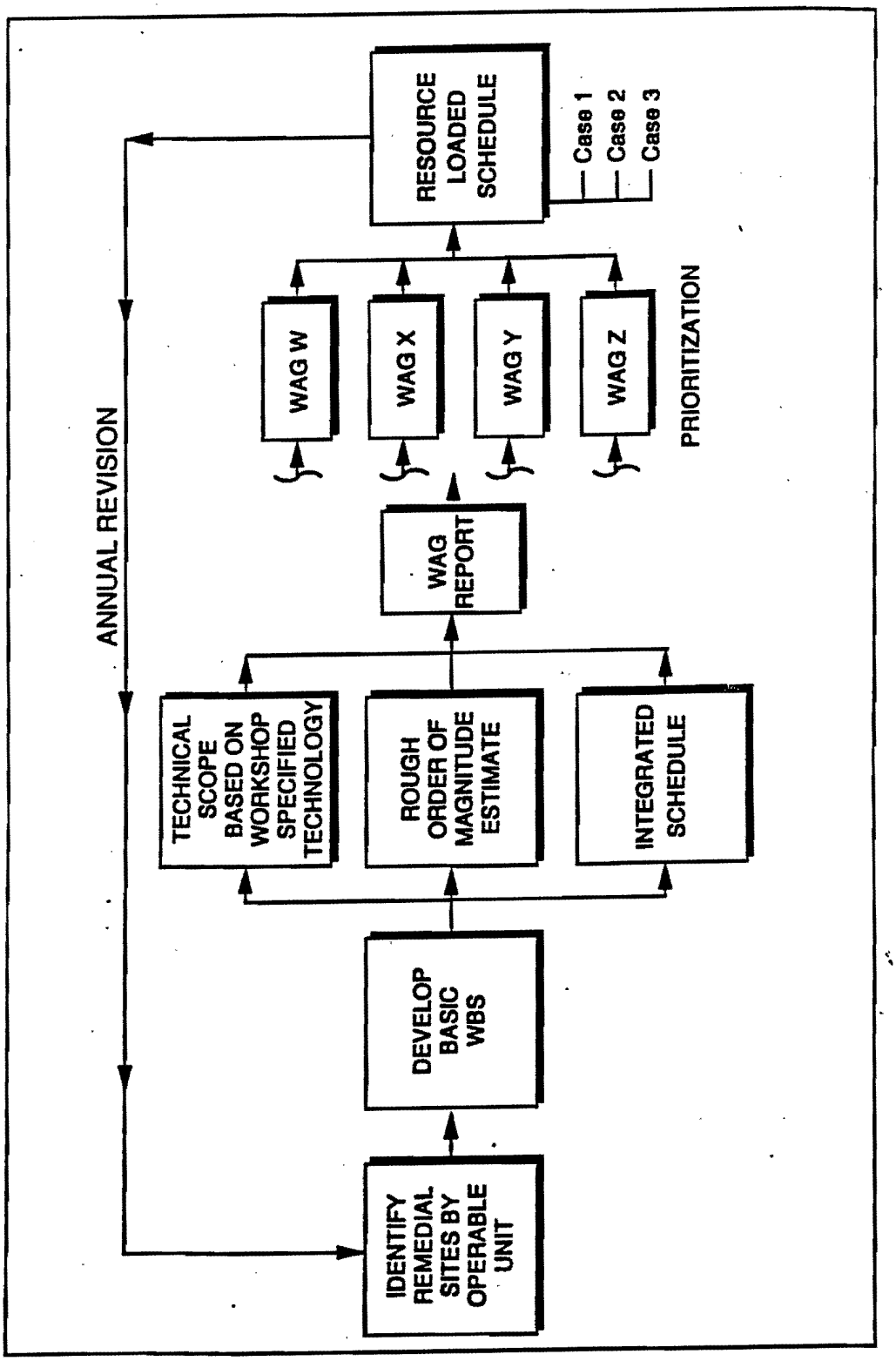


Fig. 1.4. ORNL ER Program Baseline Process.

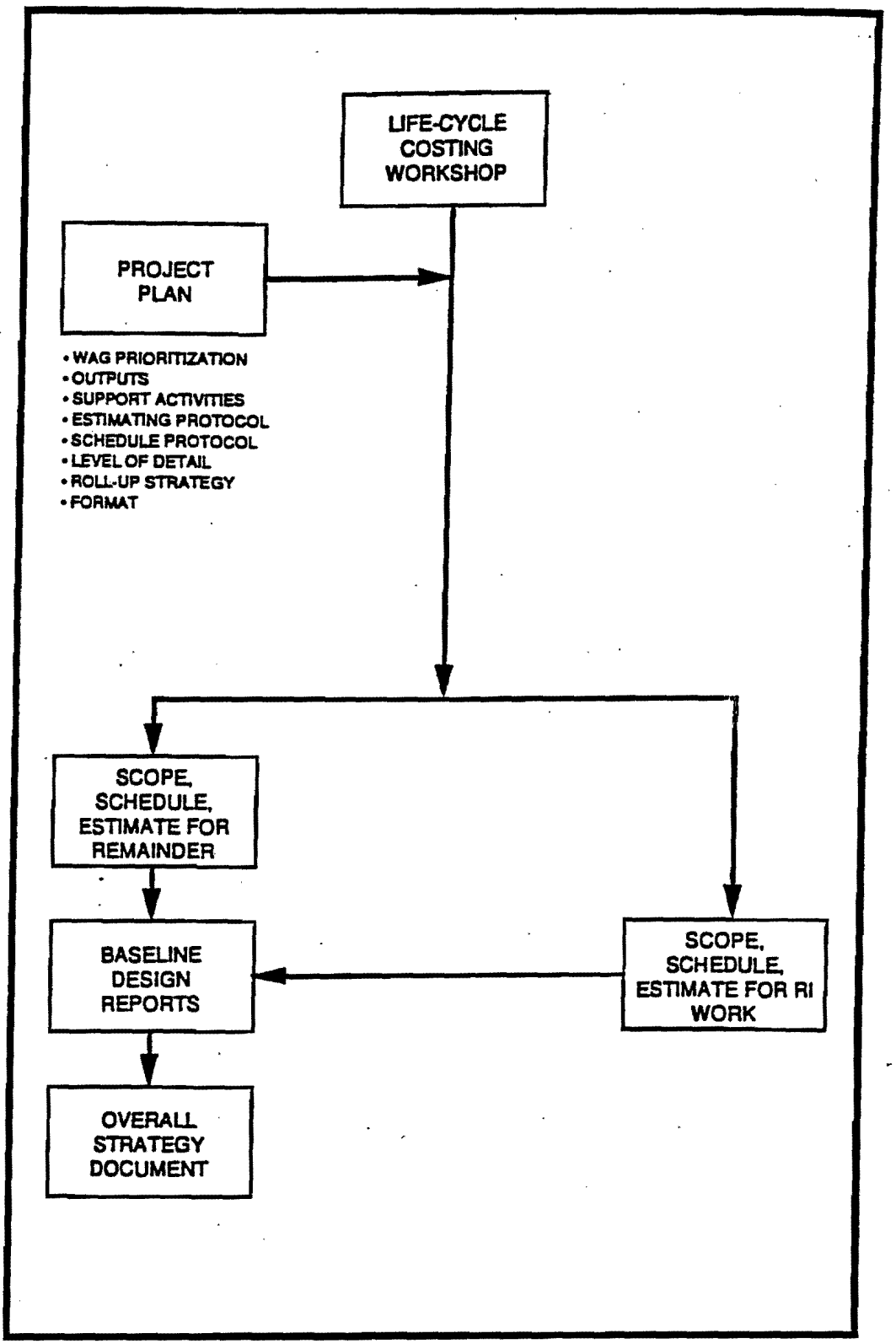


Fig. 1.5. Life Cycle Costing Workshop Process.

TABLE 1.1.
Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: Removal Actions

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Remove liquids	Tank-level trend data Sample and analyze for evaporator acceptance Determine integrity of existing piping system (planned tests in 1-2 years will only look at active system) Identify/control inleakage sources	The liquid meets the acceptance criteria of the existing evaporator Storage volume for the bottoms is available The liquids can be transferred to the evaporator through existing pipes or by trucking Inleakage is controlled/eliminated	Liquid is not acceptable to the evaporator No storage/disposal capacity Inleakage is not controlled	Characterization of liquid as removed Monitor inleakage	Build new treatment and storage capacity Install new piping systems (e.g., temporary two-walled pipe system to connect with active system) Prevent/control inleakage
Remove sludge	Sludge physical characterization Radionuclide characterization for shielding design Treatability studies (e.g., size reduction, vacuum technology, sluicing) Research on remote removal techniques	Sludge treatment has been selected an a storage site identified Liquid has been removed via sluicing, mechanical, or chemical techniques, (e.g., high pressure jets, grinding, or acid mobilization) Sludge is expected to be heterogeneous and difficult to pump	No sludge storage site is identified Sludge (some or all) cannot be removed without significant damage to tank	Video monitoring of operations Health physics monitoring Waste acceptance criteria and storage site	Remove sludge to extent possible; then grout in situ Tank removal

TABLE 1.1. (continued)
Summary of Data Needs for North and South Tank Farm
Observational Approach Workshop: Removal Actions

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Remove gunite tanks	Structural analysis of tank to determine removal method (concern with dome or side-wall failure) Radiation levels in tanks using core samples Full radiological characterization of surrounding soil Shell contamination Note: This information could be collected during the FS process	The liquid and most of the sludge has been removed An enclosure with radiation shielding is provided. This enclosure is temporary and is not governed by the DOE general design criteria (6430.1A) The surrounding soils are not removed A disposal site is identified	Contents were not removed because there is insufficient disposal/storage capacity DOE 6430.1A applies Total removal of tanks and contaminated soil is required	Radiation levels	In situ treatment or new capacity
Remove steel tanks	Radiological characterization of shell and surrounding soil	Tanks are empty Decontamination facility and disposal site are identified			

TABLE 1.2.
Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: In Situ Actions

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Grout/cement sludge in place	Risk assessment and ALARA to show that in situ stabilization is preferable to removal	Permits aer obtained. Too risky to transport to WIPP and in situ closure approved.	Permit status changes	Process controls	
	Characterization of sludges and liquids (e.g., aluminum and sulfates; solubility vs pH; inventory of TRU wastes; determine if curium-244 is TRU)	Sludge is non-homogenous but mixable (sludge can be mobilized via breakup and suspension)	Sludge cannot be mixed	Test grout mix while solidying	Modify the mix or technologies to improve mixing and setting
	Treability tests with actual sludge samples to develop mix	A temporary secondary containment building may be required during operations	Sludge samples were not representative and the mix does not set (e.g., noncompatability due to salt content, pH, solids density, acid and water solubility, inert solids in suspension, rheological properties).	Take core samples to test solid for leach rate	If leach rate is not acceptable, build containment walls around area
	Research hydrofracture performance data for the sluiced material			Long-term groundwater monitoring	
	Durability of grout mixtures (Leach Index: 10 CFR 61: Leaching tests: ANS 16.1)		The leaching characteristics of the set mix are not acceptable	Air monitoring stations during operations	
	Roger Gilchrist (Hanford) is collecting data for all USTs--all DOE inst.			Institutional controls over access	

TABLE 1.2 (continued)
Summary of Data Needs for North and South Tank Farm
Observational Approach Workshop: In Situ Actions

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Grout/cement tanks in place	Geotechnical survey Mapping of utilities in area Structural analysis for tank removal and placement	Permits are obtained Action is applicable whether sludge has been removed or is included in the tank grouting Perhaps reduce volume of grouted area by removing smaller tanks and placing them in larger tanks before grouting	Permit status changes Voids or fissures in area open to tank	Long-term groundwater monitoring	
In situ vitrification: tank contents left "as-is"	Predict/prepare for ISV "products" (e.g., off-gases, volatiles) Treatability study	Recognize hazard during melt cycles Tanks are dry (e.g., requirement to dry the tanks by evaporator) Isolate tanks from inleakage Fill tanks with cullet	Loss of control of off-gases Air handling system may break down	Process control Monitor air emissions and pressure and temperature in tank	Temporary break in operations Shutdown of process; evacuation of area Build containment to control environment
In situ vitrification: without contents	Pump contents into new LLLW line to Melton Valley	Clean walls and fill Leave "as-is" and fill			
In situ vitrification: Consolidate contents into one tank					

TABLE 1.3.
Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: Tank Management

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
No action	Risk assessement	Approval obtained	Tank failure	Groundwater	Stabilize in place Build confinement structure
Containment building over tanks: a near-term action to stop rain water infiltration and mitigate the effects of a tank failure	Determination of the design criteria (requirements will effect size and cost) Location of all utilities in the building area Soil investigation do determine suitability for building construction Radiological characterization for shielding and remote operations design			Radiation levels inside building during remediation	
Fill tanks with sand to mitigate tank collapse and prepare for future in situ vitrification	Structural assessment of tanks to determine if sand can be added and if it improves integrity	The tank liquids have already been removed and inleakages have been stopped			

TABLE 1.3. (continued)
Summary of Data Needs for North and South Tank Farm
Observational Approach Workshop: Tank Management

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Stop inleakage by -plugging old lines and using new lines for transfers -capping to exclude rain infiltration -continuing to maintain dry-well collection system -shutting off off-gas system to eliminate the negative pressure produced by the off-gas system -diverting surface water flow from storms	Determine the sources of inleakage and perform a water balance study by: -measuring vertical distributions of head (w/multiport wells) including unsaturated zone -exact location of pipes entering tanks -obtaining continuous record of precipitation -measuring pumping withdrawal from dry wells (perhaps dye tracer tests to determine flow percentages from given dry wells) -mapping storm surface water using topographical surveys and field investigations -measuring water table during storms -studying storm inleakage using video monitors	Groundwater table elevation is below level of concern for inleakage Lateral inflow of stormwater and perch GW is not significant	Groundwater enters tanks Lateral stormflow supplies inleakage	Improve (e.g., make continuous) liquid-level monitoring in tanks Conduct shallow zone monitoring of soil-water pressure (e.g., tensiometers) Use multi-level GW head monitors above bedrock Monitor water level in dry wells Estimate potential volumes of infiltration using plastic sheeting over tanks	Install/line storm drains Install cutoff/low-permeability walls to slow or divert lateral flow Use GW pumping to suppress water table near tanks Install intercept/collection trenches

TABLE 1.4.
Summary of Data Needs for North and South Tank Farm Observational Approach Workshop: Offsite Disposal

Remedial Action	Immediate Data Needs	Long-Term Data Needs
Offsite disposal	Interface with ORNL WMD to evaluate adequacy of current liquid/sludge data against current waste acceptance criteria (WAC) Interface with ORNL WMD to evaluate current liquid/sludge capacity and schedule for future capacity expansion Evaluate currently available solid waste volume projections for adequacy and validity of assumptions (look at _1986 PEER study first--are assumptions still valid?)	Evaluate critically aspects of sludges (may be an immediate, albeit proforma issue) Additional sludge charactization (perhaps better done once removal or mixing operations have begun): • Improve statistical validity • TCLP Assuming tanks and soil removal: • Radiological and TCLP analyses on tank shells (especially concrete) • Radiological and TCLP characterization on soils Volume of contaminated soils surrounding tanks that would have to be handled and disposed

TABLE 1.5.
Summary of Data Needs for WAG 1
Operable Unit 1D: Surface Impoundments

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Treatment of water	Characterize water	Can be treated at PWTP	Cannot use PWTP	Sample water	Pretreat waste: evaporation, etc.
Containment: dewater sludge and stabilize; backfill impoundment and cap	Collect sludge samples for vendor demo; remove sludges	Sludge can be stabilized	Sludge cannot be stabilized	Monitoring WAC	

TABLE 1.6.
Summary of Data Needs for WAG 1
Operable Unit 1E: Groundwater

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Containment/ collection:	Identify discrete discharge points during Phase 2 RI	Existing network is adequate	Contamination is more extensive than expected	Groundwater monitoring	Add new controls
		Treatment at PWTP; contaminants are primarily radionuclides	Wastes cannot be treated at PWTP	Sample influent	Pretreatment or design/build a new treatment system
Pump and treat	Evaluate depth of bedrock, pipe trenches, etc. during Phase 2 RI	One pump and treat operation will be sufficient	More than one pump and treat operation needed	Phase 2 RI	Add additional collection and treatment
		Treatment at PWTP	Cannot treat at PWTP	Sample influent	Pre-treatment or design a new treatment system

TABLE 1.7.
Summary of Data Needs for WAG 1
Operable Unit 1F: Pipelines and Storm Drains

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Boundary containment on West, South, East perimeters					
"Wet" trenches, south of Central Ave.	Determine locations using as-built drawings and geophysics	See groundwater OU for WAG 1			
"Dry" trenches, north of Central Ave.: plugs and cutoff collars	Tech Demo: location, collars Inventory of subsurface facilities				

TABLE D.8.
Summary of Data Needs for WAG 1
Operable Unit 1G: White Oak Creek Flood Plain Soils

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Containment: solidify "hot spots" and cap remaining wastes	Identify "hot spots"	Note: assume same as WAG 2 Reach 4 remedial action			

TABLE 1.9.
Summary of Data Needs for WAG 1
Operable Unit 1H: SWSA 1, 2, and Waste Pit

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
SWSA 2--no further action	Sample/remove anomalies	Sub-surface anomalies should be removed	No need to remove sub-surface anomolies	Sample and analyze anomalities	Contain in place
Waste Pile: limited remediation	Sampling of wste pile contents	Hazardous waste only	Mixed waste present	Sample and analyze	Contain in place
SWSA 1--containment; groundwater intercept and cap	Use geophysics and test pits to better delineate SWSA				

TABLE 1.10.
Summary of Data Needs for WAG 1
Operable Unit I: Contaminated Soils

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
Excavate: Hg contaminated soils, Y-12 Hg roasting, bioremediation, soil washing	Assessment of mobility; fate and transport study Technical development of remediation technologies	Mercury, no radionuclides; offsite RCRA landfill disposal	Radionuclides present, makes it a mixed waste	Sampling and analysis for radionuclides	Mixed waste disposal
Tanks, pipes and other • Containment and consolidation • 3001 exhaust ducts, 3019 hot blank, 3515, and Isotope Circle • Cap, slurry wall	Delineate areas	Can use conventional radioactive material handling techniques	Cannot use conventional radioactive handling techniques	Monitoring	Special materials handling techniques

TABLE 1.11.
Summary of Data Needs for WAG 1
Operable Unit 1J: Empty Steel Tanks

Remedial Action	Data Needs: RI/Special Studies/Tech Demos	Expected Conditions	Deviations	Monitoring	Contingent Action
If contains grout: perform decontamination technical demo • Leave in place, immobilize sludges	Sludge immobilization Vendor demo of surface etching Grouting demo Interval dose reading	50% of tanks leave residual sludges			
If does not contain grout: • Remove and decontamination	Inventory of tanks Decontamination Tech Demo • Sludge immobilization • Grouting Vendor demo of surface etching Internal dose reading Inventory of tanks	50% of tanks remove and decon residual sludges	Cannot remove		

Note: There are now 65 tanks (1 concrete, 12 gunite, and 52 steel).

modify cement mix or technology, but Chapter 24.0 discusses removal of sludges at a later time; therefore, no contingent action is estimated.

The Baseline Report assumes that all of the steel tanks in the Steel Tank Systems OU are left in place and grouted and that there is only a total of 16 tanks currently in this OU.

1.3 REGULATORY REQUIREMENTS

1.3.1 Oak Ridge National Laboratory Regulatory History

Before 1985, ORNL operated outside the jurisdiction of both the Tennessee Department of Environment and Conservation (TDEC) (formerly the Tennessee Department of Health and Environment, or TDHE) and EPA. Chemical, biological, and radioactive hazardous wastes were regulated by DOE Orders. In 1985, however, compliance with state and federal environmental regulations became mandatory at federal facilities under an Executive Order signed by President Ronald Reagan.

Shortly after the presidential mandate requiring federal facilities to comply with state and federal environmental regulations, ORNL applied for a Resource Conservation and Recovery Act (RCRA) permit to operate a newly constructed hazardous waste transportation, storage, and disposal (TSD) facility for Building 7652. The permitting of the facility triggered an Oak Ridge Reservation (ORR) wide requirement to report all known or suspected hazardous material release sites resulting from Solid Waste Management Units (SWMUs) as required by 40 Code of Federal Regulations (CFR) Sections 3004(u) and (v).

By late 1985, the Remedial Action Program (RA) was established to collect information and develop a strategy to deal with the ORNL SWMUs. Many of the SWMUs occurred in clusters within areas of similar geomorphology and hydrology. To enhance the efficiency of remedial actions, SWMUs were collected into WAGs. A total of 21 WAGs have been identified at ORNL. Because RAs under RCRA are required to comply with the National Environmental Policy Act (NEPA) process, the ORNL RA Program proposed a 10-year plan to conduct a site-wide Environmental Impact Statement (EIS) for the proposed RAs. EPA Region IV and TDHE took issue with the lengthy EIS process, and ORNL responded with a proposal to initiate 10 RCRA Facility Investigations (RFIs), as well as an integrated Corrective Measures Study, both of which were to be completed by 1992.

Work toward completion of RCRA requirements continued until December 14, 1989, when the Oak Ridge Reservation (ORR) was listed on the EPA docket as a National Priorities List (NPL) site. Because the site was listed, the regulatory drive changed from RCRA to CERCLA. An FFA was approved in January 1992. This federal agreement began the process of negotiations with the state and EPA to establish responsibilities, roles, approval processes, and schedules for required deliverables. The FFA will be updated and revised until remediation is completed.

After DOE-HQ ER Program reorganized the RA Program into one centralized national organization, the DOE Field Offices and the facility managers; i.e., MMES, also reorganized in 1989 to mirror the DOE-HQ ER Program. The RA Program became the ORNL ER Program, consisting of program management, remedial actions, decontaminations and decommissioning, and surveillance and maintenance.

1.3.2 Regulatory Drivers

As with most other WAGs at ORNL, the principal regulatory driver is now CERCLA (Table 1.12). RCRA requirements such as cleanup standards, have become Applicable or Relevant and Appropriate Requirements (ARARs) under CERCLA. Binding regulatory requirements are set forth in the FFA, which lists the deliverables for WAG 1. Negotiations, guidance, and information exchange with both the TDEC and EPA concerning WAG 1 is an ongoing process.

The DOE Field Office-Oak Ridge (DOE-OR) developed a NEPA strategy for the ER Program for the Oak Ridge Reservation (ORR) in 1990 that recommended preparation of a Programmatic Environmental Impact Statement (PEIS) (Lee Wan & Associates, Inc., 1990). A draft Notice of Intent to prepare the PEIS is currently being reviewed by DOE-HQ. If this strategy is adopted, a PEIS addressing the ER Program at the four major facilities (ORNL, Y-12, K-25, and Oak Ridge Associated Universities (ORAU)) will be prepared. Completion of the PEIS will take from 1 to 2 years. The current schedule for WAG 1 OU IRODs projects that the first IROD will occur for the Tank Farm OU in 1996. IRODs will be developed for the other OUs in WAG 1 with the Groundwater OU IROD completed last. It is possible that preparation of Feasibility Study/Environmental Assessment (FS/EA) documents for certain WAG 1 OUs may begin without the benefit of the comprehensive evaluation in the PEIS. Should this occur for certain OUs, NEPA documents for projects begun before completion of the PEIS will evaluate cumulative effects (1) by making qualitative estimates of the overall impact of the ER Program and other anticipated actions and (2) by assessing the relative contribution of the proposed action. NEPA documentation will also be required for a number of interim actions and supporting projects that must be started before start of the IROD to support routine operations and to enable environmental restoration of WAG 1 to remain on schedule. Categorical exclusions are required before construction of support facilities.

Numerous other regulations are applicable to remedial actions at WAG 1. These are as follows:

- Existing ORNL permits may need to be modified to include potential sources from WAG 1 activities [i.e., new point discharges to the waters of the state may require amendment of the National Pollutant Discharge Elimination System (NPDES) permit].

- Also, installation of processes with the potential to release radionuclides or hazardous constituents to the air, if any, may require amendment of the National Elimination System for Hazardous Air Pollutants (NESHAP) permit.

Table 1.12. WAG 1 Regulatory Drivers.

CERCLA	
Response Authorities	42 USC 9604 § 104
National Contingency Plan	42 USC 9605 § 105
Abatement Action	42 USC 9606 § 106
Federal Facilities	42 USC 9620 § 120
Cleanup Standards	42 USC 9621 § 121
ARARs	40 CFR 300
Permit Requirements	40 CFR 300.404
Oversight	40 CFR 300.404
PA/SI	40 CFR 300.420
RI/FS and Selection of Remedy	40 CFR 300.430
Community Relations	40 CFR 300.430
RD/RA Activities	40 CFR 300.435
RCRA	
Continuing Releases at Permitted Facilities	40 CFR 3004(u)
Corrective Actions Beyond Facility Boundaries	40 CFR 3004(v)
Hazardous Waste Management Units	40 CFR 264.118
NEPA	
Environmental Review on Federal Facilities	National Environmental Policy Act

- Worker health and safety training requirements promulgated by the Superfund Amendments and Reauthorization Act (SARA) Title III and others found in the Occupational Safety and Health Act (OSHA) in 29 CFR 1910 must be considered for compliance.

- Department of Transportation (DOT) regulations may apply to hazardous waste packaged and shipped off WAG 1.

- Compliance with DOE Orders regarding packaging, handling, storing, and transporting transuranic wastes is required.

Because of the rapidly evolving regulatory requirements concerning both radioactive and hazardous waste, a compliance review for each phase of the CERCLA action has been incorporated in the WAG 1 cost assessment. The discussion of regulatory drivers associated with work at WAG 1 is provided only to demonstrate the high degree of complexity associated with environmental compliance and is not intended to be a comprehensive list of all applicable regulations.

1.3.3 Regulatory Strategy

The regulatory strategy and requirements for the ORR are documented in the FFA, which undergoes major revisions annually and minor revisions on an "as needed" basis as the result of meetings/interactions among the parties to the FFA. At recent meetings, the concept of "Source Control WAGs" has been developed for the ORNL-ER Program. Source Control WAGs include WAGS 1, 3, 4, 5, 6, 7, 8, 9, and 10 from which known or potential pollutants release into "Integrator WAGs" such as WAG 2. Source Control WAGs will require IRODs. Integrator WAGs and other WAGs that have suspected direct offsite releases, i.e., WAGs 2, 11, and 13, will require RODs (Record of Decision). Therefore, the IROD terminology is applied to the WAG 1 OUs in this report.

2.0 PROJECT SCOPE

This chapter presents the background of operations in WAG 1, a general description of the WAG 1 area, a detailed listing of the Solid Waste Management Units (SWMUs), and a description of the 10 WAG 1 Operable Units (OUs). The conceptual scope and approach for proposed remedial activities, method of accomplishment, Work Breakdown Structure (WBS), and technology needs for WAG 1 are also described in this chapter.

2.1 DESCRIPTION

2.1.1 Background

ORNL was constructed for atomic weapons research and development during World War II and began operation in 1943. It was initially chosen as the site for the Manhattan Project because of its isolation from population centers. Initially the facility had a planned life of only 1 year. This period was lengthened to 2 or 3 years, and as nuclear research and political climates have evolved, ORNL has been continuously active.

During the 45 years of production, operations, and research activities at ORNL, a variety of radioactive and hazardous wastes have been generated. These wastes have been disposed of both onsite and offsite. Waste disposal methods used in WAG 1 included shallow land burial in selected areas using trenches only during the early evolution of waste operations at ORNL (e.g., SWSA 1); and since that time, wastes have been disposed at other ORNL locations.

Due to the long and complex history of operations under different management regimes at ORNL, identification and listing of active and inactive waste management units, contaminated facilities, and other potential sources of continuing releases to the environment, such as waste collection and storage tanks, solid waste storage areas (SWSAs), waste treatment units, impoundments, spill sites, pipeline leak sites, and areas of known contamination within buildings, is an ongoing process.

Since operations at ORNL were initiated, many radioactive waste collection and storage tanks have been installed, with capacities ranging from 500 to 170,000 gallons. The larger tanks originally were designed for long-term storage of wastes. However, as tank storage capacity became less available, ORNL began to treat wastes in the larger tanks and then dispose of the wastes. In addition, buildings at ORNL that generated radioactive wastes were provided with waste collection tanks. Wastes were stored and sampled before a decision was made regarding disposition of the waste (i.e., storage in the main tanks or release to the process waste system for treatment before disposal).

Since ORNL operations began, a number of tanks have been removed from service because of leaks in either the tanks or the piping used to transfer wastes into or out of the tanks. In addition, some tanks are no longer in service because the programs they served have ceased operation.

Nine surface impoundments identified in WAG 1 have been designated as release sites. Of these sites, four contain process wastes and two are ponds that have been taken out of service and backfilled. The remaining three sites include two aerated lagoons formerly used for treatment of ORNL sewage, and the coal pile runoff collection basin.

During early operations at ORNL (1943-1946), radioactive solid wastes were buried at two sites within the WAG 1 boundary: SWSA 1 and SWSA 2. An additional disposal site, the Former Waste Pile Area, is also within WAG 1.

2.1.2 General Site Description

2.1.2.1 Physiography and Topography

The main facilities of ORNL, including WAG 1, are located in Bethel Valley at 800 to 850 feet mean sea level (MSL). Bethel Valley is bounded on the north by Chestnut Ridge (1100 feet MSL) and on the south by Haw Ridge (1000 feet MSL).

The Oak Ridge Reservation (ORR) is located between the Cumberland Mountains to the northwest and the Great Smokey Mountains to the southeast, in the Valley and Ridge Physiographic Province of the Appalachian Mountains. The province, which is some 50 miles wide in this area, extends approximately 1300 miles from the Canadian St. Lawrence low land into Alabama. Bounded by the Appalachian Plateaus Province to the west and Blue Ridge Province to the east, the Valley and Ridge Province is a complex zone characterized by a succession of southwest-trending ridges and valleys. On the ORR, elevations range from 750 to 1400 feet MSL.

2.1.2.2 Geology

WAG 1 is underlain by the limestone, siltstone, and calcareous shale facies of the Ordovician Chickamauga Group. Figure 2.1 provides a generalized geologic cross section through the main plant area showing the approximate relative positions of Stockdale's Units C-H and selected WAG 1 SWMUs. Stockdale (1951) reports that the average strike of the units of the Chickamauga Group in the vicinity of WAG 1, 56°E, is slightly different from that of the regional trend of Bethel Valley, 58°E. The dip of these units is to the southeast, commonly between 30° and 40°.

Stockdale describes the upper limestone units of the Chickamauga Group as being tightly cemented and compact with the exception of several small solution channels, typically around 1 in. in diameter, but up to as large as 1 ft. McMaster and Waller (1965) confirmed the categorization of Stockdale on the basis of a geologic and soil study of the White Oak Creek (WOC) basin.

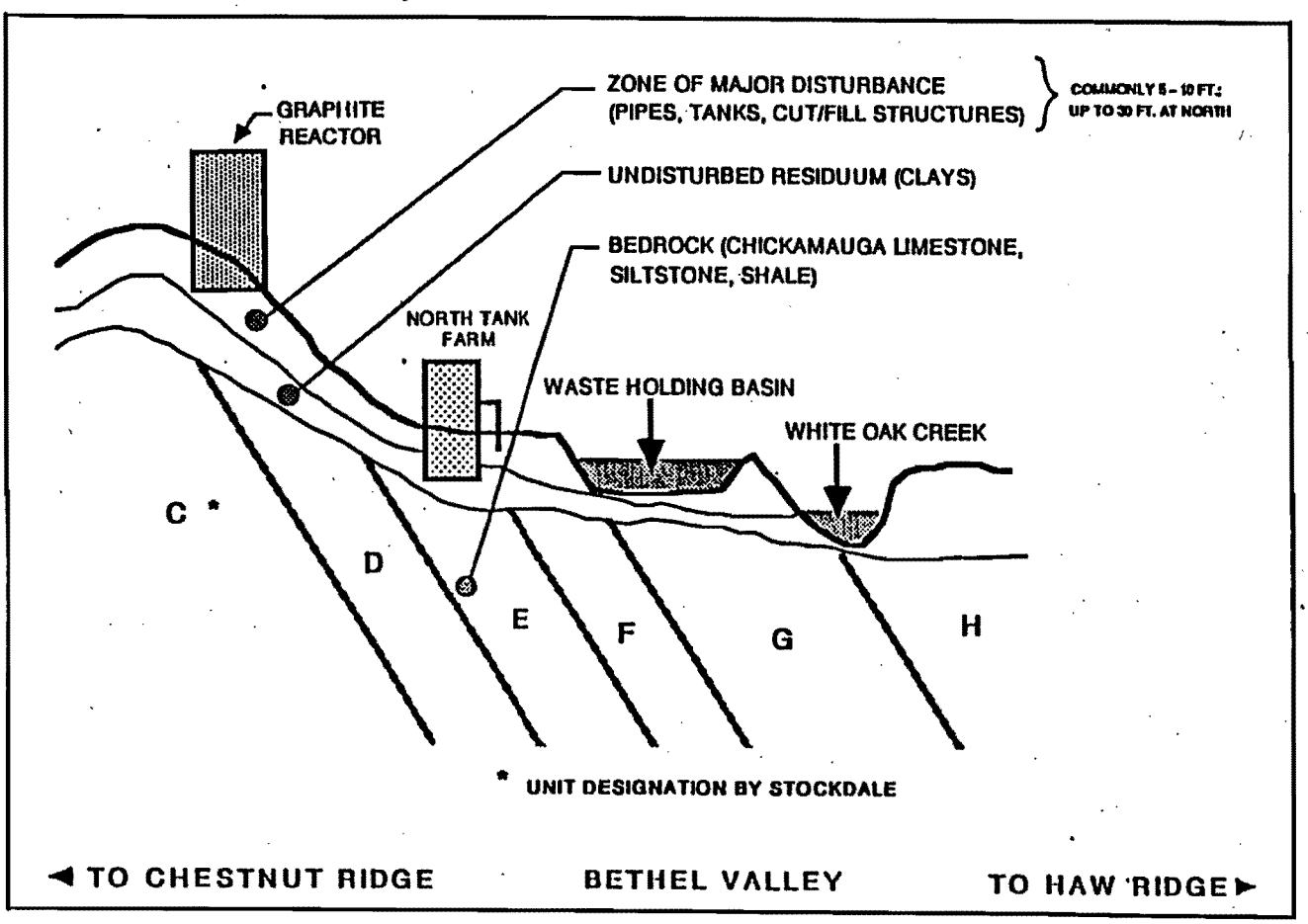


Fig. 2.1. Geologic Cross Section through Main Plant Area. *Source:* BNI, 1989.

In 1985, five boreholes, each approximately 400 ft deep, were completed in a northwest-southeast transect along the east side of Fifth Creek. The information from these boreholes provided representative cases from each of Units B through G of the Chickamauga Group (Boegly et al., 1987). It is reported that geophysical logs obtained during that study indicated that the rock is tightly cemented and competent. Fractures often appeared to be reminieralized with calcite, with some exhibiting signs of motion.

2.1.2.3 Seismic Activity

A complete list of recent seismic events detected in the Oak Ridge area and those recorded in the literature since 1800 is found in Boyle (1982). The Appalachian region from southeastern Tennessee to Virginia averages one to two seismic events per year. The maximum shock experienced in the Oak Ridge area from an earthquake with an epicenter in the East Tennessee region was a Modified Mercalli (MM) VI intensity event in 1913.

Based on Algermissen's (1982) seismic risk classification and probabilistic estimates, Oak Ridge lies in seismic zone 2 (moderate activity), and there is a 10% probability that a seismic event will produce horizontal movement at Oak Ridge in excess of 7% of gravity within a 50-year period. This corresponds to an MM intensity of VII. This estimate and historic records indicate that an earthquake of this intensity, which would cause minor to moderate damage of structures, should occur every 300 to 1000 years.

2.1.2.4 Soils

Soil thickness at the site range from 1 to 25 ft. The deepest soils are found along the low ridge that crosses the northern portion of the site, near the Graphite Reactor. The thinnest soils are found in the southern portion of the site, near the surface impoundments and WOC.

Generally, the native soils on WAG 1 are produced by the in-place weathering of the Chickamauga bedrock. The soils typically consist of yellow, light reddish-orange, or red clay of medium stiffness containing variable quantities of chert, siltstone, and limestone fragments. The mineralogy of native soils reflects composition of the underlying bedrock.

The soils at the site have been highly disturbed by construction activities. Reworked native soils and nonnative, imported fill materials have been placed in pipe trenches, under foundations and slabs, as backfill around buildings, and in other excavations throughout the site. This anthropogenic zone extends from the surface to various depths throughout the site, frequently extending to the bedrock surface, as is the case at the South Tank Farm. The anthropogenic zone is so complex that complete characterization of all material types and their distribution is not considered to be cost effective and, for practical purposes, is not feasible.

Some surface soil sampling has been conducted in specific areas, such as leak sites, spill areas, and burial grounds, within the WAG boundary. In 1976 and 1977, SWSA 2 was considered as a possible location for the Energy Systems Research Laboratory (ESRL), and soil core samples

were collected to examine the subsurface soils for radioactive contamination (Oakes and Shank, 1977). A total of 25 cores, ranging from 4 to 9 ft deep, were collected and analyzed for alpha-, beta-, and gamma-emitting isotopes. The results indicated uranium and plutonium levels slightly higher than samples collected near perimeter air monitoring stations. The samples collected for depth profile analyses indicated high levels of radioisotopes (^{123}Cs, ^{40}K, ^{226}Ra, and ^{232}Th) in the shallower samples. The average core concentrations were found to be less than those from background samples.

2.1.2.5 Surface Water

WAG 1 lies within the Bethel Valley portion of the WOC drainage basin. Three tributaries, First Creek, Fifth Creek, and Northwest Tributary, flow through WAG 1. Figure 2.2 shows the location of these streams relative to other streams in the vicinity.

The drainage area of WOC at the WAG 1 boundary is about 2040 acres. The boundaries of the basin extend to the southwest and northeast along Chestnut Ridge and Haw Ridge. The Bethel Valley quadrangle shows a spring as the source of First Creek. The spring, located near the foot of Chestnut Ridge, has a potentially large recharge area. First and Fifth Creeks collect runoff from the slope of Chestnut Ridge and then flow southeast through the plant area to their respective confluence with the Northwest Tributary and WOC. First Creek also collects water from two wells north of Bethel Valley Road. The water is pumped from the wells to a small impoundment on First Creek.

During the period February 5 to May 28, 1987, the maximum discharge for First Creek was found to be less than 6 cubic feet per second (cfs), with most flows less than 1 cfs. For WOC, for the period June 1949 to September 1955, the maximum discharge was found to be 124 cfs with the average discharge in the order of 5 cfs.

A mercury assessment program was implemented in 1988 to identify, locate, and minimize all sources of mercury contamination in ORNL discharges to maintain compliance with the National Pollutant Discharge Elimination System (NPDES) permitting program (Taylor, 1989). Surface water samples were collected from selected NPDES outfalls (Categories I, II, and III) and from previously established serial numbered sampling stations and were submitted for mercury analysis. The results of this survey indicated areas with mercury levels above background levels.

2.1.2.6 Groundwater

Groundwater movement beneath WAG 1 is not well defined, although a review of published documents and conversations with ORNL investigators suggest that there are several flow regimes of concern. Reports by Stockdale (1951); Webster (1976); and Bechtel National, Inc., (1989) describe plant-scale studies at ORNL or within Bethel Valley. Groundwater is observed to occur both in the unconsolidated overburden and within the bedrock; however, communication between these zones has not been fully evaluated.

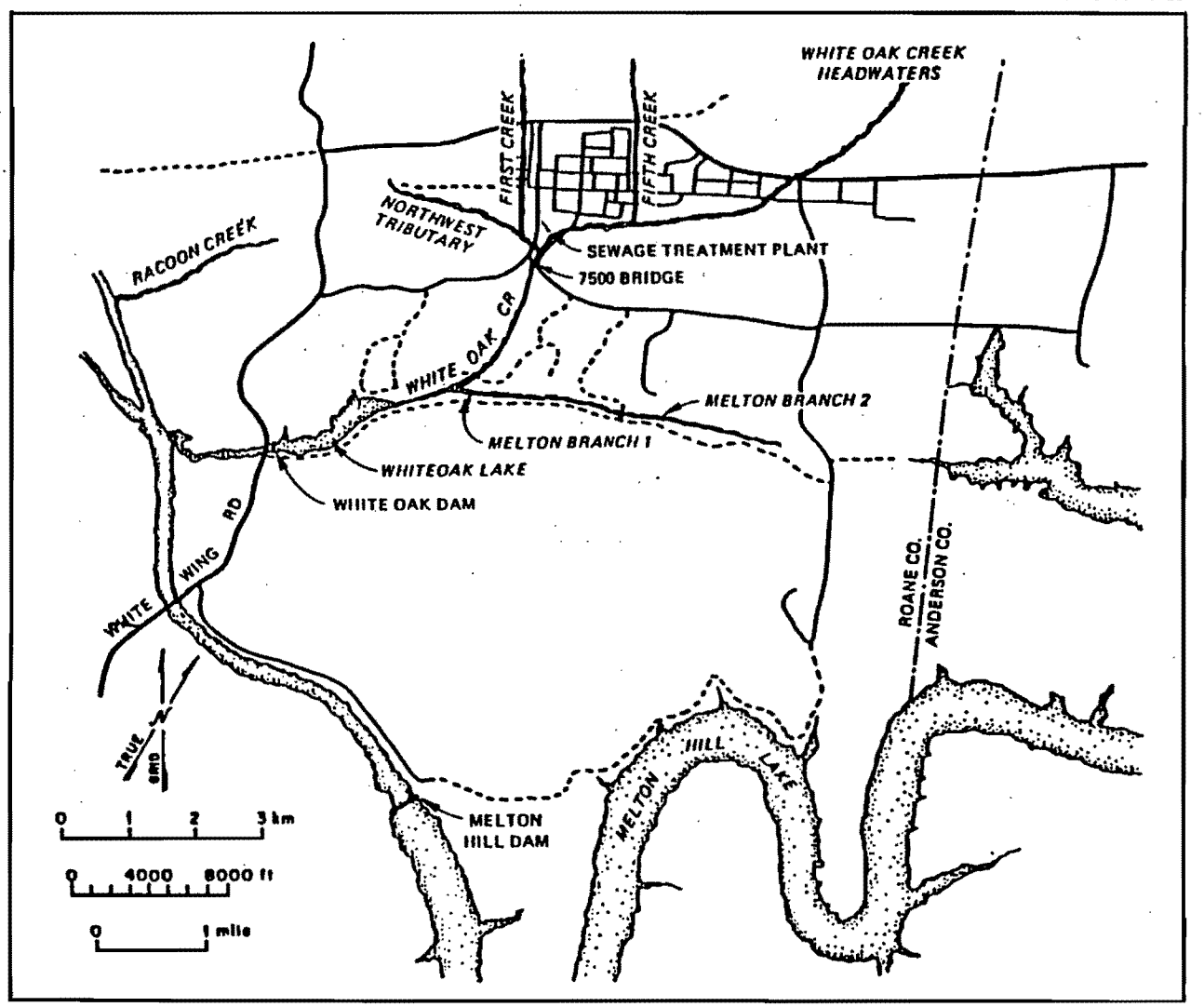


Fig. 2.2. Location Map of ORNL Streams.

The uppermost portion of the aquifer occurs under unconfined conditions. Recharge to the system is generally through infiltration with localized recharge through surface impoundments (3500 area ponds). The watertable appears as a subdued replica of ground surface topography. Under isotropic and homogeneous conditions, flow perpendicular to the groundwater contours could be predicted. However, local flow patterns at ORNL are significantly affected by activities in the anthropogenic zone including active sump pumps, directional permeabilities, and local recharge from impoundments and leaking pipes. Additionally, vertical gradients have not been well defined and are likely influenced by directional permeabilities in bedrock.

Flow of groundwater in bedrock may be highly influenced by directional permeabilities in bedrock, including flow through jointed and fractured bedrock, interconnected solution cavities and channels, and along bedding planes. Additionally, vertical gradients—both upward and downward with the aquifer—may be present. Components of flow that have been identified in certain portions of the site include horizontal — parallel to strike, horizontal — between units, horizontal — between groups, and vertical. A strong flow component parallel to strike both within the Main Plant Area and in Bethel Valley has also been reported.

Stockdale (1951) conducted the earliest studies to characterize local groundwater flow which indicated that communication exists between solution cavities (1 in. to 12 in. diameter) in Unit G and the 3513 pond. He judged that the Copper Creek Fault presented an impervious barrier to horizontal groundwater flow between the Chackamauga Group and the Rome Foundation and that Unit F o the Chickamauga Group functioned as a stratigraphic trap for groundwater, preventing its horizontal flow. Recharge to the area primarily occurs through the infiltration of meteoric waters and local recharge conditions (e.g., surface impoundments). Stockdale developed a water table map that depicts the groundwater surface as a subdued replica of the overlying surface topography with minor distortions attributed to recharge from the 3500 Area ponds.

Webster (1976) suggested that groundwater movement should not be plotted on the basis of Stockdale's watertable maps, mainly because of the anisotropic nature of the bedrock. From core logs and Stockdale's pressure tests, he concluded that solution cavity size and frequency of occurrence diminished with depth, and that circulation of groundwater in the Chickamauga Group may be restricted to the upper several hundred feet. More recent work by Stueber and Webster (1981) provided information on flow component parallel to strike within the Chickamauga Group in Bethel Valley. This is supported by observations made onsite by Ketelle et al. (1985) that fluids lost during drilling were returned at the surface parallel to strike through discharge to Fifth Creek. This also indicates that flow beneath WOC and its tributaries and discharge to those same streams ar possible scenarios for groundwater movement.

An additional observation made by Ketelle et al. (1986) is the presence of artesian conditions at depth in the Chickamauga, evidenced by flowing wells and elevated pore pressures at depth, therefore indicating the presence of both upward and downward vertical gradients at the site. They also observed a reduction in flow in two coreholes during pump testing of two wells installed north of Bethel Valley Road. Further investigation of the construction of these two supply wells indicates that water is being pumped from both the Chickamauga and Knox groups in each of the wells. The

source of the influence is therefore not well defined. The possibility exists that there is communication across the units of the Chickamauga as well as the potential for communication between the Know and Chickamauga groups.

Huff (1985) conducted a dry weather dye tracer study to investigate an LLW transfer line leak between Buildings 3019 and 3074 in WAG 1. The study showed movement of groundwater parallel to strike toward a sump located in the Oak Ridge Research Reactor building and movement around Building 3019. The study concluded that flow towards the Oak Ridge Research Reactor sump was controlled by directional permeabilities in bedrock (solution cavity, joints, fractures) and an induced hydraulic gradient towards the Oak Ridge Research Reactor sump. Flow around Building 3019 was reported as a function of directional permeabilities in the anthropogenic zone—along pipelines within permeable backfills.

2.1.2.7 Biota

The environs of the ORR are typical of the ecological systems of the Appalachian region. The dominant plant community is the Oak Hickory Forest, with extensive stands of mixed yellow pine and hardwoods. Nonforest areas include grasslands, devegetated areas, and developed locations. Nonforest areas predominate in WAG 1. Since the main plant area occupies most of WAG 1, the area is urban, paved over with streets or parking lots or covered by buildings.

The forests in the ORR serve as hosts for many wildlife species. Therefore, the area may serve as a refuge for wildlife (de Laguna et al., 1958). Approximately 60 species of reptiles and amphibians; more than 120 species of terrestrial birds; 32 species of waterfowl, wading birds, and shore birds; and about 40 species of mammals have been recorded (Nix et al., 1986).

No known species that are included in the federal list of threatened or endangered plants have been found on WAG 1. Of the 12 species on the federal endangered species list, only two species, the southern bald eagle (*Haliaeetus lencocephalus)* and the eastern cougar (*Felis coucolor cougar*), have been sighted on the reservation.

The aquatic community potentially affected by WAG 1 includes the WOC watershed and the Clinch River downstream from the mouth of WOC. The WOC watershed is not known to have any threatened or endangered species.

2.1.3 Release Sites

All currently identified WAG 1 release sites, including those reported on the "Solid Waste Management Unit List" and their current disposition are listed in Table 2.1. All of the release sites will not be considered in this Baseline Report. A total of 167 release sites, designated as Solid Waste Management Units (SWMUs), are currently associated with WAG 1. Of these, 91 are not currently considered to be within the ER scope. MMES Waste Management has custody of 36 SWMUs, and these consist primarily of active and inactive waste storage tanks or other waste storage facilities. Twenty-seven SWMUs require no further action (NFA) by the FFA, five sites are the

responsibility of the D&D program, 21 sites are the responsibility of Surplus Facilities Management, and two sites are considered to completely remediated. The remaining 76 sites are considered within the ER Program and are identified with an operable unit as shown in Table 2.1.

As a result of the budget and operating constraints, SWMUs that are still active facilities are not included in the FY92 baseline for several reasons. Active facilities go through a formal transfer procedure when they are transferred from Waste Management to the ER Program. Transition funding is provided by Waste Management until ER can include the facility in the ER Program budget planning cycle. In addition, active facilities may not be available for remediation when scheduled due to operating constraints. Schedule delays are costly and may result in failure to comply with FFA milestones.

The 76 units included in the ORNL ER WAG 1 Baseline Report are shown in Fig. 2.3 and discussed in more detail in Section 2.1.4. Appendix C of the FY 1992 FFA (DOE/OR-1014, 1992) provided the basis for including sites in the FY92 Baseline Report. As the Baseline Report is a living document, it will be revised to coincide with future revisions to the FFA. More units will be added as the baseline is updated in successive FYs until all units requiring remedial action have been addressed.

Table 2.1. WAG 1 Solid Waste Management Unit List.

SWMU #	OU #	Site Name/Description	Status
1.1	9	Mercury-contaminated soil, Building 3503	ERB
1.2	9	Mercury-contaminated soil, Building 3592	ERB
1.3	9	Mercury-contaminated soil, Building 4501	ERB
1.4	9	Mercury-contaminated soil, Building 4508	ERB
1.5A	9	LLLW Lines & Leak Sites - South of Building 3020	ERB
1.5B	9	LLLW Lines & Leak Sites - East of Building 3020	ERB
1.5C	9	LLLW Lines & Leak Sites - West of Building 3082	ERB
1.5D	9	LLLW Lines & Leak Sites - North of Building 3019	ERB
1.5E	9	LLLW Lines & Leak Sites - Southwest corner of Building 3019	ERB
1.5F	9	LLLW Lines & Leak Sites - Between Tanks W-5 and WC-19	ERB
1.5G	9	LLLW Lines & Leak Sites - Underneath Building 3047	ERB
1.5H	9	LLLW Lines & Leak Sites - General isotope area (Buildings 3037, 3038, 3034, etc.)	ERB
1.5I	9	LLLW Lines & Leak Sites - Building 3092 area	ERB
1.5J	9	LLLW Lines & Leak Sites - Underneath Building 3026	ERB
1.5K	9	LLLW Lines & Leak Sites - Between Tanks WC-1 and W-5	ERB
1.5L	9	LLLW Lines & Leak Sites - ORR water line (Building 3085)	ERB
1.5M	9	LLLW Lines & Leak Sites - Building 3028	ERB
1.5N	9	LLLW Lines & Leak Sites - East of Building 2531	ERB
1.5O	9	LLLW Lines and Leak Sites - Underneath Building 3515	ERB
1.5P	9	LLLW Lines and Leak Sites - Building 3525 to a sump	ERB
1.5Q	9	LLLW Lines and Leak Sites - Underneath Building 3550	ERB

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.5R	9	LLLW Lines and Leak Sites - Sewer near Building 3500	ERB
1.5S	9	LLLW Lines and Leak Sites - Abandoned line, Central Avenue Area	ERB
1.5T	9	LLLW Lines and Leak Sites - North of Building 4508	ERB
1.5U	9	LLLW Lines and Leak Sites - North of Building 3518 & 3544 and west of the Equalization Basin, 3524	ERB
1.5V	9	LLLW Lines and Leak Sites - Northwest of SWSA 1	ERB
1.5W	9	LLLW Lines and Leak Sites - Ground contamination by Building 3503	ERB
1.6	9	Contaminated surfaces and soil from 1959 explosion in Building 3019 Cell	ERB
1.7	9	Contamination at base of Building 3019 Stack	ERB
1.8	--	Graphite reactor storage canal overflow (Buildings 3001 and 3019)	D&D
1.9	9	Oak Ridge Research Reactor decay tank rupture site (3087)	ERB
1.10	9	Storage pads (Buildings 3503 and 3504)	ERB
1.11	9	Decommissioned waste holding basin, 3512 (was an earthern-diked pond about 40 x 40 ft, holding about 30,000 gal. Site is now part of the Building 3544 parking lot).	ERB
1.12	2	Waste holding basin 3513 was placed in service in 1944 and was removed from service in 1976. Basin measures about 200 by 200 ft at the bottom, with sloping walls, and has a normal total capacity of 1,880,000 gal.	ERB
1.13	2	Equalization basin 3524 was placed in service in 1945 at only one half of the basin's present size of 95 by 250 ft. Present total capacity is about 1,000,000 gal.	ERB

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.14	2	Process waste pond (north) 3539 was placed in service in 1964. Basin measures 65 by 90 ft at the top of the berm, has a capacity of 150,000 gal, and has a bottom liner of 6-in. thick compacted clay	ERB
1.15	2	Process waste pond (south) 3540 was placed in service in 1964. basin measures 65 by 90 ft at the top of the berm, has a capacity of 150,000 gal, and has a bottom liner of 6-in. thick compacted clay	ERB
1.16	TBD	East sewage aeration pond 2543 was placed in service in 1974. pond has a capacity of about 1,000,000 gal.	WMA
1.17	TBD	West sewage aeration pond 2544 was placed in service in 1974. pond has a capacity of about 1,000,000 gal.	WMA
1.18		Coal pile settling basin 2545 was placed in service in 1978 for the treatment of coal storage pile runoff. Basin is now used as the surge basin for the coal pile runoff treatment facility and has a capacity of 300,000 gal.	NFA
1.19	9	Low-Intensity test reactor ponds 3085W. Each pond was about 8 by 40 ft and held about 9,000 gal. In 1964 the ponds were filled with clay and earth and covered with grass.	ERB
1.20	9	Fission Product Development Lab (FPDL), east of Building 3517, was placed in service in 1958	ERB
1.21	3	FPD Lab LLLW transfer line to the vicinity of the South Tank Farm (3507 Area), was placed in service in 1958 and removed from service in 1978.	ERB
1.22	9	Isotopes ductwork, Filter House 3110, Underground ductwork received exhaust air from buildings in the Isotope Area for filtration in 3110. Placed in service in early 1960s and removed from service in 1986.	ERB

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.23A	1	Inactive LLLW Collection/Storage Tank W-14, is 800 gal domed, vertical cylindrical, Gunite tank, built in 1943, located in the North Tank Farm (3023 Area).	ERB
1.23B	1	Inactive LLLW Collection/Storage Tank W-24, is 800 gal domed, vertical cylindrical, Gunite tank, built in 1943, located in the North Tank Farm (3023 Area).	ERB
1.24A	1	Inactive LLLW Collection/Storage Tank W-3 is 42,500 gal domed, vertical cylindrical, Gunite tank, built in 1943, located in the North Tank Farm (3023 Area).	ERB
1.24B	1	Inactive LLLW Collection/Storage Tank W-4 is 42,500 gal domed, vertical cylindrical, Gunite tank, built in 1943, located in the North Tank Farm (3023 Area).	ERB
1.25A	1	Inactive LLLW Collection/Storage Tank W-13 is 2,000 gal horizontal cylindrical, stainless steel tank, installed in 1945, located in the North Tank Farm (3023 Area).	ERB
1.25B	1	Inactive LLLW Collection/Storage Tank W-14 is 2,000 gal horizontal cylindrical, stainless steel tank, installed in 1945, located in the North Tank Farm (3023 Area).	ERB
1.25C	1	Inactive LLLW Collection/Storage Tank W-15 is 2,000 gal vertical cylindrical, stainless steel tank, installed in 1945, located in the North Tank Farm (3023 Area).	ERB
1.26A	1	Inactive LLLW Collection/Storage Tank W-5 is 170,000 gal domed, vertical cylindrical. Gunite tank, built in 1943, located in the South Tank Farm (3507 Area).	ERB
1.26B	1	Inactive LLLW Collection/Storage Tank W-6 is 170,000 gal domed, vertical cylindrical. Gunite tank, built in 1943, located in the South Tank Farm (3507 Area).	ERB

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.26C	1	Inactive LLLW Collection/Storage Tank W-7 is 170,000 gal domed, vertical cylindrical. Gunite tank, built in 1943, located in the South Tank Farm (3507 Area).	ERB
1.26D	1	Inactive LLLW Collection/Storage Tank W-8 is 170,000 gal domed, vertical cylindrical. Gunite tank, built in 1943, located in the South Tank Farm (3507 Area).	ERB
1.26E	1	Inactive LLLW Collection/Storage Tank W-9 is 170,000 gal domed, vertical cylindrical. Gunite tank, built in 1943, located in the South Tank Farm (3507 Area).	ERB
1.26F	1	Inactive LLLW Collection/Storage Tank W-10 is 170,000 gal domed, vertical cylindrical. Gunite tank, built in 1943, located in the South Tank Farm (3507 Area).	ERB
1.27	1	Inactive LLLW Collection/Storage Tank W-11 is 1500 gal domed, vertical cylindrical. Gunite tank, built in 1943, located at the southeast corner of the South Tank Farm (3507 Area) near Tank W-12.	ERB
1.28	1	Inactive LLLW Collection/Storage Tank W-1A is 4000 gal horizontal cylindrical, stainless steel tank, installed in 1951, located in the North Tank Farm (3023 Area).	ERB
1.29	10	Inactive LLLW Collection/Storage Tank WC-1 is 2150 gal vertical cylindrical, stainless steel tank, installed in 1950, located in the Isotopes Circle between Buildings 3038 and 3037.	ERB
1.30A	10	Inactive LLLW Collection/Storage Tank WC-15 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1951, located southeast of Building 3587.	ERB
1.30B	10	Inactive LLLW Collection/Storage Tank WC-17 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1951, located southeast of Building 3587.	ERB

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.31A	10	Inactive LLLW Collection/Storage Tank TH-1 is 2500 gal vertical cylindrical, stainless steel tank, installed in 1948, located south of Building 3503.	ERB
1.31B	10	Inactive LLLW Collection/Storage Tank TH-2 is 2400 gal vertical cylindrical, stainless steel tank, installed in 1952, located south of Building 3503.	ERB
1.31C	10	Inactive LLLW Collection/Storage Tank TH-3 is 3300 gal vertical cylindrical, stainless steel tank, installed in 1952, located south of Building 3503.	ERB
1.32	1	Inactive LLLW Collection/Storage Tank TH-4 is 14,000 gal domed, vertical cylindrical, Gunite tank, built in 1943, located southwest of Building 3500.	ERB
1.33	TBD	Active LLLW Collection Tank 2026A os 500 gal vertical cylindrical, Hastelloy C tank with a stainless steel top head, installed in 1961, located southeast of Building 2026.	WMA
1.34	TBD	Active LLLW Collection Tank WC-2 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1951, located east of Building 3092.	WMA
1.35	TBD	Active LLLW Collection Tank WC-3 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1950, located at south side of Building 3025.	WMA
1.36	TBD	Inactive LLLW Collection Tank WC-4 is (volume uncertain), vertical cylindrical, stainless steel tank, installed in the early 1950s, located at west end of Building 3026-C	WMA
1.37A	TBD	Inactive LLLW Collection Tank WC-5/1000 gal vertical cylindrical, stainless steel tank, installed in 1952, located south of Building 3503.	WMA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.37B	TBD	Inactive LLLW Collection Tank WC-6 is 500 gal vertical cylindrical, stainless steel tank, installed in 1952, located south of Building 3503.	WMA
1.37C	TBD	Inactive LLLW Collection Tank WC-8 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1952, located south of Building 3503.	WMA
1.37D	TBD	Active LLLW Collection Tank WC-9 is 2140 gal vertical cylindrical, stainless steel tank, installed in 1952, located south of Building 3503.	WMA
1.38	TBD	Active LLLW Collection Tank WC-7 is 1100 gal vertical cylindrical, stainless steel tank, installed in 1951, located south or west of Building 3504.	WMA
1.39A	TBD	Active LLLW Collection Tank WC-10 is 2300 gal horizontal cylindrical, stainless steel tank, installed in 1951, located southeast of Building 3587.	WMA
1.39B	TBD	Inactive LLLW Collection Tank WC-11 is 4600 gal horizontal cylindrical, stainless steel tank, installed in 1951, located southeast of Building 3587.	WMA
1.39C	TBD	Inactive LLLW Collection Tank WC-12 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1951, located southeast of Building 3587.	WMA
1.39D	TBD	Inactive LLLW Collection Tank WC-13 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1951, located southeast of Building 3587.	WMA
1.39E	TBD	Inactive LLLW Collection Tank WC-14 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1951, located southeast of Building 3587.	WMA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.40	TBD	Active LLLW Collection Tank WC-19 is 2100 gal horizontal cylindrical, stainless steel tank, installed in 1953, located northeast of Building 3028.	WMA
1.41	TBD	Inactive LLLW Collection Tank W-12 is 700 gal vertical cylindrical, stainless steel tank, (year of installation uncertain), located southwest of Building 3525 near Tank W-11.	WMA
1.42A	TBD	Active LLLW Collection Tank W-16 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1950, located east of the South Tank Farm (Area 3507) and north of Building 3515.	WMA
1.42B	TBD	Inactive LLLW Collection Tank W-17 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1950, located east of the South Tank Farm (3507 Area) and north of Building 3515.	WMA
1.42C	TBD	Inactive LLLW Collection Tank W-18 is 1000 gal vertical cylindrical, stainless steel tank, installed in 1950, located east of the South Tank Farm (3507 Area) and north of Building 3515.	WMA
1.43A	--	Active LLLW Collection/Storage Tank W-21 is 50,000 gal horizontal cylindrical, stainless steel tank, installed in 1976, located in stainless-steel-lined concrete vault between Buildings 2531 and 2537.	NFA
1.43B	--	Active LLLW Collection/Storage Tank W-22 is 50,000 gal cylindrical, stainless steel tank, installed in 1976, located in stainless-steel-lined concrete vault between Buildings 2531 and 2537.	NFA
1.44	--	Active LLLW Concentrate Storage Tank W-23 is 50,000 gal horizontal cylindrical, stainless steel tank, installed in 1976, located in stainless-steel-lined concrete vault between Buildings 2531 and 2537.	NFA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.45A	--	Active LLLW Concentrate Storage Tank C-1 is 50,000 gal horizontal cylindrical, stainless steel tank, installed in 1964, located in concrete vault adjacent to north side of Building 2531.	WMA
1.45B	--	Active LLLW Concentrate Storage Tank C-2 is 50,000 gal horizontal cylindrical, stainless steel tank, installed in 1964, located in concrete vault adjacent to north side of Building 2531.	WMA
1.46	6	SWSA 1 (Area 2624), triangularly shaped with an area of about 1 acre, placed in service in 1943 and removed from service in 1944, located just south of White Oak Creek and west of Building 3608.	ERB
1.47	7	SWSA 2 (Area 4003), about 3.5 acres in size, placed in service in 1944 and removed from service in 1946, located northwest of Building 4500N and about 300 ft north of Central Avenue.	ERB
1.48	--	LLLW Evaporator Facility, Building 2531 was placed in service in 1965, located northwest of the intersection of White Oak Avenue and Third Street.	NFA
1.49	--	Neutralization Facility, Building 3518 was placed in service in the late 1950s as the Process Waste Treatment Plant (PWTP) and converted to its present use in 1979 when Building 3544 was built. It is located south of the intersection of White Oak Avenue and Third Street and northeast of Building 3544.	NFA
1.50	--	PCB Storage Area, 2018N area is 70 by 15 ft and surfaced with asphalt and concrete. It was placed in service September 1985, located just north of Building 2018.	NFA
1.51	--	PWTP, Building 3544, placed in service in 1979, located south of the intersection of White Oak Avenue and Third Street and north of White Oak Creek.	NFA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.52	--	STP, Building 2521, placed in service in 1986, located east of North Street and south of Ponds 2543 and 2544	NFA
1.53	--	Septic Tank for Buildings 3000 and 3078, 580 gal capacity concrete tank, built in 1950, located north of the substation.	NFA
1.54	--	Waste Oil Storage Tanks 2525A and 2525B/500 gal ea. steel tanks, installed in 1984, located within a 3-ft high dike near the southeast corner of the Fabrication Shop A, Building 2525.	NFA
1.55	--	Septic Tank for Buildings 5507 and 5507, 750 gal capacity pre-cast concrete tank, built in 1967, located on the southwest side of Building 5507.	NFA
1.56A	10	Inactive LLLW Collection Tank W-19, 2250 gal vertical cylindrical, stainless steel tank, installed in 1955, located north of Building 3517 and east of Building 3505, adjacent to Tank W-20.	ERB
1.56B	10	Inactive LLLW Collection Tank W-20, 2250 gal vertical cylindrical, stainless steel tank, installed in 1955, located north of Building 3517 and east of Building 3505, adjacent to Tank W-19.	ERB
1.57	--	Nonradiological Wastewater Treatment Plant (WTP) Buildings 3549 through 3608/located south of White Oak Creek and east of SWSA 1.	NFA
1.58	8	Former Waste Pile Area located directly south of Nonradiological WTP, may be an extension of SWMU 1.57.	ERB
11.59	--	Old Incinerator Site located south of White Oak Creek and west of SWMU 1.57, estimated dates of operation are 1944 to 1967.	NFA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.60	--	Office Building for Efficiency & Renewable Energy Research, Building 3147 located west of the Shock Tube Laboratory, Building 3114, and the Roof Test Center, Building 3144.	NFA
1.61A	--	Waste Accumulation Area, Building 1503, (the old cylinder dock), comprised of a covered 10 by 30 ft dock, located southwest of Building 1503, and the adjacent ground-level 30 by 30 ft concrete pad.	NFA
1.61B	--	Oil Storage Area, Building 2013, located on the north side of Building 2013.	NFA
1.61C	--	Waste Oil Storage Area, Building 2018, oil storage house about 25 by 12 ft with a diked concrete floor and a total storage capacity of 1500 gal, placed in service in late 1985, attached to Building 2018.	NFA
1.61D	--	Fluorescent Tube Container Storage Area, Building 3025, covered porch.	NFA
1.61E	--	Waste Oil Storage Area, Building 3038, dock located on the east end of Building 3038.	NFA
1.61F	--	Oil Storage Area, Building 3103, located outside of the Cooling Tower, Building 3103	NFA
1.61G	--	Hazardous Waste Accumulation Area, Building 3500 10 by 10 ft metal building on the dock located at the southeast corner of Building 3500.	NFA
1.61H	--	Waste Oil Storage Area, Building 3550, located on the south side of Building 3550.	NFA
1.61I	--	Oil Storage Area, Building 4500N, consists of the north elevator dock.	NFA
1.61J	--	Oil Storage Area, Building 4500S, consists of a diked concrete pad with ramp, placed in service about 1983, located at the west end of Building 4500S between Building 4500S and 4508.	NFA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.61K	--	Waste Oil Storage Area, Building 4509, located at the Compressor House, Building 4509, across White Oak Creek and south of Building 4500S.	NFA
1.61L	--	PCB Waste Container Storage, Building 6000/located on the south side of Building 6000 near the shop	NFA
1.62	--	Waste Evaporator Facility (Pilot Plant), Building 3506/placed in service in 1949 and removed from service in 1954(?). Located between the west edge of the South Tank Farm (Area 3507) and Third Street south of Central Avenue (formerly identified as SWMU 1A.10).	D&D
1.63	9	Transfer canal and dissolver pit, Building 3505, located on the west side of the Metal Recovery Facility (also known as the FPDL Annex), Building 3505, east of Third Street. D & D operations are presently in progress on Building 3505 OU #1 for removal of the transfer canal and dissolve over pit contents (OU1), and demolition of the canal and pit (OUa).	ERB
1.64A	TBD	Active LLLW Collection Tank S-223, 2500 gal stainless steel tank, installed in 1955, located in an epoxy-coated concrete vault at the north side or northwest corner of Building 3517	WMA
1.64B	TBD	Active LLLW Collection Tank S-324, 1000 gal stainless steel tank, installed in 1955, located in an epoxy-coated concrete vault at the north side or northwest corner of Building 3517.	WMA
1.64C	TBD	Inactive LLLW Collection Tank S-424, 500 gal glass-lined carbon steel tank, installed in 1955, located in an epoxy-coated concrete vault at the north side or northwest corner of Building 3517.	WMA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.64D	TBD	Active LLLW Collection Tank S-523, 1000 gal stainless steel tank, installed in 1955, located in an epoxy-coated concrete vault at the north side or northwest corner of Building 3517.	WMA
1.65A	TBD	Active LLLW Collection Tank F-201, 50 gal stainless steel tank, installed in 1962, located in off-gas vault south side of Building 3525.	WMA
1.65B	TBD	Active LLLW Collection Tank F-501, 200 gal stainless steel tank, installed in 1962, located in vault south side of Building 3525.	WMA
1.66	TBD	Inactive LLLW Collection Tank W-1I, 500 gal horizontal cylindrical, stainless steel tank, installed in 1959, located under Building 3028.	WMA
1.67A	--	Inactive LLLW Collection Tank 4501-C 100 gal stainless steel tank, located in basement room BG74 of Building 4501. Tank was removed and disposed of in November, 1991.	RAC
1.67B	--	Inactive LLLW Collection Tank 4501-D, 100 gal stainless steel tank, located in basement room BG74 of Building 4501. Tank was removed and disposed of in November 1991.	RAC
1.67C	TBD	Inactive LLLW Collection Tank 4501-P, 140 gal stainless steel tank, installed in 1955, located in basement room BG74 of Building 4501.	WMA
1.68	10	Inactive Filter House Seal Tank 3002-A, 2200 gal stainless steel tank, located about 20 ft south of Building 3002.	ERB
1.69A	TBD	Active LLLW Collection Tank N-71, 240 gal stainless steel tank, installed in 1954, located in Cell VII of Building 3019.	WMA
1.69B	TBD	Active LLLW Collection Tank P-3, 200 gal stainless steel tank, installed in 1954, located in Cell VI of Building 3019.	WMA

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.69C	TBD	Active LLLW Collection Tank P-4, about 200 gal stainless steel tank, installed in 1954, located in Cell VI of Building 3019.	WMA
1.70	TBD	Active LLLW Collection Tank LA-104, 296 gal stainless steel tank, located in a concrete vault under the floor at the west end of Building 3047.	WMA
1.71	10	Inactive LLLW Collection Tank H-209, 2500 gal horizontal cylindrical, stainless steel tank, installed in 1961, located at the southwest corner of Building 3517.	ERB
1.72	10	Inactive LLLW Tank 3001-S, believed to be a 2000 gal stainless steel tank, located on the south side of Building 3001.	ERB
----	--	Inactive LLLW Tank 3001-A, estimated 1500 gal square, painted steel tank used for borated water, installed in 1949 and removed from service in 1965, located west of Building 3001.	SF
1.73	10	Inactive LLLW Collection Tank 3001-B, estimated 75 gal stainless steel tank, installed in 1943 and removed from service in 1965, located under the concrete stairway landing at south edge of Building 3001.	ERB
1.74	10	Inactive LLLW Collection Tank 3003-A, 16,000 gal vertical cylindrical, concrete tank, built in 1943 and removed from service in 1965, located about 15 ft south of Building 3003.	ERB
1.75	10	Inactive LLLW Collection Tank 3004-B, 75 gal vertical cylindrical, stainless steel tank, installed in 1956, located in a concrete vault east of Building 3008.	ERB
1.76	10	Inactive LLLW Collection Tank 3013, volume uncertain, vertical cylindrical, stainless steel tank, year of installation uncertain, located south of Building 3013.	ERB

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1.77	TBD	Active LLLW Collection Tank L-11, 400 gal stainless steel tank, installed in 1976, located within the PWTP, Building 3544.	WMA
1.78	10	Inactive LLLW Collection Tank T-30, 825 gal vertical cylindrical, stainless steel tank, installed in 1961, located in a lead-shielded concrete vault at the southwest corner of Building 4507.	ERB
1.79	TBD	Storage Canal, 101-ft-long canal (7 ft wide by 11.5 ft deep) between the Graphite Reactor, Building 3001, and Building 3019, 11.5-ft deep), covered with concrete and soil, contains about 62,000 gal of water. (There is RCRA action in progress to remove sediment).	D&D
1.80A	--	Acid Storage Tank 3505A, 5000 gal stainless steel tank, located at the west end of Building 3505.	D&D
1.80B	--	Caustic Storage Tank 3505B, 5000 gal carbon steel tank, located at the west end of Building 3505. (NOTE: This tank was originally insulated, but the insulation was removed after the tank was emptied and removed from service).	D&D
1A.1A	--	Graphite Reactor, Building 3001, 5-story steel frame and corrugated metal structure, placed in service in 1943 and removed from service in 1963, located on the north side of Hillside Avenue between Buildings 3019 and 3042.	SF

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1A.1B	--	Fan House, Building 3003, placed in service in 1943 and removed from service in the 1960s except for one small auxiliary blower and the ductwork from Building 3001 to exhaust air from the Graphite Reactor to its stack, 3018. The large fans were removed and the building was remodeled in the early 1970s; this building is now named the Solid State Accelerator Facility, (This SWMU was originally part of SWMU 1A.1A).	SF
1A.1C	--	Filter House, Building 3002, placed in service in 1948, located northwest of Building 3001. (This SWMU was originally part of SWMU 1A.1A).	SF
1A.1D	--	Stack, 3018, reinforced concrete stack about 200-ft tall and 12-ft 8-in. OD at the base, put in service in 1943, located at the southwest corner of Building 3003, (This SWMU was originally part of SWMU 1A.1A).	SF
1A.1E	--	Underground Exhaust Ducts, connecting Buildings 3001, 3002, 3003, 3018 placed in service in 1943 to transfer the exhaust air from the Graphite Reactor, Building 3001 to the stack, 3018 (This SWMU was originally part of SWMU 1A.1A.).	SF
1A.2A	--	LIT Reactor, Building 3005, wood-frame structure, placed in service in 1951, as a training reactor and later converted to a test reactor, removed from service in October 1968, located north of Building 3042.	SF
1A.2B	--	Heat Exchangers, Building 3077, Marley metal cooling tower placed in service in 1951 to transfer heat from the LITR cooling water to the air, removed from service in 1968, located north of Building 3005.	SF

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1A.3	--	Oak Ridge Research Reactor, Building 3042, steel frame and corrugated metal structure with some equipment buried underground external to the building, placed in service in 1959 and shut down in 1989.	SF
1A.4	--	^{60}Co Storage Garden, Building 3029, subterranean area containing 92 stainless steel tubes surrounding an irradiation chamber, each tube can hold a Co-60 source can at the bottom; located within Building 3029 on the Isotope Circle; placed in service in the late 1950s, still operable and contains an inventory of ^{60}Co but is not presently in use.	SF
1A.5	--	FPD Laboratory, Building 3517/consists of 23 large, shielded associated manipulator galleries and operating areas, placed in service in 1958 and placed in partial standby in 1975, located northeast of the intersection of White Oak Avenue and Third Street.	SF (partial)
1A.6	--	Fission Product Pilot Program, Building 3515, consists of a concrete-shielded cell with an adjacent shielded operating area placed in service in 1948 and removed from service in 1958, located at the east side of the South Tank Farm (Area 3507).	SF
1A.7	--	Metal Recovery Facility (also known as the FPD Laboratory Annex), Building 3505, consists of 7 concrete process cells, a below-grade dissolver pit, and a transfer canal. Built in 1951, placed in service in 1952, and removed from service in 1960; located on the east side of Third Street between the South Tank Farm (Area 3507) and Building 3517.	SF

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1A.8	--	Storage Garden (3033), consists of 7 buried stainless steel wells for the storage of sealed radioactive sources, irradiated targets, and miscellaneous items; placed in service in 1956, removed from service in 1975, and decommissioned in 1990 by the removal and disposal of the wells; located just north of Building 3033 in the Isotope Circle. The D & D work has been completed.	D&D
1A.9	--	^{90}Sr Power Generators, Building 3028, consists of four ^{90}Sr thermoelectric power generators stored in a staging area located west of Building 3028 in the Isotope Circle.	SF
1A.10	--	Waste Evaporator Facility (Pilot Plant), Building 3506 (NOTE: Now listed as SWMU 1.62.).	-----
1A.11	--	Ceramic Processing Laboratory, Building 4508 consists of the complex (room 139) within Building 4508, placed in service in 196.	SF
1A.12	--	High-Level Chemical Development Laboratory, Building 4507, consists of 4 hot cells with equipment for handling highly irradiated alpha-beta-gamma sources and associated chemical make-up equipment, glove boxes, etc.; built in 1957, removed from service in 1980, and subsequently mothballed.	SF
1A.13	--	Remote Coating Furnace Loop, Building 4508, facility and associated support equipment located in Room 265A of Building 4508; placed in service in the 1960s and removed from service in 1980.	SF
1A.14	--	Transuranium Research Laboratory Room 45, Building 5505, placed in service in 1967, the 13 glove boxes were removed in 1989 for disposal.	SF

Table 2.1. WAG 1 Solid Waste Management Unit List (continued).

SWMU #	OU #	Site Name/Description	Status
1A.15	--	High-Level Radiochemical Analytical Laboratory, Building 3019B consists of 7 manipulator-equipped hot cells and a centrally located storage cell; operated from 1955 to 1980; is located just northeast of the intersection of Hillside Avenue and Third Street.	SF
1A.16	--	Oak Ridge Research Reactor Heat Exchanger, Building 3087, consists of 7 adjacent water-to-air heat exchangers on a common concrete pad; placed in service in 1959 and replaced in 1961 by 2 wood cooling towers of greater capacity; located southwest of the intersection of Northside Drive and Fifth Street.	SF
1A.17	--	Offgas Filter House, Building 3121 placed in service in 1966, located southeast of and adjacent to Building 3019	SF

LEGEND

ERB	-	Environmental Restoration Baseline Action Item
D&D	-	ORNL Decontamination and Decommissioning Program
NFA	-	No Further Action Required by Regulatory Agreement. FFA, Appendix C.
RAC	-	Remedial Action Completed/Underway
SF	-	Surplus Facility, Candidate for Future D & D
WMA	-	Waste Management Active System
*	-	Not on FFA List
TBD	-	To Be Determined as not currently in the ER Baseline
--	-	Not assigned to an OU as not anticipated to be included in ER Baseline

OU #	Description
1	North and South Tank Farms and Tanks TH-4 and W-11
2	Surface Impoundments
3	Underground Pipelines and Storm Drains
4	Groundwater
5	White Oak Creek Floodplain Soils and Sediments
6	SWSA 1
7	SWSA 2
8	Waste Pile
9	Contaminated Soils
10	Steel Tank Systems

2.1.4 Operable Units and Solid Waste Management Units

For purposes of this baseline planning process, ten WAG 1 OUs have been identified. Based on the results of the Phase I Remedial Investigation and previous studies, the 76 SWMUs with

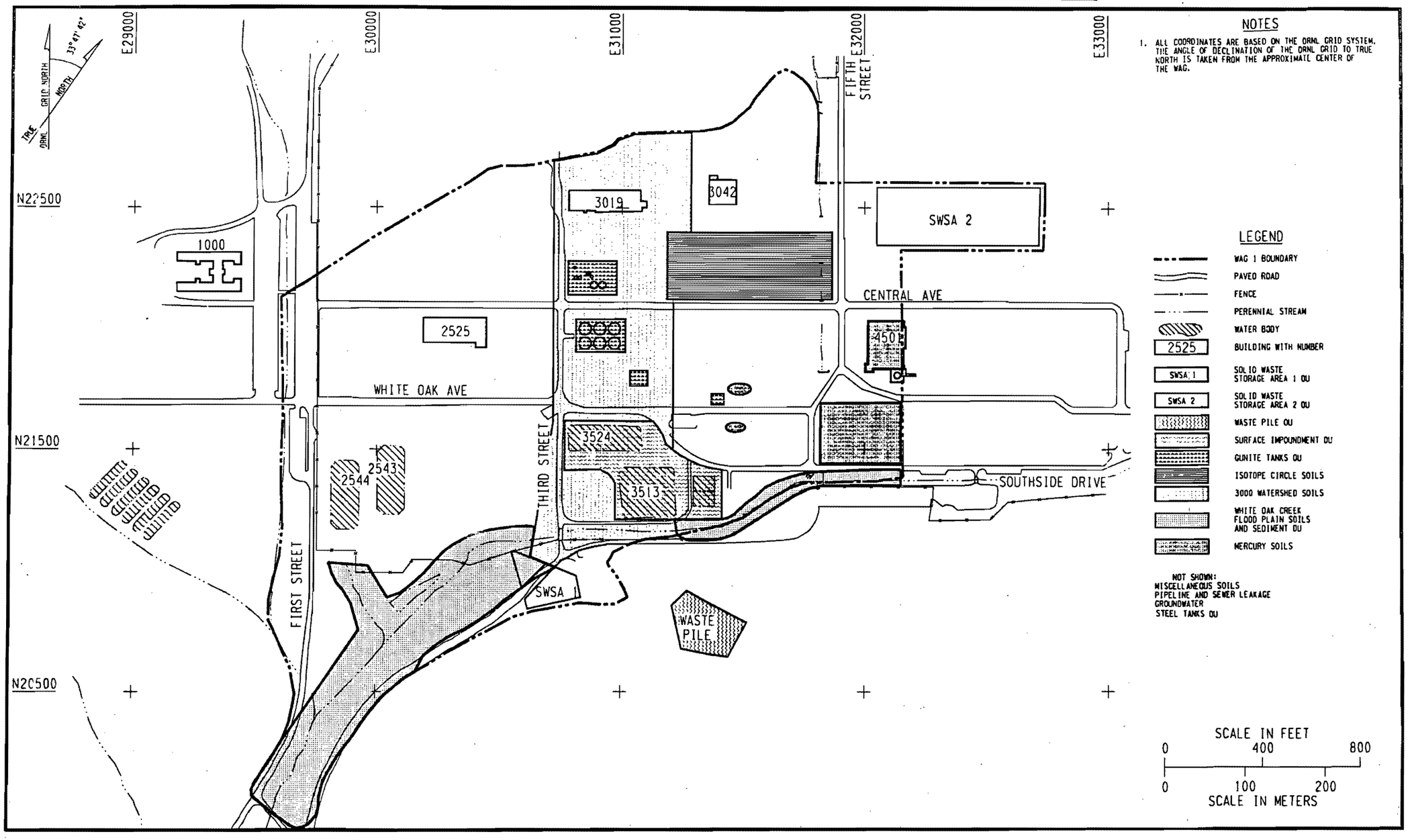


Fig. 2.3. WAG 1 Solid Waste Management Units. ***Source:*** **BNI, 1992.**

similar characteristics and/or geographical locations were grouped into these operable units. The ten operable units fall into three categories according to associated release mechanisms and potential exposure conditions. The OUs are categorized as shown.

Category 1 - Source Control

OU1 North Tank Farm, South Tank Farm and TH-4/W-11

Category 2 - Control of Off-WAG Migration

OU2 Surface Impoundments
OU3 Underground Pipelines/Storm Drains
OU4 Groundwater
OU5 White Oak Creek Flood Plain Soils/Sediments
OU6 SWSA 1

Category 3 - Control of On-WAG Migration

OU7 SWSA 2
OU8 Waste Pile
OU9 Contaminated Soils
OU10 Steel Tank Systems

Category 1 - Source Control

Approximately 95% of the documented inventory of radionuclides within waste management units in WAG 1 is contained within the underground storage tanks in the South Tank Farm. While there have been no documented releases from these Gunite tanks, their age and uncertain structural integrity suggest the potential for a release in the future. Gunite tanks in North Tank Farm and Tanks W-11 and TH-4 were also identified as potential sources of radiological contamination. Given the large radiologic inventory and similarities in terms of construction materials and potential remediation strategies, these tanks are grouped as one source control OU. The remedial action objective for this OU is to prevent future releases that might result in either groundwater contamination or exposure of the onsite work force to airborne contamination.

Category 2 - Control of Off-WAG Migration

Continued migration of contaminated groundwater, surface water, and sediment beyond the WAG boundary could result in potentially unacceptable exposures to downstream environmental receptors via surface water and sediment or could contaminate groundwater resources elsewhere within Bethel Valley. Continued discharge of contamination is also likely to increase the scope and costs of future remedial actions. The remedial action objective for the OUs identified in this category is to control the discharge of contamination beyond the WAG boundary. This includes the control of (1) unpermitted discharges to surface waters through the network of storm drains and

pipelines, (2) discharge of contaminated groundwater to surface water, and (3) potential erosion of contaminated flood plain soils and sediments along White Oak Creek through scour, suspension, and transport of bed sediments.

Category 3 - Control of On-WAG Migration

Existing contamination within the WAG 1 boundary could lead to the potential exposure of the onsite work force or future receptors unless control measures are maintained. ORNL has a rigorous environmental health and safety program designed to protect the work force from both occupational and environmental hazards. Administrative controls are in place at contaminated areas to prevent inadvertent worker exposure; some areas also have temporary covers designed to prevent the migration of transferable contamination. Based on preliminary analysis, it appears that contamination within the soils is relatively immobile because of the absorption capacity of the clayey soils for radionuclides. However, in the absence of these administrative controls, future land users may be exposed to this onsite contamination. The remedial action objective for the OUs in this category is to minimize the potential for future exposure to this contamination. Specific OUs in this category encompass several areas of contaminated soils, mercury spill areas, and steel underground waste storage tanks.

The categories imply a priority of action in the three groups of OUs; source control actions (Category 1) would need to occur before final actions are taken to control off-WAG migration (Category 2). Remediation of on-WAG contamination (Category 3) would be most efficiently accomplished in coordination with long-term plant closure and D&D projects. The following sections provide brief descriptions of WAG 1 OUs. Additional information for WAG 1 OUs is provided in the SCSR.

2.1.4.1 North and South Tank Farms and Tanks TH-4 and W-11 Operable Unit - OU1

The Tank Farm OU includes the tanks located in the North and South Tank Farms as well as Tanks TH-4 and W-11. The SWMUs within this OU are primarily the large Gunite tanks installed to store liquid wastes in 1943 and subsequently used as the main holding tanks for the LLLW system at ORNL. A number of steel tanks associated with the North Tank Farm are also included in this OU. The strategy of this grouping is to allow those tanks that are geographically similar to be remediated as a group. Some tanks contain sludge which require isolation in order to mitigate further releases, while other tanks do not contain sludge but require remedial action because of groundwater infiltration from inleakage through the tank domes.

The Tank Farm OU is commonly referenced as three separate tank groups as described below.

- South Tank Farm Waste Tanks W-5, W-6, W-7, W-8, W-9, and W-10 (SWMUs 1.26A, B, C, D, E, and F)

- North Tank Farm Waste Tanks W-1, W-2, W-3, W-4, W-13, W-14, W-15, and W-1A (SWMUs 1.23A and B; 1.24 A and B; 1.25A, B, and C; and 1.28)

- Building 3550 Laboratory Waste Tanks TH-4 and W-11 (SWMUs 1.32 and 1.27)

South Tank Farm

The STF is located near the center of WAG 1 at the southeast corner of the intersection of Central Avenue and Third Street (Fig. 2.3). This OU consists of six large, reinforced Gunite (sprayed concrete) tanks, each with a capacity of 170,000 gal (BNI, 1992). The tanks were taken out of service in 1978 and most of the tank contents (i.e., liquids and sludges) were removed via sluicing; however, liquid and sludge remain. Much of the contamination associated with the STF consists of ^{90}Sr, ^{137}Cs, ^{232}Th, ^{238}U, TRU compounds, volatile organic compounds (VOCs) and various metals.

North Tank Farm

The NTF, located across from the STF in the northeast corner of Central Avenue and the Third Street intersection (Fig. 2.3), consists of eight tanks of varying capacities constructed of either Gunite or stainless steel. All the tanks in the NTF are buried, but they are not arranged in a grid like the STF. By 1986, all tanks were removed from service. Tanks W-1, W-1A, and W-2 were used to hold waste from the 3019 Radiochemical Pilot Plant. Tanks W-3 and W-4 were designed to hold metal waste from Building 3019. Tanks W-14 and W-15 were used to collect waste from the Operations Division, and Tank W-13 collected waste from the Chemistry Division Hot Laboratory Group. The major contaminants associated with the NTF are ^{90}Sr, ^{137}Cs, ^{152}Eu, ^{233}U, ^{238}U, ^{238}Pu, ^{239}Pu, ^{241}Am, ^{244}Cm, other TRU elements, metals, VOCs, and other RCRA constituents.

Tanks TH-4 and W-11

Tanks TH-4 and W-11 are located in separate areas of WAG 1. Tank TH-4, a 14,000-gal Gunite tank at the southwest corner of Building 3500, near the intersection of Central Avenue and Third Street (Fig. 2.3), received waste from the irradiated thorium and uranium pilot plant project. It contains an estimated 17,000 gal of supernate and 6300 gal of alkaline thorium and uranium sludge. In addition to thorium and uranium, other tank contaminants of concern are ^{90}Sr, ^{137}Sr, and TRU elements.

Tank W-11 is a 1500-gal Gunite tank approximately 60 ft from the southeast corner of the STF and 100 ft north of Building 3517 (Fig. 2.3). The tank, which contains an estimated 900 gal of liquid and 100 gal of sludge, was used to collect waste from research laboratories in Building 3550. Major contaminants of concern are ^{90}Sr, ^{137}Cs, ^{238}Pu, and other TRU elements.

2.1.4.2 Surface Impoundments Operable Unit - OU2

A brief description of each of the four surface impoundments, included in OU2 (Basins 3513, 3524, 3539, and 3940), is provided below.

Basin 3513 (SWMU 1.12)

This unlined impoundment was constructed in the year 1944 to serve as a settling basin for untreated wastewaters prior to their discharge into adjacent WOC (Fig. 2.3). The impoundment basically was constructed by excavating into the clay soil overlying the limestone bedrock at the site, and no lining was added. Dimensions of the impoundment at water level elevation 778 ft are approximately 220 by 220 ft sloping to 200 by 200 ft at the bottom. The bottom elevation of the north end of the impoundment, at approximately 772 ft is approximately one foot lower than the south end. Inflow to the impoundment was by five waste lines emptying into the north side, while outflow was through the same number of opposing lines on the south side.

Operation of the facility ceased in 1976 when a new process waste treatment plant came into operation. Wastes to the basin included supernatant from the gunite tanks until 1949. Additional wastes were from laboratory floor and sink drains, chemical process, cells, and cooling water from the graphite reactor. In addition to ^{137}Cs and ^{90}Sr, the sediment contained measurable quantities of ^{60}Co, ^{154}Eu, ^{238}Pu, ^{239}Pu, ^{241}Am, and ^{244}Cm. In an earlier study, total inventory of radionuclides was estimated to be ^{235}Ci, with Cs and Sr accounting for 84% and 13%, respectively. EP Toxicity analysis of the sediment showed that it was a characteristic RCRA waste because of toxicity due to elevated levels of mercury.

Basin 3524 (SWMU 1.13)

Basin 3524 is one of four holding basins located in the south central portion of the Bethel Valley ORNL facilities complex (Fig. 2.3). Basin 3524, frequently referred to as the equalization basin, was an intermediate storage, collection, and mixing basin for the process waste treatment system located in Building 3544 but now is only used for surge capacity for storm events.

The sludge in Basin 3524 has accumulated to a depth ranging from approximately 1 to 4 ft over a period of approximately 40 years. The sludge is deepest in the vicinity of the impoundment inlet structure. It is reasonable to assume that the maximum sludge depth will not exceed 4.5 ft at any location in the pond. Analysis of sludge collected in 1986 by the EP-Tox leach test revealed no toxicity characteristics. Benzene, chloroform, and methylene chloride were three nonEP-Tox limited volatile organics present, with average concentrations of 6.9, 3.6, and 6.4 ug/L, respectively. In 1984, analysis of the sludge indicated an inventory of 150 Ci.

Basins 3539 and 3540

ORNL Basins 3539 and 3540 constructed in 1964, and frequently referred to as the 190 ponds, were formerly used as surge ponds to receive process waste streams primarily from the Building 4500 complex. The waste streams are split into identical, parallel basins and monitored primarily for radionuclides before discharge to the process waste treatment system via Basin 3524 or to WOC (Fig. 2.3). The sludges within each basin range from 2 to 4 in. deep. Currently, the ponds are only used as surge capacities for collection of stormwater during peak storm events.

Wastes are derived from floor drains, laboratory drains, steam condensates, and process vessel cooling waters. Analysis of sludge collected in 1986 indicated that none exceed the EP toxicity limits. Methylene chloride and 1,2-transdichloroetheylene were present with average concentrations of 3.6 and 2.1 ug/L, respectively. Total radioactivity present in the ponds is estimated to be less than 10 Ci.

2.1.4.3 Underground Piping and Storm Drain Operable Unit - OU3

An extensive network of underground utilities and storm drains exists throughout WAG 1. The pipeline trenches and storm drain trenches underlying WAG 1 and the LLLW transfer line in the vicinity of the STF (SWMU 1.21) are included in this OU. While many pipelines are abandoned, they are near numerous others in the same trench that are still in use. Existing RI data indicates that contaminants migrate to surface waters (e.g., WOC, First Creek, and Fifth Creek) through abandoned leaking pipelines, pipeline trench backfill soils or bedding materials, and leaking storm sewers. Currently, Outfalls 341 and 342 are known to release measurable concentrations of radionuclides to surface water. This OU addresses the release of contaminants across the WAG boundary through this network.

2.1.4.4 Groundwater Operable Unit - OU4

The Groundwater OU includes the shallow groundwater beneath the WAG which discharges to surface streams within WAG 1. The potential exists for contaminant migration from various sources within WAG 1 through both shallow and deeper groundwater movement to off-WAG receptors. Deeper groundwater movement through bedrock underneath WAG 1 is addressed in WAG 21.

2.1.4.5 White Oak Creek Flood Plan Soils and Sediments Operable Unit - OU5

This OU consists of soils and sediments within the floodplain of WOC, primarily in the southwestern portion of WAG 1. These media are primarily contaminated with cesium. This area has become contaminated from discharges into WOC and from off-WAG migration of contaminants originating almost anywhere on the WAG (e.g., the Soils OU). Some of the soil and sediments contamination eventually migrates further downstream to WAG 2.

Remediation of the WOC flood plain soils and sediments is an OU because of the geographically distinct location of the soils and sediments (1) along the water course of WOC at the southwest boundary of the WAG, and (2) along the water course extending up First Creek on the west boundary of the WAG.

2.1.4.6 Solid Waste Storage Area 1 Operable Unit - OU6

SWSA 1 (SWMU 1.45) is located southwest of the fence surrounding the main plant area at ORNL with its closest edge approximately 25 ft south of White Oak Creek. The site is triangular in shape and encompasses approximately 1 acre. The burial ground lies in the path of surface water

drainage from Haw Ridge to White Oak Creek, causing marshes to develop in the topographically low portions of the area following periods of heavy rains and wet seasons.

The site probably was selected on the basis of its proximity to ORNL with no consideration given to the possibility that contaminants might leak into the nearby water system. The site was commissioned in 1943 and closed in 1944. The earliest record of burials dates from April 1944 when cans with red tops were placed in the 706-A Building for the collection of waste materials that could not be disposed of through the drains.

The site was abandoned when water was found in an excavated trench in the northern section. No records are available to show the quantity or type of waste in this burial ground, but it is estimated that only 2000 to 4000 Ci of solid radioactive waste was buried there. A scan of the surface revealed elevated gamma levels ranging from 20 to 200 μR/h with the highest gamma levels found at the west end of SWSA 1 near White Oak Creek. Although it is believed that mostly solid radioactive wastes are buried at SWSA 1, the possibility exists for contaminant leaching due to lateral and/or downslope surface runoff.

SWSA 1 is currently surrounded by a metal chain and posts, grass-covered, and maintained by Operations Division personnel. An access road to the newly constructed High Temperature Materials Laboratory and the south parking lot passes through the area. Groundwater in the area moves toward White Oak Creek and is therefore monitored via the ORNL Stream Monitoring System.

2.1.4.7 Solid Waste Storage Area 2 Operable Unit - OU7

SWSA 2 (SWMU 1.47), in the northeast corner of WAG 1 (Fig. 2.3), was used for the disposal of solid waste containing beta- or gamma-emitting isotopes, liquid waste contaminated with plutonium in stainless steel drums, and alpha-contaminated material from off-site locations (ORNL 1990). The site was closed in 1946, and reportedly all of the buried wastes and contaminated soils were later excavated and transported to SWSA 3. An analysis of soil and groundwater samples indicates that the site does not contain concentrations of radionuclide constituents significantly higher than background. However, anomalies were found during geophysical investigations. A limited Phase II RI will be conducted to determine if NFA is appropriate.

SWSA 2 is considered a separate OU because of the potential for NFA, although additional field work or evaluation may be required to justify this decision. The purpose of identifying NFA candidates as separate OUs is to remove the candidates from the full CERCLA process and simplify the resulting documentation. The unit is also geographically separate from the other waste units. The soils and materials in SWSA 2 are core OU elements. Possible additional elements are the proximal contaminated soils.

2.1.4.8 Waste Pile Operable Unit - OU8

The Waste Pile Area (SWMU 1.58) is located directly south of the Nonradiological Wastewater Treatment Plant (NRWTP) across White Oak Lake (WOL) (Fig. 2.3). The exact extent of the area is unknown, but on the basis of old ORNL photographs, it appears to occupy 15 to 20 acres. Interviews with ORNL staff indicate that the site was used as both a soil borrow area and a disposal area for noncontaminated construction debris (Nix, 1989). Identification of particular wastes has not been undertaken, but an excavation for installation of a transfer pipeline uncovered numerous metal and glass containers, transite, and miscellaneous metal piping and scrap.

Contamination is not expected at this OU, therefore, it is another candidate for NFA. Remediation of the waste pile is considered a separate OU because of the potential for NFA, although additional work may be required to document this decision. The unit is also geographically separate from the other waste units. The soils and materials in the waste pile are core OU elements. Possible additional elements are the proximal contaminated soils.

2.1.4.9 Contaminated Soils Operable Unit - OU9

This OU contains all of the soils underlying WAG 1, and is subdivided into four areas: soils in the 3000 watershed, soils in the Isotope Circle, mercury-contaminated soils, and miscellaneous-contaminated soils.

3000 Watershed Soils

The 3000 Watershed Soils consists of the soils in the central portion of the WAG from the northern edge of the WAG to WOC on to the southern edge. The soils are contaminated with various radionuclides from spills and/or leaks, as indicated by radiological survey data, and the area is believed to be the main drainage for the entire WAG; therefore, it receives contaminated runoff from various locations. These areas are bounded by Third Street to the west, and the eastern boundary is approximately one block to the east. Also included in this OU are any additional soils (beyond those to be assigned to D&D) contaminated by releases from any of the 19 buildings within the area boundaries, as well as any additional miscellaneous pipelines, trench soils, bedding materials, and backfill soils.

Isotope Circle Soils

The Isotope Circle Soils, consisting of contaminated soils within a two-block area east of the NTF, is currently occupied by a number of buildings and several underground steel tanks. The soils are believed contaminated primarily with ^{90}Sr, ^{137}Cs, and uranium isotopes from various isotope research programs within the surrounding buildings. Also included in this OU are any additional soils (beyond those to be assigned to D&D) contaminated by releases from any of the buildings within the area boundaries, as well as any additional miscellaneous pipelines, trench soils, bedding materials, and backfill soils.

Mercury Spill Soils

The Mercury Spill Soils currently consists of four distinct locations in the southeastern corner of the WAG where spills of mercury have occurred. Soils, pipelines, and trenching materials in these areas are included in the area. Subsequent soil sampling of these areas has indicated mercury contamination. Two of the spill areas are beneath occupied buildings with soil borings installed through the bottom floor. The additional mercury spill areas are isolated from the above areas. One area is along the south side of Building 3592, and the other is beneath the roadway just south of Building 3503. During the Phase I RI, soils analyses indicated a wider distribution of mercury in soil than originally suspected. Further assessments of this information may suggest that the new mercury-contaminated waste units be added.

Miscellaneous Contaminated Soils

Miscellaneous contaminated soils exists as a "catch-all" for the remaining contaminated soils units. These soils are located in the northeast corner of the WAG, scattered along the northwestern border and western half of the WAG (west of Third Street), and in the south central area, east of the surface impoundments.

2.1.4.10 Steel Tank Systems Operable Unit - OU10

The Steel Tank Systems OU consists of the following 16 tanks constructed of stainless steel: W-19, W-20, WC-1, WC-15, WC-17, T-30, TH-1, TH-2, TH-3, H-209, 3001B, 3001S, 3002A, 3003A, 3004-B, and 3013. Although attempts have been made to empty these tanks, sludge may still be present containing ^{137}Cs, ^{90}Sr, TRU elements, and other radionuclides. The interior of these tanks and associated piping systems are contaminated, and some leakage has occurred. Steel tanks are in various locations throughout the WAG, but their remediation is designated a separate OU because the tanks may all be addressed with a similar remedial technology.

The following information was taken from the RI Plan for WAG 1 and quantities taken during period 1987 to 1989.

Tanks W-19 and W-20 (SWMU 1.56A and 1.56B)

Tanks W-19 and W-20, located south of the STF near Fourth Street, are small, vertical, stainless, tanks with a capacity of 2250 gallons. These tanks were installed in 1955 to serve the Metal Recovery Facility (MRF) and were used to collect waste produced during recovery and reprocessing of uranium and other nuclear material. The waste material mainly consisted of acidic fission product raffinate solutions (nitric acid waste), which were eventually transferred to Building 3517 for separation of fission products (UCC-ND, 1984). Following the MRF decommissioning in 1960, Tanks W-19 and W-20 were used briefly by Building 3517 before being placed out of service in the 1960s. An attempt was made in the 1987-1989 effort to sample these tanks, but they were found to be empty (Autrey et al., 1989).

Tank WC-1 (SWMU 1.29)

Tank WC-1 was used for collection and monitoring of process liquid waste from isotope production and development laboratories in Buildings 3038, 3028, 3029, 3030, 3031, 3032, 3033, 3047, Filter Building 3110, Stack 3039, and Scrubber 3092. This underground tank is a 2150 gallons capacity, vertical, stainless steel tank. It was placed in service in 1950 and was taken out of service in 1968 because of leaking discharge lines.

Tanks WC-15 and W-17 (SWMU 1.30A and 1.30B)

Tanks WC-15 and WC-17 collected waste from various laboratories in the Building 4500 complex. These underground tanks are 1000-gallon capacity, vertical, stainless steel, were placed in service in 1951, and were removed from service in the 1960s because of leaks. Waste Tank WC-15 has not been sampled due to access restrictions. Waste materials sampled in Tank WC-17 include liquids and the soft sludge. The contents of the tank were classified as RCRA liquids and RCRA sludge by ORNL because of high levels of mercury in the liquid and cadmium, chromium, lead, and mercury in the sludges. Other metals identified were uranium, silver, arsenic, barium, and nickel. Volatile organics reported for the liquid samples include styrene and xylene (total). The pH of the liquid waste ranged from 7.6 to 7.9.

Tank T-30 (SWMU 1.78)

Tank T-30 is a small, stainless steel-jacketed, vertical, underground tank with a capacity of 825 gallons. It was installed in a concrete vault south of Building 4507 in 1945 and used to store radioactive materials for the Curium Recovery Facility (Building 4507), which became the High Radiation Level Chemical Recovery Facility in 1973. The tank was inspected in 1961 and found adequate for storage of radioactive materials. No out-of-service date is available for this tank. Tank T-30 is not known to be leaking. Sampling of the liquid phase in Tank T-30 resulted in determination of 11 mg/L of methanol and a trace of phthalate.

Tanks TH-1, TH-2, and TH-3 (SWMU 1.31A, 1.31B, and 1.31C)

Tanks TH-1, TH-2, and TH-3 received wastes from the Thorium Pilot Plant in Building 3503. Tank TH-1 is an underground, 2500-gallon capacity, vertical, stainless steel tank, which was placed in service in 1948. Tank TH-2 is an underground, 2400-gallon capacity, vertical, stainless steel tank, which was placed in service in 1952. All three tanks were taken out of service in 1970, and the structural integrity of the tanks is unknown. Tank TH-2 was sampled later, and no sludges were present. Samples from Tanks TH-1 and TH-3 were liquids. Tank contents are characterized as RCRA liquids because of their corrosive nature (pH 1.8) and high levels of mercury; other metals detected near the RCRA limits are chromium and lead. Other metals detected but at lower levels are uranium, silver, barium, and nickel.

Tanks H-209, 3001S, 3001B, 3002A, 3003A, 3004B, and 3013 (SWMUs 1.71, 1.72, 1.73, 1.68, 1.74, 1.75, and 1.76) are included in the Steel Tank Systems; however, the RI Plan does not provide any information for these seven tanks.

2.2 APPROACH

The Phase I Remedial Investigation for WAG 1 is almost complete. Three RI-related reports have already been issued to the regulators for review and comments, therefore, only the resolution and incorporation of their comments remains to be performed. The Phase II RIs, planned for each of the WAG 1 OUs, will only consist of the focused effort(s), such as additional nonintrusive surveys or selected media sampling, required to acquire any remaining RI data needed to support the evaluation of alternatives for the specific OU. The results of these investigations will be used to calculate the risks to human health and the environment from this contamination and will be documented int he RI Report and the Alternatives Evaluation.

The scope of the FS/EA/IROD activities for each OU is to define the alternatives that will mitigate the risks identified in the Phase I and II RIs, select a preferred alternative or set of alternatives using the criteria established under CERCLA, and prepare the various decision documents required before implementation of the RAs. The alternatives considered will be documented in an FS Report for each OU that will be augmented with the documentation associated with the EA required under NEPA. The FS/EA Reports are intended to address the requirements of both CERCLA and NEPA and, as such, will undergo a single process. Based on the regulatory reviews, OU-specific PPs will be developed, using the criteria established under CERCLA to evaluate the alternatives, selecting a preferred alternative. These documents then will undergo public comment. Based on the public comments, IROD and NEPA documentation will be prepared and issued, signed by the EPA, DOE, and the State of Tennessee, documenting the selected alternatives to be used to remediate the contamination at each OU in WAG 1.

The scope of WAG 1 remediation identified in this Baseline Report consists of seven Early Actions and ten Operable Units.

In order to address specific areas of concerns for remediation in the near future or to provide up front development support for a number of the OUs, the current list of Early Actions identified in this FY92 WAG 1 Baseline Report include:

- EA1 - Construction of enclosure buildings for the NTF, STF and Tank TH-4.
- EA2 - Removal of remaining liquids from inactive waste storage tanks.
- EA3 - Installation of additional groundwater monitoring wells.
- EA4 - Engineering studies focusing on robotics development and treatability studies for the stabilization of sludges in the Gunite tanks.

- EA5 - Collection and treatment of groundwater from the Corehole Eight Plume.

- EA6 - Boundary control of off-WAG groundwater migration through pipes and trenches.

- EA7 - Stabilization of sediment hot spots in White Oak Creek.

The RD efforts will include Title I and Title II engineering, associated engineering studies, and Title III engineering services to support the preferred alternatives identified in the IRODs. The RA will involve the procurement of materials, bid and award of fixed-price construction contracts, construction management, and construction of associated support facilities for the following Phase I and Phase II OU remedial actions:

- OU1 - North and South Tank Farms and Tanks TH-4 and W-11

  Base Action:
  Because there is a regulatory constraint requiring that construction begin not more than 15 months after approval of the IROD, a two-phased approach was proposed for this OU.

  Phase I - Liquid removal and decontamination of empty tanks
  Phase II - in-place solidification of sludges and tank closure

- OU2 - Surface Impoundments

  Base Action: In-place treatment of sludges and capping

  Contingent Action: Pre-treatment of water drawn from impoundments

- OU3 - Underground Piping and Storm Drains

  Base Action: Intercept, collect and treat migrating contaminated water, remove contaminated underground LLW piping, and plug underground pipes.

- OU4 - Groundwater

  Base Action: Collect and treat shallow contaminated groundwater

  Contingent Action: Install additional collection and treatment capacity

- OU5 - White Oak Creek Floodplain Soils and Sediments

  Base Action: Isolation and stabilization of contaminated soils and sediments

  Contingent Action: Excavation and disposal of contaminated soils and sediments

- OU6 - SWSA 1

  Base Action: Installation of slurry wall and multi-layer cap over burial trenches, reroute Melton Valley Drive

- OU7 - SWSA 2

  Base Action: No Further Action

  Contingent Action: Containment in place.

- OU8 - Waste Pile

  Base Action: No Further Action

  Contingent Action: Containment in place.

- OU9 - Contaminated Soils

  Base Action: Excavation and off-site treatment of mercury contaminated soils, in-place treatment of other contaminated soils, and installation of a single-layer cap

  Contingent Action: Excavation and disposal in consolidation area

- OU10 - Steel Tanks Systems

  Base Action: Decontamination and grout in-place

The WAG 1 scope also includes the design and construction of the following support facilities associated with remediation activities:

- Personnel and equipment decontamination facilities.
- Grout manufacturing facility to support the Tank Farms and Surface Impoundments OUs.
- Consolidation facility for disposal of RA-generated wastes.

2.3 METHOD OF ACCOMPLISHMENT

This project will be accomplished by DOE, MMES, the RI Subcontractor, the FS Contractor, the RD Architect-Engineer (A-E), the RA Construction Manager (CM), and the Independent

Verification Contractor. The organization and interrelationship of participants involved in the ER Program are presented in Fig. 2.4. The project will be managed in accordance with the requirements established in the ER Program Management Plan "*Management Plan for the Oak Ridge Operations Environmental Restoration Program,*" (DOE-OR 931) and a WAG 1 Project Management Plan which will be prepared.

The responsibilities of each participant are summarized below.

2.3.1 United States Department of Energy - Oak Ridge Field Office

The DOE-OR will administer all contracts, furnish overall project management, and review and approve all primary documents required by the FFA. The DOE-OR will also direct and administer all aspects of the project including specific approval of work assignments to participants and approval of work performed. DOE-OR is the primary interface with the EPA, TDEC, other government agencies, and the public.

2.3.2 Martin Marietta Energy Systems, Inc.

Under prime contract to DOE-OR, MMES serves as the Facilities Manager for ORNL and will provide oversight of RI/FS activities; engineering support including design criteria, reviews, and approval recommendations for all Titles I and II engineering documents prepared by the A-E Contractor; Title III engineering services and inspection as determined by DOE; miscellaneous field services for tie-ins to existing systems and pre-operational checkouts; and overall integration of remediation activities of the other prime contractors on behalf of DOE-OR.

MMES will also provide interface with waste management operations for all the waste generated during remedial activities at WAG 1. Other interfaces, such as providing utilities, treatment plant operations, and other intrastructural work required to support remedial activities, will also be the responsibility of MMES.

2.3.3 Remedial Investigation Subcontractor

The RI Subcontractor will perform the Phase I and Phase II RIs including the preparation of the RI Work Plan, all field activities, the RI Report, the alternatives analysis, and FS activities oversight.

2.3.4 Feasibility Study Contractor

The FS Contractor will perform the FS/EA and then prepare the PP and IROD for each OU, as well as oversight of RI and RD activities.

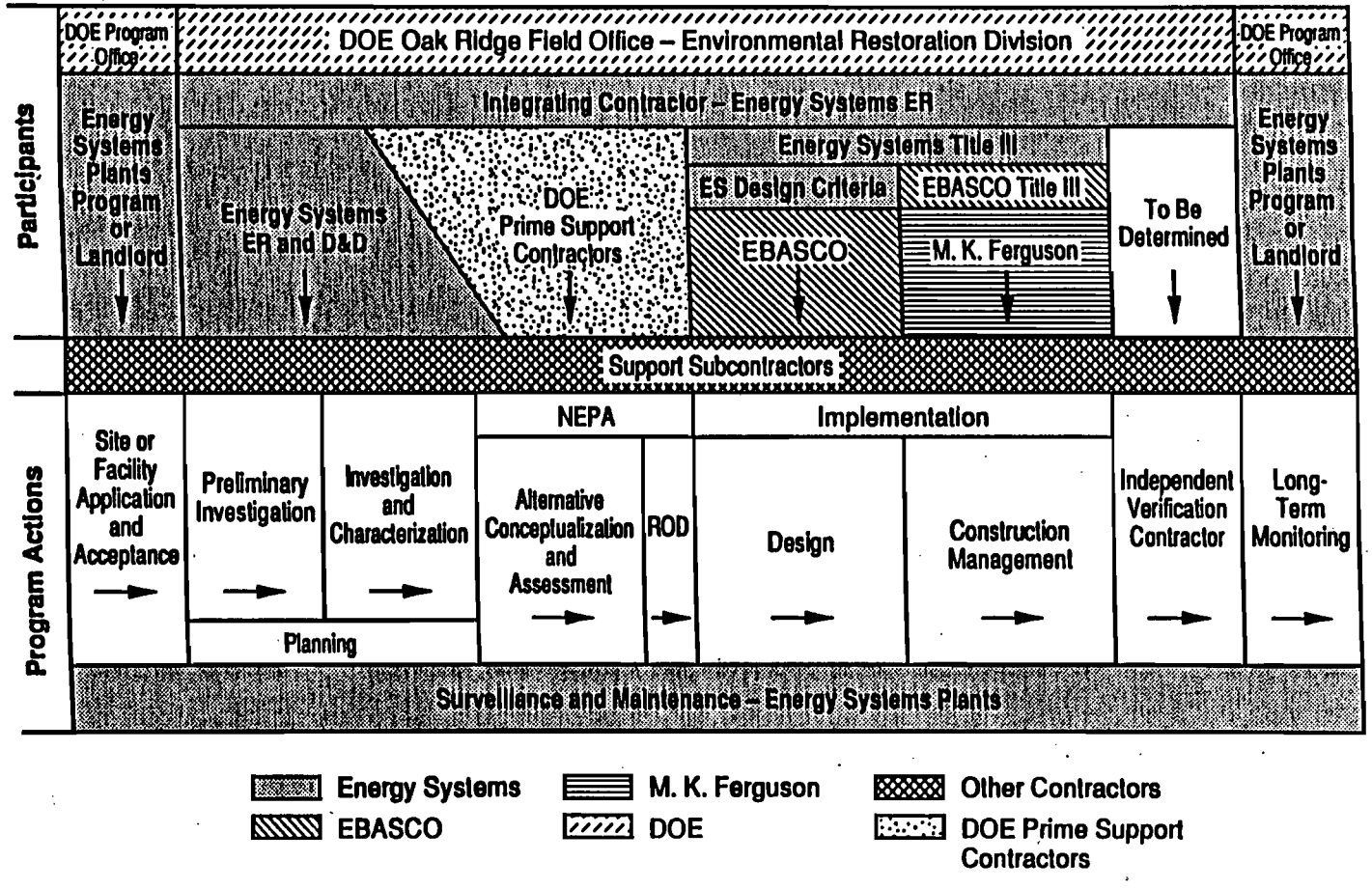


Fig. 2.4. ORR Environmental Restoration Organization.

2.3.5 Remedial Design Architect-Engineer Contractor

The RD A-E Contractor will perform Titles I and II design and engineering services, including the preparation of all working drawings, specifications, and integrated systems test plans including testing requirements summary. The RD A-E Contractor will also provide Title III services as determined by DOE and oversight of FS and RA efforts.

2.3.6 Remedial Action Construction Manager

The RA Construction Manager will provide construction planning and constructability reviews, administer fixed-price construction subcontracts, and provide direct-hire construction and RD oversight.

2.4 WORK BREAKDOWN STRUCTURE

The WBS for WAG 1 was developed using a "team concept" with each contractor providing a clear understanding and statement of technical objectives and the end products of the work to be performed. Each participant had an opportunity to determine how the WBS was structured and to identify the project elements. The product-oriented WBS used the primary documents required by the FFA as the guide for the arrangement of the elements. Careful consideration was given to how the elements would be summarized in the WBS to ensure measurable and verifiable reporting.

The Project Summary Work Breakdown Structure (PSWBS) for WAG 1 (Fig. 2.5) was initially developed using the results of the Life Cycle Costing Workshop. The workshop identified ten OUs. However, during preparation of this document, the decision was made to reorganize the OUs and separate out discrete components of work as seven early actions. Project management and support facilities are both support activities necessary to accomplish the remedial activities.

The complete Contract Work Breakdown Structure (CWBS) for WAG 1 (Volume 2: Appendix A) was developed by further expanding the PSWBS with two levels of detail to include both specific work packages and the participants who will perform the work. The WBS Dictionary was developed using the CWBS as a guide for the types of information required by the WBS elements. The WBS Dictionary characterizes the work to be performed according to objective, technical scope, deliverables, and participants.

2.5 TECHNOLOGY NEEDS

To support the screening and evaluation of technologies in the FS process, and the selection of methods, vendors, and equipment options during the RD pre-design, the following studies were identified for WAG 1:

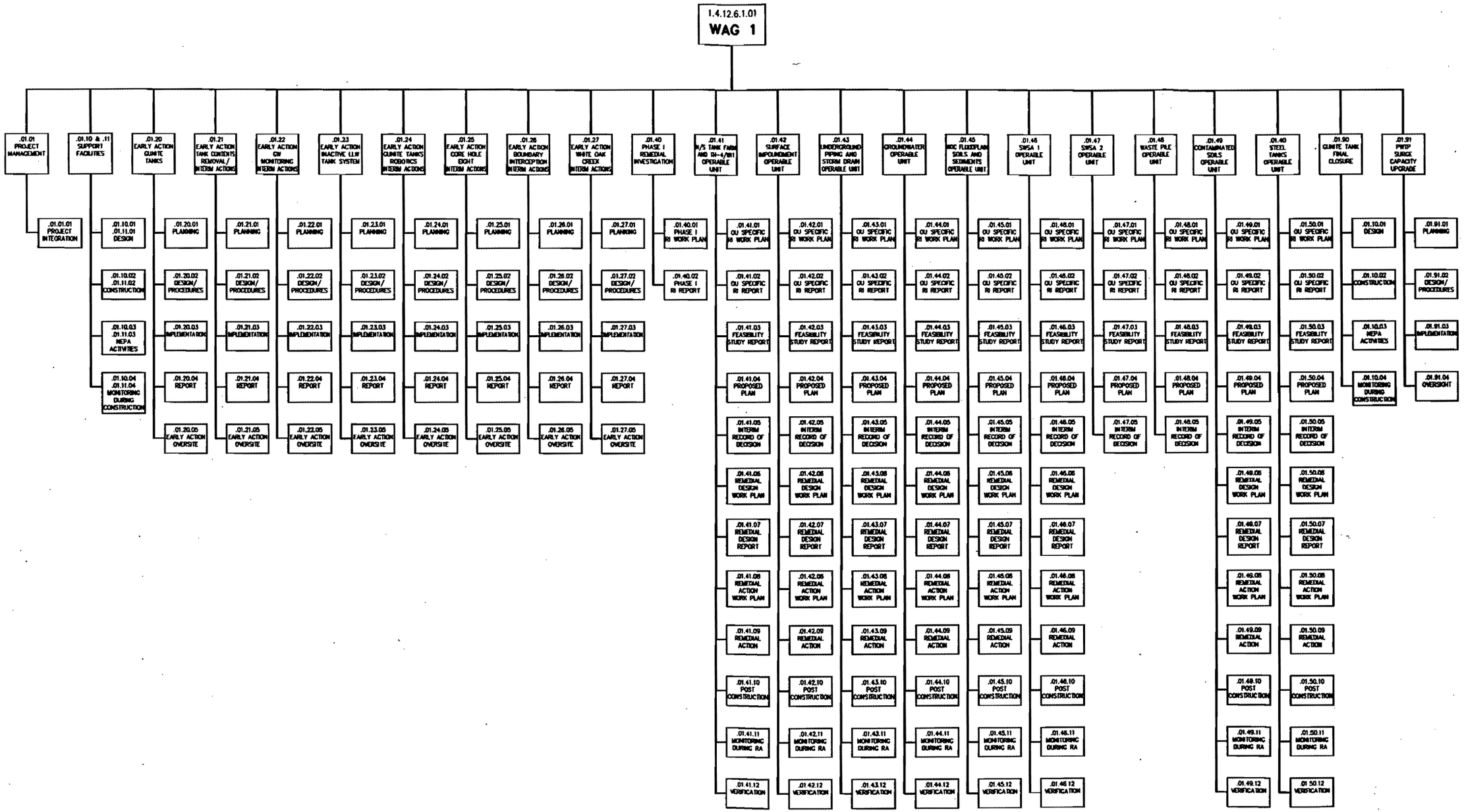


Fig. 2.5. WAG 1 Work Breakdown Structure.

- Robotic Studies and Development — To support sampling and remediation activities robotic studies and development are needed for the North/South Tank Farms and Tanks TH-4/W-11 Operable Unit. Sampling conducted using robotics will enable hands-on robotics development, and the material recovered will be used for treatability studies to be conducted to evaluate and further develop candidate technologies. Experience gained from remote sampling will be used to further evaluate and develop robotics for use during remediation.

- Stabilization of Sludges in Surface Impoundments - The assumption was made in the Life Cycle Costing Workshop for the potential RA that the sludges in the Surface Impoundments could be stabilized in place by mixing with cement grout. To properly estimate the quantities and characteristics of the cement grout and the equipment requirements for mixing, stabilization tests will be required. If initial tests are not successful, then other stabilizing agents may have to be tested or different methods for mixing, including possibly removing the sludges for stabilization, which was the contingent action identified.

- Contaminated Groundwater Treatment - Treatability Studies focusing on various treatment alternatives for contaminated water collected by the proposed remedial activities for underground piping, storm drains, and shallow groundwater will probably be required to address to different combinations of contaminants and acceptance criteria for the PWTP and LLW.

- Mercury Removal from Soils — Treatability Studies will be conducted to examine the effectiveness of mercury roasting for mercury contaminated soils. The Y-12 Plant is proposing to construct facilities that may be also capable of processing ORNL contaminated soils.

- In place stabilization of soils/sediments — Treatability studies will be required to properly evaluate the effectiveness of possible grout mixtures and to properly estimate the quantities and characteristics of stabilization agents and the equipment requirements for mixing.

To conduct these studies, technical resources will be required. These studies may be conducted independently of the WAG 1 remedial activities, as part of other WAG RAs, as treatability studies during the WAG 1 OUs Feasibility Studies, or as engineering studies during the WAG 1 RD pre-design efforts. For this Baseline Report, the majority of the studies described above have been included as treatability studies to be conducted during the FS of appropriate OUs except for the sludge stabilization tests which were identified as engineering studies during the OU 2 RD.

3.0 WAG 1 PROJECT MANAGEMENT

This chapter presents the scope of the project integration efforts required by MMES for project management and by the remediation subcontractors for general project support. The risk and uncertainties and interfaces for project integration are also identified. Fig. 3.1 presents the WBS developed for performing Project Integration. Project Integration WBS elements will be ongoing for the entire duration of the WAG 1 remediation. The summary level schedule for Project Management is shown in Fig. 3.2. Table 3.1 presents the cost assessment of $96,211,000 for performing this portion of the WAG 1 remediation by WBS activities and FY.

3.1 SCOPE AND ASSUMPTIONS

Project Management covers those activities required for the remediation of WAG 1 that are consistent with the FFA beginning with project integration and continuing through the completion of RAs. Project management activities include planning, organizing, directing, controlling, and reporting on project status.

3.1.1 Project Integration

3.1.1.1 Martin Marietta Energy Systems, Inc. Project Management (6.1.01.01.01.01)

The MMES WAG 1 Manager is accountable for all ER milestones and is responsible for (1) coordinating and integrating the work of the other DOE prime contractors and (2) informing DOE of any problems. The WAG 1 Manager performs the traditional project management function of overall planning, coordination, and cost control. He/she also interfaces with outside groups. The WAG 1 Manager will define how the project will be accomplished by preparing and maintaining an overall Project Management Plan, Quality Assurance Plan, Waste Management Plan, Health and Safety Plan, System Requirements Document (SRD), and the Baseline Design Report (BDR). Each participant will then prepare subsidiary documents, as needed. Additional personnel will be added to the WAG 1 management team to provide technical and administrative management for specific OUs, or OU groups, and will report to the WAG 1 manager.

The MMES Engineering Project Manager is responsible for oversight of the RD and RA efforts and acts as the Deputy WAG 1 Manager.

3.1.1.2 General Project Support (6.1.01.01.01.02)

General project support, provided by MMES and other DOE prime contractors, will include the following:

- All potential and actual RI, FS/EA, RD, RA, and support activities in compliance with applicable EPA and TDEC regulations and administrative requirements.

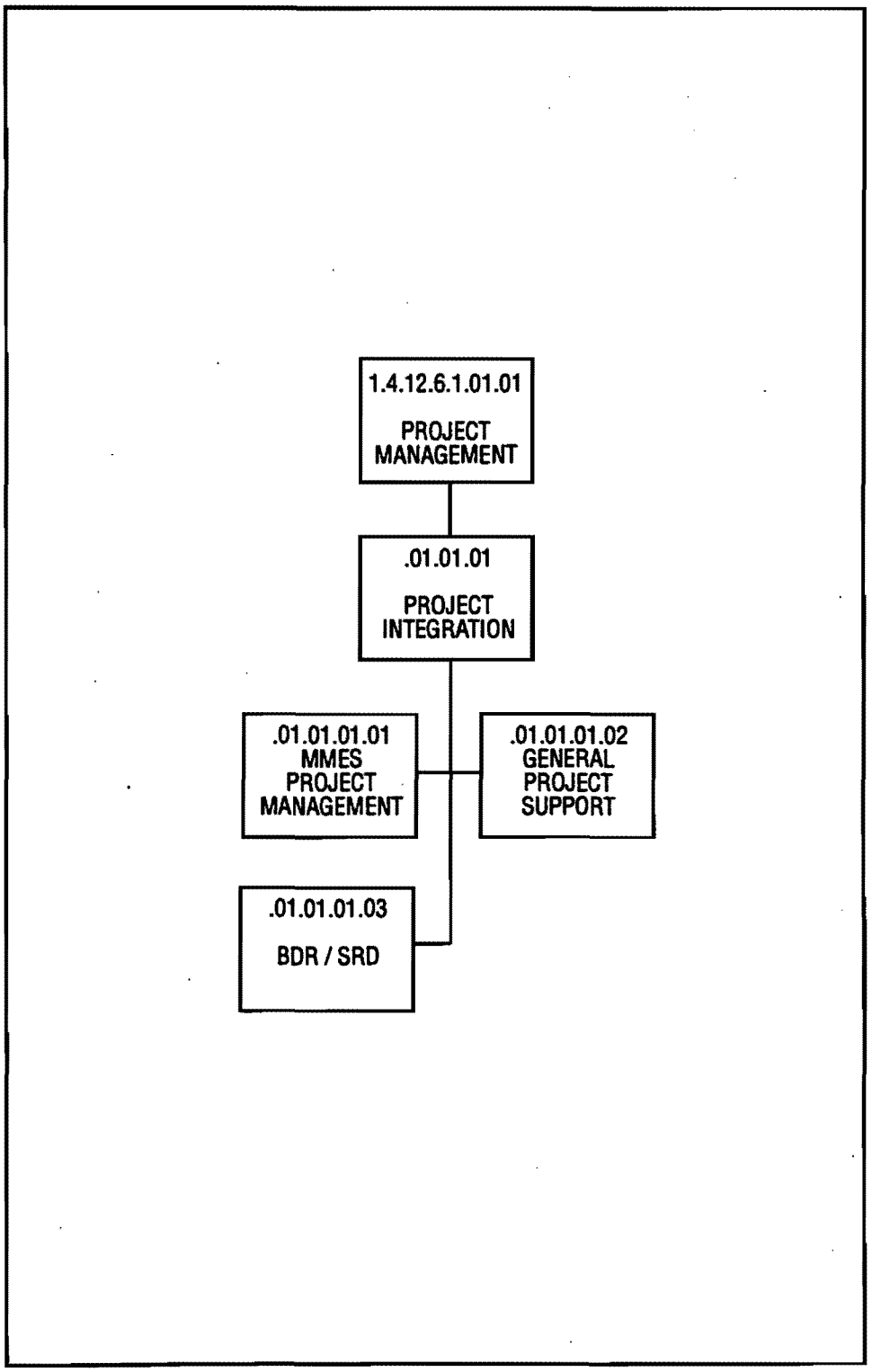


Fig. 3.1. Project Integration Work Breakdown Structure.

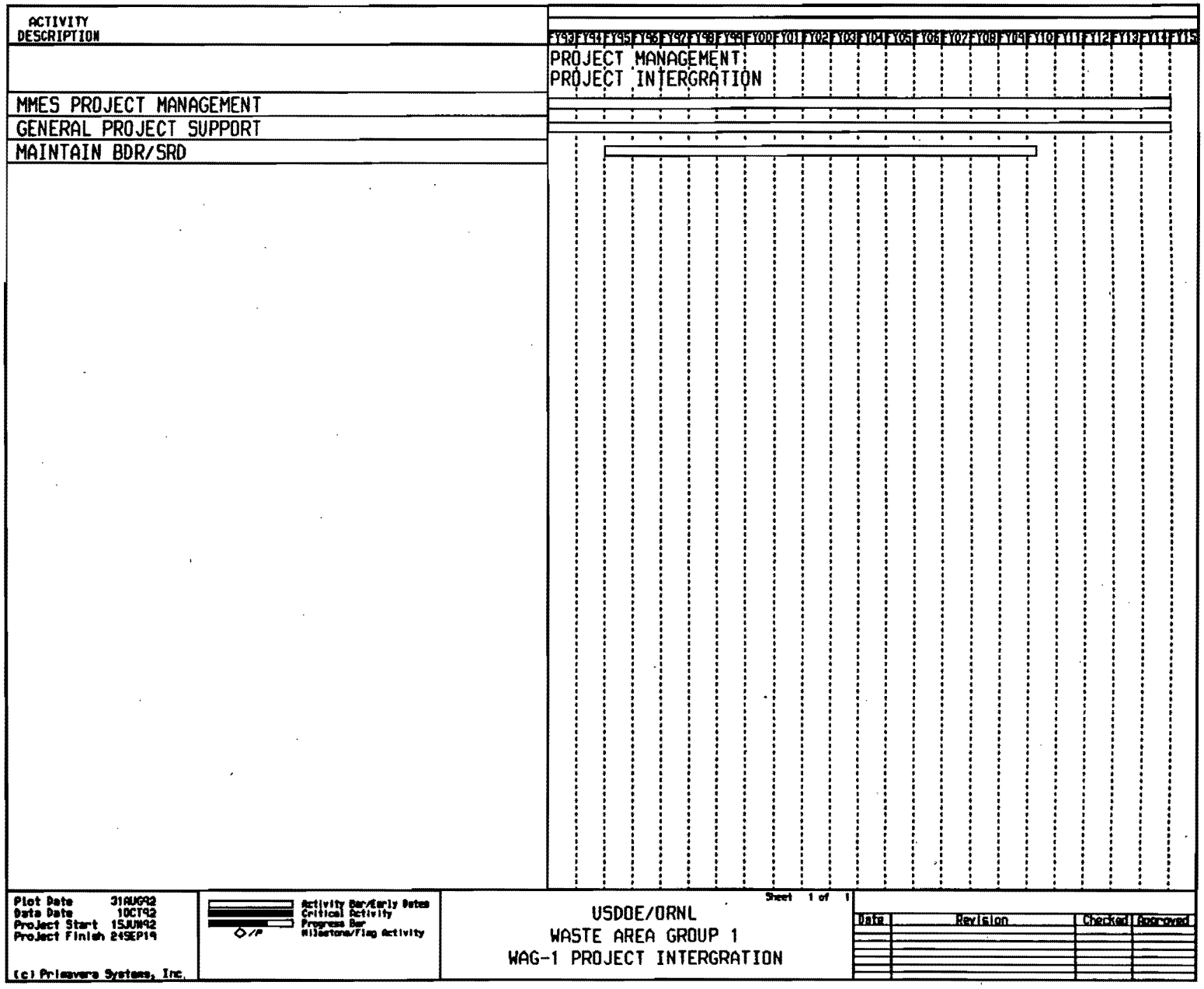


Fig. 3.2. Project Integration Summary Level Schedule.

TABLE 3.1
WAG 1 Project Management Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																							
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOTAL
Project Management	19	40	83	153	249	371	528	746	984	1,274	1,600	1,949	2,335	2,742	3,040	3,173	3,096	2,807	2,364	1,734	848	254	34	30,422
General Project Support	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	1,404	351	31,247
Maintain BDR/SRD	0	0	182	489	883	1,404	1,960	2,550	3,182	3,778	4,188	4,246	3,924	3,316	2,509	1,389	458	84	0	0	0	0	0	34,542
TOTALS	1,423	1,444	1,669	2,047	2,537	3,180	3,892	4,700	5,570	6,457	7,192	7,600	7,663	7,462	6,953	5,966	4,958	4,295	3,768	3,139	2,253	1,658	385	96,211

- Permit applications and negotiation of permits.
- Overall WAG 1 project plans.

Additional responsibilities will include the following:

- Interface with Waste Management Department.
- Interface with Utility Department staff for water, sewer, and electricity requirements.
- Interface with Security Department.
- Interface with Environment, Safety, and Health (ES&H) staff during entire construction project.
- Provide dosimeters, badges and General Employee Training (GET) for construction personnel.
- Interface for provision of other infrastructural requirements to support WAG 1 RA activities.

3.1.1.3 Baseline Design Report/System Requirement Document (6.1.01.01.01.03)

As the WAG 1 project progresses from planning to implementation, the Baseline Report will evolve into a BDR/SRD document. The technical scope, cost assessment, and integrated schedule of BDR/SRD documents will be updated during various phases of remediation activities (e.g., RI, FS, Title I design, and Title II design) as shown in Fig. 1.3. Technical, engineering, and management support and oversight required to prepare, review, maintain, and implement the BDR will be provided by MMES and other DOE prime contractors.

3.2 RISKS AND UNCERTAINTIES

A discussion of the risks and uncertainties identified with the project integration of this effort must consider the following points:

- Budgets for remediation activities are provided on an annual basis, in contrast to funding that covers the total duration of the activity. Planning will be based on an assumed funding profile. If budgets or priorities change this funding profile, activities could be delayed and additional costs would be incurred. Modification to the established plans would also be required to accommodate new assumptions.
- Estimates and schedules for the various activities anticipated at WAG 1 reflect a degree of familiarity with WAG 1 by the originating contractors. If there are changes

in these contractors (i.e., RI Subcontractor, FS Contractor), some cost and schedule impacts may be incurred due to a new learning phase.

- Baseline cost estimates and schedules are based on current regulations. Changes in these regulations could impact the baseline schedule and cost.

- Some of the concepts used in WAG 1 were based on WAG 5 assumptions. As work on WAG 1 proceeds, some of these assumptions may be invalid and may require a partial rework of the planning baseline.

3.3 INTERFACES

Project Integration for WAG 1 will require constant interaction and close coordination with the following organizations:

- ORNL Site Support — Many of the site support organizations (i.e., ES&H, Industrial Hygiene, Quality Assurance (QA), Safety, etc.) will be required to provide both input and review of (1) planned activities, (2) procedures, and (3) records from contractors performing activities on the site.

- Regulators (EPA, TDEC) — Regulatory overview will be provided through project management briefings and review of documents. Project Management will be required to address review comments from the regulator.

- MMES Waste Management — Some solid and liquid waste is expected to be generated by WAG 1 remediation activities and sent to waste management facilities for further treatment or storage. Waste acceptance criteria at these facilities and the capacities of the systems will have to be confirmed as the expected constituents, quantities, and concentrations are better defined.

- DOE — Representatives from DOE will participate in briefings and reviews of project documentation. DOE comments will be addressed.

- Other WAG remediations — The progress of activities on other WAGs will have to be followed to emphasize lessons learned. These then can be factored into the ongoing WAG 1 planning activities.

- D&D — The D&D Program must integrate its schedule with ER Program so that facilities such as the existing decontamination facility are demolished on schedule and there is no interference with the RA schedule.

- MMES Technical Advisory Group — The Technical Advisory Group is an ORNL ER Program advisory committee that provides reviews by subject matter specialists.

Additional interfaces are identified and discussed in subsequent chapters.

4.0 WAG 1 SUPPORT FACILITIES

This chapter presents the scope of the support facilities required for implementing the potential RAs. The Title I and Title II design efforts, categorical exclusions, construction activities, operations, monitoring, grout mixing/pumping, and D&D are described. The risks and uncertainties and interfaces for the support facilities are identified as well.

The WBS developed for designing, constructing, and operating the support facilities is presented in Fig. 4.1. The summary level schedule for the support facilities WBS elements is shown in Figs. 4.2 and 4.3. The cost assessment of $36,033,000 for performing activities associated with WAG 1 support facilities is presented by WBS activities and (fiscal year) FY in Table 4.1. Table 4.2 presents the cost assessment of $8,279,000 for performing activities associated with the grout mixing/pumping facility by WBS activities and FY.

4.1 SCOPE AND ASSUMPTIONS

Several support facilities are not within the scope of remediation addressed in the WAG 1 OU IRODs and are described in Chapters 14.0 through 23.0. These will have to be designed and constructed early in the schedule. This will enable the OU remediation activities to begin within 15 months after the IRODs are approved.

The following sections provide details on the scope of work and assumptions associated with these activities.

4.1.1 Support Facilities Design

4.1.1.1 Title I and Title II Design (6.1.01.10.01.01; 6.1.01.10.01.02; 6.1.01.11.01.01; 6.1.01.011.01.02)

The RD A-E Contractor will perform the Title I and Title II design work for the following support facilities:

- Personnel Decontamination Facility for onsite workers due to the risk of encountering radioactive and/or hazardous wastes during the remedial activities.
- Equipment Decontamination Facility for staging and cleaning equipment as well as staging and repackaging of waste generated during the construction activities at WAG 1.
- A gravel parking area for and improvements to an existing staging area used for receipt of construction deliveries.

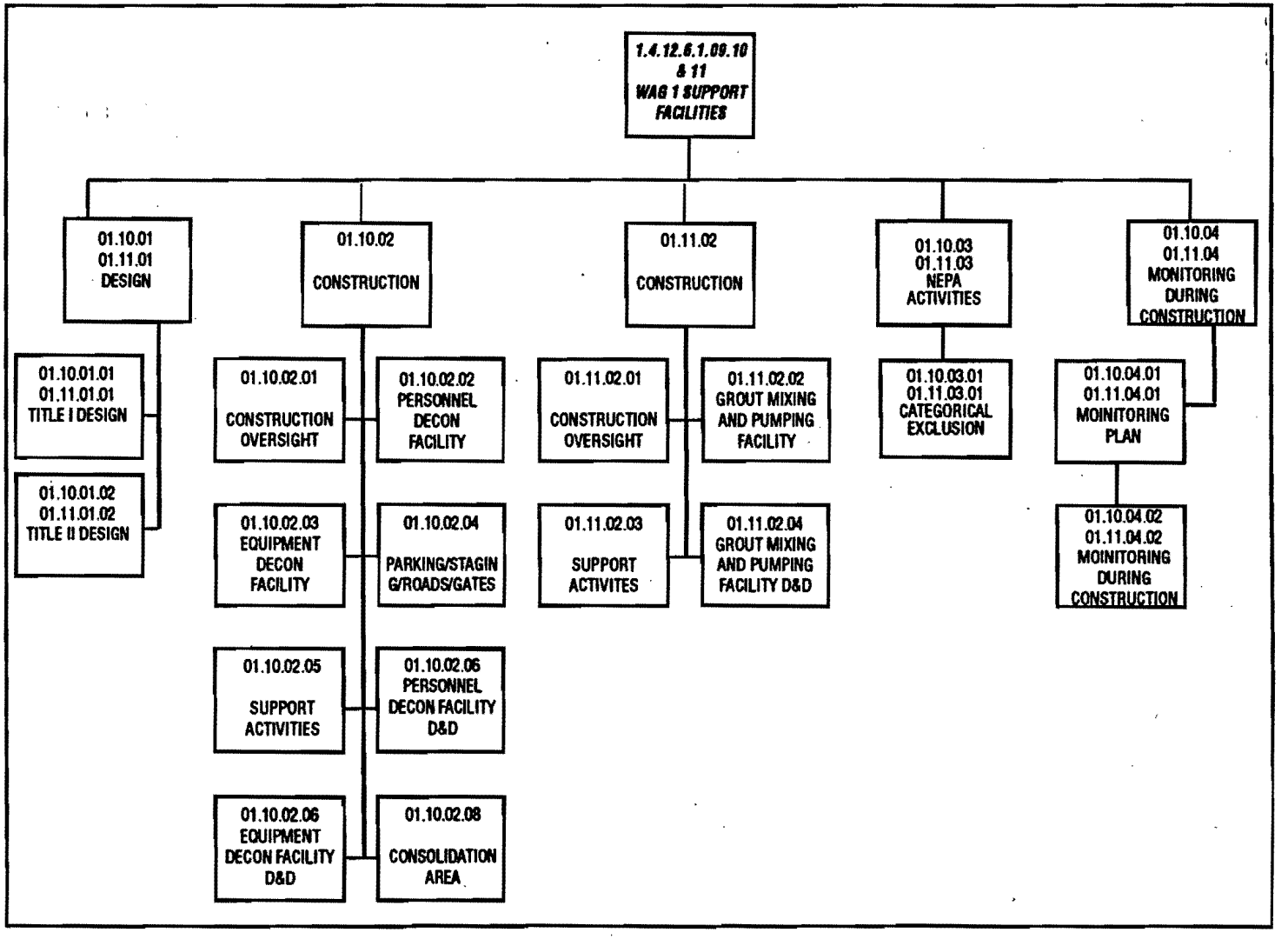


Fig. 4.1. Support Facilities Work Breakdown Structure.

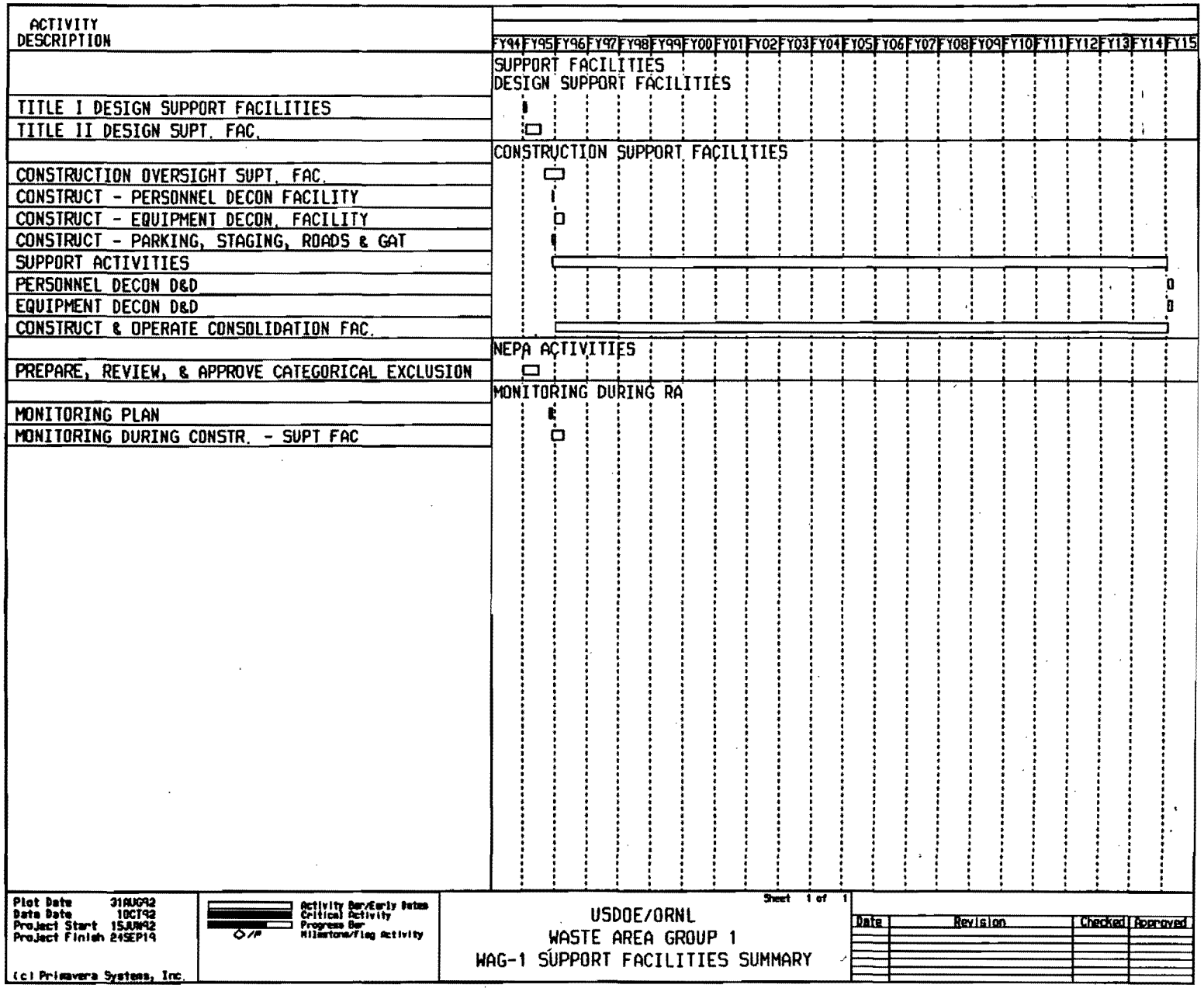


Fig. 4.2. Support Facilities Summary Level Schedule.

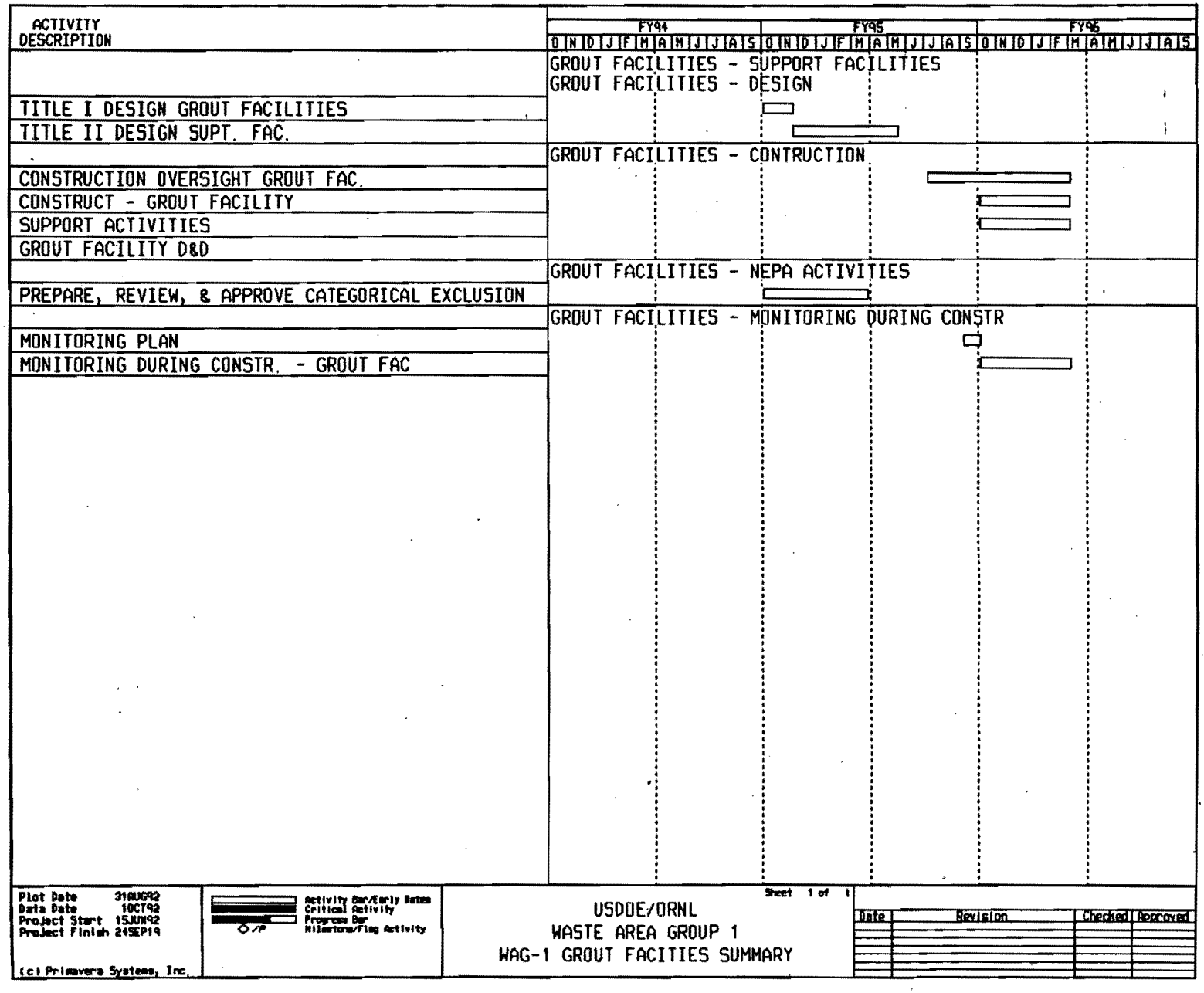


Fig. 4.3. Grout Facilities Summary Level Schedule.

TABLE 4.1
WAG 1 Support Facilities 01 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																					
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	TOTAL
Title I Design	1,233	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,233
Title II Design	1,902	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,902
NEPA Activities	152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	152
Construction Oversight	1,655	2,603	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,258
Construction	1,604	1,692	195	344	520	732	957	1,195	1,444	1,696	1,932	2,090	2,136	2,055	1,865	1,595	1,270	817	381	123	619	25,261
Monitoring During Construction	1,126	2,101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,227
TOTALS	7,672	6,395	195	344	520	732	957	1,195	1,444	1,696	1,932	2,090	2,136	2,055	1,865	1,595	1,270	817	381	123	619	36,033

TABLE 4.2
WAG 1 Support Facilities 02 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)														
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	TOTAL
Title I Design	163	0	0	0	0	0	0	0	0	0	0	0	0	0	163
Title II Design	252	0	0	0	0	0	0	0	0	0	0	0	0	0	252
NEPA Activities	338	0	0	0	0	0	0	0	0	0	0	0	0	0	338
Construction Oversight	91	502	0	0	0	0	0	0	0	0	0	0	0	0	593
Construction	0	2,768	0	0	0	0	0	0	0	0	0	0	0	217	2,768
Monitoring During Construction	32	4,132	0	0	0	0	0	0	0	0	0	0	0	0	4,165
TOTALS	876	7,402	0	0	0	0	0	0	0	0	0	0	0	217	8,279

- A 100-gpm Grout Mixing and Pumping Facility for stabilization and solidification of sludges in the tank farms, surface impoundments, and contamination soils. Grout will also be provided for filling steel and gunite tanks in WAG 1.

- A new consolidation area will be constructed for WAG 1 to receive the various wastes generated during remediation.

The cost assessment was developed with the following assumptions:

- The components and configuration of the decontamination facilities and consolidation area for WAG 1 will be similar to those at WAG 5.

- The location and components of the new consolidation area design will comply with CERCLA regulations.

- Facilities are constructed in noncontaminated areas.

- The Grout Facility is located no further than 0.6 miles from contaminated sites to be grouted.

4.1.2 Support Facilities Construction

4.1.2.1 Construction Oversight (6.1.01.10.02.01; 6.1.01.11.02.01)

The objective of this WBS element is to provide technical input and oversight during the construction of support facilities. During the preparation of the support facilities construction plan, MMES, the A-E Contractor, and the independent contractor responsible for certification, will provide the necessary technical input and oversight to ensure that the proposed construction efforts, bid process, and implementation plans comply with administrative and regulatory requirements.

4.1.2.2 Personnel Decontamination Facility (6.1.01.10.02.02)

A trailer-based mobile facility equipped with clean change lockers, clean work clothes, safety equipment storage, site access control, monitoring equipment, showers, used clothing storage, toilets, lunch area, and communication equipment will be provided to ensure personnel contamination control. Water, a collection tank for sewage, and electric utilities will be provided. This facility will be located in clean areas adjacent to work locations. The facility can be moved to various work sites as remediation progresses in WAG 1.

4.1.2.3 Equipment Decontamination Facility (6.1.01.10.02.03)

The Equipment Decontamination Facility will be a two-bay, steel-frame concrete panel building with diked and sumped floors. It will contain contaminated and clean liquid storage tanks, spray wash equipment, a truck transfer area, high efficiency particulate air filtered (HEPA) heating

and ventilation system, stack-monitoring equipment, and contamination-monitoring equipment. One bay of the building will be used for decontamination activities, while the other bay will be used for waste staging and repackaging. A gravel laydown area outside the Equipment Decontamination Facility is also provided. The liquid waste generated during cleaning operations will be transported to the PWTP for further treatment.

4.1.2.4 Parking and Staging Facility, Roads, and Gates (6.1.01.10.02.04)

A graveled parking area will be provided for employees. The area will be located outside the west access gate at ORNL. Additionally, a staging area will be provided where deliveries can be processed in such a manner that delivery personnel are not required to have been trained in radiation/hazardous material safety.

4.1.2.5 Grout Mixing and Pumping Facility (6.1.01.11.02.02)

The 100-gpm processing facility for mixing grout and pumping (Fig. 4.4) will include the necessary storage and materials handling equipment to store, proportion, blend, and mix feed materials. This equipment will also pump the formulated grout to the WAG 1 tanks, surface impoundments, and contaminated soils for in situ treatment. Portland cement, flyash, and clay are withdrawn from holding bins, metered, and collectively weighed before being conveyed to a blending system for homogenization (Fig. 4.5). The blended material is then withdrawn at a controlled rate and conveyed to a continuous rotary mixer where water is added for final grout mixing. The grout slurry is then continuously discharged to a crankshaft driven piston pump capable of pumping the grout mixture via pipe for a distance as much as 0.6 miles.

4.1.2.6 Support Activities (6.1.01.10.02.05; 6.1.01.11.02.03)

During the construction of support facilities in contaminated areas, MMES field maintenance will provide the necessary staff to maintain and operate the Personnel Decontamination Facility, Equipment Decontamination Facility, and Consolidation Area.

4.1.2.7 D&D Personnel Decontamination Facility (6.1.01.10.02.06)

Following the placement of the multilayer cap over the subsurface disposal areas and completion of all decontamination activities, the water tank; electrical equipment; mechanical equipment; fencing; deck; etc., will be dismantled, boxed, and transported with all trailers to a storage area. The non-reusable items like pipe insulation, tank insulation, and other miscellaneous items will be transported to the consolidation area. The underground fire protection piping will be plugged at the ends and will remain in place.

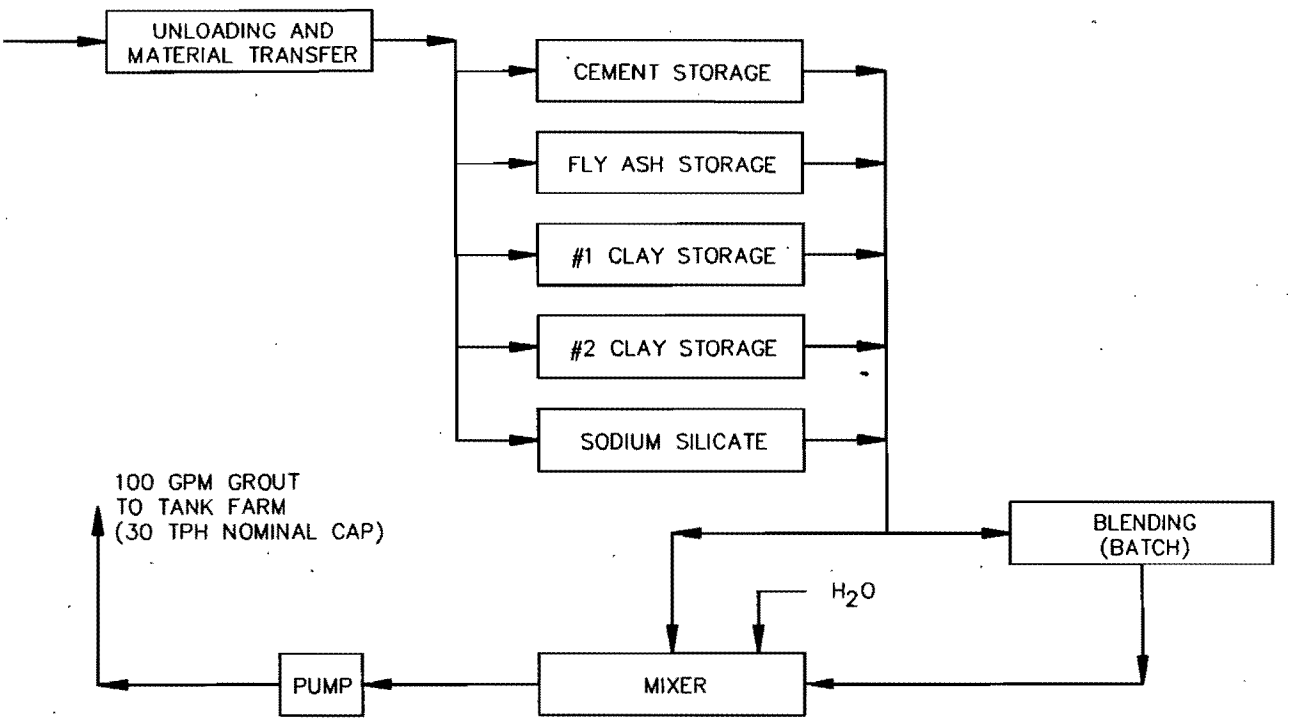


Fig. 4.4. Grout Mixing and Pumping Facility.

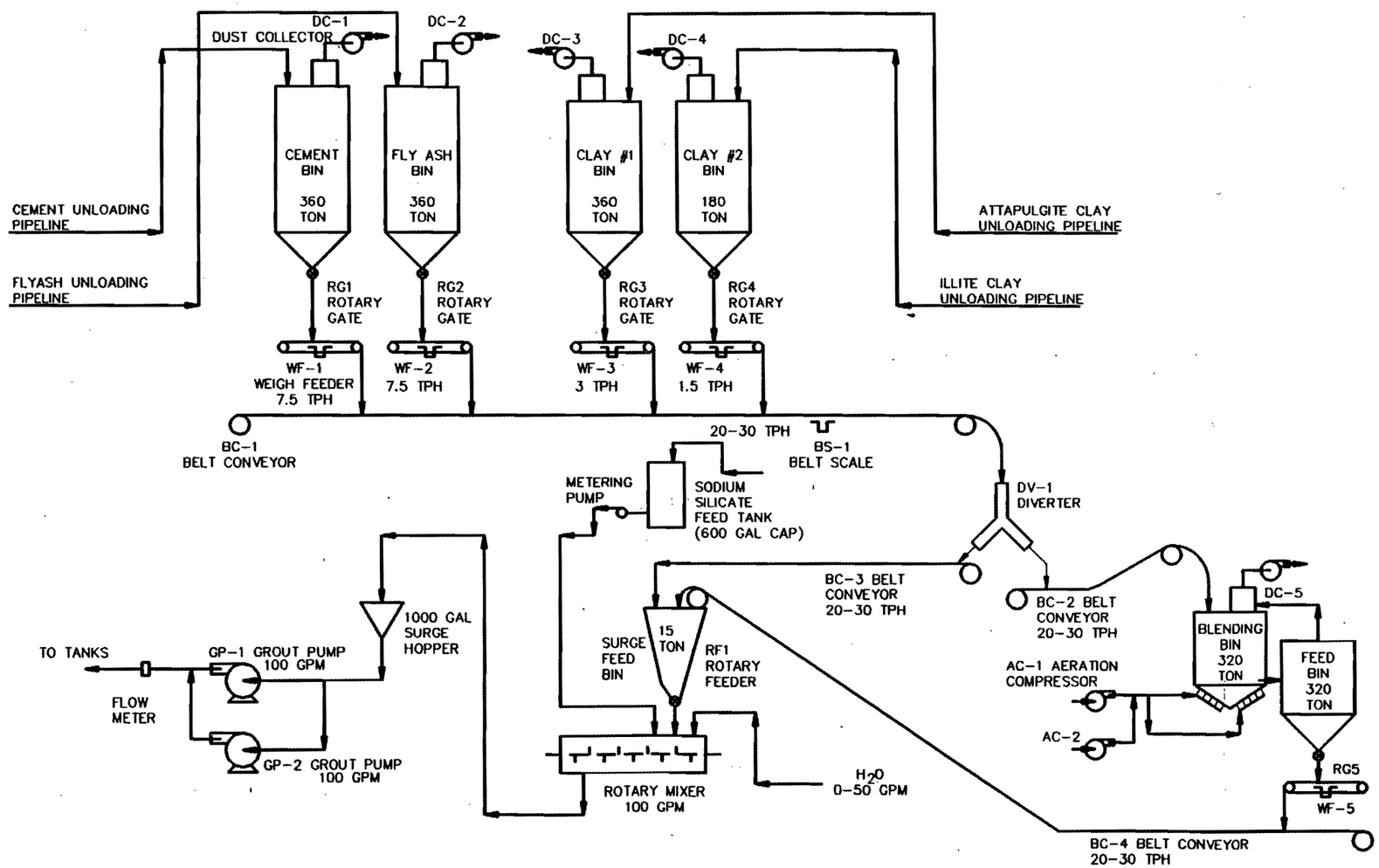


Fig. 4.5. Homogenization Blending System for Grout Mixing and Pumping Facility.

4.1.2.8 D&D Equipment Decontamination Facility and Grout Facility (6.1.01.10.02.07; 6.1.01.11.02.04)

Upon completion of all RA activities and following the decontamination of the interior of Equipment Decontamination Facility buildings, all the electrical equipment, mechanical equipment, water tank, and structures will be dismantled. The reusable portion of all equipment and structures will be transported to the ORNL storage area. The nonreusable items like block wall, insulation, and other miscellaneous items will be transported to the consolidation area.

4.1.2.9 New Consolidation Area (6.1.01.10.02.08)

A new consolidation area will be constructed to receive wastes and excavated material generated during remediation. As shown in Fig. 4.6, this area will consist of a 3-ft thick bottom clay layer, flexible membrane liners, drainage layer, leachate collection system, and filter fabrics to prevent migration of contamination into surrounding soils. A 5000-gal underground tank, equipped with gauges, will collect the leachate from the new consolidation area. The leachate will be pumped into a tanker truck and then transported to the PWTP for treatment. Presumably, leachate will be generated until the consolidation area is completely covered with a multilayer cap, after which the pipes and tank will become inactive; but will be left in place.

The consolidation area will be maintained with a daily covering of polyvinyl chloride (PVC) liner or 6 in. of soil over the waste disposed of in the consolidation area. Upon completion of all remedial activities at WAG 1, the consolidation area will be covered with a multilayered cap as shown in Fig. 4.7.

The remediation cost assessment for support facilities was based on the following assumptions:

- The parking and staging areas, the roads to the support facilities, and the support facilities, with the exception of the equipment decontamination facility, are located in noncontaminated areas.
- The location and design of the new consolidation area meets EPA/TDEC requirements.
- The cost of the consolidation area for WAG 1 is estimated to be two times the cost of the WAG 5 consolidation area.
- The personnel and equipment decontamination facilities are estimated to be equal in cost to WAG 5 facilities.

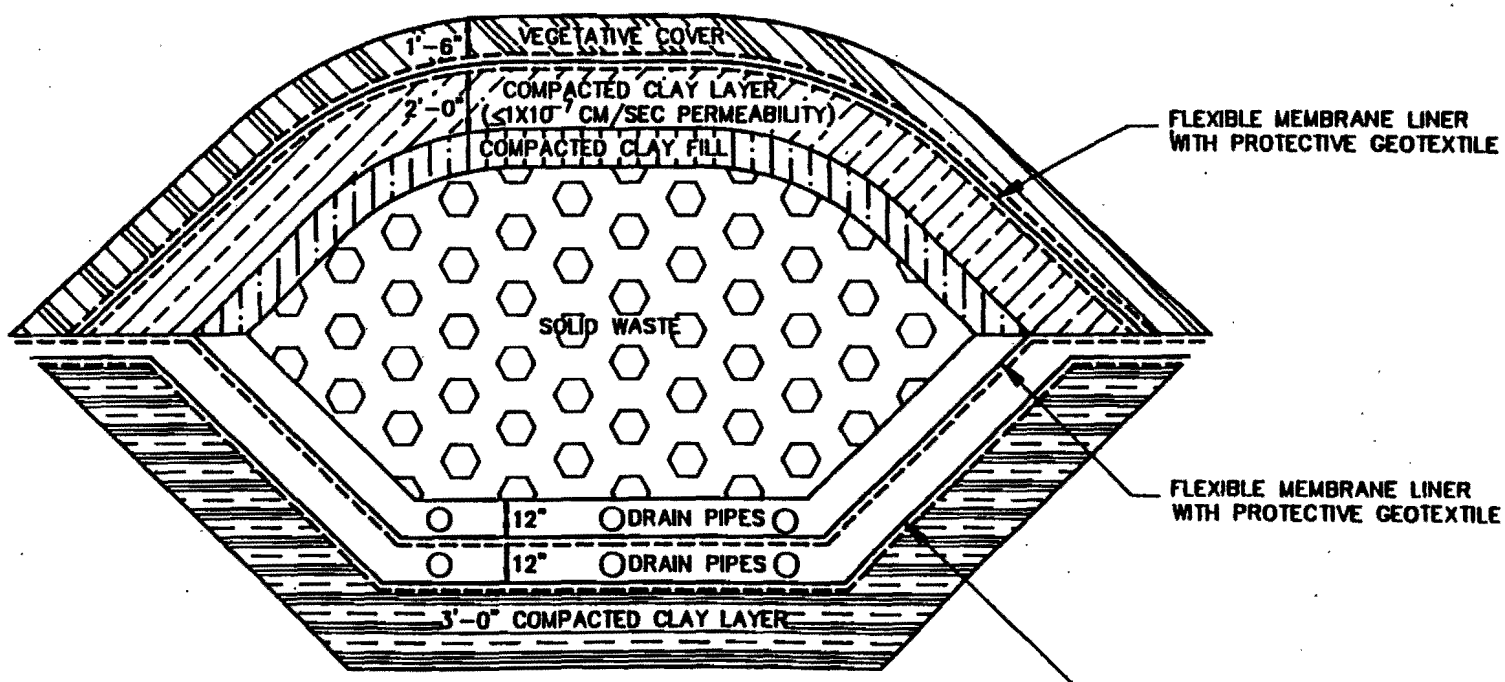


Fig. 4.6. Typical Cross Section through New Consolidation Area.

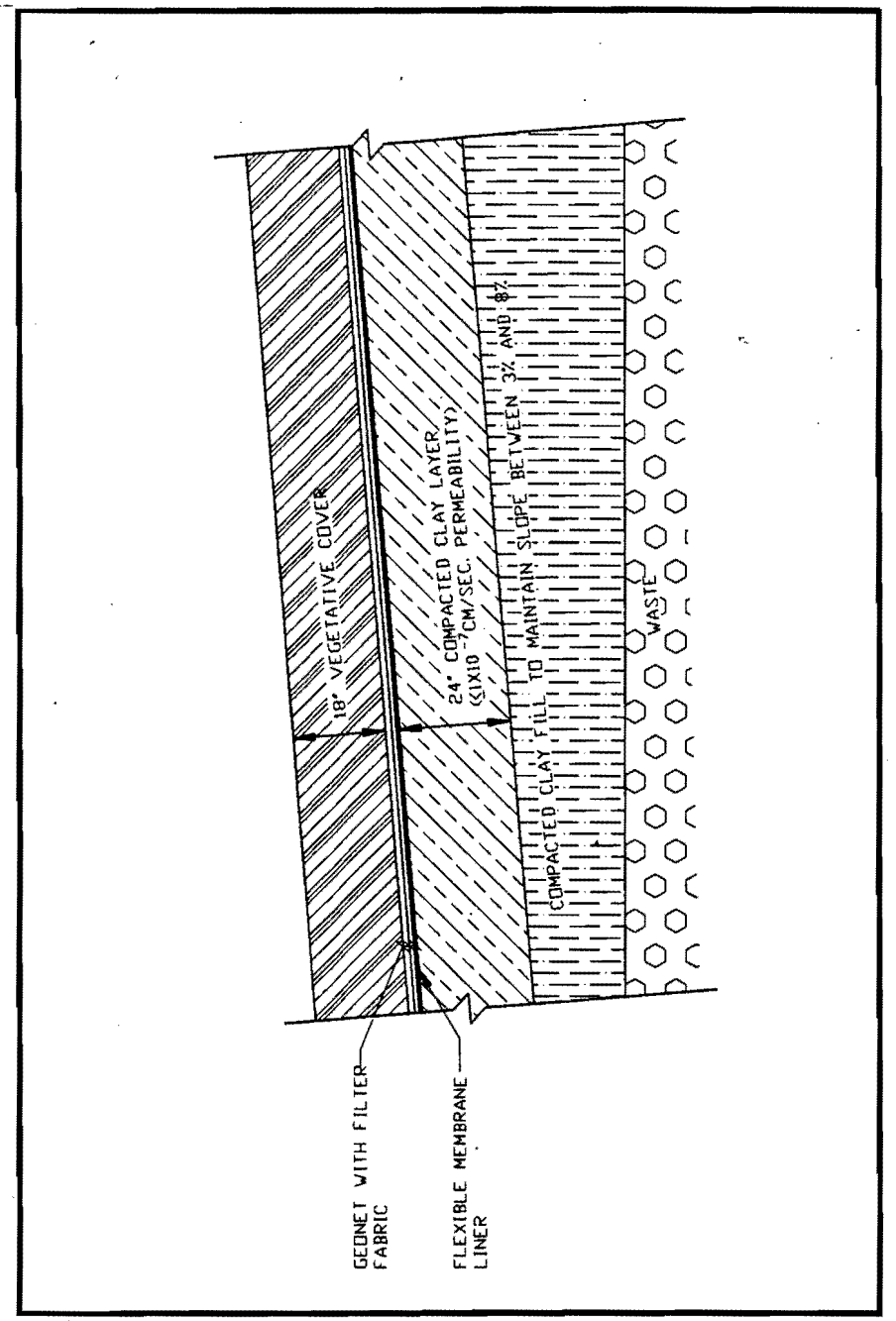


Fig. 4.7. Consolidation Area Covered with Multilayer Cap.

4.1.3 NEPA Activities

4.1.3.1 Categorical Exclusion (6.1.01.10.03.01; 6.1.01.11.03.01)

A NEPA review is required for undertakings proposed by government agencies pursuant to 40 CFR 1501.2 and 10 CFR 1021.200. NEPA compliance at ORNL is coordinated by the Environmental Review and Documentation Section (ERDS) who performs (1) the screening of actions for NEPA compliance and requirements, (2) the preparation and distribution of NEPA assessments for proposed actions, and (3) the preparation and submittal of the appropriate level of NEPA documentation to DOE-OR for approval.

The appropriate NEPA documentation for WAG 1 Support Facilities is suggested as a categorical exclusion in accordance with DOE NEPA Implementing Procedures. These are Final Rule, 57 Federal Register (FR) 15122, Subpart D, Appendix B (1992). Typical preparation, review, and approval for an exclusion cycle requires approximately 4 to 5 months. However, when an existing approved exclusion is applicable, the cycle time is reduced to approximately 1 to 1½ months.

4.1.4 Monitoring During Construction

4.1.4.1 Monitoring Plan (6.1.01.10.04.01; 6.1.01.11.04.01)

A Monitoring Plan will be developed by ER Planning to implement the monitoring of the environmental media, around the perimeter and in the vicinity of WAG 1, to determine the impact of construction activities in contaminated and uncontaminated areas for Support Facilities.

4.1.4.2 Monitoring During Construction (6.1.01.10.04.02; 6.1.01.11.04.02)

Based on the environmental plan developed by ER Planning, MMES field maintenance personnel will conduct the monitoring at WAG 1. The monitoring activity will start one month before start of construction in order to establish the baseline.

4.2 RISKS AND UNCERTAINTIES

Major risks and uncertainties include the following:

- The possibility of grout plant equipment failures during grout placement for in situ stabilization into the gunite tanks.
- The ability to provide adequate quality control (QC) in the grout plant process operation to provide the required grout formulation.
- The availability of enough uncontaminated areas within the main plant and WAG 1 boundaries for accessible support facility locations.

5.0 WAG 1 EARLY ACTION GUNITE TANKS

This chapter presents the scope and assumptions for the planning, design, implementation, and reporting of the Early Action associated with the North and South Tank Farms, Tank W-11, and Tank TH-4. The scope of the Early Action includes construction of buildings to enclose the tanks located within both the North Tank Farm and the South Tank Farm. Central Avenue divides the North and South Tank Farms, so separate buildings are proposed in order to maintain use of this street. A separate structure is proposed for Tank TH-4, while Tank W-11 does not require construction of a protective structure.

The WBS developed for this Early Action is presented in Fig. 5.1. The summary level schedule for the Early Action is shown in Fig. 5.2. The cost assessment of $20,119,000 for this Early Action is presented by WBS activity and FY in Table 5.1.

5.1 SCOPE AND ASSUMPTIONS

The Gunite Tanks Early Action includes the following principal WBS elements:

- Planning — Action Plan, Investigation/Feasibility/Requirements, and Support Documentation.
- Design/Procedures — Title I and Title II design of buildings and procedure for removal of liquid in the gunite tanks.
- Implementation — Integration and Implementation of Early Action.
- Report — Documentation of Early Action.
- Early Action Oversight.

Detailed descriptions of the scope of each activity and specific WBS elements, along with the assumptions used for the development of the cost assessments, are presented below.

5.2 PLANNING

5.2.1 Action Plan (6.1.01.20.01.01)

An Action Plan will be written to provide an overall technical strategy and management approach for performing the Early Action. The action plan will define the scope and objectives for Early Action activities; provide a mechanism for planning; and address the proposed technical and regulatory approach, timing for implementation, schedules, and key decision points. The plan will

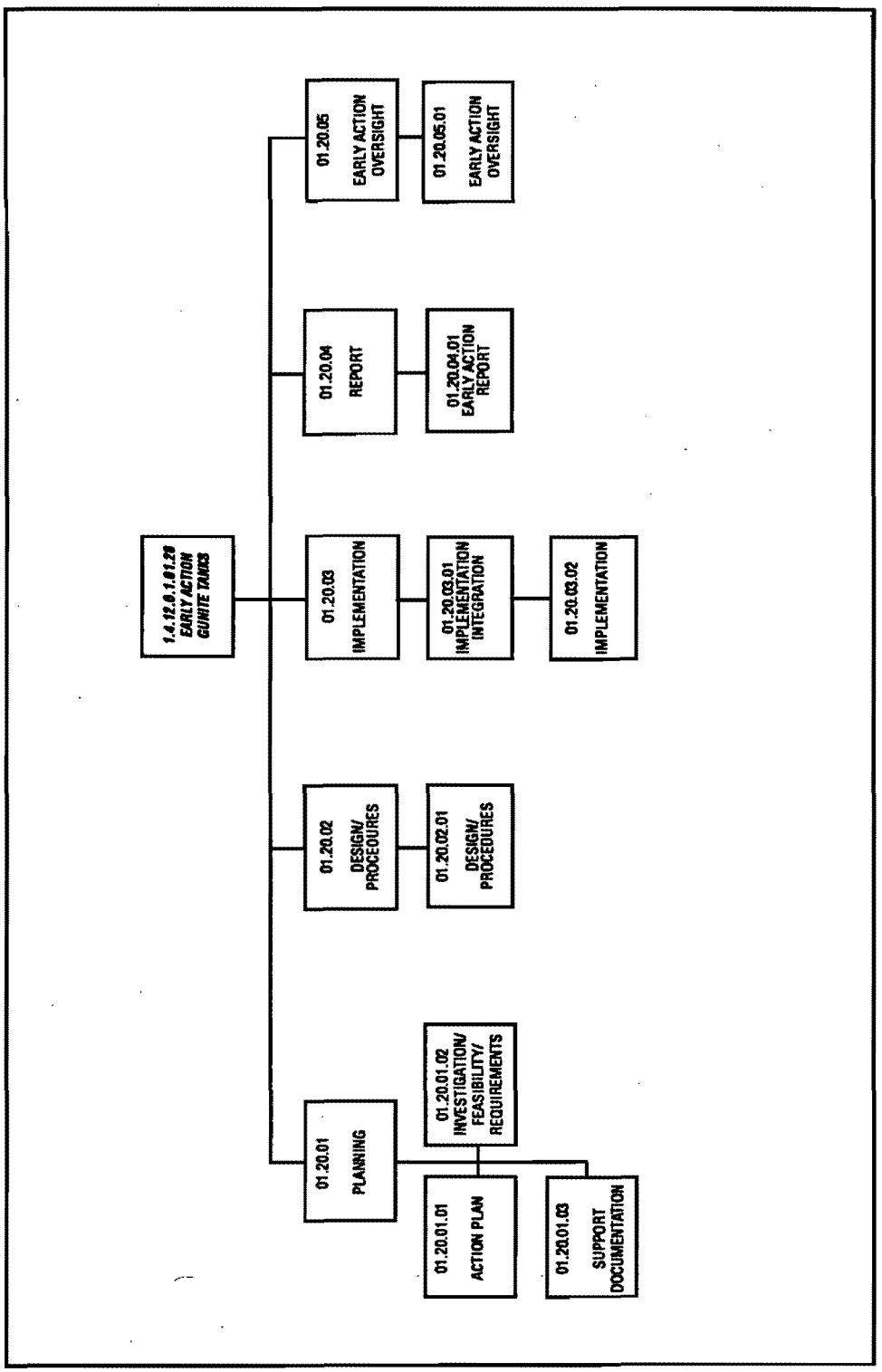


Fig. 5.1. Gunite Tanks Early Action Work Breakdown Structure.

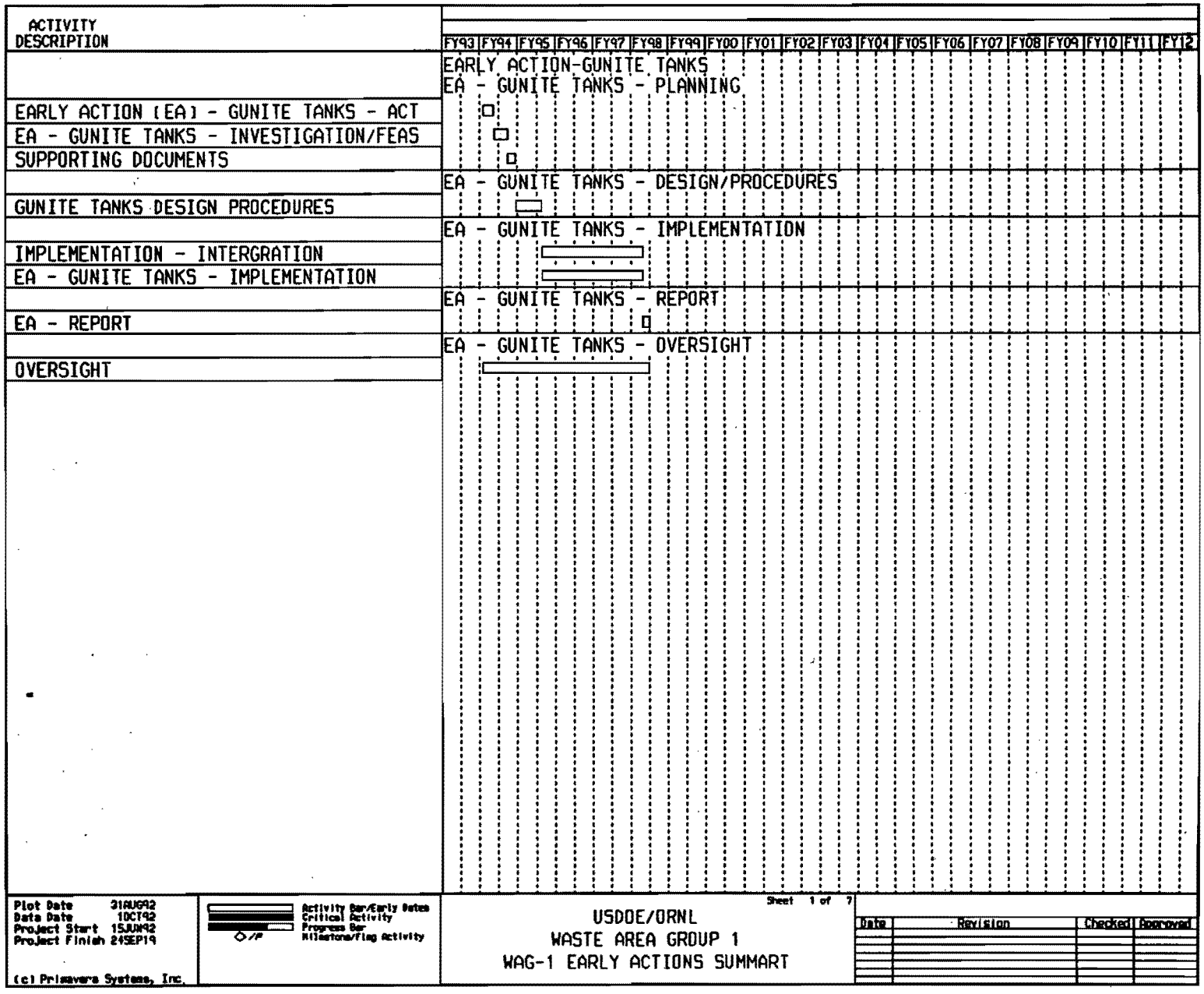


Fig. 5.2. Gunite Tanks Early Action Summary Level Schedule.

TABLE 5.1
WAG 1 Early Action 01 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)								
	1993	1994	1995	1996	1997	1998	1999	2000	TOTAL
Action Plan	0	22	0	0	0	0	0	0	22
Invest./Feasibility Requir.	0	98	0	0	0	0	0	0	98
Hood & Test Design	0	0	0	0	0	0	0	0	0
Support Documentation	0	33	0	0	0	0	0	0	33
Design/Procedure	0	90	2,732	0	0	0	0	0	2,822
Implemenation & Integration	0	0	501	5,455	8,447	924	0	0	15,328
Report	0	0	0	0	0	39	0	0	39
Early Action Oversight	0	97	370	664	551	94	0	0	1,776
									0
									0
									0
TOTALS	0	340	3,603	6,120	8,999	1,057	0	0	20,119

also include contingency planning to develop a strategy to address unexpected or unforeseen events should they occur at some future time. The plan will also identify the types of documentation required for each step of the engineering design process. The need for documents such as Engineering Studies, System Requirement Documents, and Conceptual Design Reports (CDRs) will be identified at this time.

As part of the planning process, data needs for treatability studies should be identified early so that environmental sampling and data analysis can be expedited.

5.2.2 Investigation/Feasibility/Requirements (6.1.01.20.01.02)

Studies will be conducted to support preparation of a CDR, as appropriate, as part of preliminary engineering design. Existing data may be used in these studies, or additional data may be collected. The CDR will consolidate the investigation effort into a concise report that will detail the costs, schedule, technical scope, and justification for the Early Action.

5.2.3 Support Documentation (6.1.01.20.01.03)

Applicable documentation prepared to support Title I and II design includes the following as appropriate: Engineering Studies, Contingency Plans, System Requirement Documents, and Conceptual Design Reports. Documentation will be of sufficient detail to facilitate Title I and II engineering and will include cost and schedule information as well as technical and regulatory information necessary to start detailed engineering.

5.3 DESIGN/PROCEDURES

5.3.1 Design/Procedures (6.1.01.20.02.01)

Based on the existing information available, the A-E Contractor will prepare a preliminary design and develop a framework for definitive design including site layout, preliminary details of construction work, and outline specifications for the work involved in construction of an enclosure building with the infrastructure required to prevent inleakage into the tanks located in the North and South Tank Farms. The A-E will also prepare a design document at the 30% design stage which includes the presentation of preliminary construction drawings and which outlines applicable specifications, preliminary calculations, a preliminary schedule, and a preliminary construction cost estimate. Design criteria as well as functional and systems requirements are to be completed prior to the start of Title I engineering.

The A-E Contractor will develop the Title II concept, including MMES and DOE comments, into a Final Design Report. The Title II design package will be submitted at the 60% completion stage for review by MMES and DOE. After incorporation of comments, 90% documents will be issued and will contain engineering designs, drawings, specifications, test plans, operating procedures,

and construction cost estimates in complete form for MMES and DOE final review. Upon comment resolution, Final Design Reports will be issued Certified for Construction (CFC).

5.4 IMPLEMENTATION

5.4.1 Integration (6.1.01.20.03.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E construction support as required. Integration of construction activities to support this Early Action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

5.4.2 Implementation (6.1.01.20.03.02)

North Tank Farm Enclosure

The North Tank Farm in WAG 1, located northeast of the Central Avenue and Third Street intersection at ORNL, consists of eight underground storage tanks, four steel tanks and four gunite tanks. Only two of the gunite tanks contain sludge, and the other six tanks contain only liquids. The portion of the Early Action currently identified for the North Tank Farm includes construction of an enclosure building over the area occupied by the tanks.

The enclosure for the North Tank Farm is 160 ft by 110 ft in plan, with a minimum height of 60 ft to the eave and containing a crane for installing and removing equipment. Attached facilities will include a change room, personnel decontamination facility, control room, small lab facility, and equipment decontamination facility. The enclosure will provide weather protection to workers and equipment during remedial activities and enhance security and radiological protection as well. The enclosure building is expected to significantly reduce infiltration of water into the gunite tanks, since underground valve pits and other vaults associated with the tanks will be covered and, therefore, will prevent the conveyance of precipitation to the tanks via pipe trenches. The enclosure is not specifically designed to provide secondary containment; therefore, high-efficiency particulate air (HEPA) filtration and negative pressure will not be maintained at the boundary of the building. Instead, negative pressure and HEPA is or will be filtration maintained at each tank. Remedial actions will involve equipment placement within the tanks, and an equipment bag-in/out procedure is proposed so that the containment boundary is maintained. In the event of catastrophic dome failure or airborne release, the enclosure would provide some means of protecting the environment.

The work included in the cost assessment includes rough grading for the site, a small parking area, excavation for spread foundations, and construction of the enclosure building. The proposed building will be constructed with steel columns supporting steel roof joists and attached metal siding. The soil excavated for the foundations is assumed to be contaminated and will require proper disposal. An overhead crane will be provided to facilitate movement of equipment and a separate framing system for crane support. Equipment support bridges (Fig. 5.3) will also be constructed to aid in placement of equipment during remediation. The overhead crane will be used to move the equipment support bridge to other tanks within the North Tank Farm.

Mechanical systems provided for the building include heating, ventilating and air-conditioning (HVAC) and temperature control. The building will be heated in the winter and vented during the summer months. Also included is construction of a piping system for maintenance of the water level within the tank. The piping system will also be used during remediation to pump liquid out of the tank so that remote equipment can be inserted into the tanks to solidify the tank contents. The piping will feature secondary containment and will be connected to the Bethel Valley LLLW system. Valve boxes for the Bethel Valley LLLW system are located near Central Avenue between the North and South Tank Farms. Electrical systems (lighting, etc.) are also included in the cost assessment.

South Tank Farm Enclosure

The South Tank Farm in WAG 1, located southeast of the Central Avenue and Third Street intersection at ORNL, consists of six underground storage tanks of gunite construction. All six tanks contain sludge. The portion of the Early Action currently identified for the South Tank Farm includes construction of an enclosure building over the area occupied by the tanks.

The enclosure building for the South Tank Farm is identical to that described for the North Tank Farm, except that the dimensions are 155 ft by 210 ft in plan with a 60 ft minimum eave height, due to the greater area occupied by the six gunite tanks; and the equipment support bridge system already exists as it was constructed for the Sluicing Operation conducted for the South Tank Farm in the early 1980s.

Tank TH-4 Enclosure

Tank TH-4 is a 14,000-gal capacity gunite underground storage tank located southwest of building 3500. Tank TH-4 contains a bottom layer of 6300 gal of sludge and solids and a top layer of liquids that apparently fills the tank to or past normal capacity.

An enclosure is planned for Tank TH-4 due to the length of duration for its remediation. The proposed dimensions of this building are 30 ft by 50 ft in plan, with an eave height of 40 ft. The enclosure building will include an overhead crane to facilitate movement of equipment during remedial activities but will not include personnel change rooms, decontamination facilities, nor a fixed facility for equipment decontamination. Due to space limitations imposed by the location of Tank TH-4 relative to nearby streets, parking areas, and other ORNL facilities, personnel change rooms and personnel decontamination will be provided via a portable facility. Equipment

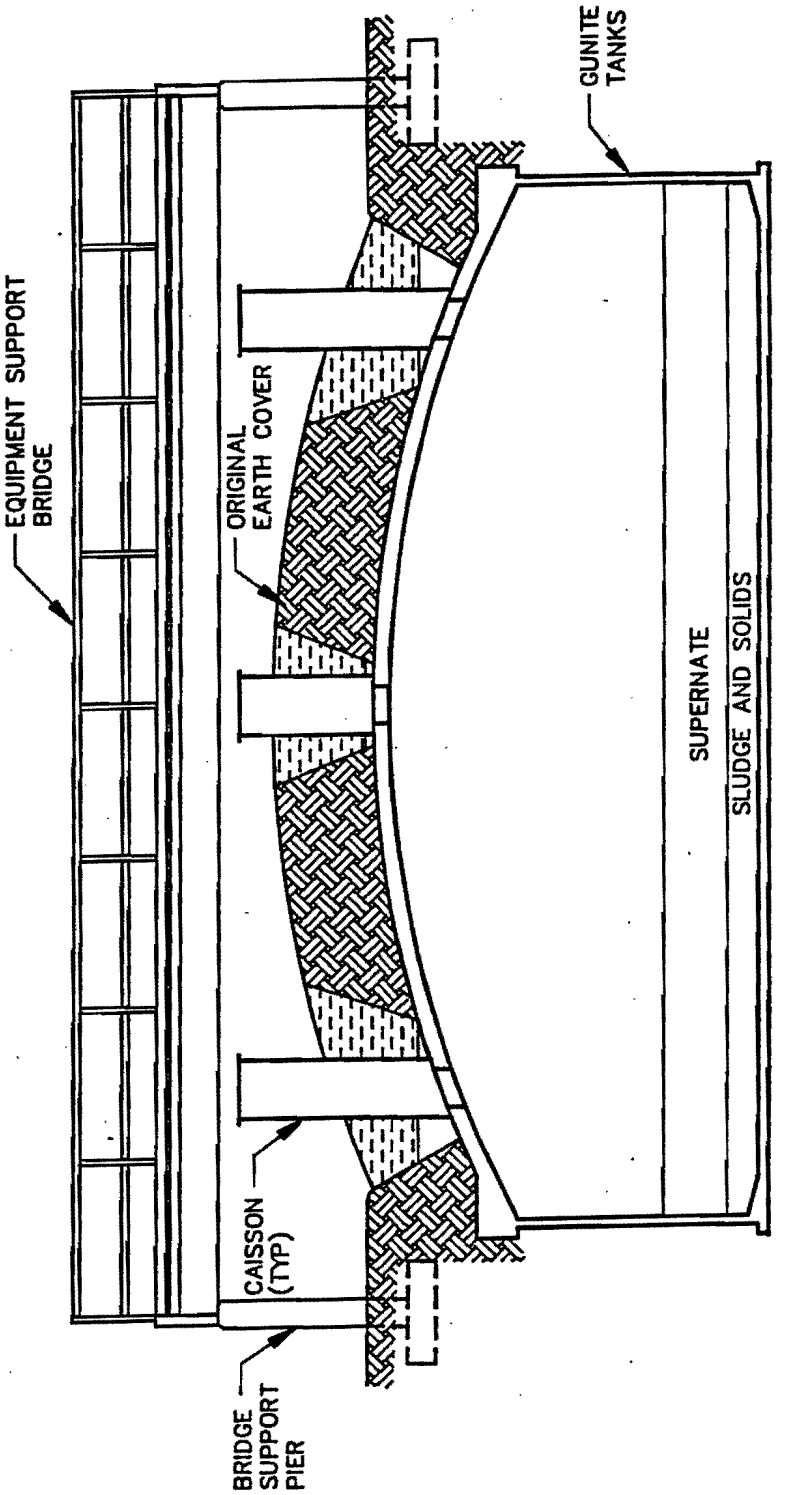


Fig. 5.3. Equipment Support Bridge System for the North Tank Farm.

decontamination will be provided by a fixed facility located elsewhere.

The cost assessment for this enclosure building includes the building itself, equipment support bridges, and mechanical and electrical systems. Tanker trucks will be utilized for the removal of water instead of an underground piping system with secondary containment. The level of water in Tank TH-4 will be monitored, and should removal of water be necessary for level maintenance prior to remediation, tanker trucks can be used.

Tank W-11

Tank W-11 is a 1500-gal gunite underground storage tank located southwest of building 3525 and contains a bottom layer of 60 gal of hard sludge (solids) covered by 950 gal of liquid. Tank W-11 is not expected to require an enclosure building, because the time to complete the remedial action for this tank is short compared to that for Tank TH-4. Should water level maintenance be necessary, tanker trucks can be utilized to remove liquid from the tank.

Assumptions made in the cost assessment include the following:

- DOE Order 6430.1A "General Design Criteria" was assumed not to impose additional criteria which may require the enclosure building to withstand certain natural phenomena. The existence of TRU wastes within the tanks will not require additional criteria to be met.

- All supernatant liquids pumped from the tanks will go to the Evaporator Facility (LLLW) and not to the PWTP.

5.5 EARLY ACTION REPORT

5.5.1 Early Action Report (6.1.01.20.04.01)

A report will be prepared that will document for activities for this Early Action. The effectiveness of reduction in infiltration will be monitored and reported. The report will also provide a summary of construction inspection activities.

5.6 EARLY ACTION OVERSIGHT

5.6.1 Early Action Oversight (6.1.01.20.05.01)

Oversight will be provided throughout the planning, design, and construction phases of the Early Action. Reviews will be provided by MMES and DOE, as appropriate, to provide assurance that the Early Action achieves compliance with regulatory requirements and administrative policies. Construction will be monitored by MMES, as well as by the A-E Contractor.

5.7 RISKS AND UNCERTAINTIES

- Construction of foundations for the enclosure building, crane supports, and equipment support bridges will require excavation within the tank farm areas. Much underground piping associated with the tank operations remains in place, and some piping remains in service, resulting in interferences.

- Since the enclosure buildings will cover nearby valve pits and valve boxes, a significant reduction in infiltration is assumed. If additional sources of inleakage are identified, additional measures (grouting pipe trenches, etc.) may be required. An alternative would be to pump out collected water without taking further action to prevent inleakage.

- If funding is not available for implementation of this Early Action, the overall and OU 1 schedules may not be maintained.

- Due to the age and unknown extent of deterioration of the tanks, some uncertainty exists regarding their structural integrity.

5.8 INTERFACES

During Early Action activities, interface and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management — To provide waste management overview and support throughout the process by focusing on the minimization of generated wastes and providing the capability to process these wastes.

- MMES D&D Program — To provide input and overview for the decontamination of radioactive handling facilities.

- MMES ES&H — To provide input and overview for the ES&H aspects.

- MMES Construction Support.

- MMES Title III Services.

- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

- Independent Certification Contractor.

6.0 WAG 1 EARLY ACTION TANK CONTENTS REMOVAL/INTERIM ACTION

This chapter presents the scope and assumptions for the planning, design, implementation, and reporting of the Early Action associated with removal of liquid from the following inactive tanks located within WAG 1: H-209, W-19, W-20, WC-15, WC-17, 3001-B, 3001-S, 3002-A, 3003-A, 3004-B, and 3013.

The WBS developed for this Early Action is presented in Fig. 6.1. The summary level schedule for the Early Action is shown in Fig. 6.2. The cost assessment of $5,446,000 is presented by WBS activity and FY in Table 6.1.

6.1 SCOPE AND ASSUMPTIONS

The Tank Contents Removal Early Action includes the following principal WBS elements:

- Planning — Action Plan, Investigation/Feasibility/Requirements, and Support Documentation.
- Design/Procedures — Title I and Title II design and procedure for removal of liquid from tanks.
- Implementation — Integration and Implementation of Early Action.
- Report — Documentation of Early Action.
- Early Action Oversight.

Detailed descriptions of the scope of each activity and specific WBS elements, along with the assumptions used for the development of the cost assessments, are presented below.

6.2 PLANNING

6.2.1 Action Plan (6.1.01.21.01.01)

An Action Plan will be written to provide an overall technical strategy and management approach for performing the Early Action. The action plan will define the scope and objectives for Early Action activities; provide a mechanism for planning; and address the proposed technical and regulatory approach, timing for implementation, schedules, and key decision points. The plan will also identify the types of documentation required for each step of the engineering design process.

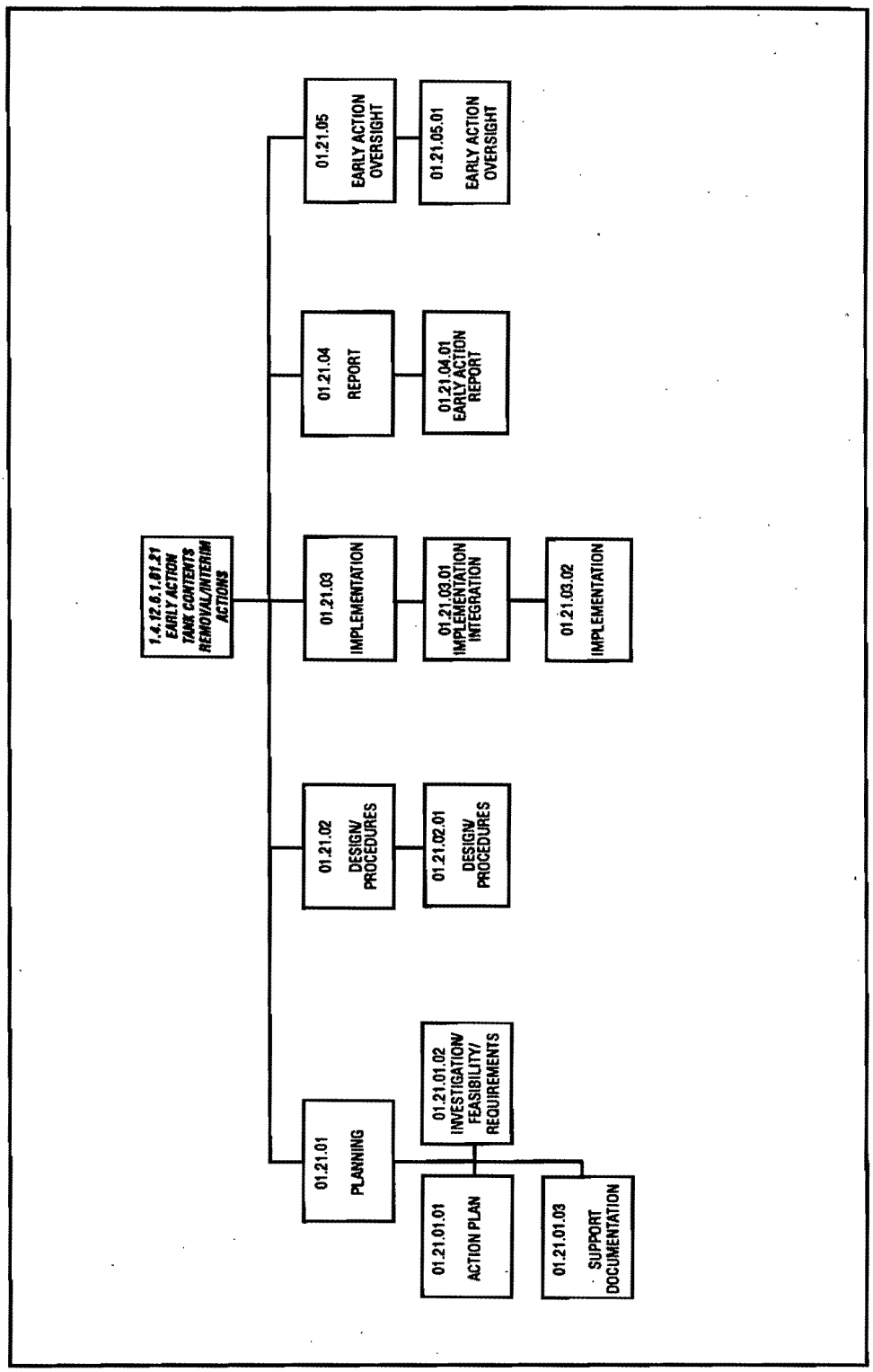


Fig. 6.1. Tank Contents Removal Early Action Work Breakdown Structure.

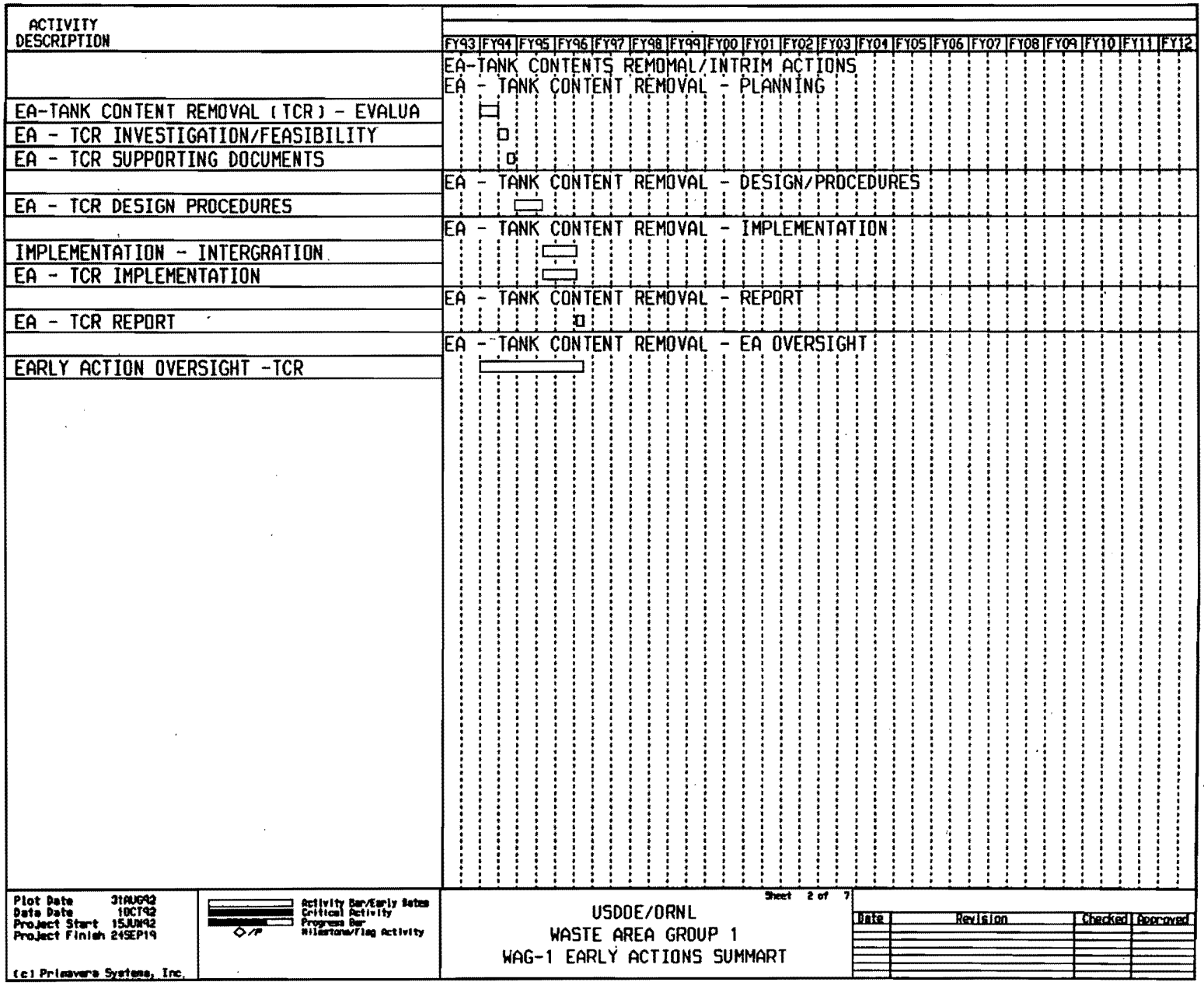


Fig. 6.2. Tank Contents Removal Early Action Summary Level Schedule.

TABLE 6.1
WAG 1 Early Action 02 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)				
	1993	1994	1995	1996	TOTAL
Action Plan	0	22	0	0	22
Invest./Feasibility/Requir.	0	98	0	0	98
Support Documentation	0	33	0	0	33
Design/Procedures	0	50	753	0	803
Implementation & Integration	0	0	980	3,217	4,197
Report	0	0	0	217	217
Early Action	0	14	47	15	76
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
	0	0	0	0	0
TOTALS	0	218	1,780	3,449	5,446

The need for documents such as Engineering Studies, System Requirement Documents, and CDRs will be identified at this time.

6.2.2 Investigation/Feasibility/Requirements (6.1.01.21.01.02)

Studies will be conducted to support the preparation of a CDR as part of preliminary engineering design, as appropriate. Existing data may be used in these studies, or additional data may be collected. The CDR will consolidate the investigation effort into a concise report that will detail the costs, schedule, technical scope, and justification for the Early Action.

6.2.3 Support Documentation (6.1.01.21.01.03)

Applicable documentation prepared to support Title I and II design includes the following as appropriate: Engineering Studies, Contingency Plans, System Requirement Documents, and CDRs. Documentation will be of sufficient detail to facilitate Title I and II engineering and will include cost and schedule information as well as technical and regulatory information necessary to start detailed engineering.

6.3 DESIGN/PROCEDURES

6.3.1 Design/Procedures (6.1.01.21.02.01)

Based on the existing information available, the A-E Contractor will prepare a preliminary design and develop a framework for definitive design including site layout, preliminary details of construction work, and outline specifications for accomplishing the Early Action. The bulk of Title I and II design will likely focus on engineering associated with tank entry. A design document will be prepared at the 30% design stage which will include the presentation of preliminary construction drawings, an outline of applicable specifications, preliminary calculations, a preliminary schedule, and a preliminary construction cost estimate. Design criteria as well as functional and systems requirements are to be completed prior to the start of Title I engineering.

The A-E Contractor will develop the Title II concept, including MMES and DOE comments, into a Final Design Report. The Title II design package will be submitted at the 60% completion stage for review by MMES and DOE. After incorporation of comments, 90% documents will be issued containing engineering designs, drawings, specifications, test plans, operating procedures, and construction cost estimates in complete form for MMES and DOE final review. Upon comment resolution, Final Design Reports will be issued CFC.

6.4 IMPLEMENTATION

6.4.1 Integration (6.1.01.21.03.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E construction support as required. Integration of construction activities to support this Early Action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

6.4.2 Implementation (6.1.01.21.03.02)

The Early Action consists of removal of liquid within the tanks previously listed. Since the tanks are buried underground, the first step will be to locate and expose tank openings. Each tank will then be opened, using a bag-in/out procedure. Equipment will then be installed to transfer any liquid contained in the tanks to a tanker truck. Precautions will be taken to prevent removal of sludge by periodically sampling liquid as it is being removed. The facility waste acceptance criteria will be used to establish a basis for maximum contamination concentrations in liquid. At completion of liquid removal, the tanker truck will transport the liquid to the LLLW system for treatment. Each tank opening will then be closed. In order to prevent additional inleakage, any piping associated with the tanks will be located and plugged. For the cost assessment, it was assumed that 2 pipes are plugged for each of the 11 tanks included in the estimate. It was also assumed for the cost assessment that all supernatant liquids pumped from the tanks will go to the Evaporator Facility (LLLW) and not to the PWTP.

6.5 EARLY ACTION REPORT

6.5.1 Early Action Report (6.1.01.21.04.01)

A report will be prepared that will document the activities for this Early Action. The effectiveness of reduction in infiltration will be monitored and reported. The report will also provide a summary of construction inspection activities.

6.6 EARLY ACTION OVERSIGHT

6.6.1 Early Action Oversight (6.1.01.21.05.01)

Oversight will be provided throughout the planning, design, and construction phases of the Early Action. Reviews will be provided by MMES and DOE, as appropriate, to provide assurance that the Early Action achieves compliance with regulatory requirements and administrative policies. Construction will be monitored by MMES, as well as by the A-E Contractor.

6.7 RISKS AND UNCERTAINTIES

- If funding is not available for implementation of this Early Action, the overall and OU10 schedules may not be maintained.
- Conditions encountered during the conduct of the Early Action do not deviate from what is planned (i.e., radiation levels encountered are expected, and tank configurations depicted on drawings are as-built).
- Inleakage may continue, resulting in the need to perform additional liquid removal.
- Difficulties, such as containment concentrations exceeding acceptance criteria, may arise during removal.

6.8 INTERFACES

During Early Action activities, interface and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview and support throughout the process by focusing on the minimization of generated wastes and providing the capability to process these wastes.
- MMES D&D Program — To provide input and overview for the decontamination of radioactive handling facilities.
- MMES ES&H — To provide input and overview for the ES&H aspects.
- MMES Construction Support.

- MMES Title III Services.
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

7.0 WAG 1 EARLY ACTION GROUNDWATER MONITORING INTERIM ACTION

This chapter presents the scope and assumptions for the planning, design, implementation, and reporting of the Early Action associated with groundwater monitoring in WAG 1. The scope of this Early Action is construction of monitoring wells to further define groundwater flow and quality in WAG 1.

The WBS developed for this Early Action is presented in Fig. 7.1. The summary level schedule for the Early Action is shown in Fig. 7.2. The cost assessment of $28,707,000 for this Early Action is presented by WBS activity and FY in Table 7.1.

7.1 SCOPE AND ASSUMPTIONS

The Groundwater Early Action includes the following principal WBS elements:

- Planning — Action Plan, Investigation/Feasibility/Requirements, and Support Documentation.
- Design/Procedures — Documentation of groundwater well location and construction.
- Implementation — Integration and Implementation of Early Action.
- Report — Documentation of Early Action.
- Early Action Oversight.

Detailed descriptions of the scope of each activity and specific WBS elements, along with the assumptions used for the development of the cost assessments, are presented below.

7.2 PLANNING

7.2.1 **Action Plan** (6.6.1.01.22.01.01)

An Action Plan will be written to provide an overall technical strategy and management approach for performing the Early Action. The action plan will define the scope and objectives for Early Action activities; provide a mechanism for planning; and address the proposed technical and regulatory approach, timing for implementation, schedules, and key decision points. The plan will also identify the types of documentation required for each step of the process. The need for documents such as Engineering Studies, System Requirement Documents, and CDRs will be identified at this time.

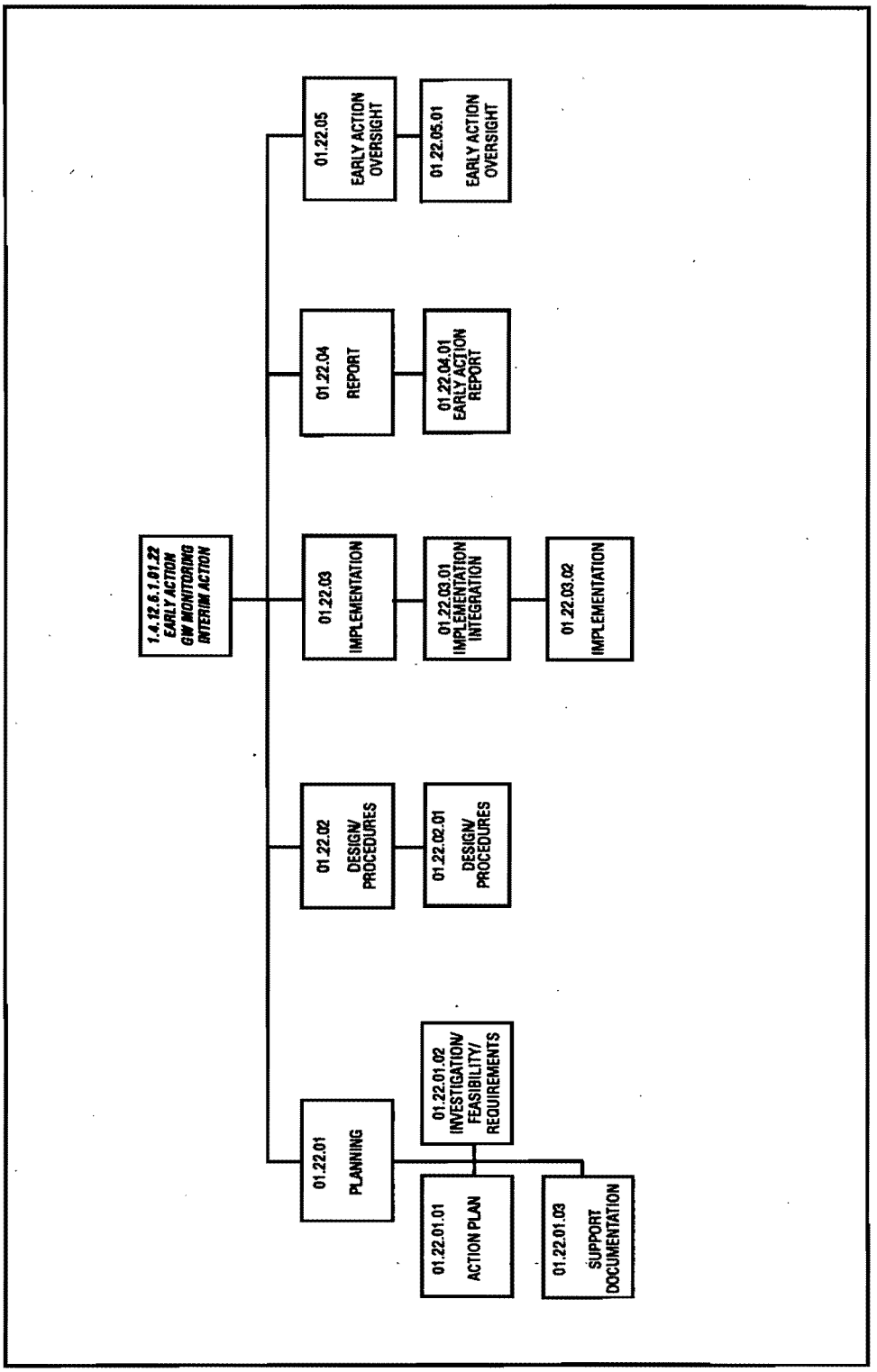


Fig. 7.1. Groundwater Monitoring Early Action Work Breakdown Structure.

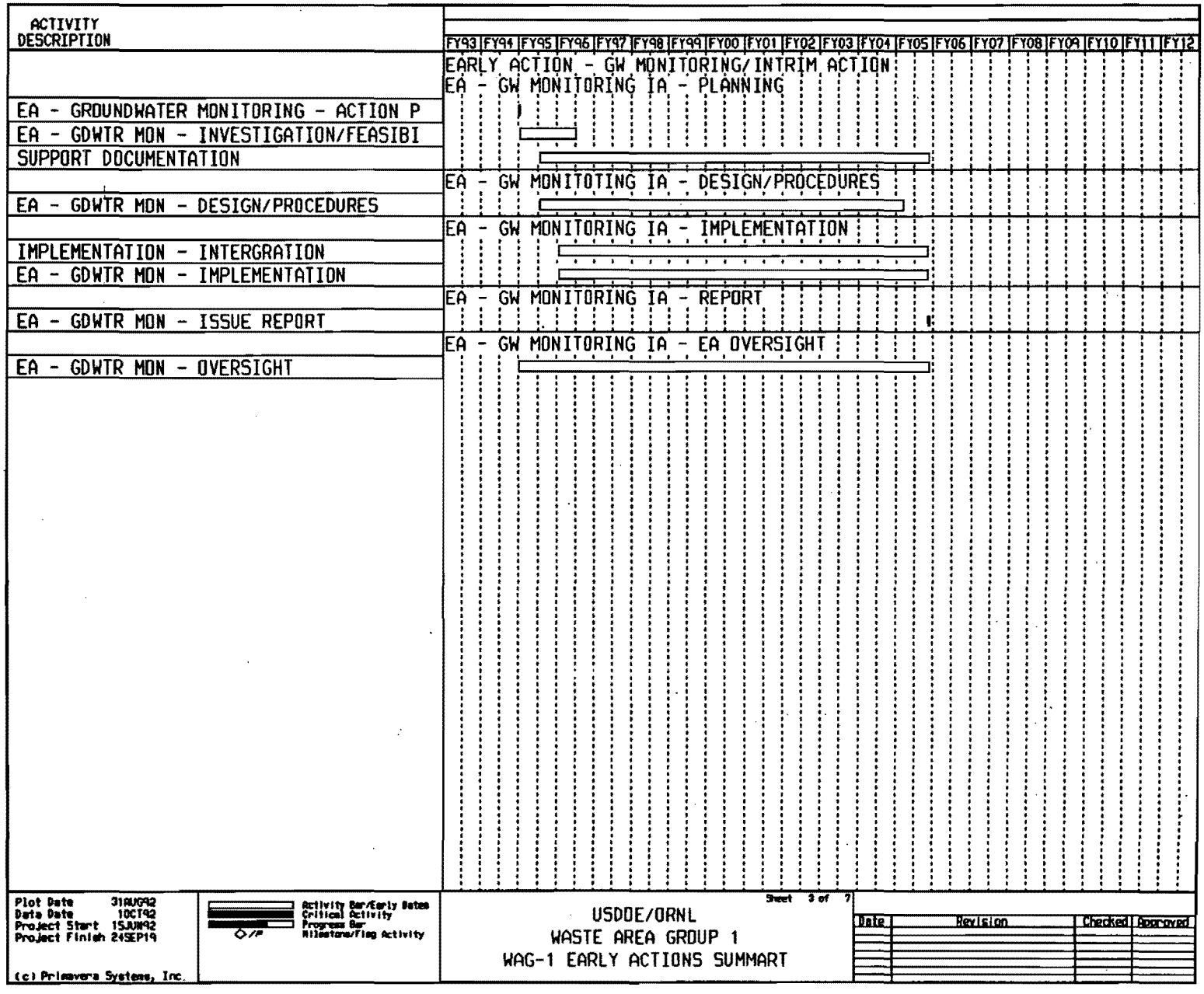


Fig. 7.2. Groundwater Monitoring Early Action Summary Level Schedule.

TABLE 7.1
WAG 1 Early Action 03 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)												
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	TOTAL
Action Plan	0	225	0	0	0	0	0	0	0	0	0	0	225
Invest./Feasibility/Require	0	513	471	0	0	0	0	0	0	0	0	0	984
Support Documentation	0	1	7	16	27	39	52	59	56	43	23	5	326
Design/Procedure	0	13	92	213	367	537	691	733	616	393	111	7	3,773
Integration	0	0	45	139	273	428	588	710	694	545	301	64	3,786
Implementation	0	0	226	705	1,381	2,166	2,975	3,598	3,516	2,763	1,525	324	19,177
Report	0	0	0	0	0	0	0	0	0	0	0	308	308
Early Action Oversight	0	1	4	7	12	16	20	22	20	15	8	2	128
	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	0	753	844	1,080	2,059	3,186	4,325	5,123	4,901	3,759	1,968	710	28,707

As part of the planning process, data needs for treatability studies should be identified early so that environmental sampling and data analysis can be expedited.

7.2.2 Investigation/Feasibility/Requirements (6.1.01.22.01.02)

As the RI proceeds, potential groundwater well locations will be selected as appropriate to satisfy the needs of the investigation. This will be performed with close coordination between the RI Subcontractor, the Groundwater WAG Team, and the ORNL Groundwater Program.

7.2.3 Support Documentation (6.1.01.22.01.03)

Applicable documentation will be prepared to support the location and construction of groundwater monitoring wells in accordance with project requirements.

7.3 DESIGN/PROCEDURES

7.3.1 Design/Procedures (6.1.01.22.02.01)

This element will involve securing permits for installation of groundwater monitoring wells within WAG 1. Well location selection will require surveying the well locations as well as investigations to determine the presence of underground utilities, LLLW lines, and other underground obstructions. It is assumed that the existing design of the groundwater monitoring well will be utilized.

7.4 IMPLEMENTATION

7.4.1 Integration (6.1.01.22.03.01)

The objective of this element is to provide construction management, independent certification, Title III services, and construction support as required. Integration of construction activities to support this Early Action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

7.4.2 **Implementation** (6.1.01.22.03.02)

Groundwater flow may constitute a significant pathway for migration of contaminants from WAG 1. ORNL has conducted preliminary investigations of groundwater flow and quality that indicate that the flow regime is complex and that radiological contaminants are present in the groundwater. An investigation of WAG 1 hydrogeology will be conducted to further define groundwater flow and quality, to determine the type and degree of interaction between the surface water and groundwater systems within the WAG 1 area, to characterize groundwater movement through and away from WAG 1, and to determine the types and levels of contaminants associated with releases from specific WAG 1 sources (i.e., SWMUs). Water level data from the groundwater monitoring wells, in conjunction with data from existing piezometers and stream gaging stations, will provide information on the interaction of surface water and groundwater systems.

As an Early Action, new wells will be installed and developed within the interior of WAG 1 to provide additional information for the hydrogeologic investigation described above. For estimating purposes, the number of wells to be constructed was assumed to be ten per year, and the average depth was assumed to be 175 ft. An additional assumption was made that the soil and/or rock is contaminated and will require disposal at the consolidation facility.

7.5 EARLY ACTION REPORT

7.5.1 **Early Action Report** (6.1.01.22.04.01)

A report will be prepared that will document the activities for this Early Action. The report will also provide a summary of construction inspection activities.

7.6 EARLY ACTION OVERSIGHT

7.6.1 **Early Action Oversight** (6.1.01.22.05.01)

Oversight will be provided throughout the planning, design, and construction phases of the Early Action. Reviews will be provided by MMES and DOE, as appropriate, to provide assurance that the Early Action achieves compliance with regulatory requirements and administrative policies. Construction will be monitored by MMES, as well as by the A-E Contractor.

7.7 RISKS AND UNCERTAINTIES

- If funding is not available for implementation of this Early Action, the overall schedule may not be maintained.

- The number of wells assumed for this cost assessment may vary according to the needs of the RI.

7.8 INTERFACES

During Early Action activities, interfaces and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview and support throughout the process by focusing on the minimization of generated wastes and providing the capability to process these wastes.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H — To provide input and overview for the ES&H aspects of conducting the RA.

8.0 WAG 1 EARLY ACTION INACTIVE LOW-LEVEL RADIOACTIVE WASTE TANK SYSTEMS

8.1 SCOPE AND ASSUMPTIONS

The scope of this chapter includes the planning, implementation, and reporting for Early Actions associated with removal of liquid from the following inactive tanks located within WAG 1: TH-1, TH-2, TH-3, W-13, W-14, W-15, T-30, and WC-1. Also included is the excavation and removal of Tank 3000-S. These activities are to commence in FY 1993, and a detailed discussion of actions, along with the schedule, is included in Activities Data Sheet 3313. The cost for performing this work are summarized separately from the WAG 1 ER Baseline and will be submitted in a separate document.

9.0. WAG 1 EARLY ACTION GUNITE TANKS ROBOTICS INTERIM ACTION

This chapter presents the scope and assumptions for the planning, design, implementation, and reporting of the Early Action associated with the engineering development for treatability studies and robotics associated with remediation of the North and South Tank Farms and Tanks TH-4/W-11. The scope of this Early Action includes additional research on recent advancements in technologies or construction techniques, development of job specific hardware, engineering studies on new equipment performance, selection of the most economical and technically superior technology/vendor, as well as the various equipment options available in order to achieve the selected remedy in the IROD prior to the start of final Title I and II design.

The WBS developed for this Early Action is presented in Fig. 9.1. The summary level schedule for the Early Action is shown in Fig. 9.2. The cost assessment of $40,038,000 for this Early Action is presented by WBS activity and FY in Table 9.1. Due to the lack of definitive waste characterization, as well as development of candidate treatment technologies, costs and schedules shown for treatability studies are based on recent projects.

9.1 SCOPE AND ASSUMPTIONS

The Gunite Tank Robotics Early Action includes the following principal WBS elements:

- Planning — Action Plan, Investigation/Feasibility/Requirements and Support Documentation.
- Design/Procedures — Performance of preliminary engineering to support early procurement of equipment and to support Title I and II engineering (performed later).
- Implementation — Integration and Implementation of Early Action.
- Report — Documentation of Early Action.
- Early Action Oversight.

Detailed descriptions of the scope of each activity and specific WBS elements, along with the assumptions used for the development of the cost assessments, are presented below.

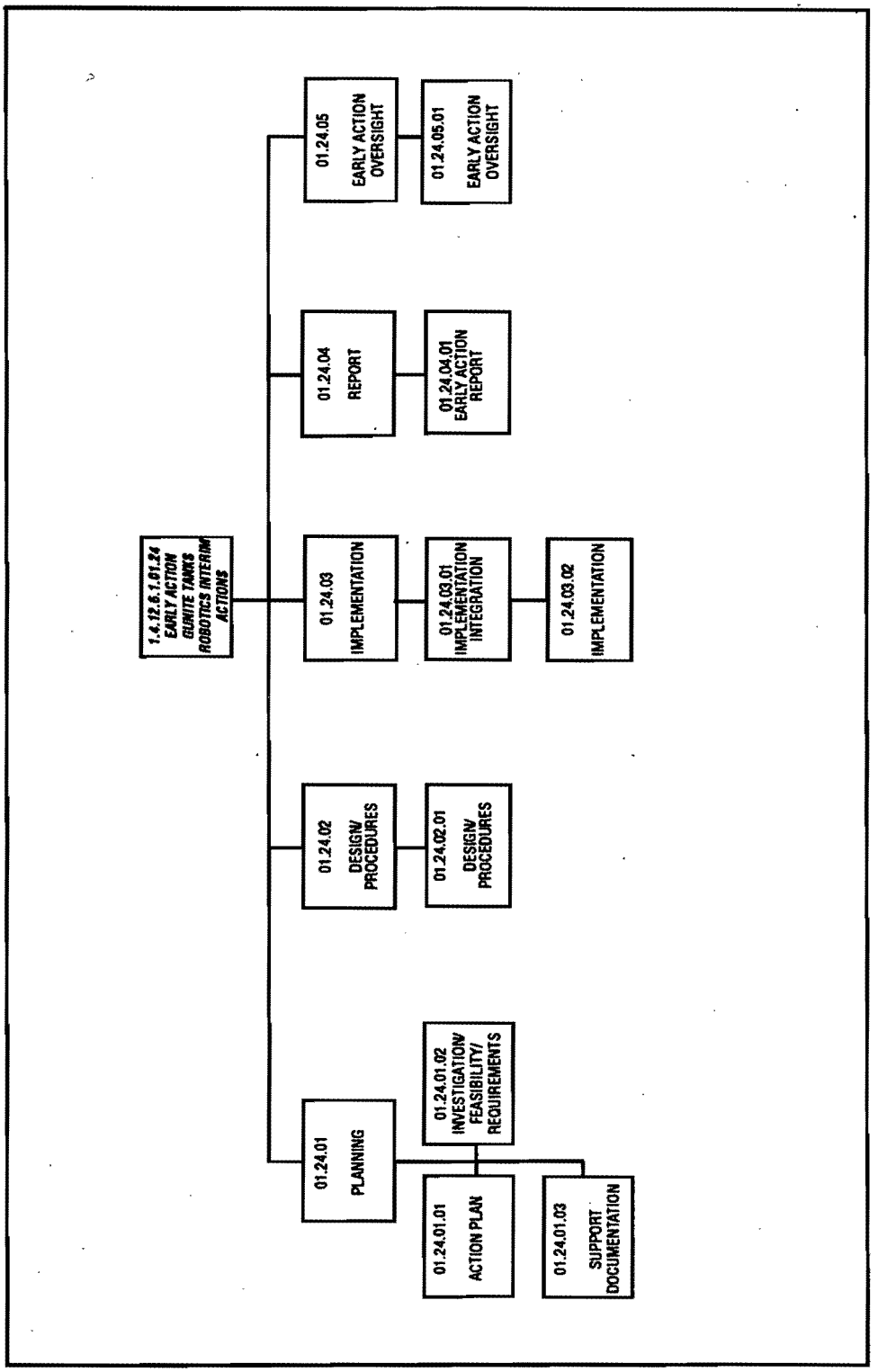


Fig. 9.1. Gunite Tanks Robotics Early Action Work Breakdown Structure.

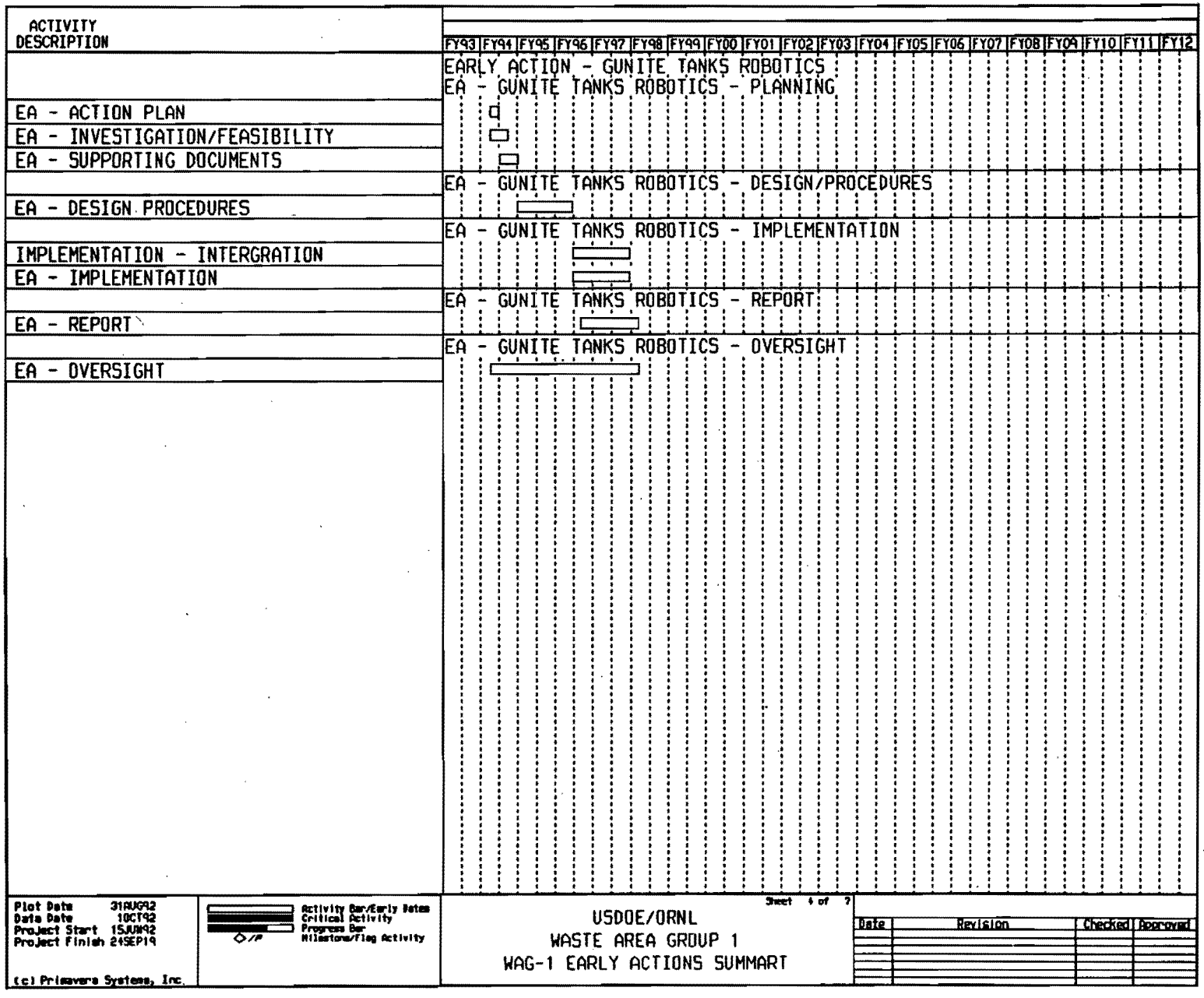


Fig. 9.2. Gunite Tanks Robotics Early Action Summary Level Schedule.

TABLE 9.1
WAG 1 Early Action 04 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)					
	1994	1995	1996	1997	1998	TOTAL
Action Plan	22	0	0	0	0	22
Invest./Feasibility/Require	98	0	0	0	0	98
Support Documentation	14	18	0	0	0	33
Design/Procedure	59	6,729	4,113	0	0	10,900
Integration	0	0	494	1,313	0	1,807
Implementation	0	0	7,373	19,582	0	26,955
Report	0	0	16	129	6	152
Early Action Oversight	3	17	32	18	0	70
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
	0	0	0	0	0	0
TOTALS	197	6,764	12,028	21,042	7	40,038

9.2 PLANNING

9.2.1 Action Plan (6.1.01.24.01.01)

An Action Plan will be written to provide an overall technical strategy and management approach for performing the Early Action. The action plan will define the scope and objectives for Early Action activities; provide a mechanism for planning; and address the proposed technical and regulatory approach, timing for implementation, schedules, and key decision points. The plan will also identify the types of documentation required for each step of the engineering design process. The need for documents such as Engineering Studies, System Requirement Documents, CDRs, Treatability Sampling Plans, and Treatability Study Work Plans will be identified at this time.

As part of the planning process, data needs for treatability studies performed in support of RD/RA should be identified early so that environmental sampling and data analysis can be expedited. The types of work plans needed for sampling waste material from the tanks and conducting treatability studies should be identified at this time.

9.2.2 Investigation/Feasibility/Requirements (6.1.01.24.01.02)

Studies will be conducted to support design and procurement of a robotic arm to assist the sampling program that will be conducted for the treatability study. The following documentation will be prepared as appropriate to support Phase I and II Title I and Title II design for the RA: CDRs, System Requirements Documents, and Engineering Studies. Other activities will be conducted to support Treatability Studies which will include, but will not be limited to, the development of sampling methodology for collection of samples for the Treatability Study and methodology for conducting a treatability study.

9.2.3 Support Documentation (6.1.01.24.01.03)

In order to perform remote sampling for the treatability study, sufficient development and design will be necessary to procure sampling equipment prior to final Title I and II design. It is expected that documentation for this will be limited to that which is necessary to procure the equipment. Applicable documentation prepared to support final Title I and II design includes the following as appropriate: Engineering Studies, Contingency Plans, System Requirement Documents, and CDRs. Documentation will be of sufficient detail to facilitate final Title I and II engineering and will include cost and schedule information as well as technical and regulatory information necessary to start detailed engineering. Treatability Sampling Plans and Treatability Study Work Plans will be prepared for submittal to DOE for review.

9.3 DESIGN/PROCEDURES

9.3.1 Design/Procedures (6.1.01.24.02.01)

Formal Title I and II for robotics development will occur later in the schedule and under other WBS elements (6.1.01.41.07.01 through 6.1.01.41.07.04). The scope of the activity conducted for the Robotics Early Action will include preliminary engineering work sufficient to procure basic components (robotic arm and necessary tools) to perform remote sampling and development of remote capability as well as preparation of sampling procedures. It is likely that due to the long procurement times associated with this type of equipment, the robotic arm, as well as certain end effectors and tools developed for sampling, will be used during actual remediation. Formal Title I and II will consist of final design of additional end effectors and tools needed to perform remote tasks, as well as modifications to components based on results of the sampling activities. Some design will occur under this WBS activity for procurement of equipment to support remote sampling.

9.4 IMPLEMENTATION

9.4.1 Integration (6.1.01.24.03.01)

The objective of this element is to provide coordination of activities being conducted to support development of robotics capability so that the remedial action may be accomplished. Activities requiring coordination include, but are not limited to, development of a robotic arm and associated end effectors; development of a sampling plan for treatability studies and waste characterization; development of treatability study plans, which integrates remote operations with activities required to support sampling, health physics coverage; acquisition of the necessary permits to open tanks; and coordination with other Early Actions, such as construction of enclosure buildings and equipment support bridges, etc.

Integration of activities to support this Early Action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Procurement of equipment is conducted according to procedures, and equipment meets the intended purpose.

- Coordination with other Early Actions affecting Gunite Tank RA activities is accomplished so that sampling activities can occur on schedule.

9.4.2 Implementation (6.1.01.24.03.02)

Robotics Development

As discussed in Section 9.3.1, some design will be performed in order to procure a robotic arm to assist in remote sampling. Due to projected procurement times for this type of equipment, it may be necessary to use the same robotic arm procured to sample waste material for remediation tasks. Therefore, design of the robotic arm for sampling must also consider the later use of the arm.

Preliminary design work supporting Phase I and II Title I and Title II for the RA will involve preparation of a CDR and/or additional documentation to support engineering design. Existing data may be used in these studies, or additional data may be collected. The CDR will consolidate the investigation effort into a concise report that will detail the costs, schedule, technical scope, and justification for the Early Action. Since it is planned to conduct remediation in two phases, engineering development for robotics will likewise support the two-phased concept. Phase I will involve remediation of tanks located in the North Tank Farm that do not contain sludge. It is expected that robotics development supporting Phase I Remediation will involve studies to adapt existing remote operation technologies to those tasks to be performed during Phase I. Remote operations planned for Phase I remediation are less complex than those required for Phase II.

Engineering studies performed to support Phase II remediation will involve the following tasks:

- Research and development into new techniques.
- Equipment procurement for remote sampling.
- Mock up remote sampling.
- Performance of remote sampling of sludge that will demonstrate the viability of remote operations, collect data to support robotics development, and collect samples for a Treatability Study.
- Refining of techniques based on results of sampling and scale up/completion of tool development.

Treatability Studies

Treatability Studies are also planned as part of this WBS element. These will involve demonstrations using actual waste samples so that one or more candidate treatment technologies can be effectively performed remotely. Treatability studies will demonstrate that the proposed treatment methods can achieve the desired effectiveness and will demonstrate compliance with performance standards. Additional characterization of waste material will also be conducted at this time, since samples collected remotely will be more representative of actual conditions. Should this

characterization reveal significant differences in physical, chemical, or radiological characteristics in sludges from different tank farms or tanks, the approach taken for the treatability study may vary depending on the types of material encountered. The following will be performed as part of the overall treatability study:

- Preparation of a Sampling Plan. The Sampling Plan will be integrated with robotics development (this will be accomplished under a separate WBS Element).
- Preparation of a Treatability Study Work Plan. The plan should contain remedial action objectives, preliminary remediation goals, descriptions of candidate treatment technologies, and the methodology for conducting the treatment and analytical testing to determine effectiveness (this will be accomplished under a separate WBS Element).
- Preparation of a Health and Safety Plan.
- Preparation of a Waste Management Plan.
- Sampling of waste sludges in concert with robotics development (discussed earlier).
- Bench and Pilot Scale testing of treatment technologies.
- Analytical testing of treated waste forms.
- Reporting.

The treatability program will be conducted both during and after the feasibility study. The completion of the treatability study is not tied to the completion of the feasibility study (being conducted under CERCLA) or the IROD, but is tied to Phase II Title I and II design in the schedule.

9.5 EARLY ACTION REPORT

9.5.1 Early Action Report (6.1.01.24.04.01)

A report will be written that will document the results of the treatability study. This report will contain results of analytical testing for input into the decision making process with regard to the final selection of treatment and/or remedial approach to be taken. Additional reports, such as CDRs, etc., will be prepared to support Title I and II design as appropriate.

9.6 EARLY ACTION OVERSIGHT

9.6.1 Early Action Oversight (6.1.01.24.05.01)

Oversight will be provided throughout the planning, design, equipment procurement, sampling, and treatability study phases of the Early Action. Reviews will be provided by MMES and DOE, as appropriate, to provide assurance that the Early Action achieves compliance with regulatory requirements and administrative policies. Equipment procurement will be monitored by MMES, as well as by the A-E Contractor.

9.7 RISKS AND UNCERTAINTIES

- The schedule shown does not reflect EPA review and approval of robotics nor treatability study sampling or work plans. Should EPA or TDEC insist on review and approval of documents developed in support of these activities prior to implementation, additional time will be needed to accomplish treatability studies.

- Preliminary characterization data of sludges contained in the tanks should be reviewed so that adequate attention is given to analytical laboratory procurement for testing of treated samples. The availability and capacities of labs to perform analytical testing of highly radioactive treated sludges should be thoroughly investigated early in the engineering development process so that schedules can be adjusted. The type of lab used may require approval of the regulators, whether it is at the site or is a commercial lab.

- Due to the lack of definitive waste characterization, as well as development of candidate treatment technologies, schedules shown for treatability are based on past experience for similar work. Available data should be reviewed and schedules revised accordingly as the treatment technologies are further defined in the RI/FS.

- Candidate treatment technologies screened during the FS are agreed to by the regulators as candidates for further study prior to completion of the Treatability Work Plan.

- No down time for weather delays is assumed in the schedule. If the enclosure buildings are constructed for both the North and South Tank Farms, weather will not become a factor for sampling of the sludges.

- If funding is not available for implementation of this Early Action, the overall and OU 1 schedule may not be maintained.

- Coordination must be made between sampling associated with the Treatability Study and construction of the enclosure buildings.

9.8 INTERFACES

During Early Action activities, interface and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview and support throughout the process by focusing on the minimization of generated wastes and providing the capability to process the wastes generated.
- MMES Technical Advisory Group — To provide technical overview support during the RA process, specifically for monitoring and field change requests.
- MMES ES&H — To provide input and overview for the ES&H aspects.
- MMES Construction Support.
- MMES Title III Services.
- A-E Contractor — Coordination with Title I and II activities.

10.0 WAG 1 EARLY ACTION CORE HOLE EIGHT INTERIM ACTION

This chapter presents the scope and assumptions for the planning, design, implementation, and reporting of the Early Action associated with the Core Hole Eight contamination plume. The scope of this Early Action is construction and operation of a groundwater interception system along the west side of First Street to collect groundwater migrating toward First Creek from the Core Hole Eight area.

The WBS developed for this Early Action is presented in Fig. 10.1. The summary level schedule for the Early Action is shown in Fig. 10.2. The cost assessment of $6,898,000 for this Early Action is presented by WBS activity and FY in Table 10.1.

10.1 SCOPE AND ASSUMPTIONS

The Core Hole Eight Early Action includes the following principal WBS elements:

- Planning — Action Plan, Investigation/Feasibility/Requirements, and Support Documentation.
- Design/Procedures — Title I and Title II design of an interception, collection, and treatment system to reduce the migration of contamination.
- Implementation — Integration and Implementation of Early Action.
- Report — Documentation of Early Action.
- Early Action Oversight.

Detailed descriptions of the scope of each activity and specific WBS elements, along with the assumptions used for the development of the cost assessments, are presented below.

10.2 PLANNING

10.2.1 **Action Plan** (6.1.01.25.01.01)

An Action Plan will be written to provide an overall technical strategy and management approach for performing the Early Action. The action plan will define the scope and objectives for Early Action activities; provide a mechanism for planning; and address the proposed technical and regulatory approach, timing for implementation, schedules, and key decision points. The plan will also identify the types of documentation required for each step of the engineering design process. The need for documents such as Engineering Studies, System Requirement Documents, and CDRs

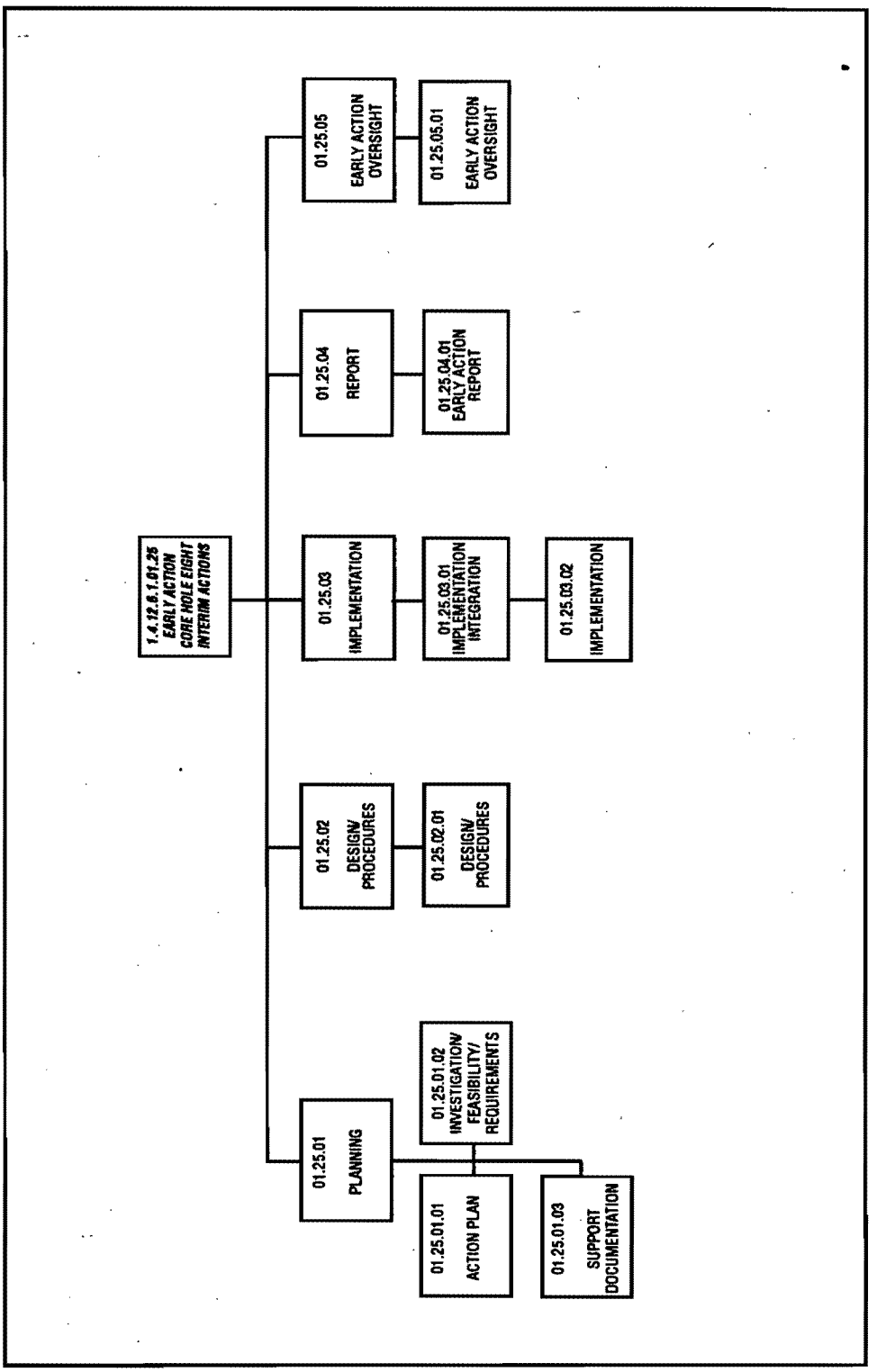


Fig. 10.1. Core Hole Eight Early Action Work Breakdown Structure.

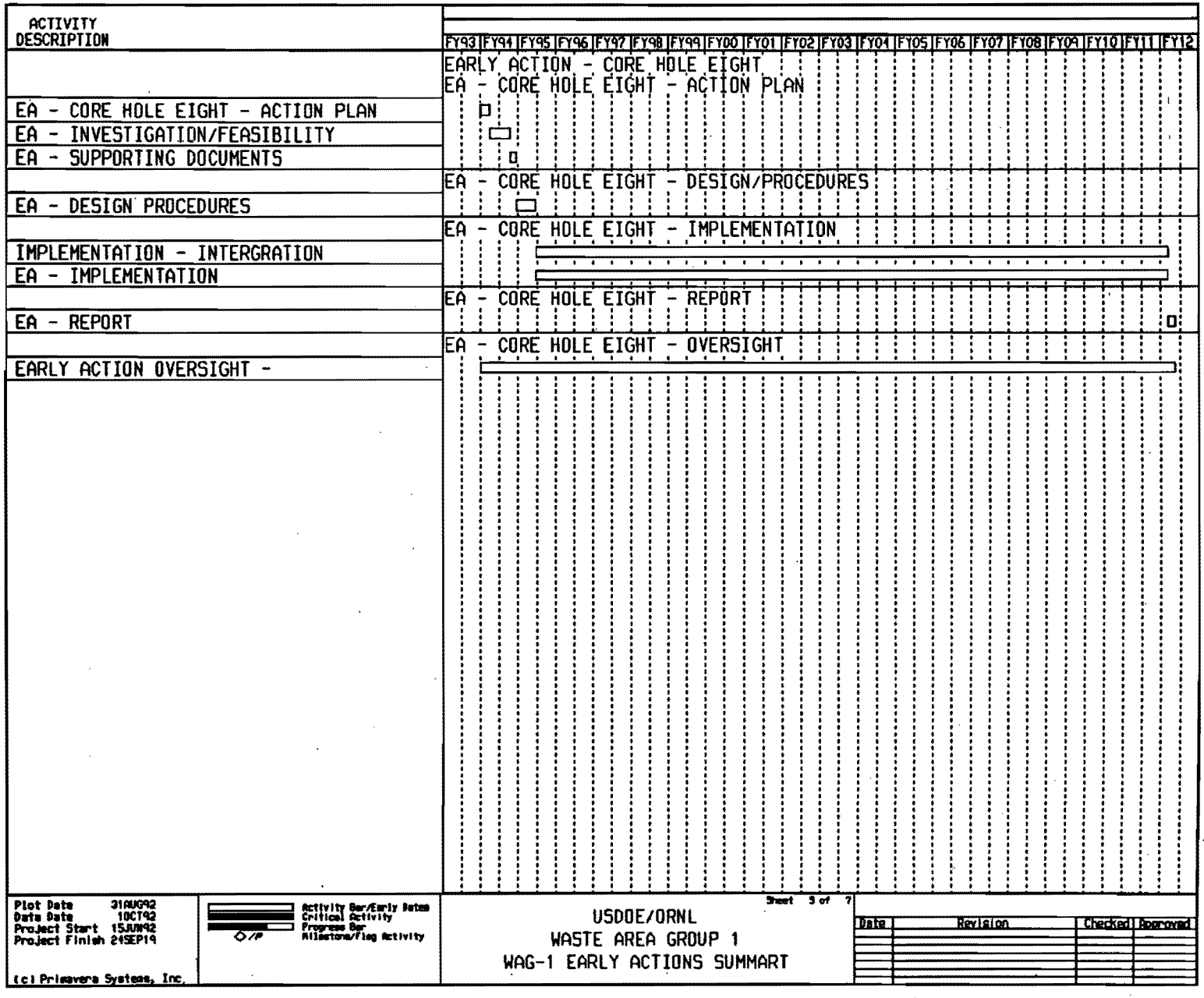


Fig. 10.2. Core Hole Eight Early Action Summary Level Schedule.

TABLE 10.1
WAG 1 Early Action 05 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)																			
	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	TOTAL
Action Plan	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
Invest./Feasibility Requir.	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98
Support Documentation	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33
Design/Procedure	24	399	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	423
Implemenation & Integration	0	18	60	115	182	264	351	442	534	624	687	703	666	584	472	328	156	47	7	6,238
Report	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	37	37
Early Action Oversight	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Early Action Oversight	0	0	1	1	2	2	3	3	4	4	5	5	4	4	3	2	1	0	0	45
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	178	417	61	116	183	266	354	446	538	628	692	707	670	587	475	330	158	47	44	6,898

will be identified at this time.

As part of the planning process, data needs for feasibility studies should be identified early so that environmental sampling and data analysis can be expedited.

10.2.2 Investigation/Feasibility/Requirements (6.1.01.25.01.02)

A report will be prepared and submitted for MMES/DOE review, as well as for TDEC/EPA review and approval. The report will summarize results of existing investigations characterizing the extent of the plume. The results of these data will be discussed in the report, and alternatives will be assembled and evaluated to determine the most effective action to be taken to accomplish the objectives. Alternatives will be evaluated regarding the effectiveness, implementability, and relative cost. Effectiveness will consider such factors as impacts to public health, the environment, reduction in toxicity/mobility/volume, as well as its consistency with the final action. Implementability will consider such factors as technical and administrative feasibility. Technical feasibility will examine whether or not a technology exists to accomplish the goals of the Early Action and, if more than one technology exists, which particular technology is easier to implement. Administrative feasibility will consider whether or not permits are required and, if so, will assess the difficulty in obtaining additional permits or modifications of existing permits.

The report will document the selection of one alternative and will address all pertinent regulatory issues likely to face implementation of an Early Action. Sufficient preliminary engineering design will be performed and documented within the report so that Title I and II design can proceed after the report is accepted by TDEC/EPA.

10.2.3 Support Documentation (6.1.01.25.01.03)

Applicable documentation prepared to support Title I and II design includes the following as appropriate: Engineering Studies, Contingency Plans, System Requirement Documents, and CDRs. Documentation will be of sufficient detail to facilitate Title I and II engineering and will include cost and schedule information as well as technical and regulatory information necessary to start detailed engineering.

10.3 DESIGN/PROCEDURES

10.3.1 Design/Procedures (6.1.01.25.02.01)

Based on the existing information available, the A-E Contractor will prepare a preliminary design and develop a framework for definitive design including site layout, preliminary details of construction work, and outline specifications for the work involved in construction of a French drain adjacent to First Street. The A-E will also prepare a design document at the 30% design stage which includes the presentation of preliminary construction drawings and an outline of applicable specifications, preliminary calculations, a preliminary schedule, and a preliminary construction cost

estimate. Design criteria, as well as functional and systems requirements, are to be completed prior to the start of Title I engineering.

In addition, the A-E Contractor will develop the Title II concept including MMES and DOE comments into a Final Design Report. The Title II design package will be submitted at the 60% completion stage for review by MMES and DOE. After incorporation of comments, 90% documents will be issued containing engineering designs, drawings, specifications, test plans, and construction cost estimates in complete form for MMES and DOE final review. Upon comment resolution, Final Design Reports will be issued CFC.

10.4 IMPLEMENTATION

10.4.1 Integration (6.1.01.25.03.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E construction support as required.

Integration of construction activities to support this Early Action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

10.4.2 Implementation (6.1.01.25.03.02)

The Core Hole Eight plume is located north of Central Avenue and extends from the North Tank Farm to beyond First Creek. The principal radiological contaminants carried in the groundwater are strontium, americium, technetium, promethium, uranium, and radium. The Early Action currently identified is construction of a French drain to collect groundwater prior to its entry into First Creek.

It is assumed for the cost assessment that a French drain will be constructed parallel to First Creek on the west side of First Street and will extend from the northern access to the Building 1000 parking area 315 feet south to the pedestrian crossing. The drain will also serve to collect groundwater flowing toward First Creek in and around existing pipes. Where existing utility lines cross the French drain, a soil/bentonite mixture will be used as backfill on the downgradient side of the drain. This will prevent further migration of contaminants along the pipe trenches. Where storm

pipes cross the French drain, a diversion box will be installed on the pipe on the downgradient side of the drain. The function of this structure will be to collect low flow in the pipe associated with groundwater infiltration while allowing storm flows to pass through.

The drain will be connected to the system proposed to collect contaminated groundwater from in and around pipes south of the Core Hole Eight plume. Ultimately, groundwater collected in this French drain will be treated at PWTP. Collection of contaminated groundwater will continue until the completion of the groundwater OU RA. Chapter 11.0 discusses the collection system proposed to intercept contaminants at the WAG 1 boundary.

The work included in the cost assessment includes excavation to the bedrock, trench shoring, French drain construction, erosion control, revegetation, and personnel protection equipment (PPE). It is assumed that soil excavated during construction will be contaminated and, therefore, will require disposal. Additional assumptions made for the cost assessment are as follows:

- It is assumed that PWTP will have the capacity to treat groundwater collected from the Core Hole Eight plume.
- It is assumed that all excavated soil will be contaminated. Therefore, the soil will be placed in B-25 boxes and sent to the proposed WAG 1 consolidation area for storage/disposal.
- It is assumed that pipes and trenches are the easiest path for contaminant migration. This assumption is the justification for collection of groundwater traveling in and around pipes.

10.5 EARLY ACTION REPORT

10.5.1 **Early Action Report** (6.1.01.25.04.01)

A report will be prepared that will document the activities for this Early Action. The effectiveness of interception of the Core Hole Eight plume will be monitored and reported. The report will also provide a summary of construction inspection activities.

10.6 EARLY ACTION OVERSIGHT

10.6.1 **Early Action Oversight** (6.1.01.25.05.01)

Oversight will be provided throughout the planning, design, and construction phases of the Early Action. Reviews will be provided by MMES and DOE, as appropriate, to provide assurance that the Early Action achieves compliance with regulatory requirements and administrative policies. Construction will be monitored by MMES, as well as by the A-E Contractor.

10.7 RISKS AND UNCERTAINTIES

- Storm flows will not be collected since it is assumed that contaminant concentrations will not be significant in surface runoff. Rather, only low flows issuing from storm pipes will be collected. Should it become necessary to collect storm flows, adequate storage capacity must be planned.

- If funding is not available for implementation of this Early Action, the overall schedule may not be maintained.

10.8 INTERFACES

During Early Action activities, interfaces and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management — To provide waste management overview and support throughout the process by focusing on the minimization of generated wastes and providing the capability to process these wastes.

- MMES Technical Advisory Group — To provide technical overview support during the RA process, specifically for monitoring and field change requests.

- Groundwater WAG Team.

- ORNL Groundwater Program.

- MMES ES&H — To provide input and overview for the ES&H aspects.

- MMES Construction Support.

- MMES Title III Services.

- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

- Independent Certification Contractor.

- EPA — To provide regulatory overview.

- TDEC — To provide state regulatory overview.

11.0. WAG 1 EARLY ACTION BOUNDARY INTERCEPTION

This chapter presents the scope and assumptions for the planning, design, implementation, and reporting of the Early Action associated with interception of contaminants at the WAG 1 boundary. The scope of this Early Action is construction of a system for collection of contaminated groundwater issuing from outfalls 341 and 342 and construction of a French drain along White Oak Creek to collect groundwater migrating from the 3500 area.

The WBS developed for this Early Action is presented in Fig. 11.1. The summary level schedule for the Early Action is shown in Fig. 11.2. The cost assessment of $15,172,000 for this Early Action is presented by WBS activity and FY in Table 11.1.

11.1 SCOPE AND ASSUMPTIONS

The Boundary Interception Early Action includes the following principal WBS elements:

- Planning — Action Plan, Investigation/Feasibility/Requirements, and Support Documentation.
- Design/Procedures — Title I and Title II of an interception, collection, and treatment system to reduce the migration of contamination.
- Implementation — Integration and Implementation of Early Action.
- Report — Documentation of Early Action.
- Early Action Oversight.

Detailed descriptions of the scope of each activity and specific WBS elements, along with the assumptions used for the development of the cost assessments, are presented below.

11.2 PLANNING

11.2.1 Action Plan (6.1.01.26.01.01)

An Action Plan will be written to provide an overall technical strategy and management approach for performing the Early Action. The action plan will define the scope and objectives for Early Action activities; provide a mechanism for planning; and address the proposed technical and regulatory approach, timing for implementation, schedules, and key decision points. The plan will also identify the types of documentation required for each step of the engineering design process. The need for documents such as Engineering Studies, System Requirement Documents, and CDRs

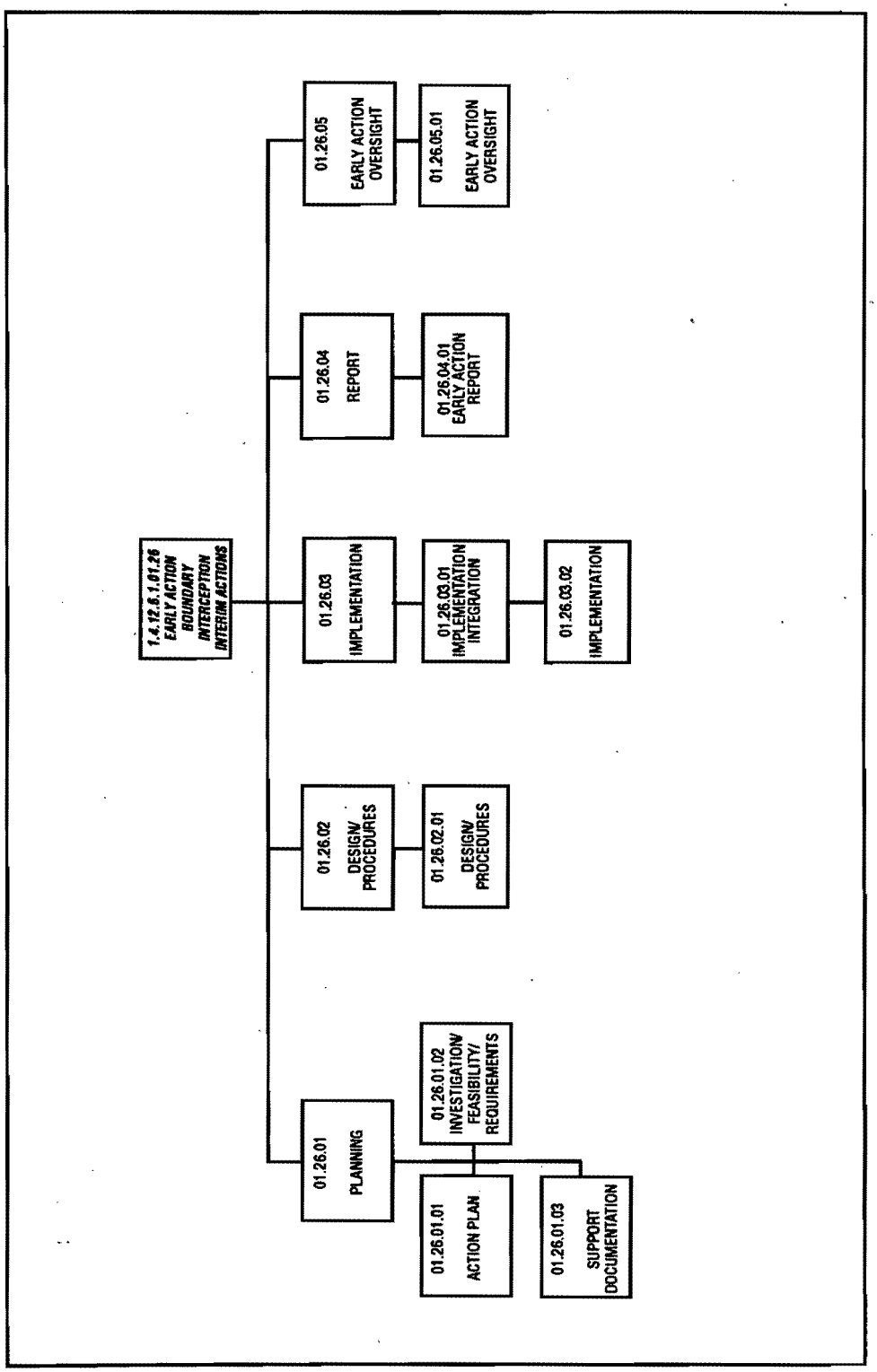


Fig. 11.1. Boundary Interception Early Action Work Breakdown Structure.

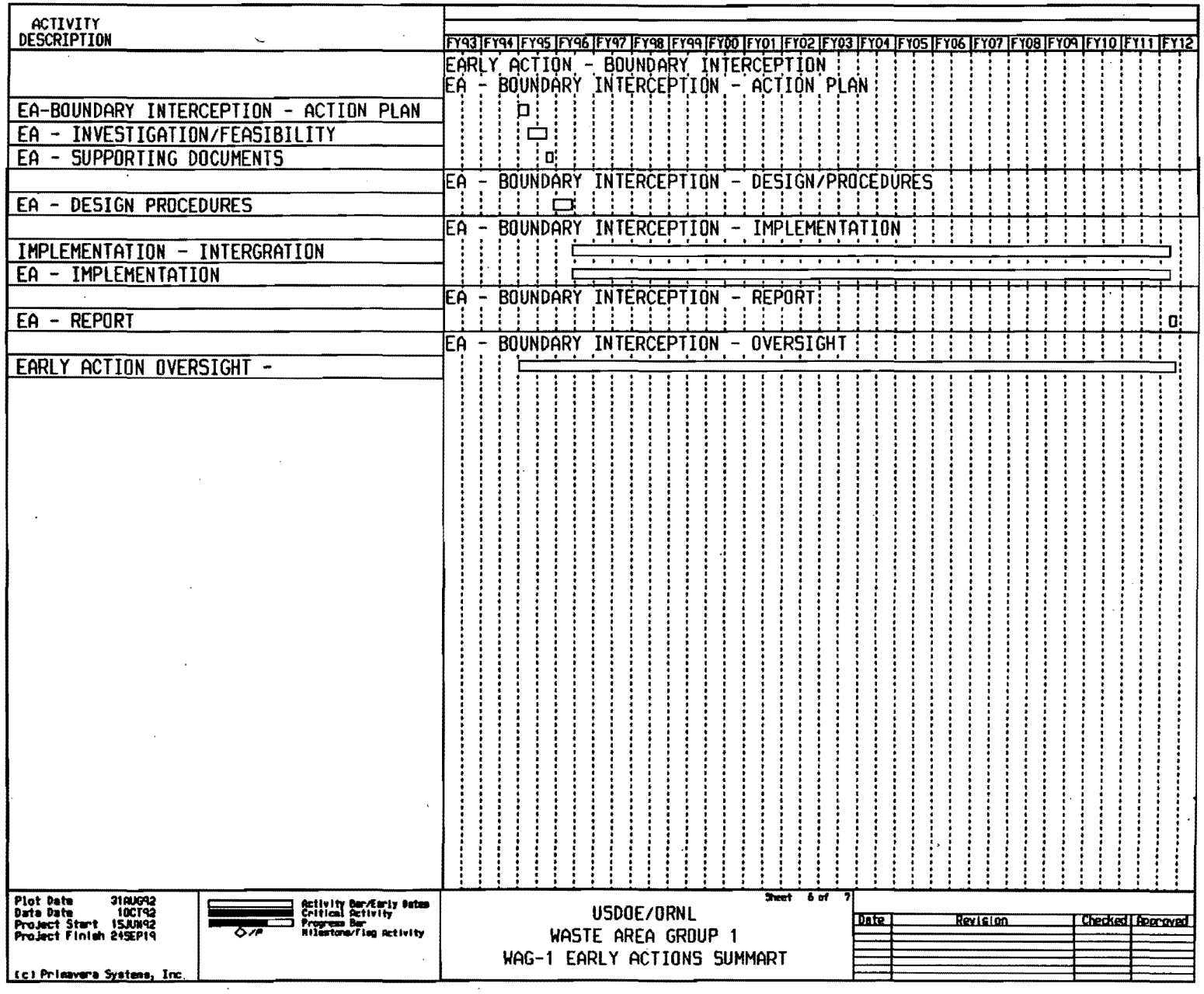


Fig. 11.2. Boundary Interception Early Action Summary Level Schedule.

TABLE 11.1
WAG 1 Early Action 06 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)																		
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	TOTAL
Action Plan	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	22
Invest./Feasibility/Require	98	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	98
Support Documentation	33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33
Design/Procedure	251	1,386	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,637
Implementation Integration	0	41	143	283	451	648	856	1,083	1,305	1,496	1,592	1,547	1,380	1,133	815	390	112	15	13,291
Report	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	45
Early Action Oversight	0	0	1	1	2	3	3	4	4	5	5	5	4	3	3	1	0	0	45
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTALS	404	1,428	144	284	453	650	859	1,087	1,310	1,501	1,597	1,552	1,384	1,137	817	392	112	60	15,172

will be identified at this time.

As part of the planning process, data needs for feasibility studies should be identified early so that environmental sampling and data analysis can be expedited.

11.2.2 Investigation/Feasibility/Requirements (6.1.01.26.01.02)

As a first step in the investigation process, a contingency plan will be developed that will recommend actions to be taken prior to remediation. The next step will involve the preparation of a CDR, as appropriate, to support engineering design. Existing data may be used in these studies, or additional data may be collected. The CDR will consolidate the investigation effort into a concise report that will detail the costs, schedule, technical scope, and justification for the Early Action.

11.2.3 Support Documentation (6.1.01.26.01.03)

Applicable documentation prepared to support Title I and II design includes the following as appropriate: Engineering Studies, Contingency Plans, System Requirement Documents, and CDRs. Documentation will be of sufficient detail to facilitate Title I and II engineering and will include cost and schedule information as well as technical and regulatory information necessary to start detailed engineering.

11.3 DESIGN/PROCEDURES

11.3.1 Design/Procedures (6.1.01.26.02.01)

Based on the existing information available, the A-E Contractor will prepare a preliminary design and develop a framework for definitive design including site layout, preliminary details of construction work, and outline specifications for the work involved in construction of the groundwater collection system and the French drain adjacent to White Oak Creek. The A-E will also prepare a design document at the 30% design stage that includes the presentation of preliminary construction drawings and an outline of applicable specifications, preliminary calculations, a preliminary schedule, and a preliminary construction cost estimate. Design criteria, as well as functional and systems requirements, are to be completed prior to the start of Title I engineering.

In addition, the A-E Contractor will develop the Title II concept including MMES and DOE comments into a Final Design Report. The Title II design package will be submitted at the 60% completion stage for review by MMES and DOE. After incorporation of comments, 90% documents will be issued containing engineering designs, drawings, specifications, test plans, and construction cost estimates in complete form for MMES and DOE final review. Upon comment resolution, Final Design Reports will be issued CFC.

11.4 IMPLEMENTATION

11.4.1 Integration (6.1.01.26.03.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E construction support as required.

Integration of construction activities to support this Early Action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

11.4.2 Implementation (6.1.01.26.03.02)

Collection System at Outfalls 341 and 342

Storm Drain Outfalls 341 and 342 are located west of First Street and south of the intersection with Central Avenue. Testing at these outfalls was conducted in an effort to determine whether or not contaminants identified at Core Hole Eight were entering First Creek. Test results indicated elevated activities of gross beta at these outfalls. The Early Action currently identified is construction of a collection system to intercept contaminated groundwater at outfalls 341 and 342 prior to entry into First Creek.

The collection system will be constructed parallel to First Creek on the west side of First Street. It will extend from the intersection of First Street and Central Avenue south to outfall 342. At each outfall, a diversion box will be constructed. The function of these structures will be to collect low flows issuing from the pipes, while allowing storm flows to pass into First Creek. It is assumed that storm flows will not be collected because contaminant concentrations will not be significant in surface runoff. Rather, only low flows issuing from storm pipes will be collected because they represent contaminated groundwater infiltration. Where existing utility lines cross the proposed system, French drains will be installed and a soil/bentonite mixture will be used as backfill on the downgradient side of the drain to prevent further migration of contaminants along the pipe trenches. The French drains will also be connected to the collection system.

The French drain proposed for collection of groundwater from the Core Hole Eight plume will be connected to the collection system as well. Chapter 10.0 discusses the French drain proposed to intercept contaminants from the Core Hole Eight plume. Groundwater collected from both the

French drain and outfalls 341 and 342 will be pumped to the PWTP for treatment. Collection and treatment of contaminated groundwater will continue until the completion of the Boundary Interception RA. Where possible, the force main to the PWTP will be constructed above ground to minimize excavation.

The work included in the cost estimate includes excavation, trench shoring, demolition and replacement of pavement, diversion boxes, piping, pump and electrical controls, erosion control, revegetation, and PPE. It is assumed that soil excavated during construction will be contaminated and will require disposal.

French Drain at White Oak Creek

Groundwater contamination has been identified in the vicinity of the surface impoundments and migration is to the south (ORNL grid) into White Oak Creek. The Early Action currently identified is construction of a French drain to collect groundwater prior to its entry into White Oak Creek.

The French drain will be constructed parallel to White Oak Creek on the north side of the creek and south of the Waste Holding Basin 3513. The drain will also serve to collect groundwater flowing toward White Oak Creek in and around existing pipes. Where existing utility lines cross the French drain, a soil/bentonite mixture will be used as backfill on the downgradient side of the drain. This will prevent further migration of contaminants along the pipe trenches. Where storm pipes cross the French drain, a diversion box will be installed on the pipe on the downgradient side of the drain. The function of this structure will be to collect low flow in the pipe associated with groundwater infiltration, while allowing storm flows to pass through.

Groundwater collected from both the French drain and diversion boxes will be pumped to the PWTP for treatment and collected until final RA is achieved for the Boundary Interception RA. Where possible, the force main to the PWTP will be constructed above ground to minimize excavation.

The work included in the cost assessment includes excavation to the bedrock, trench shoring, demolition and replacement of pavement, French drain construction, diversion boxes, piping, pump and electrical controls, erosion control, revegetation, and PPE. It is assumed that soil excavated during construction will be contaminated and will require disposal. Additional assumptions include the following:

- It is assumed that the PWTP will have the capacity to treat the contaminated groundwater collected.

- It is assumed that all excavated soil will be contaminated. Therefore, the soil will be placed in B-25 boxes and sent to the proposed WAG 1 consolidation area for storage/disposal.

- It is assumed that any pavement or concrete sidewalk will be replaced since the final disposition of the site is unknown.

11.5 EARLY ACTION REPORT

11.5.1 Early Action Report (6.1.01.26.04.01)

A report will be prepared that will document the activities for this Early Action. The effectiveness of interception of groundwater contaminants will be monitored and reported on a regular basis. The report will also provide a summary of construction inspection activities.

11.6 EARLY ACTION OVERSIGHT

11.6.1 Early Action Oversight (6.1.01.26.05.01)

Oversight will be provided throughout the planning, design, and construction phases of the Early Action. Reviews will be provided by MMES and DOE, as appropriates to provide assurance that the Early Action achieves compliance with regulatory requirements and administrative policies. Construction will be monitored by MMES, as well as by the A-E Contractor.

11.7 RISKS AND UNCERTAINTIES

- Pipes and trenches are the easiest path for contaminant migration. This assumption is the justification for collection of groundwater migration through and around pipes.

- Storm flows will not be collected since it is assumed that contaminant concentrations will not be significant in surface runoff. Rather, only low flows issuing from storm pipes will be collected. Should it become necessary to collect storm flows, adequate storage capacity must be planned.

- If funding is not available for implementation of this Early Action, the overall schedule may not be maintained.

11.8 INTERFACES

During Early Action activities, interfaces and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management — To provide waste management overview and support throughout the process by focusing on the minimization of generated wastes and providing the capability to process these wastes.

- MMES Technical Advisory Group — To provide technical overview support during the RA process, specifically for monitoring and field change requests.

- Groundwater WAG Team.

- ORNL Groundwater Program.

- MMES ES&H — To provide input and overview for the ES&H aspects.

- MMES Construction Support.

- MMES Title III Services.

- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

12.0 WAG 1 EARLY ACTION WHITE OAK CREEK INTERIM ACTION

This chapter presents the scope and assumptions for the planning, design, implementation, and reporting of the Early Action associated with White Oak Creek. The scope of the Early Action is removal and storage of mercury-contaminated soils and stabilization of radiologically contaminated soils with cement grout.

The WBS developed for this Early Action is presented in Fig. 12.1. The summary level schedule for the Early Action is shown in Fig. 12.2. The cost assessment of $5,995,000 for this Early Action is presented by WBS activity and FY in Table 12.1.

12.1 SCOPE AND ASSUMPTIONS

The White Oak Creek Early Action includes the following principal WBS elements:

- Planning — Action Plan, Investigation/Feasibility/Requirements, and Support Documentation.
- Design/Procedures — Title I and Title II design for soil and sediment stabiliation.
- Implementation — Integration and Implementation of Early Action.
- Report — Documentation of Early Action.
- Early Action Oversight.

Detailed descriptions of the scope of each activity and specific WBS elements, along with the assumptions used for the development of the cost assessments, are presented below.

12.2 PLANNING

12.2.1 **Action Plan** (6.1.01.27.01.01)

An Action Plan will be written to provide an overall technical strategy and management approach for performing the Early Action. The action plan will define the scope and objectives for Early Action activities; provide a mechanism for planning; and address the proposed technical and regulatory approach, timing for implementation, schedules, and key decision points. The plan will also identify the types of documentation required for each step of the engineering design process. The need for documents such as Engineering Studies, System Requirement Documents, and CDRs will be identified at this time.

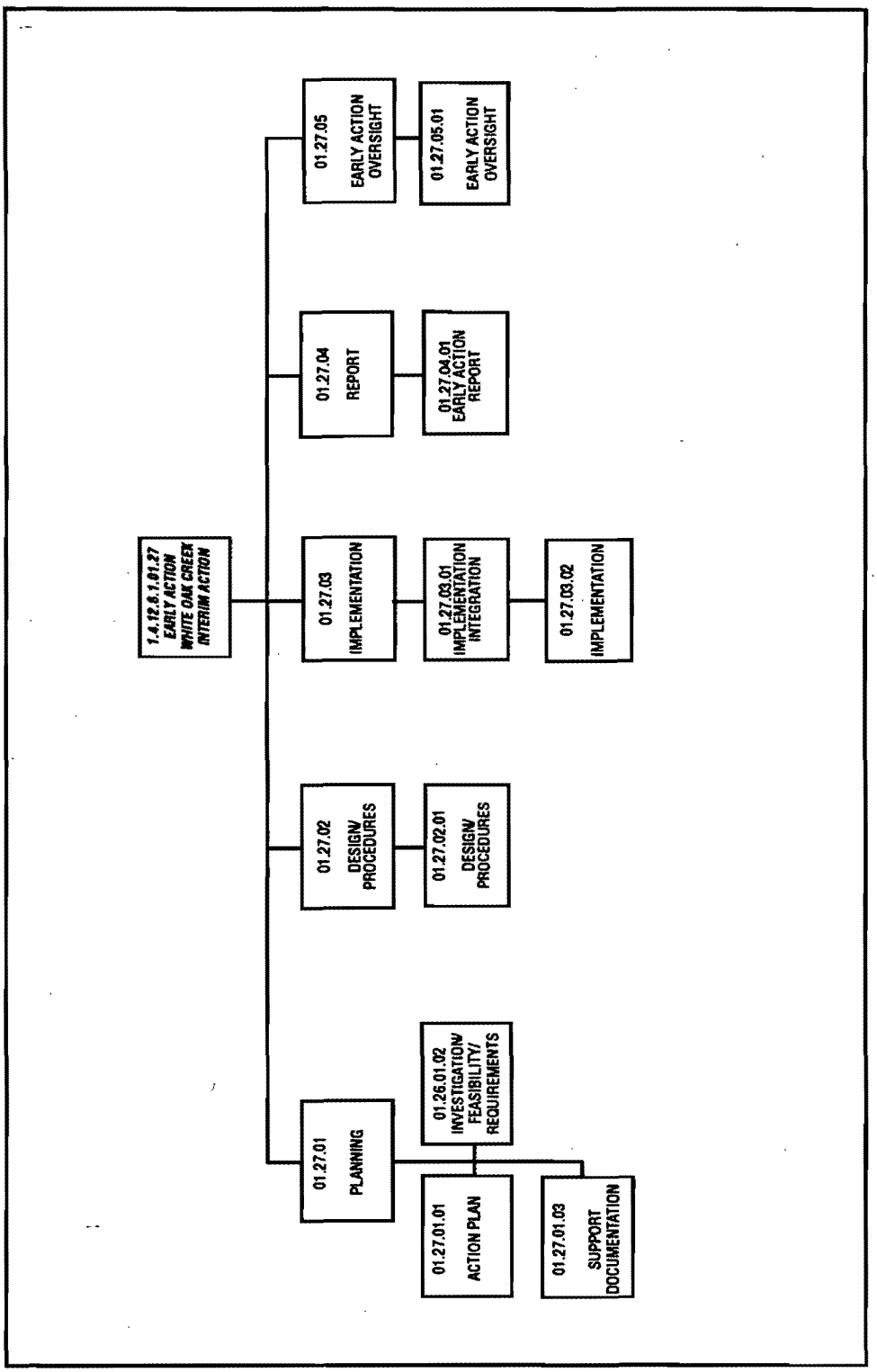


Fig 12.1. White Oak Creek Early Action Work Breakdown Structure.

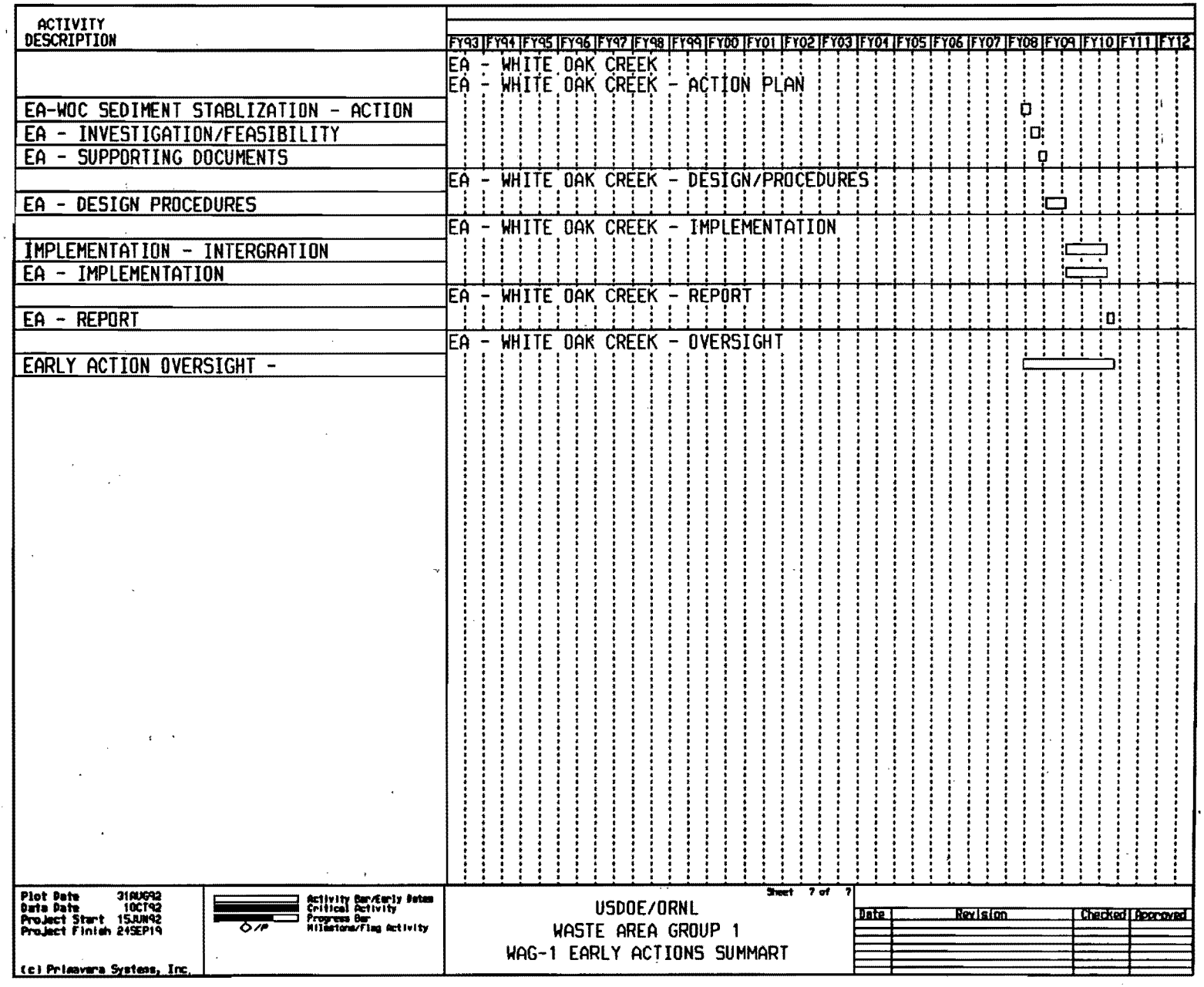


Fig 12.2. White Oak Creek Early Action Summary Level Schedule.

TABLE 12.1
WAG 1 Early Action 07 Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)			
	2008	2009	2010	TOTAL
Action Plan	45	0	0	45
Invest./Feasibility/Require	198	0	0	198
Support Documentation	25	40	0	65
Design/Procedure	0	584	0	584
Integration	0	171	561	732
Implementation	0	988	3,243	4,230
Report	0	0	58	58
Early Action Oversight	8	46	29	83
	0	0	0	0
	0	0	0	0
	0	0	0	0
	0	0	0	0
TOTALS	276	1,827	3,891	5,995

As part of the planning process, data needs for feasibility studies should be identified early, so that environmental sampling and data analysis can be expedited.

12.2.2 Investigation/Feasibility/Requirements (6.1.01.27.01.02)

Studies will be conducted to support preparation of a CDR, as appropriate, as part of the engineering design. Existing data may be used in these studies, or additional data may be collected. The CDR will consolidate the investigation effort into a concise report that will detail the costs, schedule, technical scope, and justification for the Early Action.

It is assumed that the RI/FS has generated sufficient data so that the sources of contamination are well defined with respect to chemical and radiological specification, as well as areal extent. It is also assumed that sufficient data from treatability studies exist to develop the engineering design to conduct this Early Action.

12.2.3 Support Documentation (6.1.01.27.01.03)

Applicable documentation prepared to support Title I and II design includes the following as appropriate: Engineering Studies, Contingency Plans, System Requirement Documents, and CDRs. Documentation will be of sufficient detail to facilitate Title I and II engineering and will include cost and schedule information as well as technical and regulatory information necessary to start detailed engineering.

12.3 DESIGN/PROCEDURES

12.3.1 Design/Procedures (6.1.01.27.02.01)

Based on the existing information available, the A-E Contractor will prepare a preliminary design and develop a framework for definitive design including site layout, preliminary details of construction work, and outline specifications for the work involved in remediation of contaminated soils and sediments in the White Oak Creek flood plain. The A-E will also prepare a design document at the 30% design stage that includes the presentation of preliminary construction drawings and an outline of applicable specifications, preliminary calculations, a preliminary schedule, and a preliminary construction cost estimate. Design criteria, as well as functional and systems requirements, are to be completed prior to the start of Title I engineering.

In addition, the A-E will develop the Title II concept including MMES and DOE comments into a Final Design Report. The Title II design package will be submitted at the 60% completion stage for review by MMES and DOE. After incorporation of comments, 90% documents will be issued containing engineering designs, drawings, specifications, test plans, and construction cost estimates in complete form for MMES and DOE final review. Upon comment resolution, Final Design Reports will be issued CFC.

12.4 IMPLEMENTATION

12.4.1 Integration (6.1.01.27.03.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E construction support as required. Integration of construction activities to support this Early Action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

12.4.2 Implementation (6.1.01.27.03.02)

The proposed Early Action for White Oak Creek and the associated flood plain soils is in situ stabilization of radiologically contaminated "hot spots" as identified on the USRADS survey and removal of mercury-contaminated soils. The radiologically contaminated "hot spots" assumed to require treatment were identified based on significant source terms that may pose a public health risk or risk to the environment. The mercury-contaminated soils will be placed in B-25 boxes and stored on-site until the mercury roaster is available at Y-12. The portion of co-contaminated mercury soils has been estimated and included. The co-contaminated soils will undergo assay to determine the radiological constituents and then be stored on-site until the uranium extraction and thermal adsorption processes are implemented.

Stabilization of the contaminated soils could be achieved by placing an estimated 10% grout mixture with the soils to the bedrock. Cofferdams will be constructed to prevent water flow within White Oak Creek from interfering with stabilization. Theoretically, the in situ stabilization would reduce risks of occupational exposure due to workers implementing the remedial action since the contaminants would not require exhumation. In situ treatment of soils will enhance immobilization of contaminants and, therefore, will decrease the potential for hydrologic transport of radiologically contaminated soils.

For this estimate, based on the USRADS survey, areas with greater than 50 microrem/h were assumed to be stabilized to a full depth to bedrock. Soil log profiles were utilized to approximate the depth to bedrock for volume calculations. Topography, soil type, depth to bedrock, and concentrations were taken into consideration to estimate the possible transport extent of the contaminants.

The following are included in the cost estimate: excavation of mercury-contaminated soils, backfill, dewatering during excavation and temporary stream diversion, trench shoring, erosion control, revegetation, and PPE. The radiologically contaminated in situ stabilization work in the cost estimate includes stabilization of contaminated soils and temporary stream diversion, in addition to the cost identified above.

In addition, it is assumed that all excavated soil will be contaminated. Therefore, the soil will be placed in B-25 boxes and sent to the proposed WAG 1 consolidation area for storage/disposal.

12.5 EARLY ACTION REPORT

12.5.1 **Early Action Report** (6.1.01.27.04.01)

A report will be prepared that will document the activities for this Early Action. The effectiveness of soil and sediment remediation will be monitored and reported. The report will also provide a summary of construction inspection activities.

12.6 EARLY ACTION OVERSIGHT

12.6.1 **Early Action Oversight** (6.1.01.27.05.01)

Oversight will be provided throughout the planning, design, and construction phases of the Early Action. Reviews will be provided by MMES and DOE, as appropriate, to provide assurance that the Early Action achieves compliance with regulatory requirements and administrative policies. Construction will be monitored by MMES, as well as the A-E Contractor.

12.7 RISKS AND UNCERTAINTIES

- In situ stabilization of the contaminated soil may not be homogeneous throughout the entire profile, resulting in hydrologic pathways which could provide a means for radiological transport.

- Remedial action levels for in situ stabilization may need to be reexamined to determine risk levels of possible off-site migration of radiological constituents in order to protect human health and the environment.

- If funding is not available for implementation of this Early Action, the schedule may not be maintained.

12.8 INTERFACES

During Early Action activities, interfaces and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview and support throughout the process by focusing on the minimization of generated wastes and providing the capability to process these wastes.
- MMES ES&H — To provide input and overview for the ES&H aspects.
- MMES Construction Support.
- MMES Title III Services.
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

13.0 WAG 1 PHASE I REMEDIAL INVESTIGATION

13.1 SCOPE AND ASSUMPTIONS

This chapter presents the scope for the completion of Phase I RI activities. The primary activity required is to revise and issue the Phase I SCSR, the Preliminary Risk Assessment Report, and an OU Strategy Document. The risks and uncertainties and interfaces for the remedial investigation are identified as well.

The WBS developed for performing the RI is presented in Fig. 13.1. The summary level schedule for these RI WBS elements is shown in Fig. 13.2. The cost assessment of $54,000 for performing this portion of the remediation activities summarized by WBS activity and FY is shown in Table 13.1. These estimates were prepared using TCFs, which permit the correlation of the scope of the remaining Phase I RI efforts to the scope of the RI efforts for a reference WAG (WAG 5). A discussion to the development of this methodology is included in Appendix F.

Since documents prepared for the Phase I RI have evolved throughout the Phase I RI effort, it is assumed that only minimal effort is required for revision. It is also assumed that the documents will not be subject to "dispute resolution."

13.2 PHASE I REMEDIAL INVESTIGATION REPORT

No additional work is anticipated for this WBS element.

13.2.1 **Nonintrusive Surveys** (6.1.01.40.02.01)

No additional work is anticipated for this WBS element.

13.2.2 **Groundwater Investigation** (6.1.01.40.02.02)

No additional work is anticipated for this WBS element.

13.2.3 **Surface Water and Sediment Investigations** (6.1.01.40.02.03)

No additional work is anticipated for this WBS element.

13.2.4 **Soils Investigation** (6.1.01.40.02.04)

No additional work is anticipated for this WBS element.

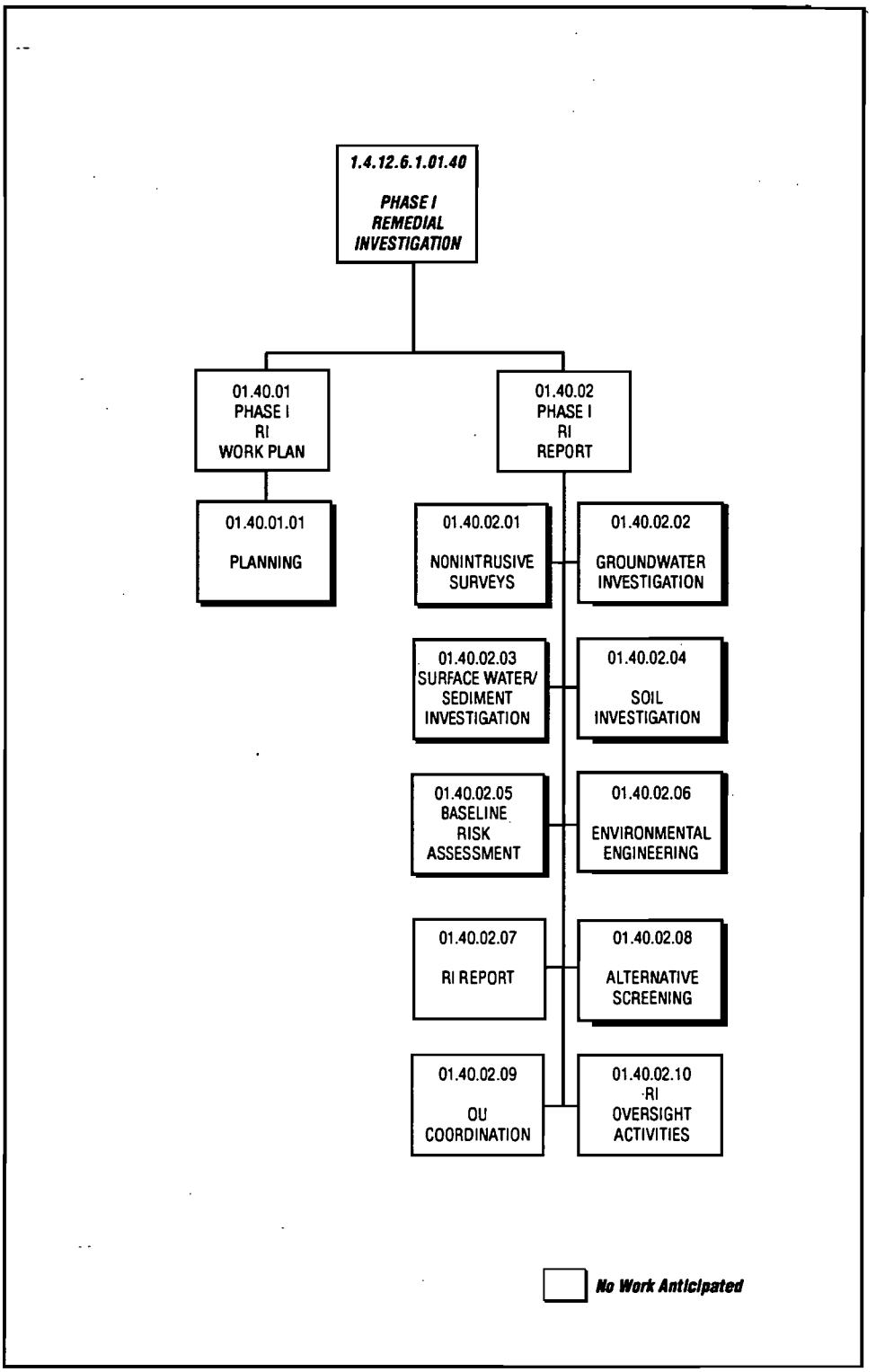


Fig. 13.1. Phase I Remedial Investigation Work Breakdown Structure.

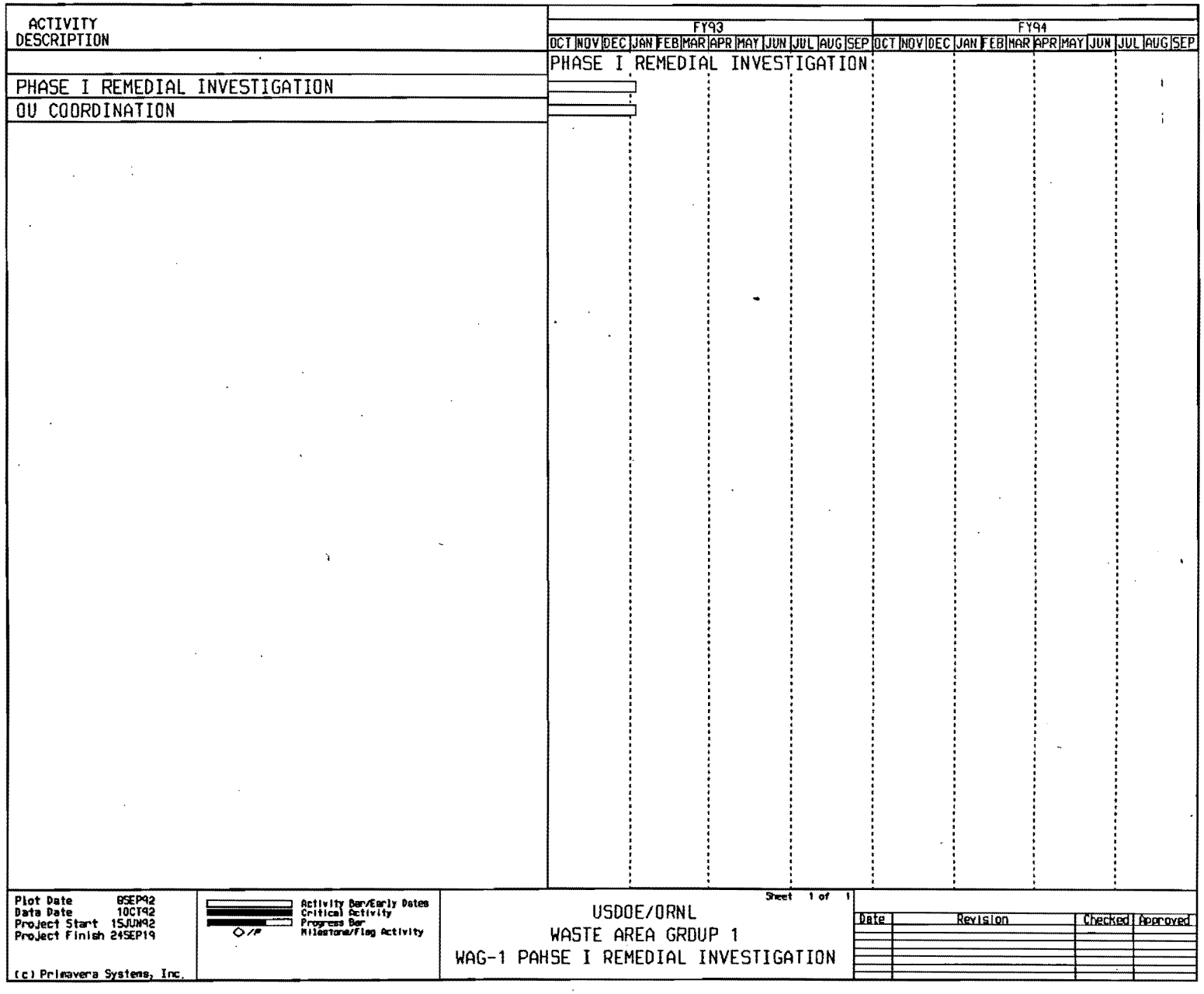


Fig. 13.2. Phase I Remedial Investigation Summary Level Schedule.

TABLE 13.1
WAG 1 Phase I Remedial Investigation Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)					
	1992	1993	1994	1995	1996	TOTAL
Planning	0	0	0	0	0	0
Nonintrusive Surveys	0	0	0	0	0	0
GW Investigation	0	0	0	0	0	0
SW/SED Investigation	0	0	0	0	0	0
Soil Investigation	0	0	0	0	0	0
Baseline Risk Assess.	0	0	0	0	0	0
Environ. Engineering	0	0	0	0	0	0
RI Report	0	54	0	0	0	54
Alternative Screening	0	0	0	0	0	0
RI OU Coordination	0	0	0	0	0	0
RI Oversight Activities	0	0	0	0	0	0
TOTALS	0	54	0	0	0	54

13.2.5 **Baseline Risk Assessment** (6.1.01.40.02.05)

No additional work is anticipated for this WBS element.

13.2.6 **Environmental Engineering** (6.1.01.40.02.06)

No additional work is anticipated for this WBS element.

13.2.7 **Remedial Investigation Report** (6.1.01.40.02.07)

Before October 1992, three reports were issued to the regulators for review and comment. The reports included the draft SCSR, the draft preliminary RA Report, and an OU Strategy Document. The SCSR consolidated available, appropriate, and applicable data on WAG 1 and summarized technical work completed to date on the project. Following receipt of comments on the draft report, the comments will be resolved, responded to, and incorporated as appropriate into the report. The report will be reissued in final form as an FFA secondary milestone document.

The preliminary RA Report (1) included identification of contaminants of concern, toxicity assessment, exposure assessment, and risk characterization and (2) provided documentation on the excess risk attributed to WAG 1 as a whole. Also included were risk index calculations using a modification of the EPA Hazardous Ranking System and an ecological risk assessment addressing risks to endangered and threatened species and sensitive environments. Following receipt of comments on the draft report, the comments will be resolved, responded to, and incorporated appropriately into the report. The report will be reissued in final form as an FFA secondary milestone document.

The OU Strategy Document included the identification and preliminary ranking of WAG 1 OUs based on existing site characterization data. Following receipt of comments on the draft report, the comments will be resolved, responded to, and incorporated appropriately into the report. The report will be reissued in final form as an FFA secondary milestone document.

13.2.8 **Alternatives Screening** (6.1.01.40.02.08)

No additional work is anticipated for this WBS element.

13.2.9 **Operable Unit Coordination** (6.1.01.40.02.09)

Activities include quality and project management and coordination. These activities will ensure that quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple WAGs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided, including general report programming, database management, and database interface with MMES. QA/QC will be performed using the home office staff necessary to perform and manage QA/QC activities.

13.2.10 Remedial Investigation Oversight Activities (6.1.01.40.02.10)

The purpose of this activity is to provide technical support, input, and oversight to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon final approval of the associated technical memoranda.

The following briefly describes the oversight roles of the various participants:

- FS Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the FS/EA.
- A-E Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the RD approach and design requirements.
- MMES Field Maintenance — Provides support for health and safety, environmental compliance, and waste management as a part conducting the RI field activities.
- MMES Environmental Sciences Division — Provides support for drilling.
- MMES Planning/Coordination — Provide necessary permits for RI field activities.
- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

13.3 RISKS AND UNCERTAINTIES

The risks and uncertainties associated with the performance of the RI are that extensive comments on these three Phase I documents by the regulators would result in increased costs and could impact Phase II activities regarding the proposed OUs.

13.4 INTERFACES

The following describes the primary interfaces and anticipated roles during the RI:

- MMES Waste Management — To provide waste management overview and support throughout the RI process by focusing on the minimization of RI-generated wastes and providing the capability to process these wastes.

- MMES Technical Advisory Group — To provide technical overview support during the RI process, specifically for overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that RI goals are achieved.

- FS Contractor — To provide data review support to the RI relative to its sufficiency to support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approve all primary documents.

- TDEC — To provide regulatory overview for the state of Tennessee during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

14.0 WAG 1 NORTH AND SOUTH TANK FARMS AND TANKS TH-4 AND W-11 OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the Tank Farm OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for the Tank Farm OU is presented in Fig. 14.1. The summary level schedule is shown in Fig. 14.2. Table 14.1 shows a cost assessment of $44,306,000 for OU 1 by remediation phase and FY.

The estimates for the RI/FS were prepared using the Technical Complexity Factors (TCFs) which permit the correlation of the scope of the RI efforts for the Tank Farm OUs to the scope of RI/FS efforts for reference WAG (WAG 5). RA discussion of the development of this methodology is included in Appendix F.

14.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare a Phase II RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives for tanks located in the North and South Tank Farms, as well as Tanks TH-4 and W-11. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the Phase II RI is presented in Fig. 14.3. The summary level schedule for these RI WBS elements is shown in Fig. 14.4. Table 14.2 shows the cost assessment of $836,000 for RI performance by WBS activities and FY.

14.1.1 Scope and Assumptions

The primary assumption for the RI effort for OU1 is that in the implementation of the observational approach, additional RI data will be required to support the development of the Feasibility Study. This RI effort will focus on collecting additional piezometer data to evaluate the potential of groundwater inleakage to the North and South Tank Farms and Tanks TH-4 and W-11.

The schedule for implementation of this focused RI process is based on the assumption that there will be no primary documentation prepared as part of this effort. The Supplemental Sampling and Analysis Plan will undergo a concurrent MMES and DOE review and will be submitted to the regulators for information only.

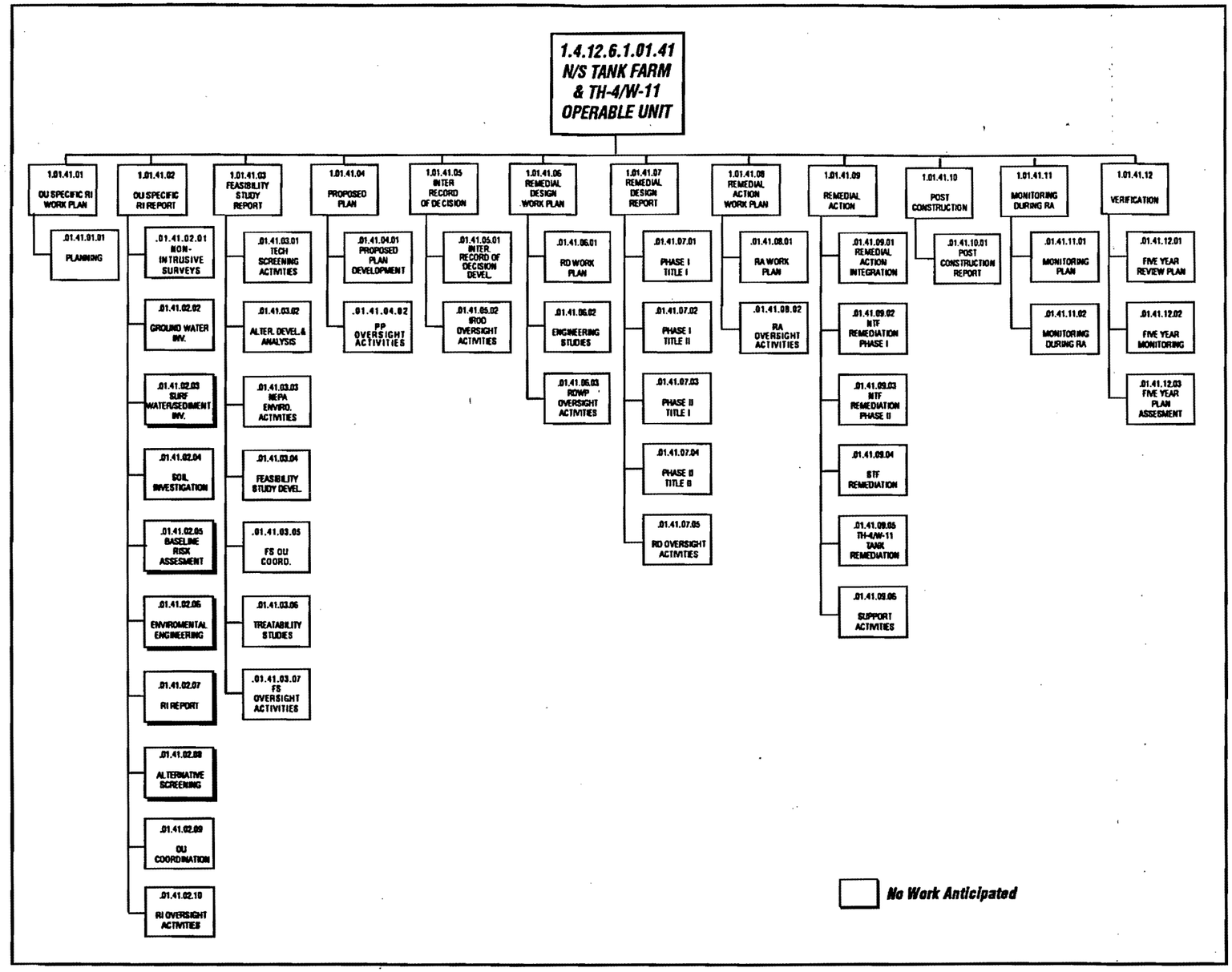


Fig. 14.1. Tank Farm OU Work Breakdown Structure.

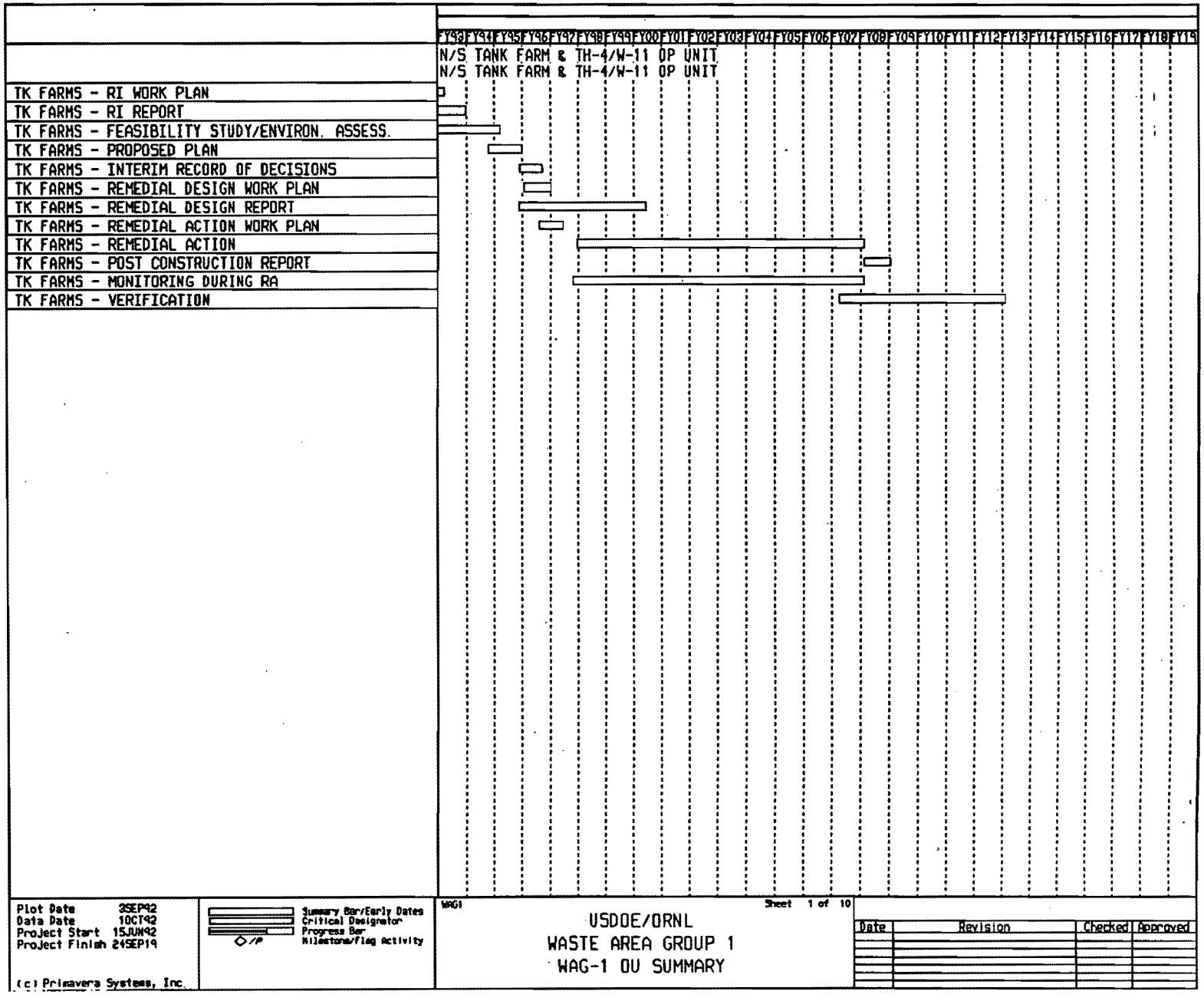


Fig. 14.2. Tank Farm OU Summary Level Schedule.

TABLE 14.1
WAG 1 Oper. Unit 01 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																					
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
Remedial Investigation	836	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	836
Feasibility Study/IROD	2,322	1,188	414	113	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,036
Remedial Design	0	0	484	3,246	664	2,034	2,040	379	0	0	0	0	0	0	0	0	0	0	0	0	0	8,847
Remedial Action	0	0	0	243	511	2,179	424	522	792	2,572	6,838	3,676	4,862	4,213	1,674	221	312	564	539	270	176	30,587
TOTALS	3,157	1,188	897	3,602	1,174	4,213	2,463	902	792	2,572	6,838	3,676	4,862	4,213	1,674	221	312	564	539	270	176	44,306

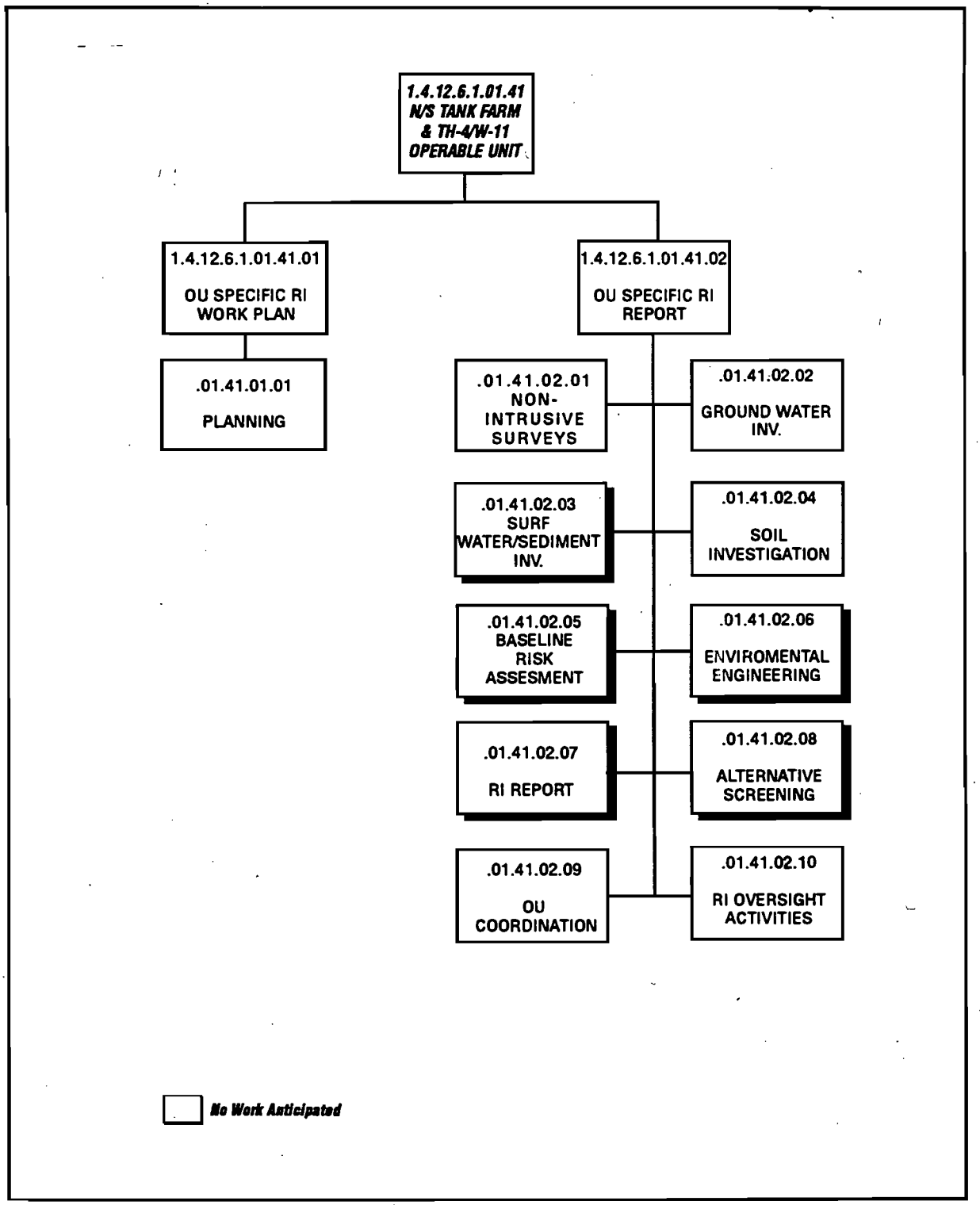


Fig. 14.3. Tank Farm OU RI Work Breakdown Structure.

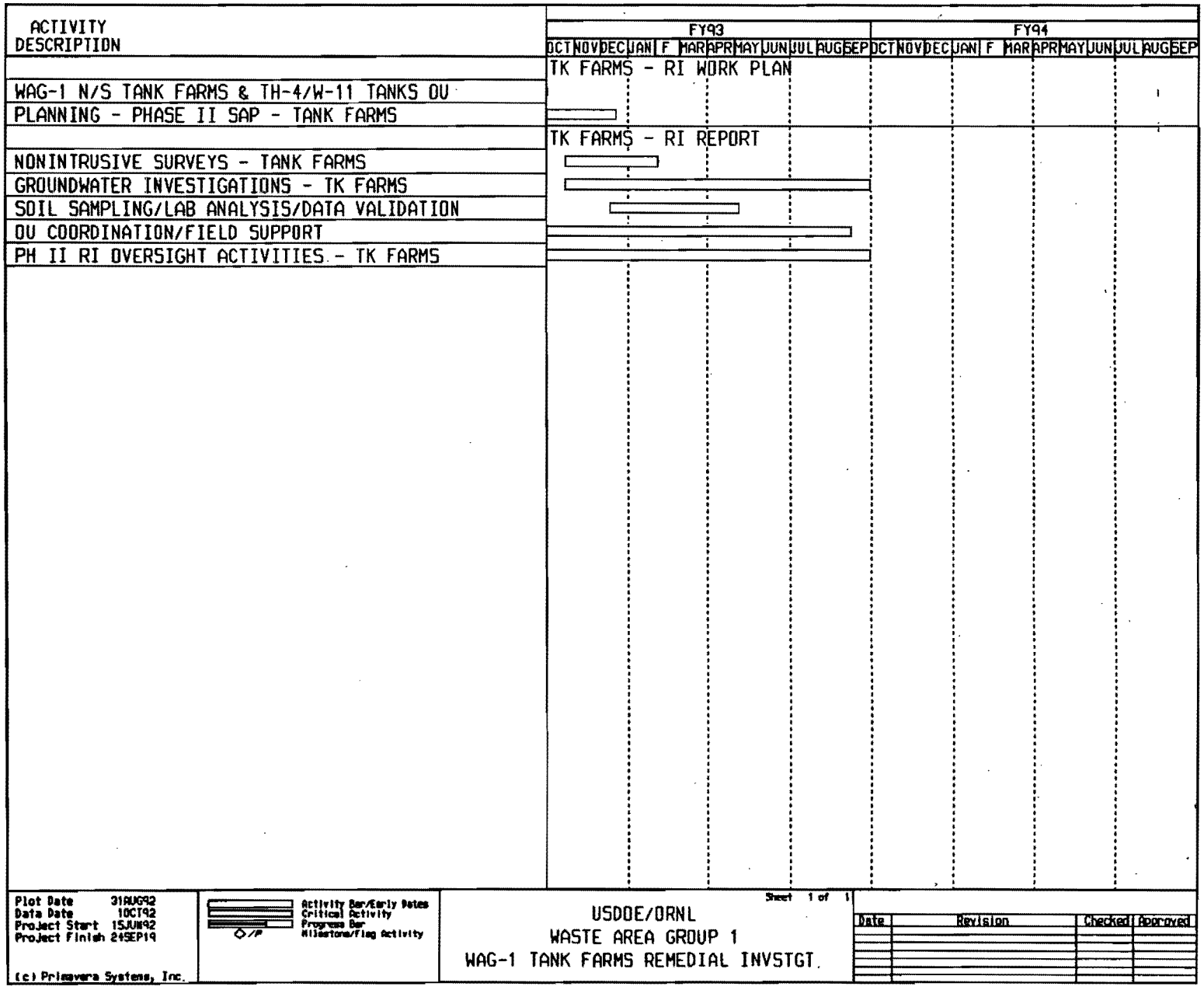


Fig. 14.4. Tank Farm OU RI Summary Level Schedule.

TABLE 14.2
WAG 1 Oper. Unit 01 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	1992	1993	1994	1995	TOTAL
Planning	0	25	0	0	25
Nonintrusive Surveys	0	2	0	0	2
GW Investigation	0	58	0	0	58
SW/SED Investigation	0	0	0	0	0
Soil Investigation	0	144	0	0	144
Baseline Risk Assess.	0	0	0	0	0
Environ. Engineering	0	0	0	0	0
RI Report	0	0	0	0	0
Alternative Screening	0	0	0	0	0
RI OU Coordination	0	233	0	0	233
RI Oversight Activities	0	373	0	0	373
TOTALS	0	836	0	0	836

14.1.2 Operable Unit Specific Remedial Investigation Work Plan

14.1.2.1 **Planning** (6.1.01.41.01.01)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI for the Tank Farm OU. The RI Work Plan defines the scope and objectives for the RI activities and provides a mechanism for planning the investigation activities. These activities may be accomplished concurrently or in a phased approach. A Project Management Strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes a summary and interpretation, as appropriate, of available environmental information. The plan addresses the applicable or relevant and appropriate requirements (ARARs), to-be-considered (TBC) guidance, and establishment of Data Quality Objectives (DQOs). It also provides specific rationale for all field and analytical work. The RI Work Plan addresses the proposed specific technical approach, timing for implementation, schedules, and decision points where appropriate. The RI Work Plan (BNI, 1988) was prepared according to provisions of applicable EPA and/or state guidance documents.

In addition, a revised Field Sampling Plan (BNI, 1991a) and a revised Quality Assurance (QA) Project Plan (BNI, 1991b) were issued to regulators in December 1991. Other WAG-specific plans and procedures were also developed including project management; environmental, safety and health (ES&H) management; waste management; and database management. Since all these planning activities occurred before October 1992, no cost or schedule information is included for this element in the WAG 1 Baseline Report.

14.1.3 Operable Unit Specific Remedial Investigation Report

14.1.3.1 **Nonintrusive Surveys** (1.01.41.02.01)

Civil surveys will be conducted to provide 3-D control for sampling and measurement activities. Civil surveying will be performed as needed to support investigation activities including as-built surveys, construction surveys, and topographic surveys. It will also help establish monitoring well locations.

Coordination with the ORNL Well Plugging and Abandonment (P&A) Program will be provided.

14.1.3.2 **Groundwater Investigation** (1.01.41.02.02)

ORNL has conducted preliminary investigations of groundwater flow and quality that indicate that the flow regime is complex. An investigation of the Tank Farm area hydrogeology will be conducted to further define groundwater flow with the following objectives: determination of the groundwater elevations within the tank farm area and evaluation of the potential of tank inleakage.

Groundwater levels will be measured in existing wells, and a total of ten piezometers will be installed to supplement the existing wells contributing engineering data to the RI activities. The water levels will be monitored using electronic, continuous monitoring devices. Preparation of well permits is included in the groundwater investigation scope.

The groundwater investigation will occur during the FS process; specifically, the investigation will begin after definition of remedial action (RA) objectives and technology screening. The results of the investigations will be used in the evaluation of alternatives.

14.1.3.3 Surface Water and Sediment Investigation (1.01.41.02.03)

No additional work is anticipated for this WBS element.

14.1.3.4 Soils Investigation (1.01.41.02.04)

Soil samples obtained from well installation activities (two samples per piezometer) will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of the Target Compound List/Target Analyte List (TCL/TAL), radiological constituents, and geotechnical parameters. Samples will be analyzed using EPA methods, where available, and prescribed Quality Control (QC) levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods, as available, will be performed on all samples where data of known quality are required.

14.1.3.5 Baseline Risk Assessment (1.01.41.02.05)

No additional work is anticipated for this WBS element.

14.1.3.6 Environmental Engineering (1.01.41.02.06)

No additional work is anticipated for this WBS element.

14.1.3.7 Remedial Investigation Report (1.01.41.02.07)

No additional work is anticipated for this WBS element.

14.1.3.8 Alternatives Screening (1.01.41.02.08)

No additional work is anticipated for this WBS element.

14.1.3.9 Operable Unit Coordination (1.01.41.02.09)

Activities covered by this WBS element include the Tank Farm OU RI QC and project management and coordination. These activities will ensure that RI quality, cost, and scheduling goals

are achieved. This element does not include those activities that support multiple WAGs tracked through the project support work element. These activities also include project management, project control, and administration support.

Data Management Services will be provided including general report programming, database management, and database interface with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Necessary field support needed to manage and direct the Tank Farm OU field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes provision of required field equipment, spare parts, and other field materials and supplies.

The portion of RI and OU coordination work associated with RI activities mentioned in earlier sections was completed before October 1992. Therefore, the cost assessment included in this WAG 1 Baseline Report reflects only 76.9% of the total cost estimated by the RI Subcontractor for this WBS element.

14.1.3.10 Remedial Investigation Oversight Activities (1.01.41.02.10)

The purpose of this activity is to provide technical support, input, and oversight to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon final approval of the associated technical memoranda.

The oversight roles of the various participants are briefly described below:

- FS Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the FS/EA.
- A-E Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the RD approach and design requirements.
- Field Maintenance — Provides support for health and safety, environmental compliance, and waste management as part of conducting the RI field activities.
- MMES Environmental Sciences — Provides support for drilling.
- MMES Planning/Coordination — Provides necessary permits for RI field activities.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities and provides an independent technical review of FS/EA activities.

14.1.4 Risks and Uncertainties

The regulatory approval of the focused Sampling and Analysis Plan delaying field investigations is an area of risk and uncertainty associated with the performance of the RI.

14.1.5 Interfaces

The primary interfaces and anticipated roles during the RI are described below:

- MMES Waste Management — To provide waste management overview and support throughout the RI process. This entails focusing on the minimization of RI- generated wastes and providing the capability to process these wastes.

- MMES Technical Advisory Group — To provide technical overview support during the RI process regarding the overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that RI goals are achieved.

- FS Contractor — To provide data review support to the RI that would sufficiently support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approval of all primary documents.

- TDEC — To provide regulatory overview for the state of Tennessee during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

14.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents in more detail the efforts necessary to perform the Tank Farm OU FS/PP/IROD process for the three remediation areas defined in Section 2.1.4: North Tank Farm, South Tank Farm, and Tanks TH-4 and W-11. The FS process will include evaluating environmental concerns as an EA within the FS report. To comply with the FFA, the process will also require

preparation of the PP, the IROD and the regulatory decision documents. The associated risks and uncertainties and the interfaces for the FS/PP/IROD effort are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is presented in Fig. 14.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig. 14.6. The cost assessment of $4,036,000 for performing the FS, PP, and IROD process is presented by WBS element and FY in Table 14.3.

14.2.1 Scope and Assumptions

The purpose of FS/PP/IROD activities conducted for the Tank Farm OU is to identify, organize, and examine remedial alternatives; to mitigate the risks identified in the RI Report; to justify selection of a preferred remedial alternative or a set of alternatives; and to prepare the regulatory-required decision documents summarizing the situation and examination process, outlining the selected remediation method(s), and establishing the remediation schedule.

The FS Contractor will be responsible for completing the FS/PP/IROD process. This process will require the preparation of the following FFA milestone documents: (1) the FS Report, which documents the process used to examine the remedial technologies, to select the preferred remedial alternative(s), and to incorporate the environmental (NEPA) considerations in an EA segment that will satisfy administrative requirements; (2) the PP, a summary plan for implementing the selected remedial alternative(s); and (3) the IROD, the legal document that declares that the selected remediation method(s) meets statutory and regulatory requirements and establishes the schedule for remediating the Tank Farm OU. To implement this process and to ensure that remediation is completed according to the process, the FS Contractor will have oversight responsibilities during the RI and RD processes. The Tank Farm FS/PP/IROD process will be accomplished by the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities
- Feasibility Study Development
- Feasibility Study Operable Unit Coordination
- Treatability Studies
- Feasibility Study Oversight Activities
- Proposed Plan Development

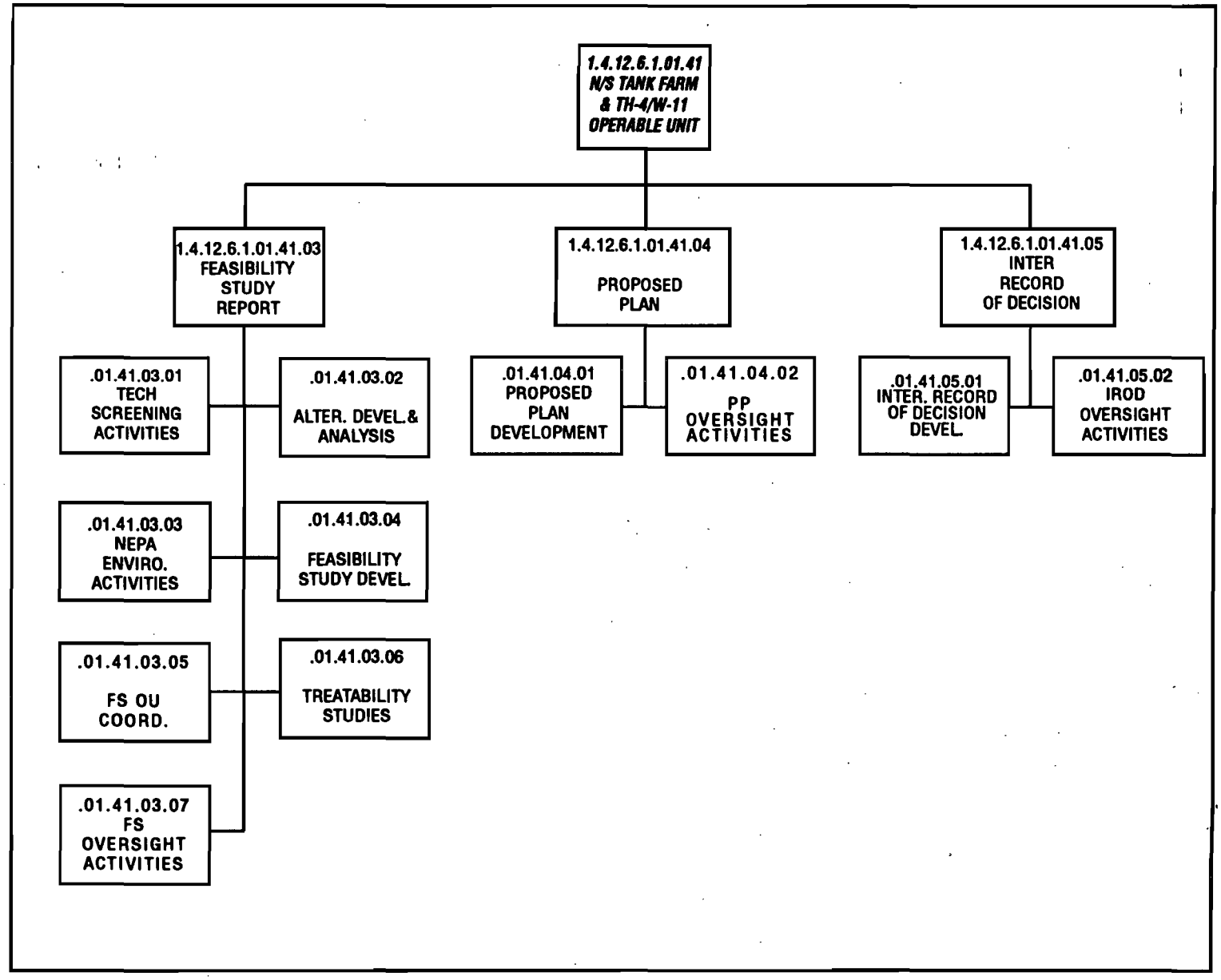


Fig. 14.5. Tank Farm OU FS/PP/IROD Work Breakdown Structure.

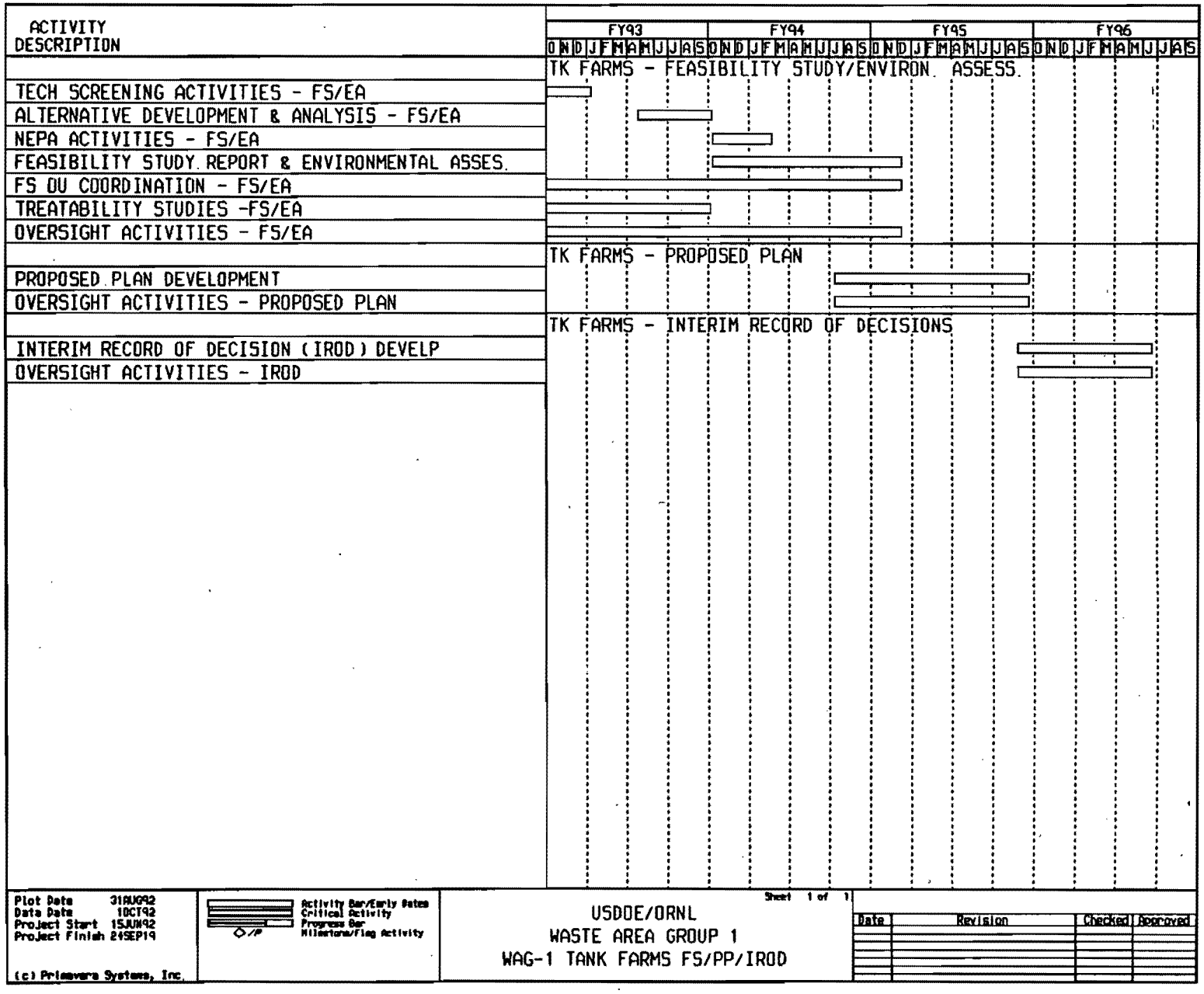


Fig. 14.6. Tank Farm OU FS/PP/IROD Summary Level Schedule.

TABLE 14.3
WAG 1 Oper Unit 01 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	1992	1993	1994	1995	1996	TOTAL
Technology Screening	0	229	0	0	0	229
Alternatives Develop./Analysis	0	93	61	0	0	154
NEPA/Environmental Activities	0	0	72	0	0	72
Feasibility Study Development	0	0	377	212	0	589
FS OU Coordination	0	138	59	2	0	200
Treatability Study	0	1,546	64	0	0	1,610
FS Oversight	0	315	551	15	0	882
SUBTOTALS FS	0	2,322	1,185	230	0	3,737
PP Development	0	0	1	101	0	102
PP Oversight Activities	0	0	1	73	0	74
SUBTOTALS PP	0	0	2	174	0	177
IROD Development	0	0	0	5	62	67
IROD Oversight Activities	0	0	0	4	51	56
SUBTOTALS IROD	0	0	0	10	113	123
TOTALS	0	2,322	1,188	414	113	4,036

- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities.

Detailed descriptions of the scope of each activity and the assumptions used for preparing the cost assessments are presented below.

14.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA Report are presented in the following sections. The FS/EA Report will generally follow the format in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA/540/G-89/004), (1989).

The cost assessments made for the FS WBS elements were based on the following assumptions:

- The RI Report will be completed as scheduled.
- The RI Report results are representative of the actual site and tank conditions and adequately characterize the extent and amount of contamination in Tank Farm OU.
- The FS process will be completed as scheduled.
- Working group meetings will be held as needed with the regulatory agencies to discuss progress. Input and feedback from these meetings can be considered as consistent with the formal agency response.
- The regulatory agencies concur with the working group meetings and the results of the technology screening memo.
- An EA will be completed on the site to evaluate the environmental effects of the RA.
- The Baseline Risk Assessment in the RI Report presents the primary contaminant and exposure pathways of concern and is complete enough to ensure that the results are compatible with the alternatives risk calculation methodology selected for the FS Report.
- All ecological risk assessment sampling activities are completed on schedule and are representative of the actual site conditions.

14.2.2.1 Technology Screening Activities (1.01.41.03.01)

Based on the ER Program remedial objectives, the RI Report findings regarding waste- and site- specific conditions, and a literature search, the FS Contractor will identify applicable remedial technologies from the available common and innovative technologies for initial evaluation. These technologies will be screened to eliminate those judged too difficult to implement based on unproven technologies, judged not able to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Those technologies judged to have a reasonable chance of success for remediating the specific waste or site conditions will be carried forward for more detailed development and analysis. A technical memorandum summarizing the findings of this task will be issued to DOE.

14.2.2.2 Alternatives Development and Analysis (1.01.41.03.02)

The FS Contractor will develop the screened technologies for analysis by arranging them into general RA alternatives. These alternatives will then be evaluated, either individually or as combinations of technologies. The purpose of this evaluation is to eliminate alternatives (1) with costs significantly higher than similar alternatives, (2) that fail to provide adequate protection of public health and safety, and/or (3) that may adversely impact the environment. A list of alternatives that meets the remedial objectives and contributes to the protection of public health, safety, and the environment will be formulated for further study. A technical memorandum summarizing the findings of this task will be issued to DOE for regulatory compliance assessment.

14.2.2.3 NEPA Environmental Activities (1.01.41.03.03)

To comply with DOE policy that NEPA criteria be considered during remedial activities, the remedial alternatives will be evaluated for their impact on the environment. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and to minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

14.2.2.4 Feasibility Study Development (1.01.41.03.04)

The FS Contractor will use the format presented in the CERCLA FS guidance document to develop the FS, with exceptions and modifications for specific wastes and conditions in the Tank Farm OU. The FS development will be based on the information obtained from the RI, the alternatives screening and analysis process, and the EA considerations. Using the list of applicable remedial alternatives, the FS will be developed in sufficient detail to allow the selection of a

preferred alternative(s) that meets the remedial objectives of mitigating release of contaminants. Criteria will be developed to assess the ability of the alternatives to meet the remedial objectives and to comply with administrative and regulatory requirements. The FS is intended to perform a detailed evaluation of the alternatives to provide an informed risk management decision and the legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE and EPA for review. The final FS/EA Report is a milestone document required by the FFA.

14.2.2.5 Feasibility Study Operable Unit Coordination (1.01.41.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to support QC efforts, to provide project management, and to coordinate project activities ensuring that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS oversight participants.

14.2.2.6 Treatability Studies (1.01.41.03.06)

Based on the information available for TRU Waste Characterization, the Fixed-Price Subcontractor will investigate/research the most appropriate method to treat/consolidate TRU sludge in existing inactive tanks. The treatability studies will include literature searches, a treatability study work plan, sampling, testing, and preparation of the report based on the above data. MMES will provide technical input and review/comment the treatability document.

14.2.2.7 Feasibility Study Oversight Activities (1.01.41.03.07)

The objective of FS oversight activities is to provide technical input and oversight during the FS/EA to ensure that the data and information obtained during the RI are incorporated properly into the FS/EA Report and that the report is adequate to prepare a PP and to support the development of an IROD and a subsequent RD. FS oversight activities begin with the technology screening and are completed upon final approval of the FS/EA Report.

The following is a brief description of the responsibilities of each participant involved in FS oversight activities:

- RI Subcontractor — Provides technical oversight to assess whether or not the technologies considered and the remedial alternatives to be developed and evaluated are consistent with the RI report conclusions and determined risks.

- A-E Contractor — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RD approach and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RA approach and can be implemented at ORNL.

- MMES — Provides technical support and review of the FS/EA process. Reviews progress reports and preliminary deliverables to ensure that the FS/EA is processing as scheduled.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities. Provides an independent technical review of the FS/EA Report.

14.2.3 Proposed Plan

14.2.3.1 Proposed Plan Development (1.01.41.04.01)

The Proposed Plan (PP) to remediate the site will be prepared using the preferred remediation alternative(s) to mitigate release of contaminants as selected in the FS/EA Report and using input from the regulatory agencies and the public. The PP documents the investigation process, administrative and regulatory actions, and the actions and schedule necessary to implement the remediation alternative(s) and to monitor performance. The PP is a primary milestone document that is subject to public review and response and to administrative and regulatory reviews. The cost assessment for this element was based on the assumption that the FS process and the regulatory review cycle will be completed as scheduled.

14.2.3.2 Proposed Plan Oversight Activities (1.01.41.04.02)

The purpose of the PP oversight activities is to provide technical input and oversight during the development of the PP and to ensure that it is in compliance with applicable regulations and policies.

During the generation of the PP, the RI Subcontractor, the A-E Contractor, and MMES will assess whether or not the preferred remedial alternative(s) to be proposed is consistent with the RI conclusions, Baseline Risk Assessment, and FS process. Progress reports and preliminary deliverables will be reviewed by the participants mentioned earlier to ensure that the PP is proceeding as scheduled.

14.2.4 Interim Record of Decision

14.2.4.1 Interim Record of Decision Development (1.01.41.05.01)

The final step in the planning process to remediate the Tank Farm OUs will be preparation of the IROD. This is the legal document that formally declares that the preferred remediation method(s) in the PP will mitigate releases and establishes the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a Decision Summary outlining the nature and extent of the contamination and the associated risks at the tank farms, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements; and (3) a Responsiveness Summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency for review. The final Tank Farm IROD is a milestone document required by the FFA.

The cost assessment for this element was based on the assumption that the FS/EA and PP schedules were followed.

14.2.4.2 Interim Record of Decision Oversight Activities (1.01.41.05.02)

During the development of the IROD document, MMES and the A-E Contractor will provide technical input and independent technical review to ensure that the IROD document is prepared in accordance with the FFA and in compliance with CERCLA. The technical review and oversight will also include the assessment of the IROD document's consistency with RI report conclusion, Baseline Risk Assessment, and FS/EA.

14.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the Tank Farm FS/PP/IROD process are the scheduling and the scoping of the activities. Minor changes in scheduling will have significant impacts on the labor and materials/equipment cost of the project. If the schedule is modified resulting in an extended total duration of the project, the total cost will increase significantly. The scope of the project will have a direct impact on labor allocations. If additional IRODs are required, the total costs associated with the project will increase. Other factors that increase the uncertainty of the budgetary assessments in this report include:

- Requirements for additional sampling activities.
- Extended review cycles initiated by the regulators.
- Program funding limitations across the DOE system.

14.2.6 Interfaces

Completion of the Tank Farm FS/PP/IROD process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as ARAR under CERCLA.
- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.
- NEPA — Provides regulations that set the policies and goals for protecting environmental quality and establish the procedures examining the impact that decisions on remediating may have on the environment.
- TDEC — Provides regulatory overview for the state of Tennessee.
- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.
- Interim Waste Management Facility — Serves as the facility that will store LLW in SWSA 5 North after shallow land burial ceases in 1995.
- Public Factions — Require access, review, and response for review of the administrative record and any proposed RAs.

14.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the North and South Tank Farms and Tanks TH-4 and W-11: an RD Work Plan, engineering studies as required, preparation of Title I and Title II design packages, and final design reports for the Phase I Fast Track Remediation Package and the Phase II Remediation Package. The risks and uncertainties and interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 14.7. The summary level schedule for these RD WBS elements is shown in Fig. 14.8. The cost assessment of $8,847,000 for performing this portion of the Tank Farm Remediation activities summarized by WBS activity an FY is shown in Table 14.4.

14.3.1 Scope and Assumptions

The scope of the RD work for the remediation of these tanks is to prepare necessary design and supporting documents required for (1) approval from DOE-OR, DOE-HQ, TDEC and

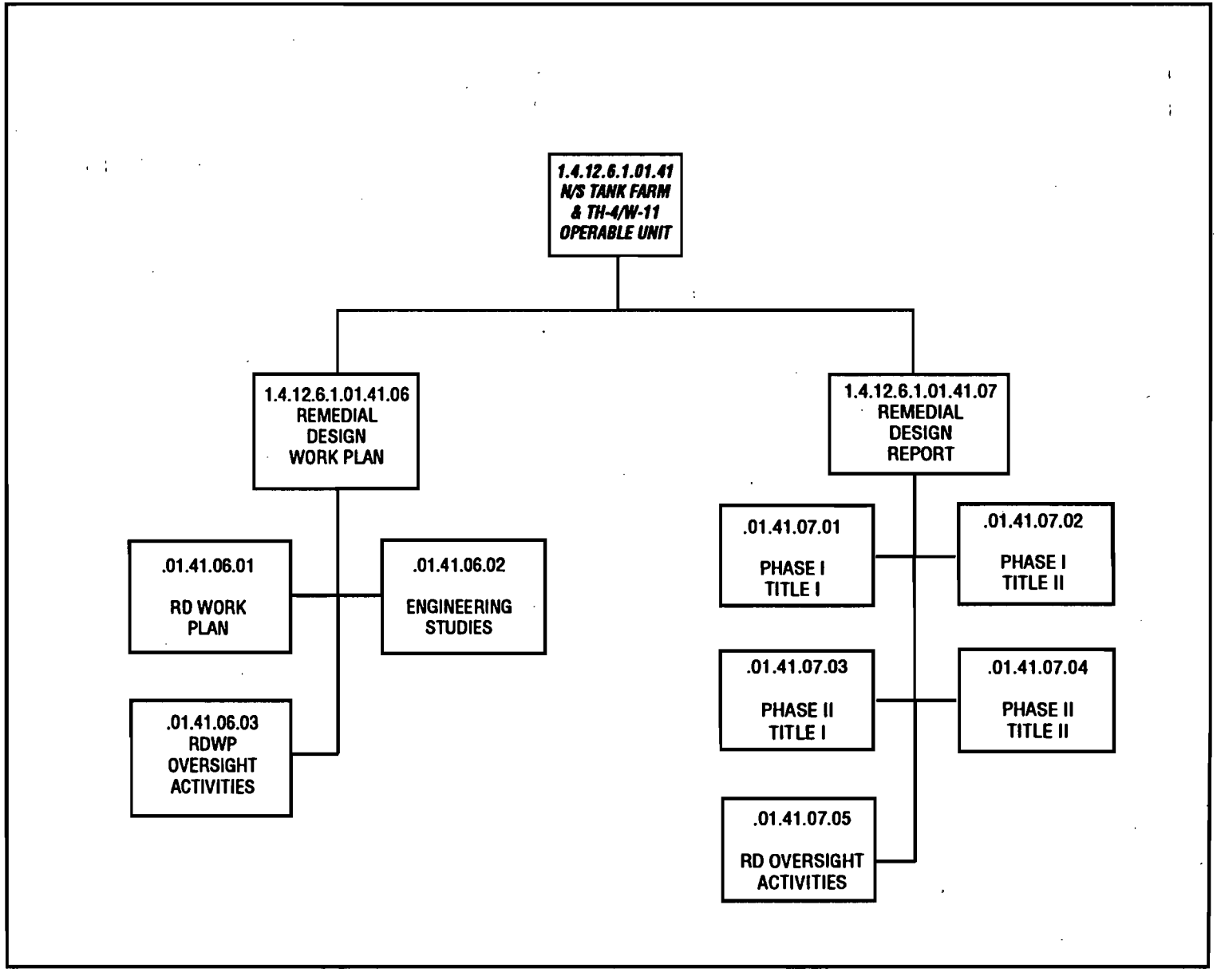


Fig. 14.7 Tank Farm OU RD Work Breakdown Structure.

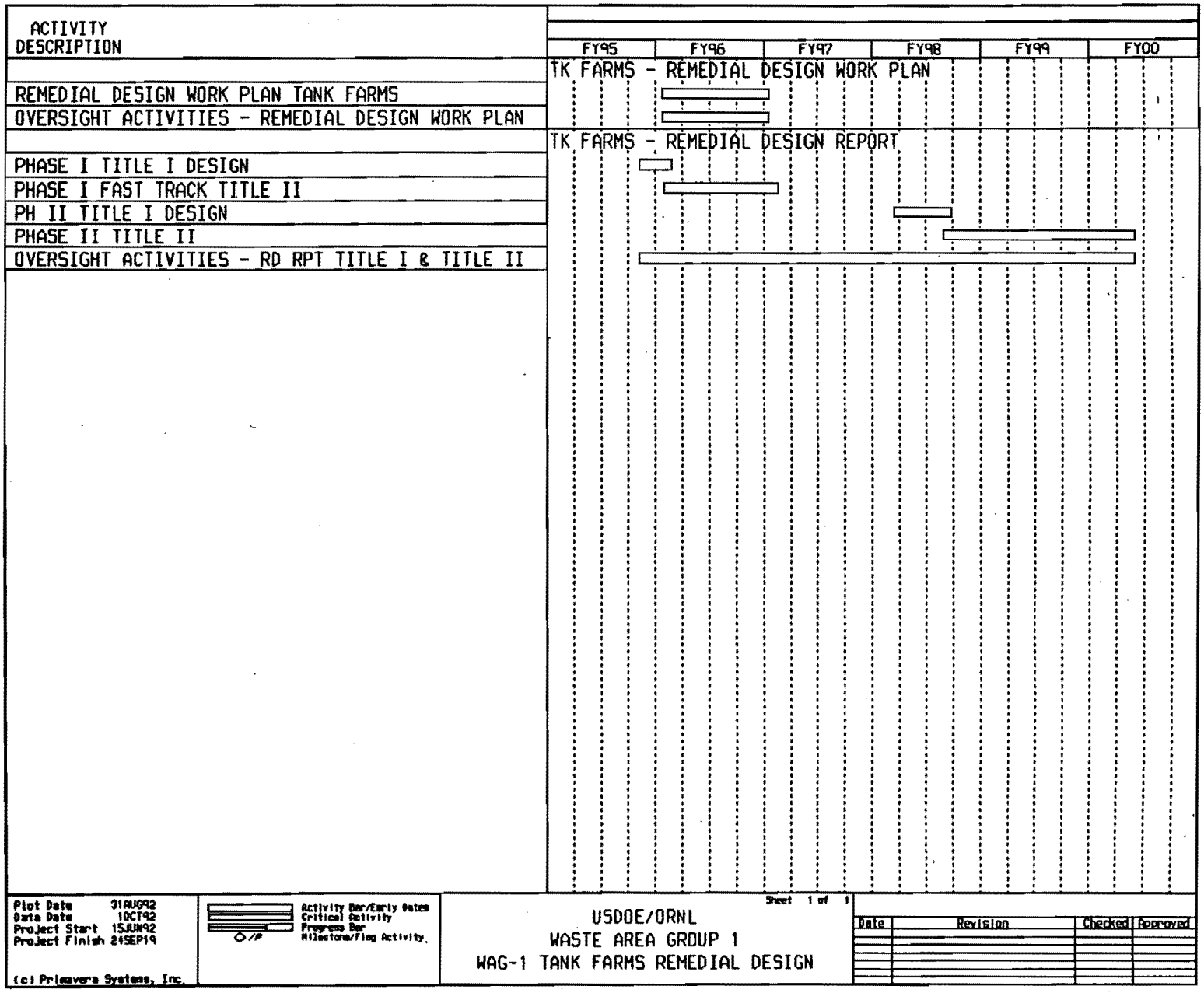


Fig. 14.8 Tank Farm OU RD Summary Level Schedule.

TABLE 14.4
WAG 1 Oper Unit 01 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)						
	1995	1996	1997	1998	1999	2000	TOTAL
Remedial Design Work Plan	0	188	20	0	0	0	208
Engineering Studies	0	0	0	0	0	0	0
RD WP Oversight Activities	0	219	23	0	0	0	243
SUBTOTALS RD WP	0	407	43	0	0	0	451
Remedial Design Phase I Title I	478	751	0	0	0	0	1,229
Remedial Design Phase I Title II	0	1,948	208	0	0	0	2,155
Remedial Design Phase II Title I	0	0	0	1,232	0	0	1,232
Remedial Design Phase II Title II	0	0	0	171	1,635	349	2,155
RD Oversight Activities	6	140	413	632	404	31	1,624
SUBTOTALS RD	484	2,839	620	2,034	2,040	379	8,396
TOTALS	484	3,246	664	2,034	2,040	379	8,847

EPA and (2) implementation of all RA activities.

Details on the scope of work and the assumptions associated with the RD work breakdown elements that the A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the Tank Farm RA are described in Chapter 4.0.

14.3.2 Remedial Design Work Plan

14.3.2.1 Remedial Design Work Plan (1.01.41.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The A-E Contractor will prepare a draft based upon the scope and design criteria specified in the PP and the IROD documents. The RD Work Plan will include the detailed design process and schedule for the design effort for the following remediation activities.

- Grouting tanks W-1, W-1A, W-2, W-13, W-14, and W-15 of the North Tank Farm are in place. These tanks are assumed to contain no sludge and may need some remote cleaning and decontamination performed before grouting.

- Tanks W-3 and W-4 of the North Tank Farm and Tank W-5 through W-10 of the South Tank Farm, as well as Tanks TH-4 and W-11, contain sludge that will be processed inside the tanks using remote operations involving size reduction of particles before mixing with grout. At the completion of sludge processing, samples of sludge will be taken and analyzed to ensure that the process performed as expected. The tanks will then be completely filled with grout.

The RD Work Plan is scheduled to begin at the completion of the IROD application preparation. Figure 14.9 depicts the schedule logic for completion of the RD Work Plan and its relationship to IROD and design activities. In order to initiate construction within 15 months of IROD approval, the RD Work Plan preparation must begin early in the IROD approval process. This schedule assumes only 32 working days for a combined DOE-OR/HQ review of this document. The risks and uncertainties associated with this schedule are discussed in Section 14.3.4.

14.3.2.2 Engineering Studies (1.01.41.06.02)

The proposed action of in situ treatment of sludge and solids using remote technology is extremely developmental in nature. Because of this, a significant amount of time will be required to develop the remote-controlled equipment necessary to handle and/or process the tank contents. However, since any RA will likely require significant remote-handling capabilities, this development work will be useful even if the final remedial approach changes.

Prototype equipment and systems will be designed and procured for use in the sampling

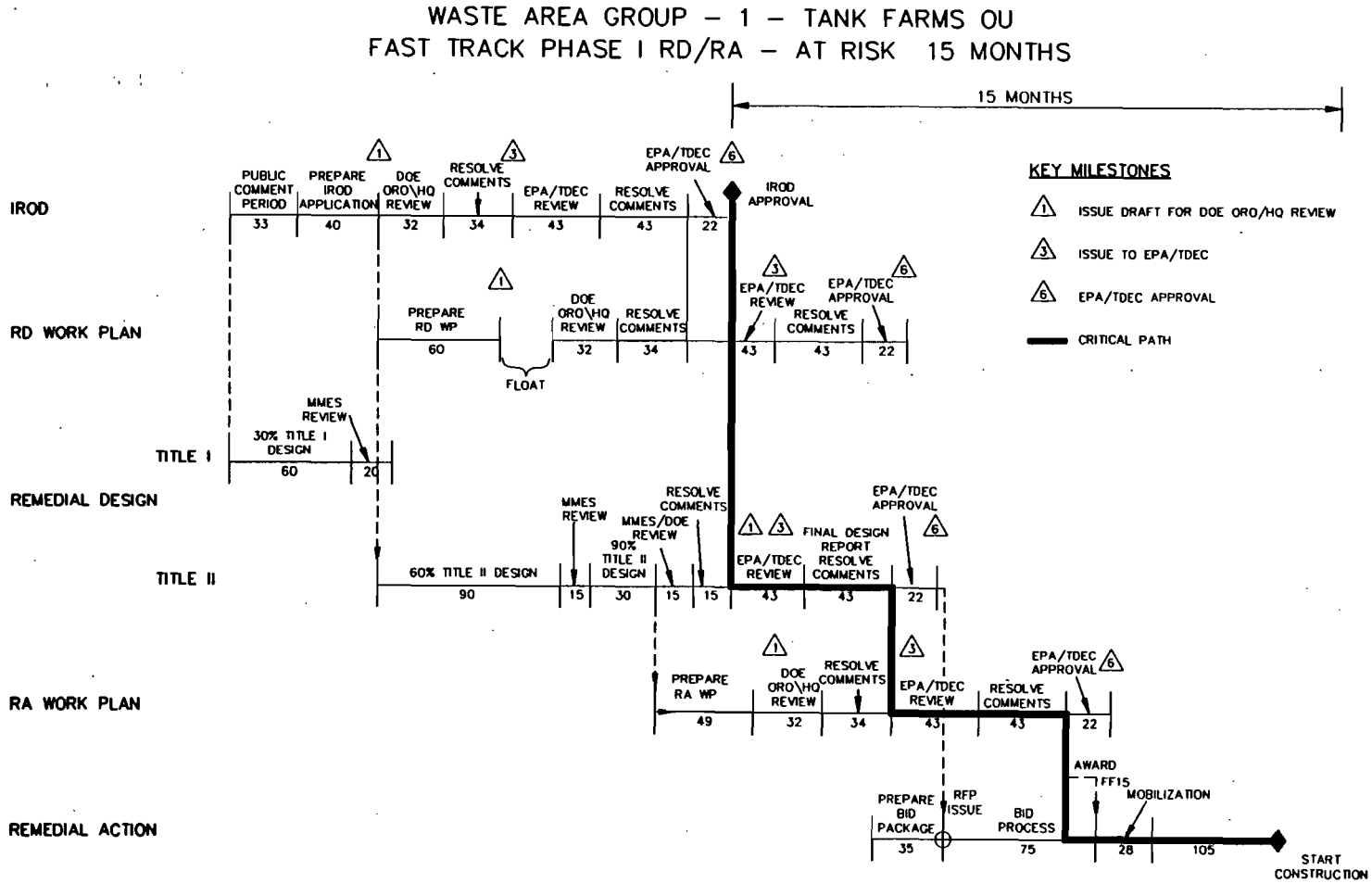


Fig. 14.9. Tank Farm OU Phase I Schedule Logic

phase of a treatability study conducted to support RD/RA. Lessons learned from the sampling phase will aid development of the prototype equipment. Many of the tools from this phase will be used for the actual tanks remediation. Engineering studies and associated RD/RA treatability studies will be conducted as an Early Action and is discussed in more detail in a previous section.

A mock run of in situ treatment will provide further operating experience and highlight potential problems. The mock run will be an abbreviated version of the proposed remedial action. It should provide feedback on operating efficiency, tool effectiveness, and processing effectiveness.

14.3.2.3 Remedial Design Work Plan Oversight Activities (1.01.41.06.03)

Technical input will be provided during the preparation of the Work Plan to ensure that the design does not violate the intent of the IROD and complies with the administrative and regulatory requirements. The Work Plan will be drafted by the RD Contractor and reviewed by the FS Contractor, MMES, and DOE.

14.3.3 Remedial Design Report

14.3.3.1 Remedial Design Report Phase I Title I Design (1.01.41.07.01)

Title I design will be performed in two phases. Phase I will support a construction schedule that will enable DOE to meet the 15-month deadline imposed for the start of construction after the IROD is approved by EPA (Fig. 14.9). Phase I of Title I will involve performing design on non-sludge containing tanks of the North Tank Farm (W-1, W-1A, W-2, W-13, W-14, and W-15).

Based on the engineering studies and other information available from the RI/FS, the RD A-E Contractor will prepare preliminary (30%) design documents showing the extent of remedial activities, site plan details, and an outline of specifications for the work involved. Since the work will be performed remotely, a major portion of the design effort will be devoted to design and specification of components to be used in performing the RA.

In order to support construction start 15 months after IROD approval, Phase I Title I must begin at the start of the public comment period for the PP. This approach involves some risk, which is discussed in Section 14.3.4.

14.3.3.2 Remedial Design Report Phase I Title II Design (1.01.41.07.02)

Title II design will also be conducted in separate phases, as was discussed for Title I design. Upon approval of the Phase I Title I design document, the A-E Contractor will prepare detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction drawings; technical specifications; and cost estimates.

All the documents will be submitted to MMES for comments at 60% completion. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and DOE. Upon resolution of these comments, the 100% design package will be issued for TDEC and EPA for further review, comment, and approval. Upon resolution of TDEC and EPA comments, the Design Report will be prepared and issued certified for construction (CFC).

The cost assessment for the Phase I Title I and Title II design was developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Additional design/permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Results of treatability and engineering studies are readily available.
- Development of remote techniques used to perform the RA have been sufficiently developed to begin detailed design.

As shown in Fig. 14.9, Phase I Title II design must be completed before IROD approval in order to begin construction 15 months after IROD approval. This approach involves substantial risk for the design effort since Title II must be completed before IROD approval. The design will, however, be approved by EPA before start of the bid process; therefore, there is minimal risk involved in the RA concern.

14.3.3.3 Remedial Design Report Phase II Title I Design (1.01.41.07.03)

Phase II Title I design will support a construction schedule for remediation of the remaining tanks in the North Tank Farm (W-3 and W-4), South Tank Farm (W-5 through W-10), and Tanks TH-4 and W-11. These tanks contain sludge left in the tanks from past removal operations. Size reduction and processing of sludge inside the tanks will be accomplished using remote operations. Preparation of Title I design documents will draw heavily on the experience gained during the engineering studies and remote sludge sampling activities.

14.3.3.4 Remedial Design Report Phase II Title II Design (1.01.41.07.04)

Phase II Title II will involve the preparation of detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction; construction drawings; technical specifications; and cost estimates for sludge-containing tanks listed previously. The documents submitted and cost assessment assumptions are the same as those discussed for Phase II of Title I.

14.3.3.5 Remedial Design Oversight Activities (1.01.41.07.05)

Oversight will be provided throughout the RD process to ensure that the design does not violate the intent of the FFA, FS/EA, PP, or IROD. Reviews will be conducted by the FS Contractor, MMES, and DOE at the 30%, 60%, and 90% completion stages to ensure that the design complies with administrative policies and regulatory requirements.

14.3.4 Risks and Uncertainties

The findings and conclusions in the final RI and FS/EA documents may impact the scope of engineering studies and development work.

It is assumed that much of the remote equipment (such as robot arms, etc.) developed during the studies will be used in actual remediation. If not, then procurement of additional new equipment will impact schedule and cost and will increase the difficulty of starting remediation within 15 months of the IROD.

The primary risks and uncertainties associated with RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the RD and, therefore, increase cost.

- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have a significant impact on RD and remediation work.

- The findings and conclusions in the Final RI and FS/EA documents may impact the scope of RD work.

- Phase I Title I and Title II must begin and end before IROD approval in order to meet the 15-month deadline for start of construction. If there are changes to the remedial alternative selected for the EPA-approved PP due to public comments or if EPA otherwise agrees to a different remedy during the IROD approval process, there may be significant impacts on design. Depending on the severity of the change, part or all of the design may require revision.

- It is assumed that the development work associated with the design of remote equipment can be accomplished in a time frame to support this schedule. Development work for remote equipment will occur as an Early Action and will involve sampling and treatment of actual material (pilot scale), analytical testing, and review of these activities in order to facilitate subsequent design activities.

14.3.5 Interfaces

The RD documents required for the remediation of the North Tank Farm will require the coordination and close interface with the following participants:

- EPA — To provide regulatory overview during the RD process and to approve all primary documents.
- TDEC — To provide regulatory overview for the state of Tennessee during the RD process.
- DOE — To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview of design considerations for waste generation, handling, and storage/disposal.
- MMES Technical Advisory Group — To provide technical overview support during the RD process (i.e., engineering studies and design criteria).
- MMES D&D Program — To provide input and overview for the decontamination of radioactive handling facilities.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- ORNL Environmental Safety and Health Division — To provide input and overview for the ES&H aspects for implementation of design.
- Construction Manager — To provide construction reviews of design.
- RD Contractor — To draft the RD Work Plan.

14.4 REMEDIAL ACTION

This section presents the scope of the RA activities required to implement the Phase I Fast Track and Phase II RA. The Phase I Fast Track work involves removing liquid contents from non-sludge tanks, decontaminating the tanks, and filling them with grout. Phase II addresses sludge tanks and includes liquid removal, in situ processing and solidification of sludges and solids with grout, and filling the tanks with grout. The risks and uncertainties and interface issues for the remedial activities are identified as well.

The WBS, Summary Level Schedule, and cost assessment for the North and South Tank Farms and Tanks TH-4 and W-11 are grouped together and shown in the figures and tables below. The WBS developed for performing the RA is presented in Fig. 14.10, and the summary level schedule for these RA WBS elements is shown in Fig. 14.11. The cost assessment of $30,587,000 for performing this portion of the WAG 1 OU1 remediation activities summarized by WBS activity and FY is shown in Table 14.5.

14.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan, construction management, Title III services, construction of the six remediation design packages, construction support, independent certification, and verification that includes monitoring and a 5-year review.

14.4.2 Remedial Action Work Plan

14.4.2.1 Remedial Action Work Plan (1.01.41.08.01)

The RA Construction Manager will prepare the draft RA Work Plan, which (1) defines the scope and objectives of the RA based upon the IROD and Final Remedial Design; (2) documents the specific construction components of the RA; and (3) presents the RA schedule, subcontracting strategy, QA Plan, Health and Safety Plan, and RA Monitoring Plan.

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

14.4.2.2 Remedial Action Work Plan Oversight Activities (1.01.41.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA Work Plan. During the preparation of the draft, MMES and the A-E Contractor responsible for the approved design report will provide necessary coordination and review the Work Plan to ensure that proposed construction efforts will implement the IROD presented in the final RD Reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

14.4.3 Remedial Action Activities

This section presents the scope of the RA activities required to implement the RA for the North and South Tank Farms and Tanks TH-4 and W-11. The risks and uncertainties and interface issues for the remedial activities are identified as well.

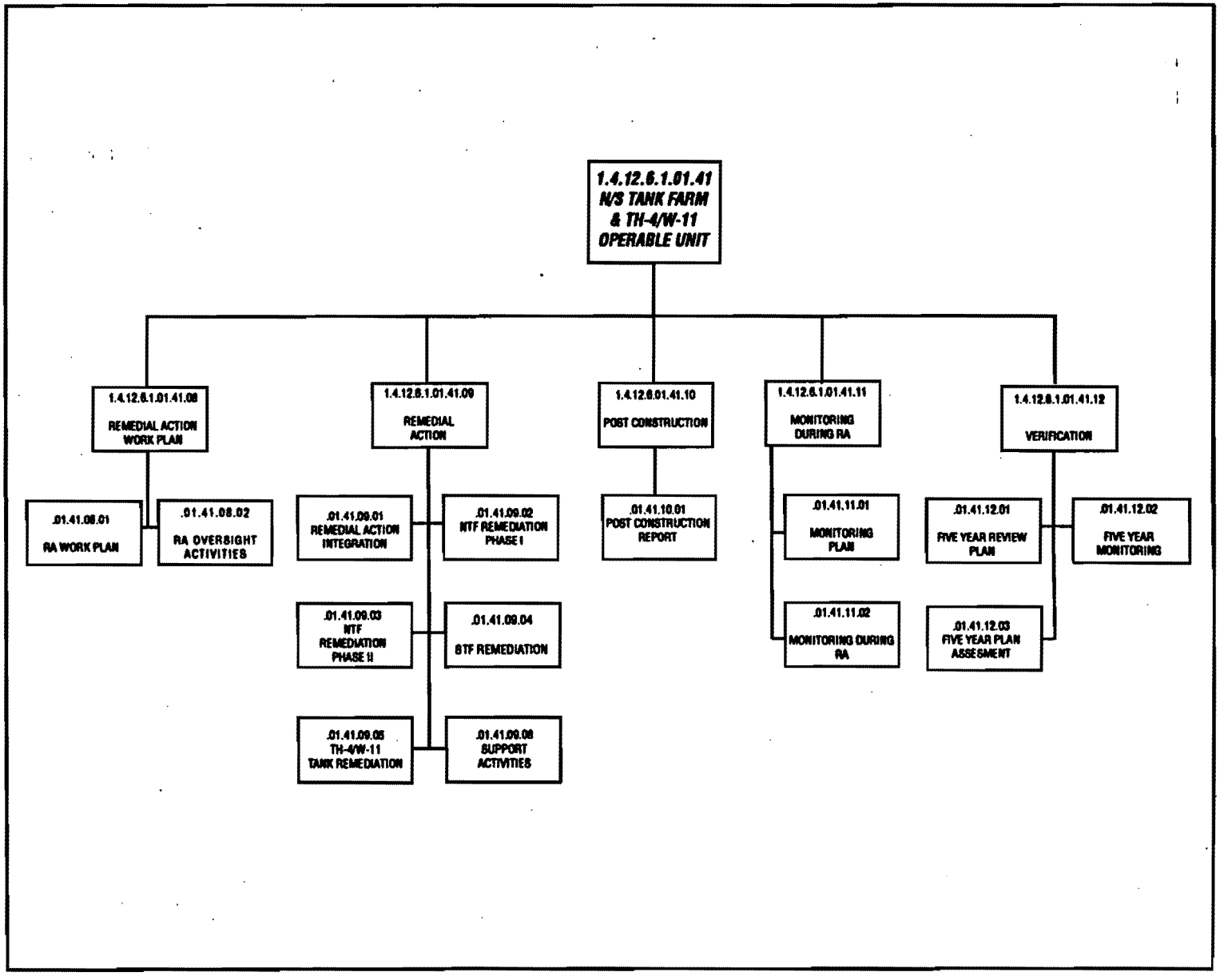


Fig. 14.10. Tank Farm OU RA Work Breakdown Structure.

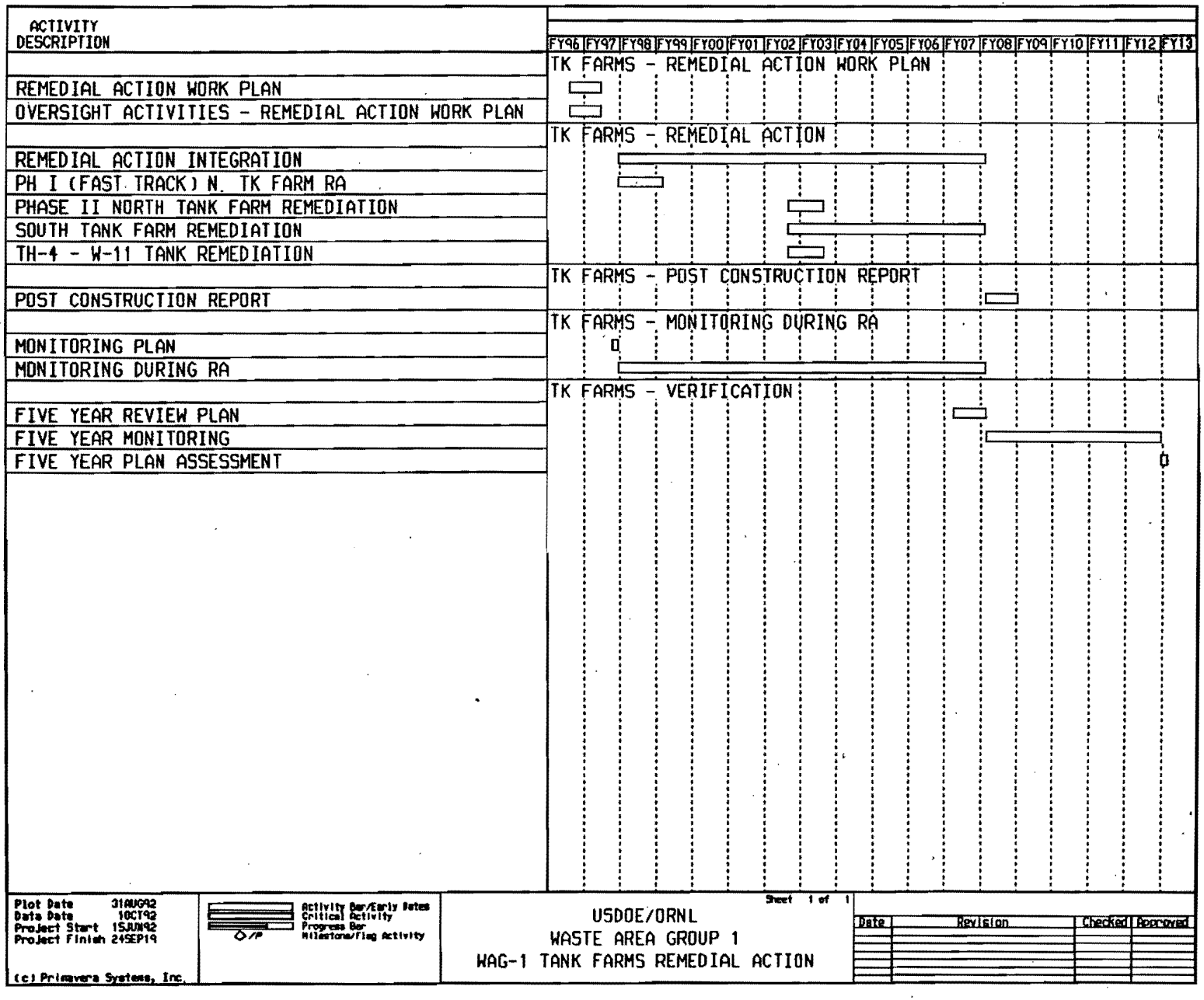


Fig. 14.11. Tank Farm OU Summary Level RA Schedule.

TABLE 14.5
WAG 1 Oper Unit 01 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																		
	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
RA Work Plan	175	275	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	450
RA WP Oversight Activities	68	108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	176
SUBTOTALS RA WP	243	382	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	625
RA Integration	0	5	68	176	320	486	654	784	775	627	388	106	8	0	0	0	0	0	4,396
Remedial Action	0	75	2,068	138	0	0	1,506	5,559	2,411	3,840	3,581	1,413	43	0	0	0	0	0	20,634
Post Construction Report	0	0	0	0	0	0	0	0	0	0	0	0	77	8	0	0	0	0	85
Monitoring During RA	0	49	43	111	202	306	412	494	489	395	244	67	5	0	0	0	0	0	2,816
Verification	0	0	0	0	0	0	0	0	0	0	0	88	89	304	564	539	270	176	2,031
SUBTOTALS RA	0	128	2,179	424	522	792	2,572	6,838	3,676	4,862	4,213	1,674	221	312	564	539	270	176	29,962
TOTALS	243	511	2,179	424	522	792	2,572	6,838	3,676	4,862	4,213	1,674	221	312	564	539	270	176	30,587

14.4.3.1 Remedial Action Integration (1.01.41.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E Contractor and construction support as required.

RA integration for remedial activities includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performing on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

14.4.3.2 North Tank Farm Remediation Phase I (1.01.41.09.02)

The North Tank Farm in WAG 1, located northeast of the Central Avenue and Third Street intersection at ORNL (Fig. 14.12.), consists of eight underground storage tanks, four steel tanks and four gunite tanks. Only two tanks contain sludge or solids and the other six contain only liquids. The Phase I Fast Track addresses remediation of the six tanks that contain only liquids. Equipment-support bridges (Fig. 14.13) will be provided for each of the gunite tanks so that the weight of the processing equipment will not be supported by the tank domes. Piers for the support bridges will be installed.

All equipment installed in and removed from every tank will be bagged in and out to prevent the spread of contamination, maintain tank containment, and reduce worker exposure. A remote-control camera and lights system capable of being inserted through a 4-in. pipe will be used to monitor the remediation processes in all of the tanks. All equipment used for the remediation tasks inside the tanks will require periodic decontamination and routine maintenance. If it is determined to be more cost efficient to dispose of a particular contaminated or broken component, that option will be considered.

Tanks W-1 and W-2 are 4800-gal capacity gunite tanks containing liquids. The liquids will be pumped from these tanks to the Evaporator Facility using a pump installed in a 30-in. diameter tank opening. Once empty, spray decontamination equipment installed in a 12-in. diameter tank opening will be used to wash down the inside of the tanks. The spraying and pumping will be performed until the tanks are as clean as is reasonably achievable. The tanks will then be filled with

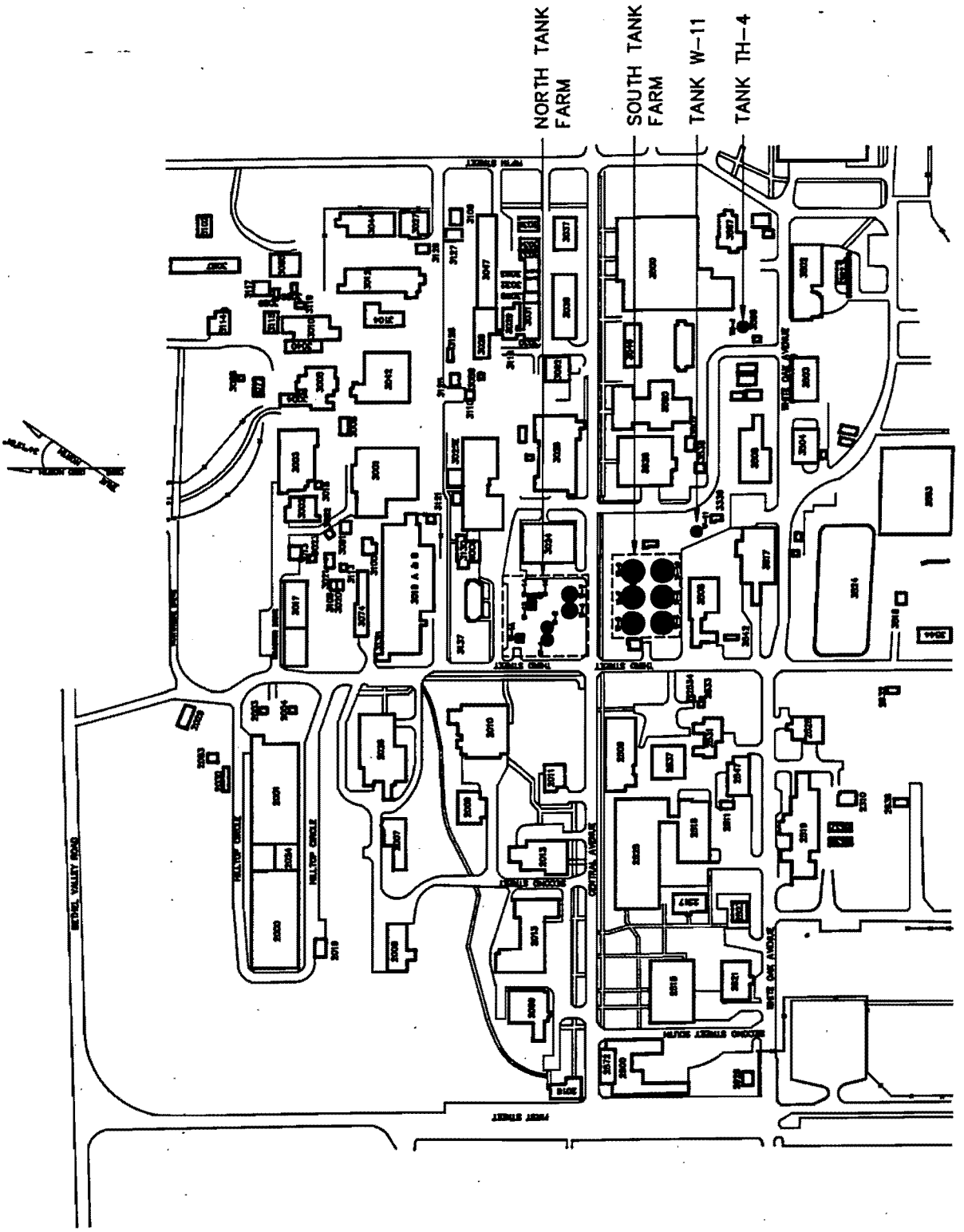


Fig. 14.12. North Tank Farm Location.

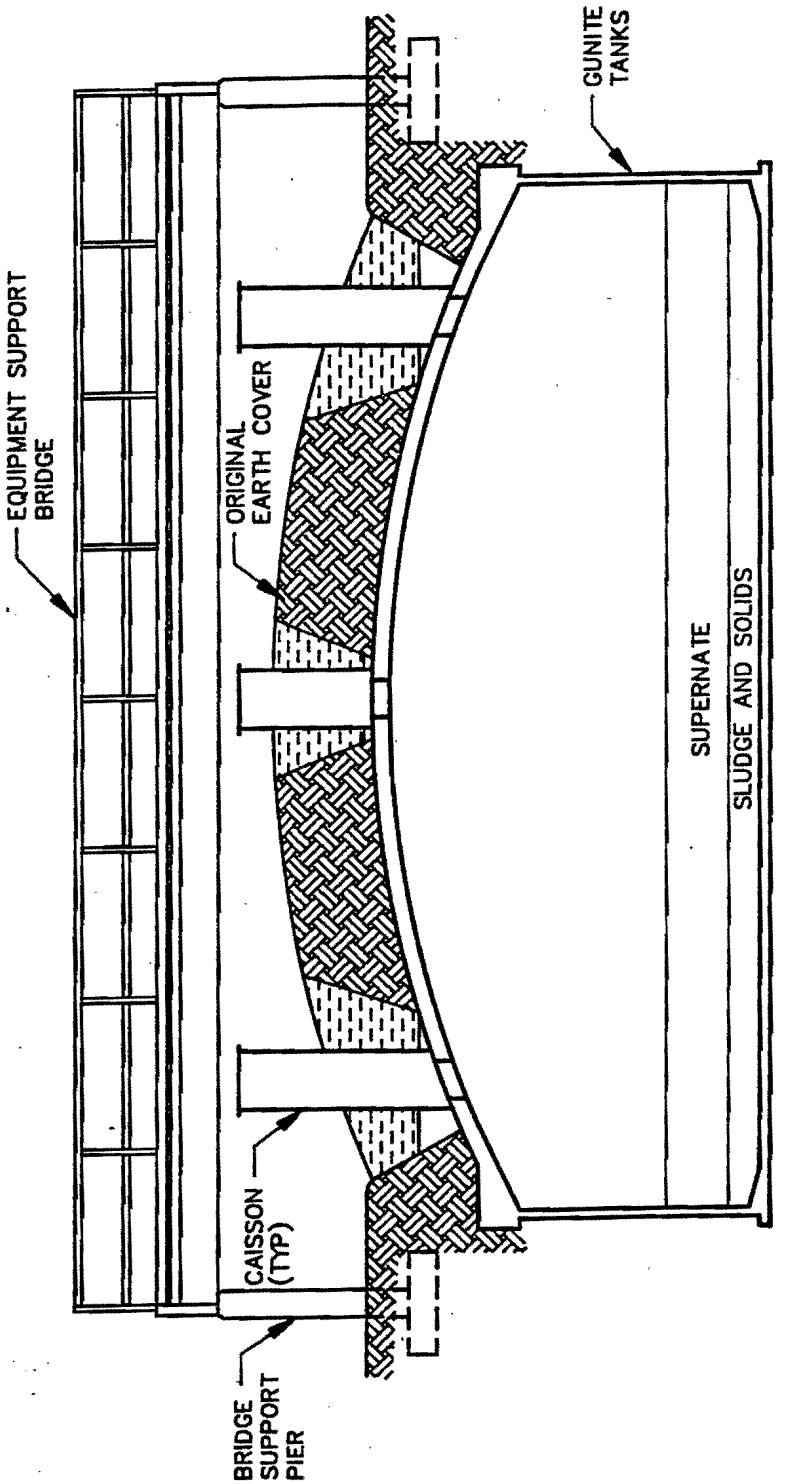


Fig. 14.13. Typical Equipment Support Bridge for Gunite Tanks.

grout. Mixing equipment will replace the pump in the 30-in. diameter tank opening and will be used to mix the grout with any residual water from the cleaning operations.

Tank W-1A is a 4000-gal capacity stainless steel tank containing liquids. The liquids will be removed from this tank to the Evaporator Facility using an existing suction line in the tank. The tank will be cleaned and filled with grout as described for Tanks W-1 and W-2. A 14-in. diameter tank opening will be used for installation of the spray decontamination and mixing equipment. This tank currently has some inleakage of groundwater and is periodically pumped to prevent overflow. It is suspected that the source of inleakage is an inlet pipe connected to the tank. This inleakage must be controlled before remediation.

Tanks W-13, W-14, and W-15 are 2000-gal capacity stainless steel tanks containing only liquids. The contents of these tanks are highly acidic (pH 0.2–3.0) and must be neutralized before removal from the tanks to the evaporator. Neutralizing solution injected through a 2-in. diameter tank opening will be mixed with the contents by a mixer installed in the 16-in. diameter tank opening. Neutralization must be planned and executed carefully to avoid precipitation of byproducts. Once neutralized, the contents will be pumped to the Evaporator Facility, and the tanks will be cleaned and filled with grout.

The following assumptions were made in developing this remediation scenario and the subsequent cost estimate and schedule:

- No external secondary confinement will be required.
- Bag-in/bag-out procedures will provide sufficient confinement during equipment installation and removal.
- Evaporator Facility capacity will be sufficient to process the liquids resulting from this remediation.
- All supernatant liquids from the tanks and tank decontamination liquids will go to the Evaporator Facility and not to the PWTP.
- The equipment and personnel decontamination liquids will go to two locations: 90% will go to the PWTP, and 10% will go to the Evaporator Facility (LLW).
- Equipment support structures will be necessary for all of the gunite tanks to minimize stresses on the tank domes, but processing equipment may be mounted directly to tank nozzles on the steel tanks.
- Groundwater leakage to and from tanks will be eliminated by Early Actions.

14.4.3.3 North Tank Farm Remediation Phase II (1.01.41.09.03)

The scope of the RA includes Construction Management, Title III services, construction and implementation of the remedial design, construction support, and independent verification.

The Phase II RA addresses remediation of the two tanks (W-3 and W-4) in the North Tank Farm that contain sludge and solids in addition to liquids. Equipment-support bridges will be provided for both of these gunite tanks so that the weight of the processing equipment will not be supported by the tank domes. Piers for the support bridges will be installed.

All equipment installed in and removed from each tank will be bagged in and out to prevent the spread of contamination, to maintain tank containment, and to reduce worker exposure. A remote-control camera and lighting system capable of being inserted through a 4-in. pipe will be used to monitor the remediation processes in both tanks. All equipment used for the remediation tasks inside the tanks will require periodic decontamination and routine maintenance. If it is determined to be more cost-efficient to dispose of a particular contaminated or broken component, that option will be considered.

Tanks W-3 and W-4 are 42,500-gal capacity gunite tanks containing solids and sludge (2300 and 4000 gal, respectively) on the tank bottom covered by liquids (31,800 and 17,100 gal, respectively). The sludges and solids in these tanks contain quantities of TRU constituents that cannot be processed at the evaporator and will remain inside the tanks. The liquids will be pumped from the waste tanks to a holding tank in 1000-gal batches (Fig. 14.14). Each batch will then be agitated in the holding tank, sampled, and analyzed to ensure that it is not TRU waste. The batch will then be pumped to the Evaporator Facility. This liquid removal process will continue until all of the liquids are removed from the tanks or analysis indicates that levels of TRU in the liquids pumped to the holding tank are reaching unacceptable values. The activity limit for TRU content in liquids sent to the evaporator is 3.7×10^6 Bq/kg (100 nCi/gm).

When the liquids are removed, processing of the solids in the tank will begin. These solids may be large and may require considerable size reduction to produce a particle size small enough to remain in solution when mixed with a special grout formula that has a watery consistency. Additionally, some solids may be attached to the bottom of the tank and require processing to detach them. All of the tank-remediation processes will be done using remote-operated equipment inside the tank. That equipment includes the following: a large (12 ft 6 in. radial-reach) robotic arm, a small (7-ft reach) robotic arm, material handling and coarse size-reduction end-effectors for the arms, an end-effector storage rack, a pump with an adjustable suction leg, a material removal system, an intermediate size-reduction machine, a final size-reduction machine, mixing equipment, and a camera with lights. As many as three of these will be installed and used at one time. Since there is only one large tank opening (30-in. diameter) on the periphery of each tank, two additional openings will be made in the tank domes; one in the center and one on the opposite side from the existing opening.

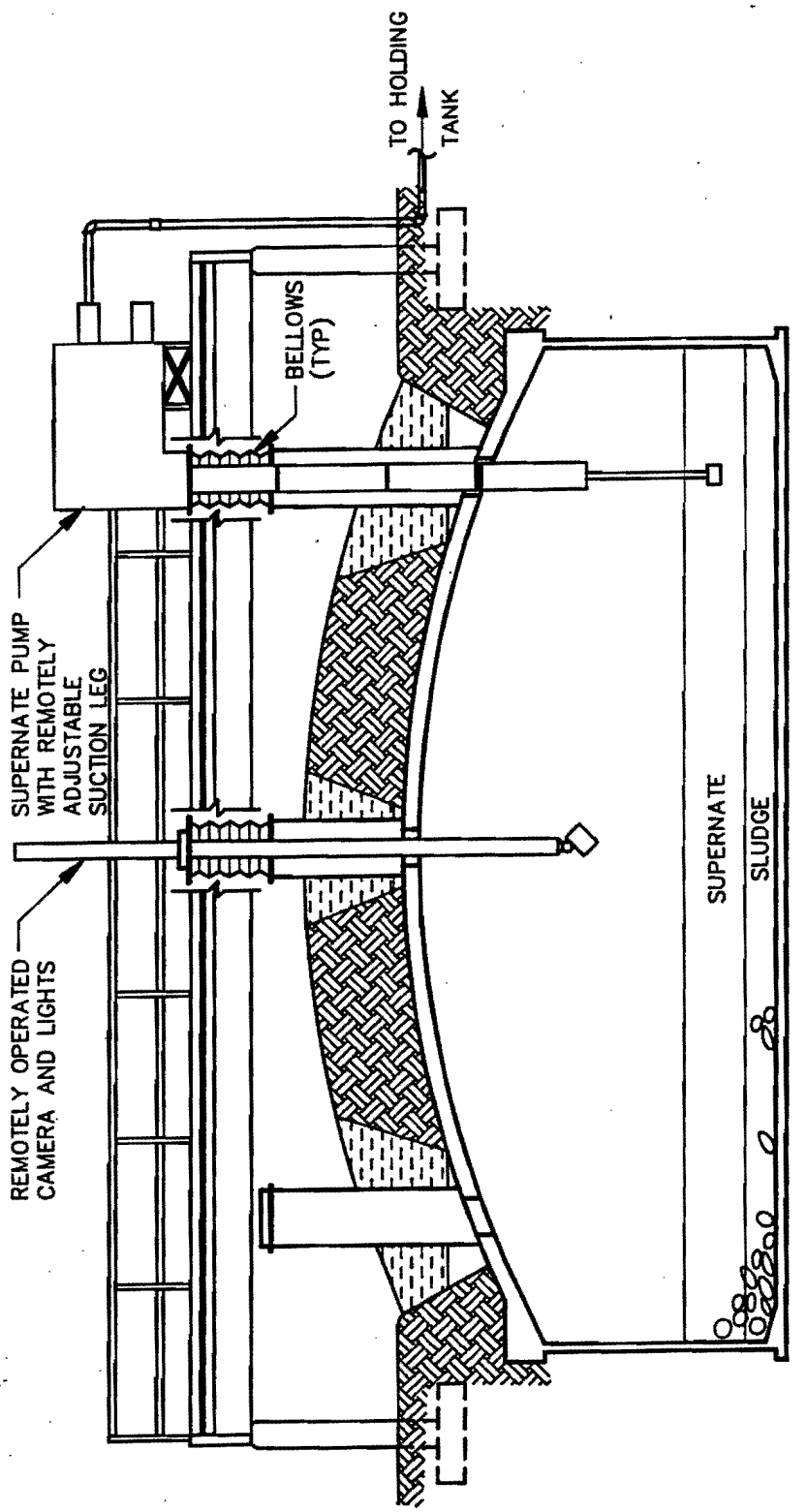


Fig. 14.14. Setup for Pumping Supernatant from Tank.

The first remediation step following liquid removal is segregation and removal of material (metallic trash, etc.) that may exist from previous tank operations that cannot be processed by the size-reduction equipment. If material is contaminated with sludge during removal, it will be decontaminated, packaged, and disposed of in the consolidation facility. The next step will be coarse-size reduction and detachment of solids from the tank bottom using the large robotic arm and various end-effectors (Fig. 14.15). Intermediate-size reduction equipment will then be used with the large robotic arm and material handling tools to further reduce particle size (Fig. 14.16). The tank walls and dome will then be cleaned using spray decontamination equipment or other appropriate cleaning techniques to remove as much loose contamination as is reasonably achievable. The small robotic arm will be mounted on the end of the large arm to provide better control during cleaning (Fig. 14.17). Final size reduction will follow cleaning (Fig. 14.18). The proper amount of the special grout formula will then be injected into the tank to be mixed with the sludge and small solid particles. Mixing equipment will be used to mix the sludge, solids, and grout homogeneously (Fig. 14.18). When the grout/sludge mixture has solidified and all processing equipment has been removed from the tank, the remainder of the tank will be filled with grout.

An enclosure (discussed in Chapter 5.0) will be built over the North Tank Farm because of the relatively long-term duration of the remediation (Fig. 14.19). The enclosure will include a crane for installing and removing equipment in the tanks. Attached facilities will include a change room, personnel decontamination facility, control room, small laboratory facility, and equipment decontamination facility. The enclosure will be ventilated in the summer and heated during the winter. The attached facilities will be provided with heating and air conditioning. The enclosure is intended to provide weather protection but also would provide some measure of confinement in the event of an airborne release or catastrophic tank dome failure. The enclosure also lends itself to security of the remediation area and will have controlled entry construction costs for this enclosure included in an Early Action estimate.

The following assumptions were made in developing this remediation scenario and the subsequent cost estimate and schedule:

- No external secondary confinement will be required.
- Bag-in/bag-out procedures will provide sufficient confinement during equipment installation and removal.
- Almost all of the liquids can be removed from the tanks before processing the solids.
- Evaporator facility capacity will be sufficient to process the liquids resulting from this remediation.
- All supernatant liquids from the tanks and tank decontamination liquids will go to the Evaporator Facility (LLW) and not to the PWTP.

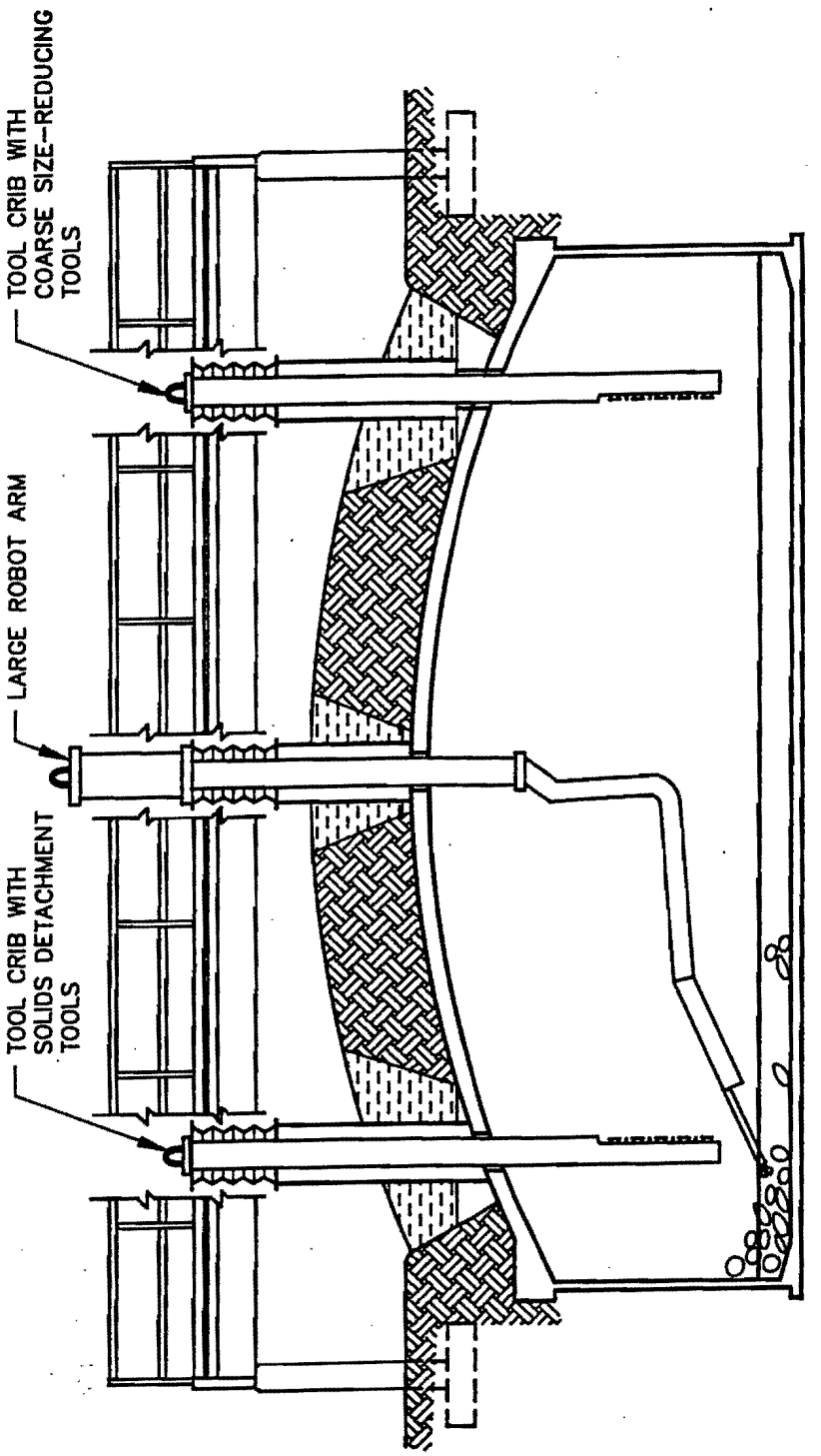


Fig. 14.15. Setup for Detaching Solids from Tank Bottom and Coarse Size-Reduction of Solids.

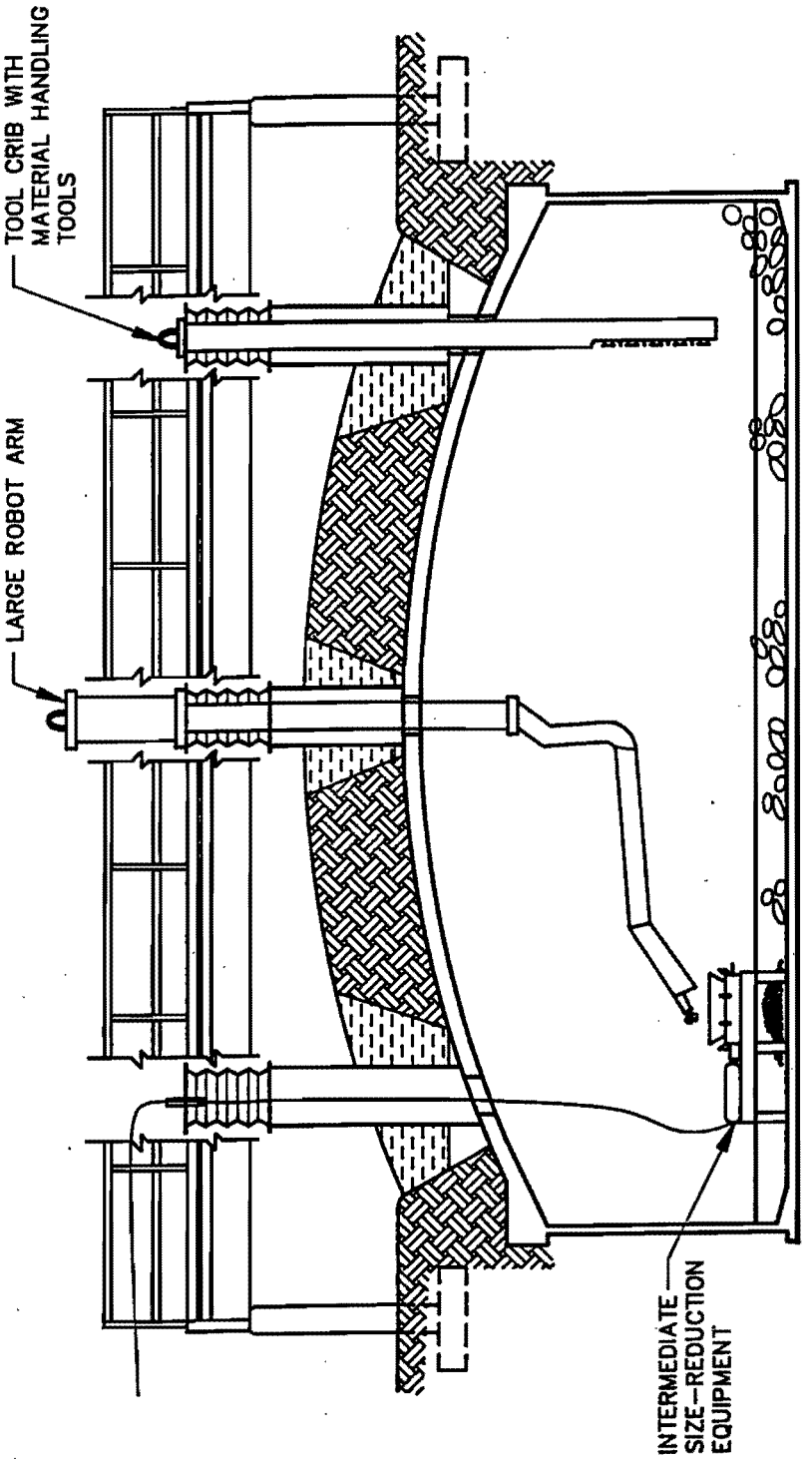


Fig. 14.16. Setup for Intermediate Size-Reduction of Solids.

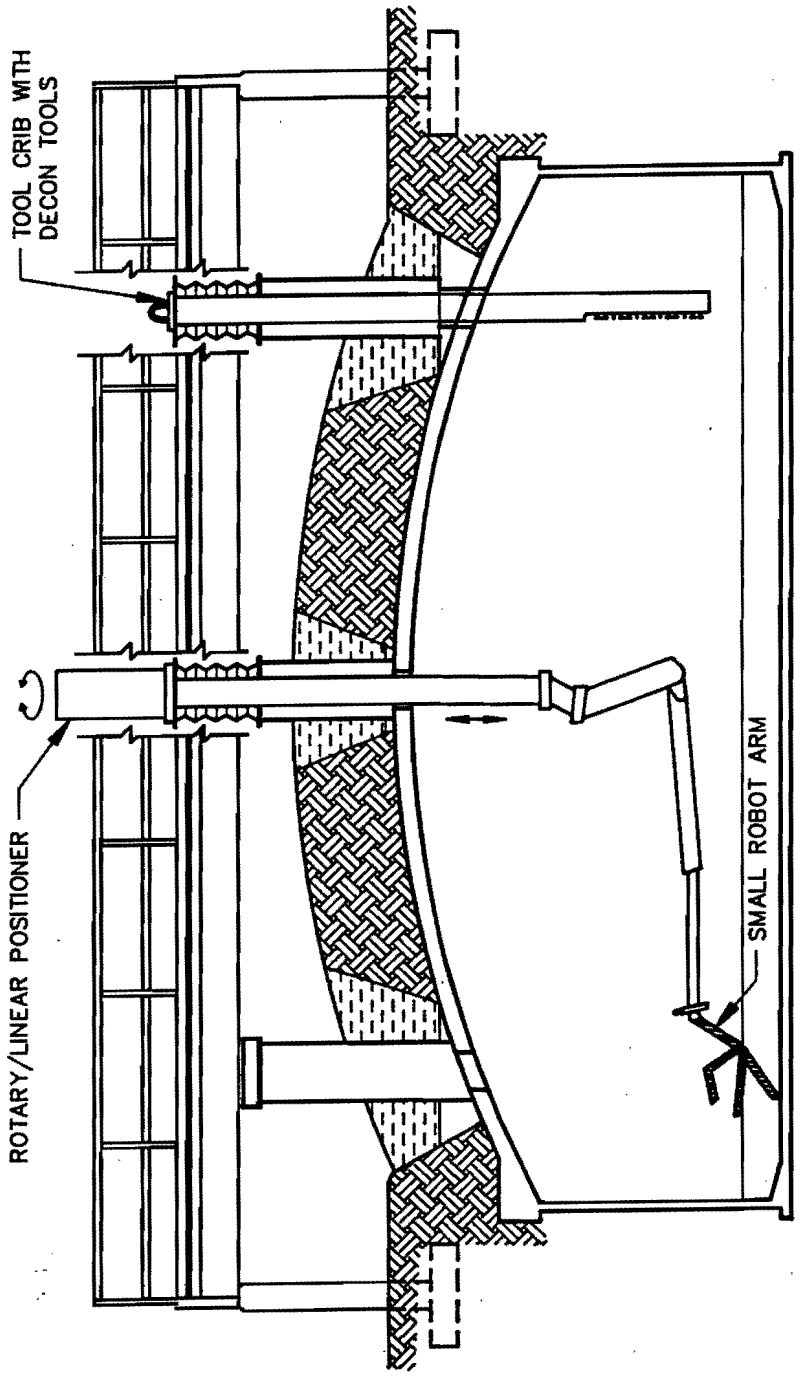


Fig. 14.17. Setup to Decontaminate Inside of Tank.

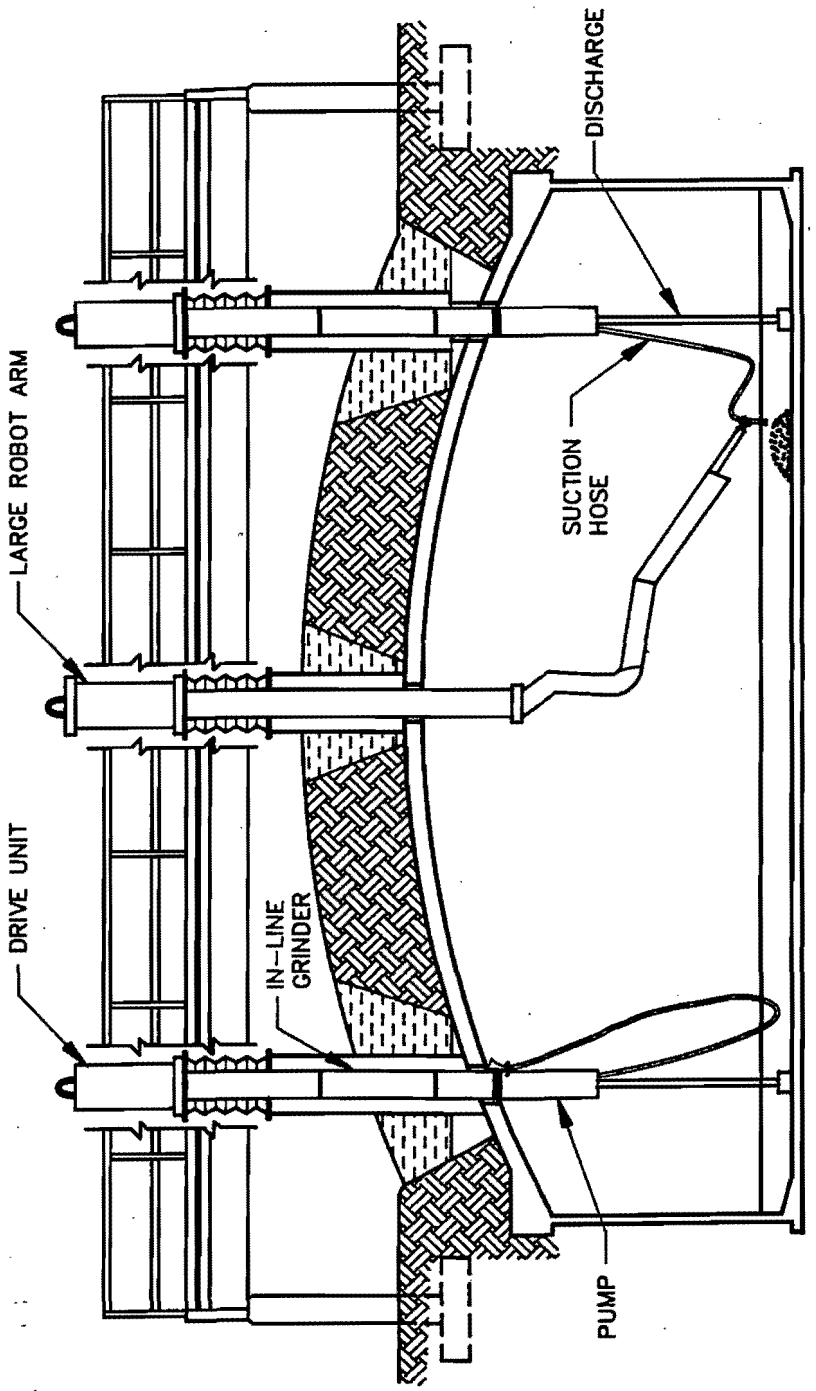


Fig. 14.18. Setup for Final Size-Reduction of Solids and Mixing.

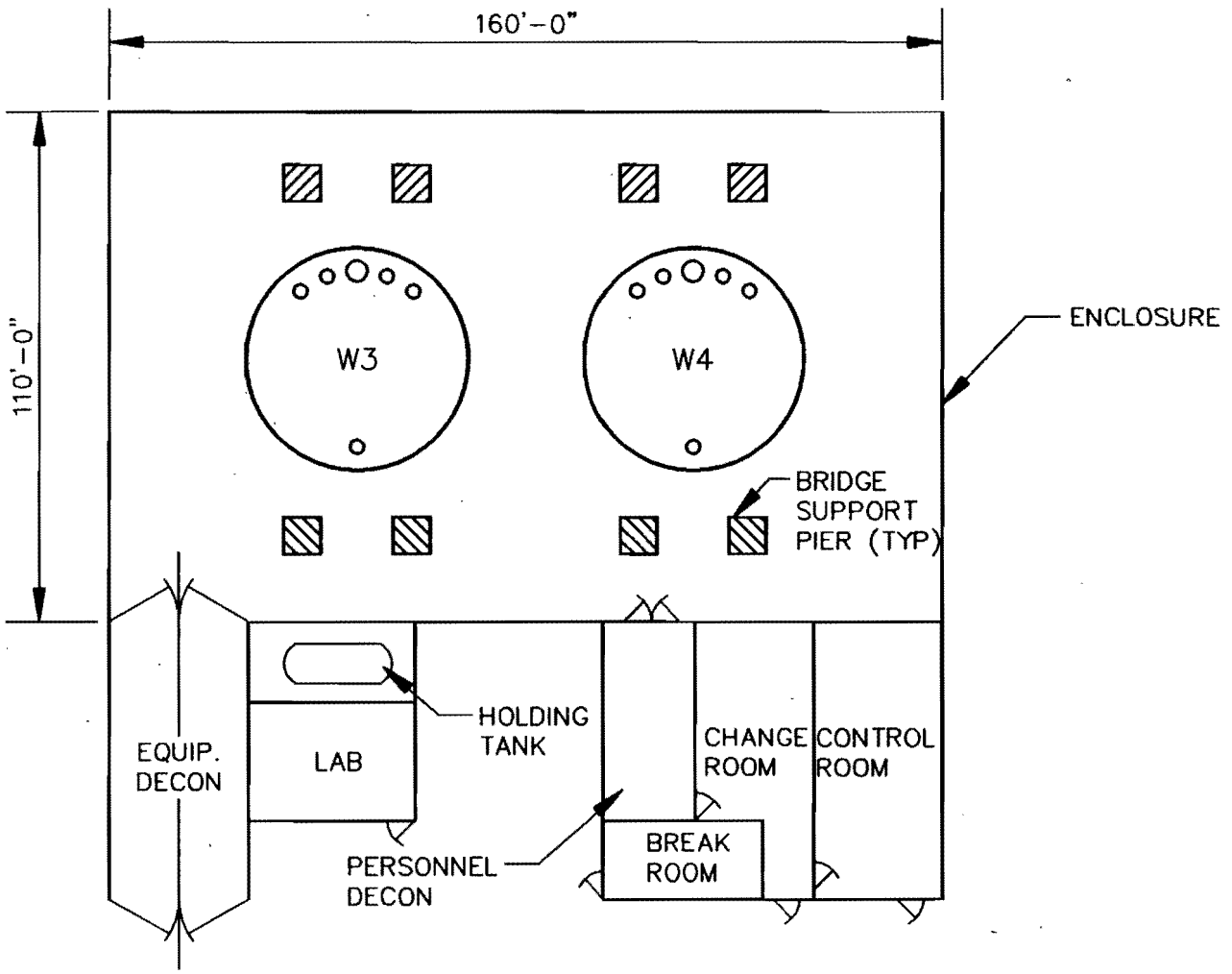


Fig. 14.19. North Tank Farm Enclosure.

- Liquids removed from tanks that have levels and types of radionuclide concentrations that exceed those levels defined as TRU waste will not be sent to the evaporator. The liquid will be placed back into the tank instead.

- Phase I Remedial Action construction starts within 15 months of IROD approval for the North Tank Farm, but Phase II Remedial Action cannot begin until after completion of Phase I. It is assumed that no regulatory problems (or violations of the FFA) exist as a result of the schedule.

- The equipment and personnel decontamination liquids will go to two locations; 90% will go to the PWTP and 10% will go to the Evaporator Facility (LLW).

- Equipment support structures will be necessary for all of the gunite tanks to minimize stresses on the tank domes but processing equipment may be mounted directly to tank nozzles on the steel tanks.

- Groundwater leakage to and from tanks will be reduced sufficiently by Early Actions taken to reduce inleakage.

- All sludges and solids will be solidified in place regardless of TRU waste classification.

14.4.3.4 South Tank Farm Remediation (1.01.41.09.04)

This section presents the scope of the RA activities for the South Tank Farm required to implement the in situ processing and solidification of sludges in sludge tanks with grout and then filling them with grout. The Risks and Uncertainties and interface issues for the remedial activities are identified as well.

The South Tank Farm in WAG 1, located southeast of the Central Avenue and Third Street intersection (Fig. 14.12), consists of six underground storage tanks. All six tanks are of gunite construction with a capacity of 170,000 gal each. Each tank is assumed to contain a top layer of liquids and a bottom layer of sludge and solids. Liquid contents for all six tanks total 315,000 gal, while sludge and solids total 26,900 gal.

The tanks included in this OU are W-5, W-6, W-7, W-8, W-9, and W-10. Tanks W-5 through W-9 have three 24-in. diameter openings each; one in the center of the dome and two on the periphery of the dome 180° apart. Tank W-10 has five 24-in. openings, one in the center and four on the periphery of the dome. Remote-operated equipment will be installed in these openings. Existing equipment support bridges and piers will be used so that the weight of the processing equipment will not be supported by the tank domes. All equipment installed in and removed from every tank will be bagged in and out to prevent the spread of contamination, maintain tank

containment, and reduce worker exposure. A remote-control camera and light system will be used to monitor the remediation processes in all of the tanks. All equipment used for the remediation tasks inside the tanks will require periodic decontamination and routine maintenance.

The sludges and solids in these tanks contain quantities of TRU constituents that cannot be processed at the evaporator and will remain inside the tanks. The liquids will be pumped from the waste tanks to a holding tank in 1000-gal batches (Fig. 14.14). Each batch will then be agitated in the holding tank, sampled, and analyzed to assure that it is not TRU waste. The batch will then be pumped to the evaporator facility. This liquid-removal process will continue until all of the liquids are removed from the tanks or analysis indicates that levels of TRU in the liquids pumped to the holding tank are reaching unacceptable values. The activity limit for TRU content in liquids sent to the evaporator is 3.7×10^6 Bq/kg (100 nCi/gm).

When the liquids are removed, processing of the solids in the tank will begin. These solids may be large and will likely require considerable size-reduction to produce a particle size that is small enough to remain in solution when mixed with a special grout formula that has a watery consistency. Additionally, some solids may be attached to the bottom of the tank and require processing to detach them. All of the tank remediation processes will be done using remote-operated equipment inside the tank. That equipment includes the following: a large (25-ft radial reach) robotic arm, a small (7-ft reach) robotic arm, material handling and coarse size-reduction end-effectors for the arms, end-effector storage racks, a pump with an adjustable suction leg, a material-removal system, an intermediate size-reduction machine, a final size-reduction machine, mixing equipment, and a camera with lights. As many as three of these will be installed and used at one time.

The first remediation step following liquid removal is segregation and removal of material (metallic trash, etc.) that may exist from previous tank operations that cannot be processed by the size-reduction equipment. If material is contaminated with sludge during removal, it will be decontaminated, packaged, and placed in the consolidation facilities. The next step will be coarse size-reduction and detachment of solids from the tank bottom using the large robot arm and various end-effectors (Fig. 14.15). Intermediate size-reduction equipment will then be used with the large robotic arm and material handling tools to further reduce particle size (Fig. 14.16). The tank walls and dome will then be cleaned using spray decon equipment or other appropriate cleaning techniques to remove as much loose contamination as is reasonably achievable. The small robot arm will be mounted on the end of the large arm to provide better control during cleaning (Fig. 14.17). Final size-reduction will follow cleaning (Fig. 14.18). The proper amount of the special grout formula will then be injected into the tank to be mixed with the sludge and small solid particles. Mixing equipment will be used to mix the sludge, solids, and grout homogeneously (Fig. 14.18). When the grout/sludge mixture has solidified and all processing equipment has been removed from the tank, the remainder of the tank will be filled with grout.

An enclosure will be built over the South Tank Farm tanks because of the long-term duration of the remediation (Fig. 14.20) and is discussed fully in Chapter 5.0. The enclosure will include cranes for installing and removing equipment in the tanks. Attached facilities will include

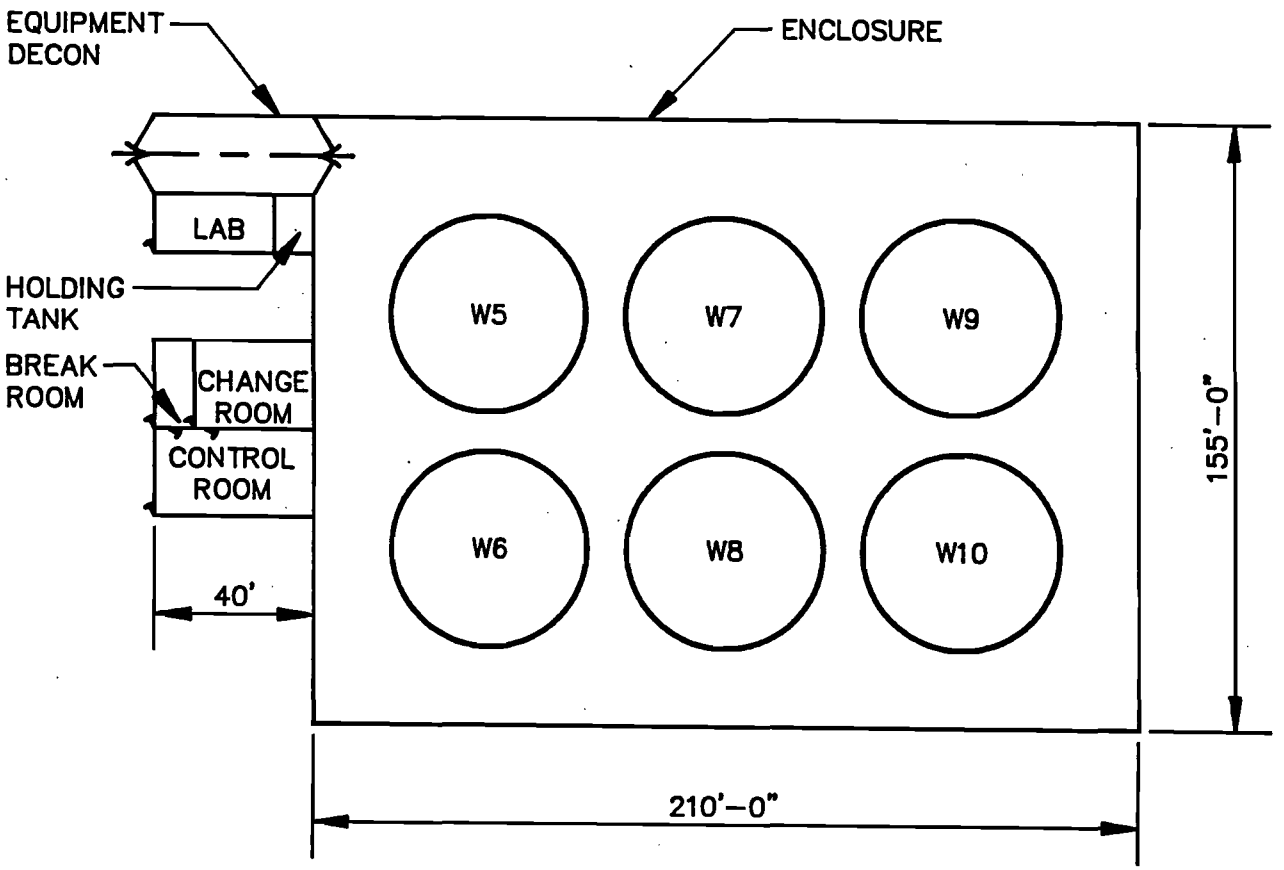


Fig. 14.20. South Tank Farm Enclosure.

a change room, personnel decontamination facility, control room, small laboratory facility, and equipment decontamination facility. The enclosure will be vented in the summer and heated during winter. The attached facilities will be provided with heating and air conditioning. The enclosure is intended to provide weather protection, but also would provide some measure of confinement in the event of an airborne release or catastrophic tank dome failure. The enclosure also lends itself to security of the remediation area and will have controlled entry. Construction costs for this enclosure are included in an Early Action cost assessment.

The following assumptions were made in developing this remediation scenario and the subsequent cost estimate and schedule:

- No external secondary confinement will be required.
- Bag-in/bag-out procedures will provide sufficient confinement during equipment installation and removal.
- Almost all of the liquids can be removed from the tanks before processing the solids.
- Evaporator facility capacity will be sufficient to process the liquids resulting from this remediation.
- All supernatant liquids from the tanks and tank decontamination liquids will go to the Evaporator Facility and not to the PWTP.
- The equipment and personnel decontamination liquids will go to two locations: 90% will go to the PWTP and 10% will go to the Evaporator Facility (LLW).
- Existing equipment support bridges and piers will be structurally sound enough to be used for the remediation after minor repair and maintenance.
- Groundwater leakage to and from tanks will be reduced sufficiently by Early Actions and have no impact on the remedial action.
- All sludges and solids will be solidified in place regardless of TRU waste classification.
- Liquids removed from tanks that have levels and types of radionuclides concentrations that exceed those levels defined as TRU waste will not be sent to the evaporator, but instead will be returned to the tank.

14.4.3.5 TH-4 and W-11 Tank Remediation (1.01.41.09.05)

This section presents the scope of the RA activities for Tanks TH-4 and W-11 required to implement the in situ processing and solidification of sludges in sludge tanks with grout and then filling them with grout. The risks and uncertainties and interface issues for the remedial activities are identified as well.

Tank TH-4 is a 14,000-gal capacity gunite underground storage tank located southwest of Building 3500. Tank W-11 is a 1500-gal gunite underground storage tank located southwest of Building 3525. Fig. 14.12 shows the location of both tanks. Tank TH-4 contains a bottom layer of 6300 gal of sludge and solids and a top layer of liquids that apparently fills the tank to or past capacity (one data source shows 17,000 gal of liquid in addition to the sludge while a second source shows total sludge and liquid contents of 14,000 gal). Tank W-11 contains a bottom layer of 60 gal of hard sludge (solids) covered by 950 gal of liquid.

Tank TH-4 has a 30-in. manhole opening, three 4-in. openings, and a 12-in. opening to the surface. Since there is only one large tank opening (30-in. diameter) on the periphery of the tank, two additional openings will be made in the tank dome, one in the center and one on the opposite side from the existing opening. Remote-operated equipment will be installed in these openings. Equipment support bridges and piers will be built and installed so that the weight of the processing equipment will not be supported by the tank dome. All equipment installed in and removed from the tank will be bagged in and out to prevent the spread of contamination, maintain tank containment, and reduce worker exposure. A remote-control camera and lights system will be used to monitor the remediation processes in the tank. Some equipment used for the remediation tasks inside the tank may require periodic decontamination and routine maintenance. If it is determined to be more cost-efficient to dispose of a particular contaminated or broken component, that option will be considered.

The sludges and solids in this tank may contain quantities of TRU constituents that cannot be processed at the evaporator and will remain inside the tank. The liquids will be pumped from the waste tank to a tanker truck in 1000-gal batches (Fig. 14.14). Each batch will then be sampled and analyzed to ensure that it is not TRU waste. The batch will then be delivered to the evaporator facility. This liquid removal process will continue until all of the liquids are removed from the tank or analysis indicates levels of TRU in the liquids pumped to the tanker truck are reaching unacceptable values. The activity limit for TRU content in liquids sent to the evaporator is 3.7×10^6 Bq/kg (100 nCi/gm).

When the liquids are removed, processing of the solids in the tank will begin. These solids may be large and will likely require considerable size-reduction to produce a particle size that is small enough to remain in solution when mixed with a special grout formula that has a watery consistency. Additionally, some solids may be attached to the bottom of the tank and require processing to detach them. All of the tank remediation processes will be performed using remote operated equipment inside the tank. That equipment includes the following: a large (at least 10-ft

radial reach) robotic arm, a small (7-ft reach) robotic arm, material handling and coarse size-reduction end-effectors for the arms, end-effector storage racks, a pump with an adjustable suction leg, a material removal system, an intermediate size-reduction machine, a final size-reduction machine, mixing equipment, and a camera with lights. As many as three of these will be installed and used at one time.

The first remediation step following liquid removal is segregation and removal of material (metallic trash, etc.) that may exist from previous tank operations that cannot be processed by the size reduction equipment. If material is contaminated with sludge during removal, it will be decontaminated, packaged, and placed in the consolidation facility. The next step will be coarse size-reduction and detachment of solids from the tank bottom using the large robot arm and various end-effectors (Fig. 14.15). Intermediate size-reduction equipment will then be used with the large robotic arm and material handling tools to further reduce particle size (Fig. 14.16). The tank walls and dome will then be cleaned using spray decontamination equipment or other appropriate cleaning techniques to remove as much loose contamination as is reasonably achievable. The small robot arm will be mounted on the end of the large arm to provide better control during cleaning (Fig. 14.17). Final size-reduction will follow cleaning (Fig. 14.18). The proper amount of the special grout formula will then be injected into the tank to be mixed with the sludge and small solid particles. Mixing equipment will be used to mix the sludge, solids, and grout homogeneously. When the grout/sludge mixture has solidified and all processing equipment has been removed from the tank, the remainder of the tank will be filled with grout.

An enclosure will be built over Tank TH-4 because of the long-term duration of the remediation (Fig. 14.21) and is discussed fully in Chapter 5.0. The enclosure will include a crane for installing and removing equipment in the tanks. Attached facilities will include a change room, personnel decontamination facility, control room, small laboratory facility, and equipment decontamination facility. The enclosure will be vented in the summer and heated during winter. The attached facilities will be provided with heating and air conditioning. The enclosure is intended to provide weather protection, but also would provide some measure of confinement in the event of an airborne release or catastrophic tank dome failure. The enclosure also lends itself to security of the remediation area and will have controlled entry.

Tank W-11 has a 30-in. manhole opening, a 12-in. diameter opening, two 4-in. openings, and a 2-in. (approximate) opening to the surface. Because Tank W-11 is relatively small and there is no space to make additional openings in its dome, all remote operations will have to be conducted using existing openings.

The solids in this tank may contain quantities of TRU constituents that cannot be processed at the evaporator and will remain inside the tank. The liquids will be pumped from the waste tank to a tanker truck where it will be sampled and analyzed to ensure that it is not TRU waste. The liquid will then be delivered to the evaporator facility assuming it is below the TRU activity limit.

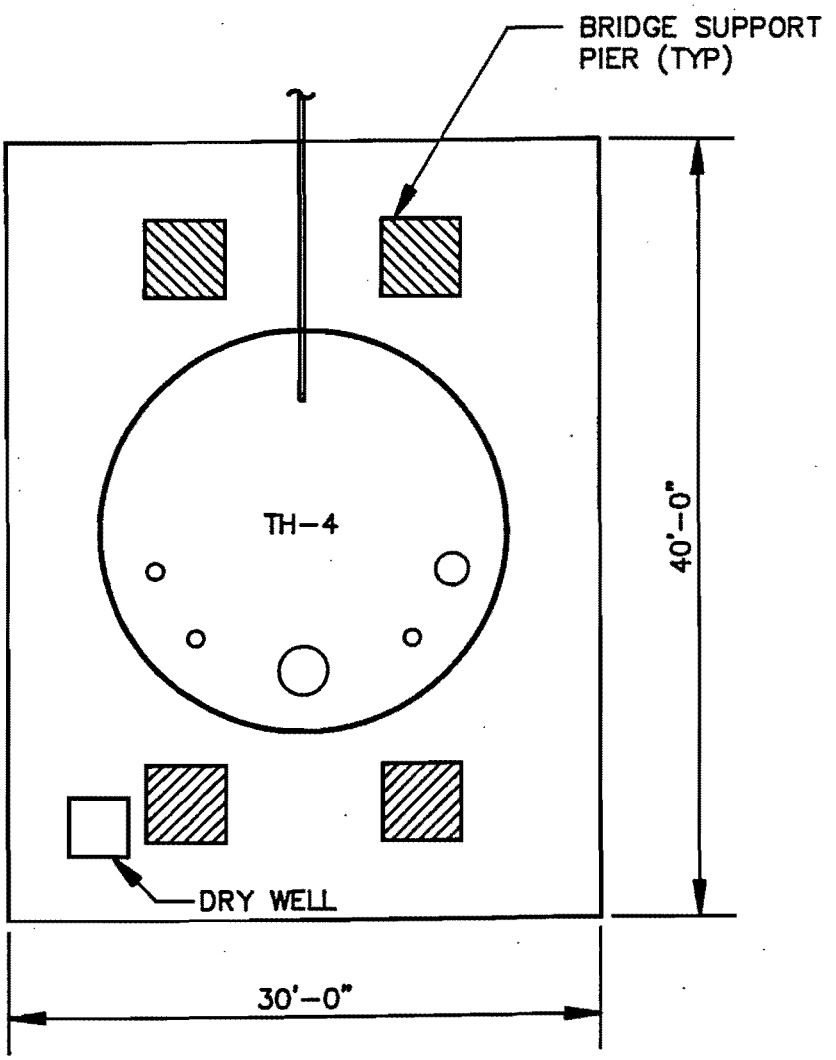


Fig. 14.21. Enclosure for Tank TH-4.

When the liquids are removed, processing of the solids in the tank will begin. These solids will require size reduction and detachment as in Tank TH-4. The same types of remote equipment used for Tank TH-4 will be used for Tank W-11 with the possible exception of the 10-ft reach robotic arm. The 7-ft reach arm will probably be able to handle all of the required remote operations in the tank. Only two pieces of equipment can be installed in the tank at one time because of limited access. This access restriction may increase the time required to complete remote operations if frequent equipment or tool changes are necessary. The relatively small size of the second opening (12-in. diameter) is a further restriction affecting equipment installation.

The remaining remediation steps for Tank W-11 are the same as for Tank TH-4 except that the 7-ft arm will take the place of the 10-ft arm.

No enclosure is planned for Tank W-11 because the time required to complete the RA for this small tank is expected to be short compared to time for Tank TH-4. Figure 14.22 shows the tank arrangement and setup for Tank W-11. Facilities required to support the RA include change rooms, personnel decontamination, control room, small laboratory, and equipment decontamination. A crane will be required to install and remove equipment in the tank.

The following assumptions were made in developing this remediation scenario and the subsequent cost estimate and schedule:

- No external secondary confinement will be required.
- Bag-in/bag-out procedures will provide sufficient confinement during equipment installation and removal.
- Almost all of the liquids can be removed from the tanks before processing the solids.
- Evaporator facility capacity will be sufficient to process the liquids resulting from this remediation.
- All supernatant liquids from the tanks and tank decontamination liquids will go to the Evaporator Facility and not to the PWTP.
- The equipment and personnel decontamination liquids will go to two locations: 90% will go to the PWTP, and 10% will go to the Evaporator Facility (LLW).
- Equipment support structures will be necessary for all of the gunite tanks to minimize stresses on the tank domes, but processing equipment may be mounted directly to tank nozzles on the steel tanks.
- Groundwater leakage to and from tanks will be reduced sufficiently by Early Actions to have no impact on the remedial action.

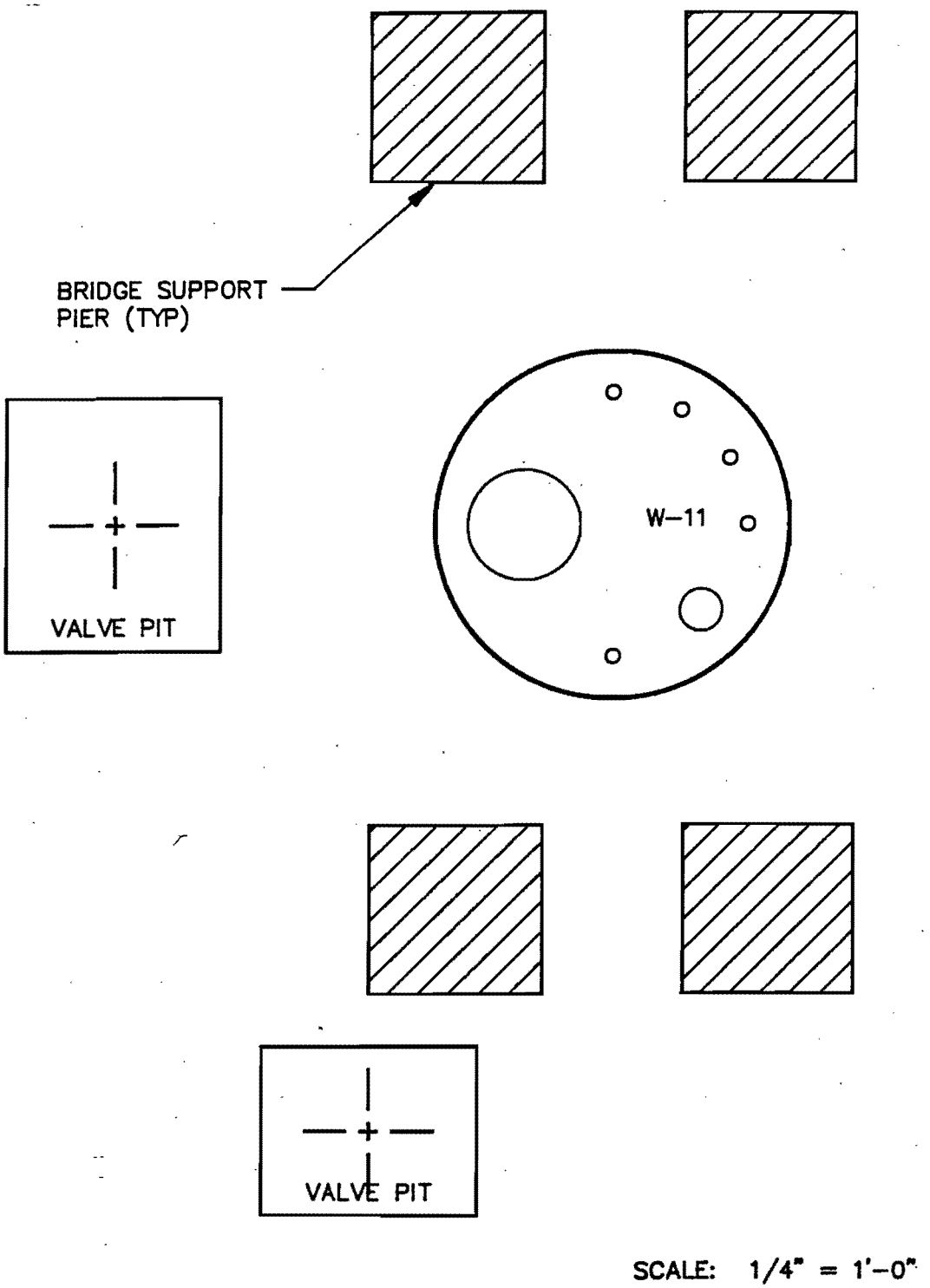


Fig. 14.22. Tank Arrangement and Setup for Tank W-11.

- All sludges and solids will be solidified in place regardless of TRU waste classification.

- Liquids removed from tanks that have levels and types of radionuclide concentrations that exceed those levels defined as TRU waste will not be sent to the evaporator, but instead will be returned to the tank.

14.4.3.6 Support Activities (1.01.41.09.05)

During the RA activities, MMES will provide the necessary staff and support personnel to operate and maintain the Personnel and Equipment Decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities and to move leachate from the consolidation area to the PWTP and the LLW for further treatment.

14.4.4 Post Construction

14.4.4.1 Post Construction Report (1.01.41.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, completion of construction activities, and effectiveness of selected remedies. MMES and the Construction Manager will be responsible for the following activities to prepare the Post Construction Report.

- Conduct an independent certification, as well as a site inspection with EPA and TDEC to determine whether the RA is complete and consistent with the (DOE) agency-approved remedies, and to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

  - a brief re-capsulation of site description, chronology of major events, and the selected remedies;

  - an explanation of construction activities, modifications, performance standards, and QC; and

  - an explanation of operation and maintenance, including monitoring, to be undertaken at the site.

14.4.5 Monitoring During Remedial Action (1.01.41.11.01)

14.4.5.1 Monitoring Plan

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program for the media around the perimeter and in the vicinity of the North and South Tank Farms and Tanks W-11 and TH-4. This plan will determine the impact of construction activities and the effectiveness of the remediation conducted.

14.4.5.2 Environmental Monitoring Program During Remedial Action (1.01.41.11.02)

MMES will implement an Environmental Monitoring Program that will:

- Start one month before start of construction in order to establish the baseline.
- Be conducted during the various Phase I and Phase II RA activities to document the impacts of remedial activities.
- Continue until after the RA is completed to (1) assess the effectiveness of the remedies implemented, (2) provide data for the Post Construction Report and Five-Year Review Plan, (3) and generate routine monitoring reports with analytical results.

14.4.6 Verification

14.4.6.1 Five-Year Review Plan (1.01.41.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s), then, in accordance with CERCLA and the FFA, an RA Assessment Plan is required in order for EPA and TDEC to review the RA no less than once every 5 years after the initiation of the final RA(s). This would ensure that human health and the environment are protected by the RA(s) being implemented. Because contaminants will remain after remediation, the A-E Contractor and MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity/status of the RA(s) implemented.

14.4.6.2 Five-Year Monitoring (1.01.41.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program, around the perimeter of waste sites to determine the impact of construction activities and the effectiveness of remediation. The results shall be documented on the monitoring reports that will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of MMES.

14.4.6.3 Five-Year Plan Assessment (1.01.41.12.03)

The data obtained during the five years of monitoring will be analyzed. The status of the RA(s) implemented at this site will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, the Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether the RA(s) implemented are still complying after 5 years with the intent and criteria established in the IROD and current regulations and policies.

14.4.7 Risks and Uncertainties

- If aboveground secondary confinement is required, the enclosure design will require significant change, and cost and schedule will be affected.

- Treatability and processability of the sludge and solids is largely unknown. Significant studies are required to analyze treatability and processability. Results of these studies and the time required to complete them will affect the cost and schedule.

- DOE Order 5820.2A allows only two options for TRU waste disposal. One is shipment to the Waste Isolation Pilot Plant (WIPP). The other allows disposal by an alternative method if that method has been approved by DOE-HQ and complies with NEPA and EPA/state regulations. If approval is not granted for in situ solidification, removal and ex situ processing of the TRU sludge and solids will be required.

- Verification that all solids have been size-reduced sufficiently will be difficult.

- Verification that the grout/sludge mixture has solidified properly throughout will be difficult. Leachability tests on core samples from the solidified mixture will likely be required and will provide some measure of verification.

- Verification that the grout and sludge have been mixed homogeneously will be difficult.

- It may prove difficult to detach solids from the tank bottoms without damaging the tank.

- It may prove difficult to clean the tank walls and dome without causing damage to the gunite. Additionally, any cleaning effort may have limited effectiveness since available data indicates the walls may be permeated from continuous exposure to LLLW and sludge.

- The maximum amount of time required to retard this type of grout mixture has been estimated at about 24 hours. If an equipment failure occurred during grout and sludge

mixing, it would be difficult to recover before the grout began setting up. If mixing were incomplete at the time of failure, unaffixed sludge would likely be left free to migrate. This could create a situation similar to that before the start of remediation.

- Complete information about the structural integrity of the tanks is not available. The possibility exists that the dome on one of the gunite tanks could collapse or the tank wall could rupture during remediation. The Early Action Tank Integrity studies should provide some more certainty about this issue. The cost and schedule could be affected by the results of these studies.

- Any changes in the RD due to the risks and uncertainties mentioned in Section 14.3.4 will have a direct effect on remediation cost.

- Difficulties may result from the fact that Tank TH-4 is about half full of sludge and solids. For example, if the grout-to-sludge ratio for this tank is too high, the tank may not be large enough to contain the mixture. In addition, the large robotic arm will have to be submerged in the sludge to accomplish some of the remediation tasks. Many difficulties will be associated with requiring the robotic arm to operate submerged in sludge.

14.4.8 Interfaces

During remediation activities, interface and coordination will be necessary with the following agencies:

- EPA — To provide regulatory overview during the RA process, to approve all primary documents, and to conduct routine inspections.

- TDEC — To provide regulatory overview for the state of Tennessee during the RA process and to conduct routine inspections.

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management — To provide waste management overview and support throughout the RA process with a focus on the minimization of RA-generated wastes. To provide the capability to process the wastes generated.

- ORNL Technical Advisory Group — To provide technical overview support during the RA process, specifically, monitoring and field-change requests.

- MMES D&D Program — To provide input and overview for the decontamination of radioactive-handling facilities.

- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division — To provide input and overview for the health and safety aspects of conducting the RA.
- Construction Manager — To provide construction support for MMES.
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.
- Independent Certification Contractor.

14.4.9 Contingent Action

A contingent action is not cost estimated for this OU since costs are allocated in WBS 90 for final closure of sludge-containing tanks. Chapter 24.0 provides a discussion of activities pertaining to tank closure.

15.0 WAG 1 SURFACE IMPOUNDMENTS OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the Surface Impoundments OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for WAG 1 Surface Impoundments OU is presented in Fig. 15.1. The summary level schedule for this OU is shown in Fig. 15.2. The cost assessment(s) of $17,046,000 for the OU is presented by remediation phase and FY in Table 15.1. TCFs are used to estimate the costs of various RI/FS tasks, as discussed for the Tank Farm OU.

15.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risks Assessment, prepare an RI Report, and perform a preliminary screening of alternatives for the following surface impoundments in WAG 1: 3513, 3524, 3539 and 3540. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 15.3. The summary level schedule for these RI WBS elements is shown in Fig. 15.4. The cost assessments of $1,383,000 for performing the RI is presented by WBS activities and FY in Table 15.2.

15.1.1 Scope and Assumptions

The primary assumption for the additional RI effort is that a baseline risks assessment and the screening of alternatives will be the only tasks required to be performed before the preparation of an RI Report based on RI data. Therefore, no additional RI data will be collected, so no RI tasks associated with field investigation activities are required.

15.1.2 Operable Unit Specific Remedial Investigation Work Plan

15.1.2.1 Planning (1.01.42.01.01)

The RI Work Plan will provide an overall technical strategy and management approach for performing the RI. It will define the scope and objectives for the RI activities, which may be accomplished either concurrently or in a phased approach. The RI work Plan documents scoping activities and includes a summary and interpretation (as appropriate) of available environmental information. It (1) addresses the potential federal and state ARARs, TBC guidance, and DQOs; (2) provides specific rationale for all field and analytical work; and (3) addresses the schedules and decision points where appropriate. The RI Work Plan will be prepared according to provisions of applicable EPA and TDEC guidance documents.

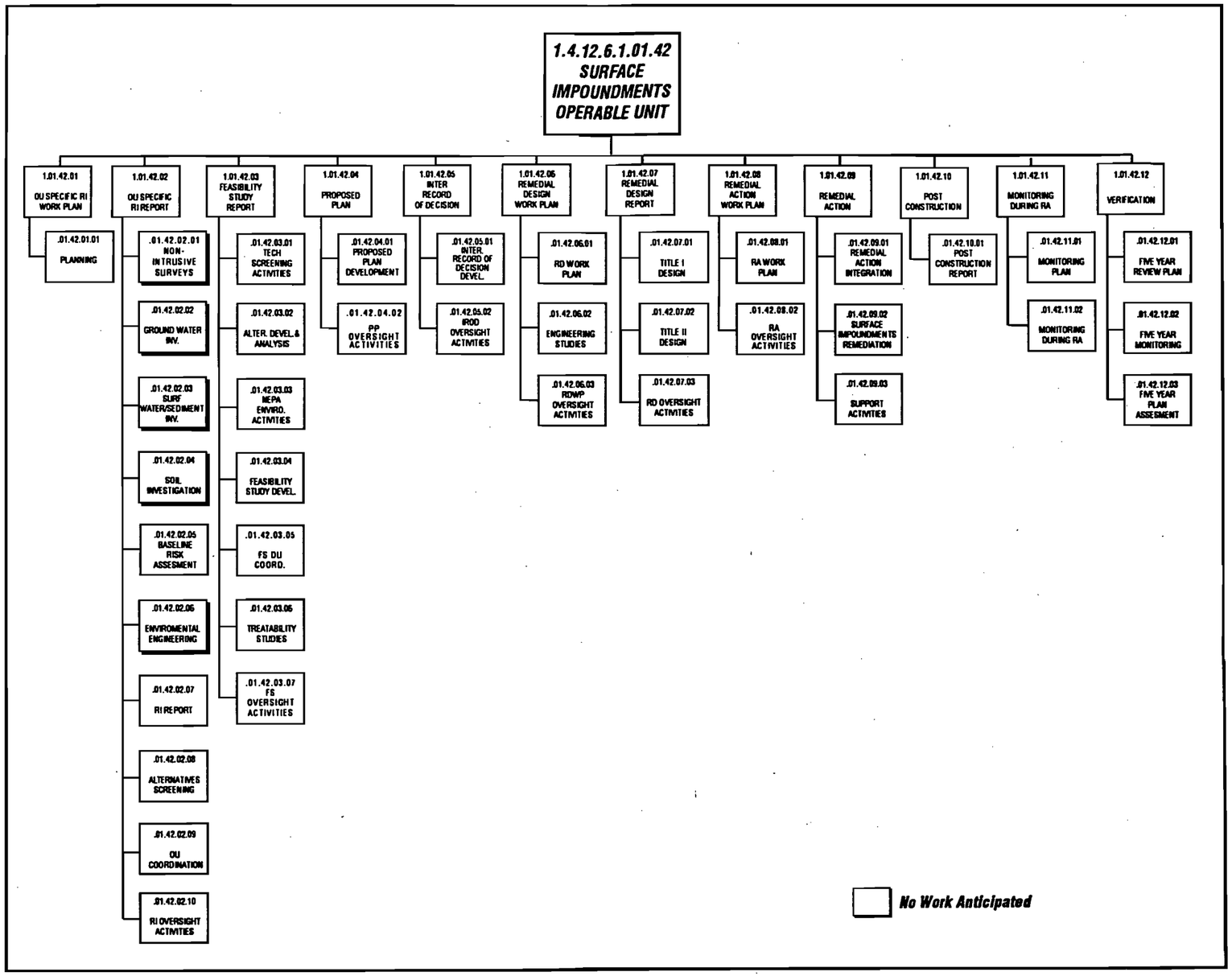


Fig. 15.1. Surface Impoundments OU Work Breakdown Structure.

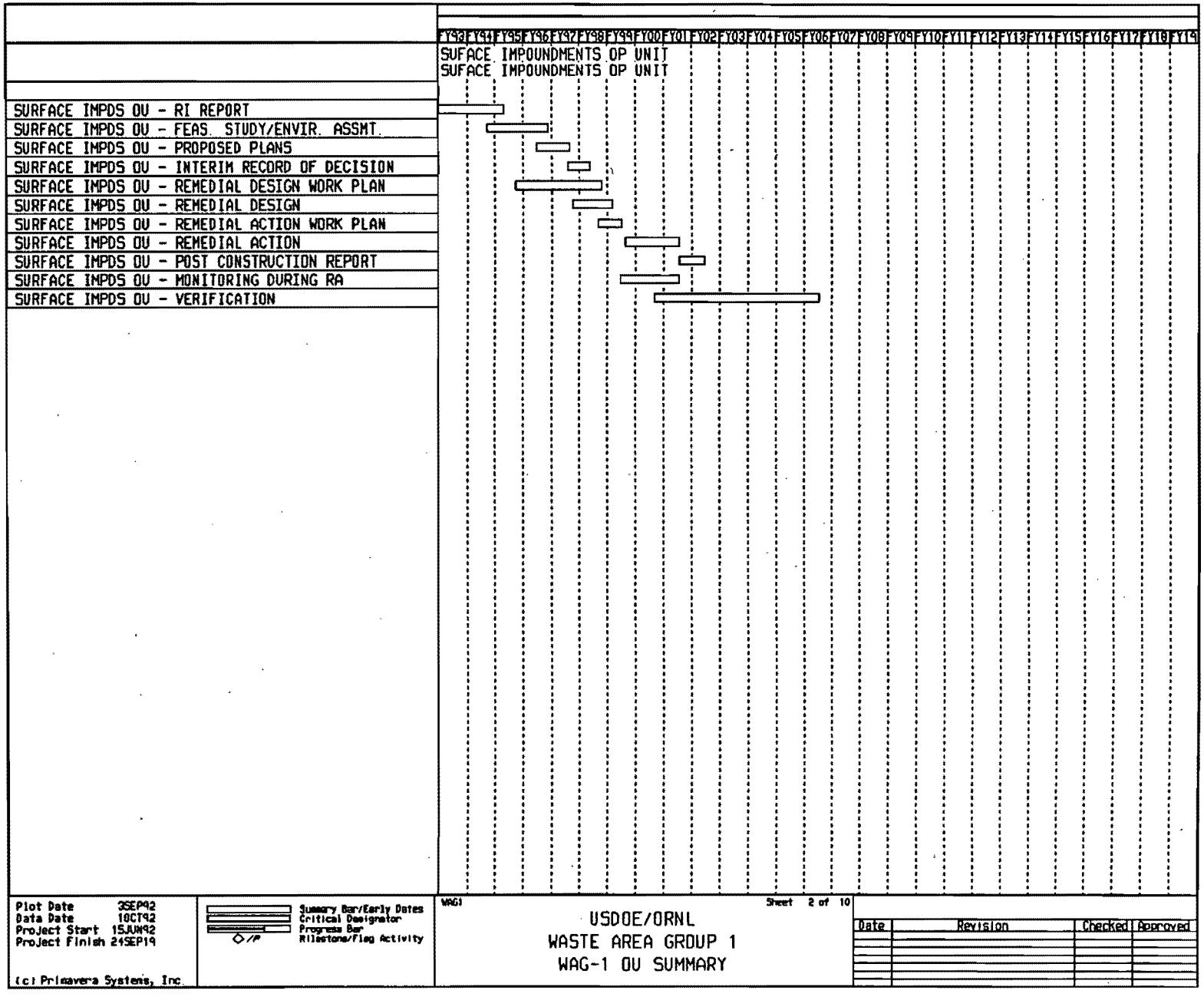


Fig. 15.2. Surface Impoundments OU Summary Level Schedule.

TABLE 15.1
WAG 1 Oper. Unit 02 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)																					
	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	TOTAL
Remedial Investigation	0	289	817	277	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,383
Feasibility Study/IROD	0	0	269	1,690	997	127	71	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,154
Remedial Design	0	0	0	147	2,111	247	1,645	137	0	0	0	0	0	0	0	0	0	0	0	0	0	4,287
Remedial Action	0	0	0	0	0	0	82	677	3,177	2,300	168	351	643	494	330	0	0	0	0	0	0	8,221
TOTALS	0	289	1,086	2,114	3,109	374	1,798	814	3,177	2,300	168	351	643	494	330	0	0	0	0	0	0	17,046

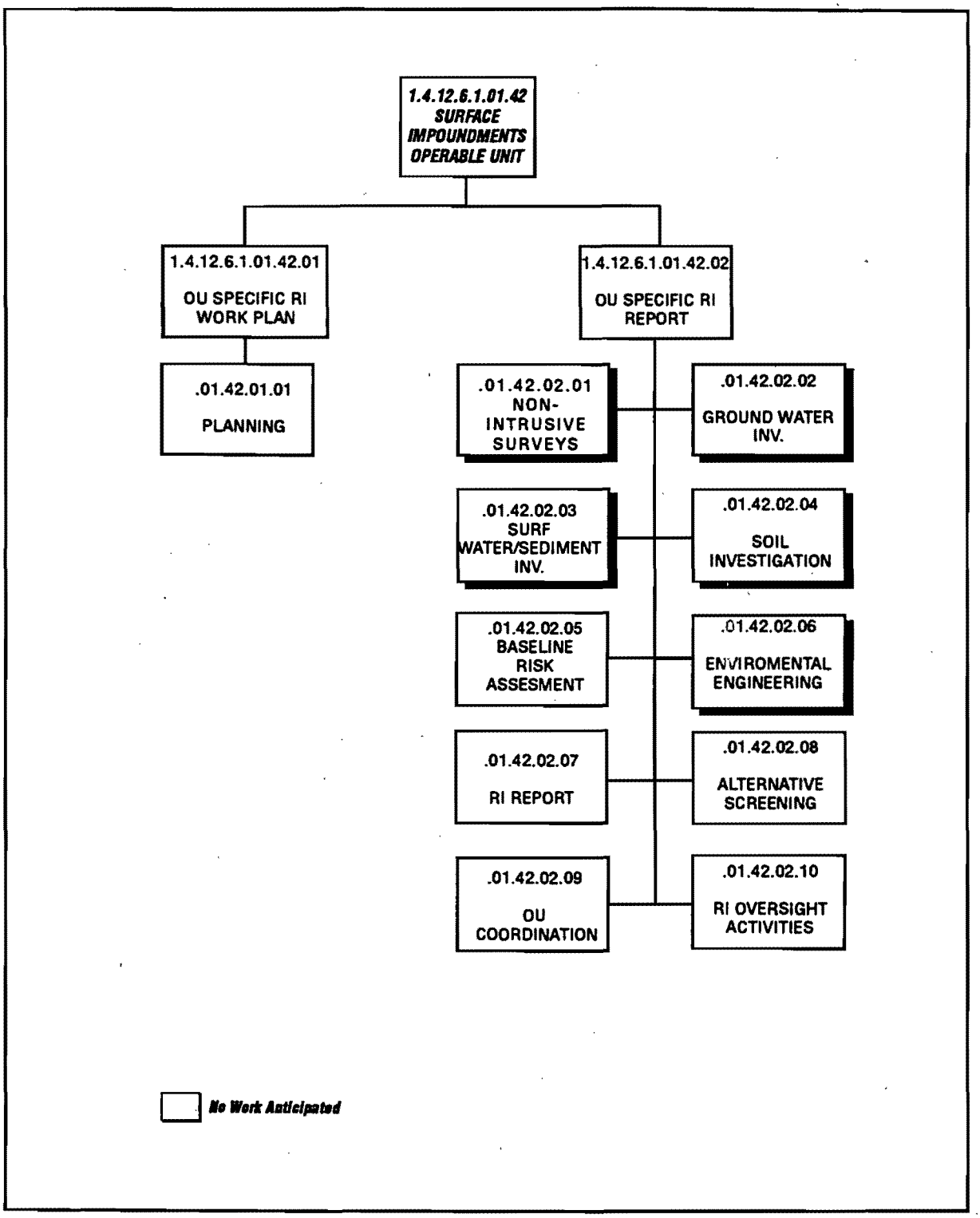


Fig. 15.3. Surface Impoundments OU RI Work Breakdown Structure.

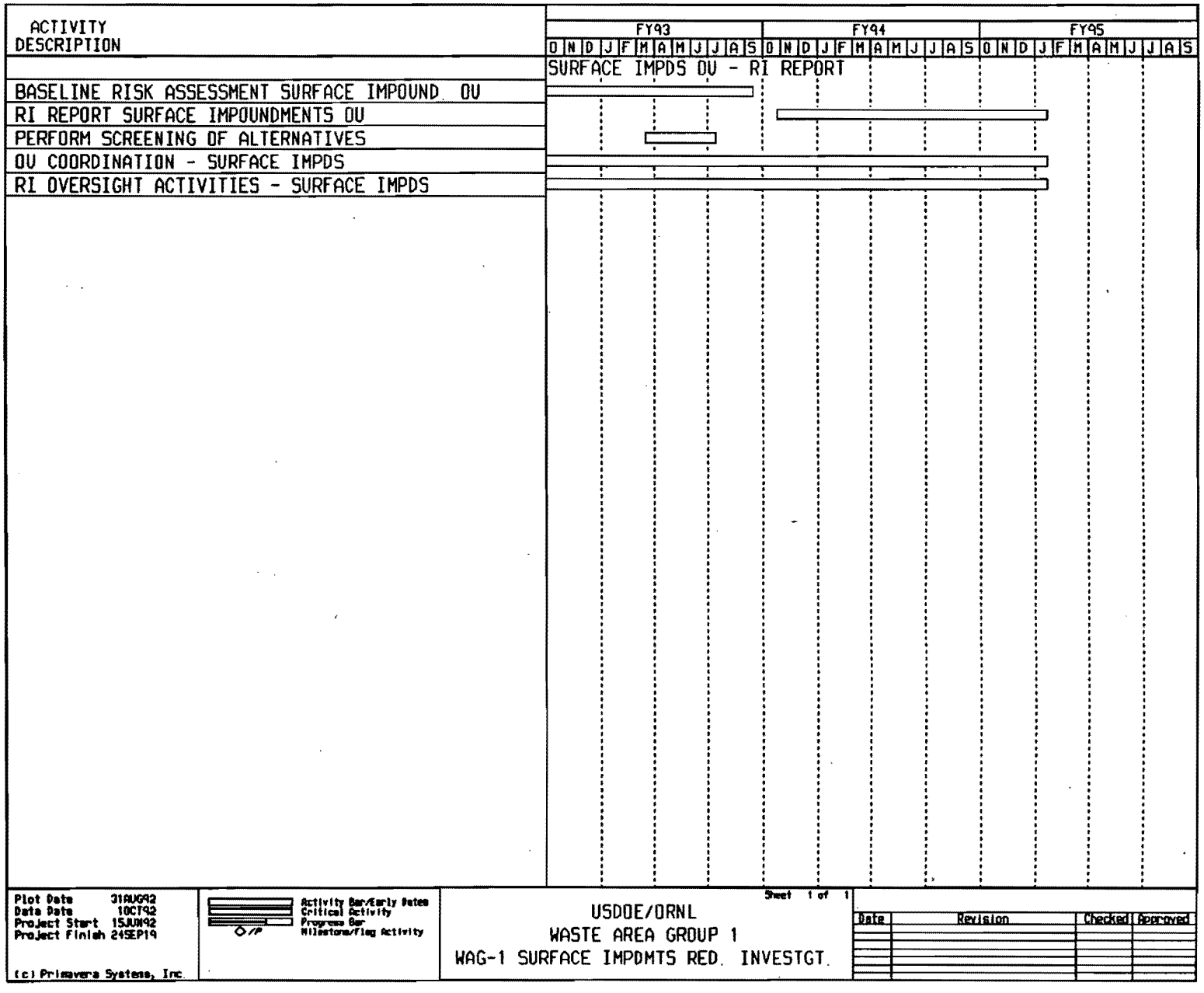


Fig. 15.4. Surface Impoundments OU RI Summary Level Schedule.

TABLE 15.2
WAG 1 Oper Unit 02 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)							
	1992	1993	1994	1995	1996	1997	1998	TOTAL
Planning	0	0	0	0	0	0	0	0
Nonintrusive Surveys	0	0	0	0	0	0	0	0
GW Investigation	0	0	0	0	0	0	0	0
SW/SED Investigation	0	0	0	0	0	0	0	0
Soil Investigation	0	0	0	0	0	0	0	0
Baseline Risk Assess.	0	116	0	0	0	0	0	116
Environ. Engineering	0	0	0	0	0	0	0	0
RI Report	0	0	111	136	0	0	0	247
Alternative Screening	0	20	0	0	0	0	0	20
RI OU Coordination	0	92	427	85	0	0	0	604
RI Oversight Activities	0	61	280	56	0	0	0	396
TOTALS	0	289	817	277	0	0	0	1,383

15.1.3 Operable Unit Specific RI Report

No additional work is anticipated for this WBS element.

15.1.3.1 Nonintrusive Surveys (1.01.42.02.01)

No additional work is anticipated for this WBS element.

15.1.3.2 Groundwater Investigation (1.01.42.02.02)

No additional work is anticipated for this WBS element.

15.1.3.3 Surface Water and Sediment Investigation (1.01.42.02.03)

No additional work is anticipated for this WBS element.

15.1.3.4 Soil Investigation (1.01.42.02.04)

No additional work is anticipated for this WBS element.

15.1.3.5 Baseline Risks Assessment (1.01.42.02.05)

A Baseline Risks Assessment for the surface impoundments will be performed and will consist of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with the surface impoundments for current and future exposure scenarios. The objectives of the environmental evaluation are to determine whether the surface impoundments pose a current or potential future risks to environmental resources in the absence of any remediation and to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

The human health evaluation will be performed in accordance with EPA's *Risks Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)* (1989). The work will include an evaluation of chemical and radiological data collected before and during the RI. An exposure assessment, a toxicity assessment, and a risks characterization will be conducted and the information will be used to compute human health risks. The average annual concentrations of radionuclides and chemicals in surface water, groundwater, soils, and sediments for current and future time periods at locations in the surface impoundments will be estimated utilizing a surface/subsurface model.

The baseline environmental evaluation will be performed to meet the requirements of Section 121 (b) (1) and (d) of CERCLA and other statutes that mandate protection of wildlife, fisheries, threatened and endangered species, and sensitive environments. Guidelines for conducting this evaluation are provided by EPA in *Risks Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (1989). The evaluation will be both a quantitive and qualitative appraisal of the actual or potential effects of this mixed waste site on plants and animals other than humans and domestic species.

15.1.3.6 Environmental Engineering

No additional work is anticipated for this WBS element.

15.1.3.7 Remedial Investigation Report (1.01.42.02.07)

The Surface Impoundments RI Report will serve as documentation of data collection and analyses in support of the Surface Impoundments FS. The results of the RI are presented as an analysis of site characteristics, the risks associated with such characteristics, and a summary of potentially feasible remedial actions. The evaluation of site characteristics will focus on the site physical characteristics, the source characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Before the issuance of the draft Surface Impoundments RI Report, a draft determination of the ARARs will be submitted to EPA and TDEC. These agencies will confer with DOE to identify and propose all potential ARARs pertinent to the remediation of the Surface Impoundments OU.

The draft Surface Impoundments RI Report will be produced for concurrent review by ORNL, DOE, EPA, and TDEC. The report will consolidate available, appropriate, and applicable data on secondary sources and will summarize technical work completed to date on the project.

15.1.3.8 Alternatives Screening (1.01.42.02.08)

The objectives of the alternatives screening are to (1) establish preliminary remediation goals and (2) develop and screen a range of alternatives.

Preliminary development and screening of remedial alternatives will be performed according to the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA/540/G-89/004) (1989). The effort consist for the following six steps:

1. Develop remedial action objectives specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed.

2. Develop general response actions for each medium of interest that may be taken to satisfy the remedial action objectives for the site.

3. Identify volumes or areas of media to which general response actions might be applied.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the site.

5. Identify and evaluate technology process options to select a representative process for each technology type retained for further consideration.

6. Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

15.1.3.9 **Operable Unit Coordination** (1.01.42.02.09)

OU coordination activities covered by this WBS element include quality control and project management and coordination. These activities will ensure that surface impoundments RI quality, cost, and scheduling goals are achieved. This element does not include those activities that support multiple WAGs tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, database management, and database interfaces with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Necessary field support needed to manage and direct RI field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes provision of required field equipment, spare parts, and other field materials and supplies.

The portion of RI and OU coordination work associated with RI activities mentioned in earlier sections was completed before October 1992. Therefore, the cost assessment(s) included in this Baseline Report reflects only 76.9% of the total cost estimated by the RI Subcontractor for this WBS element.

15.1.3.10 Remedial Investigation Oversight Activities (1.01.42.02.10)

Activities in this work element will include technical support, input, and oversight to ensure that the data and information obtained are adequate to perform the FS/EA, RD, and RA. RI oversight activities will be coordinated with the performance of the technical analyses and continue through the preparation of the associated technical memoranda. The following briefly describes the oversight roles of the various participants:

- FS Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the RD approach and design requirements.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

15.1.4 Risks and Uncertainties

Delays in the review of the Site Characterization Report would impact the initiation of the screening level risks assessment.

15.1.5 Interfaces

The following describes the primary interfaces and their anticipated roles during the RI:

- MMES Technical Advisory Group — To provide technical overview support during the RI process, specifically as to overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that MMES RI goals are achieved.

- FS Contractor — To provide sufficient data review to the RI to support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approve all primary documents.

- TDEC — To provide regulatory overview for the state of Tennessee during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

15.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents in more detail the effort necessary to perform the FS/PP/IROD process for the Surface Impoundments OU. This OU consists of four waste-storage impoundments. The FS process will include incorporating environmental concerns as an EA within the FS Report. To comply with the FFA, the process will require preparing a PP to remediate the OU and an IROD to comply with regulations. The associated risks and uncertainties and the interfaces for the FS efforts are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is shown in Fig. 15.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig. 15.6. The cost assessments of $3,154,000 for performing these portions of the Surface Impoundments OU remedial activities are summarized by WBS activity and FY in Table 15.3.

15.2.1 Scope and Assumptions

The purpose of FS/PP/IROD activities is to identify, organize, and examine remedial alternatives; to mitigate the risks identified in the RI Report; to justify selection of a preferred remedial alternative or a set of alternatives; and to prepare the regulatory required decision documents summarizing the situation and examination process, outlining the selected remediation method(s), and establishing the remediation schedule.

The FS Contractor will be responsible for completing the FS/PP/IROD process. This process will require the preparation of the following FFA milestone documents: (1) the FS Report, which documents the process used to examine the remedial technologies, selects the preferred remedial alternative(s), and incorporates the environmental (NEPA) considerations in an EA segment to satisfy administrative requirements; (2) the PP, a summary plan for implementing the selected remedial alternative(s); and (3) the IROD, the legal document that declares the selected remediation method(s) meets statutory and regulatory requirements and establishes the schedule for remediating the Surface Impoundment OUs. To implement this process and to ensure that remediation is completed according to the process, the FS Contractor will have oversight responsibilities during the RI and RD processes. The FS/PP/IROD process will be accomplished by the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities

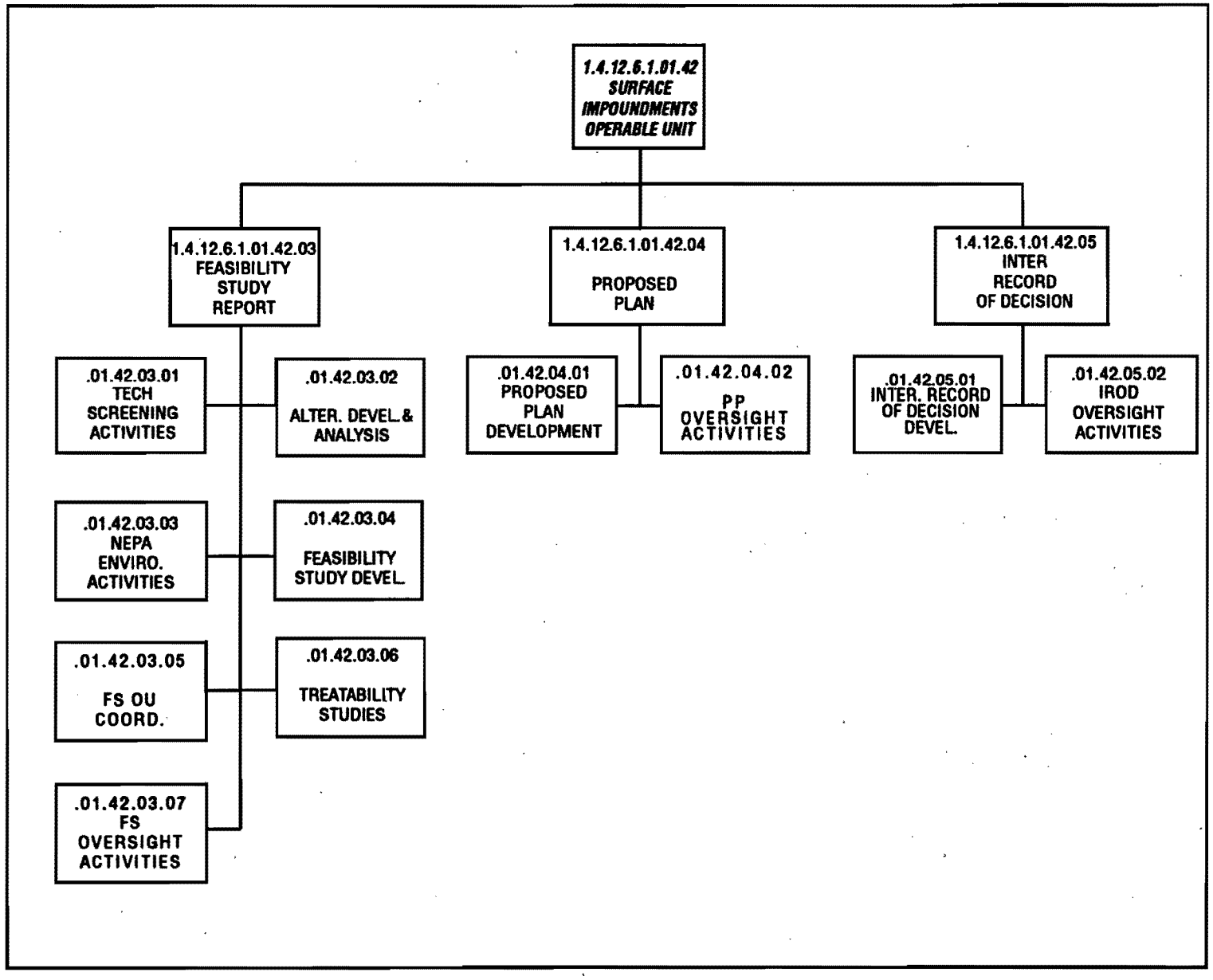


Fig. 15.5. Surface Impoundments OU FS/PP/IROD Work Breakdown Structure.

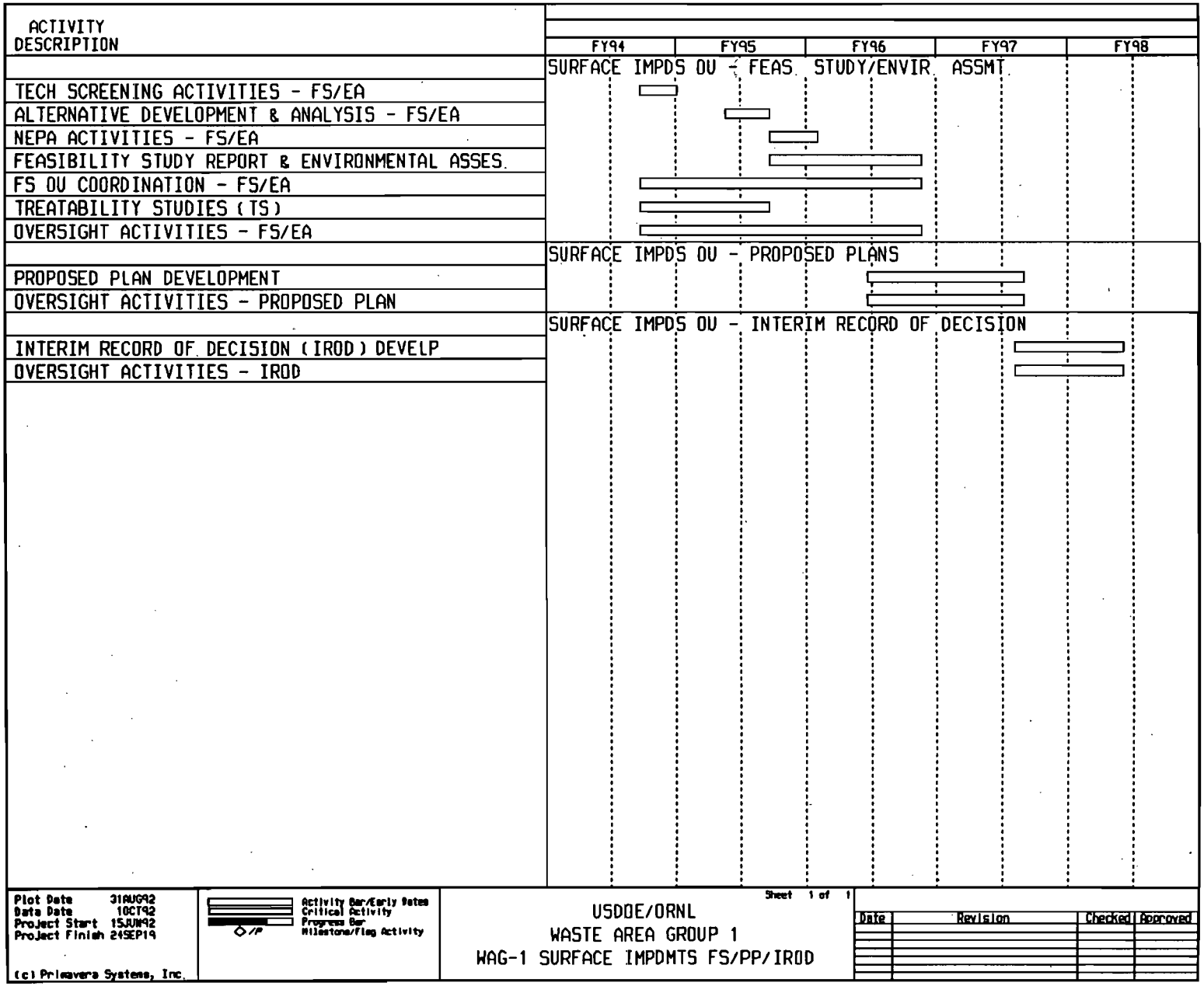


Fig. 15.6. Surface Impoundments OU FS/PP/IROD Summary Level Schedule.

TABLE 15.3
WAG 1 Oper Unit 02 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)					
	1994	1995	1996	1997	1998	TOTAL
Technology Screening	118	112	0	0	0	230
Alternatives Develop./Analysis	0	154	0	0	0	154
NEPA/Environmental Activities	0	44	29	0	0	72
Feasibility Study Development	0	55	535	0	0	589
FS OU Coordination	8	64	128	0	0	200
Treatability Study	126	1127	0	0	0	1253
FS Oversight	17	134	267	0	0	417
SUBTOTALS FS	269	1,690	958	0	0	2,917
PP Development	0	0	29	73	0	102
PP Oversight Activities	0	0	10	26	0	36
SUBTOTALS PP	0	0	39	99	0	139
IROD Development	0	0	0	19	48	67
IROD Oversight Activities	0	0	0	9	23	32
SUBTOTALS ROD	0	0	0	28	71	99
TOTALS	269	1,690	997	127	71	3,154

- Feasibility Study Development
- Feasibility Study Operable Unit Coordination
- Treatability Studies
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities.

15.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA Report are presented in the following sections. The FS/EA Report will in general follow the format in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA/540/G-89/004) (1989).

The cost assessments made for the FS WBS elements were based on the following assumptions:

- The RI Report will be completed as scheduled.
- The RI Report results are representative of the actual site conditions and adequately characterize the extent and amount of contamination in the surface impoundments.
- The FS process will be completed as scheduled in Fig. 15.6.
- The alternatives development and analysis process is completed as scheduled and is complete and considered accurate enough to proceed with the FS.
- The Baseline Risks Assessment conducted during the RI was complete enough to ensure the FS/EA team that the contents are compatible to proceed with the methodology required to complete the preferred alternative(s) specific risks calculations.
- The requirements of CERCLA and NEPA can be satisfactorily integrated into a single document.

- Working group meetings with regulatory agencies will be held as required to discuss progress and results and to obtain input and feedback to gauge the possible formal agency response.

- The regulatory agencies will concur with results from the working group meetings and the results in the technology screening technical memorandum.

- All ecological risks assessment sampling activities are completed on schedule and are representative of the actual site conditions.

- An EA of the Surface Impoundments will be completed to evaluate the environmental effects of the alternatives.

- The level of effort for this WBS element will require about 85% of the cost assessment as WAG 5.

15.2.2.1 Technology Screening Activities (1.01.42.03.01)

Based on the remedial objectives established under the ER Program and RI Report findings regarding waste- and site-specific conditions, the FS Contractor will research and identify the applicable common and innovative remediation technologies available for preliminary consideration. These technologies will be screened to eliminate those judged too difficult to implement, based on unproven technologies, judged unable to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Only those technologies judged to have a reasonable chance of success for remediation will be carried forward. The FS Contractor will issue a technical memorandum to DOE that will summarize these findings and document the research and the screening criteria and methodology.

15.2.2.2 Alternatives Development and Analysis (1.01.42.03.02)

The FS Contractor will then develop the screened technologies and arrange them into general remedial alternatives, which may be an individual technology or combinations of technologies, for further analysis. These alternatives may then be grouped or considered singularly to evaluate them quantitatively to eliminate (1) those with costs significantly higher than similar alternatives, (2) those that are judged inadequate to protect public health and safety, and/or (3) those that may adversely impact the environment. Those alternatives that meet the remedial objectives and offer protection of public health and safety will be advanced for final study in the FS process. The FS Contractor will issue a technical memorandum to DOE summarizing this task so regulatory compliance can be confirmed.

The following are assumptions considered in the development of the cost assessment for the alternative development and analysis.

- Working group meetings will be held as needed with the regulatory agencies to discuss progress. Input and feedback from these meetings can be considered as consistent with the formal agency response.

- The regulatory agencies will concur with the working group meetings and the results of the technology screening memo.

15.2.2.3 NEPA Environmental Activities (1.01.42.03.03)

To comply with the DOE policy that NEPA criteria are considered during remedial activities, the impact of the screened remedial alternatives on the environment must be evaluated. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid both duplication and conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological studies, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

The cost assessment for this element was based on the following assumptions:

- An onsite EA Report will be completed to evaluate the environmental effects of the RA.

- The Baseline Risks Assessment will describe the primary exposure pathways of concern and be complete enough to ensure that the results are compatible with the alternatives risks calculation methodology selected for the FS Report.

- All ecological risks assessment sampling activities will be completed on schedule and will be representative of the actual site conditions.

15.2.2.4 Feasibility Study Development (1.01.42.03.04)

In general, the FS Contractor will use the format presented in the CERCLA FS guidance document as the basis to develop the FS. Exceptions and modifications will be made for the specific wastes at the surface impoundments as required. The FS will be based on the information obtained from the RI findings, the technologies screening process, the alternatives screening and evaluation process, and the EA findings. The FS Contractor will use the remedial alternatives in the technical

memorandum approved by administrative and regulatory review to develop a detailed evaluation to permit the selection of a preferred alternative(s) that meets the program objective of mitigating contaminant releases. The FS Contractor will develop criteria to assess the ability of each alternative to meet the remedial objectives and to comply with administrative and regulatory requirements. The FS will be developed in sufficient detail to provide informed risks management decision and legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE, TDEC, and EPA for review. The final FS/EA Report, a milestone document required by the FFA, will be issued for approval to EPA.

15.2.2.5 **Feasibility Study Operable Unit Coordination** (1.01.42.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to support quality control efforts, to provide project management, and to coordinate project activities ensuring that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS oversight participants.

15.2.2.6 **Treatability Studies** (1.01.42.03.06)

Based on the information available for TRU Waste Characterization, the Fixed-Price Subcontractor will investigate/research the most appropriate method to treat/consolidate sludge in existing impoundments. The treatability studies will include literature searches, a treatability study work plan, sampling, testing, and preparation of the report based on the above data. MMES will provide technical input and review/comment the treatability document.

15.2.2.7 **Feasibility Study Oversight Activities** (1.01.42.03.07)

The objective of FS oversight activities is to provide technical input and oversight of the FS Contractor during the FS/EA process to ensure that the data and information obtained during the RI is appropriately incorporated into the FS/EA Report. It should also determine that the FS/EA Report is adequate and technically complete to support the preferred remedial alternative(s) for the PP and the development of an IROD and RD. FS oversight activities begin with the screening of remedial technologies and are complete upon final approval of the FS/EA Report.

A brief description of the scope of the responsibilities of each participant involved in the FS oversight follows:

- RI Subcontractor — Provides a technical review of the FS/EA Report to ensure that the alternatives considered and the remedial technologies evaluated are sufficient and consistent with the RI Report conclusions and determined risks.

- A-E Contractor — Provides technical oversight to ensure that the alternatives considered and the remedial technologies evaluated are consistent with the RD approach and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are compatible and consistent with the RA methodology and can be implemented at the site.

- MMES Planning/Coordination — Provides technical support and reviews FS/EA progress and draft deliverables to ensure that the FS/EA is being developed in a timely and efficient manner.

- MMES Technical Advisory Group — Provides technical support to the FS Team by furnishing technical expertise by necessary disciplines to support the effort. Provides an independent technical review of FS/EA progress.

15.2.3 Proposed Plan

15.2.3.1 Proposed Plan Development (1.01.42.04.01)

The RA PP to remediate the site will be prepared using the preferred remediation alternative(s) to mitigate release of contaminants as selected in the FS/EA Report and input from the regulatory agencies and the public. The PP documents the investigative process, administrative and regulatory actions, and the actions and schedule necessary to implement the remediation alternative(s). It also monitors performance. The PP is a primary milestone document that is subject to public review and response and to administrative and regulatory reviews. The cost assessment(s) for this element was based on the assumptions that the FS process and the regulatory review cycle will be completed as scheduled.

15.2.3.2 Proposed Plan Oversight Activities (1.01.42.04.02)

The objective of oversight activities during the PP process is to provide technical input and oversight of the FS Contractor to ensure that the data and information presented and the RA(s) selected in the FS/EA Report are appropriate and incorporated and documented in the PP. This data should ensure that the PP is in compliance with applicable regulations and policies. The PP should be sufficiently and technically complete to support development of the IROD and the RD. PP oversight activities begin when the FS Contractor begins its development and are complete upon final approval of the PP by the regulatory agencies. The cost assessment(s) for this element was based on the assumptions that the FS process and the regulatory review cycle schedule will be completed as scheduled.

15.2.4 Interim Record of Decision

15.2.4.1 Interim Record of Decision Development (1.01.42.05.01)

The final step in the planning process to remediate the Surface Impoundments OU will be preparation of the IROD. This is the legal document that formally declares the preferred remediation method(s) in the PP will both mitigate releases and establish the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a decision summary outlining the nature and extent of the contamination and the associated risks at the Surface Impoundments OU, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements; and (3) a responsiveness summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency for review. The final IROD is a milestone document required by the FFA.

The cost assessment(s) for this element was based on the assumption that the FS/EA and PP schedules were followed.

15.2.4.2 Interim Record of Decision Oversight Activities (1.01.42.05.02)

The objective of oversight activities during the IROD process is to provide technical input and oversight of the FS Contractor to ensure that the IROD appropriately incorporates and documents the data and information presented in the FS/EA Report and the PP and that it is adequate and technically complete to support the development of the IROD and the RD. IROD oversight activities begin when the FS Contractor begins IROD development after approval of the PP and are complete upon final approval and signing of the IROD by the regulatory agencies and DOE.

15.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the FS/PP/IROD process for the Surface Impoundments OU are scheduling and the scoping of the defined activities. Other risks are approval of the FS/EA and the public and regulatory review and comment. Minor scheduling changes will significantly impact the labor and material/equipment cost of the project. Schedule delays caused by funding and the availability of skilled labor and/or the lack of proven remedial technologies could increase the total project cost greatly as the duration of the project is extended. Even minor interruptions in the review cycle changes may impact the schedule and the labor cost. Although the total project cost will not increase substantially, any delays in approval of the PP and the IROD will impact the total project duration. If additional IRODs or Early Actions are required in the surface impoundments, the total cost of the project will increase. Other factors that increase the uncertainty of the cost assessments in this report include the following:

- Administrative requirements and/or regulatory decisions that prevent waste sludges from remaining within the impoundments.

- The chemical composition of the sludge in the surface impoundments may severely restrict any remediation options and require more expensive solidification technologies and the installation of physical barriers to prevent migration.

- Requirements to increase ALARA guidelines for the ORNL personnel in nearby facilities would significantly increase costs and impact the schedule.

- Requirements for additional sampling activities or treatability studies.

- Extended review cycles initiated by the regulators.

- Program funding limitations within the DOE system.

15.2.6 Interfaces

Completion of the Surface Impoundments FS/EA process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.

- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.

- NEPA — Provides regulations that set the policies and goals for protecting environmental quality and establishes the procedures to examine the impact that decisions on remediating may have on the environment.

- TDEC — Provides regulatory overview for the state of Tennessee.

- EPA — Provides regulatory overview for compliance with federal regulations.

- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.

- ORNL Office of Radiation Protection — Provides for radiation monitoring and environmental surveillance.

- DOE TRU Waste Management — provides for the management and retrieval of TRU waste stored at DOE facilities for eventual packaging at WHPP and storage at WIPP.

- Public Factions — Require access, review, and response for the public review of the administrative record and any proposed RA.

- ORNL Groundwater Program.

15.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the Surface Impoundments: an RD Work Plan, engineering studies as required, a Title I 30% design package, Title II 60% and 90% design packages, and final design reports. The risks and uncertainties and interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 15.7. The summary level schedule for the RD WBS elements is shown in Fig. 15.8. Table 15.4 shows the cost assessments of $4,287,000 for performing this portion of the Surface Impoundments remedial activities summarized by WBS activity and FY.

15.3.1 Scope and Assumptions

The scope of the RD work for the remediation of these impoundments is to prepare necessary design and supporting documents that implement all RA activities. Approval is required from DOE-OR, DOE-HQ, TDEC, and EPA.

Details on the scope of work and assumptions associated with the RD WBS that the RD A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the Surface Impoundment RAs are described in Chapter 4.

Figure 15.9 depicts the schedule logic for completion of the RD effort required to support a construction start in 15 months from IROD approval.

15.3.2 Remedial Design Work Plan

15.3.2.1 Remedial Design Work Plan (1.01.42.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The RD A-E Contractor will prepare a draft RD Work Plan based upon the scope and design criteria specified in the PP and IROD documents. The RD Work Plan will include the detailed design process and schedule for the following remediation design efforts:

- Stabilizing the sediments.

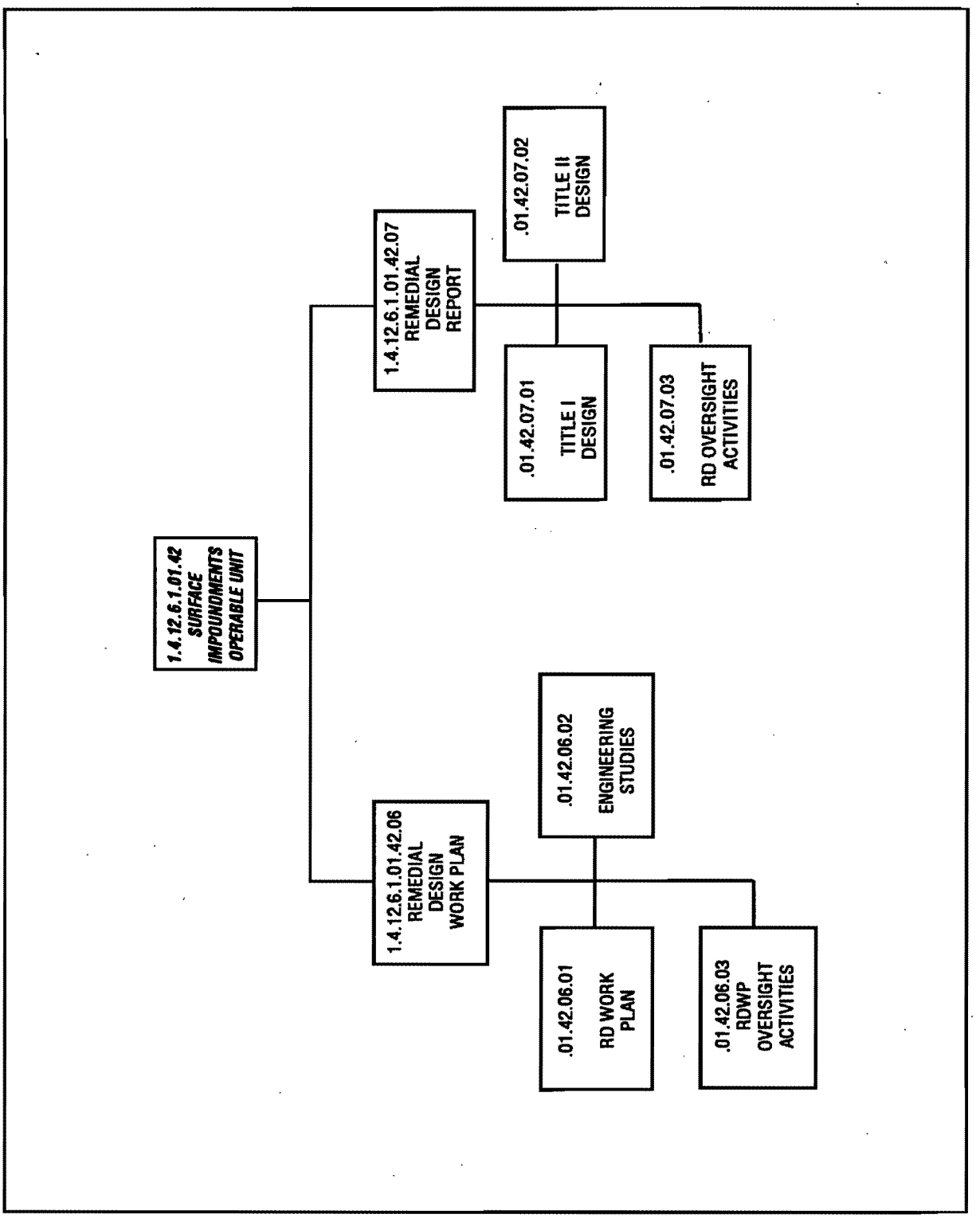


Fig. 15.7. Surface Impoundments RD Work Breakdown Structure.

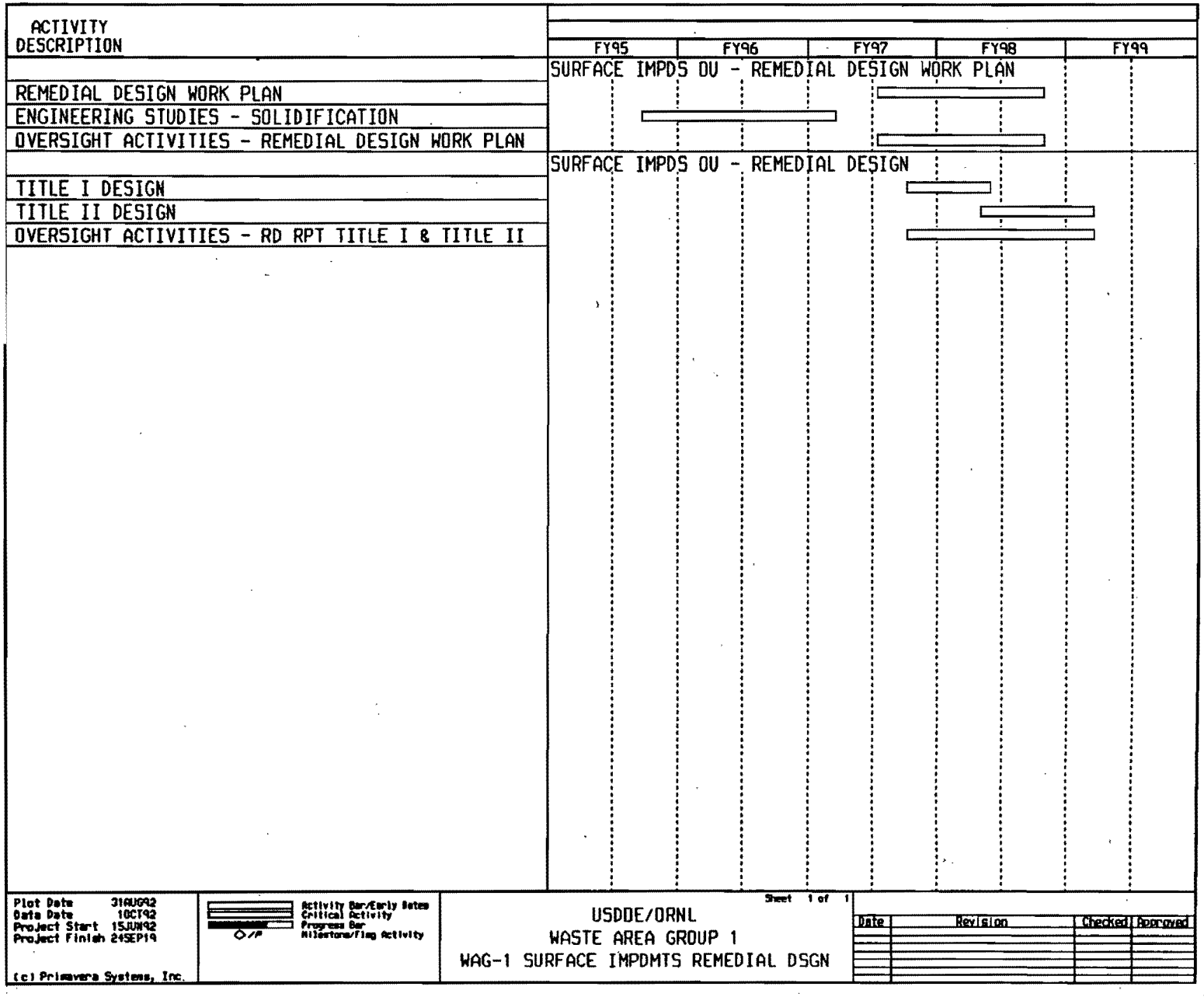


Fig. 15.8. Surface Impoundments RD Summary Level Schedule.

TABLE 15.4
WAG 1 Oper Unit 02 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	1995	1996	1997	1998	1999	TOTAL
Remedial Design Work Plan	0	0	19	189	0	208
Engineering Studies	147	2,111	151	0	0	2,409
RD WP Oversight Activities	0	0	48	466	0	513
SUBTOTALS RD WP	147	2,111	218	655	0	2,476
Remedial Design Phase I Title I	0	0	20	194	0	214
Remedial Design Phase I Title II	0	0	0	289	85	374
Remedial Design Phase II Title I	0	0	0	0	0	0
Remedial Design Phase II Title II	0	0	0	0	0	0
RD Oversight Activities	0	0	9	507	52	568
SUBTOTALS RD	0	0	29	990	137	1,157
TOTALS	147	2,111	247	1,645	137	4,287

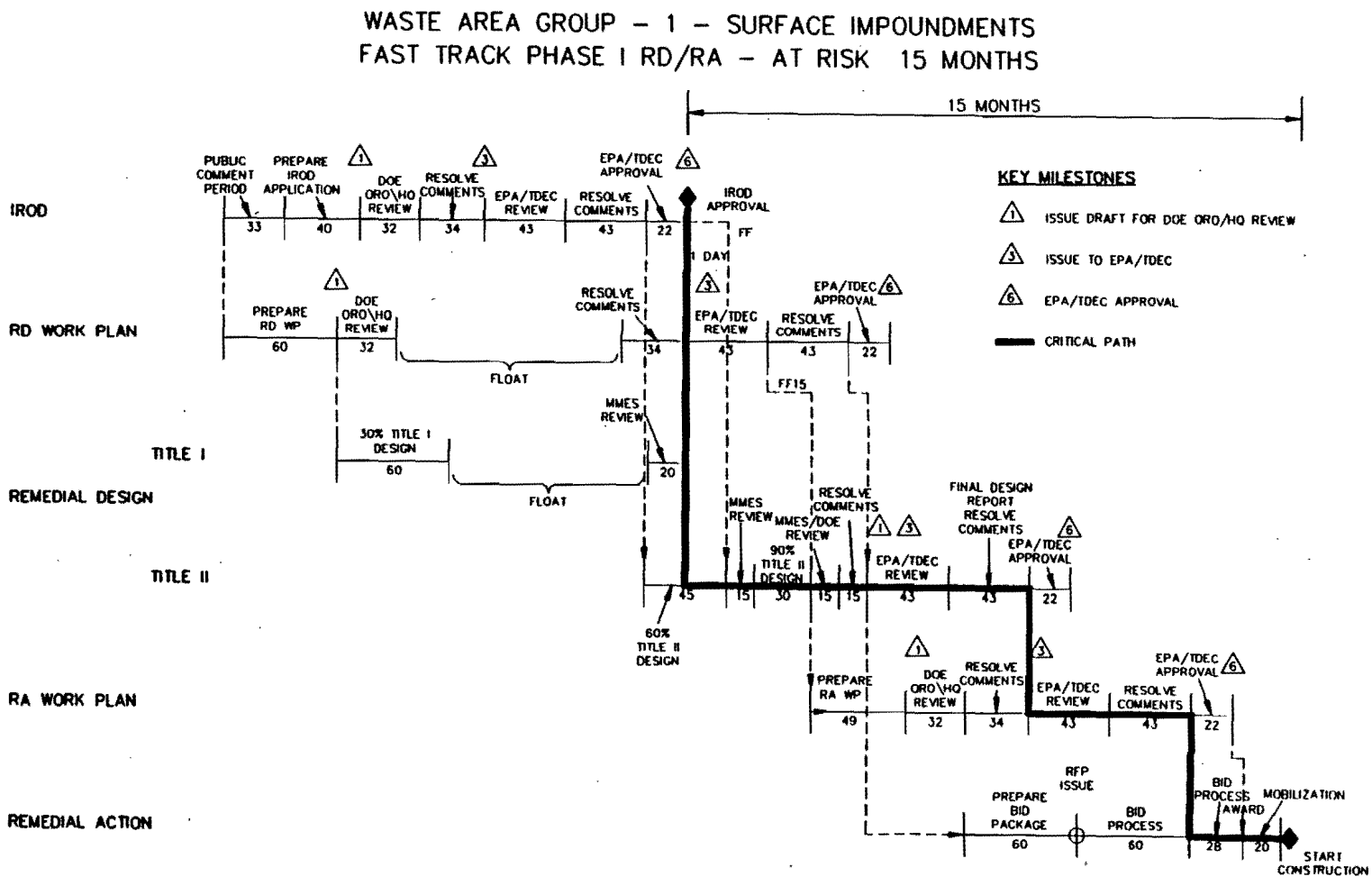


Fig. 15.9. Surface Impoundments OU Phase I Schedule Logic.

- Backfilling with clean soil.
- Constructing a cap over Waste Holding Basin 3513, Equalization Basin 3524, and Process Waste Ponds 3539 and 3540.

15.3.2.2 Engineering Studies (1.01.42.06.02)

Before and during Title I design, research into recent advancements in remedial technologies and construction techniques and/or engineering studies on new equipment performance and effectiveness will be conducted as outlined in the RD Work Plan. These studies of various vendors and equipment available in the environmental market are required in order to narrow equipment options and to select the most economically and technically superior methodologies that can achieve the selected remedy in the IROD for incorporation into the Title I and Title II designs.

An assumption was made for baseline cost estimating purposes. This assumption indicates that the sediments in the surface impoundments could be stabilized in place by mixing with cement grout. To properly estimate the quantities and characteristics of the cement grout and the equipment requirements for mixing, stabilization tests will be required. If initial tests are not successful, then other stabilizing agents or methods for mixing may have to be tested.

15.3.2.3 Remedial Design Work Plan Oversight Activities (1.01.42.06.03)

Technical input will be provided during the preparation of the RD Work Plan to ensure that the design does not violate the intent of the IROD and will comply with the administrative and regulatory requirements. The work plan will be drafted by the remedial design contractor with review being conducted by the FS Contractor, MMES, and DOE. Based on the logic shown in Fig. 15.9, the design effort will start after the RD Work Plan is prepared and will be nearly completed before EPA approval. Section 15.3.4 discusses risks and uncertainties associated with this strategy.

15.3.3 Remedial Design Report

15.3.3.1 Title I Design (1.01.42.07.01)

Based on the engineering studies and other information available from the RI/FS, the RD A-E Contractor will prepare preliminary (30%) design documents showing the extent of remedial activities, site plan, details, and outline of specifications for the work involved. A detailed cost estimate for the construction will be submitted with the 30% design document to MMES for review/comments/approval.

In order to support construction start within 15 months of IROD approval, Title I design must begin during the IROD preparation and approval process.

15.3.3.2 **Title II Design** (1.01.42.07.02)

Upon approval of the Title I design document, the RD A-E Contractor will prepare detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction, construction drawings, technical specifications, and cost estimates.

All the documents will be submitted at 60% completion to the facility Manager for comments. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and DOE. Upon resolution of these comments, the 100% design package will be issued to TDEC and EPA for further review/comments/approval. Upon resolution of TDEC and EPA comments, the RA Design Report will be prepared and issued CFC.

The cost assessments for the Title I and Title II design was developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Any additional design/permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Specific conditions or waste characteristics in the surface impoundments will allow for in situ stabilization of sediments.
- A support facility is already constructed that will produce grout for use in solidifying surface impoundments.
- Other support facilities are available for personnel decontamination and equipment decontamination.
- A consolidation area (or other disposal facility) is available for disposal of LLW generated during remediation.

15.3.3.3 **Remedial Design Oversight Activities** (1.01.42.07.03)

During the review of the 30%, 60%, and 90% design documents, the following participants will provide oversight and technical input to help submit the final design document to both DOE and EPA in the given time frame:

- FS Contractor — Ensures that the RD document is consistent with the FFA, FS/EA, PP, and IROD.

- MMES — Reviews all design drawings/calculations and ensures that the RD document meets all administrative and regulatory requirements.

- Construction Manager — Reviews the design drawings for constructability concerns and compliance with codes and regulations.

15.3.4 Risks and Uncertainties

The primary risks and uncertainties associated with RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the remedial design and, therefore, cost.

- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have significant impact on RD and remediation work.

- The findings and conclusions in the final RI and FS/EA documents may impact the scope of RD work.

- Regulatory approval is granted for leaving sludges within the surface impoundments.

- Title II design is completed before approval of the RD Work Plan by EPA. EPA comments to the RD Work Plan could adversely impact completion of RD.

- Title II design is started before IROD approval by EPA. The risks are lessened by the fact that comments should be resolved before the start of Title II design.

15.3.5 Interfaces

The RD documents required for the remediation of the surface impoundments will require the coordination and close interface with the following participants:

- EPA — To provide regulatory overview during the RD process and approve all primary documents.

- TDEC — To provide regulatory overview for the state of Tennessee during the RD process.

- DOE — To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management Division — To provide waste management overview of design considerations for waste generation, handling, and storage/disposal.
- MMES Technical Advisory Group — To provide technical overview support during the RD process, i.e., engineering studies and design criteria.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES Environment, Safety and Health Division — To provide input and overview for the ES&H aspects for implementation of design.
- RA Construction Manager — To provide constructibility reviews of design.
- RD Contractor — To draft the RD Work Plan.

15.4 REMEDIAL ACTION

This section presents the scope of the RA activities required to implement stabilization of sediments and capping of surface impoundments. The risks and uncertainties and interface issues for the remedial activities are identified as well.

The WBS developed for performing the RA is presented in Fig. 15.10. The summary level schedule for these RA WBS elements is shown in Fig. 15.11. The cost assessments of $8,221,000 for performing this portion of the WAG 1 OU2 remediation activities summarized by WBS activity and FY is shown in Table 15.5.

15.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan, construction management, Title III services, construction of the six remediation design packages, construction support, independent certification, and verification (which includes monitoring and a 5-year review).

15.4.2 Remedial Action Work Plan

15.4.2.1 Remedial Action Work Plan (1.01.42.08.01)

The Construction Manager will prepare the draft RA Work Plan that defines the scope and objectives of the RA. This draft is based upon the IROD and final remedial design. It documents the specific construction components of the RA and presents the RA schedule, subcontracting strategy, QA Plan, ES&H Plan, and RA Monitoring Plan.

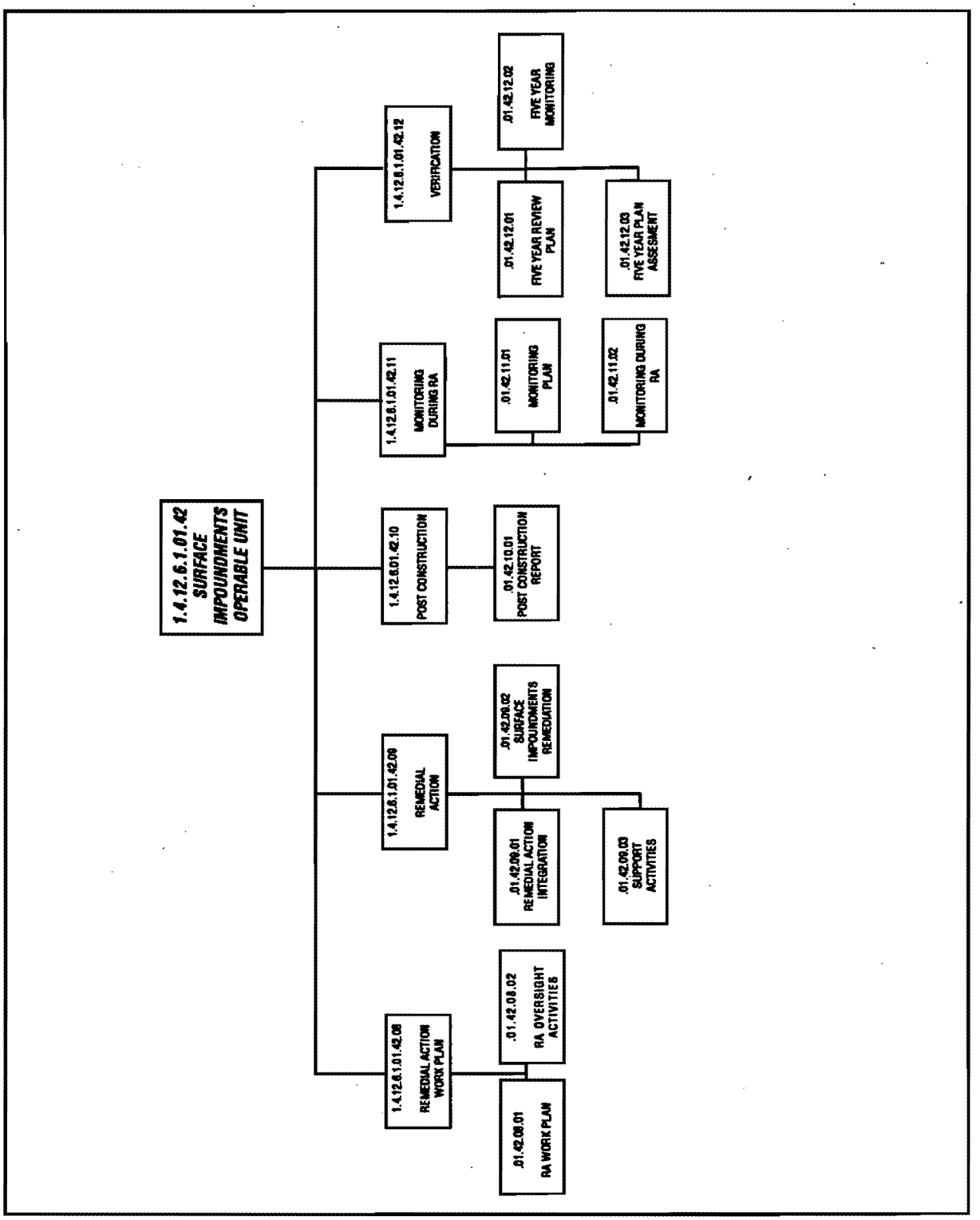


Fig. 15.10. Surface Impoundments OU RA Work Breakdown Structure.

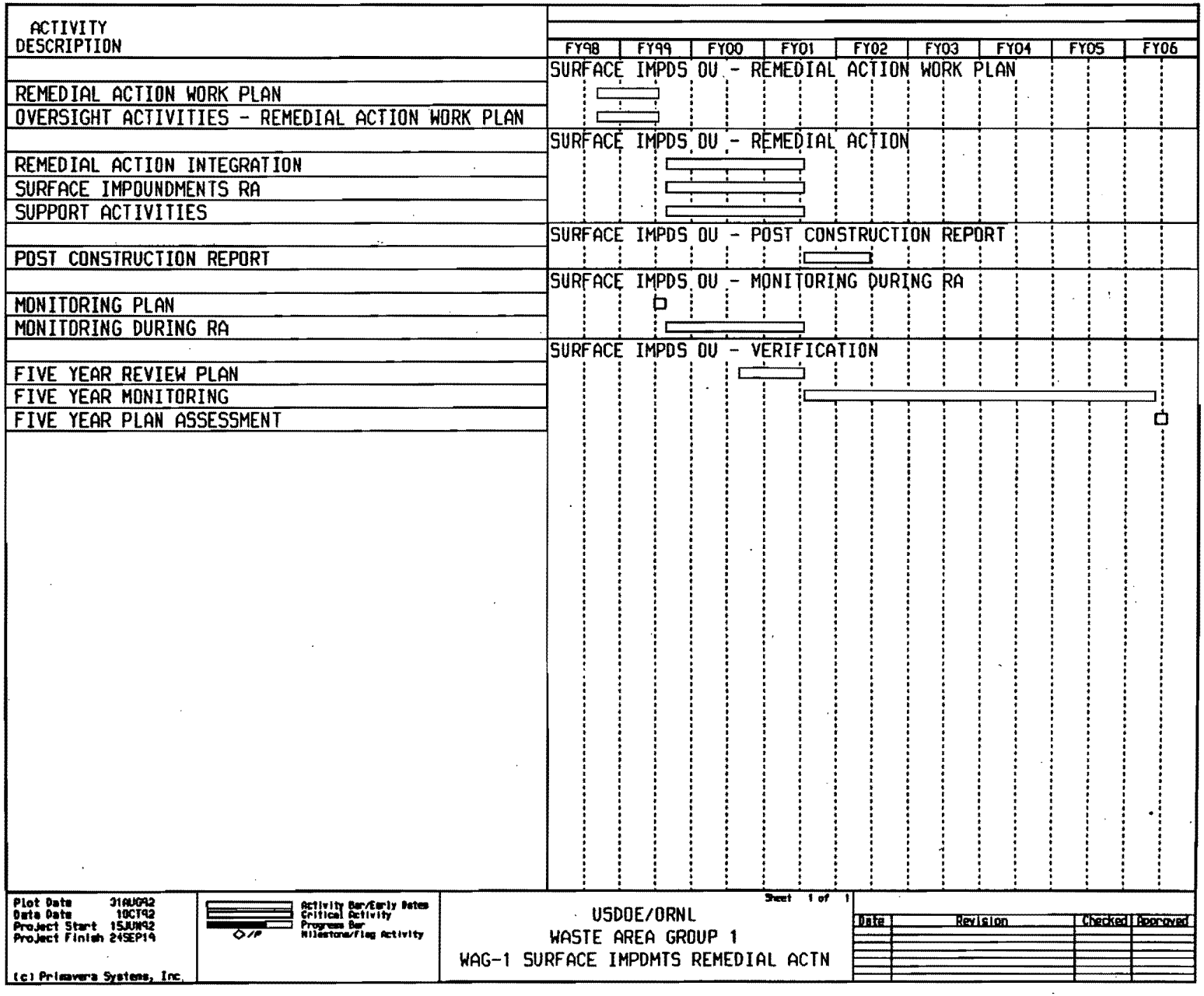


Fig. 15.11. Surface Impoundments OU RA Summary Level Schedule.

TABLE 15.5
WAG 1 Oper Unit 02 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)													
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	TOTAL
RA Work Plan	69	381	0	0	0	0	0	0	0	0	0	0	0	450
RA WP Oversight Activities	13	74	0	0	0	0	0	0	0	0	0	0	0	88
SUBTOTALS RD WP	82	455	0	0	0	0	0	0	0	0	0	0	0	537
RA Integration	0	27	489	338	0	0	0	0	0	0	0	0	0	854
Remedial Action	0	128	2,297	1,586	0	0	0	0	0	0	0	0	0	4,011
Post Construction Report	0	0	0	24	61	0	0	0	0	0	0	0	0	85
Monitoring During RA	0	67	377	260	0	0	0	0	0	0	0	0	0	704
Verification	0	0	15	91	107	351	643	494	330	0	0	0	0	2,031
SUBTOTALS RA	0	222	3,177	2,300	168	351	643	494	330	0	0	0	0	7,684
TOTALS	82	677	3,177	2,300	168	351	643	494	330	0	0	0	0	8,221

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

15.4.2.2 Remedial Action Work Plan Oversight Activities (1.01.42.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA Work Plan. During the preparation of the draft RA Work Plan, MMES and the A-E Contractor responsible for the approved design report will (1) provide necessary coordination and (2) review the RA Work Plan to ensure that the proposed construction efforts will implement the IROD as presented in the final RD reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

15.4.3 Remedial Action

15.4.3.1 Remedial Action Integration (1.01.42.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E Contractor and construction support as required.

RA integration for remedial activities includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule, in accordance with all technical requirements, and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

15.4.3.2 Surface Impoundments Remediation (1.01.42.09.02)

The surface impoundments in WAG-1 are located south of South Side Drive, east of Third Street, and north of White Oak Creek. The four impoundments are the Waste Holding Basin (3513), the Equalization Basin (3524), and the Process Waste Ponds (3539 and 3540). The RA for these basins consists of stabilizing sediments with cement grout and constructing a multilayer cap. The liquids pumped from the basins will go to the PWTP.

The Waste Holding Basin (3513) is approximately 220 ft by 220 ft at the water surface sloping to 200 ft by 200 ft at the bottom. The storage capacity is approximately 1,880,000 gal. Sediment depths in the basin have been measured and range from 1.6 ft to 3.3 ft. For estimating purposes, an average depth of 2.5 ft was used. The basin will be back-filled with enough soil to provide a firm base for operation of stabilization equipment, as well as provide sufficient radiation shielding. Sediments will be stabilized with cement using an auger type mixer suspended from a crane. By this method the mixing depth can be controlled. Therefore, sediments may be mixed thoroughly with cement without drawing much of the radioactive material to the surface. Following stabilization, backfill will be compacted and a multilayer cap will be constructed as shown in Fig. 15.12.

The Equalization Basin (3524) is approximately 95 ft by 250 ft at the water surface with a storage capacity of 1,000,000 gal. Sediment depths range from 1 to 4 ft. An average depth of 2.6 ft was used for estimating purposes. The RA for this basin mirrors that presented above for the Waste Holding Basin (3513).

For the Process Waste Ponds (3539 and 3540), the RA activities differ somewhat. Both ponds are approximately 65 ft by 90 ft at the top of berm and 8 ft deep. Sediment depths are estimated to be between 1 in. and 4 in. For the cost assessment, a sediment depth of 4 in. was used. The pond-side slopes are lined with riprap, which must be removed before sediment stabilization. Sediments will be mixed with cement using an auger type mixer suspended from a crane. Following stabilization, the impoundments will be back-filled and multilayer caps will also be constructed as shown in Fig. 15.12.

The following assumptions were made in developing this remediation scenario and the subsequent cost estimate and schedule:

- Back-filling impoundments such as the Waste Holding Basin (3513) and the Equalization Basin (3524) can be accomplished without displacing sediments.
- The PWTP capacity will be sufficient to process water drawn out of the impoundments.
- All water from the impoundments will go to the PWTP, not the evaporator facility.
- All sediments will be solidified in place regardless of TRU waste classification.

15.4.3.3 **Support Activities** (1.01.42.09.03)

During the RA activities, MMES will provide the necessary staff and support to operate and maintain the Personnel and Equipment Decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities from the new Consolidation Area to the PWTP for further treatment.

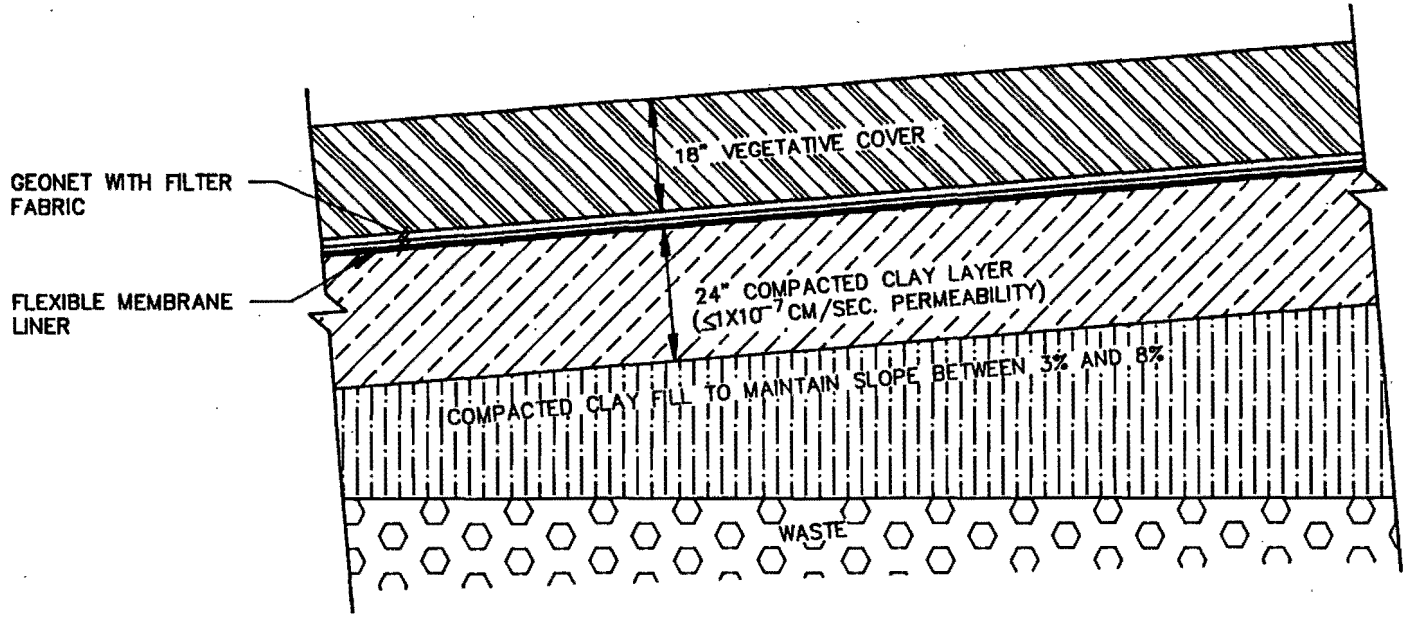


Fig. 15.12. Typical Cross Section of Multilayer Cap.

15.4.4 Post Construction

15.4.4.1 Post Construction Report (1.01.42.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, completion of construction activities, and effectiveness of selected remedies. MMES and the Construction Manager will be responsible for the following activities to prepare the Post Construction Report.

- Conduct a site inspection with EPA and TDEC to determine whether the RA is complete and consistent with the agency-approved remedies and to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

  - brief re-capsulation of site description, chronology of major events, and the selected remedies;

  - explanation of construction activities, modifications, performance standards, and QC; and

  - explanation of operation and maintenance, including monitoring, to be undertaken at the site.

15.4.5 Monitoring During Remedial Action

15.4.5.1 Monitoring Plan (1.01.42.11.01)

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of the remediation conducted.

15.4.5.2 Monitoring During Remedial Action (1.01.42.11.02)

MMES will implement an Environmental Monitoring Program that will accomplish the following:

- Start 1 month before start of construction in order to establish the baseline.

- Be conducted during the various RA activities to document the impacts of remedial activities.

- Continue until the RA activities are completed to assess the effectiveness of the remedies implemented and to provide data for the Post Construction Report and Five-Year Review Plan.

- Generate routine monitoring reports with analytical results.

15.4.6 Verification

15.4.6.1 **Five-Year Review Plan** (1.01.42.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s); then, in accordance with CERCLA and the FFA, an RA Assessment Plan is required in order for EPA and TDEC to review the RA activities no less than once every 5 years after the initiation of the final RA(s). This would ensure that human health and the environment are protected by the RA(s) being implemented. Because contaminants will remain after remediation, the A-E Contractor and MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity/status of the RA(s) implemented.

15.4.6.2 **Five-Year Monitoring** (1.01.42.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program. This would determine the impact of construction activities and the effectiveness of remediation. The results shall be documented on the monitoring reports, which will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of MMES.

15.4.6.3 **Five-Year Plan Assessment** (1.01.42.12.03)

The data obtained during the 5 years of monitoring will be analyzed. The status of the RA(s) implemented at the Surface Impoundment OU will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, the Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether the RA(s) implemented are still in compliance after 5 years with the intent and criteria established in the IROD and current regulations and policies.

15.4.7 Risks and Uncertainties

The primary risks and uncertainties associated with the RA activities are as follows:

- During stabilization tests, cement grout may be determined to be incompatible with the sludges present. In which case, significant studies will be required to assess

treatability with other stabilizing agents. Results of these studies and the time required to complete them will affect the cost and schedule.

- The method of mixing in situ may prove to be ineffective for achieving a homogeneous solid. Other mixing methods would have to be studied. The cost and schedule will be affected by a change in mixing method.

- Verification that the grout/sludge mixture has solidified properly throughout will be difficult. Leachability tests on core samples from the solidified mixture likely will be required and will provide some measure of verification.

- Verification that the grout and sludge have been mixed homogeneously will be difficult.

- Any changes in the RD activities due to the risks and uncertainties mentioned in Section 15.3.4 will have a direct effect on remediation cost.

15.4.8 Interfaces

During remediation activities, interface and coordination will be necessary with the following agencies:

- EPA — To provide regulatory overview during the RA process, approve all primary documents, and conduct routine inspections.

- TDEC — To provide the regulatory overview for the state of Tennessee during the RA process and conduct routine inspections.

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management — To provide waste management overview, support throughout the RA process focusing on the minimization of RA-generated wastes, and the capability to process the wastes generated.

- MMES Technical Advisory Group — To provide technical overview support during the RA process, i.e., monitoring and field change requests.

- Groundwater WAG Team.

- ORNL Groundwater Program.

- MMES Environment, Safety and Health Division — To provide input and overview for the ES&H aspects when conducting the RA activities.
- Construction Manager — To provide construction support.
- MMES — To provide Title III Services (includes Inspection Services).
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.
- Independent Certification Contractor.

15.4.9 Contingent Action

The contingent action discussed here is assumed in the event that the base action discussed within this Section cannot be implemented due to technical, regulatory, or political constraints. This contingent action would then include pre-treatment of water drawn from impoundments before treatment at the PWTP.

16.0 WAG 1 UNDERGROUND PIPING AND STORM DRAIN OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the following OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for this OU is presented in Fig. 16.1. The summary level schedule for this WAG 1 OU is shown in Fig. 16.2. Table 16.1 shows the cost assessment of $28,834,000 for the OU3 by remediation phase and FY. TCFs are used to estimate costs for RI/FS tasks in this OU as discussed in Chapter 14.0.

16.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 16.3. The summary level schedule for these RI WBS elements is shown in Fig. 16.4. Table 16.2 show the cost assessment of $12,025,000 for performing the RI by WBS activities and FY.

16.1.1 Scope and Assumptions

The primary assumption for the RI effort for OU3 is that in the implementation of the observational approach, additional RI data will be required to support the development of the Feasibility Study.

The WAG 1 Underground Piping and Drains OU response actions and their RI activities are as follows:

- Containment — geophysical surveys, geotechnical properties (soils), and perimeter soils sampling.
- Water Diversion — geophysical (seismic) surveys and groundwater sampling/monitoring.
- Groundwater Treatment — sampling/treatment of deep groundwater zone will be performed under the WAG groundwater sampling/monitoring of stormflow zone.

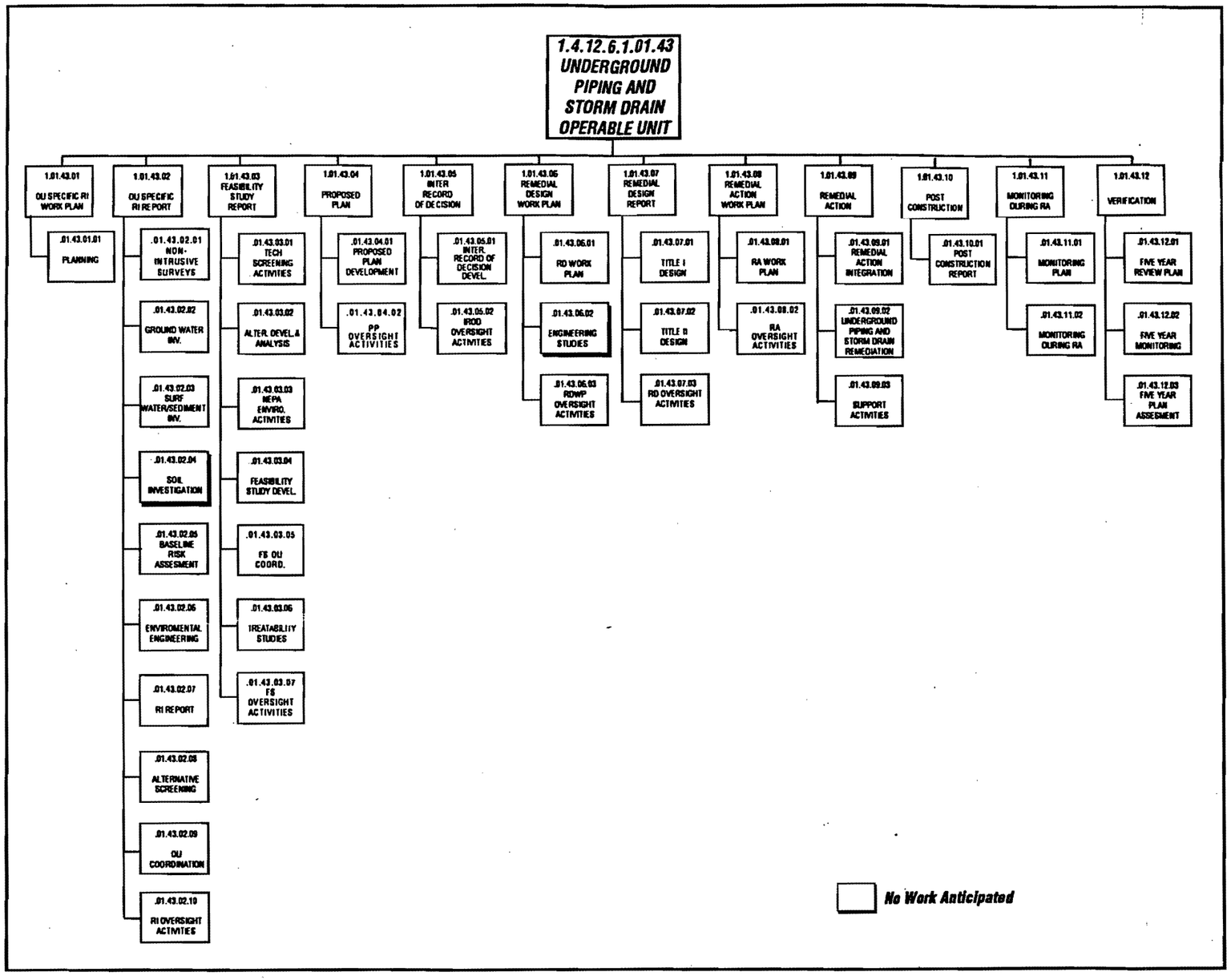


Fig. 16.1. WAG 1 Underground Piping and Storm Drains OU Work Breakdown Structure.

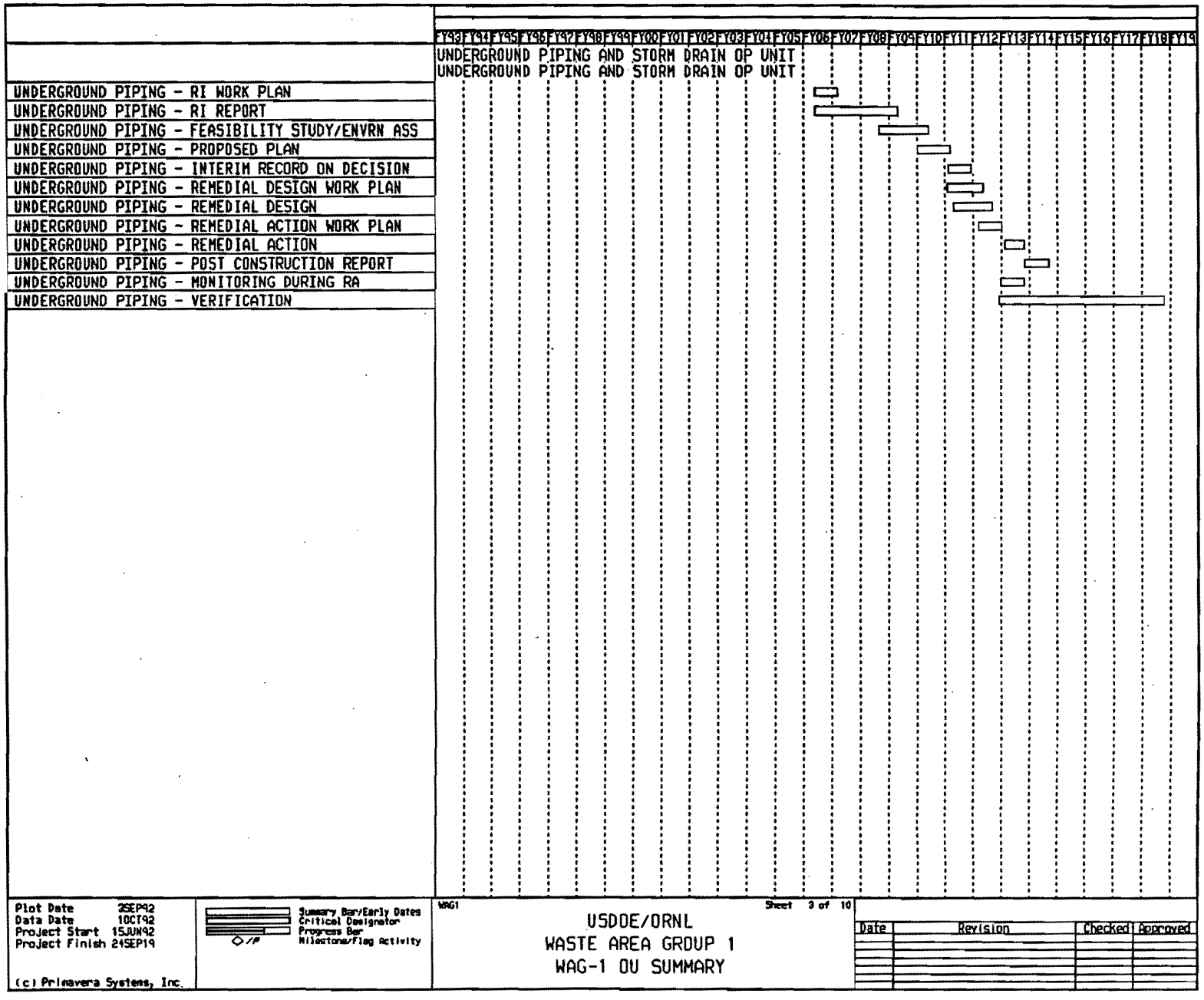


Fig. 16.2. WAG 1 Underground Piping and Storm Drains OU Summary Level Schedule.

TABLE 16.1
WAG 1 Oper. Unit 03 Baseline Cost Assessment

PHASES	FISCAL YEARS ($1000s unescalated)																	
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	TOTAL
Remedial Investigation	2,218	5,135	3,589	1,082	0	0	0	0	0	0	0	0	0	0	0	0	0	12,025
Feasibility Study/IROD	0	0	452	869	547	158	0	0	0	0	0	0	0	0	0	0	0	2,025
Remedial Design	0	0	0	0	0	1,781	1,618	0	0	0	0	0	0	0	0	0	0	3,399
Remedial Action	0	0	0	0	0	0	599	8,480	475	411	411	411	596	0	0	0	0	11,385
TOTALS	2,218	5,135	4,041	1,950	547	1,939	2,218	8,480	475	411	411	411	596	0	0	0	0	28,834

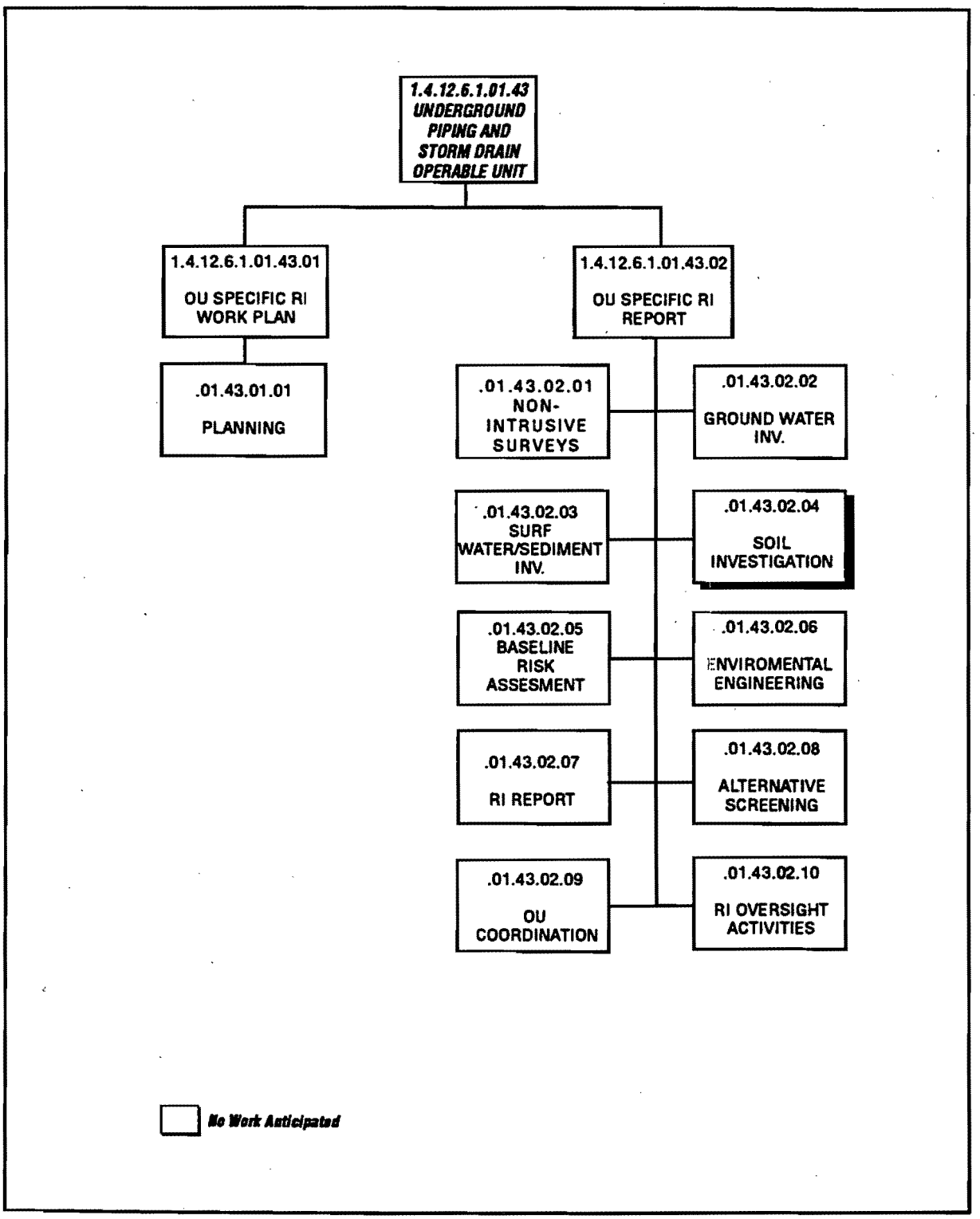


Fig. 16.3. Underground Piping and Storm Drains RI Work Breakdown Structure.

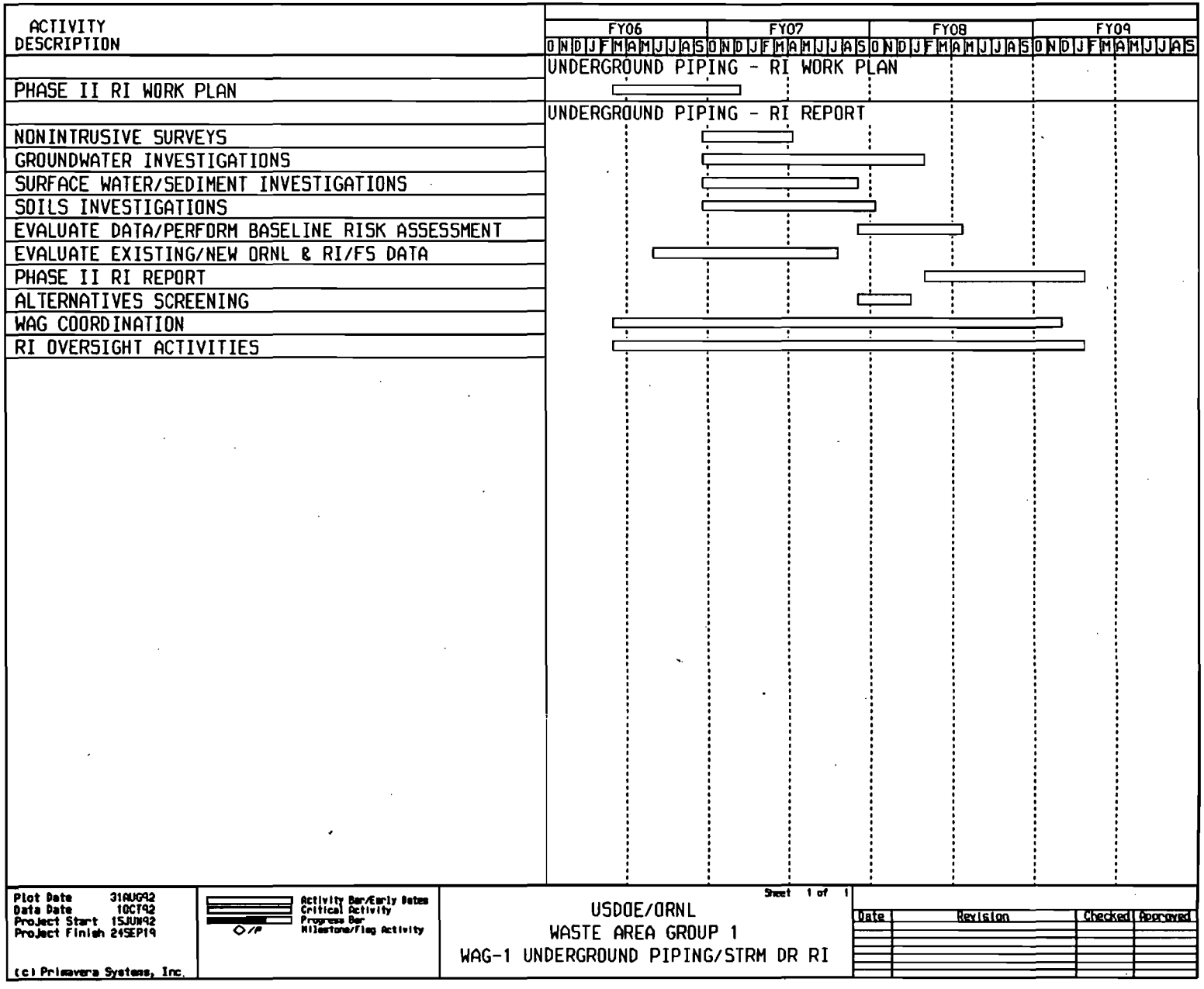


Fig. 16.4. Underground Piping and Storm Drains OU RI Summary Level Schedule.

TABLE 16.2
WAG 1 Oper Unit 03 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)					
	2006	2007	2008	2009	2010	TOTAL
Planning	148	30	0	0	0	178
Nonintrusive Surveys	20	194	0	0	0	214
GW Investigation	56	1,251	374	0	0	1,680
SW/SED Investigation	58	893	0	0	0	951
Soil Investigation	0	0	0	0	0	0
Baseline Risk Assess.	0	43	422	0	0	465
Environ. Engineering	187	375	0	0	0	562
RI Report	0	0	444	296	0	740
Alternative Screening	0	16	16	0	0	32
RI OU Coordination	1,142	1,523	1,523	381	0	4,570
RI Oversight Activities	608	810	810	405	0	2,633
TOTALS	2,218	5,135	3,589	1,082	0	12,025

The following assumptions have significant roles specific to the schedule for implementation of the RI process:

- All primary documentation will undergo a concurrent MMES and DOE (agency) review. Additionally, the review process for these documents will follow the "Accelerated Review Cycle" defining review times for each step in the review process.

- Sufficient coordination with the regulators will occur throughout the RI process. It is anticipated that any comments received on primary documentation will not require additional sampling, major revision of these documents, or the application of the disputes resolution process.

- Nonintrusive surveys will be authorized by the regulators and may be initiated within 1 week subsequent to transmittal of the draft RI Work Plan to the regulators.

- Intrusive investigations will be authorized by the regulators and may be initiated upon of completion of regulatory review of the draft RI Work Plan.

16.1.2 Operable Unit Specific Remedial Investigation Work Plan

16.1.2.1 Planning (6.1.01.43.01.1)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI for WAG 1. The RI Work Plan defines the scope and objectives for the RI activities and provides a mechanism for planning the investigation. A project management strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes a summary and interpretation, which are appropriate for available environmental information. The Work Plan addresses the potential federal and state ARARs, TBC guidance, the establishment of DQOs, and provides specific rationale for all field and analytical work. The RI Work Plan addresses the proposed technical approach and timing for implementation, schedules, and decision points where appropriate. The RI Work Plan is prepared according to provisions of applicable EPA and TDEC guidance documents.

Because of the need to review data reported as part of the WAG 1 Phase I RI effort, and incorporate changes in project approach, a supplement to the WAG 1 RI Work Plan and associated documents will be developed as needed.

16.1.3 Operable Unit Specific Remedial Investigation Report

16.1.3.1 Nonintrusive Surveys (6.1.01.43.02.01)

The following nonintrusive surveys will be conducted before initiation of media-specific sampling. Analysis of the site-wide surveys will identify areas in need of more detailed investigation.

Civil surveying will be performed as needed to support the Underground Piping and Drains OU investigation activities including as-built surveys, construction surveys, topographic surveys, establishing locations for the geophysical surveys, and establishing sampling locations.

The underground pipeline systems are extensive. Selected surface geophysical surveys (i.e., primarily pipe locator surveys or magnetometer surveys) will be conducted to delineate underground pipelines used for waste transport.

The storm drain networks in WAG 1 are extensive and are of various designs/materials. The storm drain evaluation consists of digitizing a 3-D map of the networks using various network descriptors such as horizontal and vertical coordinates, access points and junctions, and pipe lengths and diameters; performing a video camera survey of those lengths of storm drain suspected of inleakage; and evaluating the storm drain network with regard to water balance and contaminant load/contribution.

16.1.3.2 Groundwater Investigation (6.1.01.43.02.02)

Groundwater flow may constitute a significant pathway for migration of contaminants from WAG 1 to potential receptors offsite. Potential pathways may include inleakage to, and subsequent flow through, underground pipelines and storm drains, as well as flow along the relatively unconsolidated soil forming the pipe/drain beds. The groundwater investigation has the following objectives: determination of the types and levels of contaminants associated with pipe/ drain and bed flow and determination of the type and degree of interaction between the shallow groundwater and the underground piping and storm drain systems.

During the WAG 1 Phase I RI, nine temporary pipeline piezometers were installed along various pipelines to monitor contaminant transport along pipe beds. Shallow groundwater samples were taken from each piezometer. Twenty new temporary pipeline piezometers will be installed during this OU investigation to depths of approximately 8 ft using hand augers.

Water samples will be taken from both the temporary pipeline piezometers and from the storm drains. With regard to the piezometers, two samples will be taken from each. The timing of the first and second sampling events will coincide with regional seasonal low and high groundwater conditions. The storm drain network will be sampled at 60 locations corresponding to access/entry points. Thirty (of the 60) storm drain locations will be sampled twice, once during each of the low and high base conditions. The remaining 30 storm drain locations will be sampled only once.

Data validation using EPA-prescribed methods, as available, will be performed on all samples to be included in risk assessments and other instances where data of known quality are required. Samples from groundwater investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and water quality parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation.

The results of the groundwater investigation associated with WAG 1 Underground Piping and Drains OU will be made available to the Groundwater WAG Team in order to facilitate site-wide groundwater remediation assessments. It is conceivable that as the groundwater investigation proceeds, additional data needs will be identified by the Groundwater WAG Team, which will result in additional requirements being placed on the WAG 1 Underground Piping and Drains OU groundwater investigation. No allowances for additional investigation requirements are included in the scope of effort for the WAG 1 Underground Piping and Drains OU RI. Continuing interface between WAG 1 Underground Piping and Drains OU and the Groundwater WAG Team will be required throughout the RI process.

16.1.3.3 Surface Water and Sediment Investigations (6.1.01.43.02.03)

The Phase I surface water sampling effort determined that contaminants released from WAG 1 SWMUs/additional areas of concern are migrating into the surface water regime via underground pipelines and storm drains. The objective of this OU investigation is to determine the extent of migration. This contaminant load information will be used for fate and transport analysis, risk assessment, and evaluation of remedial alternatives.

According to WAG 1 records, 176 outfalls in WAG 1 have been discovered. Some of the outfalls may have intermittent flow and/or may be difficult to find. Approximately 100 of the outfalls will be located during the OU investigation; each outfall found will be sampled once.

Samples from surface water investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and water quality parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples to be included in risk assessments and other instances where data of known quality are required.

New flow monitoring stations will be installed at 10 outfalls to help determine water balance. The stations will be constructed to minimize disturbance to the outflow, but prohibit uncontrolled access to the monitoring station. The configuration of the outflow, its flow volume, and its contaminant load will be considered in designing the secured monitoring station.

16.1.3.4 Soils Investigation (6.1.01.43.02.04)

No additional work is anticipated for this WBS element.

16.1.3.5 Baseline Risk Assessment (6.1.01.43.02.05)

The Baseline Risk Assessment for the Underground Piping and Drains OU consists of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with the Underground Piping and Drains OU for current and future exposure scenarios. The objectives of the environmental evaluation are to determine whether the Underground Piping and Drains OU poses a current or potential future risk to environmental resources in the absence of any remediation and to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

The human health evaluation will be performed in accordance with EPA's *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)* (1989). The work will include an evaluation of chemical and radiological data collected before and during the Underground Piping and Drains OU RI. An exposure assessment, a toxicity assessment, and a risk characterization will be conducted with the information used to compute human health risks. The average annual concentrations of radionuclides and chemicals in surface water, groundwater, soils, and sediments for current and future time periods at OU locations will be estimated using a surface subsurface model.

The environmental evaluation will be performed to meet the requirements of Section 121 (b)(1) and (d) of CERCLA and other statutes that mandate protection of wildlife, fisheries, threatened and endangered species, and sensitive environments. Guidelines for conducting this evaluation are provided by EPA in *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (1989). The evaluation will be both a quantitative and qualitative appraisal of the actual or potential effects of this waste site on plants and animals other than humans and domestic species.

16.1.3.6 Environmental Engineering (6.1.01.43.02.06)

Environmental engineering provides technical support and engineering analyses for data collection and field investigation tasks.

Before field mobilization, a detailed evaluation of existing data for the Underground Piping and Drains OU will be performed. Support to the ORNL/DOE/EPA/TDEC technical review process, the ORNL environmental assessment documentation process, and the ORNL readiness review process will be provided as requested. Evaluation of new ORNL data (i.e., semiannual groundwater data) will be performed and will include the review and tabulation of data as it becomes available (i.e., SIMS). These data will be compared to the OU-focused RI Work Plan supplement with comparisons and conclusions drawn with respect to the data generated by the Pipes and Drains OU RI.

An environmental engineering analysis will be performed on all data generated from the Underground Piping and Drains OU RI field activities. These data will be tabulated for use in writing the technical memorandums and technical bulletins.

Data regarding pipelines and storm drains will be evaluated and will involve reviewing ORNL electronic data bases for appropriate and applicable information. Also, engineering drawings will be reviewed to determine actual locations of pipelines and storm drains.

The data summarized by the three previous tasks will be reviewed with respect to implementation of remedial alternatives. This task is iterative in nature and consists of the following steps: (1) summarized RI/FS data is reviewed as it becomes available; (2) the preliminary remedial alternatives scenario is refined, if necessary; (3) data needs are re-evaluated based on the new alternatives scenario, and (4) data collection efforts are altered to meet any new data needs.

16.1.3.7 Remedial Investigation Report (6.1.01.43.02.07)

The OU RI Report will serve as documentation of data collection and analyses in support of the OU Field Study. The results of the OU RI are presented as an analysis of site characteristics, the risk associated with such characteristics (see element definition for the Baseline Risk Assessment), and a summary of potentially feasible remedial actions (see element definition for Alternative Screening). The evaluation of site characteristics will focus on the site physical characteristics, the source characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Before the issuance of the draft Underground Piping and Drains OU RI Report, a draft determination of the ARARs will be submitted to EPA and TDEC. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to the Underground Piping and Drains OU remediation.

The draft Underground Piping and Drains OU RI Report will be produced for review by ORNL, DOE, EPA, and TDEC. The OU RI Report will consolidate available, appropriate, and applicable data on the Underground Piping and Drains OU and will summarize technical work completed to date on the project. In addition to the field work (Phase II) proposed for this OU, one of the primary references for the Underground Piping and Drains OU RI Report will be the WAG 1 Site Characterization Summary Report.

16.1.3.8 Alternatives Screening (6.1.01.43.02.08)

The objectives of the alternative screening are to develop preliminary RA goals and a range of alternatives and perform a screening level alternatives evaluation.

Preliminary development and screening of remedial alternatives will be performed according to the EPA *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, (October 1988). The effort consists of the following six steps:

1. Develop RA objectives specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed.

2. Develop general response actions for each medium of interest that may be taken to satisfy the remedial action objectives for the site.

3. Identify volumes or areas of media where general response actions might be applied.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the site.

5. Identify and evaluate technology process options to select a representative process for each technology type retained for further consideration.

6. Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

16.1.3.9 Operable Unit Coordination (6.1.01.43.02.09)

Activities include Underground Piping and Drains OU RI quality control and project management and coordination. These activities will ensure that Underground Piping and Drains OU RI quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple WAGs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, data base management, and data bases interface with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage Underground Piping and Drains OU QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Necessary field support needed to manage and direct Underground Piping and Drains OU RI field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes providing required field equipment, spare parts, and other field materials and supplies.

16.1.3.10 Remedial Investigation Oversight Activities (6.1.01.43.02.10)

This element, RI oversight activities, provides technical support, input, and oversight activities during the RI to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon issuance of the revised Site Characterization Study to the regulators.

- FS Contractor — Provides technical oversight to ensure that the nature and extent of contamination and the associated risks are developed and presented in the Site Characterization Study consistent with the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the data and information obtained and the nature and extent of contamination developed during the RI are adequate and presented in a manner consistent with the RD approach and design requirements.

- MMES Field Maintenance — Provides support for health and safety, environmental compliance, and waste management as a part conducting the RI field activities.

- Sample Validation Subcontractor — Provides support to perform validation of chemical sampling performed during the RI.

- MMES Environmental Services Division — Provides support for geophysical surveys and drilling.

- MMES Planning/Coordination — Provides necessary permits for RI field activities.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

16.1.4 Risks and Uncertainties

The following list describes the areas of risks and uncertainties associated with the RI performance:

- Areal extent of contamination is not fully defined. This would require additional investigation and study to determine remedial alternatives.

- New regulatory requirements may result in changes to the level of effort required for the risk assessment and alternatives screening.

- Lack of approval for the RI Work Plan would delay field investigations and would require additional work to incorporate regulatory concerns into the RI.

16.1.5 Interfaces

The following section describes the primary interfaces and anticipated roles during the RI:

- MMES Waste Management Division — To provide waste management overview and support throughout the RI process. The focus would be minimizing RI-generated wastes and providing the capability to process the wastes generated during the RI.

- MMES Technical Advisory Group — To provide technical overview support during the RI process; (i.e., overall approach, validity of data collected, and calculation of risks.

- MMES — To provide overall project management support during the RI process to ensure that MMES RI goals are achieved.

- FS Contractor — To provide data review support to the RI so that it can sufficiently support the FS/ROD process.

- EPA — To provide regulatory overview during the RI process and approval of all primary documents.

- TDEC — To provide regulatory overview for the state of Tennessee during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

16.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents in more detail the efforts necessary to perform the FS/PP/IROD process for the Underground Piping and Storm Drains OU. The FS process will include evaluating environmental concerns as an EA within the FS Report. To comply with the FFA, the process will also require preparation of the PP the regulatory decision documents, and the IROD. The associated risks and uncertainties and the interfaces for the FS/PP/IROD effort are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is presented in Fig. 16.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig. 16.6. Table 16.3 shows the cost assessment of $2,025,000 for performing the FS, PP, and IROD process by WBS element and FY.

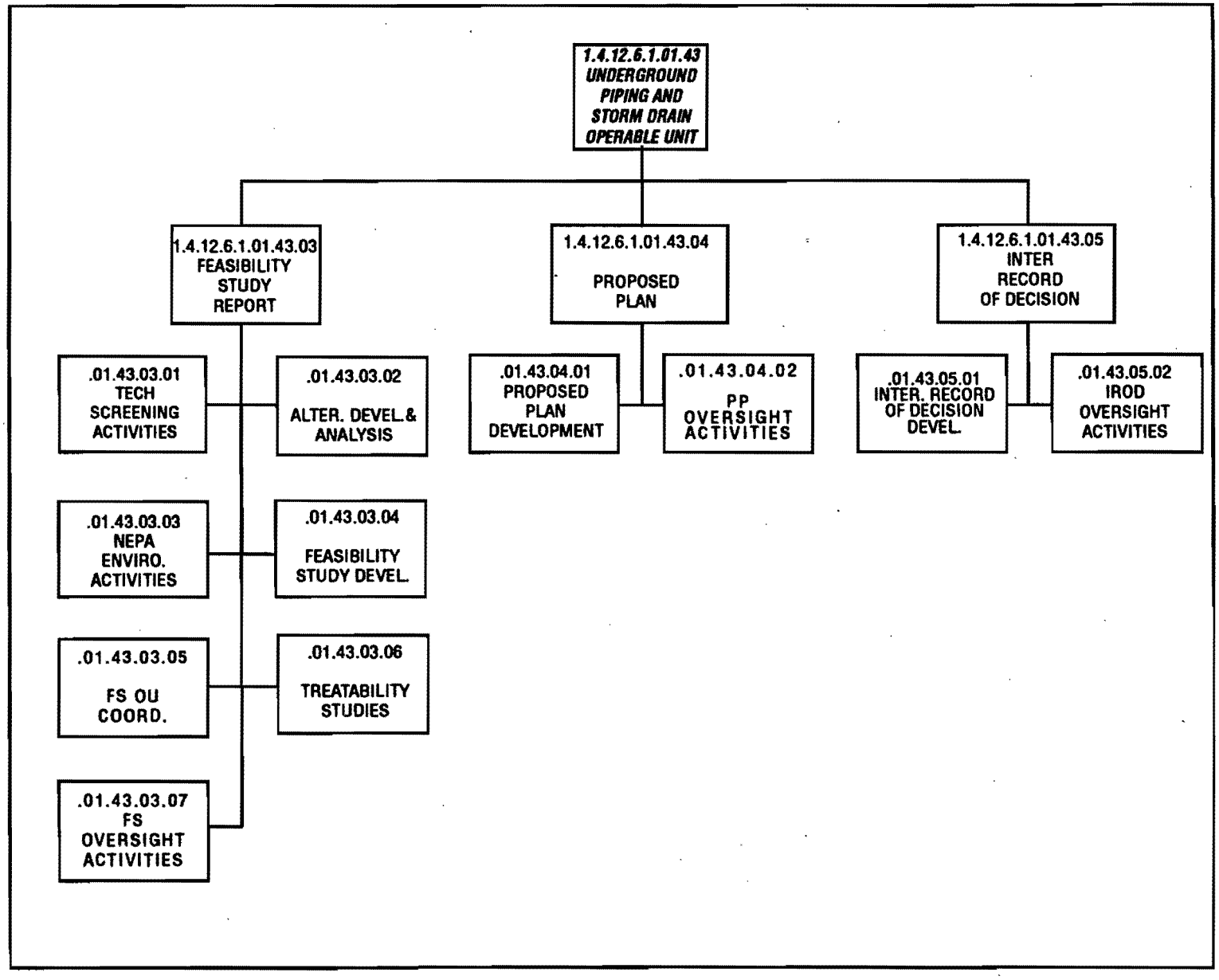


Fig. 16.5. Underground Piping and Storm Drains FS/PP/IROD Work Breakdown Structure.

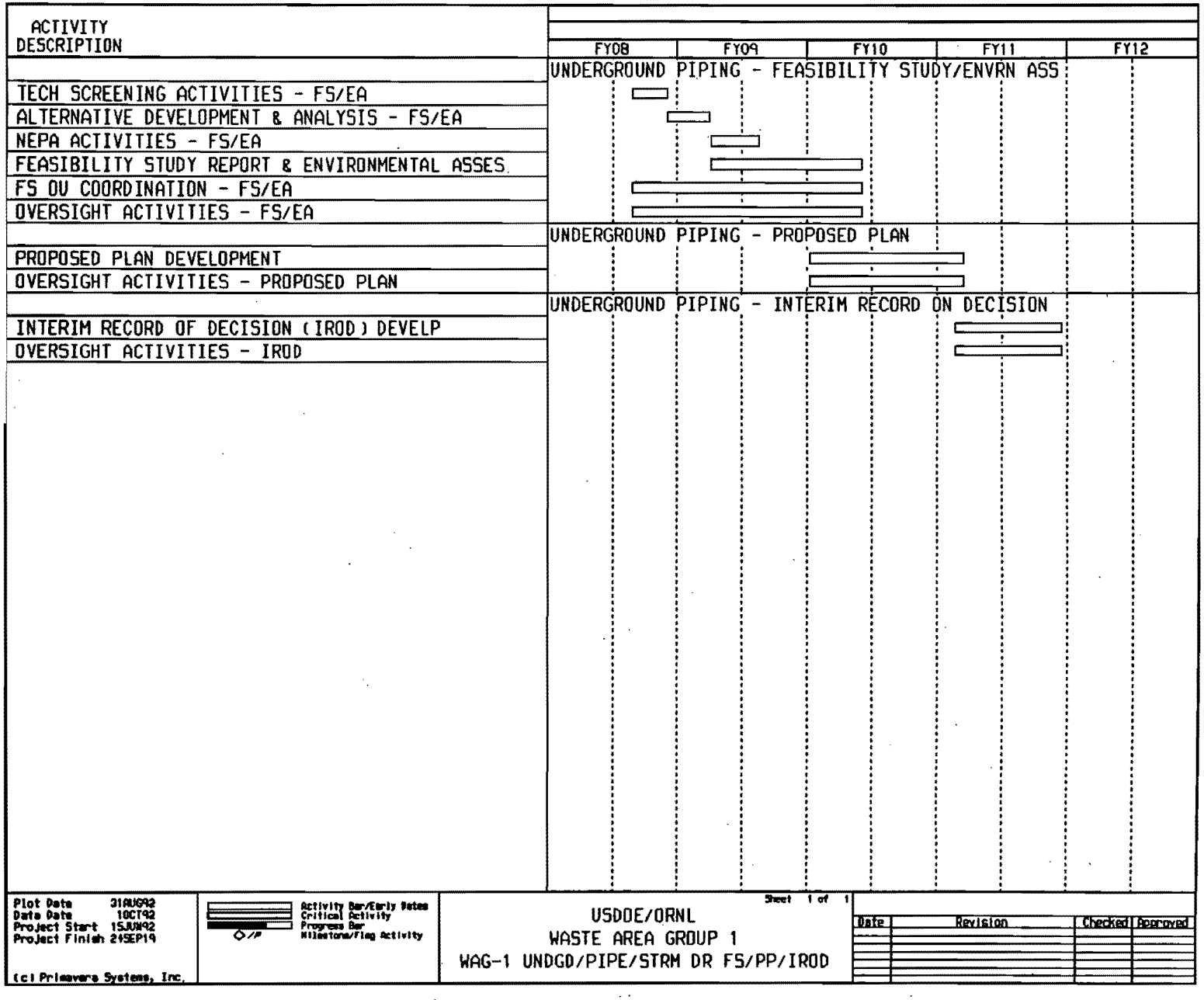


Fig. 16.6. Underground Piping and Storm Drains FS/PP/IROD Summary Level Schedule.

TABLE 16.3
WAG 1 Oper Unit 03 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)					
	2008	2009	2010	2011	2012	TOTAL
Technology Screening	230	0	0	0	0	230
Alternatives Develop./Analysis	51	103	0	0	0	154
NEPA/Environmental Activities	0	72	0	0	0	72
Feasibility Study Development	0	354	236	0	0	589
FS OU Coordination	50	100	50	0	0	200
Treatability Study	0	0	0	0	0	0
FS Oversight	120	240	120	0	0	479
SUBTOTALS FS	452	869	406	0	0	1,726
PP Development	0	0	82	20	0	102
PP Oversight Activities	0	0	60	15	0	74
SUBTOTALS PP	0	0	141	35	0	177
IROD Development	0	0	0	67	0	67
IROD Oversight Activities	0	0	0	56	0	56
SUBTOTALS IROD	0	0	0	123	0	123
TOTALS	452	869	547	158	0	2,025

16.2.1 Scope and Assumptions

The purpose of the FS/PP/IROD activities for the Underground Piping and Storm Drains OU is to identify, organize, and examine remedial alternatives; to mitigate the risks identified in the RI Report; to justify selection of a preferred remedial alternative or a set of alternatives; and to prepare the regulatory required decision documents summarizing the situation and examination process, outlining the selected remediation method(s), and establishing the remediation schedule.

The FS Contractor will be responsible for completion of the FS/PP/IROD process for the Underground Piping and Storm Drains OU. This process will require the preparation of the following milestone documents: (1) the FS Report, which documents the process used to examine the remedial technologies, selects the preferred remedial alternative(s), and incorporates the environmental (NEPA) considerations in an EA segment to satisfy administrative requirements; (2) the PP, a summary plan for implementing the selected remedial alternative(s); and (3) the IROD, the legal document that declares that the selected remediation method(s) meets statutory and regulatory requirements and establishes the schedule for remediating this OU. To implement this process and to ensure that remediation is completed according to the process, the FS Contractor will have oversight responsibilities during the RI and RD. The FS/PP/IROD process for OU3 will be accomplished by the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities
- Feasibility Study Development
- Treatability Studies
- Feasibility Study Operable Unit Coordination
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities.

16.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA Report are presented in the following sections. The FS/EA Report will in general follow the format in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (1988).

The cost assessment made for the FS WBS elements were based on the following assumptions:

- The OU-specific RI Report will be completed as scheduled.
- The RI Report results are representative of the actual site conditions and adequately characterize the extent and amount of contamination.
- The FS process will be completed as scheduled.

16.2.2.1 Technology Screening Activities (6.1.01.43.03.01)

Based on the remedial objectives established under the ER Program remedial objectives, the RI Report findings regarding waste and site-specific conditions, and a literature search; the FS Contractor will identify applicable remedial technologies from the available common and innovative technologies for initial evaluation. These technologies will be screened to eliminate those judged too difficult to implement based on unproven technologies, judged not able to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Those technologies judged to have a reasonable chance of success for remediating the specific waste or site conditions will be carried forward for more detailed development and analysis. A technical memorandum summarizing the findings if this task will be issued to DOE.

16.2.2.2 Alternatives Development and Analysis (6.1.01.43.03.02)

The FS Contractor will develop the screened technologies for analysis by arranging them into general RA alternatives. These alternatives will then be evaluated, either individually or as combinations of technologies. The purpose of this evaluation is to eliminate those alternatives (1) with costs significantly higher than similar alternatives, (2) that fail to provide adequate protection of public health and safety, and/or (3) that may adversely impact the environment. A list of alternatives that meets the remedial objectives and contributes to the protection of public health, safety, and the environment will be formulated for further study. A technical memorandum summarizing the findings of this task will be issued to DOE for regulatory compliance assessment.

The following items are assumptions considered in the development of the cost assessment for alternatives development and analysis:

- Working group meetings will be held as needed with the regulatory agencies to discuss progress. Input and feedback from these meetings can be considered as consistent with the formal agency response.

- The regulatory agencies concur with the working group meetings and the results of the technology screening memo.

16.2.2.3 NEPA Environmental Activities (6.1.01.43.03.03)

To comply with DOE policy that NEPA criteria are considered during remedial activities, the remedial alternatives will be evaluated for their impact on the environment. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and to minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

The cost assessment for this element was based on the following assumptions:

- An EA will be completed on the site to evaluate the environmental effects of the RA.

- The Baseline Risk Assessment in the RI Report presents the primary contaminant and exposure pathways of concern and is complete enough to ensure that the results are compatible with the alternatives risk calculation methodology selected for the FS Report.

- All ecological risk assessment sampling activities are completed on schedule and are representative of the actual site conditions.

16.2.2.4 Feasibility Study Development (6.1.01.43.03.04)

The FS Contractor will use the format presented in the CERCLA guidance document to develop the FS with exceptions and modifications for the specific wastes and conditions in the Underground Piping and Storm Drains OU. The FS development will be based on the information obtained from the RI, the alternatives screening and analysis process, and the EA considerations. Using the list of applicable remedial alternatives, the FS will be developed in sufficient detail to allow the selection of a preferred alternative(s) that meets the remedial objectives of mitigating release of contaminants. Criteria will be developed to assess the ability of the alternatives to meet

the remedial objectives and to comply with administrative and regulatory requirements. The FS is intended to perform a detailed evaluation of the alternatives to provide an informed risk-management decision and the legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE and EPA for review. The final FS/EA Report is a milestone document required by the FFA.

16.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.43.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to (1) support QC efforts, (2) provide project management, and (3) coordinate project activities to ensure that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS oversight participants.

16.2.2.6 Treatability Studies (6.1.01.43.03.06)

It is anticipated that information generated from Treatability Studies conducted for the Groundwater OU could be utilized for OU3.

16.2.2.7 Feasibility Study Oversight Activities (6.1.01.43.03.07)

The objective of FS oversight activities is to provide technical input and oversight during the FS/EA to ensure that the data and information obtained during the RI are incorporated properly into the FS/EA Report and that it is adequate to prepare a PP and support the development of an IROD. FS oversight activities begin with the technology screening and are completed upon final approval of the FS/EA Report.

The following is a brief description of the responsibilities of each participant involved in FS oversight activities:

- RI Subcontractor — Provides technical oversight to assess whether the technologies considered and the remedial alternatives to be developed and evaluated are consistent with the RI report conclusions and determined risks.

- A-E Contractor — Provide technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RD approach and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RA approach and can be implemented at ORNL.

- MMES — Provides technical support and review of the FS/EA process. Reviews progress reports and preliminary deliverables to ensure that the FS/EA is processing as scheduled.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of FS/EA activities, technical advice, and an independent technical review of the FS/EA Report.

16.2.3 Proposed Plan

16.2.3.1 Proposed Plan Development (6.1.01.43.04.01)

The PP to remediate the site will be prepared using the preferred remediation alternative(s) to mitigate release of contaminants as selected in the FS/EA Report and input from the regulatory agencies and the public. The PP documents the investigation process, administrative and regulatory actions, and the actions and schedule necessary to implement the remediation alternative(s) and to monitor performance. The PP is a primary milestone documents that is subject to public review and response and to administrative and regulatory reviews. The cost assessment for this element was based on the assumption that the FS process and the regulatory review cycle will be completed as scheduled.

16.2.3.2 Proposed Plan Oversight Activities (6.1.01.43.04.02)

The purpose of the PP oversight activities is to provide technical input and oversight during the development of the PP and ensure that it is in compliance with applicable regulations and policies.

During the generation of the PP, the RI Subcontractor, A-E Contractor, and MMES will assess whether the preferred remedial alternative(s) to be proposed is consistent with the RI conclusions, Baseline Risk Assessment, and FS process. Progress reports and preliminary deliverables will be reviewed by the participants mentioned earlier to ensure that the PP is proceeding as scheduled.

16.2.4 Interim Record of Decision

16.2.4.1 Interim Record of Decision Development (6.1.01.43.05.01)

The final step in the planning process to remediate the Underground Piping and Storm Drains OU will be preparation of the IROD, the legal document that formally declares the preferred remediation method(s) and establishes the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) A decision summary outlining the nature and extent of the contamination and the associated risks at the evaluation and analysis of the RA alternatives considered, an explanation of how the selected

alternative(s) will meet statutory requirements; and (3) a responsiveness summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE for review. After DOE review and incorporation of comments, the IROD will be issued to EPA and TDEC for review. The final IROD is a milestone document required by the FFA.

The cost assessment for this element was based on the assumption that the FS/EA and PP schedules were followed.

16.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.43.05.02)

During the development of the IROD document, MMES and the A-E Contractor will provide technical input and independent technical review to ensure that the IROD document is prepared in accordance with the FFA and in compliance with CERCLA. The technical review and oversight will also include the assessment of the IROD document's consistency with RI report conclusion, Baseline Risk Assessment, and FS/EA.

16.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the FS/PP/IROD process for this OU are scheduling and scoping of the activities. Minor changes in scheduling will have significant impacts on the labor costs of the project. If the schedule is modified, resulting in an extended total duration of the project, the total costs will increase significantly. The scope of the project will have a direct impact on labor allocations. If additional IRODs are required, the total cost of the effort will increase. Other factors which increase the uncertainty of the budgetary assessments in this report include:

- Requirements for additional sampling activities.
- Extended review cycles initiated by the regulators.
- Program funding limitations across the DOE system.

16.2.6 Interfaces

Completion of the Underground Piping and Storm Drains OU process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.
- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.

- NEPA — Regulations that set the policies and goals for protecting environmental quality and establish the procedures to examine the impact that decisions on remediation may have on the environment.

- TDEC — Provides regulatory overview for the state of Tennessee.

- MMES Waste Management Division — Provides for the management of waste and waste facilities at ORR.

16.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the Underground Piping and Storm Drains OU: a RD Work Plan, engineering studies as required, a Title I 30% design package, Title II 60% and 90% design packages, and final design reports. The risks and uncertainties and interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 16.7. The summary level schedule for these RD WBS elements is shown in Fig. 16.8. Table 16.4 shows the cost assessment of $3,399,000 for performing this portion of the Underground Piping and Storm Drains RD activities summarized by WBS activity and FY.

16.3.1 Scope and Assumptions

The scope of the RD work for the remediation of the underground piping and storm drains is to prepare necessary design and supporting documents required for (1) approval from DOE-OR, DOE-HQ, TDEC, and EPA; and (2) implementation of all RA activities.

Details on the scope of work and assumptions associated with the RD work breakdown elements that the A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the Underground Piping and Storm Drains RA are described in Chapter 4.0.

Figure 16.9 depicts the scheduling logic for completion of the RD effort required to support a construction start 15 months from IROD approval.

16.3.2 Remedial Design Work Plan

16.3.2.1 Remedial Design Work Plan (6.1.01.43.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The A-E Contractor will prepare a draft RD Work Plan based on the scope and design criteria specified in the PP and IROD documents. The RD Work Plan will include the detailed

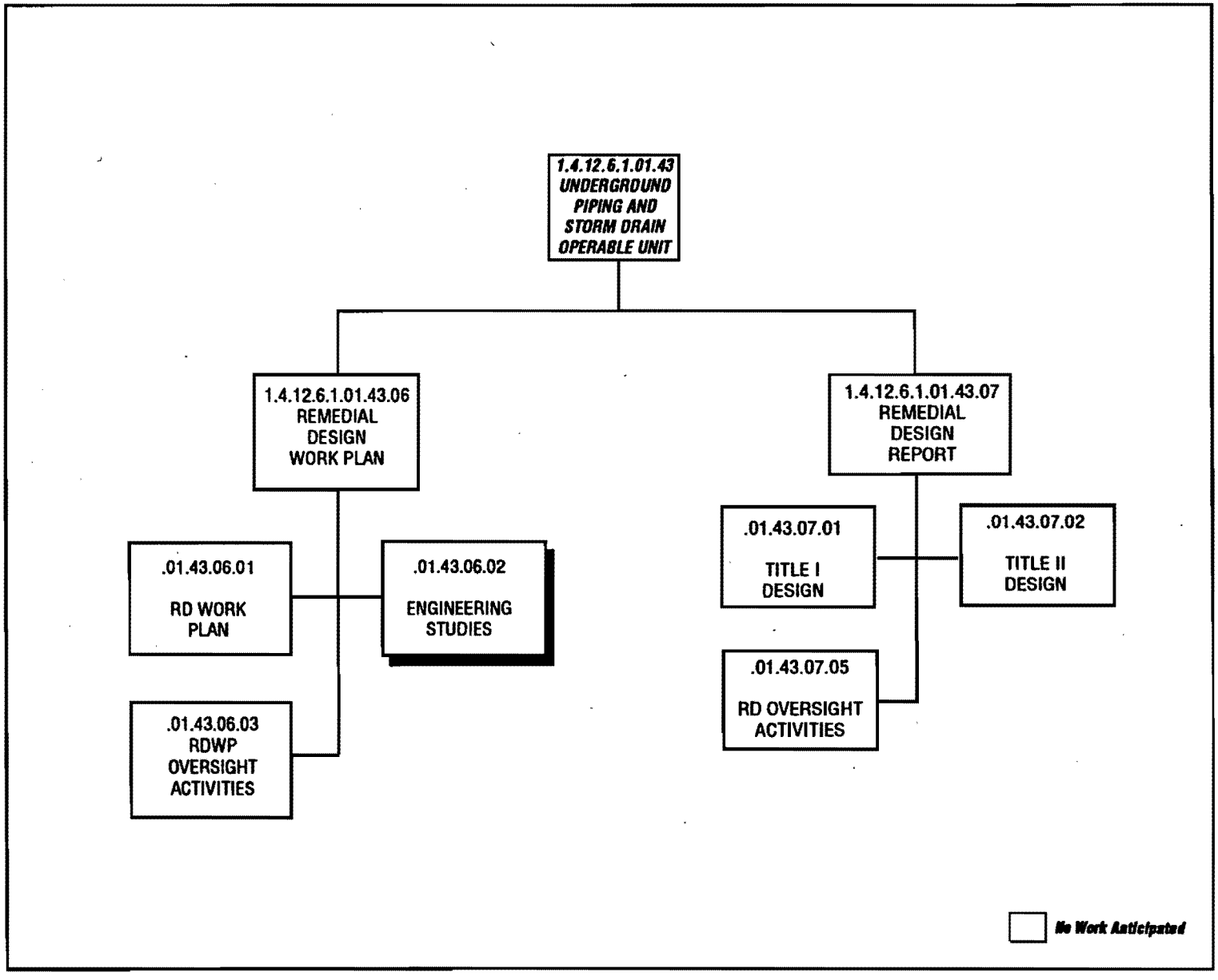


Fig. 16.7. Underground Piping and Storm Drains RD Work Breakdown Structure.

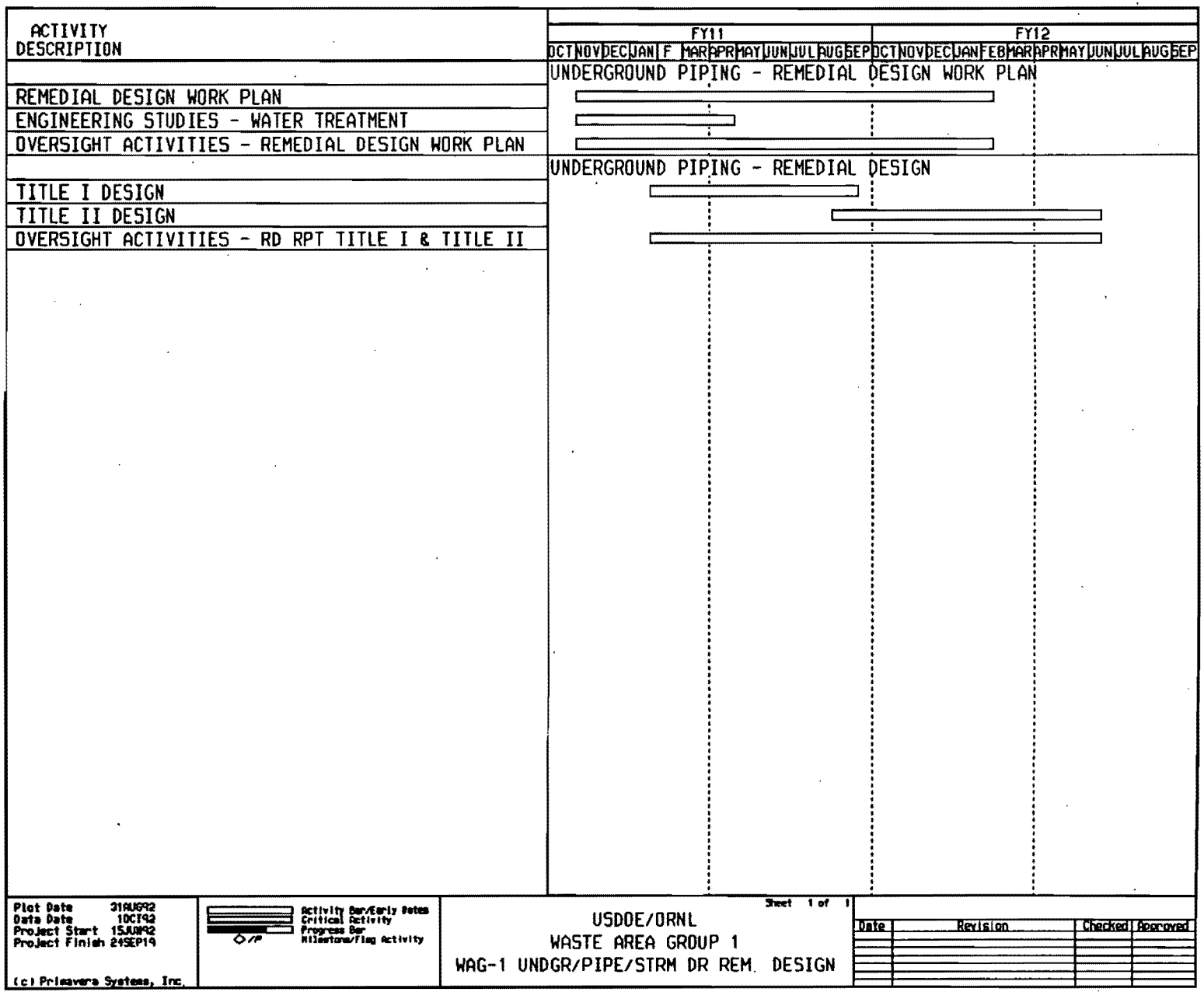


Fig. 16.8. Underground Piping and Storm Drains RD Summary Level Schedule.

TABLE 16.4
WAG 1 Oper Unit 03 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	2011	2012	2013	2014	TOTAL
Remedial Design Work Plan	139	69	0	0	208
Engineering Studies	0	0	0	0	0
RD WP Oversight Activities	61	30	0	0	91
SUBTOTALS RD WP	199	100	0	0	299
Remedial Design Phase I Title I	1,247	0	0	0	1,247
Remedial Design Phase I Title II	99	1,148	0	0	1,247
Remedial Design Phase II Title I	0	0	0	0	0
Remedial Design Phase II Title II	0	0	0	0	0
RD Oversight Activities	236	371	0	0	607
SUBTOTALS RD	1,581	1,519	0	0	3,100
TOTALS	1,781	1,618	0	0	3,399

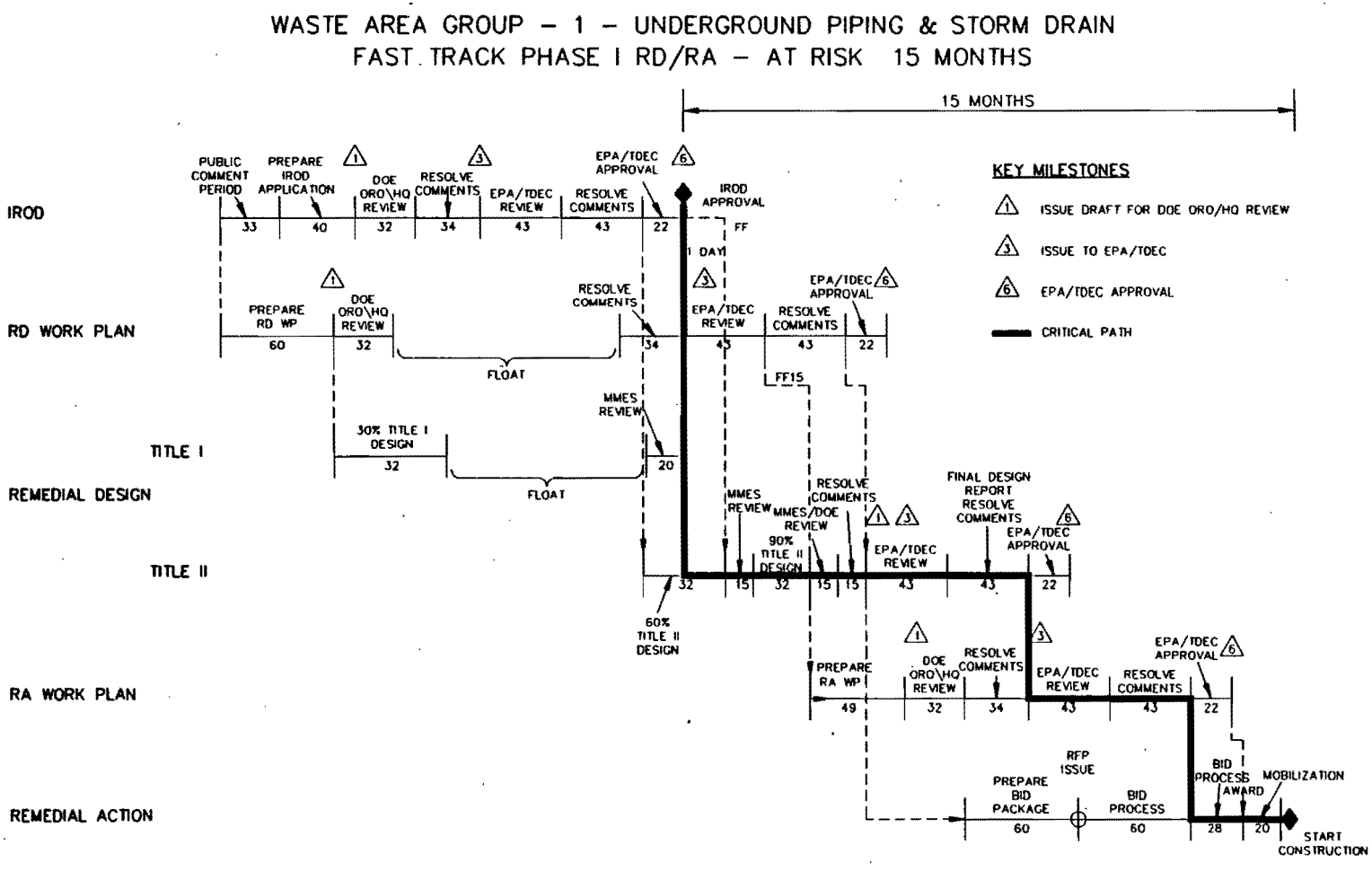


Fig. 16.9. Underground Piping and Storm Drains Phase I Schedule Logic.

design process and schedule for the design effort for the following remediation activities:

- Excavation and removal of 15% of existing LLLW lines.
- Grouting and abandonment of 15% of existing LLLW lines.

Remaining piping is assumed to remain in place as is.

16.3.2.2 Engineering Studies (6.1.01.43.06.02)

Due to the type of technologies being proposed for remediation, no engineering studies for the Underground Piping and Storm Drains OU are currently planned.

16.3.2.3 Remedial Design Work Plan Oversight Activities (6.1.01.43.06.03)

Technical input will be provided during the preparation of the RD Work Plan to ensure that the design does not violate the intent of the IROD and will comply with the administrative and regulatory requirements. The RD Work Plan will be drafted by the RD Contractor and will be reviewed by the FS Contractor, MMES, and DOE. Based on the logic shown in Fig. 16.9, the design effort will start after the RD Work Plan is prepared and will be nearly completed before EPA approval. Section 16.3.4 discusses risks and uncertainties associated with this strategy.

16.3.3 Remedial Design Report

16.3.3.1 Title I Design (6.1.01.43.07.01)

Based on information available from the RI/FS, the RD A-E Contractor will prepare preliminary (30%) design documents showing the extent of remedial activities, site plan, details, and an outline of specifications for the work involved. A detailed cost estimate for the construction will be submitted with the 30% design document to MMES for review/comments/approval.

In order to support construction starting within 15 months of IROD approval, Title I design must begin during the IROD preparation and approval process.

16.3.3.2 Title II Design (6.1.01.43.07.02)

Upon approval of the Title I design document, the RD A-E Contractor will prepare detailed engineering designs and analyses. The A-E Contractor will also provide calculations required for all civil, structural, mechanical, and electrical construction, construction drawings, technical specifications, and cost estimates.

All the documents will be submitted to MMES for comments at 60% completion. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and DOE. Upon resolution of these comments, the 100% design packages will be issued to TDEC and EPA for

further review, comment, and approval. Upon resolution of TDEC and EPA comments, the design report for remedial activities will be prepared and issued.

The cost assessments for the Title I and Title II design were developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Any additional design/permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Support facilities are available for personnel and equipment decontamination.
- A consolidation area (or other disposal facility) is available for disposal of wastes generated during remediation.

16.3.3.3 Remedial Design Oversight Activities (6.1.01.43.07.03)

Oversight will be provided throughout the remedial design process to ensure that the design does not violate the intent of the FFA, FS/EA, PP, or IROD. Reviews will be conducted by the FS Contractor, MMES, and DOE at the 30%, 60%, and 90% completion stages to provide assurance that the design complies with administrative policies and regulatory requirements.

16.3.4 Risks and Uncertainties

The primary risks and uncertainties associated with RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the remedial design and, therefore, cost.
- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have significant impact on RD and remediation work.
- The findings and conclusions in the Final RI and FS/EA documents may impact the scope of RD work.
- Title II design is completed before approval of the RD Work Plan by EPA. EPA comments to the RD Work Plan could adversely impact completion of RD.
- Title II design is started before IROD approval by EPA. The risk is lessened by the fact that comments should be resolved before start of Title II design.

16.3.5 Interfaces

The RD documents required for the remediation of the underground piping and storm drains will require the coordination and close interface with the following participants:

- EPA — To provide regulatory overview during the RD process and to approve all primary documents.
- TDEC — To provide regulatory overview for the state of Tennessee during the RD process.
- DOE — To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management Division — To provide an waste management overview of design considerations for waste generation, handling, and storage/disposal.
- MMES Technical Advisory Group — To provide technical overview support during the RD process, i.e., engineering studies and design criteria.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division — To provide input and overview for the health and safety aspects for implementation of design.
- Construction Manager — To provide construction reviews of design.
- RD Contractor — To draft the RD Work Plan.

16.4 REMEDIAL ACTION

This section presents the scope of the RA activities required to implement removal and grouting of underground piping. The risk and uncertainties and interface issues for the remedial activities are identified as well.

The WBS developed for performing the RA is presented in Fig. 16.10. The summary level schedule for these RA WBS elements is shown in Fig. 16.11. Table 16.5 shows the cost assessment of $11,385,000 for performing this portion of the WAG 1 OU3 remediation activities summarized by WBS activity and FY.

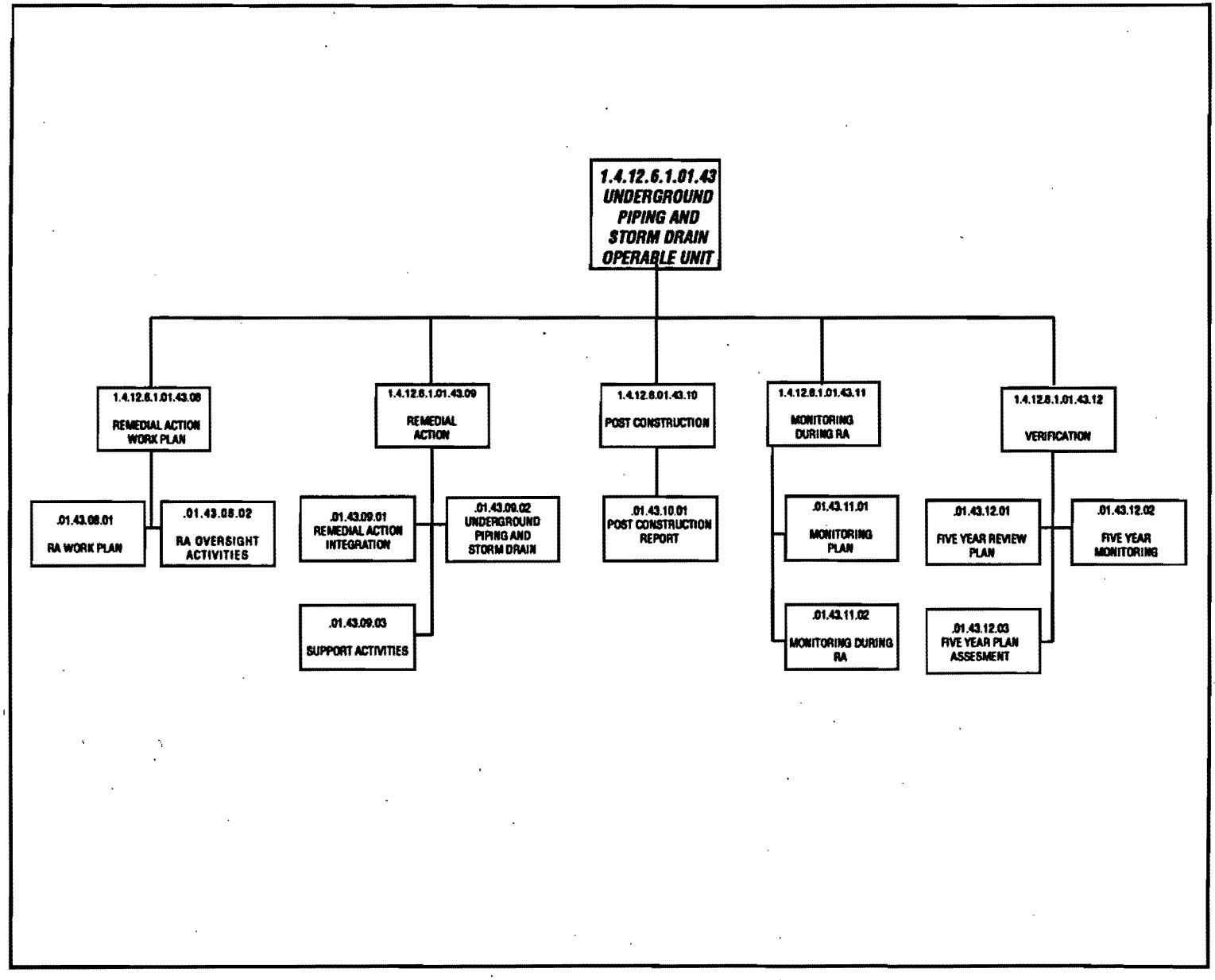


Fig. 16.10. Underground Piping and Storm Drains RA Work Breakdown Structure.

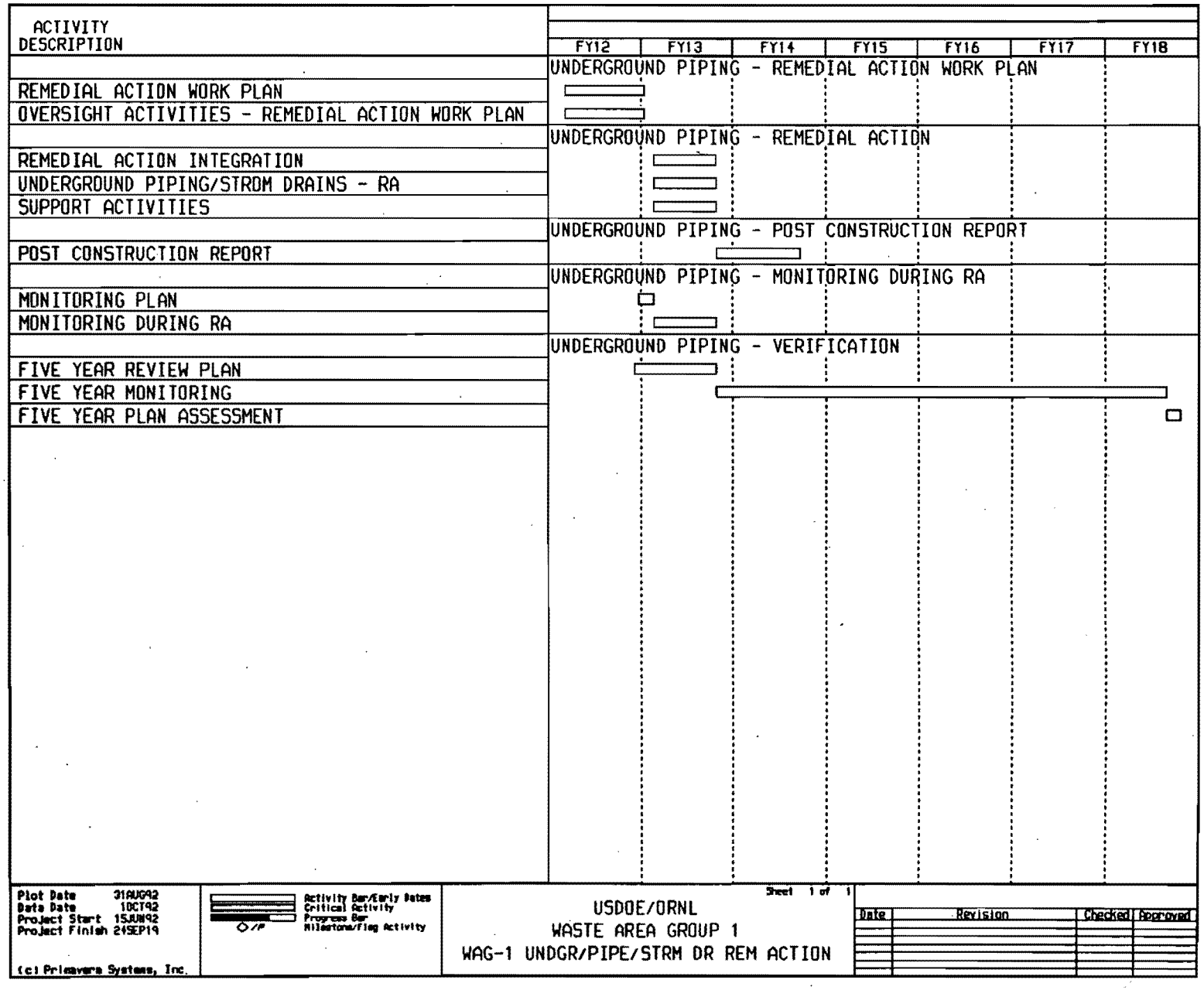


Fig. 16.11. Underground Piping and Storm Drains RA Summary Level Schedule.

TABLE 16.5
WAG 1 Oper Unit 03 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($1000s unescalated)									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
RA Work Plan	403	47	0	0	0	0	0	0	0	450
RA WP Oversight Activities	154	22	0	0	0	0	0	0	0	176
SUBTOTALS RD WP	557	69	0	0	0	0	0	0	0	625
RA Integration	0	1,440	0	0	0	0	0	0	0	1,440
Remedial Action	0	6,523	0	0	0	0	0	0	0	6,523
Post Construction Report	0	21	64	0	0	0	0	0	0	85
Monitoring During RA	23	247	0	0	0	0	0	0	0	269
Verification	20	181	411	411	411	411	596	0	0	2,442
SUBTOTALS RA	42	8,412	475	411	411	411	596	0	0	10,759
TOTALS	599	8,480	475	411	411	411	596	0	0	11,385

16.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan, Construction Management, Title III services, construction of the RD, construction support, and independent certification and verification that includes monitoring and a 5-year review.

16.4.2 Remedial Action Work Plan

16.4.2.1 Remedial Action Work Plan (6.1.01.43.08.01)

The RA Construction Manager will prepare the draft RA Work Plan, which (1) defines the scope and objectives of the RA based upon the IROD and Final Remedial Design; (2) documents the specific construction components of the RA; and (3) presents the RA schedule, subcontracting strategy, QA Plan, Health and Safety Plan, and RA Monitoring Plan.

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

16.4.2.2 Remedial Action Work Plan Oversight Activities (6.1.01.43.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA Work Plan. During the preparation of the draft RA Work Plan, MMES and A-E Contractor responsible for the approved design report will provide necessary coordination and review the work plan to ensure that the proposed construction efforts will implement the IROD as presented in the final RD Reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

16.4.3 Remedial Action Activities

This section presents the scope of the RA activities required to implement the remedial action for the Underground Piping and Storm Drains OU. The risks and uncertainties and interface issues for the remedial activities are identified as well.

16.4.3.1 Remedial Action Integration (6.1.01.43.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E Contractor and construction support as required.

RA integration for remedial activities includes the following tasks:

- Ensure that the subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

16.4.3.2 Underground Piping and Storm Drain Remediation (6.1.01.43.09.02)

Underground piping systems within WAG 1 are extensive. Groundwater flow via inleakage to these underground pipelines and storm drains, as well as flow along the relatively previous soil forming the pipe beds, may constitute a significant pathway for migration of contaminants.

Two storm drain outfalls, 341 and 342, have been identified as contaminant discharge points. Collection of base flows issuing from these outfalls has been included in the Boundary Interception Early Action. Refer to Chapter 11.0 for a discussion of this Early Action. In addition to these outfalls, all storm drains crossing the French drains proposed as part of the Boundary Interception Early Action, Core Hole Eight Early Action, and Groundwater OU will be modified for collection of base flow. Contaminants flowing along the beds of piping crossing these French drains will be collected in the drains.

The piping and storm drains included in Boundary Interception Early Action, Core Hole Eight Early Action, and the Groundwater OU are those located in radiologically contaminated areas. For the purpose of this estimate, no further storm drain remediation is proposed. The pipelines targeted for the RA for this OU are the liquid low level waste (LLLW) lines. For estimating purposes, existing single-walled LLLW lines were located on the area Atlas maps for the ORNL and 15% of these lines were assumed to require excavation and removal. Another 15% of these lines were assumed to require grouting before abandonment. These actions are assumed to lessen the migration potential of contaminants through pipelines and trenches. Only the LLLW lines were included in the estimate because they may be contaminant sources and under the FFA all of these lines are to be taken out of service.

The RI will clarify the actual extent of contamination; however, at this time the following assumptions were made in developing the remediation scenario and the subsequent cost estimate and schedule:

- Of existing LLLW lines, 15% will be excavated and removed.

- Of existing LLLW lines, 15% will be grouted and abandoned in place.

- It is assumed that all excavated soil will be contaminated. Therefore, the soil will be boxed in B-25 boxes and sent to the proposed WAG 1 consolidation area for storage/disposal.

- It is assumed that any pavement or sidewalk disturbed during the RA will be replaced since the final disposition of the site is unknown.

- It is assumed that the piping and storm drains carrying contaminants are those that pass through the contaminated areas. Collection of contaminants flowing in and around these pipes is included in Early Actions and operable unit mentioned above.

16.4.3.3 Support Activities (6.1.01.43.09.03)

During the RA activities, MMES will provide the necessary staff and support to operate and maintain the Personnel and Equipment Decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities from the consolidation area to the PWTP for further treatment.

16.4.4 Post Construction

16.4.4.1 Post Construction Report (6.1.01.43.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, completion of construction activities, and effectiveness of selected remedies. MMES and the Construction Manager will be responsible for the following activities to prepare the Post Construction Report.

- Conduct a site inspection with EPA and TDEC (1) to determine whether the RA is complete and consistent with the agency-approved remedies and (2) to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

  — a brief recapsulation of site description, chronology of major events, and the selected remedies;

  — an explanation of construction activities, modifications, performance standards, and QC; and

  — an explanation of operation and maintenance, including monitoring to be undertaken at the site.

16.4.5 Monitoring During Remedial Action

16.4.5.1 Monitoring Plan (6.1.01.43.11.01)

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of the remediation conducted.

16.4.5.2 Environmental Monitoring Program During Remedial Action (1.05.43.11.02)

MMES will implement an Environmental Monitoring Program that will accomplish the following:

- Start 1 month before start of construction in order to establish the baseline.
- Be conducted during the various RA activities to document the impacts of remedial activities.
- Continue until the RA is completed to (1) assess the effectiveness of the remedies implemented, (2) provide data for the Post Construction Report and Five-Year Review Plan, and (3) generate routine monitoring reports with analytical results.

16.4.6 Verification

16.4.6.1 Five-Year Review Plan (1.05.43.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s), then, in accordance with CERCLA and the FFA, an RA Assessment Plan is required in order for the EPA and TDEC to review the RA no less than once every 5 years after the initiation of the final RA(s). This would ensure that human health and the environment are protected by the RA(s) being implemented. Because contaminants will remain after remediation, the A-E Contractor and MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity/status of the RA(s) implemented.

16.4.6.2 Five-Year Monitoring (1.05.43.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of remediation. The results shall be documented on the monitoring reports that will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of ORNL.

16.4.6.3 Five-Year Plan Assessment (1.05.43.12.03)

The data obtained during the 5 years of monitoring will be analyzed. The status of the RA(s) implemented will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether the RA(s) implemented are still in compliance after 5 years with the intent and criteria established in the IROD and current regulations and policies.

16.4.7 Risks and Uncertainties

- During the RI, sampling at storm drain outfalls may uncover contamination in areas where base flow collection has not been proposed.
- Inactive lines other than LLLW lines may be discovered to be pathways for contaminants.
- Quantities of LLLW lines requiring removal or grouting may differ significantly from those assumed for this estimate.
- Any changes in the RD due to the risk and uncertainties mentioned in Section 16.3.4 will have a direct effect on remediation cost.
- Additional remediation will be needed if the RA proves unsuccessful.

16.4.8 Interfaces

During remediation activities, interface and coordination will be necessary with the following agencies:

- EPA — To provide regulatory overview during the RA process, to approve all primary documents, and to conduct routine inspections.
- TDEC — To provide regulatory overview for the state of Tennessee during the RA process and to conduct routine inspections.
- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management Division — To provide waste management overview and support throughout the RA process focusing on the minimization of RA-generated wastes and to provide the capability to process the wastes generated.

- MMES Technical Advisory Group — To provide technical overview support during the RA process, i.e., monitoring and field change requests.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division — To provide input and overview for the health and safety aspects of conducting the RA.
- Construction Manager — To provide construction support during RA activities.
- Title III Services (includes Inspection Services).
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.
- Independent Certification Contractor.

16.4.9 Contingent Action

No contingent actions were identified in the Life Cycle Cost Observational Approach Workshop.

17.0 WAG 1 GROUNDWATER OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the Groundwater OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for this OU is presented in Fig. 17.1. The summary level schedule for the Groundwater OU is shown in Fig. 17.2. Table 17.1 shows a cost assessment of $34,325,000 for OU4 by remediation phase and FY. TCFs are used to estimate cost for RI/FS tasks in this OU, as discussed in Chapter 14.0.

17.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 17.3. The summary level schedule for these RI WBS elements is shown in Fig. 17.4. The cost assessment of $14,785,000 for performing the RI is presented by WBS activities and FY in Table 17.2.

17.1.1 Scope and Assumptions

The primary assumption for the RI effort for OU4 is that in the implementation of the observational approach, additional RI data will be required to support the development of the Feasibility Study.

The WAG 1 Groundwater OU response actions and associated RI activities are as follows:

- Containment — geophysical surveys, geotechnical properties (soils), and perimeter soils sampling.
- Water Diversion — geophysical (seismic) surveys and groundwater sampling/monitoring.
- Groundwater Treatment — sampling/treatment of deep groundwater zone will be performed under the WAG groundwater sampling/monitoring of stormflow zone.

The following assumptions have significant roles specific to the schedule for implementation of the RI process:

- All primary documentation will undergo a concurrent MMES and DOE review. Additionally, the review process for these documents will follow the "Accelerated Review Cycle" defining review times for each step in the review process.

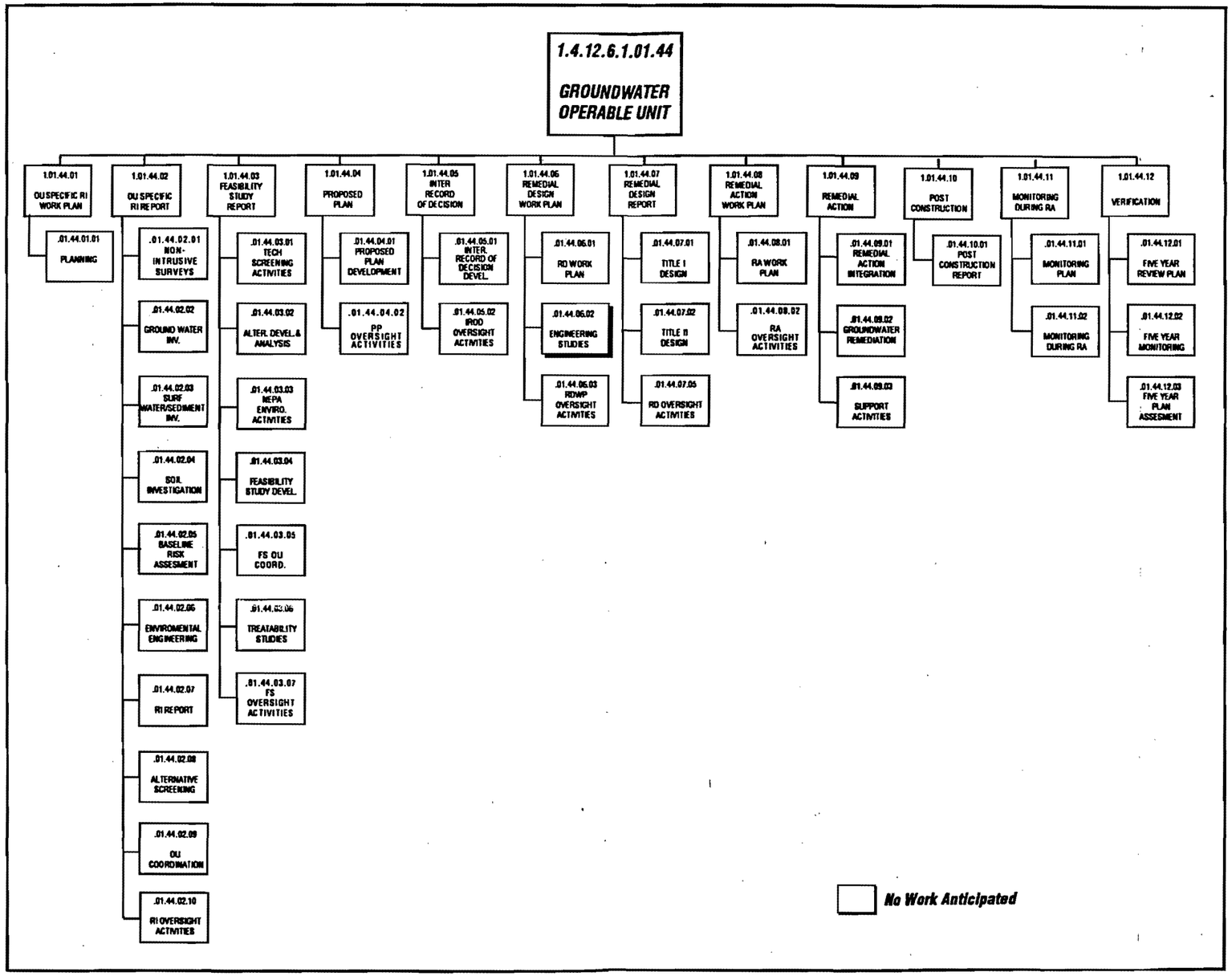


Fig. 17.1. Groundwater OU Work Breakdown Structure.

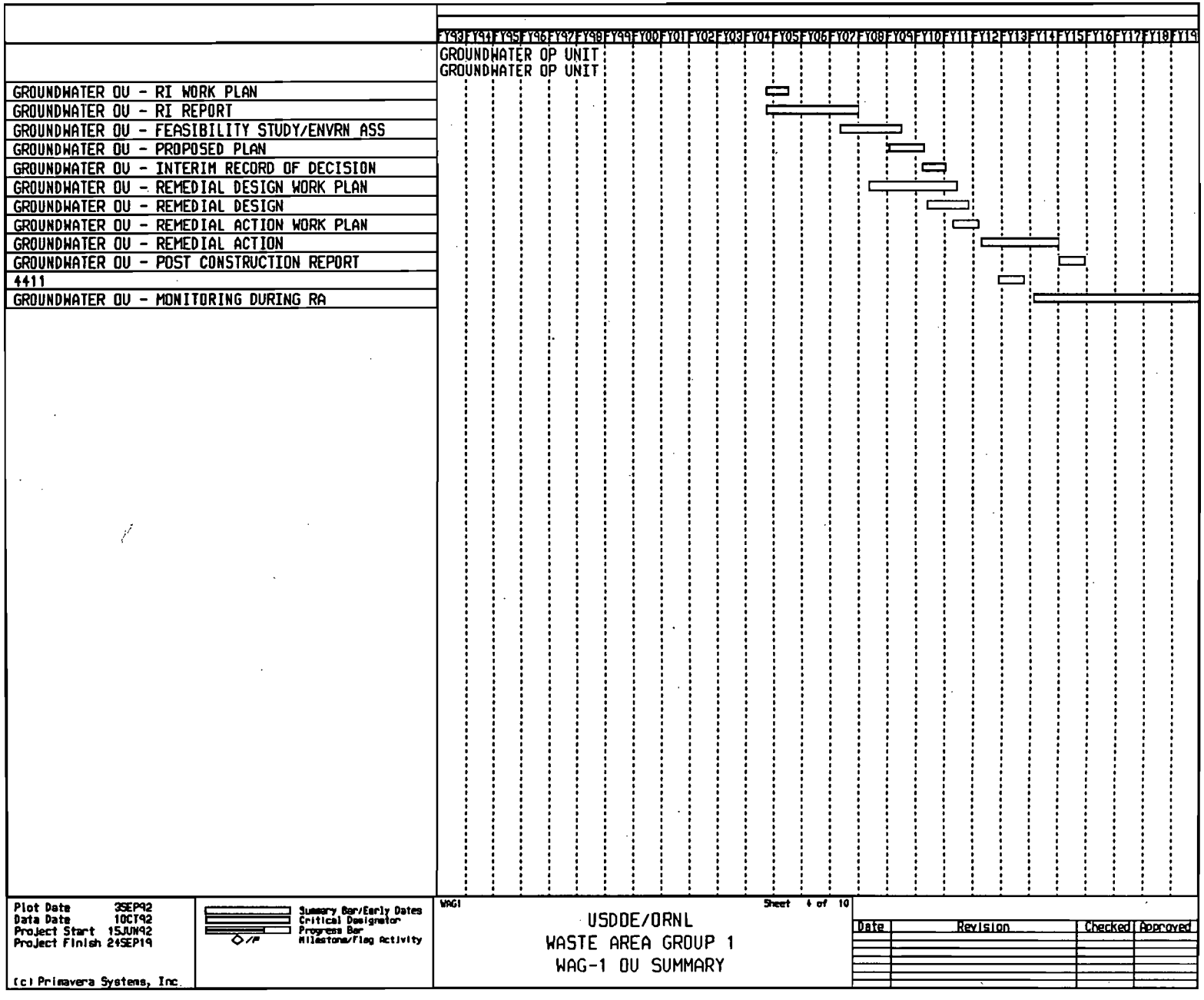


Fig. 17.2. Groundwater OU Summary Level Schedule.

TABLE 17.1
WAG 1 Oper. Unit 04 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																		
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Remedial Investigation	0	334	4,353	6,910	3,189	320	0	0	0	0	0	0	0	0	0	0	0	0	15,105
Feasibility Study/IROD	0	0	0	0	1,512	1,512	616	157	25	0	0	0	0	0	0	0	0	0	3,822
Remedial Design	0	0	0	0	0	0	0	1,476	1,951	0	0	0	0	0	0	0	0	0	3,427
Remedial Action	0	0	0	0	0	0	0	0	517	1,080	4,022	3,695	723	411	411	411	699	0	11,970
TOTALS	0	334	4,353	6,910	4,701	1,832	616	1,633	2,493	1,080	4,022	3,695	723	411	411	411	699	0	34,325

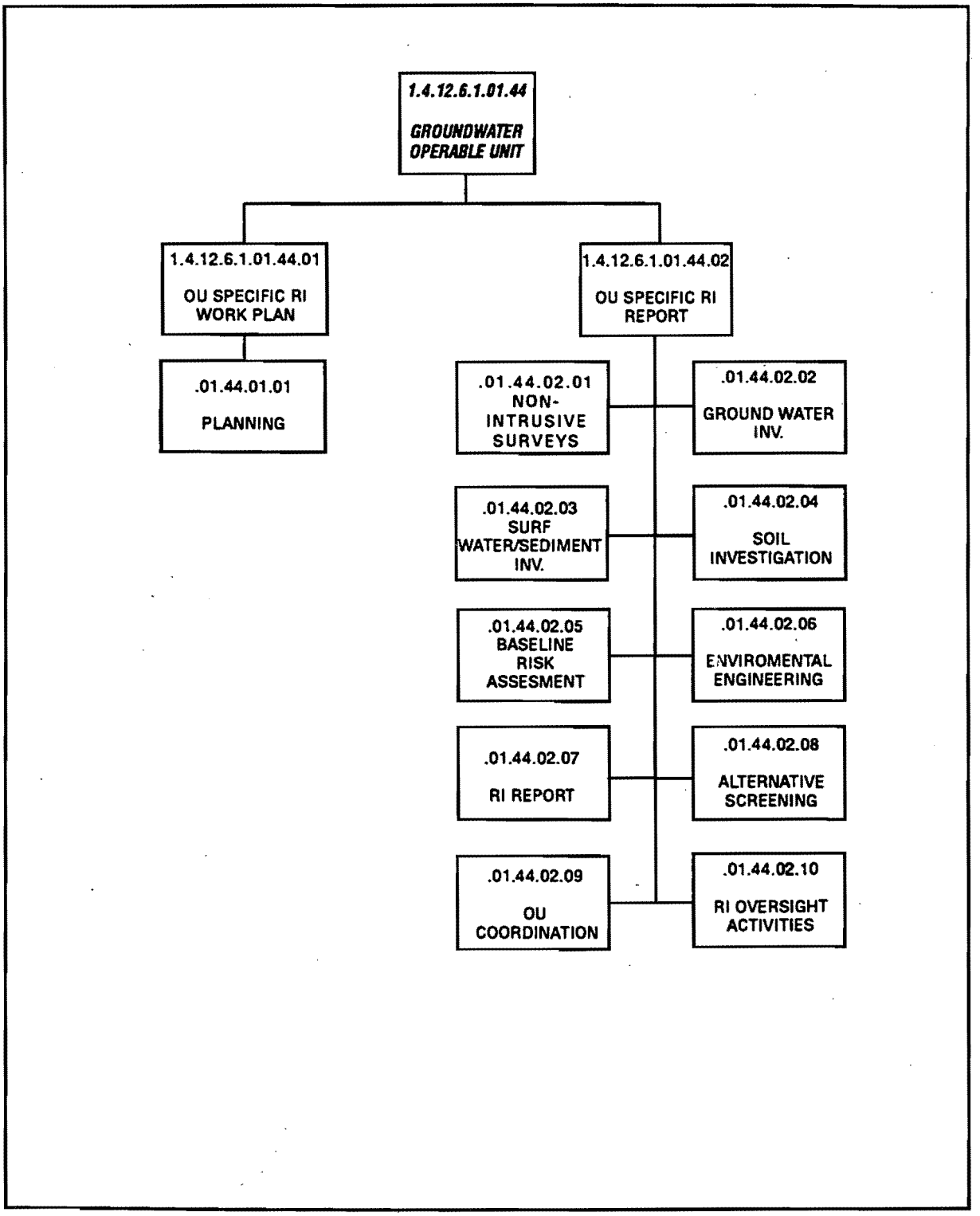


Fig. 17.3. Groundwater OU RI Work Breakdown Structure.

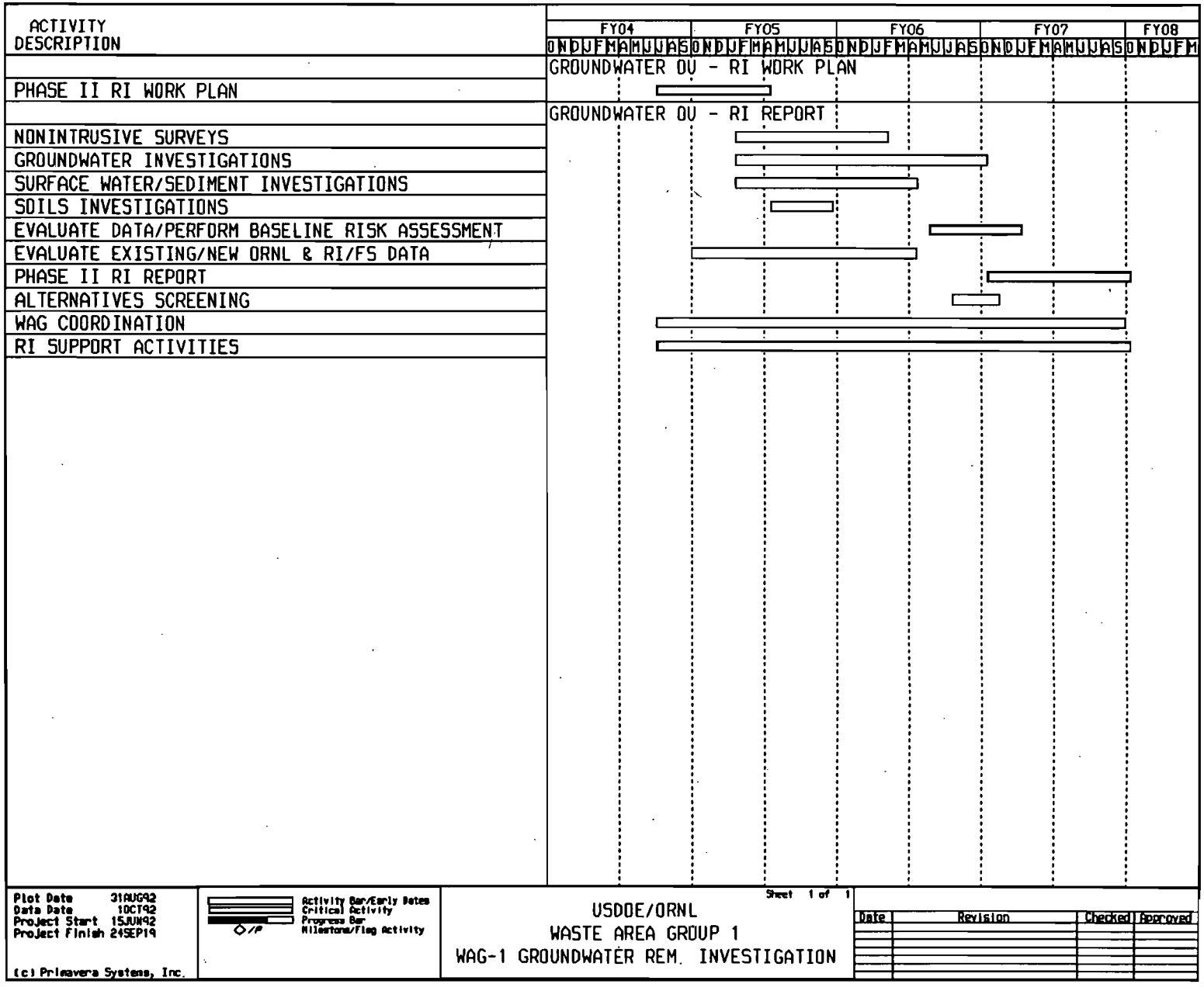


Fig. 17.4. Groundwater OU RI Summary Level Schedule.

TABLE 17.2
WAG 1 Oper. Unit 04 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2004	2005	2006	2007	2008	TOTAL
Planning	19	185	0	0	0	203
Nonintrusive Surveys	0	77	56	0	0	133
GW Investigation	0	502	1,746	86	0	2,333
SW/SED Investigation	0	908	1,377	0	0	2,285
Soil Investigation	0	397	0	0	0	397
Baseline Risk Assess.	0	0	185	280	0	465
Environ. Engineering	15	336	211	0	0	562
RI Report	0	0	0	663	77	663
Alternative Screening	0	0	8	12	0	20
RI OU Coordination	58	978	2,356	1,177	0	4,570
RI Oversight Activities	243	970	970	970	243	3,153
TOTALS	334	4,353	6,910	3,189	320	14,785

- Sufficient coordination with the regulators will occur throughout the RI process. It is anticipated that any comments received on primary documentation will not require additional sampling, major revision of these documents, or the application of the resolution process for disputes.

- Nonintrusive surveys will be authorized by the regulators and may be initiated within 1 week subsequent to transmittal of the draft RI Work Plan to the regulators.

- Intrusive investigations will be authorized by the regulators and may be initiated upon completion of regulatory review of the draft RI Work Plan.

17.1.2 Operable Unit Specific Remedial Investigation Work Plan

17.1.2.1 Planning (6.1.01.44.01.01)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI. The RI Work Plan defines the scope and objectives for the RI activities and provides a mechanism for planning the investigation. A project management strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes a summary and interpretation, when appropriate, for available environmental information. The work plan addresses the potential federal and state ARARs, TBC guidance, and the establishment of DQOs. It provides specific rationale for all field and analytical work. The RI Work Plan addresses the proposed technical approach and timing for implementation, schedules, and decision points where appropriate. The RI Work Plan is prepared according to provisions of applicable EPA and TDEC guidance documents.

Because of the need to review data reported as part of the Groundwater Phase I RI effort and incorporate changes in project approach, a supplement to the WAG 1 RI Work Plan and associated documents will be developed as needed.

17.1.3 Operable Unit Specific Remedial Investigation Report

17.1.3.1 Nonintrusive Surveys (6.1.01.44.02.01)

The following two nonintrusive surveys will be generally conducted before initiation of media-specific sampling. Civil surveys will be performed as needed to support the Groundwater OU investigation activities including as-built surveys, construction surveys, and topographic surveys. They will also help to monitor well and sampling locations.

Borehole geophysical logging will be performed in ten new intermediate and deep boreholes (as indicated in Section 17.3.2) before installation of these wells. The full range of log types includes natural gamma ray, caliper, temperature, differential temperature, self potential, borehole televiewer, variable density acoustic log, short/long normal resistivity, single-point resistance, deviation survey, 4-Pi density, neutron, sonic, and borehole flowmeter.

17.1.3.2 Groundwater Investigation (6.1.01.44.02.02)

Groundwater flow may constitute a significant pathway for migration of contaminants from WAG 1 OUs to potential receptors offsite. MMES has conducted preliminary investigations of groundwater flow and quality that indicate that the flow regime is complex and that there are radiological contaminants present in the groundwater. An investigation of WAG 1 hydrogeology will supplement the Groundwater OU Phase I investigation by further defining groundwater flow and quality with the following objectives:

- Determination of the type and degree of interaction between the surface water and shallow groundwater systems within the WAG 1 OUs,
- Characterization of shallow groundwater movement through and away from WAG 1 OUs,
- Determination of the types and levels of contaminants associated with releases from specific WAG 1 sources (i.e., SWMUs).

Water-level data from the shallow groundwater monitoring wells and piezometers, in conjunction with data from stream-gauging stations, will provide information on the interaction of surface water and groundwater systems. Groundwater studies performed as part of WAG 1 focus on shallow groundwater (defined as groundwater which discharges to the surface within WAG 1). WAG 21 will focus on deeper groundwater located within bedrock strata.

Forty RCRA water-quality wells are located within and around the WAG 1 OU perimeter. The perimeter wells are used to monitor the overall movement of contaminants from WAG 1 OUs and to characterize groundwater quality. Twenty shallow wells were installed and developed within the interior of WAG 1 OUs during the Phase I RI to evaluate deeper bedrock flow regimes in each lithology and in conditions around individual SWMUs. New wells will be installed during the OU investigation to obtain background or reference analytical data. These wells will further monitor the overall movement of contaminants from WAG 1 OUs and characterize groundwater quality.

The eight background wells will be located outside of the WAG 1 area up Bethel Valley to the east. Preparation of well permits is included in the groundwater investigation scope.

Five coreholes exist in the WAG 1 area. During the OU investigation, a Westbay System (i.e., a multiport groundwater sampling and monitoring system) will be installed in each corehole.

Groundwater levels will be measured at approximately 90 locations. These include existing wells and monitoring wells installed during the OU investigation. The water levels will be measured seasonally (i.e., at least four times throughout the year).

The groundwater samples will be obtained during two sampling episodes from 65 wells: 25 (of the 40) RCRA wells, 20 existing Phase I wells, and 20 new wells. The timing of the first and

second sampling events will coincide with regional seasonal low and high groundwater conditions. The remaining RCRA wells (15 of the 40) will be sampled and analyzed by MMES personnel and results will be transmitted to the RI Subcontractor.

Samples from the OU investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents and water quality parameters. Both filtered and unfiltered samples will be collected for the metals and radiological analyses. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods, as available, will be performed on all samples to be included in risk assessments and other instances where data of known quality are required.

The results of the groundwater investigation associated with the WAG 1 Groundwater OU will be made available to the Groundwater WAG Team in order to facilitate site-wide groundwater remediation assessments. It is conceivable that as the groundwater investigation proceeds, additional data needs will be identified by the Groundwater WAG Team, which will result in additional requirements being placed on the Groundwater OU groundwater investigation. No allowances for additional investigation requirements are included in the scope of effort for the Groundwater OU RI. Continuing interface between Groundwater OU RI and the Groundwater WAG Team will be required throughout the RI process.

17.1.3.3 Surface Water and Sediment Investigations (6.1.01.44.02.03)

Existing data indicate that surface water constitutes a migration pathway for radiological contaminants such as ^{90}Sr and ^{137}Cs, which originate at WAG 1 OUs. Information on surface water is needed to further evaluate whether contaminants released from WAG 1 SWMUs/additional areas of concern have migrated or are migrating into the surface water/sediment regime. If they have or are migrating, information is needed to determine the extent of migration. This contaminant load information will be used for fate and transport analysis, risk assessment, and evaluation of remedial alternatives.

Existing data indicate that stream sediments constitute a potential migration pathway for radiological contaminants originating at WAG 1 OUs. Some contaminants preferentially sorb to sediments because of the clay mineralogy and bulk properties of the sediment. Contaminated sediments migrate with surface runoff and along stream channels. During storm events, these sediments can be carried significant distances. Uptake by benthic biota concentrates contaminants at higher trophic levels and results in a pathway of environmental exposure.

One surface water sampling station will be constructed and equipped with flow-control devices and continuous water-level instrumentation. The rest of the stations will receive discrete flow measurements during storm and non-storm events four times per year.

Fifteen new seep sampling stations (i.e., small reservoirs) will be constructed at WAG 1 seep areas identified during the surface water sampling. The stations will minimize disturbance to the

seeps, but will prohibit uncontrolled access to the sampling stations. The configuration of the seep, its flow volume, and the source of the seep will be considered in designing the secured sampling station.

Samples from surface water/sediment investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and water quality parameters (surface water only). Water samples will include both filtered and unfiltered samples for the metals and radiological analyses. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples included in risk assessments and in other instances where data of known quality are required.

17.1.3.4 Soils Investigation (6.1.01.44.02.04)

Soil-sampling activities will be conducted during drilling of the new OU-investigation wells to (1) further delineate contamination within the Groundwater OU, (2) define specific contaminant sources, and (3) discern the extent of vertical migration. Vertically composited soil samples will be collected during installation of the eight new background quality wells and the 20 new groundwater quality wells (see the section on groundwater investigation). Two samples will be collected from each site.

Samples from soils investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and geotechnical parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples included in risk assessments and in other instances where data of known quality are required.

17.1.3.5 Baseline Risk Assessment (6.1.01.44.02.05)

The Groundwater OU Baseline Risk Assessment consists of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with the WAG 1 Groundwater OU for current and future exposure scenarios. The objectives of the environmental evaluation are (1) to determine whether that particular OU poses a current or potential future risk to environmental resources in the absence of any remediation and (2) to provide information evaluating the relative environmental impacts of remedial alternatives on the environment.

The human health evaluation will be performed in accordance with EPA's *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)* (1989). The work will include an evaluation of chemical and radiological data collected before and during the WAG 1 Groundwater OU RI. An exposure assessment, a toxicity assessment, and a risk characterization will be conducted with the information used to compute human health risks. The average annual

concentrations of radionuclides and chemicals in surface water, groundwater, soils, and sediments for current and future time periods at OU locations will be estimated utilizing a surface/subsurface model.

The environmental evaluation will be performed to meet the requirements of Section 121 (b)(1) and (d) of CERCLA and other statutes that mandate protection of wildlife, fisheries, threatened and endangered species, and sensitive environments. Guidelines for conducting this evaluation are provided by EPA in *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (1989). The evaluation will be both a quantitative and qualitative appraisal of the actual or potential effects of this waste site on plants and animals other than humans and domestic species.

17.1.3.6 Environmental Engineering (6.1.01.44.02.06)

Environmental engineering provides technical support and engineering analyses for data collection and field investigation tasks.

A detailed evaluation of existing data for the Groundwater OU will be performed before field investigation is begun. Support to the ORNL/DOE/EPA/TDEC technical review process, the ORNL environmental assessment documentation process, and the ORNL readiness review process will be provided as requested. Evaluation of new ORNL data (i.e., semi-annual groundwater data) will be performed and will include the review and tabulation of data as it becomes available (i.e., SIMS). This data will be compared to the OU-focused RI Work Plan supplement, as appropriate. Comparisons and conclusions drawn with respect to the data generated by the Groundwater OU investigation may also be used.

An environmental engineering analysis will be performed on all data generated from the Groundwater OU field activities. This data will be tabulated for use in writing the technical memorandums and technical bulletins. The data will also be evaluated by modelers and risk assessment specialists for use in models (see the element description for Baseline Risk Assessment).

The data summarized by the two previous tasks will be reviewed for implementation of remedial alternatives. This task is iterative in nature and consists of the following steps: (1) summarized RI/FS data is reviewed as it becomes available, (2) the preliminary remedial alternatives scenario is refined if necessary, (3) data needs are re-evaluated based on the new alternatives scenario, and (4) data collection efforts are altered to meet any new data needs.

17.1.3.7 Remedial Investigation Report (6.1.01.44.02.07)

The OU RI Report will serve as documentation of data collection and analyses. The results of the OU RI are presented as an analysis of site characteristics, the risk associated with such characteristics, and a summary of potentially feasible remedial actions (see element definition for Alternative Screening). The evaluation of site characteristics will focus on the site physical characteristics, the source characteristics, the current nature and extent of contamination, and

important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

A draft determination of the ARARs will be submitted to EPA and TDEC before the draft Groundwater OU RI Report is issued. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to the Groundwater OU remediation. The draft Groundwater OU RI Report will be produced for review by ORNL, DOE, EPA, and TDEC. The OU RI report will consolidate available, appropriate, and applicable data on the Groundwater OU and summarize technical work completed to date on the project. In addition to the fieldwork (Phase II) proposed for this OU, the primary basis or reference for the Groundwater OU RI Report will be the WAG 1 Site Characterization Summary Report.

17.1.3.8 Alternatives Screening (6.1.01.44.02.08)

The objectives of the alternatives screening are to develop preliminary RA goals, develop a range of alternatives, and perform a screening level alternatives evaluation.

Preliminary development and screening of remedial alternatives will be performed according to the EPA *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (1988). The effort consists of the following six steps:

1. Develop RA objectives specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed.

2. Develop general response actions for each medium of interest that may be taken to satisfy the remedial action objectives for the site.

3. Identify volumes or areas of media where general response actions might be applied.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the site.

5. Identify and evaluate technology process options to select a representative process for each technology type retained for further consideration.

6. Assemble, as appropriate, the selected representative technologies into alternatives representing a range of treatment and containment combinations.

17.1.3.9 Operable Unit Coordination (6.1.01.44.02.09)

Activities include Groundwater OU RI quality control and project management and coordination. These activities will ensure that RI quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple WAGs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided, which includes general report programming, data base management, and data base interfacing with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Necessary field support needed to manage and direct Groundwater OU RI field activities will be performed, which includes decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes providing required field equipment, spare parts, and other field materials and supplies.

17.1.3.10 Remedial Investigation Oversight Activities (6.1.01.44.02.10)

This element, RI Oversight Activities, provides technical support, input and oversight during the RI to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon issuance of the revised Site Characterization Summary Report to the regulators.

- FS Contractor — Provides technical oversight to ensure that the nature and extent of contamination and the associated risks are developed and presented in the Site Characterization Summary Report consistent with the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the data and information obtained and the nature and extent of contamination developed during the RI are adequate and presented in a manner consistent with the RD approach and design requirements.

- MMES ES&H Division — Provides support for health and safety, environmental compliance, and waste management as part of conducting the RI field activities.

- Sample Validation Subcontract — Provides support to perform validation of chemical sampling performed during the RI.

- MMES Environmental Sciences Division — Provides support for geophysical surveys and drilling.

- MMES Planning/Coordination — Provides necessary permits for RI field activities.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

17.1.4 Risks and Uncertainties

The following list describes the area of risks and uncertainties associated with the performance of the RI:

- The areal extent of contamination is not fully defined; this would require additional investigation and study to determine remedial alternatives.

- New regulatory requirements may result in changes to the level of effort required for the risk assessment and alternatives screening.

- Lack of approval for the RI Work Plan would delay field investigations and would require additional work to incorporate regulatory concerns into the RI.

17.1.5 Interfaces

The following list describes the primary interfaces and anticipated roles during the RI:

- MMES Waste Management — To provide waste management overview and support throughout the RI process focusing on the minimization of RI-generated wastes. To provide the capability to process the wastes generated during the RI.

- MMES Technical Advisory Group — To provide technical overview support during the RI process; i.e., overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that RI goals are achieved.

- FS Contractor — To provide data review support to the RI that would sufficiently support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and to approve all primary documents.

- TDEC — To provide regulatory overview for the State of Tennessee during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

17.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents in more detail the efforts necessary to perform the FS/PP/IROD process for the WAG 1 Groundwater Operable Unit. The FS process will include incorporating environmental concerns as an EA within the FS Report. To comply with the FFA, the process will also require preparation of the regulatory decision documents, the PP, and IROD. The associated risks and uncertainties and the interfaces for the FS/PP/IROD effort are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is presented in Fig. 17.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig. 17.6. The cost assessment of $3,822,000 for performing the FS, PP, and IROD process is presented by WBS element and FY in Table 17.3.

17.2.1 Scope and Assumptions

The purpose of Groundwater OU FS/PP/IROD activities is to identify, organize, and examine remedial alternatives; to mitigate the risks identified in the RI Report; to justify selection of a preferred remedial alternative or a set of alternatives; and to prepare the regulatory required decision documents summarizing the situation and examination process, outlining the selected remediation method(s), and establishing the remediation schedule.

The FS Contractor will be responsible for completing the Groundwater OU FS/PP/IROD process. This process will require the preparation of the following milestone documents: (1) the FS Report, which documents the process used to examine the remedial technologies and select the preferred remedial alternative(s) and incorporates the environmental (NEPA) considerations in an EA segment to satisfy administrative requirements; (2) the PP, a summary plan for implementing the selected remedial alternative(s); and (3) the IROD, the legal document that declares that the selected remediation method(s) meets statutory and regulatory requirements and establishes the schedule for remediating WAG 1. To implement this process and to ensure that the remediation is completed according to the process, the FS Contractor will have oversight responsibilities during the RI and RD processes. The FS/PP/IROD process will be accomplished by the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities
- Feasibility Study Development

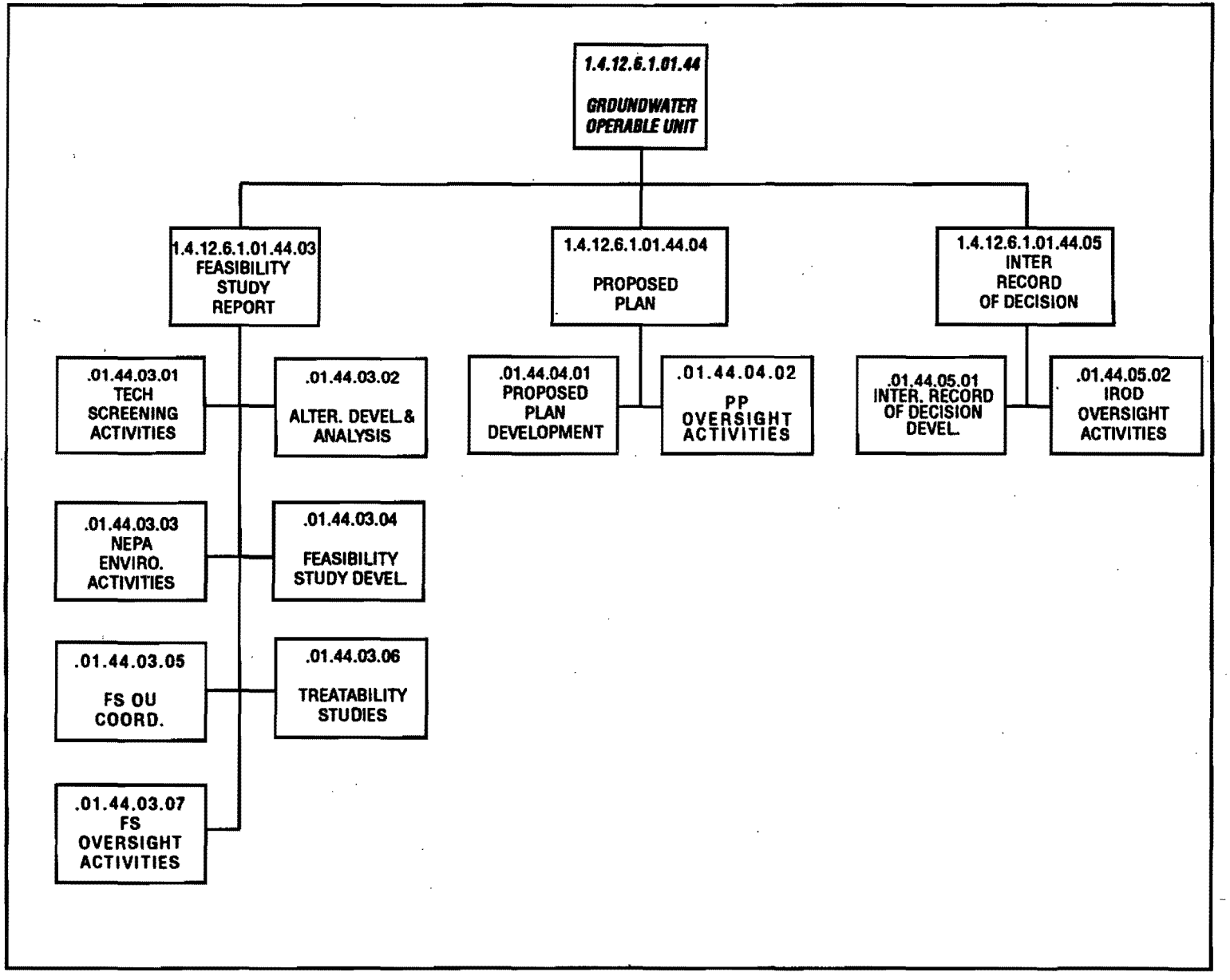


Fig. 17.5. Groundwater OU FS/PP/IROD Work Breakdown Structure.

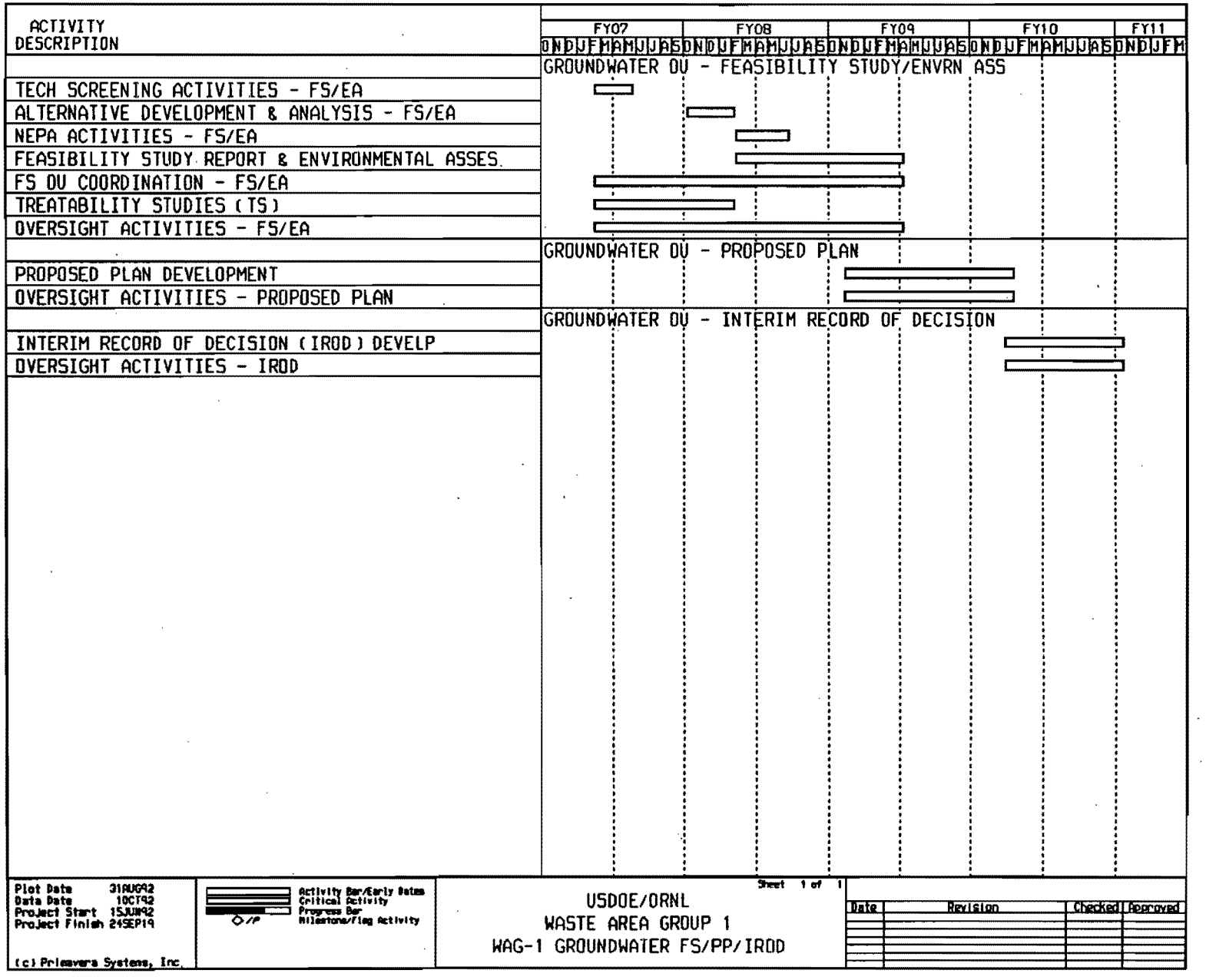


Fig. 17.6. Groundwater OU FS/PP/IROD Summary Level Schedule.

TABLE 17.3
WAG 1 Oper Unit 04 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2007	2008	2009	2010	2011	TOTAL
Technology Screening	230	0	0	0	0	230
Alternatives Develop./Analysis	0	154	0	0	0	154
NEPA/Environmental Activities	0	72	0	0	0	72
Feasibility Study Development	0	295	295	0	0	589
FS OU Coordination	60	80	60	0	0	200
Treatability Study	1,078	718	0	0	0	1,796
FS Oversight	144	192	144	0	0	480
SUBTOTALS FS	1,512	1,512	499	0	0	3,522
PP Development	0	0	68	34	0	102
PP Oversight Activities	0	0	50	25	0	74
SUBTOTALS PP	0	0	118	59	0	177
IROD Development	0	0	0	54	13	67
IROD Oversight Activities	0	0	0	45	11	56
SUBTOTALS IROD	0	0	0	98	25	123
TOTALS	1,512	1,512	616	157	25	3,822

- Feasibility Study Operable Unit Coordination
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities

Detailed descriptions of the scope of each activity and the assumptions used to prepare the cost assessments are presented below.

17.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA Report are presented in the following sections. The FS/EA Report will in general follow the format in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (1988).

The cost assessments made for the FS WBS elements were based on the following assumptions:

- The RI Report and the FS process will be completed as scheduled.
- The RI Report results are representative of the actual site conditions and adequately characterize the extent and amount of contamination in WAG 1 OUs.

17.2.2.1 Feasibility Study Technology Screening Activities (6.1.01.44.03.01)

Based on the remedial objectives established under the ER Program remedial objectives, the RI Report findings regarding waste- and site-specific conditions, and a literature search; the FS Contractor will identify applicable remedial technologies from the available common and innovative technologies for initial evaluation. These technologies will be screened to eliminate those judged too difficult to implement based on unproven technologies, judged not able to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Those technologies judged to have a reasonable chance of success for remediating the specific waste or site conditions will be carried forward for more detailed development and analysis. A technical memorandum summarizing the findings if this task will be issued to DOE.

17.2.2.2 Alternatives Development and Analysis (6.1.01.44.03.02)

The FS Contractor will develop the screened technologies for analysis by arranging them into general RA alternatives. These alternatives will then be evaluated, either individually or as combinations of technologies. The purpose of this evaluation is to eliminate alternatives (1) with costs significantly higher than similar alternatives, (2) that fail to provide adequate protection of public health and safety, and/or (3) that may adversely impact the environment. A list of alternatives that meets the remedial objectives and contributes to the protection of public health, safety, and the environment will be formulated for further study. A technical memorandum summarizing the findings of this task will be issued to DOE for regulatory compliance assessment.

The following are assumptions considered in the development of the cost assessment for alternatives development and analysis:

- Working group meetings will be held as needed with the regulatory agencies to discuss progress. Input and feedback from these meetings can be considered as consistent with the formal agency response.

- The regulatory agencies concur with the working group meetings and the results of the technology screening memo.

17.2.2.3 NEPA Environmental Activities (6.1.01.44.03.03)

To comply with DOE policy that NEPA criteria are considered during remedial activities, the remedial alternatives will be evaluated for impact on the environment. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

The cost assessment for this element was based on the following assumptions:

- An EA will be completed on the site to evaluate the environmental effects of the RA.

- The Baseline Risk Assessment in the RI Report presents the primary contaminant and exposure pathways of concern and is complete enough to ensure that the results are compatible with the alternatives risk calculation methodology selected for the FS Report.

- All ecological risk assessment sampling activities are completed on schedule and are representative of the actual site conditions.

17.2.2.4 Feasibility Study Development (6.1.01.44.03.04)

The FS Contractor will use the format presented in the CERCLA FS guidance document to develop the FS with exceptions and modifications for the specific wastes and conditions in the Groundwater OU. The FS development will be based on the information obtained from the RI, the alternatives screening and analysis process, and the EA considerations. Using the list of applicable remedial alternatives, the FS will be developed in sufficient detail to allow the selection of a preferred alternative(s) that meets the remedial objectives of mitigating release of contaminants. Criteria will be developed to assess the ability of the alternatives to meet the remedial objectives and to comply with administrative and regulatory requirements. The FS is intended to perform a detailed evaluation of the alternatives to provide an informed risk management decision and the legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE and EPA for review. The final FS/EA Report is a milestone document required by the FFA.

17.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.44.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to support QC efforts, to provide project management, and to coordinate project activities ensuring that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS oversight participants.

17.2.2.6 Treatability Studies (6.1.01.44.03.06)

Based on the information available for groundwater, the Fixed-Price Subcontractor will investigate/research the most appropriate method to treat contaminated groundwater. The treatability studies will include literature searches, a treatability study work plan, sampling, testing, and preparation of the report based on the above data. MMES will provide technical input and review/comment on the treatability document.

17.2.2.7 Feasibility Study Oversight Activities (6.1.01.44.03.07)

The objective of FS oversight activities is to provide technical input and oversight during the FS/EA to ensure that the data and information obtained during the RI are incorporated properly into the FS/EA Report and that it is adequate to prepare a PP and support the development of an IROD and a subsequent RD. FS oversight activities begin with the technology screening and are completed upon final approval of the FS/EA Report.

A brief description of the responsibilities of each participant involved in FS oversight activities follows:

- RI Subcontractor — Provides technical oversight to assess whether the technologies considered and the remedial alternatives to be developed and evaluated are consistent with the RI report conclusions and determined risks.

- A-E Contractor — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RD approach and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RA approach and can be implemented at ORNL.

- MMES — Provides technical support and review of the FS/EA process. Reviews progress reports and preliminary deliverables to ensure the FS/EA is processing as scheduled.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of FS/EA activities, technical advice, and an independent technical review of the FS/EA Report.

17.2.3 Proposed Plan

17.2.3.1 Proposed Plan Development (6.1.01.44.04.01)

The RA PP to remediate the site will be prepared using the preferred remediation alternative(s) to mitigate release of contaminants as selected in the FS/EA Report and from input from the regulatory agencies and the public. The PP documents the investigation process, administrative and regulatory actions, and the actions and schedule necessary to implement the remediation alternative(s) and to monitor performance. The PP is a primary milestone document that is subject to public review and response and to administrative and regulatory reviews.

The cost assessment for this element was based on the following assumptions: the FS process and the regulatory review cycle will be completed as scheduled.

17.2.3.2 Proposed Plan Oversight Activities (6.1.01.44.04.02)

The purpose of the PP oversight activities is to provide technical input and oversight during the development of the PP and to ensure that it is in compliance with applicable regulations and policies.

During the generation of the PP; the RI Subcontractor, A-E Contractor, and MMES will assess whether the preferred remedial alternative(s) to be proposed is consistent with the RI conclusions, Baseline Risk Assessment, and FS process. Progress reports and preliminary deliverables will be reviewed by the participants mentioned earlier to ensure that the PP is proceeding as scheduled.

17.2.4 Interim Record of Decision

17.2.4.1 Interim Record of Decision Development (6.1.01.44.05.01)

The final step in the planning process to remediate the Groundwater OU will be preparation of the IROD. This is the legal document that formally declares the preferred remediation method(s) in the PP that will mitigate releases and establish the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a decision summary outlining the nature and extent of the contamination and the associated risks at the Groundwater OU, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements; and (3) a responsiveness summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency of review. The final Groundwater IROD is a milestone document required by the FFA.

The cost assessment for this element was based on the assumption that the FS/EA and PP schedules were followed.

17.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.44.05.02)

During the development of the IROD document, MMES and the A-E Contractor will provide technical input and independent technical review to ensure that the IROD document is prepared in accordance with the FFA and in compliance with CERCLA. The technical review and oversight will also include the assessment of the IROD document's consistency with RI report conclusion, Baseline Risk Assessment, and FS/EA review.

17.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the Groundwater FS/PP/IROD process are the scheduling and the scoping of the activities. Minor changes in scheduling will have significant impacts on the labor cost of the project. If the schedule is modified, resulting in an extended total duration of the project, the totals cost will increase significantly. The scope of the project will have a direct impact on labor allocations. If additional IRODs are required, the total cost of the project will increase. Other factors that increase the uncertainty of the budgetary assessments in this report include:

- Requirements for additional sampling activities.
- Extended review cycles initiated by the regulators.
- Program funding limitations within the DOE system.

17.2.6 Interfaces

Completion of the Groundwater FS/PP/IROD process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.
- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.
- NEPA — Regulations that set the policies and goals for protecting environmental quality and establish the procedures to examine the impact that decisions on remediating may have on the environment.
- TDEC — Provides regulatory overview for the state of Tennessee.
- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.

17.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the Groundwater OU: an RD Work Plan, engineering studies as required, a Title I 30% design package, Title II 60% and 90% design packages, and final design reports. The risks and uncertainties and interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 17.7. The summary level schedule for these RD WBS elements is shown in Fig. 17.8. Table 17.4 show the cost assessment of 3,427,000 for performing this portion of the Groundwater OU remediation activities summarized by WBS activity and FY.

17.3.1 Scope and Assumptions

The scope of the RD work for the remediation of the Groundwater OU is to prepare necessary design and supporting documents required for (1) approval from DOE-OR, DOE-HQ, TDEC, and EPA; and (2) implementation of all RA activities.

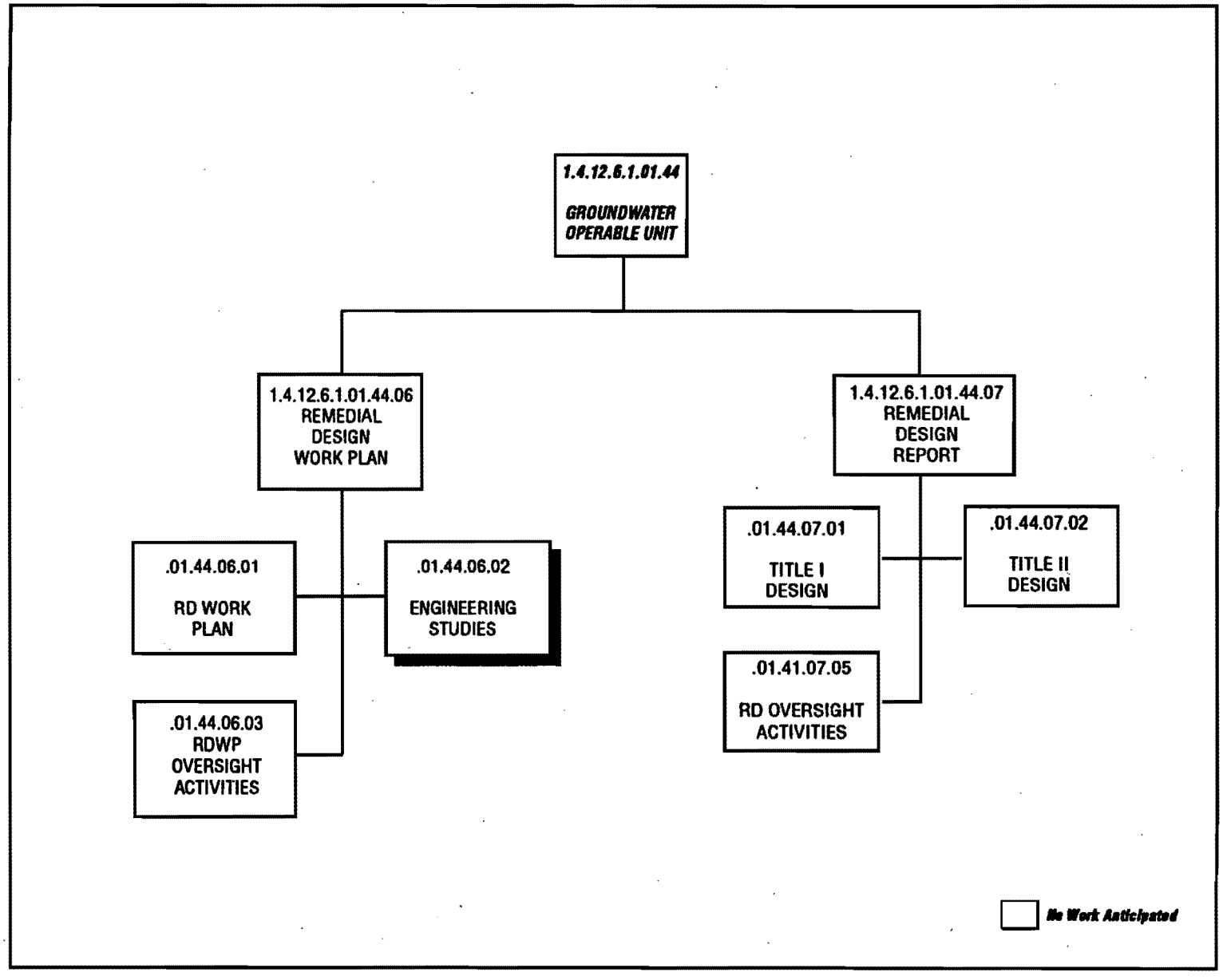


Fig. 17.7. Groundwater OU RD Work Breakdown Structure.

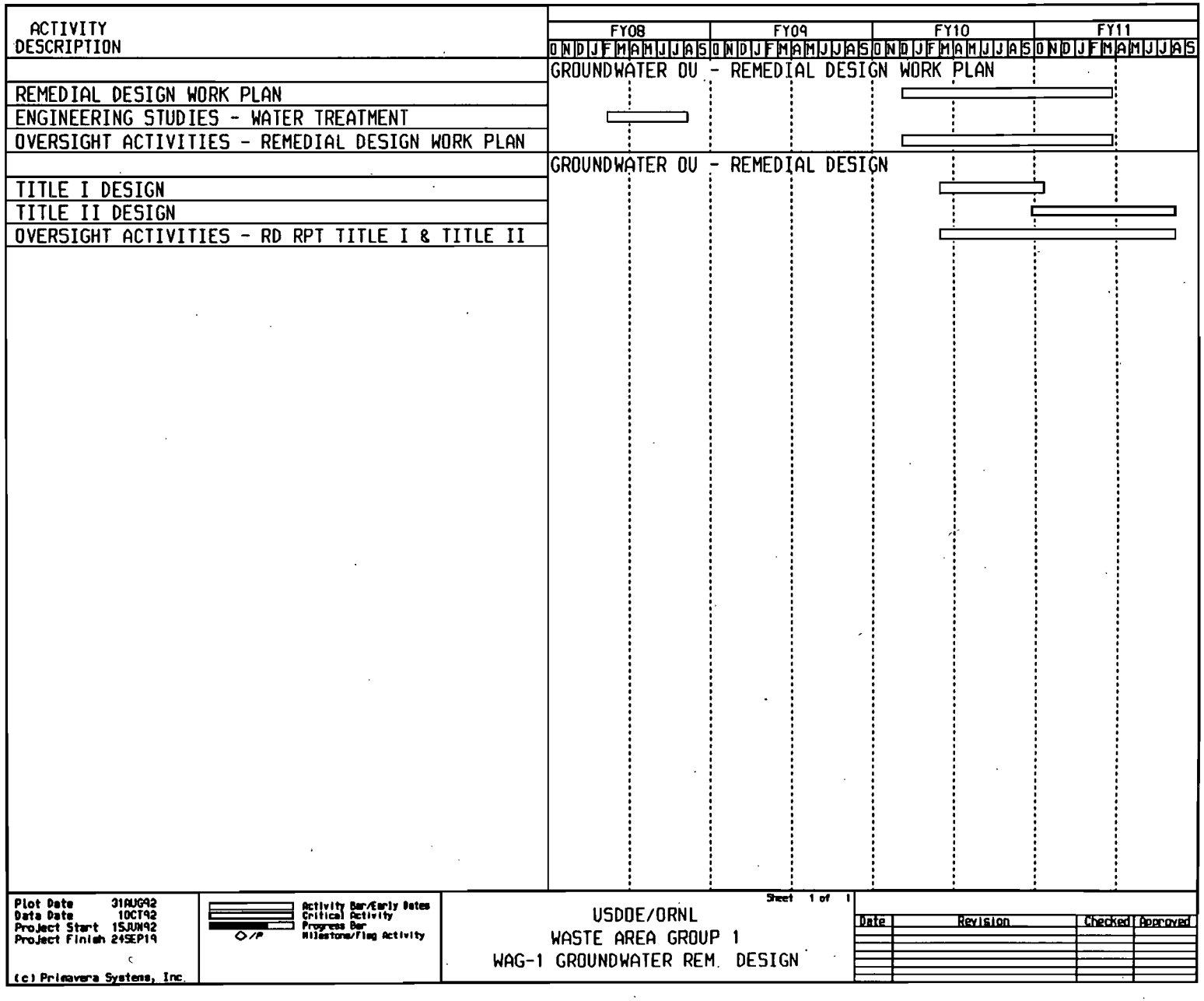


Fig. 17.8. Groundwater OU RD Summary Level Schedule.

TABLE 17.4
WAG 1 Oper Unit 04 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	2008	2009	2010	2011	TOTAL
Remedial Design Work Plan	0	0	139	69	208
Engineering Studies	0	0	0	0	0
RD WP Oversight Activities	0	0	59	30	89
SUBTOTALS RD WP	0	0	198	99	297
Remedial Design Phase I Title I	0	0	1,040	201	1,241
Remedial Design Phase I Title II	0	0	60	1,181	1,241
Remedial Design Phase II Title I	0	0	0	0	0
Remedial Design Phase II Title II	0	0	0	0	0
RD Oversight Activities	0	0	177	471	648
SUBTOTALS RD	0	0	1,278	1,852	3,130
TOTALS	0	0	1,476	1,951	3,427

Details on the scope of work and assumptions associated with the RD work breakdown elements that the RD A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the Groundwater RA are described in Chapter 4.0.

The RD Work Plan is scheduled to begin at the completion of the IROD application preparation. Fig. 17.9 depicts the schedule logic for completion of the RD Work Plan and its relationship to IROD and design activities. In order to initiate construction within 15 months of approval, the RD Work Plan preparation must begin early in the IROD approval process. This schedule assumes only 32 working days for a combined DOE-OR/HQ review of this document. The risks and uncertainties associated with this schedule are discussed in Section 17.3.4.

17.3.2 Remedial Design Work Plan

17.3.2.1 Remedial Design Work Plan (6.1.01.44.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The RD A-E Contractor will prepare a draft RD Work Plan based upon the scope and design criteria specified in the PP and IROD documents. The RD Work Plan will include the detailed design process and schedule for the design effort for the following remediation activities.

- Extension of the French drain proposed for collection of contaminated shallow groundwater migrating from Core Hole Eight plume upgradient. The additional drain will extend to the north to collect contaminants migrating toward First Creek.

- Extension of the French drain proposed for collection of contaminants in shallow groundwater migrating from the surface impoundments to White Oak Creek. The additional drain will extend to the east to intercept potential contaminant migration to White Oak Creek.

17.3.2.2 Engineering Studies (6.1.01.44.06.02)

Due to the type of technology being proposed for remediation (e.g., French drains), no engineering studies for the Groundwater OU are currently being planned.

17.3.2.3 Remedial Design Work Plan Oversight Activities (6.1.01.44.06.03)

Technical input will be provided during the preparation of the RD Work Plan to ensure that the design does not violate the intent of the IROD and will comply with the administrative and regulatory requirements. The RD Work Plan will be drafted by the RD Contractor with review conducted by the FS Contractor, MMES, and DOE. Based on the logic shown in Figure 17.9, the design effort will start after the RD Work Plan is prepared and will be nearly completed before EPA approval. Section 17.3.4 discusses risks and uncertainties associated with this strategy.

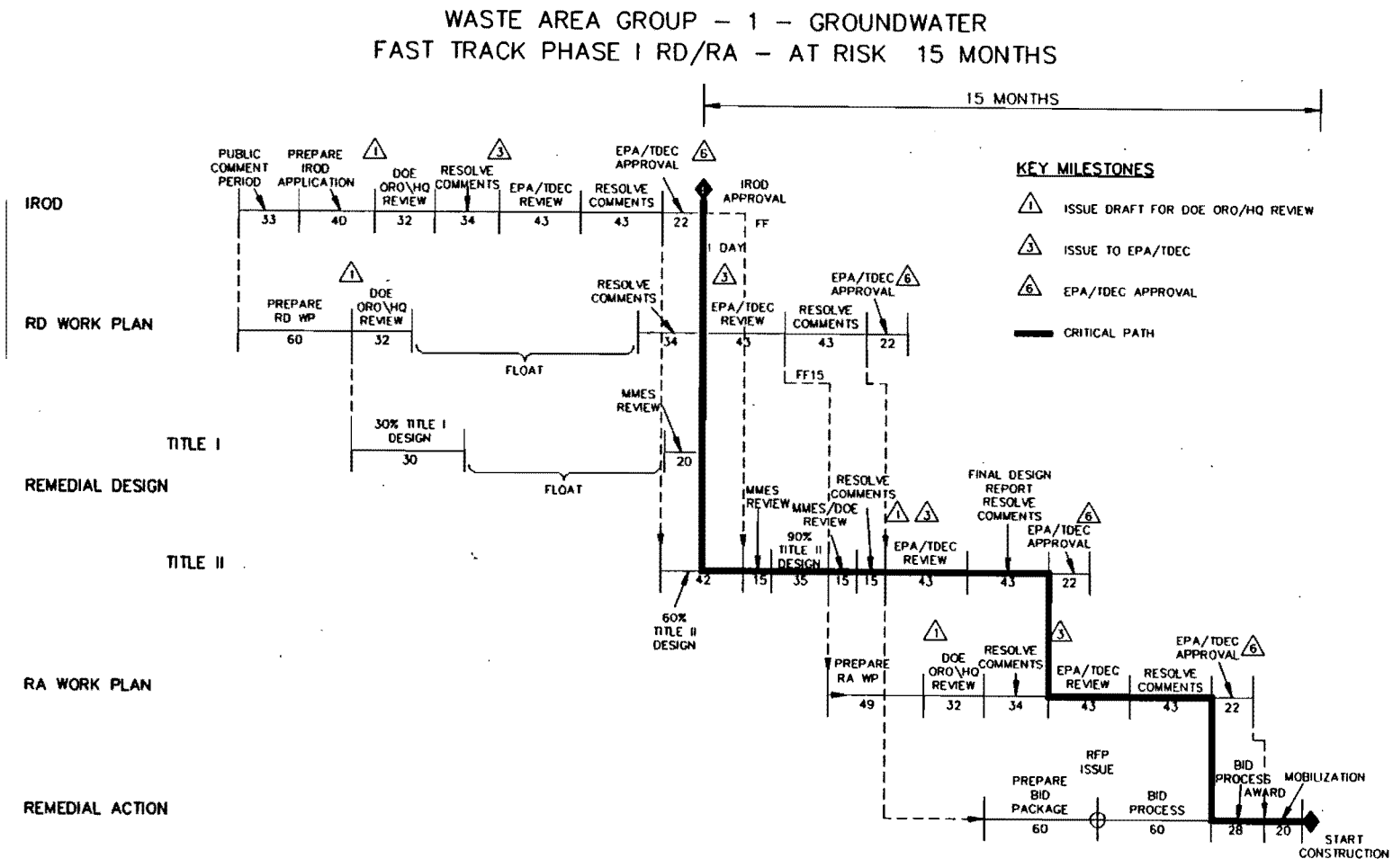


Fig. 17.9. Groundwater OU Phase I Schedule Logic.

17.3.3 Remedial Design Report

17.3.3.1 Title I Design (6.1.01.44.07.01)

Based on information available from the RI/FS, the RD A-E Contractor will prepare preliminary (30%) design documents showing the extent of remedial activities, site plan, details, and an outline of specifications for the work involved. A detailed cost estimate for the construction will be submitted with the 30% design document to MMES for review/comments/approval.

In order to support construction start within 15 months of IROD approval, Title I design must begin during the IROD preparation and approval process.

17.3.3.2 Title II Design (6.1.01.44.07.02)

Upon approval of the Title I design document, the RD A-E Contractor will prepare detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction; construction drawings; technical specifications; and cost estimates.

All the documents will be submitted to MMES for comments at 60% completion. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and DOE. Upon resolution of these comments, the 100% design package will be issued to TDEC and EPA for further review, comment, and approval. Upon resolution of the TDEC and EPA comments, the design report for remedial activities will be prepared and issued CFC.

The cost assessment for the Title I and Title II design was developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Any additional design/permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Support facilities are available for personnel and equipment decontamination.
- A consolidation area (or other disposal facility) is available for disposal of wastes generated during remediation.

17.3.3.3 Remedial Design Oversight Activities (6.1.01.44.07.03)

Oversight will be provided throughout the remedial design process to ensure that the design does not violate the intent of the FFA, FS/EA, PP, or IROD. Reviews will be conducted by the FS Contractor, MMES, and DOE at the 30%, 60%, and 90% completion stages to provide assurance that the design complies with administrative policies and regulatory requirements.

17.3.4 Risks and Uncertainties

The findings and conclusions in the Final RI and FS/EA documents may impact the scope of engineering studies and development work.

The primary risks and uncertainties associated with RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the remedial design and, therefore, cost.
- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have significant impact on RD and remediation work.
- The findings and conclusions in the Final RI and FS/EA documents may impact the scope of RD work.
- Title II design is completed before approval of the RD Work Plan by EPA. EPA comments to the RD Work Plan could adversely impact completion of RD.
- Title II design is started before IROD approval by EPA. The risk is lessened by the fact that comments should be resolved before start of Title II design.

17.3.5 Interfaces

The RD documents required for the remediation of the groundwater will require the coordination and close interface with the following:

- EPA — To provide regulatory overview during the RD process and to approve all primary documents.
- TDEC — To provide regulatory overview for the state of Tennessee during the RD process.
- DOE — To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management Division — To provide waste management overview of design considerations for waste generation, handling, and storage/disposal.
- MMES Technical Advisory Group — To provide technical overview support during the RD process; i.e., engineering studies and design criteria.

- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division — To provide input and overview for the safety and health aspects for implementation of design.
- Construction Manager — To provide construction reviews of design.
- RD Contractor — To draft the RD Work Plan.

17.4 REMEDIAL ACTION

This section presents the scope of the RA activities required to implement groundwater flow control for shallow groundwater underlying WAG 1. The risks and uncertainties and interface issues for the remedial activities are identified as well.

The WBS developed for performing the RA is presented in Fig. 17.10. The summary level schedule for these RA WBS elements is shown in Fig. 17.11. Table 17.5 shows the cost assessment of $11,970,000 for performing this portion of the WAG 1 OU4 remediation activities summarized by WBS activity and FY.

17.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan, construction management, Title III services, construction of the remedial design packages, construction support, and independent certification and verification. This includes monitoring and a 5-year review.

17.4.2 Remedial Action Work Plan

17.4.2.1 Remedial Action Work Plan (6.1.01.44.08.01)

The RA Construction Manager will prepare the draft RA Work Plan, which (1) defines the scope and objectives of the RA based upon the IROD and final remedial design; (2) documents the specific construction components of the RA; and (3) presents the RA schedule, subcontracting strategy, QA Plan, Health and Safety Plan, and RA Monitoring Plan.

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

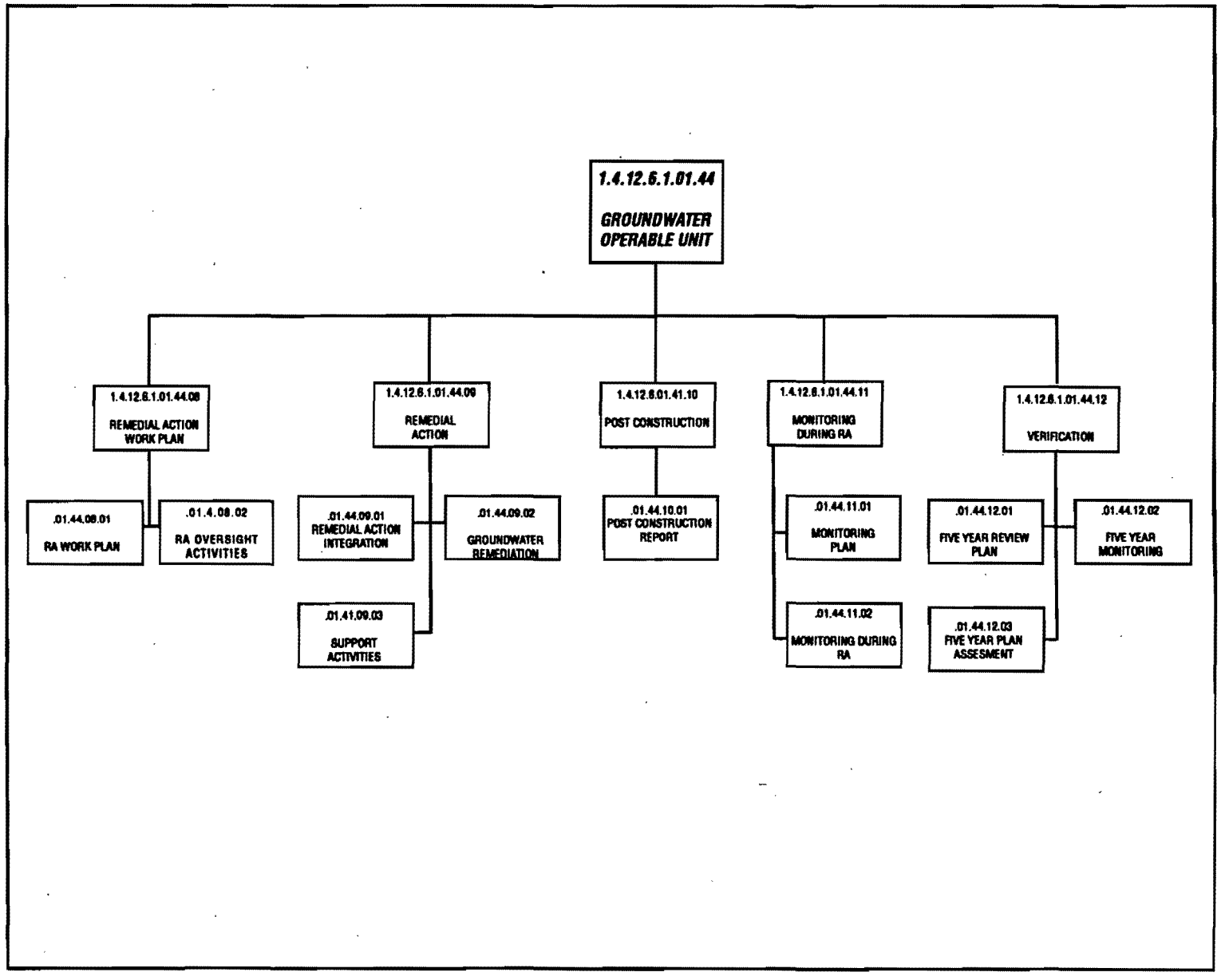


Fig. 17.10. Groundwater OU RA Work Breakdown Structure.

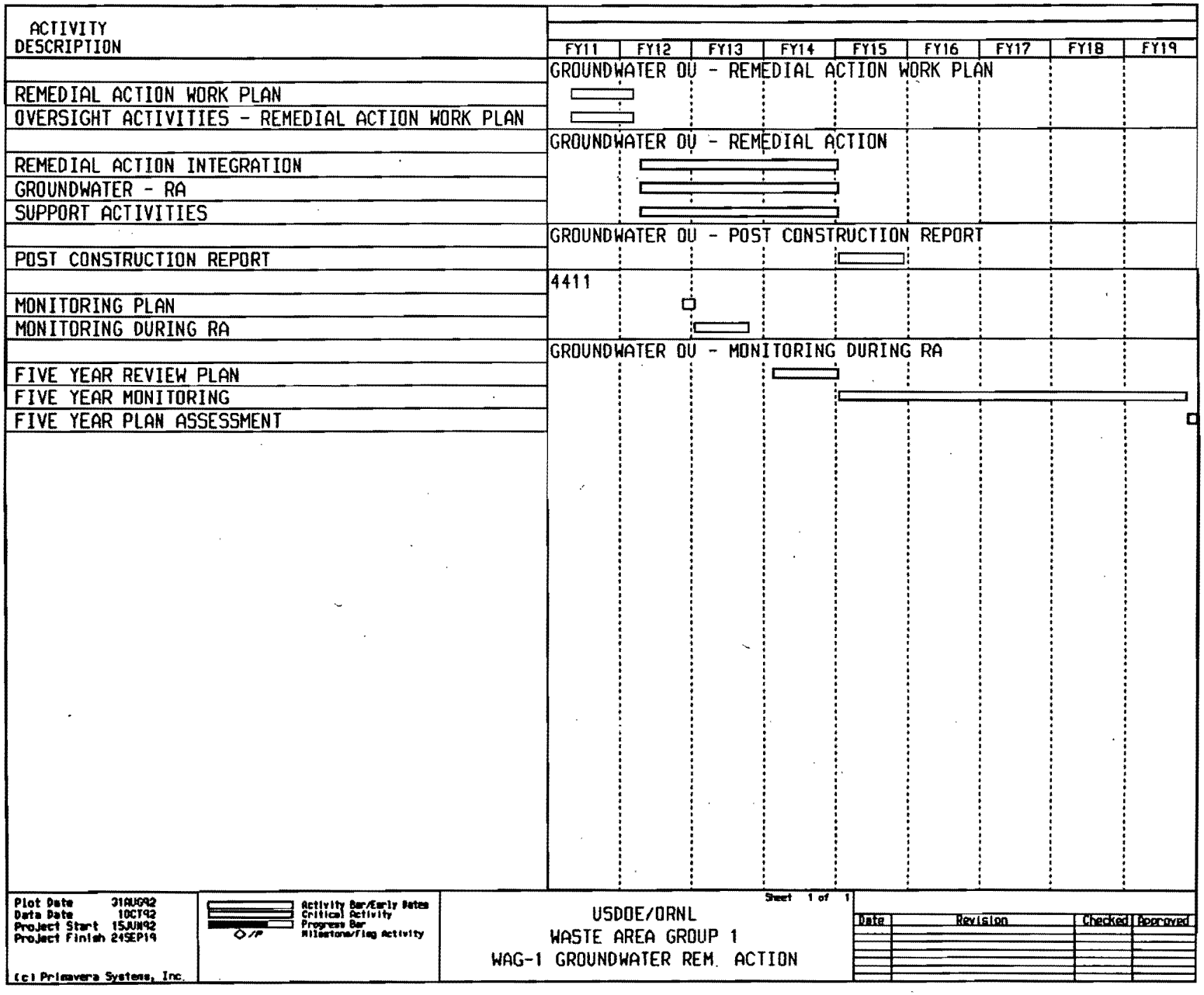


Fig. 17.11. Groundwater OU RA Summary Level Schedule.

TABLE 17.5
WAG 1 Oper Unit 04 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)													
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	TOTAL
RA Work Plan	374	76	0	0	0	0	0	0	0	0	0	0	0	450
RA WP Oversight Activities	144	32	0	0	0	0	0	0	0	0	0	0	0	176
SUBTOTALS RA WP	517	108	0	0	0	0	0	0	0	0	0	0	0	625
RA Integration	0	345	607	599	109	0	0	0	0	0	0	0	0	1,659
Remedial Action	0	604	3,146	3,018	98	0	0	0	0	0	0	0	0	6,866
Post Construction Report	0	0	0	0	85	0	0	0	0	0	0	0	0	85
Monitoring During RA	0	23	270	0	0	0	0	0	0	0	0	0	0	292
Verification	0	0	0	78	431	411	411	411	699	0	0	0	0	2,442
SUBTOTALS RA	0	972	4,022	3,695	723	411	411	411	699	0	0	0	0	11,345
TOTALS	517	1,080	4,022	3,695	723	411	411	411	699	0	0	0	0	11,970

17.4.2.2 Remedial Action Work Plan Oversight Activities (6.1.01.44.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA Work Plan. During the preparation of this draft, the Facilities Manager and A-E Contractor responsible for the approved design report will provide necessary coordination and will review the work plan to ensure that the proposed construction efforts will implement the IROD as presented in the final RD Reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

17.4.3 Remedial Action

17.4.3.1 Remedial Action Integration (6.1.01.44.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E Contractor and construction support as required. RA integration for remedial activities includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule in accordance with all technical requirements and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

17.4.3.2 Groundwater Remediation (6.1.01.44.09.02)

Two French drains were proposed as Early Actions to collect contaminated shallow groundwater. One of the drains proposed would intercept shallow groundwater associated with the Core Hole Eight plume upgradient of First Creek. The other drain proposed would intercept contaminated shallow groundwater migrating from the surface impoundments area to White Oak Creek. The RA currently identified is an extension of each of these French drains to intercept other contamination plumes.

The French drain proposed to intercept the Core Hole Eight plume upgradient will be extended to the north approximately 630 ft to Bethel Valley Road. Its purpose will be to collect contaminated shallow groundwater flowing to First Creek from a large plume originating north of Building 2000. The drain will also serve to collect groundwater flowing toward First Creek in and around existing storm drains. Diversion boxes will be installed on these pipes on the downgradient side of the drain, thereby allowing the drain to collect contaminants flowing in the relatively

unconsolidated soil forming the pipe beds. The function of the diversion boxes will be to collect low flow associated with groundwater infiltration while allowing storm flows to pass.

The French drain proposed to intercept contaminants flowing from the surface impoundments to White Oak Creek will be extended to the east approximately 350 ft. The purpose of this extension will be to collect contaminated groundwater flowing toward White Oak Creek from the Building 3503 area. The drain will also serve to collect groundwater flowing toward White Oak Creek in and around existing pipes. As previously described, diversion boxes will be installed on storm drains on the downgradient side of the French drain.

The drains will be connected to the French drains proposed as Early Actions. Ultimately, groundwater collected in these drains will be pumped to the PWTP. Collection and treatment of groundwater will continue until sources of contamination are remediated. Chapters 10.0 and 11.0 discuss the collection systems proposed as Early Actions.

The work included in the cost estimate includes excavation to the bedrock, trench shoring, demolition and replacement of pavement, French drain construction, diversion boxes, piping, erosion control, revegetation, and personnel protection equipment (PPE). It is assumed that soil excavated during construction will be contaminated and will require disposal.

17.4.3.3 Support Activities

During the RA activities, MMES will provide the necessary staff and support to operate and maintain the personnel and equipment decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities and to move leachate from the consolidation area to the PWTP for further treatment.

17.4.4 Post Construction

17.4.4.1 Post Construction Report (6.1.01.44.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, completion of construction activities, and effectiveness of selected remedies. MMES and Construction Manager will be responsible for the following activities to prepare the Post Construction Report:

- Conduct a site inspection with EPA and TDEC to determine whether the RA is complete and is consistent with the agency-approved (DOE) remedies, and to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

- a brief recapsulation of site description, chronology of major events, and the selected remedies;
- an explanation of construction activities, modifications, performance standards, and QC; and
- an explanation of operation and maintenance, including monitoring, to be undertaken at the site.

17.4.5 Monitoring During Remedial Action

17.4.5.1 Monitoring Plan (6.1.01.44.11.01)

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of the remediation conducted.

17.4.5.2 Environmental Monitoring Program During Remedial Action (1.05.44.11.02)

MMES will implement an Environmental Monitoring Program for the Groundwater OU that will accomplish the following:

- Start 1 month before start of construction in order to establish the baseline,
- Be conducted during the various RA activities to document the impacts of remedial activities,
- Continue until the RA is completed to assess the effectiveness of the remedies implemented and provide data for the Post Construction Report and Five-Year Review Plan,
- Generate routine monitoring reports with analytical results.

17.4.6 Verification

17.4.6.1 Five-Year Review Plan (1.05.44.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s), then, in accordance with CERCLA and the FFA, an RA Assessment Plan is required in order for the EPA and TDEC to review the RA no less than once every 5 years after the initiation of the final RA(s). This would ensure that human health and the environment are protected by the RA(s) being implemented. Because contaminants will remain after remediation, the A-E Contractor and the MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity/status of the RA(s) implemented.

17.4.6.2 Five-Year Monitoring (1.05.44.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of remediation. The results shall be documented on the monitoring reports, which will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of ORNL.

17.4.6.3 Five-Year Plan Assessment (1.05.44.12.03)

The data obtained during the 5 years of monitoring will be analyzed. The status of the RA(s) implemented will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether the RA(s) implemented are still complying after 5 years with the intent and criteria established in the IROD and current regulations and policies.

17.4.7 Risks and Uncertainties

The primary risks and uncertainties associated with the RA are as follows:

- It is assumed that the PWTP will have the capacity to treat groundwater collected from the proposed French drains.
- It is assumed that all excavated soil will be contaminated. Therefore, the soil will be boxed in B-25 boxes and sent to the proposed WAG 1 consolidation area for storage/disposal.
- It is assumed that pipes and trenches are the easiest path for contaminant migration. This assumption is the justification for collection of groundwater in and around pipes.
- It is assumed that storm flows will not be collected because contaminant concentrations will not be significant in surface runoff. Rather, only low flows issuing from storm drains will be collected because they represent contaminated groundwater infiltration.
- Any changes in the RD due to the risks and uncertainties mentioned in Section 17.3.4 will have a direct effect on remediation cost.
- Additional remediation will be needed if the RA proves unsuccessful.

17.4.8 Interfaces

During remediation activities, interface and coordination will be necessary with the following agencies:

- EPA — To provide regulatory overview during the RA process, to approve all primary documents, and to conduct routine inspections.
- TDEC — To provide regulatory overview for the state of Tennessee during the RA process and to conduct routine inspections.
- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview and support throughout the RA process with a focus on the minimization of RA-generated wastes. To provide the capability to process the wastes generated.
- MMES Technical Advisory Group — To provide technical overview support during the RA process, specifically monitoring and field-change requests.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division — To provide input and overview for the health and safety aspects of conducting the RA.
- Construction Manager — To provide construction support during the RA.
- MMES Title III Services (includes Inspection Services).
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.
- Independent Certification Contractor.

17.4.9 Contingent Action

The contingent action includes a pretreatment system to treat collected groundwater prior to final treatment at the PWTP.

18.0 WAG 1 WHITE OAK CREEK FLOOD PLAIN SOILS AND SEDIMENTS OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the White Oak Creek Flood Plain OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for this OU is presented in Fig. 18.1. The summary level schedule is shown in Fig. 18.2. Table 18.1 shows cost assessment of $16,136,000 for OU5 as presented by remediation phase and FY. TCFs are used to estimate costs for RI/FS tasks in this OU, as discussed in Chapter 14.0.

18.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 18.3. The summary level schedule for these RI WBS elements is shown in Fig. 18.4. The cost assessment of $3,169,000 for performing the RI is presented by WBS activities and FY in Table 18.2.

18.1.1 Scope and Assumptions

The primary assumption for the RI effort for OU5 is that the observational approach provides an adequate basis for the development of the RI approach. The observational approach provides a conceptual framework for integrating site characterization and remediation, focusing on sufficient data in support of potential response actions and the Baseline Risk Assessment rather than a complete quantitative characterization of the site. Additional RI data will be required to support the development of the Feasibility Study.

The primary White Oak Creek Flood Plain Soils and Sediments OU response action and RI activity is containment — geophysical surveys, geotechnical properties (soils), and perimeter soils sampling.

The following assumptions have significant specific roles in the scheduled implementation of the RI process:

- All primary documentation will undergo a concurrent MMES and DOE review. Additionally, the review process for these documents will follow the "Accelerated Review Cycle" defining review times for each step in the review process.

- Nonintrusive surveys will be authorized by the regulators and may be initiated within 1 week subsequent to transmittal of the draft RI Work Plan to the regulators.

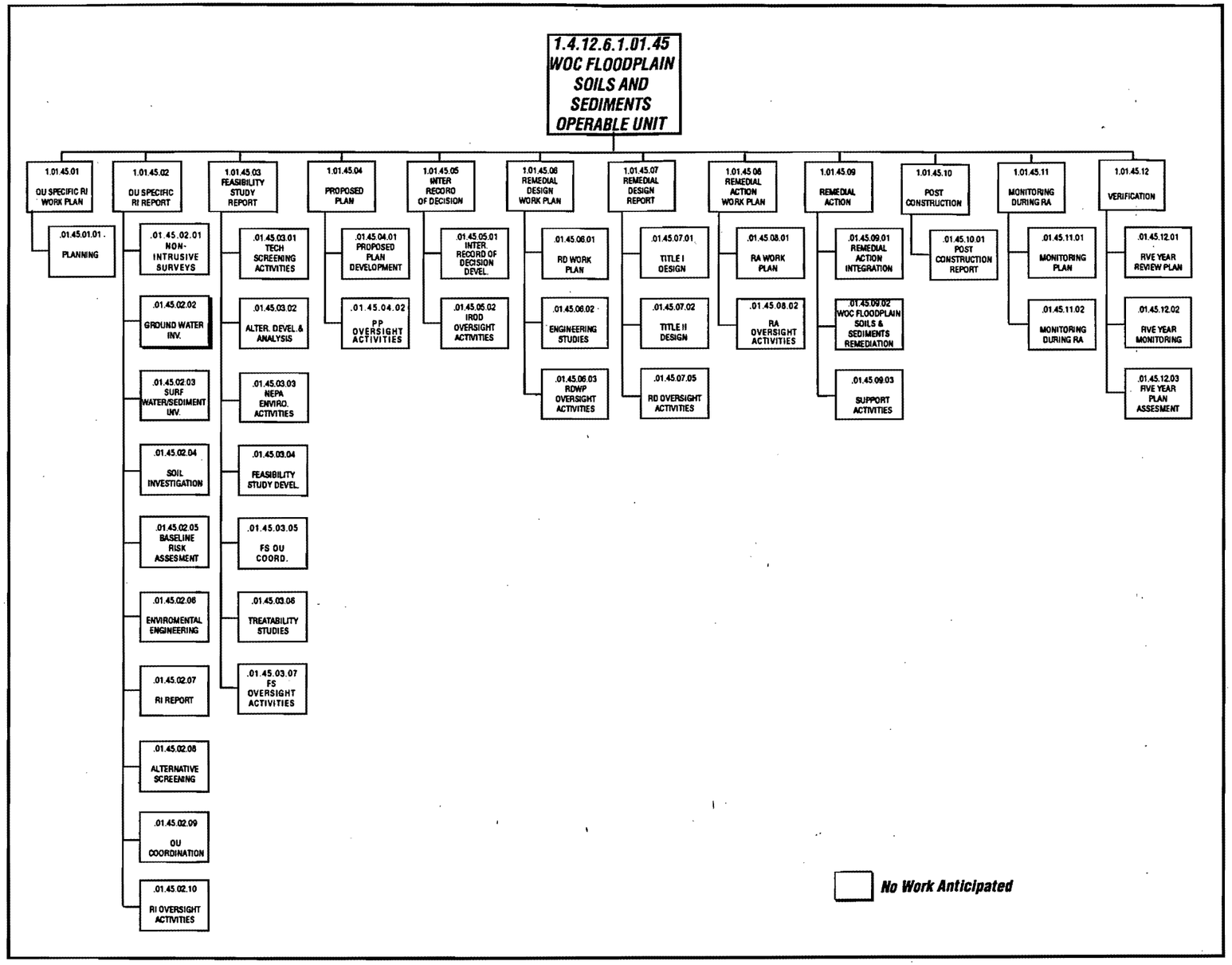


Fig. 18.1. White Oak Creek Flood Plain Soils and Sediments OU Work Breakdown Structure.

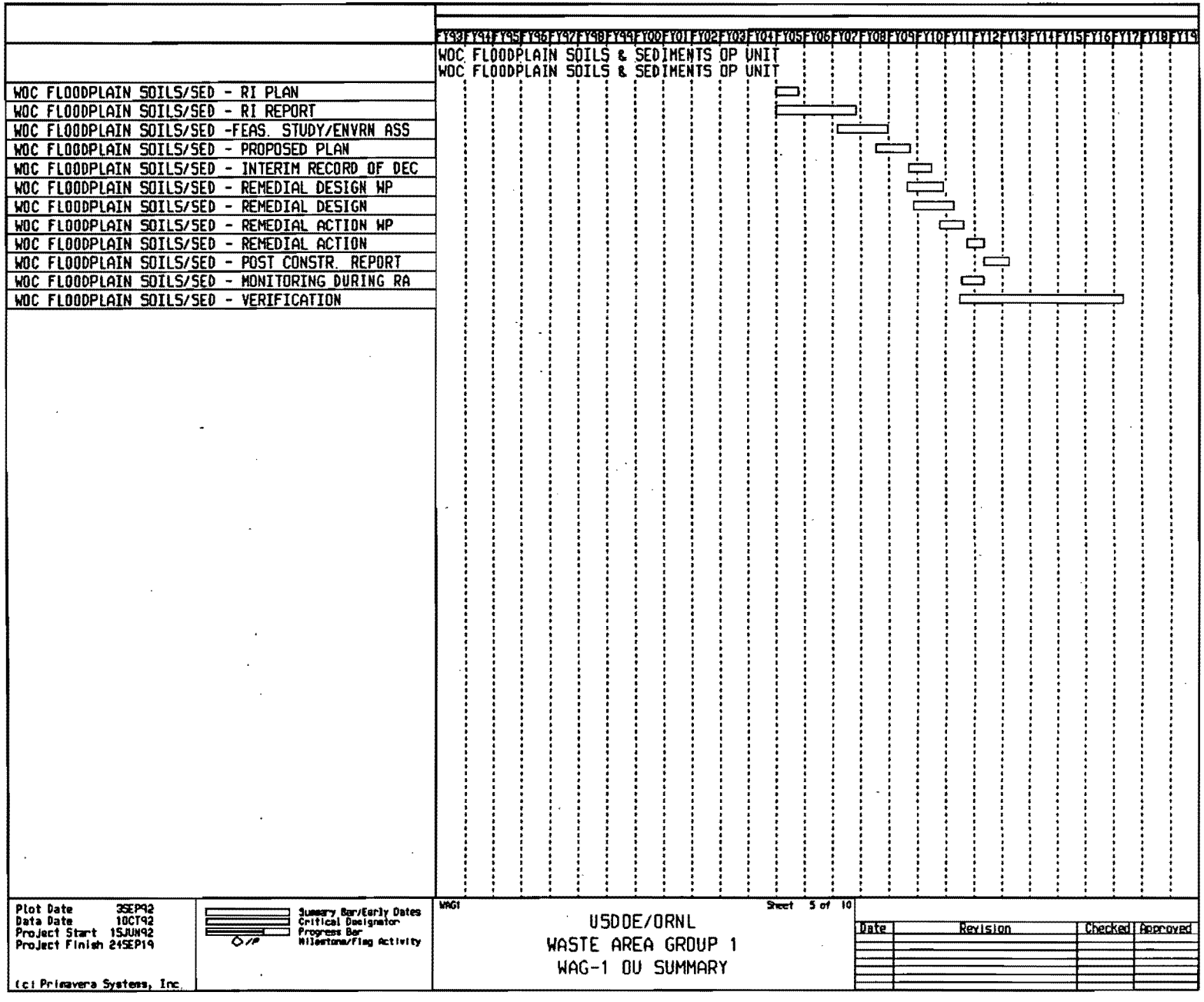


Fig. 18.2. White Oak Creek Flood Plain Soils and Sediment OU Summary Level Schedule.

TABLE 18.1
WAG 1 Oper. Unit 05 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)															
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	TOTAL
Remedial Investigation	0	742	1,365	1,062	0	0	0	0	0	0	0	0	0	0	0	3,169
Feasibility Study/IROD	0	0	0	879	906	167	74	0	0	0	0	0	0	0	0	2,026
Remedial Design	0	0	0	0	0	167	1,724	437	0	0	0	0	0	0	0	2,327
Remedial Action	0	0	0	0	0	0	63	2,910	3,583	433	411	411	411	390	0	8,614
TOTALS	0	742	1,365	1,941	906	334	1,861	3,347	3,583	433	411	411	411	390	0	16,136

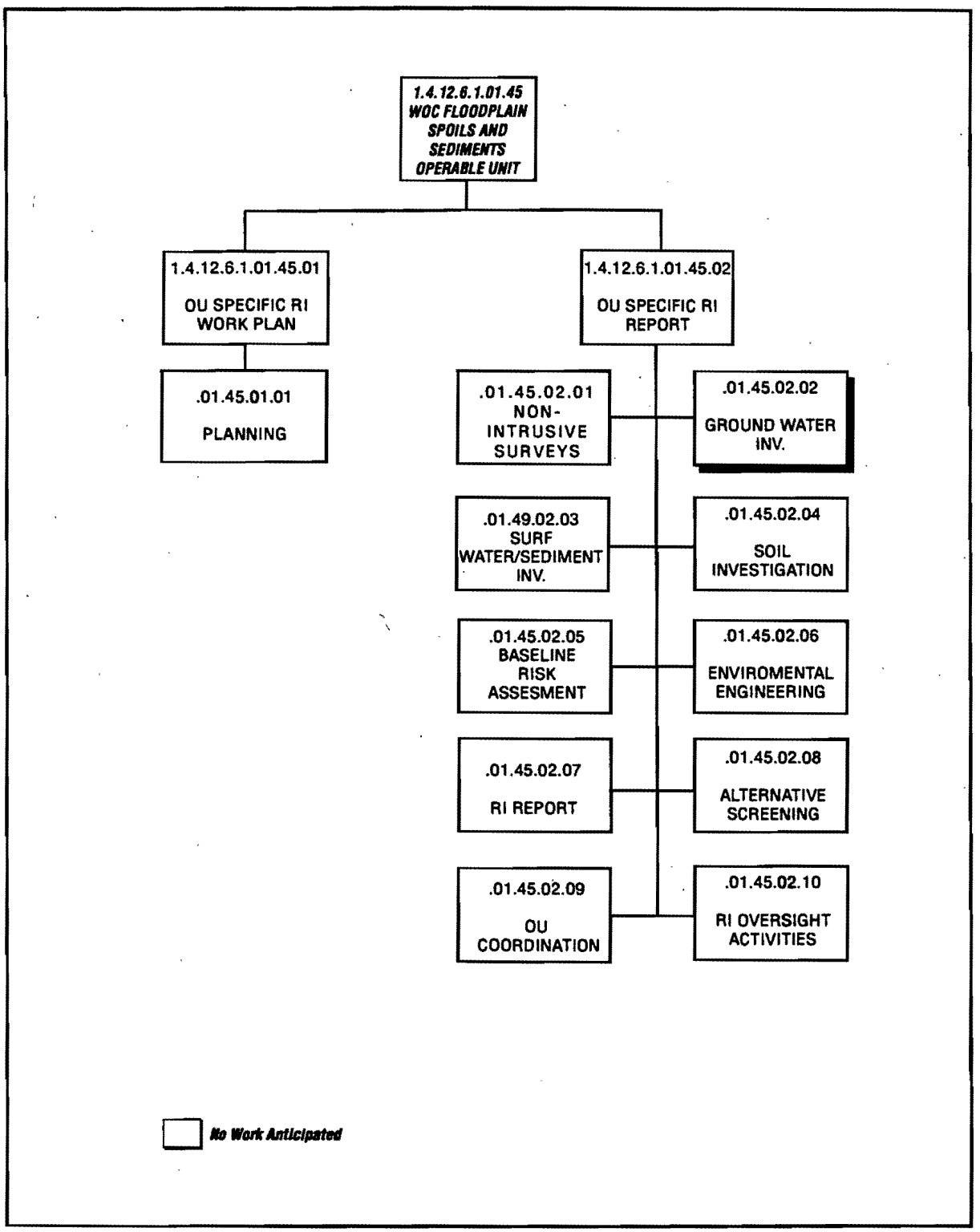


Fig. 18.3. White Oak Creek Flood Plain Soils and Sediments OU RI Work Breakdown Structure.

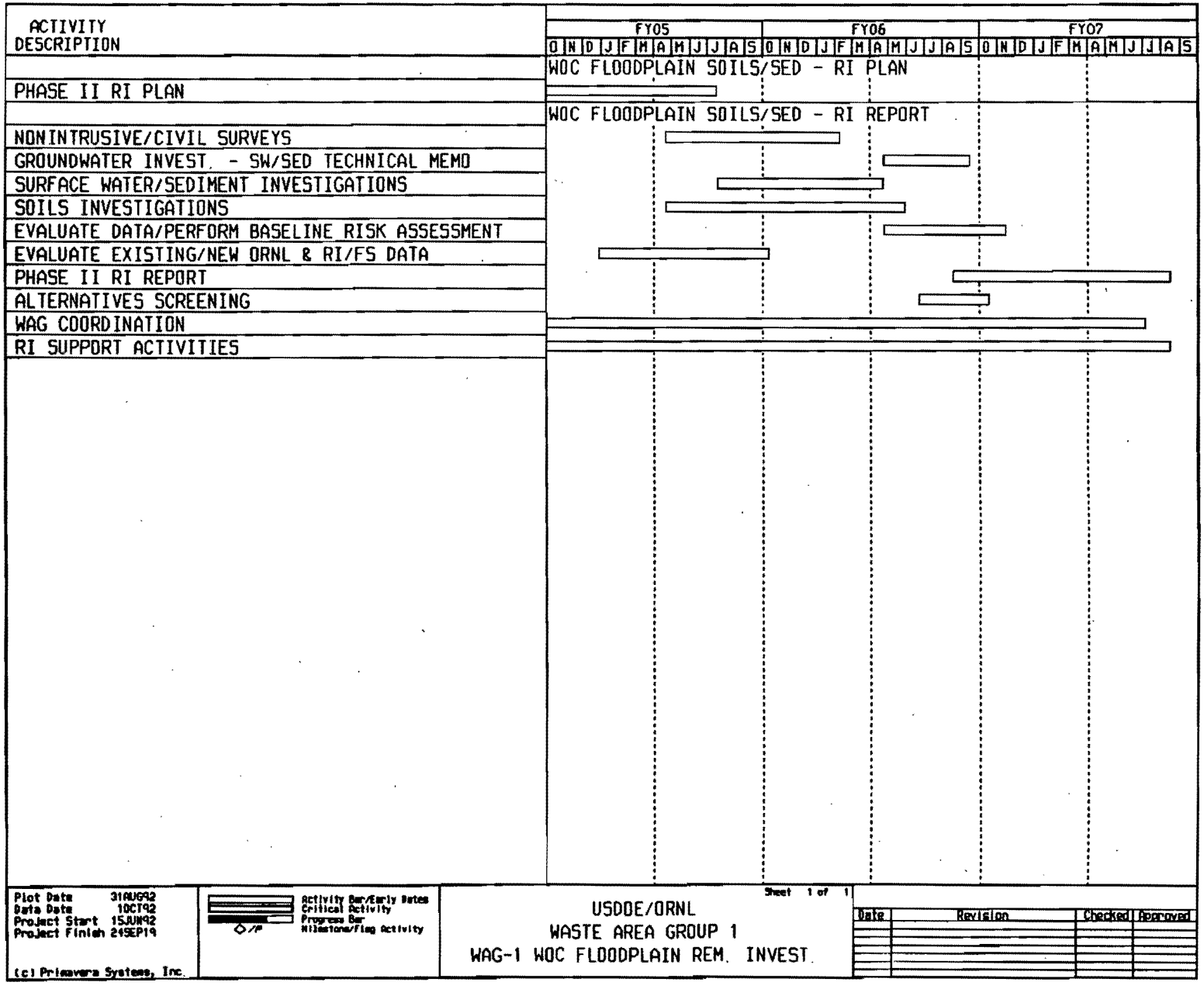


Fig. 18.4. White Oak Creek Flood Plains Soils and Sediments OU RI Summary Level Schedule.

TABLE 18.2
WAG 1 Oper. Unit 05 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2005	2006	2007	2008	2009	TOTAL
Planning	127	0	0	0	0	127
Nonintrusive Surveys	4	6	0	0	0	10
GW Investigation	0	0	0	0	0	0
SW/SED Investigation	8	76	0	0	0	84
Soil Investigation	93	284	0	0	0	377
Baseline Risk Assess.	0	325	140	0	0	465
Environ. Engineering	151	18	0	0	0	169
RI Report	0	30	463	0	0	493
Alternative Screening	0	17	7	0	0	24
RI OU Coordination	115	364	206	0	0	685
RI Oversight Activities	245	245	245	0	0	734
TOTALS	742	1,365	1,062	0	0	3,169

- Intrusive investigations will be authorized by the regulators and may be initiated upon of completion of regulatory review of the draft RI Work Plan.

18.1.2 Operable Unit Specific Remedial Investigation Work Plan

18.1.2.1 Planning (6.1.01.45.01.01)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI. The RI Work Plan defines the scope and objectives for the RI activities and provides a mechanism for planning the investigation. A project management strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes an appropriate summary and interpretation of available environmental information. The Work Plan addresses the potential federal and state ARARs, TBC guidance, and the establishment of DQOs. It also provides specific rationale for all field and analytical work. The RI Work Plan addresses the proposed technical approach, timing for implementation, schedules, and decision points where appropriate. The RI Work Plan (BNI, 1988) was prepared according to provisions of applicable EPA and TDEC guidance documents.

Because of the need to review data reported as part of the WAG 1 Phase I RI effort, and incorporate changes in project approach, a supplement to the WAG 1 RI Work Plan and associated documents will be developed as needed.

18.1.3 Operable Unit Specific Remedial Investigation Report

18.1.3.1 Nonintrusive Surveys (6.1.01.45.02.01)

Nonintrusive surveys will be generally conducted before initiation of media-specific sampling. Civil surveys will be performed as needed to support White Oak Creek Flood Plain Soils and Sediments investigation activities. These include as-built surveys, construction surveys, and topographic surveys. These surveys help establish monitoring well and sampling locations.

18.1.3.2 Groundwater Investigation (6.1.01.45.02.02)

No additional work is anticipated for this element. However, the results of the Phase 1 groundwater investigation associated with White Oak Creek Flood Plain Soils and Sediments OU will be made available to the Groundwater WAG Team in order to facilitate site-wide groundwater remediation assessments. It is conceivable that as the groundwater investigation proceeds, additional data needs will be identified by the Groundwater WAG Team. If this occurs, the result will be additional requirements placed on the White Oak Creek Flood Plain Soils and Sediments groundwater investigation. No allowances for additional investigation requirements are included in the scope of effort for the White Oak Creek Flood Plain Soils and Sediments RI. Continuing interface between this OU and the Groundwater WAG Team will be required throughout the RI process.

18.1.3.3 Surface Water and Sediment Investigations (6.1.01.45.02.03)

The objective of the surface water and sediment investigations is to assess the mobility of flood plain contaminants and to gain a greater understanding of transport mechanisms. This contaminant load information will be used for fate and transport analysis, risk assessment, and evaluation of remedial alternatives.

Stream sediments constitute a potential migration pathway for radiological contaminants originating at WAG 1 OUs. Certain contaminants preferentially sorb to sediments because of the clay mineralogy and bulk properties of the sediment. Contaminated sediments migrate with surface runoff and along stream channels. During storm events, these sediments can be carried significant distances. Uptake by benthic biota concentrates contaminates at higher trophic levels and results in a pathway of environmental exposure.

To assess contaminant mobility, five surface runoff and surface water samples will be taken at selected locations along White Oak Creek during each of two storm events. The samples will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and water quality parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples to be included in risk assessments and in other instances where data of known quality are required.

18.1.3.4 Soils Investigation (6.1.01.45.02.04)

Soil sampling activities will focus on delineating the extent of contamination within the White Oak Creek OU area and defining specific contaminant sources. Samples will be collected to the depth required to discern the extent of vertical migration.

Fifteen shallow (10-ft deep) borings will be drilled within the White Oak Creek Flood Plain OU using hand augers. Three samples will be collected from each boring. The first soil sample will be a surface sample or near-surface composite. The second and third samples will be vertically composited over larger (e.g., 4 to 5 ft) intervals. An additional 15 surface soil samples, composited to a maximum depth of approximately 1 ft, will also be taken throughout the White Oak Creek Flood Plain OU.

Samples from soils investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and geotechnical parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples included in risk assessments and in other instances where data of known quality are required.

18.1.3.5 Baseline Risk Assessment (6.1.01.45.02.05)

The White Oak Creek Flood Plain OU Baseline Risk Assessment consists of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with the White Oak Creek Flood Plain OU for current and future exposure scenarios. The objectives of the environmental evaluation are (1) to determine whether the White Oak Creek Flood Plain OU poses a current or potential future risk to environmental resources in the absence of any remediation and (2) to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

The human health evaluation will be performed in accordance with EPA's *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)* (EPA 1989). The work will include an evaluation of chemical and radiological data collected before and during the White Oak Creek Flood Plain OU RI. An exposure assessment, a toxicity assessment, and a risk characterization will be conducted with the information used to compute human health risks. The average annual concentrations of radionuclides and chemicals in surface water, groundwater, soils, and sediments for current and future time periods at OU locations will be estimated utilizing a surface subsurface model.

The environmental evaluation will be performed to meet the requirements of Section 121 (b)(1) and (d) of CERCLA and other statutes that mandate protection of wildlife, fisheries, threatened and endangered species, and sensitive environments. Guidelines for conducting this evaluation are provided by EPA in *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (EPA, 1989). The evaluation will be both a quantitative and qualitative appraisal of the actual or potential effects of this waste site on plants and animals other than humans and domestic species.

18.1.3.6 Environmental Engineering Analysis (6.1.01.45.02.06)

An environmental engineering analysis will be performed on all data generated from White Oak Creek Flood Plain RI field activities. This data will be tabulated for use in writing the technical memorandums and technical bulletins. The data will be reviewed with respect to implementation of remedial alternatives. This task is iterative in nature and consists of the following steps:

- Summarized RI/FS data are reviewed as they become available.
- The preliminary remedial alternatives scenario is refined, if necessary.
- Data needs are re-evaluated based on the new alternatives scenario.
- Data collection efforts are altered to meet any new data needs.

18.1.3.7 **Remedial Investigation Report** (6.1.01.45.02.07)

The White Oak Creek Flood Plain RI Report will serve as documentation of data collection and analyses in support of the OU FS. The results of the OU RI are presented as an analysis of site characteristics, the risk associated with such characteristics (see element definition for the Baseline Risk Assessment), and a summary of potentially feasible remedial actions (see element definition for Alternative Screening). The evaluation of site characteristics will focus on the site physical characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Before the draft White Oak Creek Flood Plain OU RI Report is issued, a determination of the ARARs will be submitted to EPA and TDEC. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to the White Oak Creek Flood Plain OU remediation.

The draft White Oak Creek Flood Plain OU RI Report will be reviewed by ORNL, DOE, EPA, and TDEC. The OU RI report will consolidate available, appropriate, and applicable data on the White Oak Creek Flood Plain OU and summarize technical work completed to-date on the project. In addition to the fieldwork (Phase II) proposed for this OU, the primary basis or reference for the White Oak Creek Flood Plain OU RI Report will be the WAG 1 Site Characterization Summary Report.

18.1.3.8 **Alternatives Screening** (6.1.01.45.02.08)

The objectives of the alternatives screening are to develop preliminary RA goals, develop a range of alternatives, and perform a screening level alternatives evaluation.

Preliminary development and screening of remedial alternatives will be performed according to the EPA *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA, 1988). The effort consists of the following six steps:

1. Develop RA objectives specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed.

2. Develop general response actions for each medium of interest that may be taken to satisfy the remedial action objectives for the site.

3. Identify volumes or areas of media where general response actions might be applied.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the site.

5. Identify and evaluate technology process options to select a representative process for each technology type retained for further consideration.

6. Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

18.1.3.9 Operable Unit Coordination (6.1.01.45.02.09)

Activities include White Oak Creek Flood Plain Soils and Sediments RI quality control and project management and coordination. These activities will ensure that RI quality, cost, and scheduling goals for this WAG 1 OU are achieved. The activity coordination does not include those activities that support multiple WAGs tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, data base management, and data base interface with MMES. QA/QC will be performed using staff from the home office and field office necessary to perform and manage White Oak Creek Flood Plain Soils and Sediments QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Necessary field support needed to manage and direct White Oak Creek Flood Plain Soils and Sediments RI field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes providing required field equipment, spare parts, and other field materials and supplies.

18.1.3.10 Remedial Investigation Oversight Activities (6.1.01.45.02.10)

This element provides technical support, input, and oversight during the RI to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD and RA. RI oversight activities begin with the field investigation and are completed upon issuance of the revised Site Characterization Study Report to the regulators.

The oversight roles of the various participants are briefly described below:

FS Contractor — Provides technical oversight to ensure that the nature and extent of contamination and the associated risks are developed and presented in the Site Characterization Study Report consistent with the FS/EA.

A-E Contractor — Provides technical oversight to ensure that the data and information obtained and the nature and extent of contamination developed during the RI are adequate and presented in a manner consistent with the RD approach and design requirements.

MMES HS&E Division — Provides support for health and safety, environmental compliance and waste management as a part conducting the RI field activities.

Sample Validation Subcontractor — Provides support to perform validation of chemical sampling performed during the RI.

MMES Environmental Sciences Division — Provides support for geophysical surveys and drilling.

MMES Planning/Coordination — Provides necessary permits for RI field activities.

MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

18.1.4 Risks and Uncertainties

The following information describes the areas of risk and uncertainty associated with the performance of the RI.

- The areal extent of contamination is not fully defined. This would require additional investigation and study to determine remedial alternatives.
- New regulatory requirements may result in changes to the level of effort required for the risk assessment and alternatives screening.
- Lack of approval for the RI Work Plan would delay field investigations and would require additional work to incorporate regulatory concerns into the RI.

18.1.5 Interfaces

The primary interfaces and anticipated roles during the RI are described below:

- MMES Waste Management — To provide waste management overview and support throughout the RI process. This entails focusing on the minimization of RI- generated wastes and providing the capability to process the wastes generated during the RI.
- MMES Technical Advisory Group — To provide technical overview support during the RI process, i.e., overall approach, validity of data collected, and calculation of risks.
- MMES Project Management — To provide overall project management support during the RI process to ensure that RI goals of MMES are achieved.

- FS Contractor — To provide data review support to the RI that would sufficiently support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approval of all primary documents.

- TDEC — To provide regulatory overview for the state of Tennessee during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

18.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents in more detail the efforts necessary to perform the WAG 1 FS/PP/IROD process for the WAG 1 White Oak Creek Flood Plain Soils and Sediments OU. The FS process will include incorporating environmental concerns as an EA within the FS Report. To comply with the FFA, the process will also require preparation of the regulatory decision documents, the PP, and IROD. The associated risks and uncertainties and the interfaces for the FS/PP/IROD effort are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is presented in Fig. 18.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig. 18.6. The cost assessment of $2,026,000 for performing the FS, PP, and IROD process is presented by WBS element and FY in Table 18.3.

18.2.1 Scope and Assumptions

The purpose of WAG 1 White Oak Creek Flood Plain Soils and Sediments Operable Unit FS/PP/IROD activities is to identify, organize, and examine remedial alternatives; to mitigate the risks identified in the RI Report; to justify selection of a preferred remedial alternative or a set of alternatives; and to prepare the regulatory required decision documents summarizing the situation and examination process, outlining the selected remediation method(s), and establishing the remediation schedule.

The FS Contractor will be responsible for completing the WAG 1 White Oak Creek Flood Plain Soils and Sediments OU FS/PP/IROD process. This process will require the preparation of the following milestone documents; (1) the FS Report, which documents the process used to examine the remedial technologies, to select the preferred remedial alternative(s), and to incorporate the environmental (NEPA) considerations in an EA segment to satisfy administrative requirements; (2) the PP, a summary plan for implementing the selected remedial alternative(s); and (3) the IROD, the legal document that declares that the selected remediation method(s) meets statutory and regulatory requirements and establishes the schedule for remediating the White Oak Creek OU. To implement

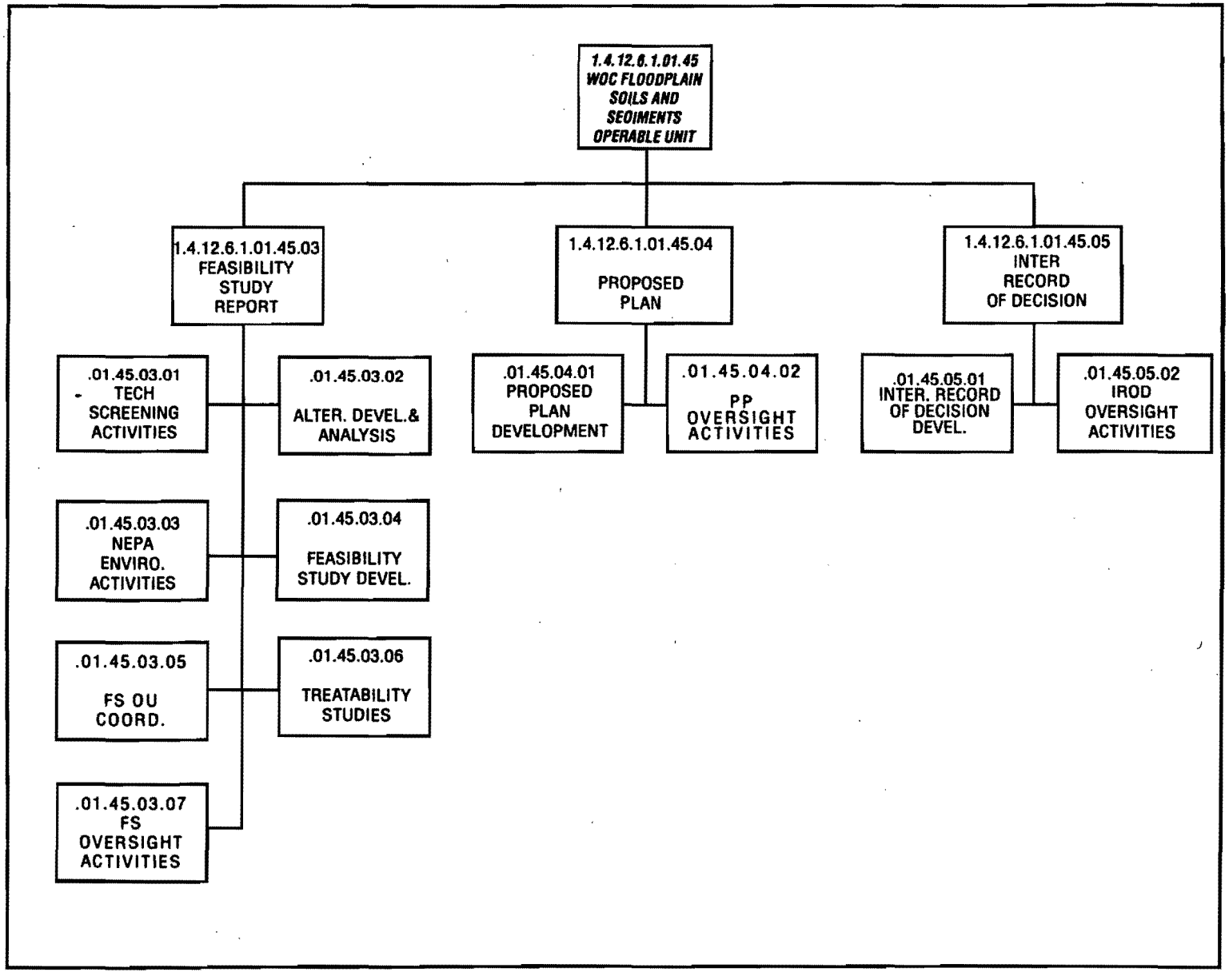


Fig. 18.5. White Oak Creek Flood Plain Soils and Sediments OU FS/PP/IROD Work Breakdown Structure.

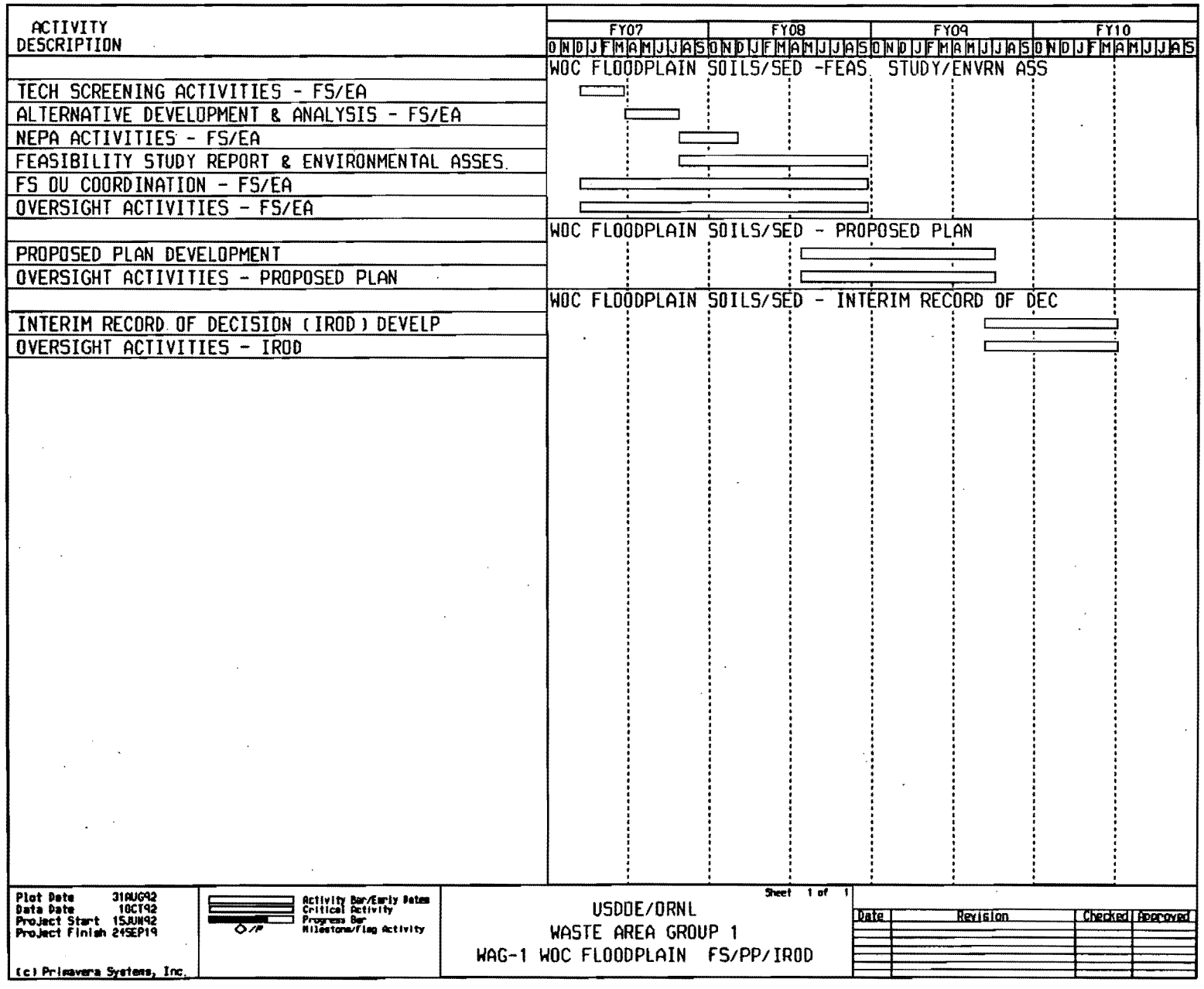


Fig. 18.6. White Oak Creek Flood Plain Soils and Sediments OU FS/PP/IROD Summary Level Schedule.

TABLE 18.3
WAG 1 Oper Unit 05 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2007	2008	2009	2010	2011	TOTAL
Technology Screening	230	0	0	0	0	230
Alternatives Develop./Analysis	154	0	0	0	0	154
NEPA/Environmental Activities	36	36	0	0	0	72
Feasibility Study Development	118	471	0	0	0	589
FS OU Coordination	100	100	0	0	0	200
Treatability Study	0	0	0	0	0	0
FS Oversight	240	240	0	0	0	480
SUBTOTALS FS	879	848	0	0	0	1,726
PP Development	0	34	68	0	0	102
PP Oversight Activities	0	25	50	0	0	74
SUBTOTALS PP	0	59	118	0	0	177
IROD Development	0	0	27	40	0	67
IROD Oversight Activities	0	0	22	33	0	56
SUBTOTALS IROD	0	0	49	74	0	123
TOTALS	879	906	167	74	0	2,026

this process and to ensure that Feasibility Study Report remediation is completed according to the process, the FS Contractor will have oversight responsibilities during the RI and RD processes. The White Oak Creek OU FS/PP/IROD process will be accomplished by the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities
- Feasibility Study Development
- Feasibility Study Operable Unit Coordination
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Development Oversight Activities.

18.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA Report are presented in the following sections. The FS/EA Report will in general follow the format in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA, 1988).

The cost assessments made for the FS WBS elements were based on the following assumptions:

- The RI Report and the FS process will be completed as scheduled.
- The RI Report results are representative of the actual site conditions and adequately characterize the extent and amount of contamination in WAG 1.

18.2.2.1 Technology Screening Activities (6.1.01.45.03.01)

Based on the remedial objectives established under the Environment Restoration Program remedial objectives, the RI Report findings regarding waste- and site-specific conditions, and a

literature search, the FS Contractor will identify applicable remedial technologies from the available common and innovative technologies for initial evaluation. These technologies will be screened to eliminate those judged too difficult to implement based on unproven technologies, judged not able to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Those technologies judged to have a reasonable chance of success for remediating the specific waste or site conditions will be carried forward for more detailed development and analysis. A technical memorandum summarizing the findings if this task will be issued to DOE.

18.2.2.2 Alternatives Development and Analysis (6.1.01.45.03.02)

The FS Contractor will develop the screened technologies for analysis by arranging them into general RA alternatives. These alternatives will then be evaluated, either individually or as combinations of technologies. The purpose of this evaluation is to eliminate those alternatives (1) with costs significantly higher than similar alternatives, (2) that fail to provide adequate protection of public health and safety, and/or (3) that may adversely impact the environment. A list of alternatives that meets the remedial objectives and contributes to the protection of public health, safety, and the environment will be formulated for further study. A technical memorandum summarizing the findings of this task will be issued to DOE for regulatory compliance assessment.

The following are assumptions considered in the development of the cost assessment for alternatives development and analysis.

- Working group meetings will be held as needed with the regulatory agencies to discuss progress. Input and feedback from these meetings can be considered as consistent with the formal agency response.

- The regulatory agencies concur with the working group meetings and the results of the technology screening memo.

18.2.2.3 NEPA Environmental Activities (6.1.01.45.03.03)

To comply with DOE policy that NEPA criteria are considered during remedial activities, the remedial alternatives will be evaluated for their impact on the environment. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and to minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

The cost assessment for this element was based on the following assumptions:

- An EA will be completed on the site to evaluate the environmental effects of the RA.
- The Baseline Risk Assessment in the RI Report presents the primary contaminant and exposure pathways of concern and is complete enough to ensure that the results are compatible with the alternatives risk calculation methodology selected for the FS Report.
- All ecological risk assessment sampling activities are completed on schedule and are representative of the actual site conditions.

18.2.2.4 Feasibility Study Development (6.1.01.45.03.04)

The FS Contractor will use the format presented in the CERCLA FS guidance document to develop the FS with exceptions and modifications for the specific wastes and conditions in the White Oak Creek Flood Plain Soils and Sediments OU. The FS development will be based on the information obtained from the RI, the alternatives screening and analysis process, and the EA considerations. Using the list of applicable remedial alternatives, the FS will be developed in sufficient detail to allow the selection of a preferred alternative(s) that meets the remedial objectives of mitigating release of contaminants. Criteria will be developed to assess the ability of the alternatives to meet the remedial objectives and to comply with administrative and regulatory requirements. The FS is intended to perform a detailed evaluation of the alternatives to provide an informed risk management decision and the legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE and EPA for review. The final FS/EA Report is a milestone document required by the FFA.

18.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.45.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to support QC efforts, to provide project management, and to coordinate project activities to ensure that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS oversight participants.

18.2.2.6 Treatability Studies

Treatability studies conducted for this OU can be coordinated with treatability studies conducted for the Contaminated Soils OU. The cost assessment conducted for this OU assumes no costs for this activity.

18.2.2.7 Feasibility Study Oversight Activities (6.1.01.45.03.04)

The objective of FS oversight activities is to provide technical input and oversight during the FS/EA to ensure that the data and information obtained during the RI are incorporated properly into the FS/EA Report and that it is adequate to prepare a PP and support the development of an

IROD and a subsequent RD. FS oversight activities begin with the technology screening and are completed upon final approval of the FS/EA Report.

The following is a brief description of the responsibilities of each participant involved in FS oversight activities:

- RI Subcontractor — Provides technical oversight to assess whether the technologies considered and the remedial alternatives to be developed and evaluated are consistent with the RI report conclusions and determined risks.

- A-E Contractor — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RD approach and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RA approach and implementable at ORNL.

- MMES — Provides technical support and review of the FS/EA process. Reviews progress reports and preliminary deliverables to ensure that the FS/EA is processing as scheduled.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of FS/EA activities, technical advice, and an independent technical review of the FS/EA Report.

18.2.3 Proposed Plan

18.2.3.1 Proposed Plan Development (6.1.01.45.04.01)

The PP to remediate the site will be prepared using the preferred remediation alternative(s) to mitigate release of contaminants as selected in the FS/EA Report and from input from the regulatory agencies and the public. The PP documents the investigation process, administrative and regulatory actions, and the actions and schedule necessary to implement the remediation alternative(s) and to monitor performance. The PP is a primary milestone document that is subject to public review and response and to administrative and regulatory reviews. The cost assessment for this element was based on the assumption that the FS process and the regulatory review cycle will be completed as scheduled.

18.2.3.2 Proposed Plan Oversight Activities (6.1.01.45.04.02)

The purpose of the PP oversight activities is to provide technical input and oversight during the development of the PP and to ensure that it is in compliance with applicable regulations and policies.

During the generation of the PP, the RI Subcontractor, A-E Contractor, and MMES will assess whether the preferred remedial alternative(s) to be proposed is consistent with the RI conclusions, Baseline Risk Assessment, and FS process. Progress reports and preliminary deliverables will be reviewed by the participants mentioned earlier to ensure that the PP is proceeding as scheduled.

18.2.4 Interim Record of Decision

18.2.4.1 Interim Record of Decision Development (6.1.01.45.05.01)

The final step in the planning process to remediate the White Oak Creek Flood Plain Soils and Sediments Operable Unit will be preparation of the IROD for this OU. This is the legal document that formally declares the preferred remediation method(s) in the PP will mitigate releases and establish the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations, (2) a decision summary outlining the nature and extent of the contamination and the associated risks at White Oak Creek, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements, and (3) a responsiveness summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency for review. The final White Oak Creek IROD is a milestone document required by the FFA.

The cost assessment for this element was based on the assumption that the FS/EA and PP schedules were followed.

18.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.45.05.02)

During the development of the IROD document, MMES and the A-E Contractor will provide technical input and independent technical review to ensure that the IROD document is prepared in accordance with the FFA and in compliance with CERCLA. The technical review and oversight will also include the assessment of the IROD document's consistency with RI report conclusion, Baseline Risk Assessment, and FS/EA.

18.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the White Oak Creek FS/PP/IROD process are scheduling and the scoping of the activities. Minor changes in scheduling will have significant impacts on the labor cost of the project. If the schedule is modified, resulting in an extended total duration of the project, the total cost will increase significantly. The scope of the project will have a direct impact on labor allocations. If additional IRODs are required, the total cost of the project will increase. Other factors that increase the uncertainty of the budgetary assessments in this report include:

- Requirements for additional sampling activities.
- Extended review cycles initiated by the regulators.
- Program funding limitations across the DOE system.

18.2.6 Interfaces

Completion of the White Oak Creek Flood Plain Soils and Sediments FS/PP/IROD process will require close interface and coordination with the following agencies/regulations:

- WAG 1 Project Management — to develop consistent approaches regarding FS criteria, technologies, etc.
- RCRA — Serves as an ARAR under CERCLA.
- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.
- NEPA — Regulations that set the policies and goals for protecting environmental quality and establish the procedures examining the impact that decisions on remediating may have on the environment.
- TDEC — Provides regulatory overview for the state of Tennessee.
- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.

18.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the White Oak Creek Flood Plain Soils and Sediments OU: a RD Work Plan, engineering studies as required, a Title I 30% design package, Title II 60% and 90% design packages, and final design reports. The risks and uncertainties and interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 18.7. The summary level schedule for these RD WBS elements is shown in Fig. 18.8. Table 18.4 shows the cost assessment of $2,327,000 for performing this portion of the White Oak Creek Soil and Sediment OU remediation activities summarized by WBS activity and FY.

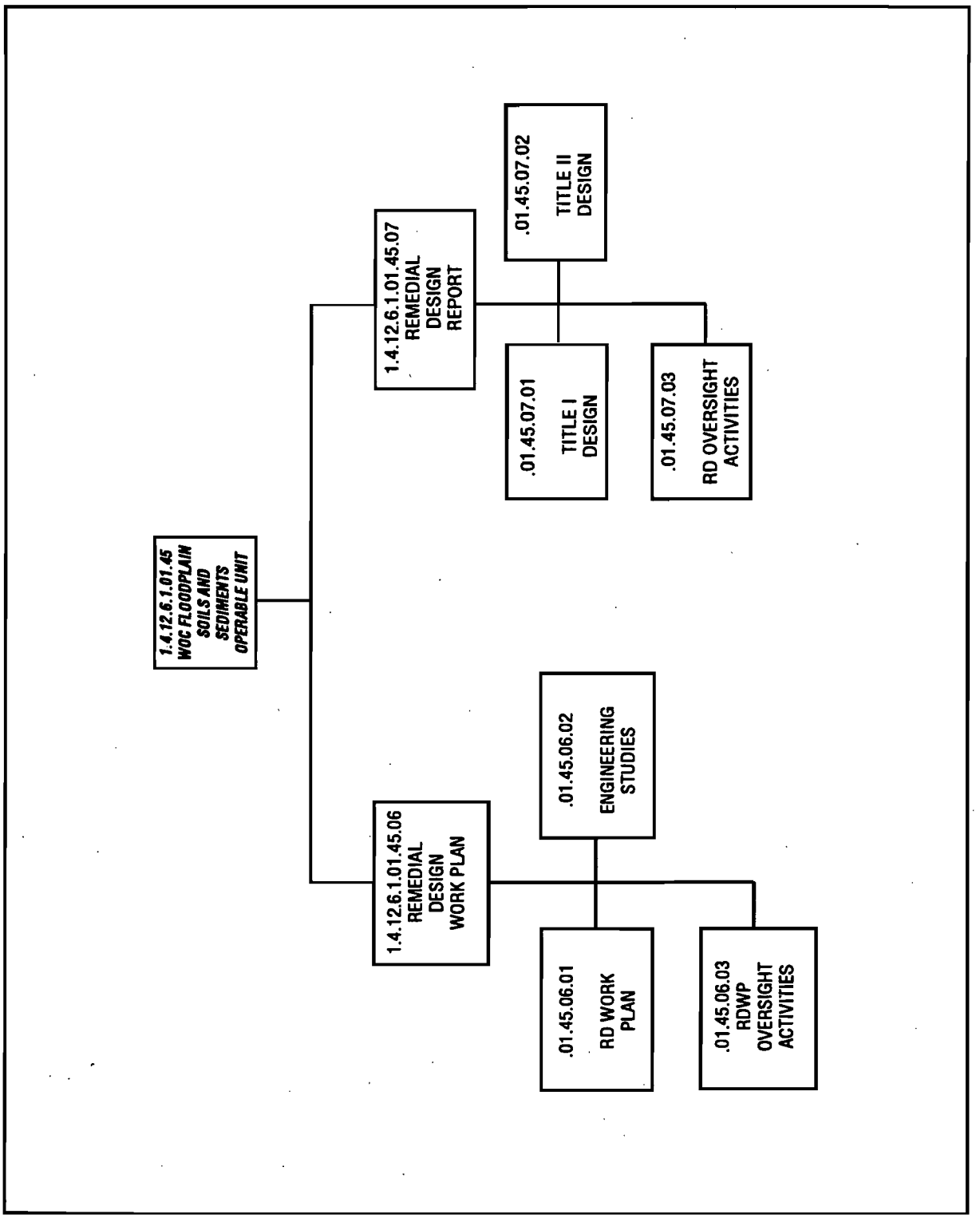


Fig. 18.7. White Oak Creek Flood Plain Soils and Sediments OU RD Work Breakdown Structure.

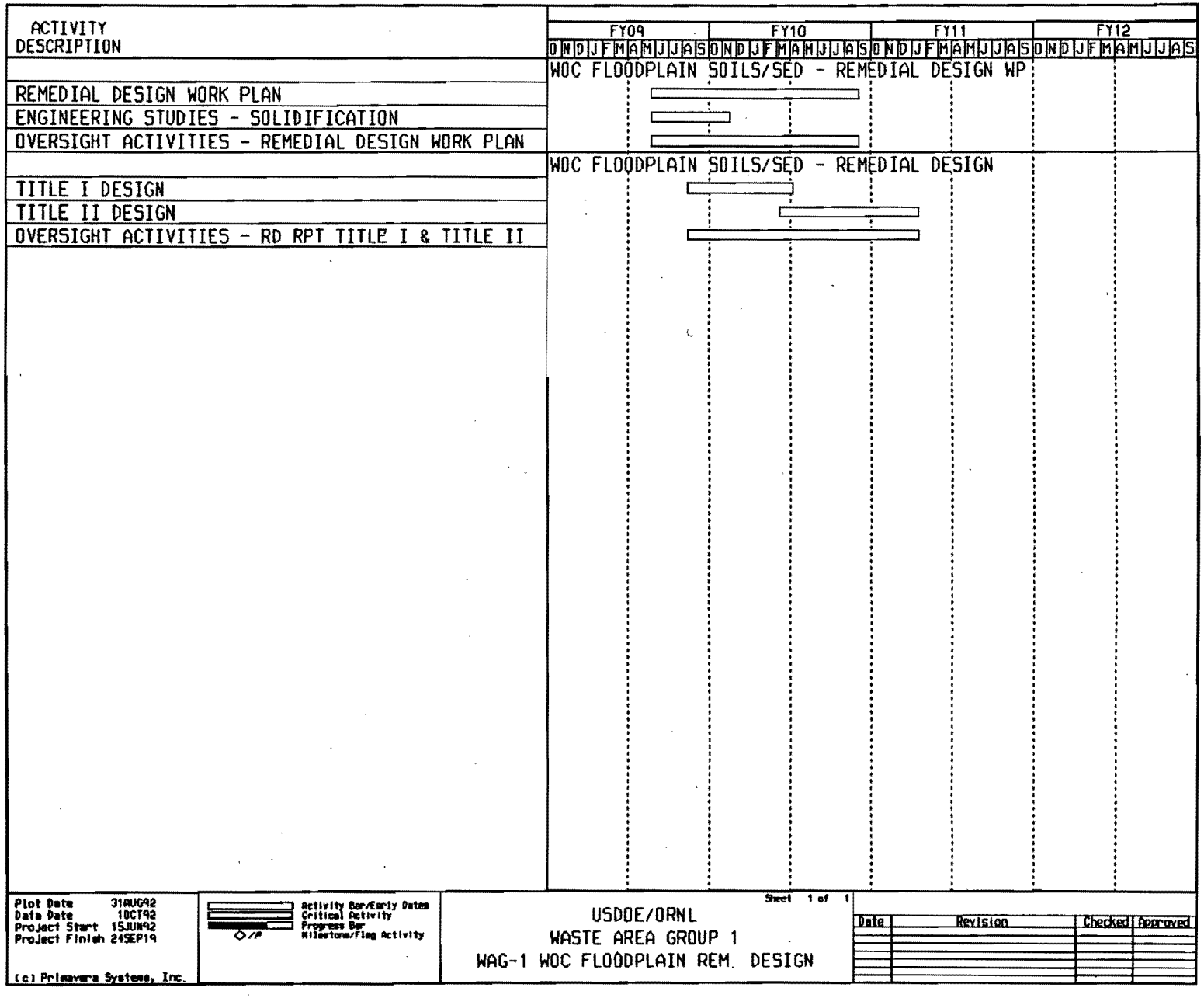


Fig. 18.8. White Oak Creek Flood Plain Soils and Sediments OU RD Summary Level Schedule.

TABLE 18.4
WAG 1 Oper Unit 05 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2009	2010	2011	2012	2013	TOTAL
Remedial Design Work Plan	69	139	0	0	0	208
Engineering Studies	0	0	0	0	0	0
RD WP Oversight Activities	23	46	0	0	0	70
SUBTOTALS RD WP	93	185	0	0	0	278
Remedial Design Phase I Title I	63	736	0	0	0	799
Remedial Design Phase I Title II	0	460	339	0	0	799
Remedial Design Phase II Title I	0	0	0	0	0	0
Remedial Design Phase II Title II	0	0	0	0	0	0
RD Oversight Activities	11	343	98	0	0	451
SUBTOTALS RD	74	1,539	437	0	0	2,049
TOTALS	167	1,724	437	0	0	2,327

18.3.1 Scope and Assumptions

The scope of the RD work for the remediation of the White Oak Creek soils and sediments is to prepare necessary design and supporting documents required for (1) approval from DOE-OR, DOE-HQ, TDEC, and EPA; and (2) implementation of all RA activities.

Details on the scope of work and assumptions associated with the RD work breakdown elements that the A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the White Oak Creek Flood Plain Soils and Sediments RA are described in Chapter 4.0.

Figure 18.9 depicts the scheduling logic for completion of the RD effort required to support a construction start 15 months from IROD approval.

18.3.2 Remedial Design Work Plan

18.3.2.1 Remedial Design Work Plan (6.1.01.45.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The A-E Contractor will prepare a draft RD Work Plan based upon the scope and design criteria specified in the PP and IROD documents. The RD Work Plan will include the detailed design process and schedule for the design effort for the following remediation activities.

- In situ stabilization of radiologically contaminated soils to provide institutional control and decay of intermediate-lived fission products.

- Installation of revetment over the stabilized area to minimize surface erosion.

18.3.2.2 Engineering Studies (6.1.01.45.06.02)

Both before and during Title I design, research into recent advancements in remedial technologies and construction techniques and/or engineering studies on new equipment performance and effectiveness will be conducted as outlined in the RD Work Plan. These studies of various vendors and equipment available in the environmental market are required in order to assess equipment options and select the most economical and technically superior methodologies that can achieve the selected remedy in the IROD for incorporation into the Title I and Title II designs.

18.3.2.3 Remedial Design Work Plan Oversight Activities (6.1.01.45.06.03)

Technical input will be provided during the preparation of the RD Work Plan to ensure that the design does not violate the intent of the IROD and will comply with the administrative and regulatory requirements. The RD Work Plan will be drafted by the RD Contractor with review conducted by the FS Contractor, MMES, and DOE. Based on the logic shown in Fig. 18.9, the

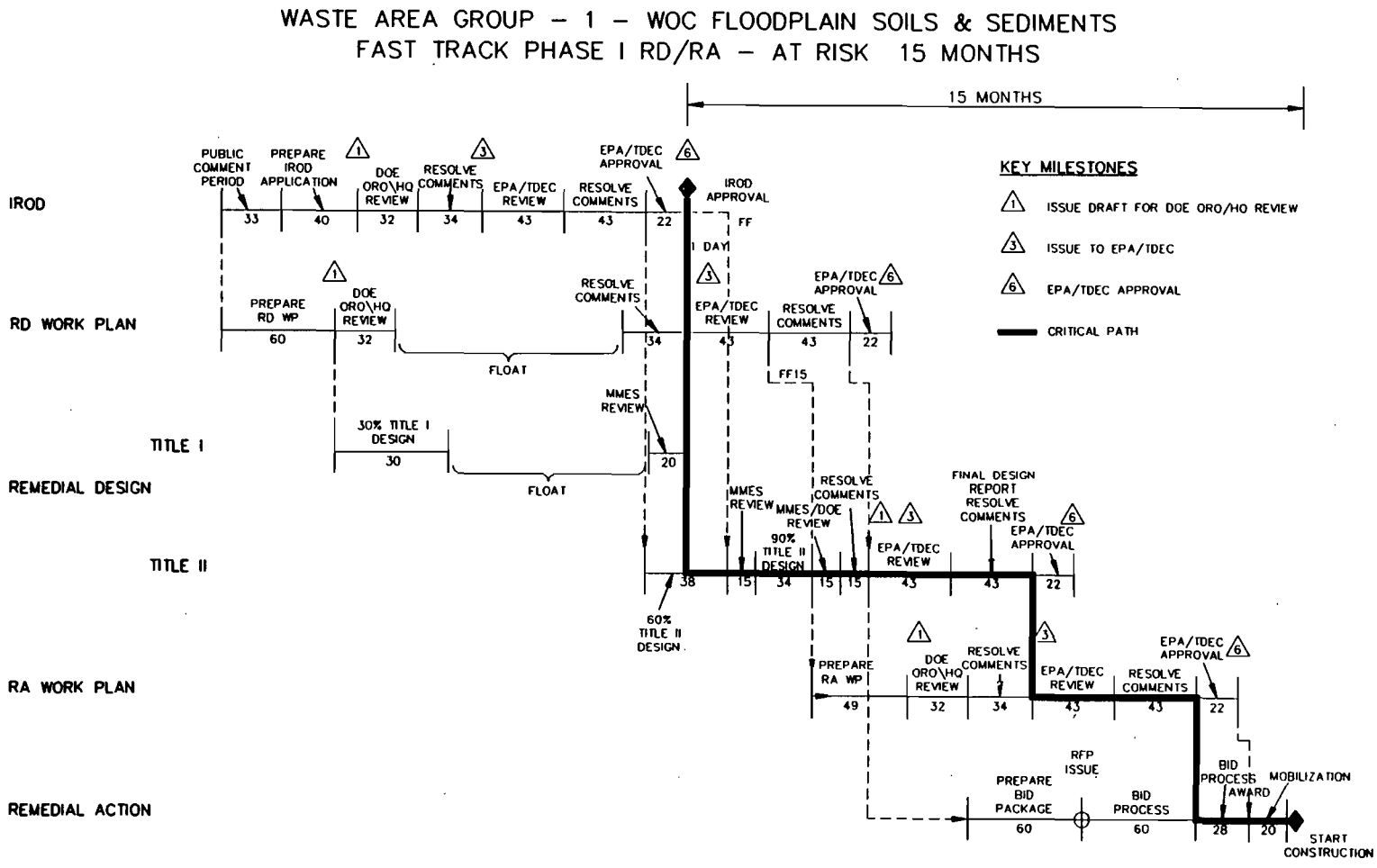


Fig. 18.9. White Oak Creek Flood Plain Soils and Sediments OU Phase I Schedule Logic.

design effort will start after the RD Work Plan is prepared and will be nearly completed before EPA approval. Section 18.3.4 discusses risks and uncertainties associated with this strategy.

18.3.3 Remedial Design Report

18.3.3.1 Title I Design (6.1.01.45.07.01)

Based on information available from the RI/FS, the RD A-E Contractor will prepare preliminary (30%) design documents showing the extent of remedial activities, site plan, details, and an outline of specifications for the work involved. A detailed cost estimate for the construction will be submitted with the 30% design document to MMES for review/comments/approval.

In order to support construction start within 15 months of IROD approval, Title I design must begin during the IROD preparation and approval process.

18.3.3.2 Title II Design (6.1.01.45.07.02)

Upon approval of the Title I design document, the A-E Contractor will prepare detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction. They will also prepare construction drawings, technical specifications, and cost estimates.

All the documents will be submitted to MMES for comments at 60% completion. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and DOE. Upon resolution of these comments, the 100% design package will be issued to TDEC and EPA for further review, comment, and approval. Upon resolution, the final Design Report for remedial activities will be prepared and issued CFC.

The cost assessment for the Title I and Title II design was developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Additional design/permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Support facilities are available for personnel and equipment decontamination.
- A consolidation area (or other disposal facility) is available for disposal of wastes generated during remediation.

18.3.3.3 Remedial Design Oversight Activities (6.1.01.45.07.03)

Oversight will be provided throughout the remedial design process to ensure that the design does not violate the intent of the FFA, FS/EA, PP, or IROD. Reviews will be conducted by the FS Contractor, MMES, and DOE at the 30%, 60%, and 90% completion stages to provide assurance that the design complies with administrative policies and regulatory requirements.

18.3.4 Risks and Uncertainties

The primary risks and uncertainties associated with the RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the remedial design and, therefore, cost.
- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have significant impact on RD and remediation work.
- The findings and conclusions in the final RI and FS/EA documents may impact the scope of RD work.
- Title II design is completed before approval of the RD Work Plan by EPA. EPA comments to the RD Work Plan could adversely impact completion of RD.
- Title II design is started before IROD approval by EPA. The risk is lessened by the fact that comments should be resolved before start of Title II design.

18.3.5 Interfaces

The RD documents required for the remediation of the White Oak Creek flood plain soils and sediments will require the coordination and close interface with the following:

- WAG 1 Project Management - to develop consistent approaches regarding design criteria, etc.
- EPA - To provide regulatory overview during the RD process and to approve all primary documents.
- TDEC - To provide regulatory overview for the state of Tennessee during the RD process.
- DOE - To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management Division - To provide waste management overview of design considerations for waste generation, handling, and storage/disposal.
- MMES Technical Advisory Group - To provide technical overview support during the RD process, i.e., engineering studies and design criteria.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division - To provide input and overview for the health and safety aspects for implementation of design.
- Construction Manager - To provide construction reviews of design.
- RD Contractor — To draft the RD Work Plan.

18.4 REMEDIAL ACTION

This section presents the scope of the RA activities required to implement in situ stabilization and capping of contaminated soils and sediments in the White Oak Creek Flood Plain OU. The risks and uncertainties and interface issues for the remedial activities are identified as well.

The WBS developed for performing the RA is presented in Fig. 18.10. The summary level schedule for these RA WBS elements is shown in Fig. 18.11. Table 18.5 shows the cost assessment of $8,614,000 for performing this portion of the WAG 1 OU5 remediation activities summarized by WBS activity and FY.

18.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan Construction Management, Title III Services, construction of the RD, construction support, and independent certification and verification that includes monitoring and a 5-year review.

18.4.2 Remedial Action Work Plan

18.4.2.1 Remedial Action Work Plan (6.1.01.45.08.01)

The RA CM will prepare the draft RA Work Plan, which (1) defines the scope and objectives of the RA based on the IROD and final remedial design; (2) documents the specific construction components of the RA; and (3) presents the RA schedule, subcontracting strategy, QA Plan, Health and Safety Plan, and RA Monitoring Plan.

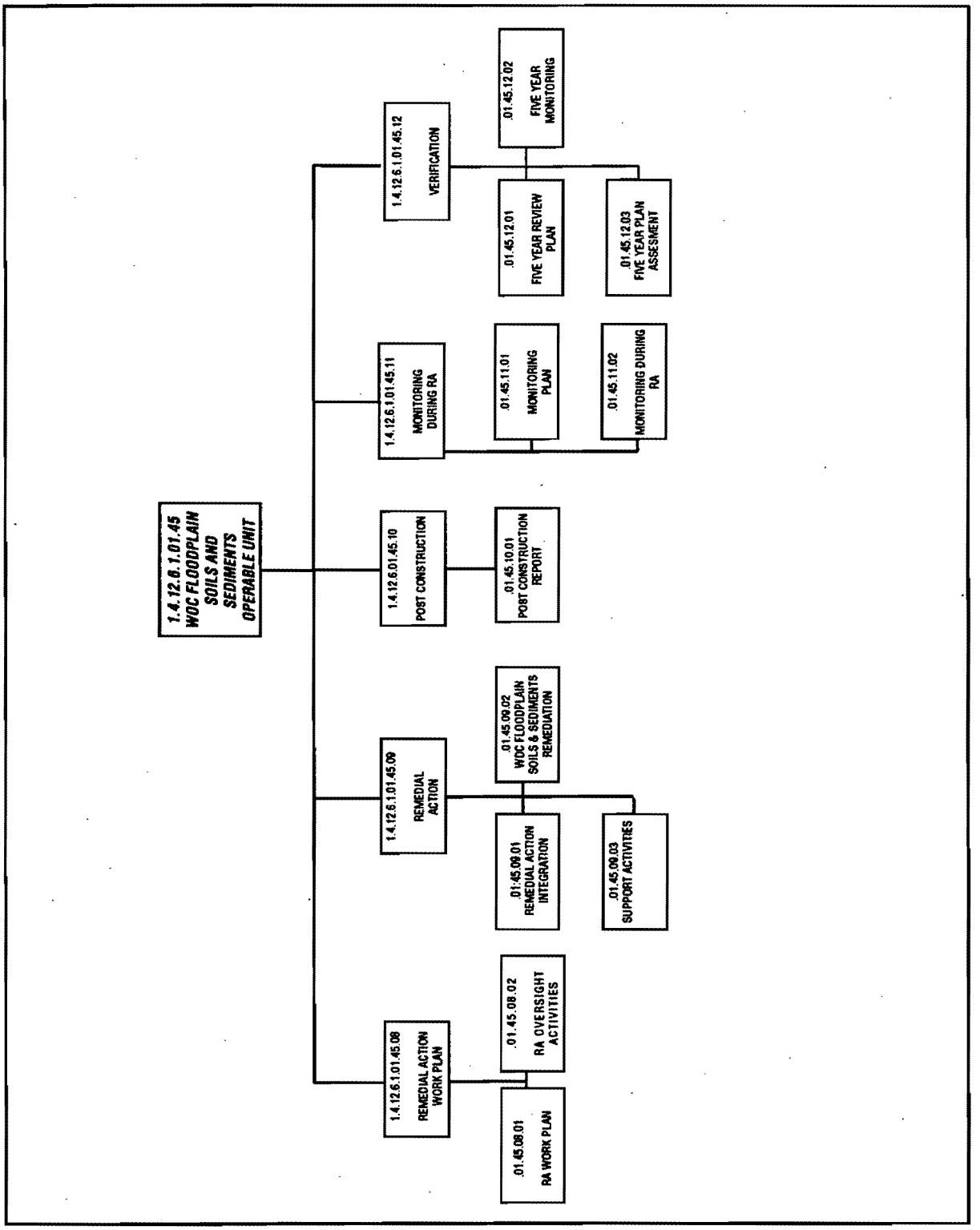


Fig. 18.10. White Oak Creek Flood Plain Soils and Sediments OU RA Work Breakdown Structure.

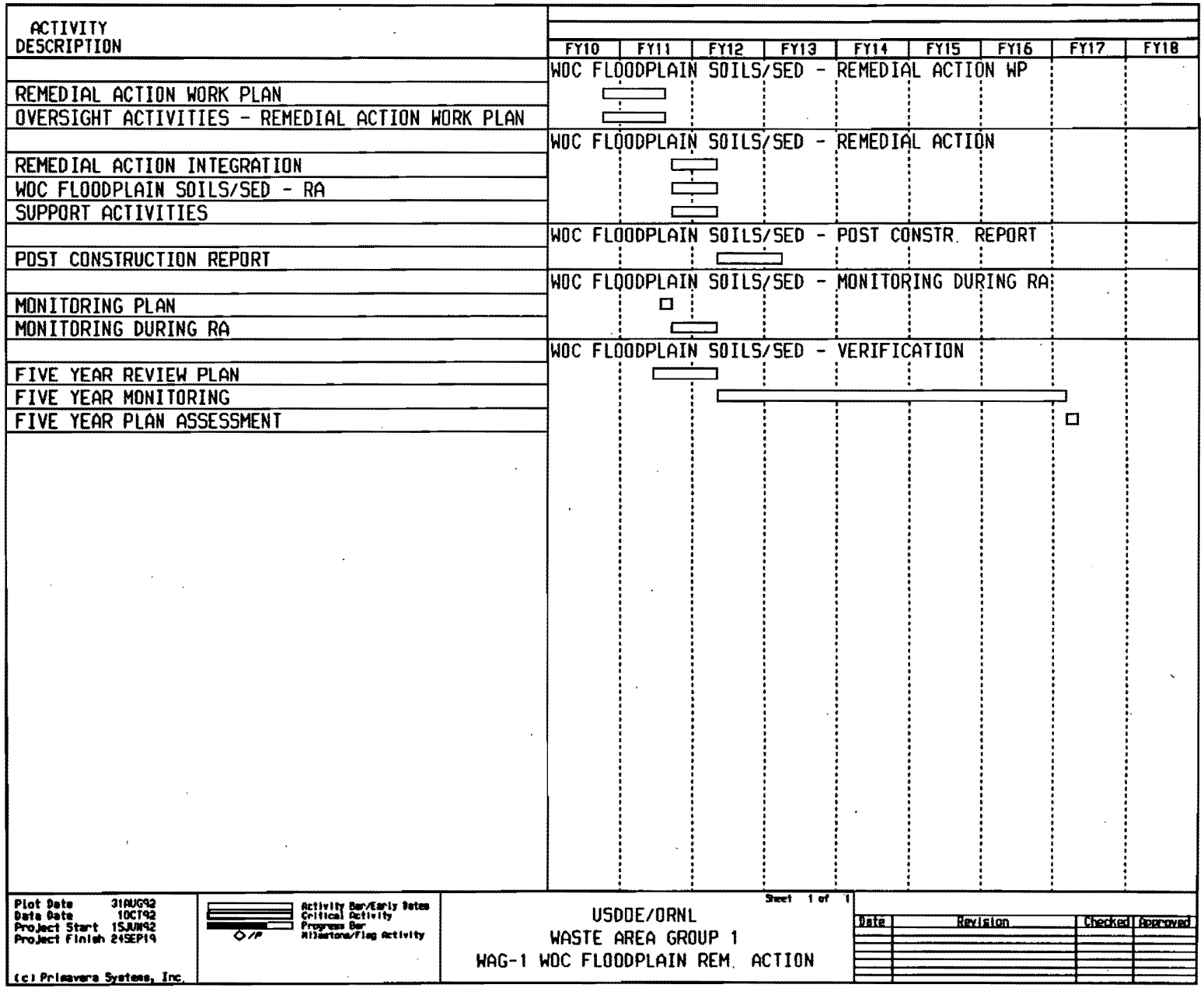


Fig. 18.11. White Oak Creek Flood Plain Soils and Sediments OU RA Summary Level Schedule.

TABLE 18.5
WAG 1 Oper Unit 05 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)								
	2010	2011	2012	2013	2014	2015	2016	2017	TOTAL
RA Work Plan	42	408	0	0	0	0	0	0	450
RA WP Oversight Activities	21	154	0	0	0	0	0	0	176
SUBTOTALS RA WP	63	562	0	0	0	0	0	0	625
RA Integration	0	423	466	0	0	0	0	0	890
Remedial Action	0	1,717	2,602	0	0	0	0	0	4,319
Post Construction Report	0	0	64	21	0	0	0	0	85
Monitoring During RA	0	149	104	0	0	0	0	0	253
Verification	0	59	348	411	411	411	411	390	2,442
SUBTOTALS RA	0	2,348	3,583	433	411	411	411	390	7,988
TOTALS	63	2,910	3,583	433	411	411	411	390	8,614

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

18.4.2.2 Remedial Action Work Plan Oversight Activities (6.1.01.45.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA work plan. During the preparation of the draft RA Work Plan, the Facilities Manager and A-E Contractor responsible for the approved design report will provide necessary coordination and review the Work Plan to ensure that proposed construction efforts will implement the IROD as presented in the final RD Reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

18.4.3 Remedial Action Activities

18.4.3.1 Remedial Action Integration (6.1.01.45.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E Contractor and construction support as required. RA integration for remedial activities includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provides as-built drawings, approves Design Change Notices and Field Change Requests as applicable, and ensures that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

18.4.3.2 White Oak Creek Flood Plain Soils and Sediments Remediation (6.1.01.45.09.02)

The long-term strategy for the remediation of the portion of White Oak Creek within WAG 1 is to provide for the minimization of long-term contaminated sediment transport to off-WAG receptors. The Early Action described in Chapter 12.0 discusses removal of mercury-contaminated sediments and in situ grouting of radiologically contaminated sediments. For this portion of White Oak Creek within WAG 1, it is proposed to place a fiberform revetment mat along the main channel. The RA will complement the Early Action by providing additional long-term erosion protection, thus decreasing the possibility of contaminated sediment transport downstream.

A revetment mat is placed over the previously stabilized areas to minimize infiltration and erosion.

18.4.3.3 Support Activities

During the RA activities, MMES will provide the necessary staff and support to operate and maintain the personnel and equipment decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities and to move leachate from the consolidation area to the PWTP for further treatment.

18.4.4 Post Construction

18.4.4.1 Post Construction Report (6.1.01.45.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, completion of construction activities, and effectiveness of selected remedies. The Facility Manager and the Construction Manager will be responsible for the following activities to prepare the Post Construction Report:

- Conduct a site inspection with EPA and TDEC (1) to determine whether the RA is complete and is consistent with the agency-approved (1) OE remedies, and (2) to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

  - brief recapsulation re-cap of site description, chronology of major events, and the selected remedies;

  - an explanation of construction activities, modifications, performance standards, and QC; and

  - an explanation of operation and maintenance, including monitoring to be undertaken at the site.

18.4.5 Monitoring During Remedial Action

18.4.5.1 Monitoring Plan (6.1.01.45.11.01)

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program for the White Oak Creek Flood Plain. This plan will determine the impact of construction activities and the effectiveness of the remediation conducted.

18.4.5.2 Monitoring During Remedial Action (6.1.01.45.11.02)

MMES will implement an Environmental Monitoring Program for the White Oak Creek OU that will accomplish the following:

- Start 1 month before start of construction in order to establish the baseline.
- Be conducted during the various RA activities to document the impacts of remedial activities.
- Continue until the RA is completed to assess the effectiveness of the remedies implemented and provide data for the Post Construction Report and Five-Year Review Plan.
- Generate routine monitoring reports with analytical results.

18.4.6 Verification

18.4.6.1 Five-Year Review Plan (6.1.01.45.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s), then, in accordance with CERCLA and the FFA, an RA Assessment Plan is required in order for the EPA and TDEC to review the RA no less than once every 5 years after the initiation of the final RA(s). This would ensure that human health and the environment are protected by the RA(s) being implemented. Because contaminants will remain after remediation, the A-E Contractor and MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity/status of the RA(s) implemented.

18.4.6.2 Five-Year Monitoring (6.1.01.45.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of remediation. The results shall be documented in the monitoring reports, which will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of ORNL.

18.4.6.3 Five-Year Plan Assessment (6.1.01.45.12.03)

The data obtained during the 5 years of monitoring will be analyzed. The status of the RA(s) implemented will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, the Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether the RA(s) implemented are still

complying after 5 years with the intent and criteria established in the IROD and current regulations and policies.

18.4.7 Risks and Uncertainties

The primary risks and uncertainties associated with the RA are as follows:

- It is uncertain whether the in situ stabilization of the soil will be homogeneous throughout the entire profile. Hydrologic pathways may still exist and provide a means for radiological transport.
- Remedial action levels for in situ stabilization may need to be re-examined to determine risk levels of possible offsite migration of radiological constituents to protect human health and the environment.
- Co-contaminated waste may have been generated in the stream bed and flood plain, which may require alternative treatment technologies.
- Any changes in the RD due to the risks and uncertainties mentioned in Section 18.3.4 will have a direct effect on remediation cost.
- Additional remediation will be needed if the RA proves unsuccessful.

18.4.8 Interfaces

During remediation activities, interface and coordination will be necessary with the following agencies:

- WAG 1 Project Management — To coordinate remedial activities and schedule.
- EPA — To provide regulatory overview during the RA process, to approve all primary documents, and to conduct routine inspections.
- TDEC — To provide regulatory overview for the state of Tennessee during the RA process and to conduct routine inspections.
- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview and support throughout the RA process with a focus on the minimization of RA-generated wastes. To provide the capability to process the wastes generated.

- MMES Technical Advisory Group — To provide technical overview support during the RA process, i.e., monitoring and field change requests.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division — To provide input and overview for the health and safety aspects of conducting the RA.
- Construction Manager — To provide construction support to MMES.
- MMES Title III Services (includes Inspection Services).
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.
- Independent Certification Contractor.

18.4.9 Contingent Action

Since the Early Action scenario included removal of mercury-contaminated soils and sediments, no contingent action is included for the baseline.

19.0 WAG 1 SOLID WASTE STORAGE AREA 1 OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the Solid Waste Storage Area (SWSA) 1 OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for the SWSA 1 OU is presented in Fig. 19.1. The summary level schedule for the SWSA 1 OU is shown in Fig. 19.2. The cost assessment of $13,142,000 for the OU6 is presented by remediation phase and FY in Table 19.1.

The estimates for the RI and FS were prepared using Technical Complexity Factors (TCFs) which permit the correlation of the scope of the RI efforts for the SWSA 1 OU to the scope of the RI efforts for a reference WAG (WAG 5). A discussion of the development of this methodology is included in Appendix F.

19.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 19.3. The summary level schedule for the RI WBS element is shown in Fig. 19.4. The cost assessment of $4,397,000 for performing the RI is presented by WBS activities and FY in Table 19.2.

19.1.1 Scope and Assumptions

The primary assumption for the additional RI effort is that a focused effort is required to acquire the remaining RI data to support the evaluation of alternatives for OU6. This RI effort will focus on collecting groundwater, surface water/sediment, and soils data to be provided for the evaluation of the potential impact to human health and the environment specific to this OU.

The Supplemental Sampling and Analysis Plan will undergo a concurrent MMES and DOE review and will be submitted to the regulators for information only. The schedule for implementation of this focused RI process is based on the assumption that there be no primary documentation prepared as part of this effort.

19.1.2 Operable Unit Specific Remedial Investigation Work Plan

19.1.2.1 Planning (6.1.01.46.01.01)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI for this OU. The RI Work Plan defines the scope and objectives for the RI

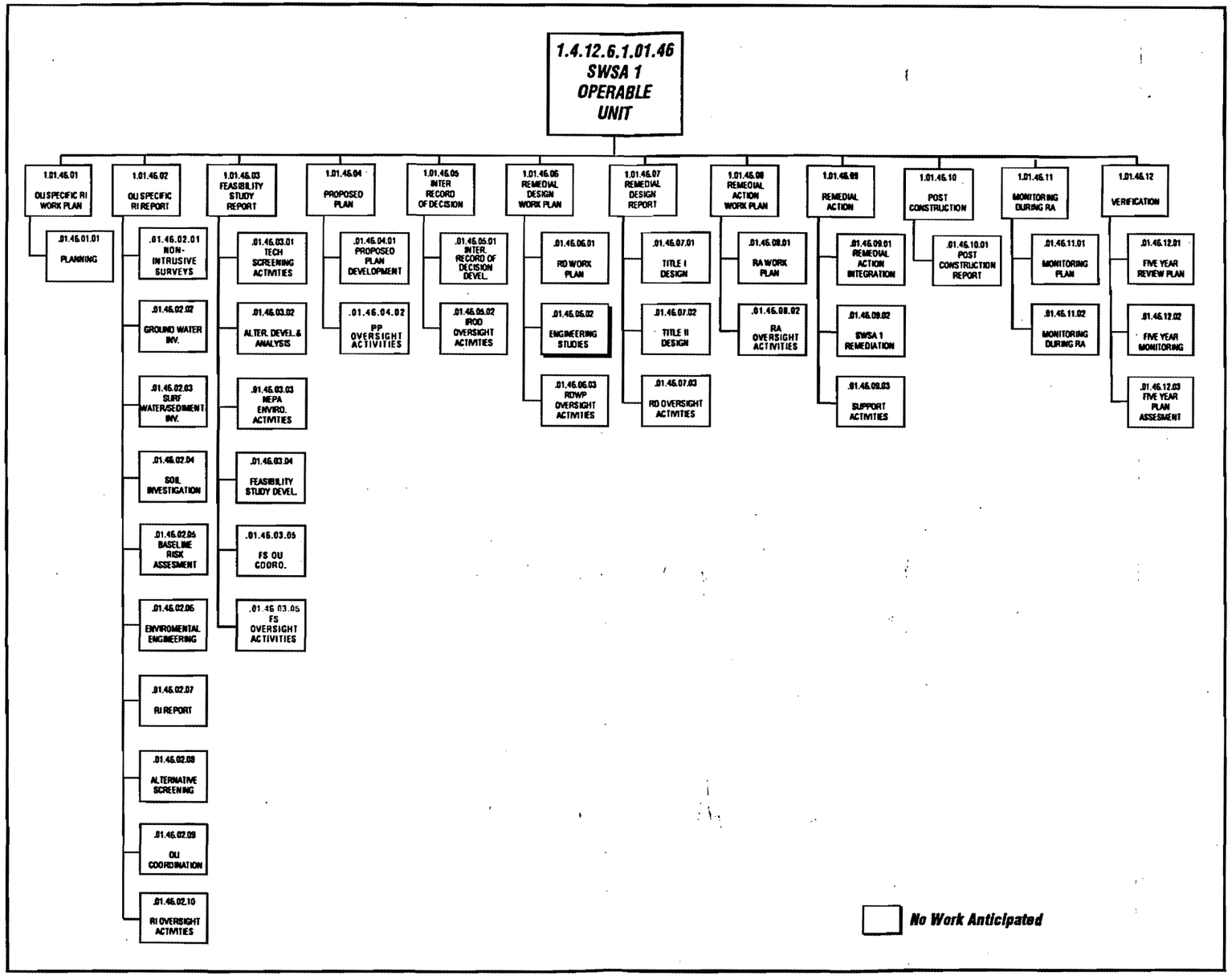


Fig. 19.1. SWSA 1 OU Work Breakdown Structure.

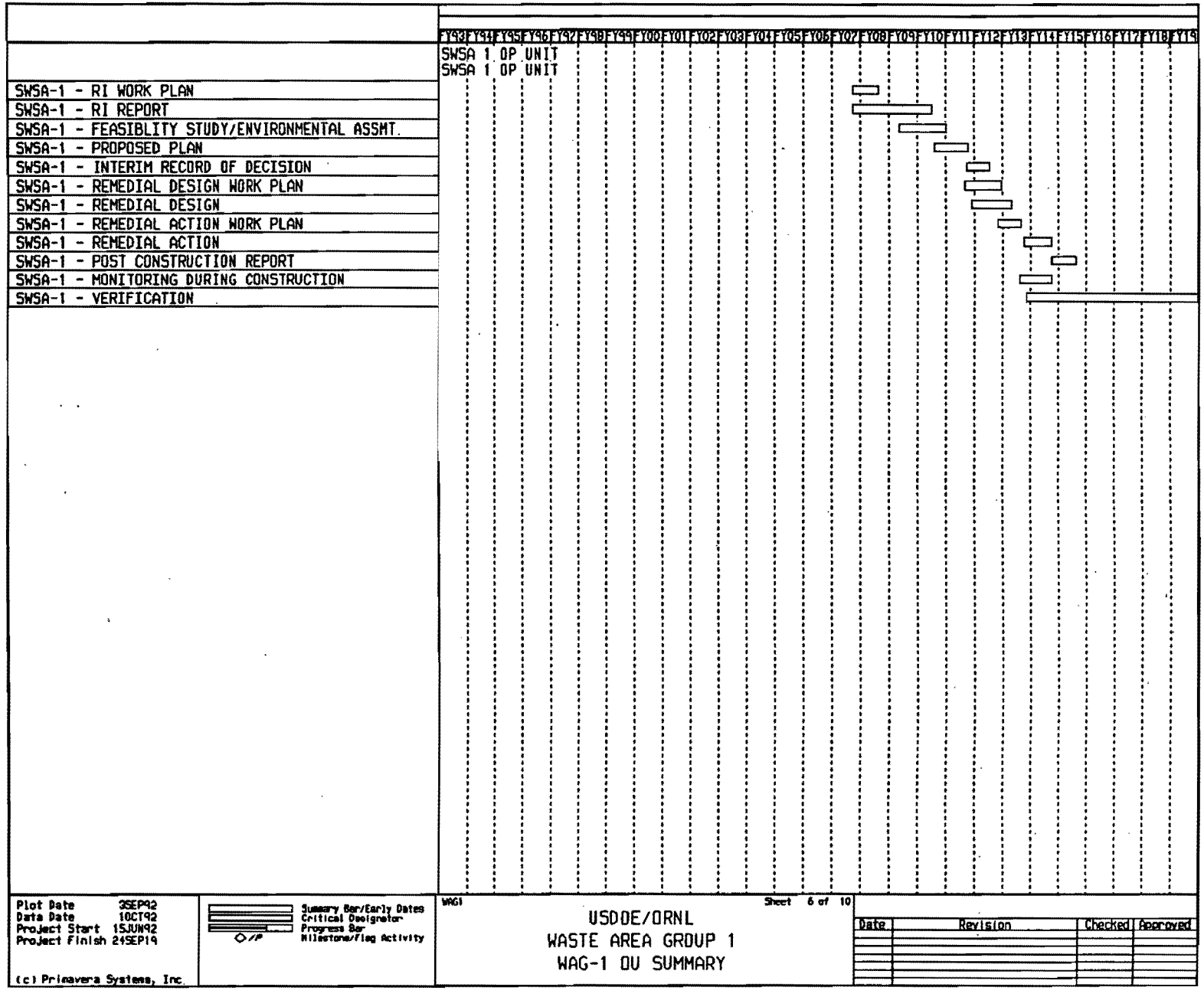


Fig. 19.2. SWSA 1 OU Summary Level Schedule.

TABLE 19.1
WAG 1 Oper. Unit 06 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)														
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Remedial Investigation	312	1,512	1,607	966	0	0	0	0	0	0	0	0	0	0	4,397
Feasibility Study/IROD	0	0	778	851	328	62	0	0	0	0	0	0	0	0	2,018
Remedial Design	0	0	0	0	123	680	160	0	0	0	0	0	0	0	963
Remedial Action	0	0	0	0	0	39	630	3,180	393	329	329	329	534	0	5,763
TOTALS	312	1,512	2,385	1,817	451	781	790	3,180	393	329	329	329	534	0	13,142

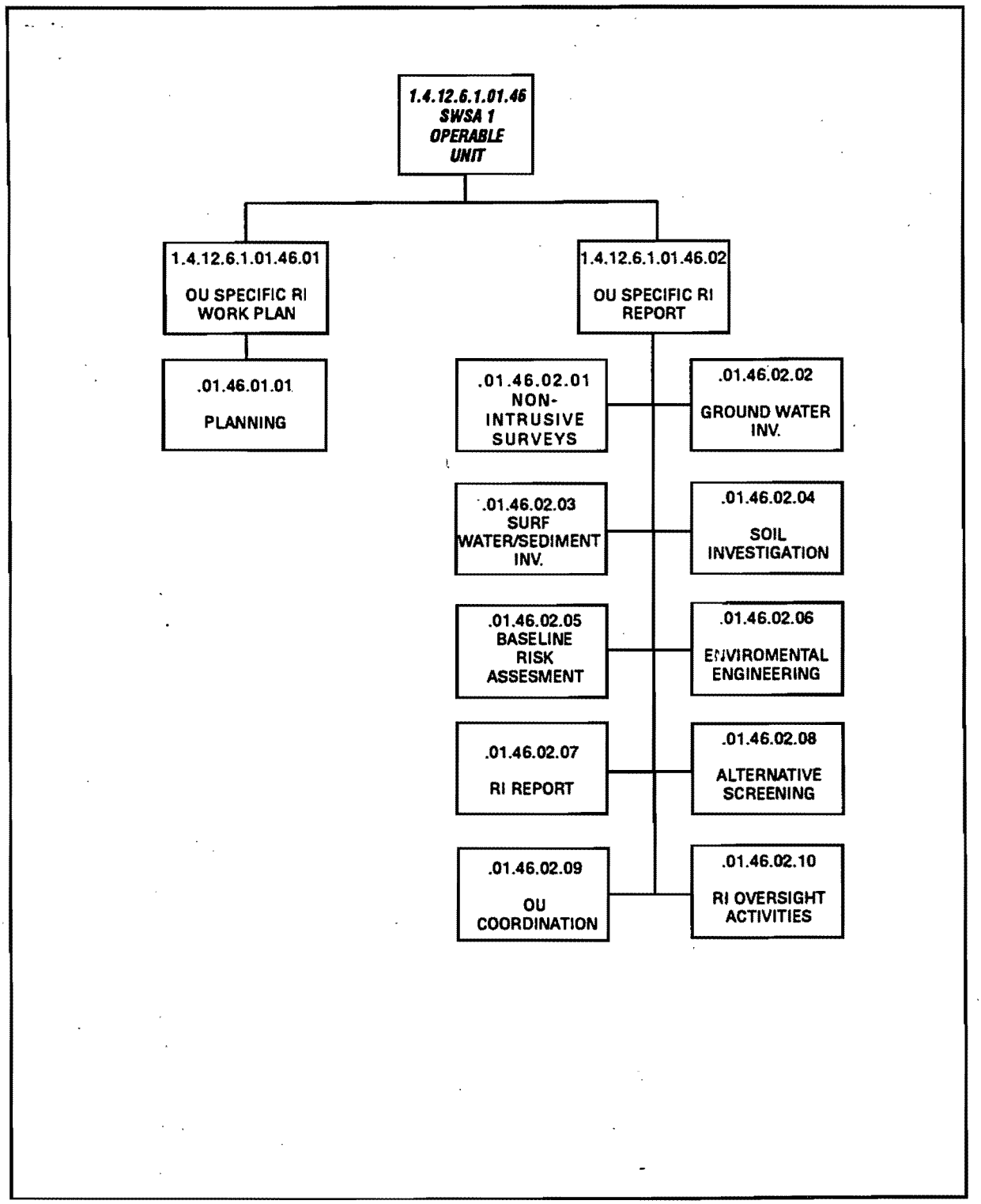


Fig. 19.3. SWSA 1 OU RI Work Breakdown Structure.

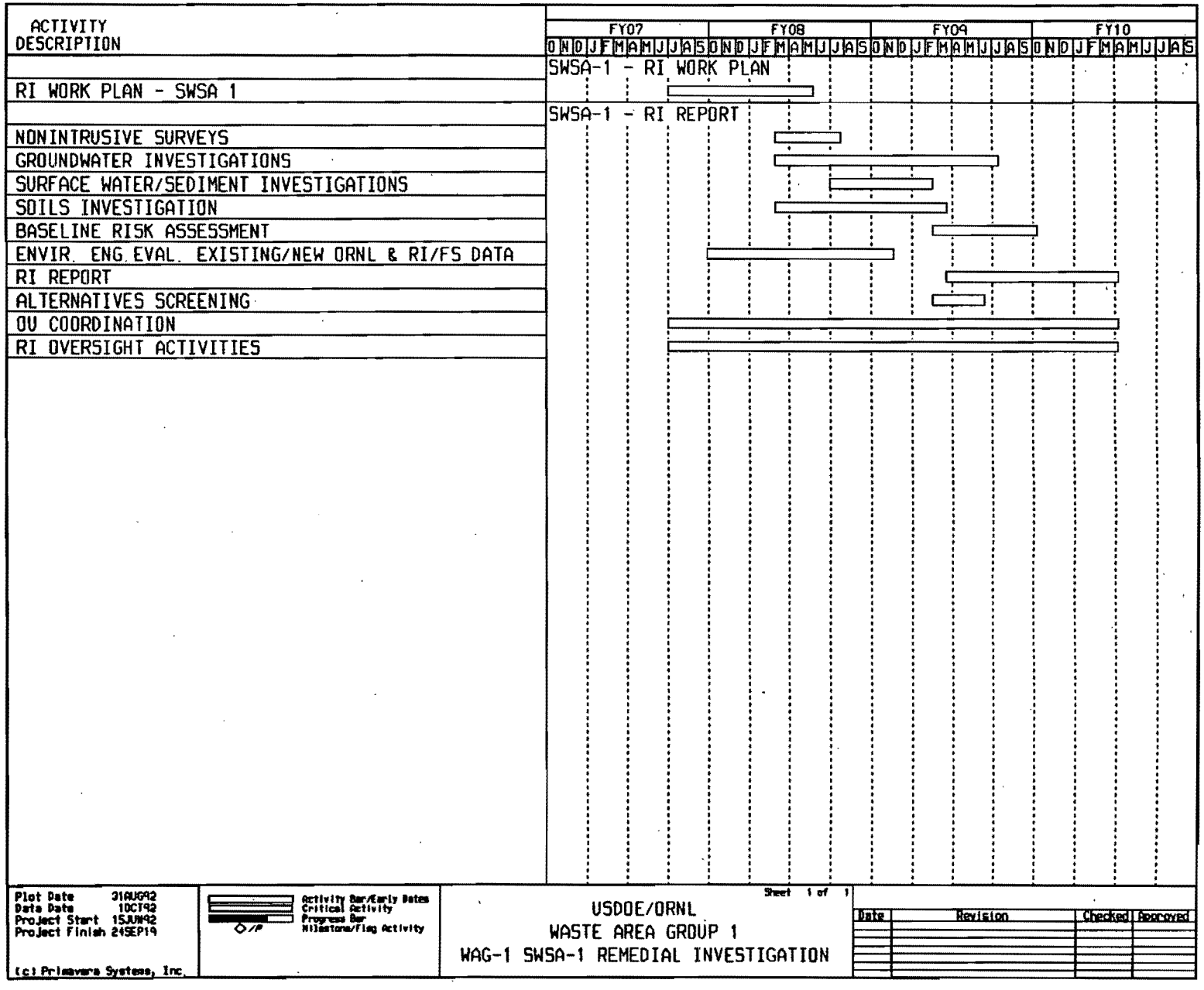


Fig. 19.4. SWSA 1 OU RI Summary Level Schedule.

TABLE 19.2
WAG 1 Oper. Unit 06 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	2007	2008	2009	2010	TOTAL
Planning	19	57	0	0	76
Nonintrusive Surveys	0	11	0	0	11
GW Investigation	0	83	111	0	195
SW/SED Investigation	0	121	121	0	242
Soil Investigation	0	68	46	0	114
Baseline Risk Assess.	0	0	70	23	93
Environ. Engineering	28	112	28	0	169
RI Report	0	0	148	148	296
Alternative Screening	0	0	24	0	24
RI OU Coordination	117	467	467	350	1,400
RI Oversight Activities	148	593	593	445	1,779
TOTALS	312	1,512	1,607	966	4,397

activities and provides a mechanism for planning the investigation activities. These activities may be accomplished concurrently or in a phased approach. A Project Management Strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes a summary and interpretation, as appropriate, of available environmental information. The plan addresses the ARARs, TBC guidance, and establishment of Data Quality Objectives and provides specific rationale for all field and analytical work. The RI Work Plan addresses the proposed technical approach, timing for implementation, schedules, and decision points where appropriate. The RI Work Plan (BNI, 1988) was prepared according to provisions of applicable EPA and/or state guidance documents.

In addition, a revised Field Sampling Plan (BNI, 1991a) and a revised QA Project Plan (BNI, 1991b) were issued to regulators in December 1991. Other WAG-specific plans and procedures were also developed including project management, ES&H management, waste management, and database management. Since all these planning activities occurred before October 1992, no cost or schedule information is included for this element in the Baseline Report.

19.1.3 Operable Unit Specific Remedial Investigation Report

19.1.3.1 Nonintrusive Surveys (6.1.01.46.02.01)

Civil surveys will be conducted to provide 3-D control for sampling and measurement activities. Civil surveying will be performed as needed to support investigation activities including as-built surveys, construction surveys, and topographic surveys, and establishing monitoring well locations.

Coordination with the ORNL Well P&A Program will be provided.

19.1.3.2 Groundwater Investigation (6.1.01.46.02.02)

Groundwater flow may constitute a significant pathway for migration of contaminants from the SWSA 1 OU to potential receptors offsite. ORNL has conducted preliminary investigations of groundwater flow and quality which indicate that the flow regime is complex and that radiological contaminants are present in the groundwater. The investigation of hydrogeology, performed as part of the WAG 1 Phase I RI, will be supplemented to further define groundwater flow and quality in and around SWSA 1. Water level data from the groundwater monitoring wells and piezometers, in conjunction with data from stream gauging stations, will provide information on the interaction of surface water and groundwater systems.

Six monitoring wells are located near SWSA 1. These wells will be used to monitor the overall movement of contaminants from SWSA 1 and to characterize groundwater quality. A new, deep water quality well (<200 ft) will be installed and developed south (downdip) of SWSA 1 to evaluate deeper bedrock flow regimes.

Groundwater levels will be measured in existing wells, in monitoring wells installed during the SWSA 1 RI, and at selected stream locations. The water levels will be measured at least four times during discrete time intervals (e.g., one set of measurements for each of the four seasons during the year).

The groundwater samples will be obtained during two sampling episodes at seven wells: four RCRA wells, one new well, and two pre-RA Program and RA Program wells.

Samples from groundwater investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL radiological constituents, and water quality parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation.

The results of the groundwater investigation will be made available to the Groundwater WAG Team in order to facilitate site-wide groundwater remediation assessments. It is conceivable that as the groundwater investigation proceeds, additional data needs will be identified by the Groundwater WAG Team, which will result in additional requirements being placed on the SWSA 1 groundwater investigation. No allowances for additional investigation requirements are included. Continuing interface with the Groundwater WAG Team will be required throughout the investigation process.

19.1.3.3 Surface Water and Sediment Investigations (6.1.01.46.02.03)

Existing data indicate that stream sediments may constitute a potential migration pathway for radiological contaminants originating at SWSA 1. Certain contaminants preferentially sorb to sediments because of the clay mineralogy and bulk properties of the sediment. Contaminated sediments migrate with surface runoff and along stream channels. During storm events, these sediments can be carried significant distances. Uptake by benthic biota concentrates contaminants at higher trophic levels and results in a pathway of environmental exposure.

Surface water grab samples will be taken at ten locations along White Oak Creek in the stream interval between the impoundments and a point just downstream from SWSA 1. Sediment samples will be taken at the same locations as five of the surface water samples.

Samples from surface water/sediment investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and water quality parameters (surface water only). Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples to be included in risk assessments and for other instances where data of known quality are required.

19.1.3.4 Soils Investigation (6.1.01.46.02.04)

According to early accounts of disposal at SWSA 1, a small number of trenches were excavated to receive waste. Partial characterization of SWSA 1 was accomplished in the Phase I RI via seven soil borings and via electromagnetic and magnetometer surveys. Soils investigation activities in this second phase will focus on more clearly delineating trenches or other areas of concern in SWSA 1.

The SWSA 1 investigation consists of digging two test pits or transect trenches (each approximately 20 ft long) that pass through the suspected waste trenches. The test pits allow a careful examination of soil profiles. A physical description of excavated soils/materials will also be performed.

Two composite samples will be collected during each test pit excavation. Samples from soils investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and geotechnical parameters.

Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples to be included in risk assessments and for other instances where data of known quality are required.

19.1.3.5 Baseline Risk Assessment (6.1.01.46.02.05)

A Screening-Level Risk Assessment for SWSA 1 will be performed and will consist of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with SWSA 1 for current and future exposure scenarios. The objectives of the environmental evaluation are (1) to determine whether or not SWSA 1 poses a current or potential future risk to environmental resources in the absence of any remediation, and (2) to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

The SWSA 1 Screening-Level Risk Assessment, composed of human health and baseline environmental evaluations, will be submitted as a secondary document for EPA and TDEC review and will then be presented as a section of the SWSA 1 RI Report.

19.1.3.6 Environmental Engineering (6.1.01.46.02.06)

This task involves four principal activities:

1. Prior to field mobilization, a detailed evaluation of existing data for SWSA 1 will be performed. Support to the ORNL/DOE/EPA/TDEC technical review process, the ORNL environmental assessment documentation process, and the ORNL readiness

review process will be provided as requested. Evaluation of new ORNL data (i.e., semi-annual groundwater data) will be performed and will include the review and tabulation of data as they become available (i.e., SIMS). These data will be compared to the focused RI Work Plan supplement or TM, as appropriate, and to conclusions drawn from the data generated by the SWSA 1 RI. The scope also includes review of ORNL reports published since March 1988, when the SWSA 1 RI Work Plan supplements were issued.

2. An environmental engineering analysis will be performed on all data generated from SWSA 1 RI field activities. These data will be tabulated for use in writing the technical memorandums and technical bulletins.

3. Contaminant/contents data will be evaluated, which will involve reviewing ORNL electronic data bases for information about the contents of SWSA 1. Also, aerial photographs and engineering drawings will be reviewed to determine actual locations of SWSA 1 areas of concern.

4. The data summarized by the three previous tasks will be reviewed with respect to implementation of remedial alternatives. This task is iterative in nature and consists of the following steps: 1) summarized RI/FS data is reviewed as it becomes available; 2) the preliminary remedial alternatives scenario is refined, if necessary; 3) data needs are re-evaluated based on the new alternatives scenario; and 4) data collection efforts are altered to meet any new data needs.

19.1.3.7 **Remedial Investigation Report** (6.1.01.46.02.07)

The SWSA 1 RI Report will serve as documentation of data collection and analyses in support of the SWSA 1 FS. The results of the RI are presented as an analysis of site characteristics and of the risk associated with such characteristics and a summary of potentially feasible remedial actions. The evaluation of site characteristics will focus on the site physical characteristics, the source characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Prior to the issuance of the Draft SWSA 1 RI Report, a draft determination of the ARARs will be submitted to EPA and TDEC. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to the SWSA 1 remediation.

The draft SWSA 1 RI Report will be produced for concurrent review by the FM and DOE, revised to incorporate pertinent comments, and issued to EPA and TDEC for review and approval.

19.1.3.8 Alternatives Screening (6.1.01.46.02.08)

Preliminary development and screening of remedial alternatives will consist of the following steps:

1. Develop RA objectives specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed.

2. Develop general response actions for each medium of interest that may be taken to satisfy the RA objectives for the site.

3. Identify volumes or areas of media to which general response actions might be applied.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the site.

5. Identify and evaluate technology process options to select a representative process for each technology type retained for further consideration.

6. Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

19.1.3.9 Operable Unit Coordination (6.1.01.46.02.09)

Activities include quality control and project management and coordination. These activities will ensure that quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple WAGs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, database management, and database interface with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Field support needed to manage and direct the field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes providing required field equipment, spare parts, and other field materials and supplies.

19.1.3.10 Remedial Investigation Oversight Activities (6.1.01.46.02.10)

This element provides technical support, input, and oversight to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon final approval of the associated technical memoranda.

The following briefly describes the oversight roles of the various participants:

- FS Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the FS/EA.
- A-E Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the RD approach and design requirements.
- MMES HS&E Division — Provides support for health and safety, environmental compliance, and waste management as a part conducting the RI field activities.
- MMES Environmental Sciences Division — Provides support for drilling.
- MMES Planning/Coordination — Provides necessary permits for RI field activities.
- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

19.1.4 Risks and Uncertainties

The following list describes the areas of risks and uncertainties associated with the performance of the RI.

- Delays in the review of the Site Characterization Report would impact the initiation of the preparation of the Sampling and Analysis Plan.
- The implementation of regulator approval of the focused Sampling and Analysis Plan would delay field investigations.

19.1.5 Interfaces

The following list describes the primary interfaces and anticipated roles during the RI:

- MMES Waste Management — To provide waste management overview and support throughout the RI process by focusing on the minimization of RI-generated wastes and providing the capability to process these wastes.

- MMES Technical Advisory Group — To provide technical overview support during the RI process, specifically pertaining to the overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure MMES RI goals are achieved.

- FS Contractor — To provide data review support to the RI relative to its sufficiency to support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approve all primary documents.

- TDEC — To provide state (Tennessee) regulatory overview during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and programmatic direction.

19.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents in more detail the efforts necessary to perform the WAG 1 SWSA 1 FS/PP/IROD process. The FS process will include incorporating environmental concerns as an EA within the FS Report, preparing a PP to remediate the OU, and preparing an IROD to comply with regulations. The associated risks and uncertainties and the interfaces for the FS efforts are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is presented in Fig. 19.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig. 19.6. The cost assessment of $2,018,000 for performing this portion of WAG OU6 remediation activities is summarized by WBS activity and FY in Table 19.3.

19.2.1 Scope and Assumptions

The scope of the WAG 1 SWSA 1 OU FS process considers the soil and suspected groundwater contamination from solid LLW disposal. The FS/PP/IROD will not consider the remediation of groundwater in the OU. The FS will consider methods and actions to isolate or remove the soil contamination to mitigate contaminant movement off-WAG. The SWSA 1 OU FS activities are based on the following assumptions. The scope of the PP for SWSA 1 will summarize the results of the FS and present the proposed remedial alternative. As the final step in the planning process, the IROD will be prepared. This is the legal document that formally declares that the Interim RA(s) selected in the PP will mitigate the release of contaminant from the tanks, establishes the schedule for performing the Interim RA(s), and establishes the site monitoring requirements and remediation schedule. The IROD is a primary milestone document that is subject to administrative

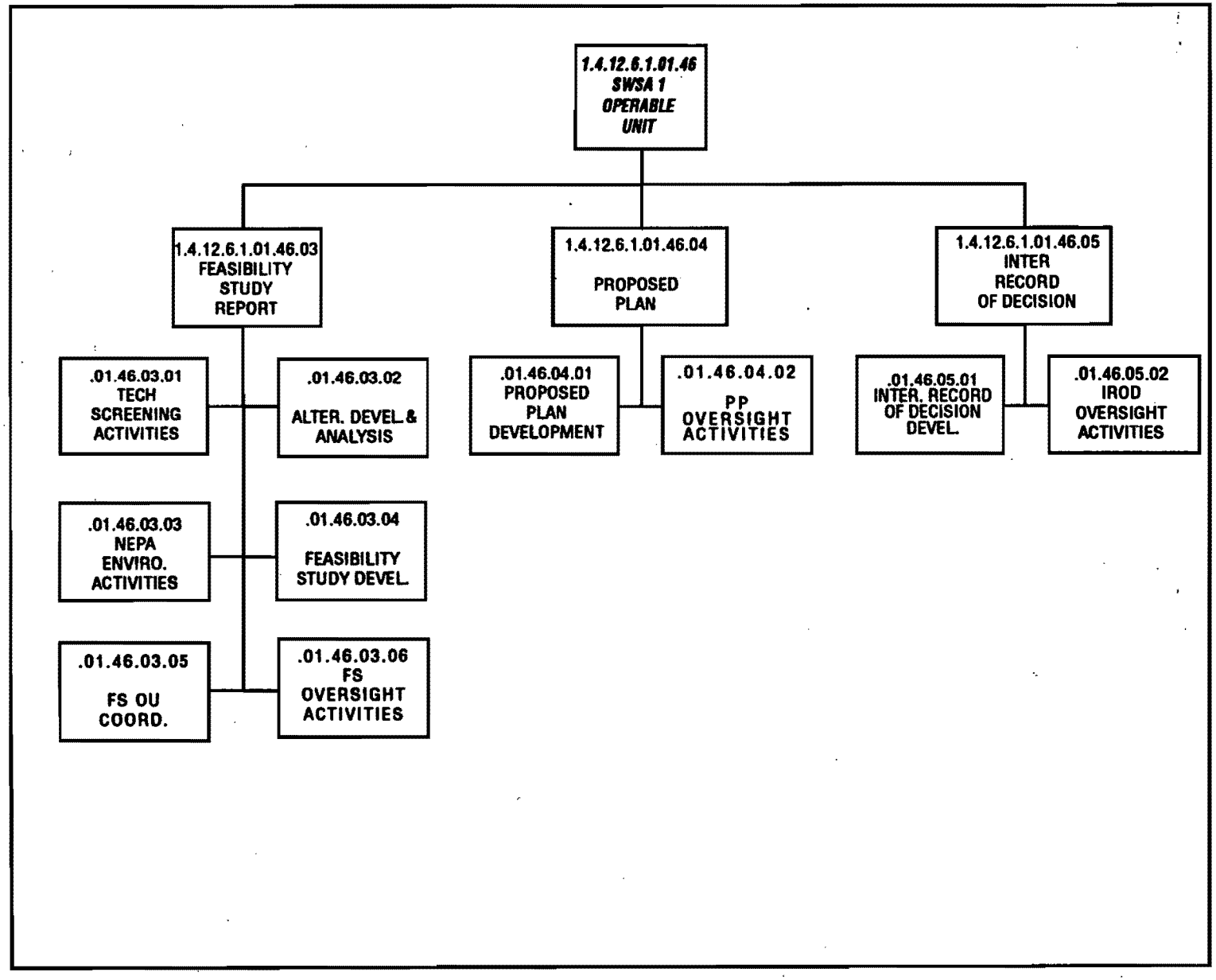


Fig. 19.5. SWSA 1 OU FS/PP/IROD Work Breakdown Structure.

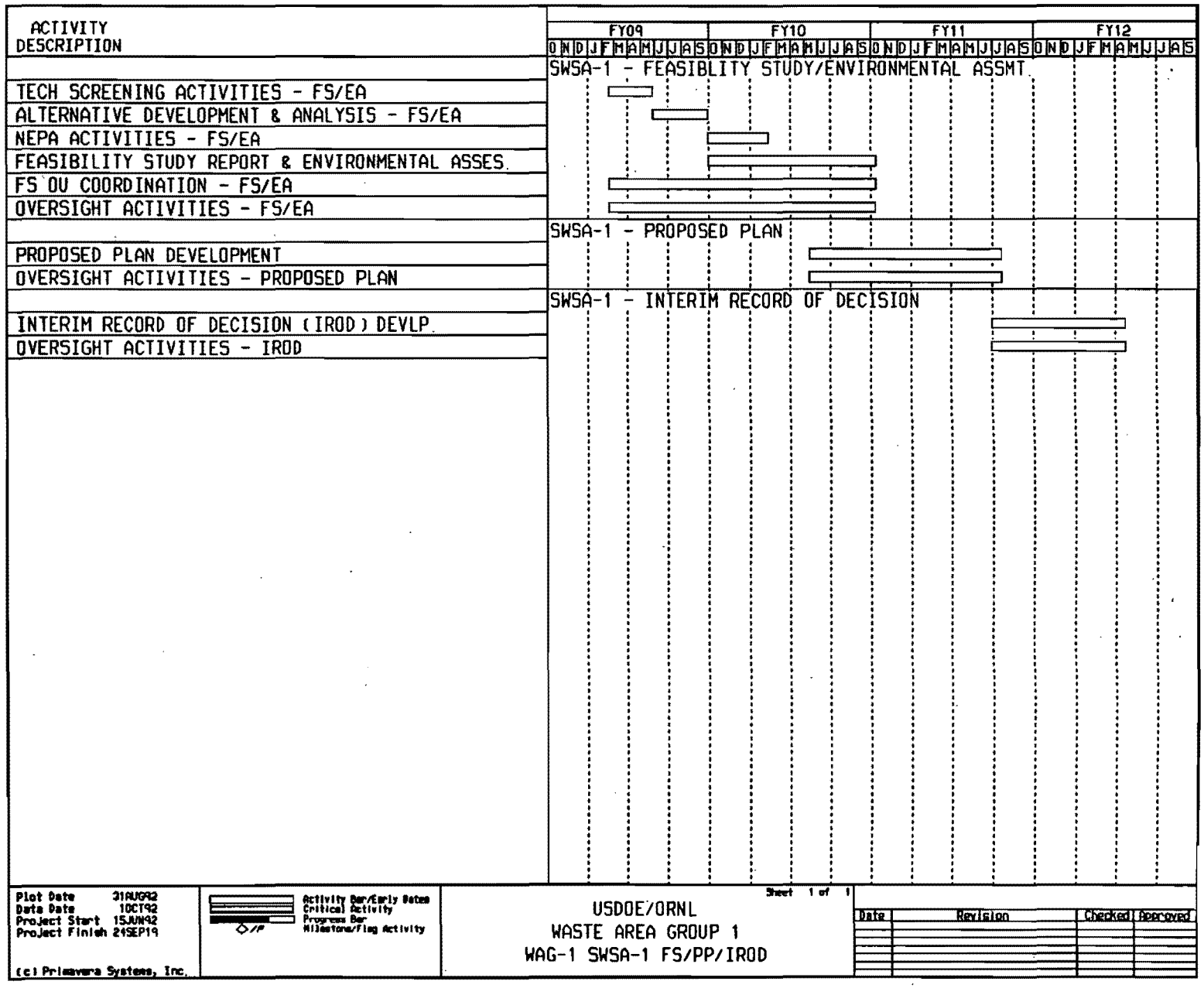


Fig. 19.6. SWSA 1 OU FS/PP/IROD Summary Level Schedule.

TABLE 19.3
WAG 1 Oper Unit 06 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2009	2010	2011	2012	2013	TOTAL
Technology Screening	230	0	0	0	0	230
Alternatives Develop./Analysis	154	0	0	0	0	154
NEPA/Environmental Activities	24	48	0	0	0	72
Feasibility Study Development	98	393	98	0	0	589
FS OU Coordination	75	100	25	0	0	200
Treatability Study	0	0	0	0	0	0
FS Oversight	196	261	65	0	0	522
SUBTOTALS FS	778	802	188	0	0	1,768
PP Development	0	34	68	0	0	102
PP Oversight Activities	0	15	30	0	0	44
SUBTOTALS PP	0	49	98	0	0	147
IROD Development	0	0	27	40	0	67
IROD Oversight Activities	0	0	15	22	0	37
SUBTOTALS IROD	0	0	42	62	0	104
TOTALS	778	851	328	62	0	2,018

and regulatory review.

The FS Contractor will be responsible for developing and completing the SWSA 1 OU FS/EA process. Specifically, the FS Contractor will be responsible for screening and developing groups of applicable remediation technologies and for analyzing the various alternatives to provide a list of technologies deemed appropriate for further study. The FS process will require the preparation of the following FFA milestone documents: (1) the FS Report, which documents the process used to examine the remediation technologies, selects the preferred remedial alternative(s), and incorporates the environmental (NEPA) considerations into the EA portion of the report to satisfy DOE orders; (2) the PP, a summary plan for implementing the selected remedial alternative(s) for the SWSA 1 OU; and (3) the IROD, the legal document stating that the selected remediation method(s) meets statutory and regulatory requirements and establishing the remediation schedule for this portion of WAG 1. The FS/EA preparation will consist of the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities
- Feasibility Study Development
- Feasibility Study Operable Unit Coordination
- Treatability Studies
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities

Descriptions of the scope of each activity and the assumptions used for preparing the cost assessment are presented below.

19.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA Report are presented in the following sections. The FS/EA Report will generally follow the format presented in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, October 1988 (USEPA, 1988).

The cost assessments made for the FS WBS elements were based on the following assumptions:

- The RI Report and the FS process will be completed as scheduled.
- The RI Report results are representative of the actual site and adequately characterize the extent and amount of contamination in SWSA 1.
- An EA of SWSA 1 will be completed to evaluate the environmental effects of the alternatives.
- Working group meetings with regulatory agencies will be held as required to discuss progress and results to obtain input and feedback in order to gauge the possible formal agency response.
- The regulatory agencies will concur with the working group meetings and the results of the technology screening technical memorandum.
- The RI Report, particularly the Baseline Risk Assessment, presents the primary contaminant and exposure pathways of concern at the site.

19.2.2.1 Technology Screening Activities (6.1.01.46.03.01)

Based on the remedial objectives established under the ER Program and from RI Report findings regarding waste- and site-specific conditions, the FS Contractor will research and identify the applicable common and innovative remediation technologies available for preliminary consideration. These technologies will be screened to eliminate those judged too difficult to implement (based on unproven technologies), judged unable to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Only those technologies judged to have a reasonable chance of success for remediating the site will be carried forward to the next stage of the FS process. The FS Contractor will issue a technical memorandum to DOE that will summarize these findings and document the research and the screening criteria and methodology.

19.2.2.2 Alternatives Development and Analysis (6.1.01.46.03.02)

The FS Contractor will then develop the screened technologies and arrange them into general remedial alternatives which may be an individual technology or combinations of technologies for further analysis. These alternatives may then be grouped or considered singularly for quantitative evaluation in order to eliminate those (1) with costs significantly higher than similar alternatives, (2) that are judged inadequate to protect public health and safety, and/or (3) that may adversely impact the environment. Those alternatives that meet the remedial objectives and offer protection of public health and safety will be advanced for final study in the FS process. The FS Contractor will issue a technical memorandum to DOE summarizing this task so that regulatory compliance can be confirmed.

19.2.2.3 NEPA Environmental Activities (6.1.01.46.03.03)

To comply with the DOE policy that NEPA criteria be considered during remedial activities, the impact of the screened remedial alternatives on the environment must be evaluated. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

19.2.2.4 Feasibility Study Development (6.1.01.46.03.04)

In general, the FS Contractor will use the format presented in the CERCLA FS guidance document as the basis to develop the FS with exceptions and modifications for the specific wastes at SWSA 1, as required. The FS will be based on the information obtained from (1) the RI findings, (2) the technologies screening process, (3) the alternatives screening and evaluation process, and (4) the EA findings. The FS Contractor will use the remedial alternatives in the technical memorandum approved by administrative and regulatory review to develop a detailed evaluation to permit the selection of a preferred alternative(s) that meets the program objective of mitigating contaminant releases. The FS Contractor will develop criteria to assess the ability of each alternative to meet the remedial objectives and to comply with administrative and regulatory requirements. The FS must be developed in sufficient detail to provide an informed risk management decision and legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE, TDEC, and EPA for review. The final FS/EA Report, a milestone document required by the FFA, will be issued for approval to EPA.

19.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.46.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to support QC efforts, provide project management, and coordinate project activities to ensure that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS team.

19.2.2.6 Treatability Studies (6.1.01.46.03.06)

Since the proposed remedial action involves containment (i.e., construction of a slurry wall and cap), treatability studies are not currently planned as part of this cost assessment. Should the Phase II RI reveal conditions that differ from scenarios assumed in this assessment, treatability studies may be considered at that time.

19.2.2.7 Feasibility Study Oversight Activities (6.1.01.46.03.07)

The objective of FS oversight activities is to provide technical input and oversight of the FS Contractor during the FS/EA process to ensure that the data and information obtained during the RI are appropriately incorporated into the FS/EA Report and that the FS/EA Report is technically complete and sufficient to support the preferred remedial alternative(s) for the PP and the development of an IROD and the RD. FS oversight activities begin with the screening of remedial technologies and are complete upon final approval of the FS/EA Report.

A brief description of the scope of the responsibilities of each participant involved in the FS oversight follows.

- RI Subcontractor — Provides a technical review of the FS/EA Report to ensure that the conclusions and determined risks in the RI Report have been properly presented in the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the alternatives considered and the remedial technologies evaluated are sufficient and consistent with the RI Report conclusions, remedial objectives, and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are compatible and consistent with the RA methodology and can be implemented at the site.

- MMES Planning/Coordination — Provides technical support and reviews FS/EA progress and draft deliverables to ensure that the FS/EA is being developed in a timely and efficient manner.

- MMES Technical Advisory Group — Provides technical support to FS Team by furnishing technical expertise by necessary disciplines to support the effort. Provides an independent technical review of FS/EA.

19.2.3 Proposed Plan

19.2.3.1 Proposed Plan Development (6.1.01.46.04.01)

The PP will be prepared using the preferred remedial alternative(s) presented in the FS/EA Report as a basis for the recommended interim action(s) and with input from the regulatory agencies and the public. The PP will document the investigation process (the RI and FS/EA Reports), administrative and regulatory actions, monitoring activities, and scheduling necessary to monitor for the migration of contamination after the Interim RA.

19.2.3.2 Proposed Plan Oversight Activities (6.1.01.46.04.02)

The objective of oversight activities during the PP process is to provide technical input to and oversight of the FS Contractor to ensure that the data and information presented and the RA(s) selected in the FS/EA Report are appropriate and are incorporated and documented in the PP and that the PP is technically complete and sufficient to support the development of the IROD and the RD. PP oversight activities begin when the FS Contractor begins PP development and are complete upon final approval of the PP by the regulatory agencies.

19.2.4 Interim Record of Decision

19.2.4.1 Interim Record of Decision Development (6.1.01.46.05.01)

The final step in the planning process to remediate SWSA 1 will be the preparation of the IROD, the legal document that formally declares that the preferred remediation method(s) in the PP will mitigate releases and establishes the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a decision summary outlining the nature and extent of the contamination and the associated risks at SWSA 1, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements; and (3) a Responsiveness Summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency for review. The final IROD is a milestone document required by the FFA.

The cost assessment for this element was based on the assumption that the FS/EA and PP schedules are followed.

19.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.46.05.02)

The objective of oversight activities during the IROD process is to provide technical input and oversight of the FS Contractor to ensure that the IROD appropriately incorporates and documents the data and information presented in the FS/EA Report and the PP and that it is technically complete and sufficient to support the development of the IROD and the RD. IROD oversight activities begin when the FS Contractor begins IROD development after approval of the PP and are complete upon final approval and signing of the IROD by the regulatory agencies and DOE.

19.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the SWSA 1 IROD process are the approval of the FS/EA and the PP, and public and regulatory review and comment. Minor interruptions in the review cycle may impact the schedule and the labor cost of this portion of the project. Although the total project cost will not increase substantially, any delays in approval of the IROD will impact the total project duration. Other factors that increase the uncertainty of the cost assessments in this report include the following:

- Administrative requirements and/or regulatory decisions that require removal of the waste in the flood plain.
- Requirements to increase ALARA guidelines for the ORNL personnel in nearby facilities which would significantly increase costs and impact the schedule.
- Extended review cycles initiated by the regulators.
- Program funding limitations across the DOE system.

19.2.6 Interfaces

Completion of the SWSA 1 IROD process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.
- DOE Orders — Provides for the management and regulation of hazardous wastes at DOE facilities.
- NEPA — Provides regulations that set the policies and goals for protecting environmental quality and establish the procedures to examine the impact that decisions on remediating may have on the environment.
- TDEC — Provides regulatory overview for Tennessee.

- EPA — Provides regulatory overview for compliance with federal regulations.
- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.
- Public Factions — Require access, review, and response for the public review of the administrative record and any proposed RA.

19.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the SWSA 1 OU: an RD Work Plan, engineering studies as required, a Title I 30% design package, Title II 60% and 90% design packages, and final design reports. The risks and uncertainties and the interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 19.7. The summary level schedule for these RD WBS elements is shown in Fig. 19.8. The cost assessment of $963,000 for performing this portion of the SWSA 1 remediation activities summarized by WBS activity and FY is shown in Table 19.4.

19.3.1 Scope and Assumptions

The scope of the RD work for the remediation of these impoundments is to prepare necessary design and supporting documents required for approval from DOE-OR, DOE-HQ, TDEC, and EPA and for implementation of all RA activities.

Details on the scope of work and assumptions associated with the RD work breakdown elements that the A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the SWSA 1 RA are described in Chapter 4.0.

Figure 19.9 depicts the scheduling logic for completion of the RD effort required to support a construction start 15 months from IROD approval.

19.3.2 Remedial Design Work Plan

19.3.2.1 Remedial Design Work Plan (6.1.01.46.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The A-E Contractor will prepare a draft RD Work Plan based upon the scope and design criteria specified in the PP and IROD documents. The RD Work Plan will include the detailed design process and schedule for the design effort for the following remediation activities:

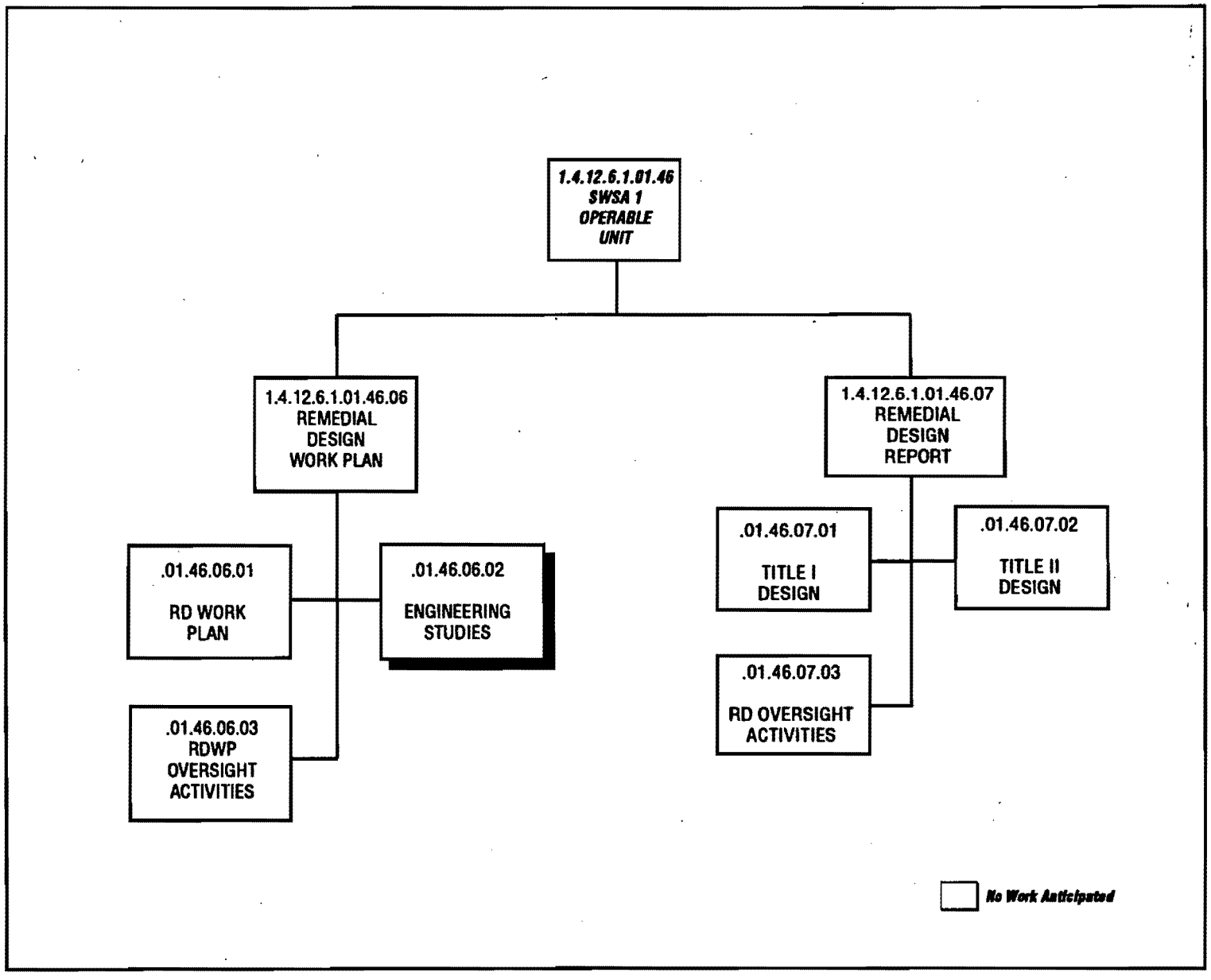


Fig. 19.7. SWSA 1 OU RD Work Breakdown Structure.

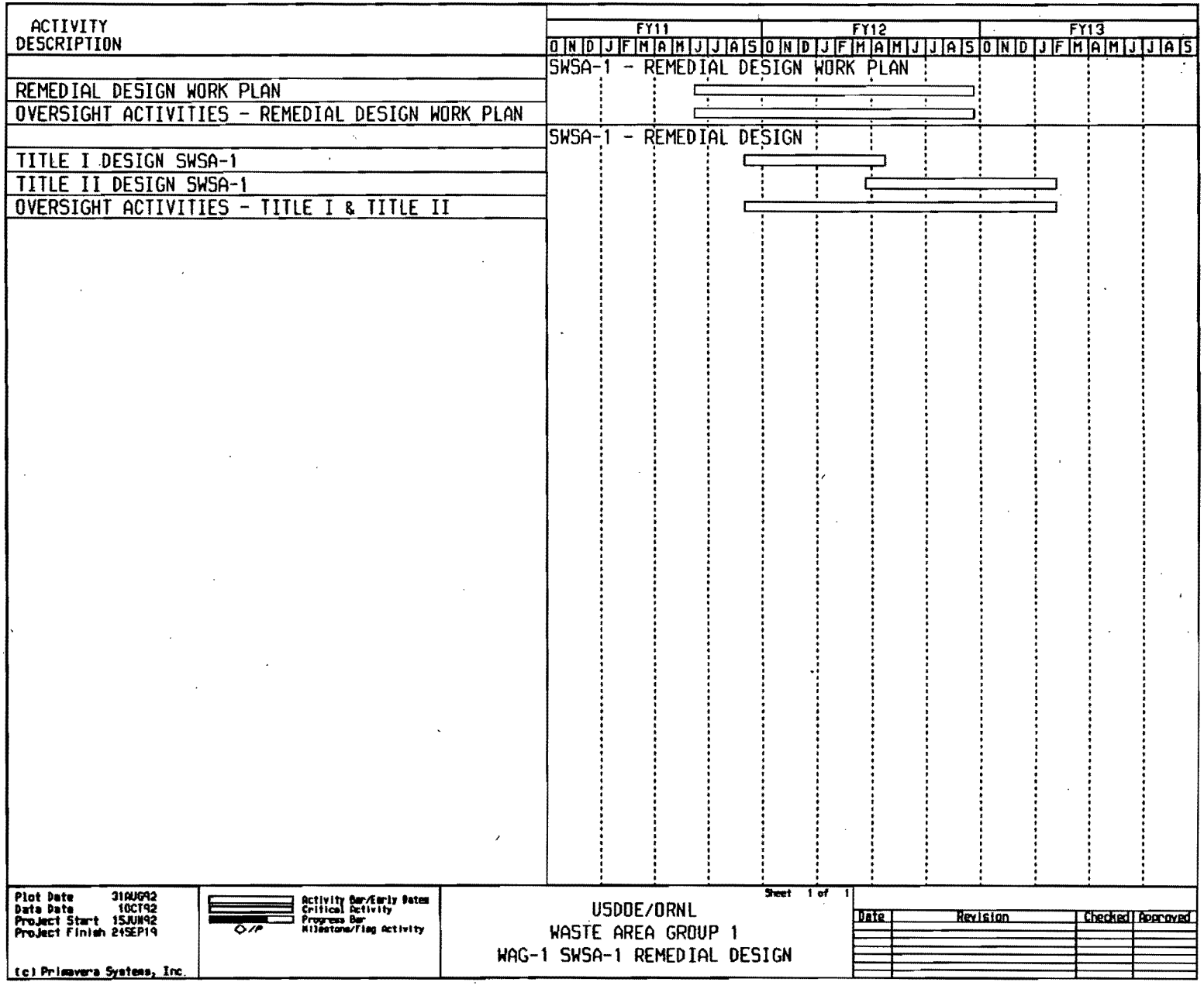


Fig. 19.8. SWSA 1 OU RD Summary Level Schedule.

TABLE 19.4
WAG 1 Oper Unit 06 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	2010	2011	2012	2013	TOTAL
Remedial Design Work Plan	0	52	104	0	156
Engineering Studies	0	0	0	0	0
RD WP Oversight Activities	0	54	108	0	162
SUBTOTALS RD WP	0	106	212	0	318
Remedial Design Phase I Title I	0	10	122	0	132
Remedial Design Phase I Title II	0	0	135	99	235
Remedial Design Phase II Title I	0	0	0	0	0
Remedial Design Phase II Title II	0	0	0	0	0
RD Oversight Activities	0	7	212	61	279
SUBTOTALS RD	0	17	469	160	646
TOTALS	0	123	680	160	963

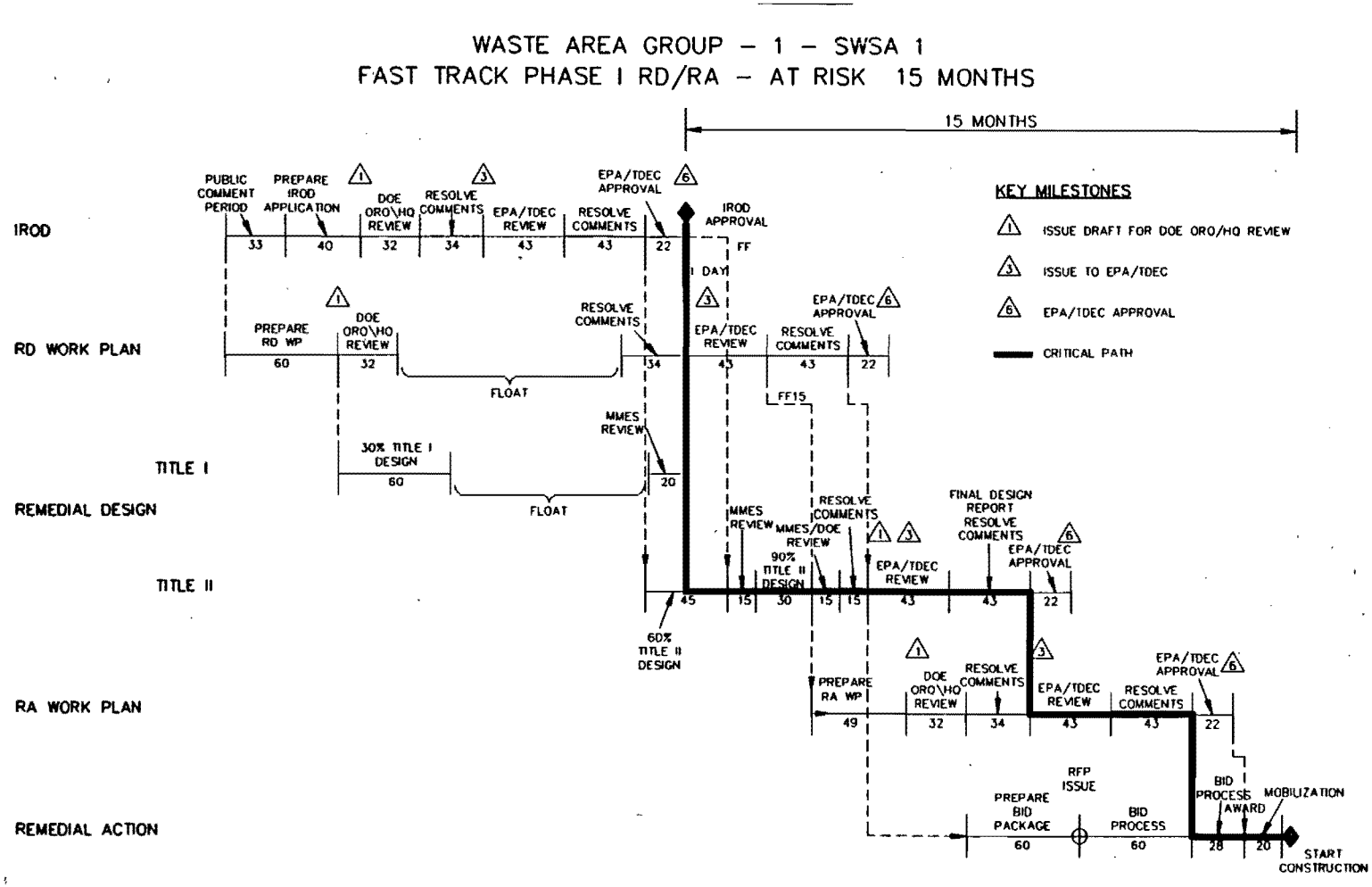


Fig. 19.9. SWSA 1 OU Phase I Schedule Logic.

- Construction of a slurry wall to limit groundwater flow through the site.
- Construction of a cap to reduce stormwater infiltration.

Figure 19.9 depicts the scheduling logic for completion of the RD effort required to support a construction start 15 months from IROD approval.

19.3.2.2 Engineering Studies (6.1.01.46.06.02)

Due to the type of technologies being proposed for remediation (slurry wall/cap), no engineering studies for SWSA 1 are currently planned.

19.3.2.3 Remedial Design Work Plan Oversight Activities (6.1.01.46.06.03)

Technical input will be provided during the preparation of the RD Work Plan to ensure that the design does not violate the intent of the IROD and will comply with the administrative and regulatory requirements. The RD Work Plan will be drafted by the RD Contractor and reviewed by the FS Contractor, MMES, and DOE. Based on the logic shown in Fig. 19.7, the design effort will start after the RD Work Plan is prepared and will be nearly completed prior to EPA approval. Section 19.3.4 discusses risks and uncertainties associated with this strategy.

19.3.3 Remedial Design Report

19.3.3.1 Title I Design (6.1.01.46.07.01)

Based on the engineering studies and other information available from the RI/FS, the A-E Contractor will prepare preliminary (30%) design documents showing the extent of remedial activities, site plan details, and an outline of specifications for the work involved. A detailed cost estimate for the construction will be submitted with the 30% design document to MMES for review/comments/approval.

In order to support construction start within 15 months of IROD approval, Title I design must begin during the IROD preparation and approval process.

19.3.3.2 Title II Design (6.1.01.46.07.02)

Upon approval of the Title I design document, the A-E Contractor will prepare detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction; construction drawings; technical specifications; and cost estimates.

All the documents will be submitted to MMES for comments at 60% completion. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and to DOE. Upon resolution of these comments, the 100% design package will be issued to TDEC and

EPA for further review, comment, and approval. Upon resolution of TDEC and EPA comments, the Design Report for remedial activities will be prepared and issued CFC.

The cost assessment for the Title I and Title II designs was developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Additional design/permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Support facilities are available for personnel and equipment decontamination.
- A consolidation area (or other disposal facility) is available for disposal of wastes generated during remediation.

19.3.3.3 Remedial Design Oversight Activities (6.1.01.46.07.03)

Oversight will be provided throughout the RD process to ensure that the design does not violate the intent of the FFA, FS/EA, PP, or IROD. Reviews will be conducted by the FS Contractor, MMES, and DOE at the 30%, 60%, and 90% completion stages to provide assurance that the design complies with administrative policies and regulatory requirements.

19.3.4 Risks and Uncertainties

The primary risks and uncertainties associated with RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the RD and, therefore, cost.
- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have significant impact on RD and remediation work.
- The findings and conclusions in the final RI and FS/EA documents may impact the scope of RD work.
- Title II design is completed prior to approval of the RD Work Plan by EPA. EPA comments to the RD Work Plan could adversely impact completion of RD.
- Title II design is started prior to IROD approval by EPA. The risk is lessened by the fact that comments should be resolved before start of Title II design.

19.3.5 Interfaces

The RD documents required for the remediation of SWSA 1 will require the coordination and close interface with the following:

- EPA — To provide regulatory overview during the RD process and approve all primary documents.
- TDEC — To provide state (Tennessee) regulatory overview during the RD process.
- DOE — To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview of design considerations for waste generation, handling, and storage/disposal.
- MMES Technical Advisory Group — To provide technical overview support during the RD process, specifically pertaining to engineering studies and design criteria.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H Division — To provide input and overview for the ES&H aspects for implementation of design.
- Construction Manager — To provide constructibility reviews of design.

19.4 REMEDIAL ACTION

This section presents the scope of the RA activities required to implement groundwater flow control and capping of SWSA 1. The risks and uncertainties and interface issues for the remedial activities are identified as well.

The WBS developed for performing the RA is presented in Fig. 19.10. The summary level schedule for these RA WBS elements is shown in Fig. 19.11. The cost assessment of $5,763,000 for performing this portion of the OU6 remediation activities summarized by WBS activity and FY is shown in Table 19.5.

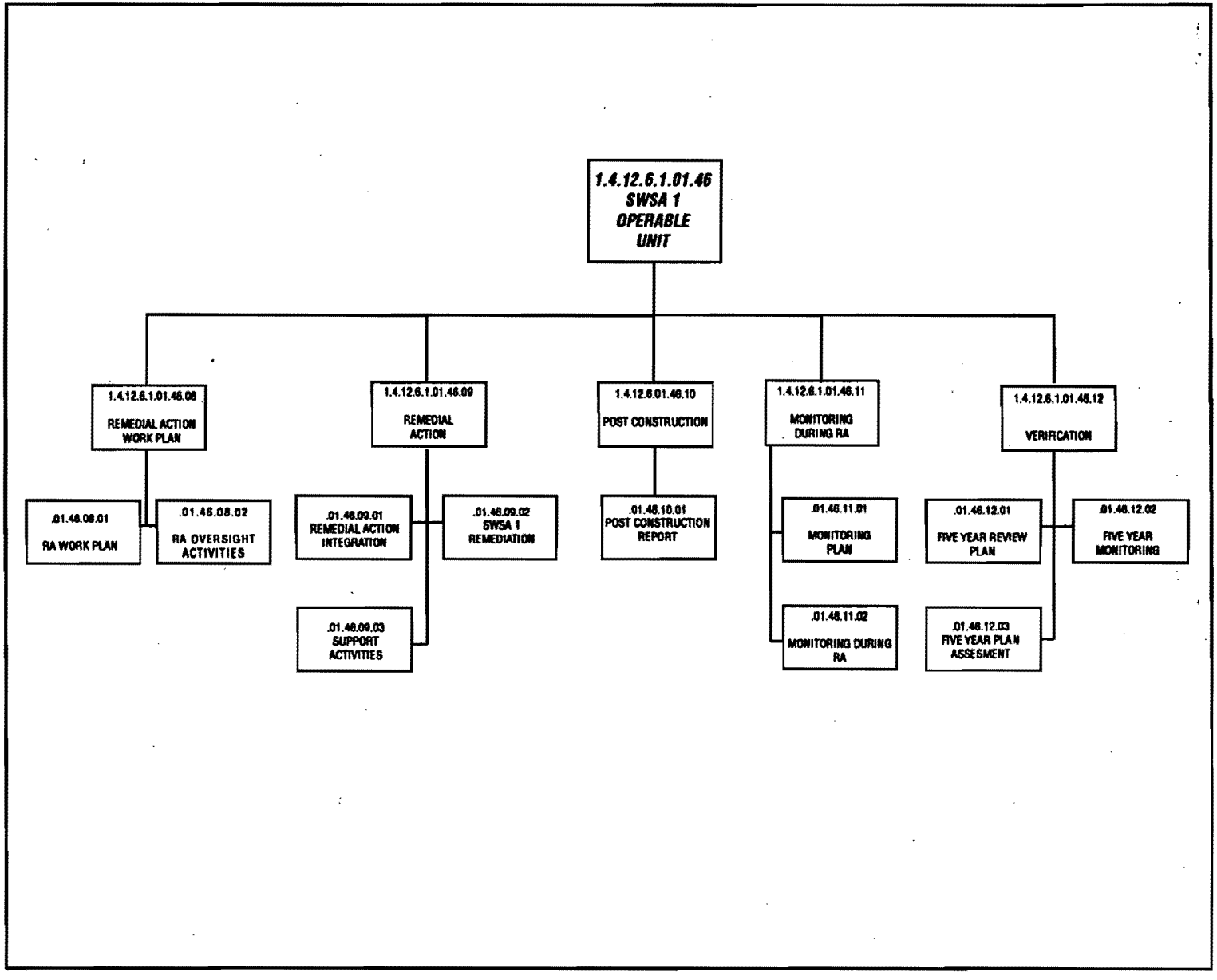


Fig. 19.10. SWSA 1 OU RA Work Breakdown Structure.

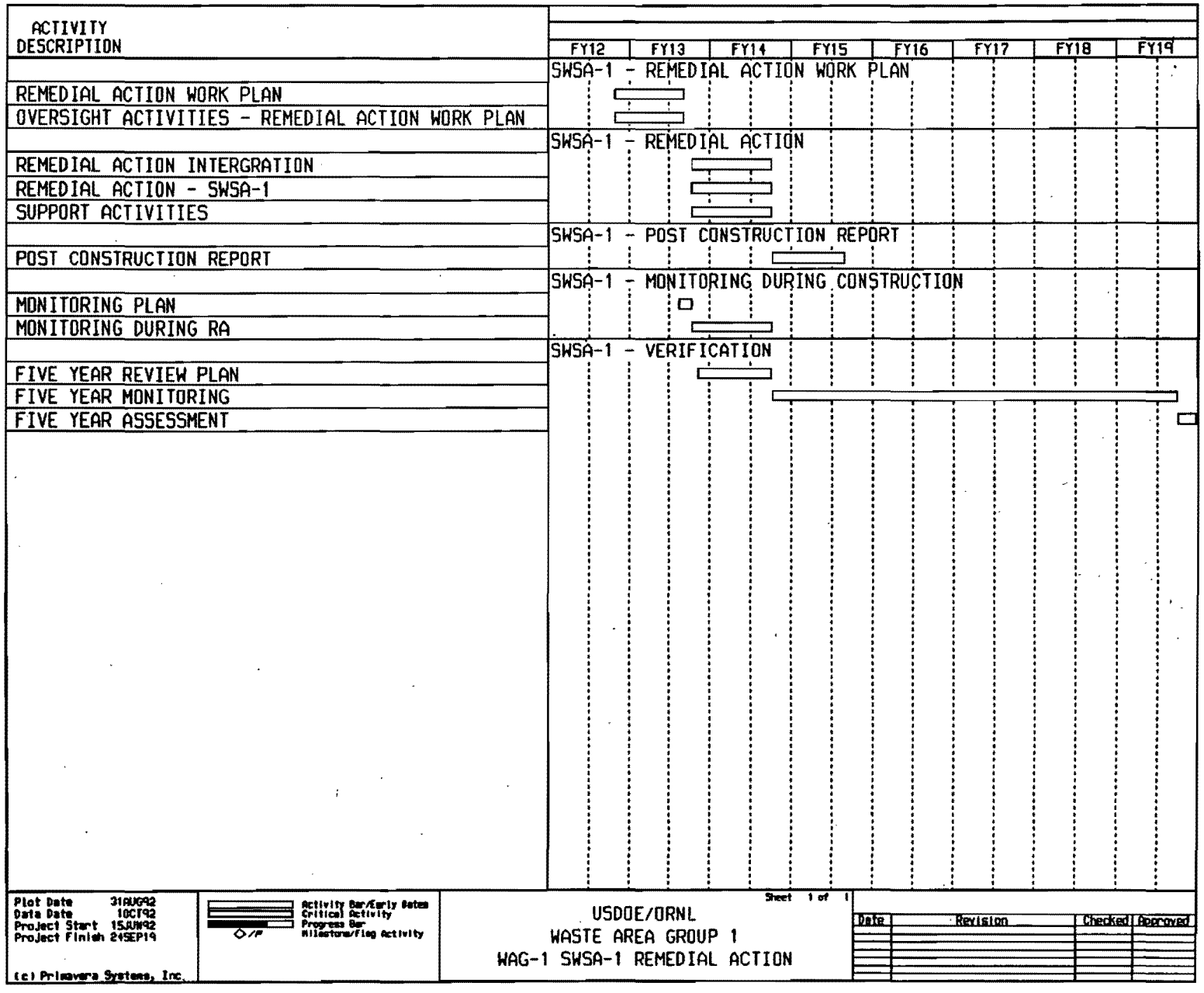


Fig. 19.11. SWSA 1 OU RA Summary Level Schedule.

TABLE 19.5
WAG 1 Oper Unit 06 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)									
	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
RA Work Plan	28	272	0	0	0	0	0	0	0	300
RA WP Oversight Activities	11	88	0	0	0	0	0	0	0	99
SUBTOTALS RA WP	39	360	0	0	0	0	0	0	0	398
RA Integration	0	20	385	0	0	0	0	0	0	405
Remedial Action	0	120	2,350	0	0	0	0	0	0	2,470
Post Construction Report	0	0	21	64	0	0	0	0	0	85
Monitoring During RA	0	111	263	0	0	0	0	0	0	375
Verification	0	20	160	329	329	329	329	534	0	2,031
SUBTOTALS RA	0	270	3,180	393	329	329	329	534	0	5,365
TOTALS	39	630	3,180	393	329	329	329	534	0	5,763

19.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan Construction Management, Title III services, construction of the RD, construction support, and independent certification and verification that includes monitoring and a 5-year review.

19.4.2 Remedial Action Work Plan

19.4.2.1 Remedial Action Work Plan (6.1.01.46.08.01)

The RA Construction Manager will prepare the draft RA Work Plan which (1) defines the scope and objectives of the RA based on the IROD and final RD; (2) documents the specific construction components of the RA; and (3) presents the RA schedule, subcontracting strategy, QA Plan, Health and Safety Plan, and RA Monitoring Plan.

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

19.4.2.2 Remedial Action Work Plan Oversight Activities (6.1.01.46.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA Work Plan. During the preparation of the draft RA Work Plan, MMES and A-E responsible for the approved design report will provide necessary coordination and will review the Work Plan to ensure that the proposed construction efforts will implement the IROD as presented in the final RD Reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

19.4.3 Remedial Action Activities

19.4.3.1 Remedial Action Integration (6.1.01.46.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E and construction support as required. RA integration for remedial activities includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

19.4.3.2 Solid Waste Storage Area 1 Remediation (6.1.01.46.09.02)

SWSA 1 is located south of White Oak Creek on Melton Valley Drive and encompasses approximately 1 acre in area. From 1943 to 1944, SWSA 1 was used for burial of an estimated 2000 to 4000 Ci of low-level solid radioactive waste. Groundwater flows through the site to White Oak Creek.

RA consists of constructing a slurry wall around the site to prevent groundwater flow through SWSA 1 and a multilayer cap to reduce stormwater infiltration. Presently, Melton Valley Drive runs through the middle of SWSA 1. Prior to initiating remediation of the site, this road will have to be rerouted around the south side of SWSA 1 to maintain access to buildings to the east. Upon completion of the roadway realignment, a slurry wall will be constructed around the perimeter of the site. This wall will be constructed to the limestone bedrock at an approximate depth of 9 to 25 ft on the uphill and downhill sides, respectively. The area will then be covered with a multilayer cap as shown in Fig. 19.12.

The following assumptions were made in developing this remediation scenario and the subsequent cost estimate and schedule:

- Soil/rock excavated from the hillside south of SWSA 1 will not be contaminated and may be used as fill for the proposed road alignment.

- For roadway realignment, 60% of excavation from the hillside will involve the excavation of rock.

- Melton Valley Drive can be rerouted without disturbing existing lines to the east of SWSA 1.

- The limestone bedrock is at an approximate elevation of 771 ft. The nearest available data were for surface impoundment 3513, which is about 300 ft to the northeast.

19.4.3.3 Support Activities

During the RA activities, MMES will provide the necessary staff and support to operate and maintain the personnel and equipment decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities and leachate from the consolidation area to the PWTP for further treatment.

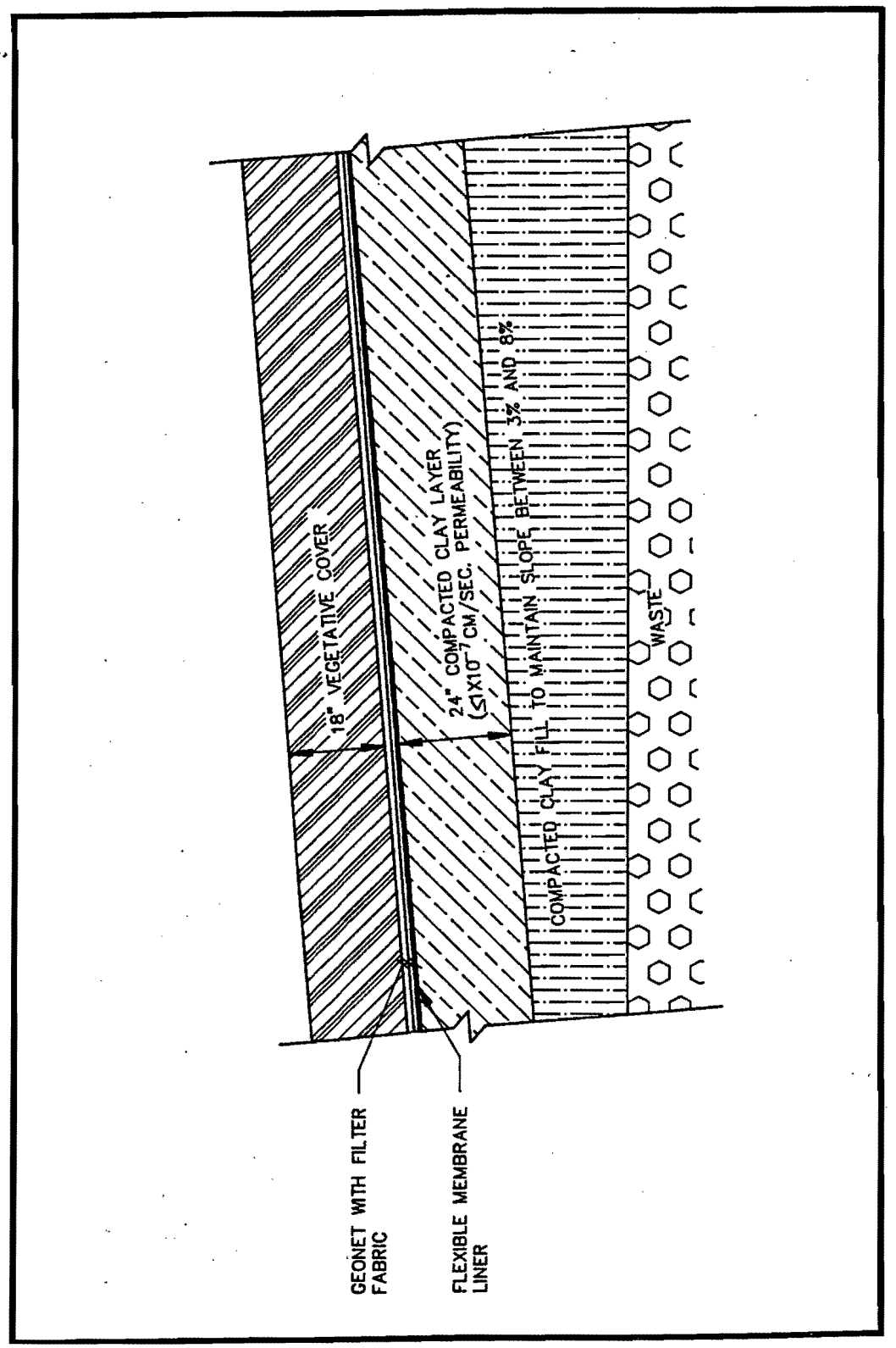


Fig. 19.12. SWSA 1 Multilayer Cap.

19.4.4 Post Construction

19.4.4.1 Post Construction Report (6.1.01.46.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, the completion of construction activities, and the effectiveness of selected remedies. MMES and the Construction Manager will be responsible for the following activities to prepare the Post Construction Report.

- Conduct a site inspection with EPA and TDEC to determine whether the RA is complete and consistent with the agency approved remedies and to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

  - brief re-cap of site description, chronology of major events, and selected remedies;

  - explanation of construction activities, modifications, performance standards, and QC; and

  - explanation of operation and maintenance, including monitoring to be undertaken at the site.

19.4.5 Monitoring During Remedial Action

19.4.5.1 Monitoring Plan (6.1.01.46.11.01)

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of the remediation conducted.

19.4.5.2 Monitoring During Remedial Action (6.1.05.40.11.02)

MMES will implement an Environmental Monitoring Program for SWSA 1 that will accomplish the following:

- Begin 1 month prior to start of construction in order to establish the baseline.

- Be conducted during the various Phase I and Phase II RA activities to document the impacts of remedial activities.

- Continue until the RA is completed to assess the effectiveness of the remedies implemented and to provide data for the Post Construction Report and Five-Year Review Plan.

- Generate routine monitoring reports with analytical results.

19.4.6 Verification

19.4.6.1 Five-Year Review Plan (6.1.05.40.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s), then, in accordance with CERCLA and FFA, an RA Assessment Plan is required in order for the EPA and TDEC to review the RA no less than once every 5 years after the initiation of the final RA(s) to ensure that human health and the environment are protected by the RA(s) being implemented. Because contaminants will remain after remediation, the A-E Contractor and MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity/status of the RA(s) implemented.

19.4.6.2 Five-Year Monitoring (6.1.05.40.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program, to determine the impact of construction activities and the effectiveness of remediation. The results shall be documented on the monitoring reports, which will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of ORNL.

19.4.6.3 Five-Year Plan Assessment (6.1.05.40.12.03)

The data obtained during the 5 years of monitoring will be analyzed. The status of the RA(s) implemented will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, the Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether or not the RA(s) implemented are still complying after 5 years with the intent and criteria established in the IROD and current regulations and policies.

19.4.7 Risks and Uncertainties

- The nature of the waste buried in SWSA 1 is unknown. Although it is believed to be solid waste only, subsidence of SWSA 1 under the proposed cap is a possibility.

- Verification that the slurry wall has been constructed to achieve the desired permeability throughout will be difficult. Permeability tests on core samples from the mixture will likely be required and will provide some measure of verification.

- Any changes in the RD due to the risks and uncertainties mentioned in Section 19.3.4 will have a direct effect on remediation cost.

- Additional remediation will be needed if the RA proves unsuccessful.

19.4.8 Interfaces

During remediation activities, interface and coordination with the following agencies will be necessary:

- EPA — To provide regulatory overview during the RA process, approve all primary documents, and conduct routine inspections.

- TDEC — To provide state (Tennessee) regulatory overview during the RA process and conduct routine inspections.

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and programmatic direction.

- MMES Waste Management — To provide waste management overview and support throughout the RA process, focusing on the minimization of RA-generated wastes and to provide the capability to process these wastes.

- MMES Technical Advisory Group — To provide technical overview support during the RA process, specifically pertaining to monitoring and field change requests.

- Groundwater WAG Team.

- ORNL Groundwater Program.

- MMES ES&H Division — To provide input and overview for the ES&H aspects of conducting the RA.

- Construction Manager — To provide construction support for MMES.

- MMES Title III Services (includes Inspection Services).

- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

- Independent Certification Contractor.

19.4.9 Contingent Actions

No contingent action was identified in the workshop for SWSA 1.

20.0 WAG 1 SOLID WASTE STORAGE AREA 2 OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the SWSA 2 OU activities: FI, FS/PP, IROD, RD, and RA. The WBS developed for this OU is presented in Fig. 20.1, and the summary level schedule is shown in Fig. 20.2. The cost assessment of $3,367,000 for OU7 remediation is presented by remediation phase and FY in Table 20.1.

20.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 20.3, and the summary level schedule for these RI WBS elements is shown in Fig. 20.4. The cost assessment of $2,083,000 for performing the RI is presented by WBS activities and FY in Table 20.2.

20.1.1 Scope and Assumptions

The primary assumption for the additional RI effort is that only a small, focused effort is required to acquire the remaining RI data to support the evaluation of alternatives for this OU. This RI effort will focus on collecting additional soils data to support the candidacy for an NFA alternative.

The schedule for implementation of this focused RI process is based on the assumption that no primary documentation will be prepared as part of this effort. The Supplemental Sampling and Analysis Plan will undergo a concurrent MMES and DOE review and will be submitted to the regulators for information only.

20.1.2 Operable Unit Specific Remedial Investigation Work Plan

20.1.2.1 Planning (6.1.01.47.01.01)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI for SWSA 2. The RI Work Plan defines the scope and objectives for the RI activities and provides a mechanism for planning the investigation activities. These activities may be accomplished concurrently or in a phased approach. A Project Management Strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes a summary and interpretation, as appropriate, of available environmental information. The plan also addresses the ARARs, TBC guidance, and EPA and/or state guidance documents.

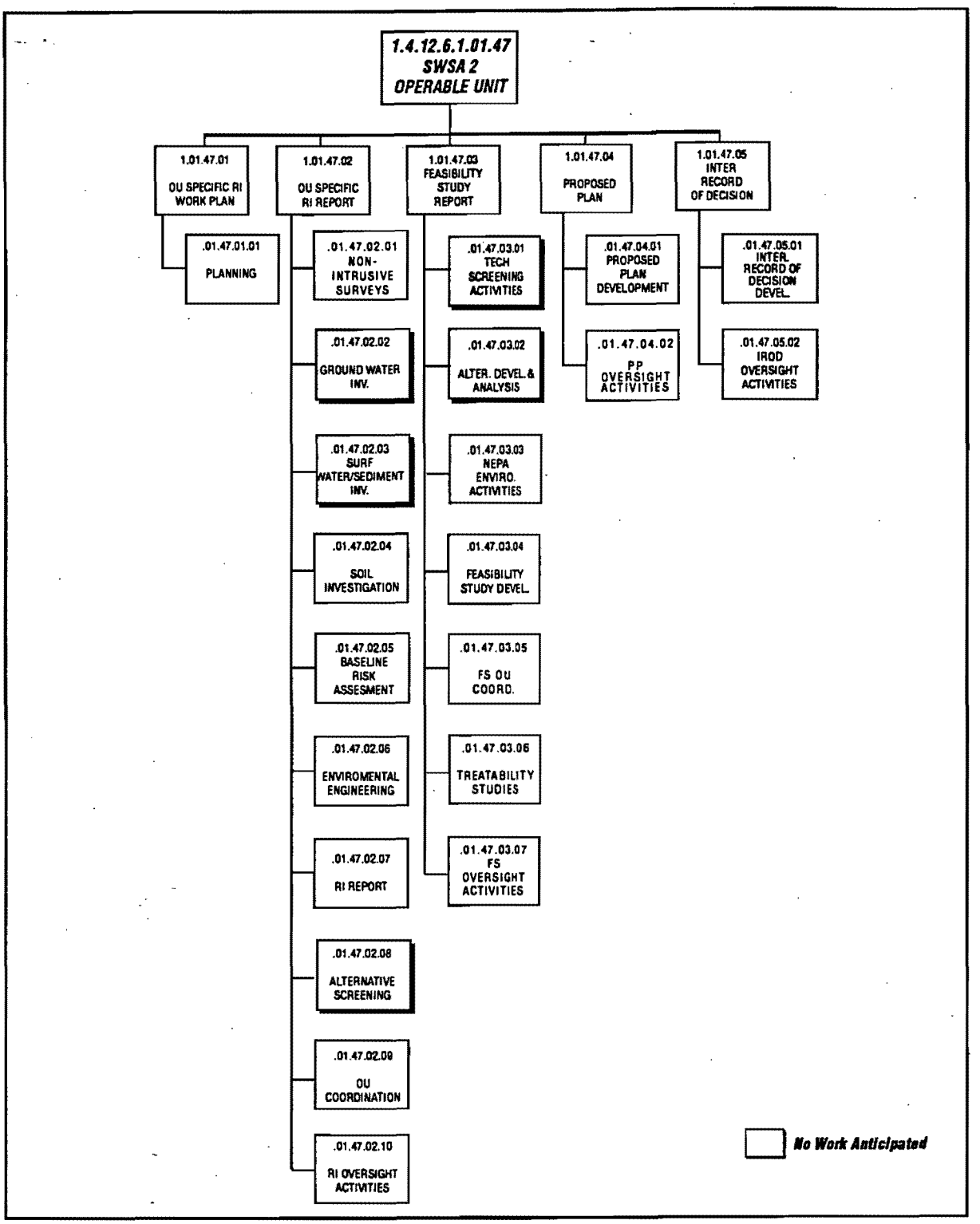


Fig. 20.1. SWSA 2 OU Work Breakdown Structure.

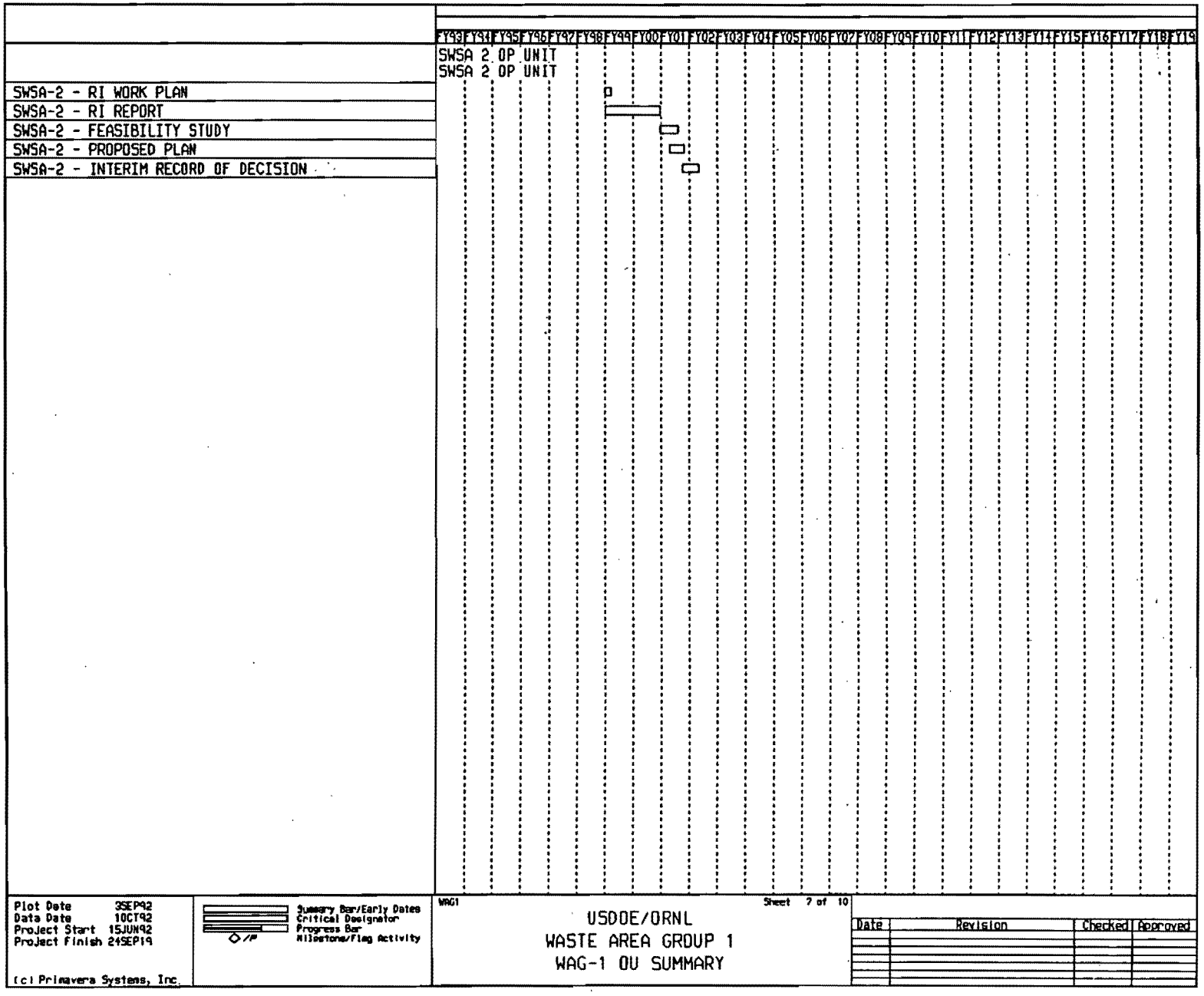


Fig. 20.2. SWSA 2 OU Summary Level Schedule.

TABLE 20.1
WAG 1 Oper. Unit 07 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	1999	2000	2001	2002	TOTAL
Remedial Investigation	1,174	909	0	0	2,083
Feasibility Study/IROD	0	284	938	61	1,284
Remedial Design	0	0	0	0	0
Remedial Action	0	0	0	0	0
TOTALS	1,174	1,193	938	61	3,367

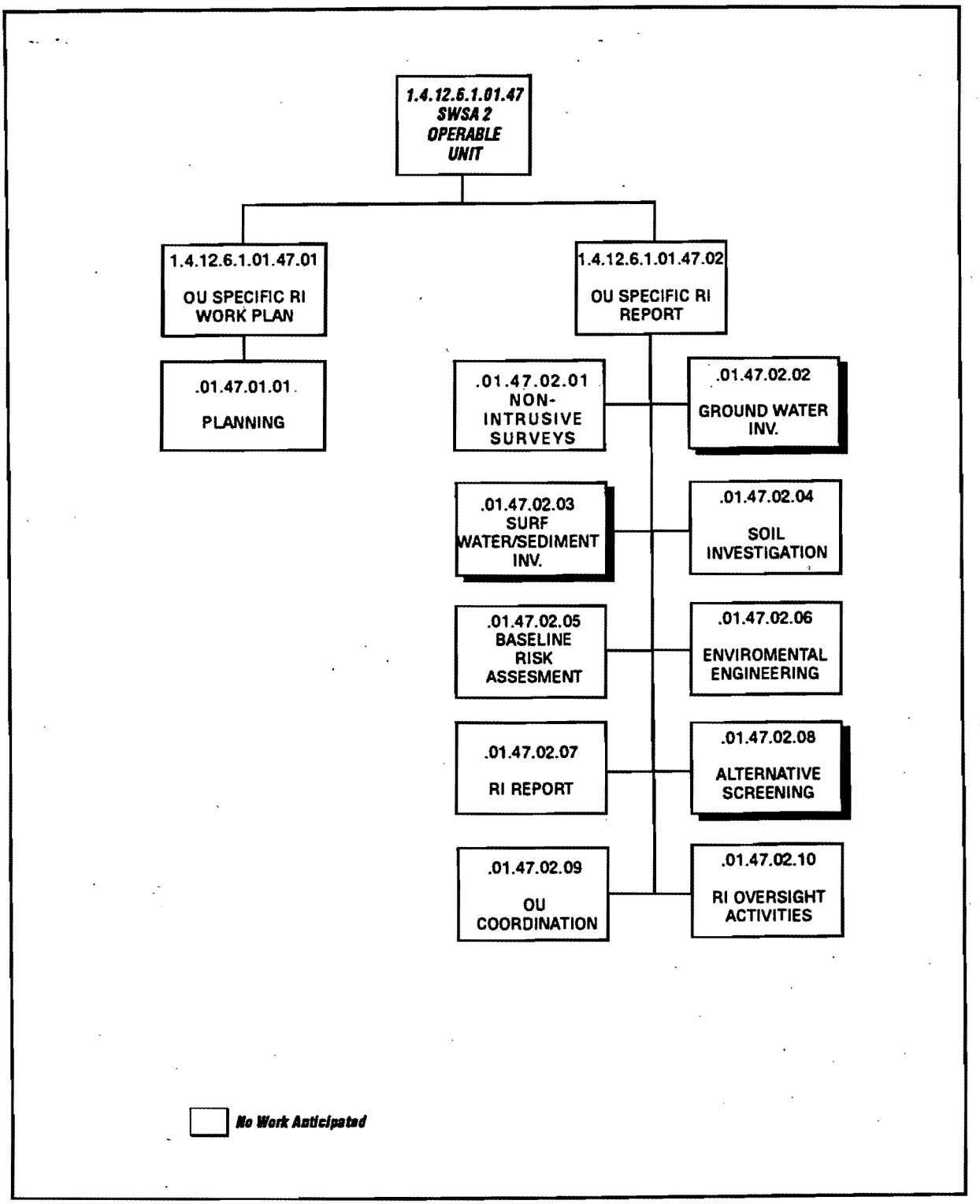


Fig. 20.3. SWSA 2 OU RI Work Breakdown Structure.

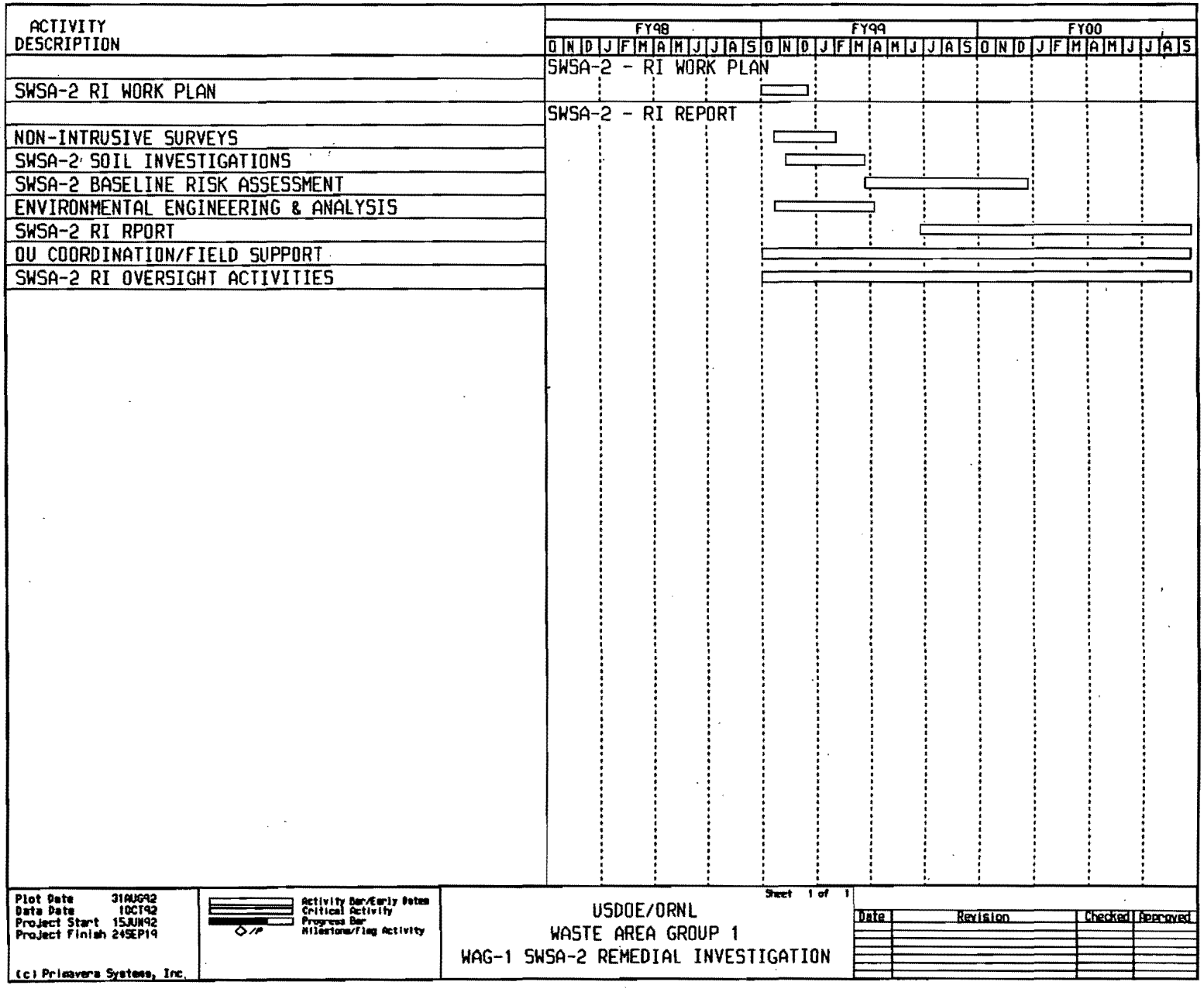


Fig. 20.4. SWSA 2 OU RI Summary Level Schedule.

TABLE 20.2
WAG 1 Oper. Unit 07 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	1999	2000	2001	2002	TOTAL
Planning	64	0	0	0	64
Nonintrusive Surveys	11	0	0	0	11
GW Investigation	0	0	0	0	0
SW/SED Investigation	0	0	0	0	0
Soil Investigation	114	0	0	0	114
Baseline Risk Assess.	70	23	0	0	93
Environ. Engineering	112	0	0	0	112
RI Report	82	164	0	0	247
Alternative Screening	0	0	0	0	0
RI OU Coordination	467	467	0	0	933
RI Oversight Activities	255	255	0	0	510
TOTALS	1,174	909	0	0	2,083

In addition, a revised Field Sampling Plan (BNI, 1991a) and a revised QA Project Plan (BNI, 1991b) were issued to regulators in December 1991. Other WAG-specific plans and procedures were also developed including project management, ES&H management, waste management, and database management. Since all these planning activities occurred before October 1992, no cost or schedule information is included for this element in the Baseline Report.

20.1.3 Operable Unit Specific Remedial Investigation Report

20.1.3.1 Nonintrusive Surveys (6.1.01.47.02.01)

Civil surveys will be conducted to provide 3-D control for sampling and measurement activities. Civil surveying will be performed as needed to support investigation activities including as-built surveys, construction surveys, topographic surveys, and establishing monitoring well locations.

Coordination with the ORNL Well P&A Program will be provided.

20.1.3.2 Groundwater Investigation (6.1.01.47.02.02)

No additional work is anticipated for this WBS element.

20.1.3.3 Surface Water and Sediment Investigations (6.1.01.47.02.03)

No additional work is anticipated for this WBS element.

20.1.3.4 Soils Investigation (6.1.01.47.02.04)

Soils investigation activities will focus on uncovering, sampling, and removing anomalies that were discovered during the Phase I RI electromagnetic and magnetometer surveys of SWSA 2.

One survey anomaly was discovered in the northeast corner of SWSA 2. Reportedly, alpha-contaminated waste was placed in drums, buried in the northeast corner of SWSA 2, and then covered with a concrete pad. The survey anomaly perhaps coincides with the location of the suspected concrete pad. It is not known whether or not the pad and buried waste were previously removed along with other SWSA 2 waste and disposed of within SWSA 3.

The soils investigation for this anomaly will consist of an excavation using a backhoe or similar equipment to search for the concrete pad, and a soil boring south of the excavation to test for potential downgradient migration of contaminants. Two continuous, composited soil samples will be taken from the excavation and disposed of within the soil boring.

Other survey anomalies curiously coincide with locations of soil borings previously installed on the western side of SWSA 2. The soils investigation for these anomalies will consist

of excavations at three of the anomaly locations to search for possible buried objects or other causes of the anomalous readings. Two soil samples will be composited from each of the three excavations.

Samples from soils investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and geotechnical parameters. The samples from the three excavations at previously installed soil borings will be analyzed at the close support laboratory only. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples to be included in risk assessments and other instances where data of known quality are required.

20.1.3.5 Baseline Risk Assessment (6.1.01.47.02.05)

A Screening-Level Risk Assessment for SWSA 2 will be performed and will consist of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with SWSA 2 for current and future exposure scenarios. The objectives of the environmental evaluation are (1) to determine whether or not SWSA 2 poses a current or potential future risk to environmental resources in the absence of any remediation and (2) to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

20.1.3.6 Environmental Engineering (6.1.01.47.02.06)

This task involves four principal activities:

1. Prior to field mobilization, a detailed evaluation of existing data for SWSA 2 will be performed. Support to the ORNL/DOE/EPA/TDEC technical review process, the ORNL environmental assessment documentation process, and the ORNL readiness review process will be provided as requested. Evaluation of new ORNL data (i.e., semi-annual groundwater data) will be performed and will include the review and tabulation of data as they become available (i.e., SIMS). These data will be compared to the focused RI Work Plan supplement or TM, as appropriate, and to conclusions drawn from the data generated by the SWSA 2 RI. The scope also includes review of ORNL reports published since the SWSA 2 RI Work Plan supplements were issued.

2. An environmental engineering analysis will be performed on all data generated from SWSA 2 RI field activities. These data will be tabulated for use in writing the technical memorandums and technical bulletins.

3. Contaminant/contents data will be evaluated and will involve reviewing ORNL electronic data bases for information about the contents of SWSA 2. Also, aerial photographs and engineering drawings will be reviewed to determine actual locations of SWSA 2 areas of concern.

4. The data summarized by the three previous tasks will be reviewed with respect to implementation of remedial alternatives. This task is iterative in nature and consists of the following steps: (1) summarized RI/FS data is reviewed as it becomes available; (2) the preliminary remedial alternatives scenario is refined, if necessary; (3) data needs are re-evaluated based on the new alternatives scenario; and 4) data collection efforts are altered to meet any new data needs.

20.1.3.7 **Remedial Investigation Report** (6.1.01.47.02.07)

The SWSA 2 RI Report will serve as documentation of data collection and analyses in support of the SWSA 2 FS. The results of the RI are presented as an analysis of site characteristics and the risk associated with such characteristics, and a summary of potentially feasible remedial actions. The evaluation of site characteristics will focus on the site physical characteristics, the source characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Prior to the issuance of the draft SWSA 2 RI Report, a draft determination of the ARARs will be submitted to EPA and TDEC. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to the SWSA 2 remediation.

The draft SWSA 2 RI Report will be produced for concurrent review by MMES and DOE; revised to incorporate pertinent comments; and issued to EPA and TDEC for review and, ultimately, approval.

20.1.3.8 **Alternatives Screening** (6.1.01.47.02.08)

No additional work is anticipated for this WBS element.

20.1.3.9 **Operable Unit Coordination** (6.1.01.47.02.09)

Activities include quality control and project management and coordination. These activities will ensure that quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple OUs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, database management, and database interface with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Field support needed to manage and direct the field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes providing required field equipment, spare parts, and other field materials and supplies.

20.1.3.10 Remedial Investigation Oversight Activities (6.1.01.47.02.10)

RI oversight activities provide technical support, input, and oversight to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon final approval of the associated technical memoranda.

The following briefly describes the oversight roles of the various participants:

- FS Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the FS/EA.
- A-E Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the RD approach and design requirements.
- MMES ES&H Division — Provides support for health and safety, environmental compliance, and waste management as a part of conducting the RI field activities.
- MMES Environmental Sciences Division — Provides support for drilling.
- MMES Planning/Coordination — Provides necessary permits for RI field activities.
- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

20.1.4 Risks and Uncertainties

The following list describes the areas of risk and uncertainty associated with the performance of the RI:

- Delays in the review of the Site Characterization Report would impact the initiation of the preparation of the Sampling and Analysis Plan.
- The implementation of regulator approval of the focused Sampling and Analysis Plan would delay field investigations.

20.1.5 Interfaces

The following list describes the primary interfaces and anticipated roles during the RI:

- MMES Waste Management — To provide waste management overview and support throughout the RI process. This entails focusing on the minimization of RI-generated wastes and providing the capability to process these wastes.

- MMES Technical Advisory Group — To provide technical review during the RI process, specifically pertaining to overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that RI goals of MMES are achieved.

- FS Contractor — To provide data review support to the RI that would sufficiently support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approve all primary documents.

- TDEC — To provide state (Tennessee) regulatory overview during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

20.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents the scope for performing the FS process for the SWSA 2 OU. This process includes incorporating environmental concerns in an EA within the report, preparing the PP for public review, and preparing the IROD for agency approval. It is assumed that the RI Report findings and any Interim RAs required to remove any anomalies will support the decision that an FS is not required and that the EA will produce a finding of no significant impact (FONSI). Immediately following the issue of the FONSI, the PP and IROD will be issued. The risks and uncertainties and interfaces for these efforts are identified as well.

The WBS developed for performing the FS/EA and preparing the PP and IROD is presented in Fig. 20.5. The summary level schedule for these FS/EA, PP, and IROD WBS elements is shown in Fig. 20.6. The cost assessment of $1,284,000 for performing these portions of the SWSA 2 remediation activities summarized by WBS activity and FY is shown in Table 20.3.

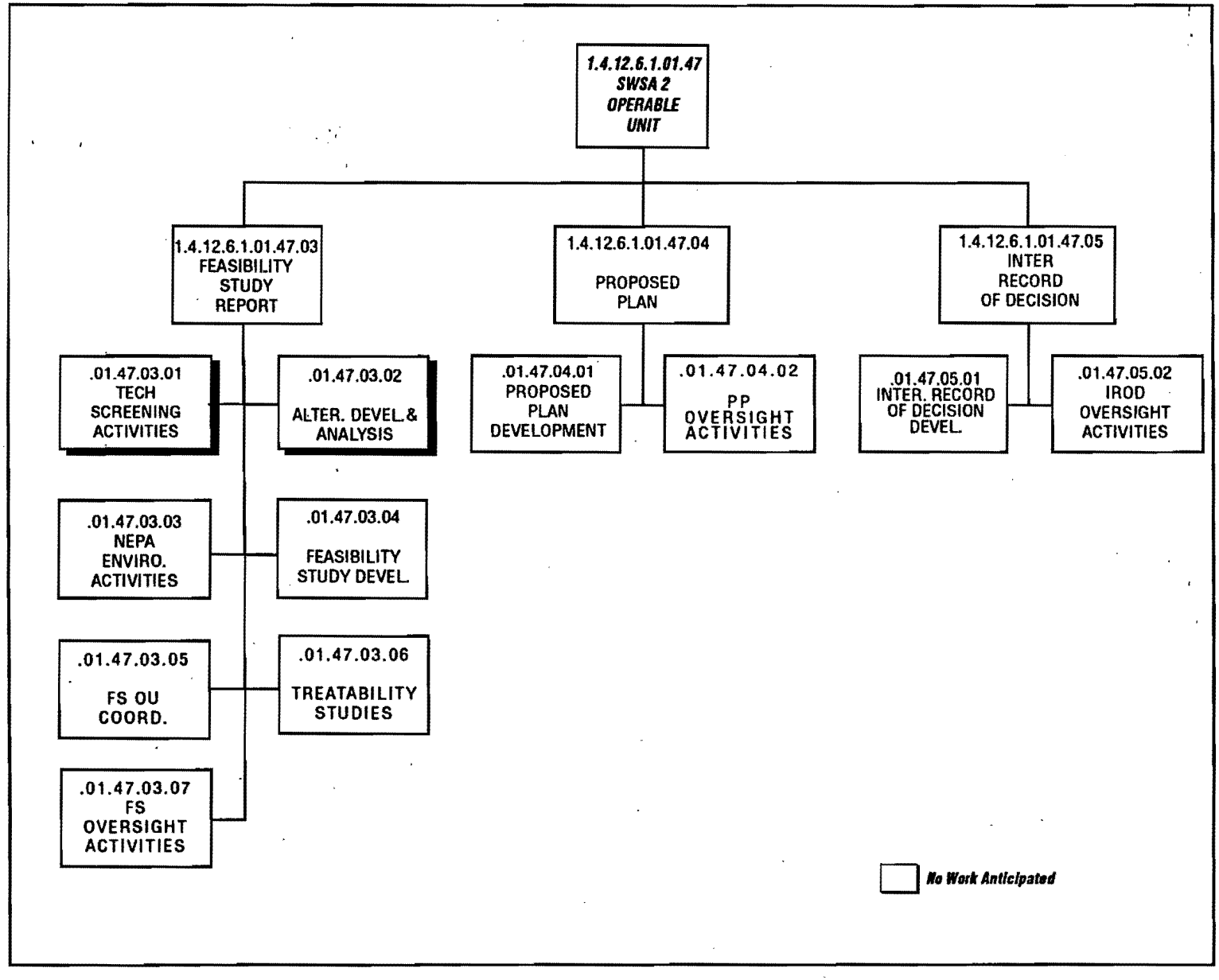


Fig. 20.5. SWSA 2 OU FS/PP/IROD Work Breakdown Structure.

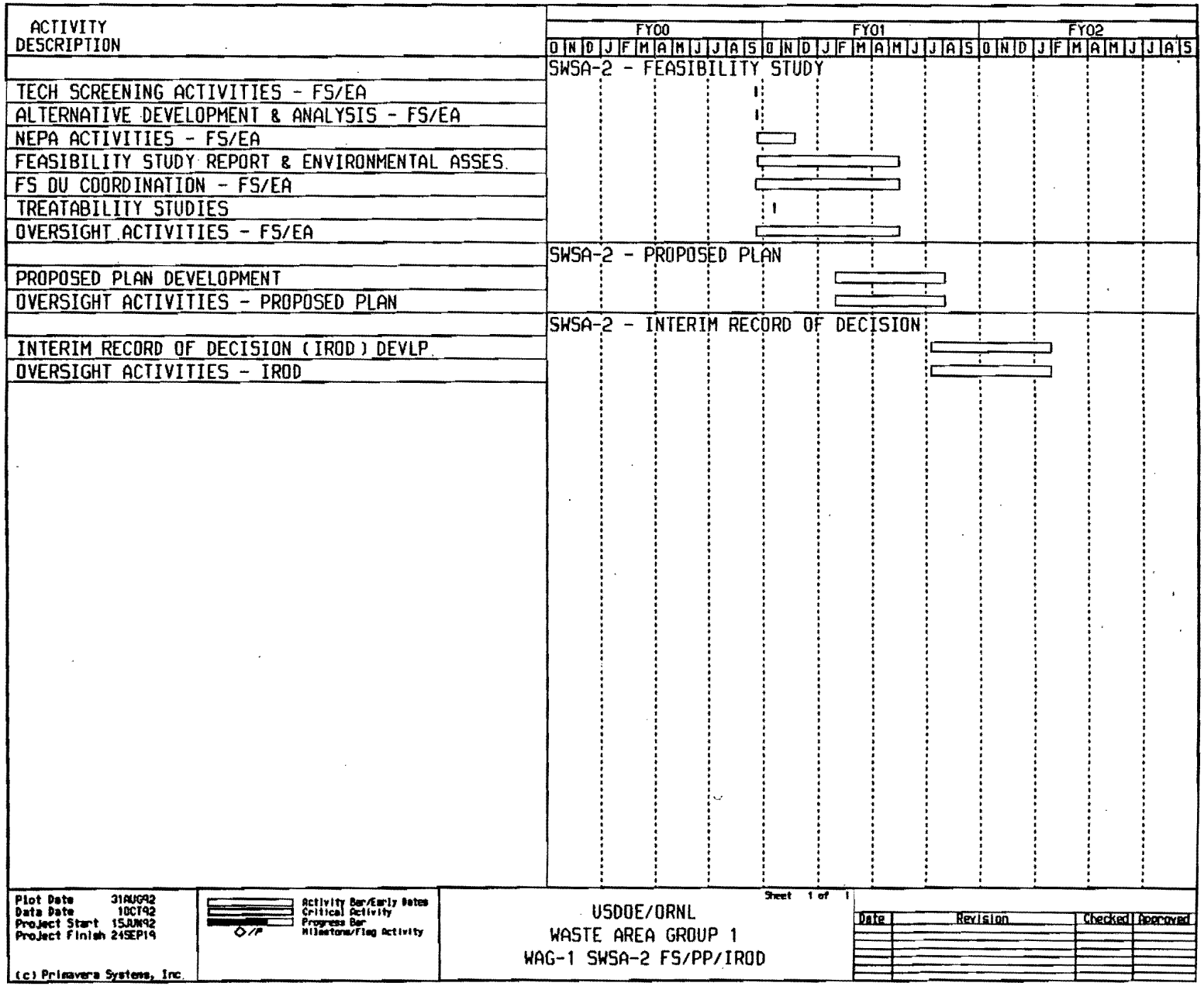


Fig. 20.6. SWSA 2 OU FS/PP/IROD Summary Level Schedule.

TABLE 20.3
WAG 1 Oper Unit 07 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2000	2001	2002	2003	2004	TOTAL
Technology Screening	0	0	0	0	0	0
Alternatives Develop./Analysis	0	0	0	0	0	0
NEPA/Environmental Activities	36	36	0	0	0	72
Feasibility Study Development	147	442	0	0	0	589
FS OU Coordination	50	150	0	0	0	200
Treatability Study	0	0	0	0	0	0
FS Oversight	51	152	0	0	0	203
SUBTOTALS FS	284	780	0	0	0	1,064
PP Development	0	102	0	0	0	102
PP Oversight Activities	0	25	0	0	0	25
SUBTOTALS PP	0	128	0	0	0	128
IROD Development	0	22	45	0	0	67
IROD Oversight Activities	0	8	16	0	0	25
SUBTOTALS IROD	0	31	61	0	0	92
TOTALS	284	938	61	0	0	1,284

20.2.1 Scope and Assumptions

The scope for the SWSA 2 OU FS/PP/IROD process covers in more detail the items each element considers and the methods chosen to implement the remedial activities associated with the SWSA 2 OU. The FS will consider the soil and suspected groundwater contamination from the disposal of solid LLW. The FS will also consider methods and actions to isolate or remove the soil contamination to mitigate contaminant movement off-WAG. The scope for the PP concerns ensuring that the NFA be related to the soil contamination onsite. The PP will also consider monitoring activities and the schedule to ensure contaminants do not migrate from the SWSA 2 OU.

The final step in the planning process is the preparation of the IROD, the legal document that formally declares the NFA decision in the PP that mitigation contaminants from the OU will not endanger the environment or the public and establishes the site monitoring requirements and remediation schedule. The FS/PP/IROD process will not consider the remediation of groundwater in the OU.

The FS Contractor will be responsible for developing and completing the SWSA 2 OU FS process. The FS contractor will be responsible for preparing and developing the environmental document to justify the NFA. The FS process will (1) document the process used to examine the environmental (NEPA) considerations that results in the FONSI and NFA for the site to satisfy DOE orders; (2) the PP, a summary document used for outlining the RI Report findings and determination that NFA is required at the site and for stating the monitoring plan; and (3) the IROD, the legal document stating that the statutory and regulatory requirements have been met during the FS process that results in the FONSI and establishing the monitoring plan and schedule for SWSA 2. The FS preparation will consist of the following principal WBS elements:

- NEPA Environmental Activities
- Feasibility Study Development
- Feasibility Study Operable Unit Coordination
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities.

Detailed descriptions of the scope of each activity and the assumptions used for preparing the cost assessment are presented below.

20.2.2 Feasibility Study Report

The FS/EA Report will generally follow the format in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, October 1988 (USEPA 1988).

Based on the RI Report findings regarding waste- and site-specific conditions, it is anticipated that technology screening activities and alternative development and analysis are not required. A technical memorandum summarizing the findings will be issued to DOE.

20.2.2.1 Technology Screening Activities (6.1.01.47.03.01)

No additional work is anticipated for this WBS element.

20.2.2.2 Alternatives Development and Analysis (6.1.01.47.03.02)

No additional work is anticipated for this WBS element.

20.2.2.3 NEPA Environmental Activities (6.1.01.47.03.03)

To comply with the DOE policy that NEPA criteria be considered during remedial activities, the impact of the screened remedial alternatives on the environment must be evaluated. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives and any Interim RAs required will be considered an integral component of the evaluation and selection process. It is anticipated that a FONSI can be issued for SWSA 2 which will lead directly to the PP and IROD.

20.2.2.4 Feasibility Study Development (6.1.01.47.03.04)

Based on the RI report, it is anticipated that these activities are not required. The findings of the RI will be evaluated, in general, with the CERCLA FS guidance document and the information obtained from the RI in order to issue a technical memorandum declaring that a formal FS is not required.

20.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.47.03.05)

Technical support and oversight will be provided to ensure that the EA Memorandum is prepared within project quality, cost, and scheduling goals. Engineering and technical resources are required to support QC efforts, provide project management, and coordinate project activities to ensure that these goals are achieved. Monthly progress reports on the FS process will be issued to DOE and the FS team.

20.2.2.6 Treatability Studies (6.1.01.47.03.06)

No additional work is anticipated for this WBS element.

20.2.2.7 Feasibility Study Oversight Activities (6.1.01.47.03.07)

The objective of FS oversight activities is to provide technical input and oversight of the FS Contractor during the FS/EA process to ensure that the data and information obtained during the RI are appropriately incorporated into the FS/EA Report and that the FS/EA Report is technically complete and sufficient to support the preferred remedial alternative(s) for the PP and the development of an IROD and the RD. FS oversight activities begin with the screening of remedial technologies and are complete upon final approval of the FS/EA Report.

A brief description of the scope of the responsibilities of each participant involved in the FS oversight follows:

- RI Subcontractor — Provides a technical review of the FS/EA Report to ensure that the conclusions and determined risks in the RI Report have been properly presented in the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the alternatives considered and the remedial technologies evaluated are sufficient and consistent with the RI Report conclusions, remedial objectives, and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are compatible and consistent with the RA methodology and can be implemented at the site.

- MMES Planning/Coordination — Provides technical support and reviews FS/EA progress and draft deliverables to ensure that the FS/EA is being developed in a timely and efficient manner.

- MMES Technical Advisory Group — Provides technical support to the FS Team by furnishing technical expertise by necessary disciplines to support the effort. Provides an independent technical review of FS/EA.

20.2.3 Proposed Plan

20.2.3.1 Proposed Plan Development (6.1.01.47.04.01)

The PP will be prepared using the NFA Decision Document prepared during EA activities as a basis and using input from the regulatory agencies and the public. The PP will document the investigation process during EA activities, administrative and regulatory actions, and monitoring and scheduling activities necessary to monitor for the migration of contamination after the interim remedial action.

20.2.3.2 Proposed Plan Oversight Activities (6.1.01.47.04.02)

The objective of oversight activities during the PP process is to provide technical input and oversight of the FS Contractor to ensure that the data and information presented and the RA(s) selected in the FS/EA Report are appropriate and are incorporated and documented in the PP and that the PP is technically complete and sufficient to support the development of the IROD and the RD. PP oversight activities begin when the FS Contractor begins PP development and are complete upon final approval of the PP by the regulatory agencies.

20.2.4 Interim Record of Decision

20.2.4.1 Interim Record of Decision Development (6.1.01.47.05.01)

The final step in the planning process to remediate SWSA 2 will be preparation of the IROD, the legal document that formally declares that the preferred remediation method(s) in the PP will mitigate releases and establishes the remediation schedule and monitoring plan for the site. The SWSA 2 IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a Decision Summary outlining the nature and extent of the contamination and the associated risks at SWSA 2, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements; and (3) a Responsiveness Summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency for review. The final IROD is a milestone document required by the FFA.

The cost assessment for this element was based on the assumption that the FS/EA and PP schedules were followed.

20.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.47.05.02)

The objective of oversight activities during the IROD process is to provide technical input and oversight of the FS Contractor to ensure that the IROD appropriately incorporates and documents the data and information presented in the FS Report and the PP and that it is technically complete and sufficient to support the development of the IROD and the RD. IROD oversight activities begin

when the FS Contractor begins IROD development after approval of the PP and are complete upon final approval and signing of the IROD by the regulatory agencies and DOE.

20.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the SWSA 2 FS/PP/IROD process are the scheduling and the scoping of the activities. Minor changes in scheduling will have significant impacts on the labor and materials/equipment cost of the project. If the schedule is modified, resulting in an extended total duration of the project, the total cost will increase substantially. The scope of the project will have a direct impact on labor allocations. If additional investigations are required, the total cost of the project will increase. Other factors that increase the uncertainty of the cost assessments in this report include the following:

- Regulators contesting the NFA decision and FONSI.
- Extended review cycles initiated by the regulators.
- Program funding limitations across the DOE system.

20.2.6 Interfaces

Completion of the SWSA 2 FS/PP/IROD process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.
- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.
- NEPA — Provides regulations that set the policies and goals for protecting environmental quality and establish the procedures to examine the impact that decisions on remediating may have on the environment.
- TDEC — Provides regulatory overview for Tennessee.
- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.
- Public Factions — Require access, review, and response for the public review of the administrative record and any proposed RA.
- ORNL Groundwater Program.

20.2.7 Contingent Action

The contingent action identified in the workshop for SWSA 2 is containment in place.

21.0 WAG 1 WASTE PILE OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the Waste Pile OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for the Waste Pile OU is presented in Fig. 21.1, and the summary level schedule is shown in Fig. 21.2. The cost assessment of $3,542,000 for OU8 is presented by remediation phase and FY in Table 21.1. TCFs are used to estimate costs for RI/FS tasks in this OU, as discussed in Chapter 14.0.

21.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 21.3, and the summary level schedule for these RI WBS elements is shown in Fig. 21.4. The cost assessment of $2,190,000 for performing the RI is presented by WBS activities and FY in Table 21.2.

21.1.1 Scope and Assumptions

The primary assumption for the additional RI effort is that only a small, focused effort is required to acquire the remaining RI data to support the evaluation of alternatives for this OU. This RI effort will focus on collecting soils data for the evaluation of the potential impact to human health and the environment specific to this OU.

The following assumptions have significant roles specific to the schedule for implementation of this focused RI process:

- The review of the WAG 1 Site Characterization Summary Report will be completed in a timely manner so as to not impact the initiation of the preparation of the focused Sampling and Analysis Plan.

- The supplemental Sampling and Analysis Plan will undergo a concurrent MMES and DOE review and will be submitted to the regulators for information only.

21.1.2 Operable Unit Specific Remedial Investigation Work Plan

21.1.2.1 Planning (6.1.01.48.01.01)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI for the Waste Pile. The RI Work Plan defines the scope and objectives for the

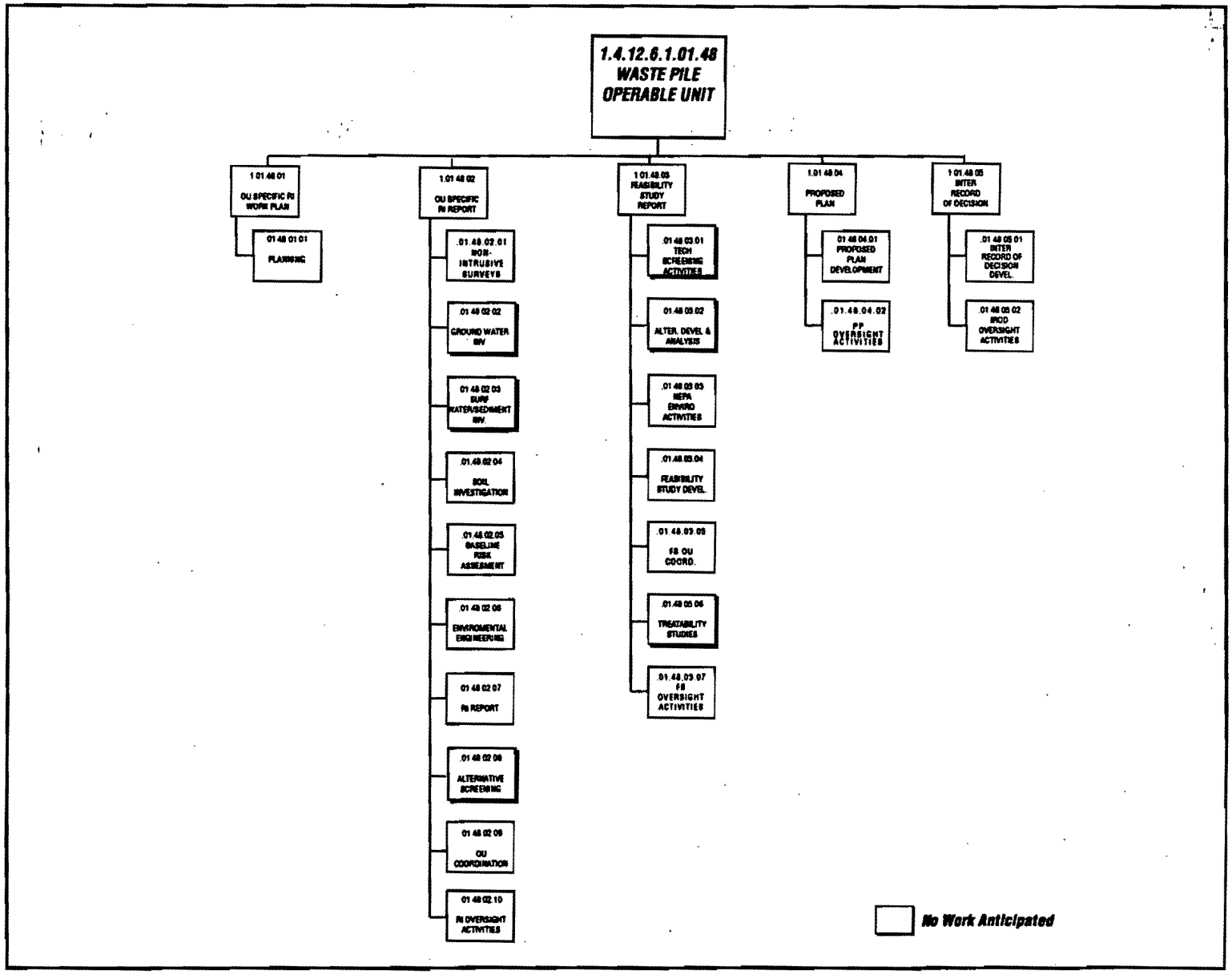


Fig. 21.1. Waste Pile OU Work Breakdown Structure

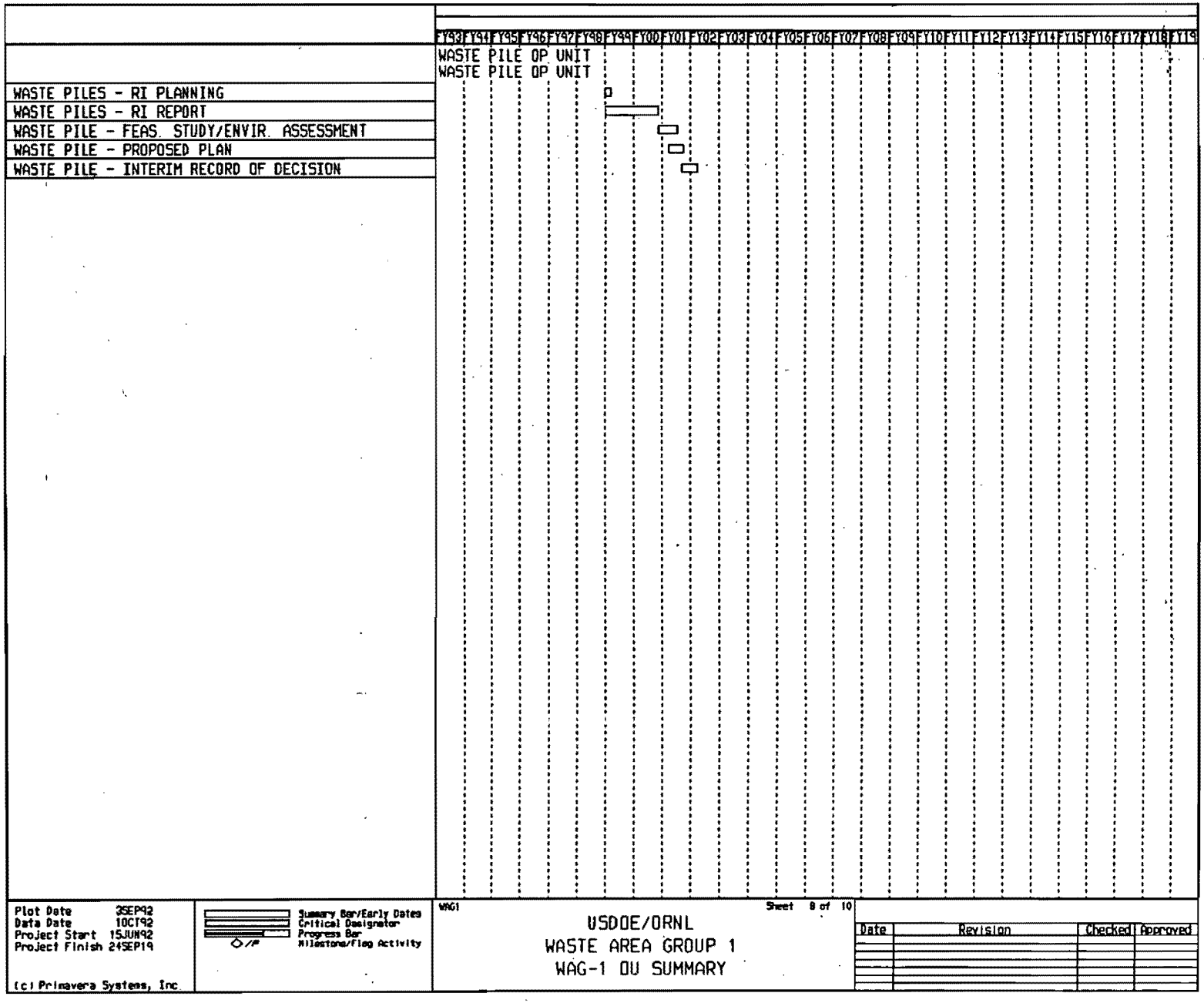


Fig. 21.2. Waste Pile OU Summary Level Schedule.

TABLE 21.1
WAG 1 Oper. Unit 08 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	1999	2000	2001	2002	2003	TOTAL
Remedial Investigation	1,227	963	0	0	0	2,190
Feasibility Study/IROD	298	1,006	48	0	0	1,352
Remedial Design	0	0	0	0	0	0
Remedial Action	0	0	0	0	0	0
TOTALS	1,526	1,968	48	0	0	3,542

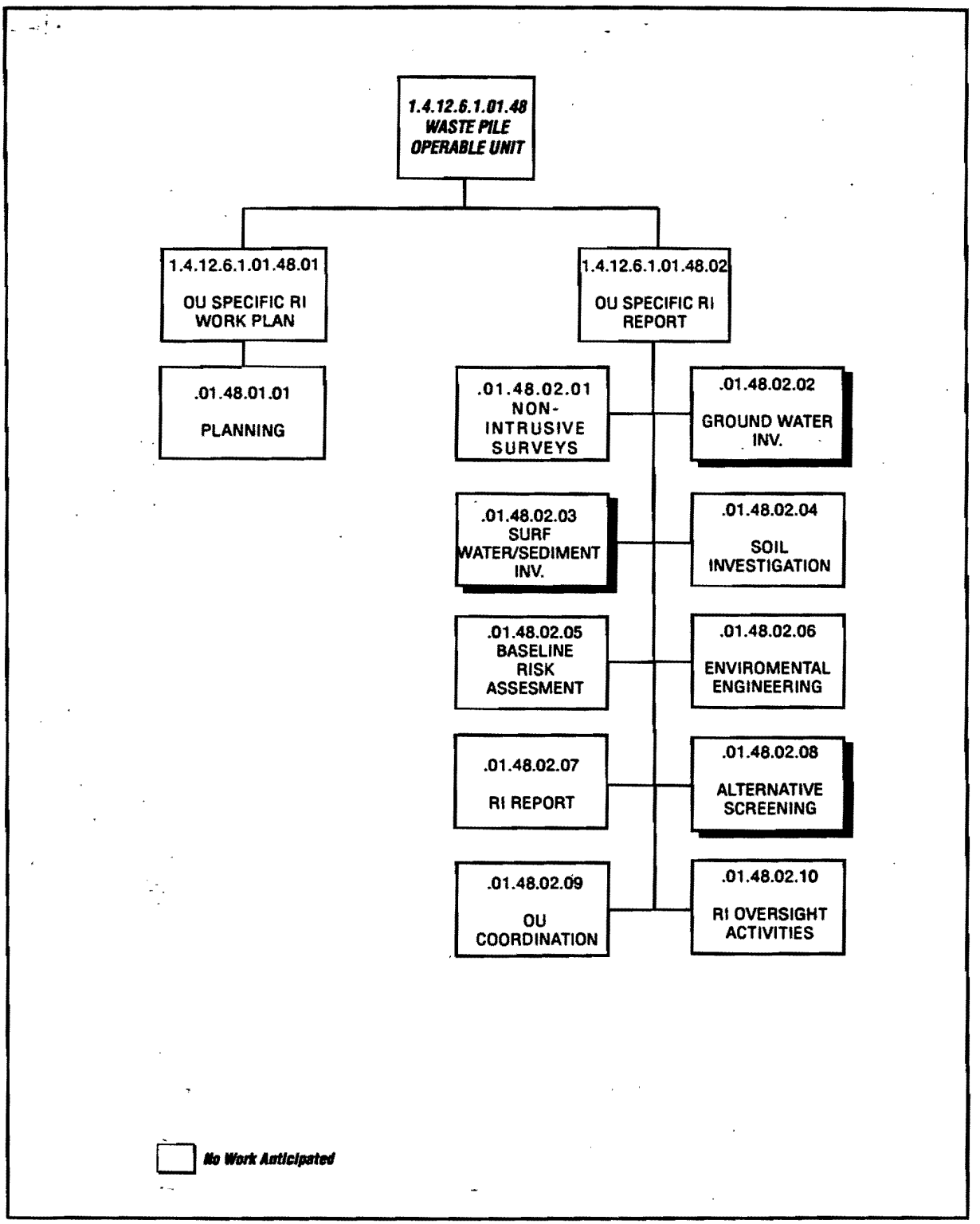


Fig. 21.3. Waste Pile OU RI Work Breakdown Structure

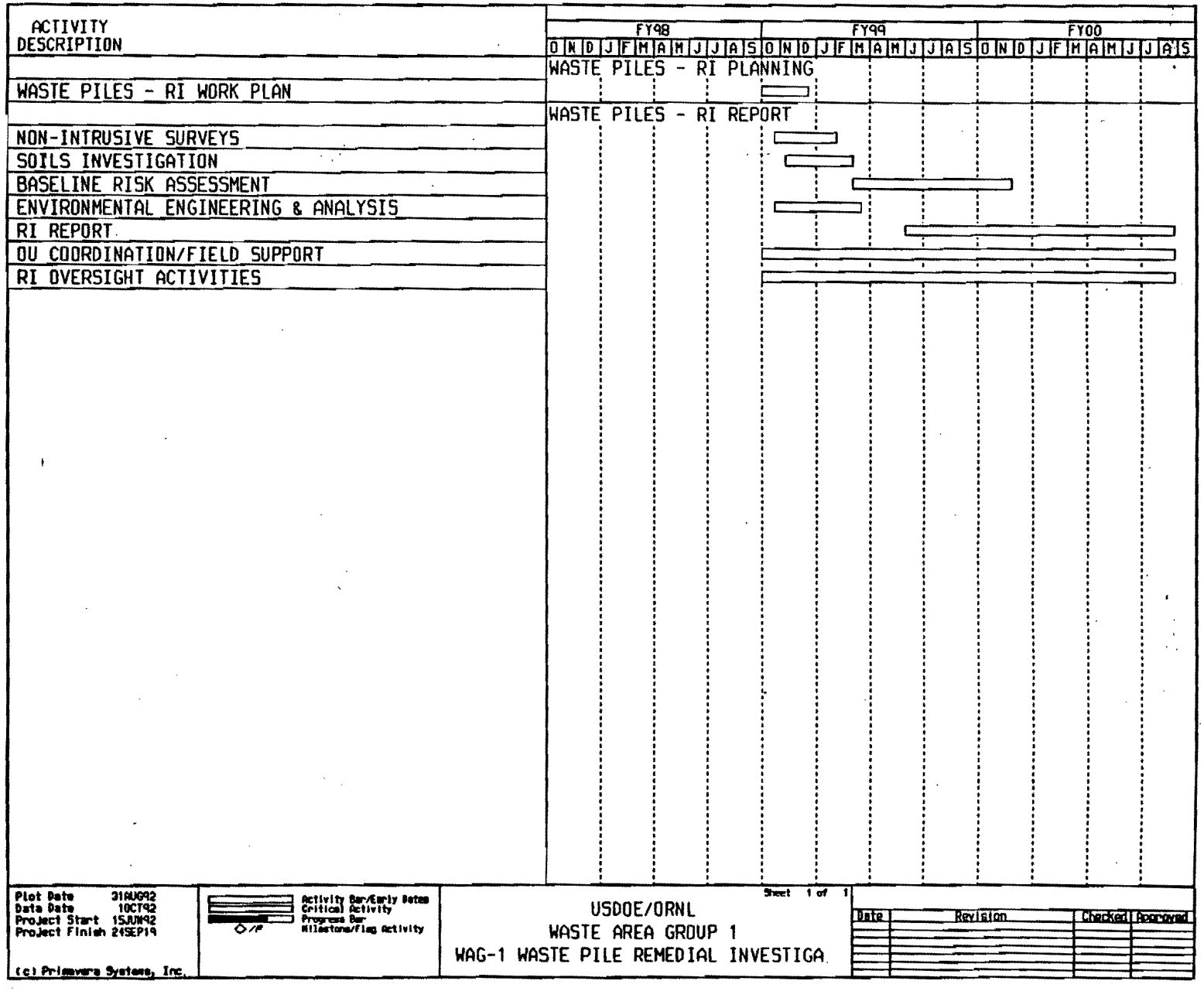


Fig. 21.4. Waste Pile OU RI Summary Level Schedule.

TABLE 21.2
WAG 1 Oper. Unit 08 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	1999	2000	2001	2002	TOTAL
Planning	64	0	0	0	64
Nonintrusive Surveys	11	0	0	0	11
GW Investigation	0	0	0	0	0
SW/SED Investigation	0	0	0	0	0
Soil Investigation	114	0	0	0	114
Baseline Risk Assess.	70	23	0	0	93
Environ. Engineering	112	0	0	0	112
RI Report	82	164	0	0	247
Alternative Screening	0	0	0	0	0
RI OU Coordination	467	467	0	0	933
RI Oversight Activities	308	308	0	0	617
TOTALS	1,227	963	0	0	2,190

RI activities and provides a mechanism for planning the investigation activities. These activities may be accomplished concurrently or in a phased approach. A Project Management Strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes a summary and interpretation, as appropriate, of available environmental information. The plan addresses the ARARs, TBC guidance, and establishment of DQOs and provides specific rationale for all field and analytical work. The RI Work Plan addresses the proposed technical approach, timing for implementation, schedules, and decision points where appropriate.

A revised Field Sampling Plan for WAG 1 (BNI, 1991a) and a revised QA Project Plan for WAG 1 (BNI, 1991b) were issued to regulators in December 1991. Other WAG-specific plans and procedures were also developed including project management, ES&H management, waste management, and database management. Since all these planning activities occurred before October 1992, no cost or schedule information is included for this element in the Baseline Report.

21.1.3 Operable Unit Specific Remedial Investigation Report

21.1.3.1 Nonintrusive Surveys (6.1.01.48.02.01)

Civil surveys will be conducted to provide 3-D control for sampling and measurement activities. Civil surveying will be performed as needed to support investigation activities including as-built surveys, construction surveys, topographic surveys, and establishing monitoring well locations.

Coordination with the ORNL Well P&A Program will be provided.

21.1.3.2 Groundwater Investigation (6.1.01.48.02.02)

No additional work is anticipated for this WBS element.

21.1.3.3 Surface Water and Sediment Investigations (6.1.01.48.02.03)

No additional work is anticipated for this WBS element.

21.1.3.4 Soils Investigation (6.1.01.48.02.04)

Soils investigation activities will focus on sampling and removing anomalies that were discovered during the Phase I RI electromagnetic and magnetometer surveys of the Waste Pile. This soils investigation is part of a limited Waste Pile (Phase II) RI that serves to support the Waste Pile candidacy for NFA.

Four survey anomalies (e.g., indications of buried metal) were discovered at various locations in the Waste Pile. The soils investigation for this limited RI will consist of four soil borings, one at each of the four locations with anomalous readings. Two continuous, composite soil

samples will be taken from each soil boring. The soil columns from each location will also be physically described (e.g., waste contained in the column).

Samples from soils investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and geotechnical parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples to be included in risk assessments and other instances where data of known quality are required.

21.1.3.5 Baseline Risk Assessment (6.1.01.48.02.05)

A Screening-Level Risk Assessment for the Waste Pile will be performed and will consist of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with the Waste Pile for current and future exposure scenarios. The objectives of the environmental evaluation are to determine whether or not the Waste Pile poses a current or potential future risk to environmental resources in the absence of any remediation and to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

The Screening-Level Risk Assessment will be submitted as a secondary document for EPA and TDEC review and then will be presented as a section of the Waste Pile RI Report.

21.1.3.6 Environmental Engineering (6.1.01.48.02.06)

This task involves four principal activities:

1. Prior to field mobilization, a detailed evaluation of existing data for the Waste Pile will be performed. Support to the ORNL/DOE/EPA/TDEC technical review process, the ORNL environmental assessment documentation process, and the ORNL readiness review process will be provided as requested. Evaluation of new ORNL data (i.e., semi-annual groundwater data) will be performed and will include the review and tabulation of data as they become available (i.e., SIMS). These data will be compared to the focused RI Work Plan supplement or TM, as appropriate, and to conclusions drawn from the data generated by the Waste Pile RI. The scope also includes review of ORNL reports published since the Waste Pile RI Work Plan supplements were issued.

2. An environmental engineering analysis will be performed on all data generated from the Waste Pile RI field activities. These data will be tabulated for use in writing the technical memoranda and technical bulletins.

3. Contaminant/contents data will be evaluated and will involve reviewing ORNL electronic data bases for information about the contents of the Waste Pile. Also,

aerial photographs and engineering drawings will be reviewed to determine actual locations of areas of concern.

4. The data summarized by the three previous tasks will be reviewed with respect to implementation of the NFA alternative.

21.1.3.7 **Remedial Investigation Report** (6.1.01.48.02.07)

The Waste Pile RI Report will serve as documentation of data collection and analyses in support of the Waste Pile FS. The results of the RI are presented as an analysis of site characteristics and the risk associated with such characteristics (see element definition for the Screening-Level Risk Assessment). The evaluation of site characteristics will focus on the site physical characteristics, the source characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Prior to the issuance of the draft Waste Pile RI Report, a draft determination of the ARARs will be submitted to EPA and TDEC. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to Waste Pile remediation.

The draft Waste Pile RI Report will be produced for review by ORNL, DOE, EPA, and TDEC. The RI report will consolidate available, appropriate, and applicable data on the Waste Pile and will summarize technical work completed on the project. In addition to the field work (Phase II) proposed for this OU, the primary basis or reference for the Waste Pile RI Report will be the WAG 1 Site Characterization Summary Report to be issued in September 1992.

21.1.3.8 **Alternatives Screening** (6.1.01.48.02.08)

No additional work is anticipated for this WBS element.

21.1.3.9 **Operable Unit Coordination** (6.1.01.48.02.09)

Activities include quality control and project management and coordination. These activities will ensure that quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple WAGs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, database management, and database interface with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Field support needed to manage and direct the field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes providing required field equipment, spare parts, and other field materials and supplies.

21.1.3.10 Remedial Investigation Oversight Activities (6.1.01.48.02.10)

RI oversight activities provide technical support, input, and oversight to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RI. RI oversight activities begin with the field investigation and are completed upon final approval of the associated technical memoranda.

The following list briefly describes the oversight roles of the various participants:

- FS Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the FS/EA.
- A-E Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the RD approach and design requirements.
- MMES ES&H — Provides support for health and safety, environmental compliance, and waste management as a part conducting the RI field activities.
- MMES Environmental Sciences Division — Provides support for drilling.
- MMES Planning/Coordination — Provides necessary permits for RI field activities.
- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

21.1.4 Risks and Uncertainties

The following list describes the areas of risk and uncertainty associated with the performance of the RI:

- Delays in the review of the Site Characterization Report would impact the initiation of the preparation of the Sampling and Analysis Plan.
- The implementation of regulator approval of the focused Sampling and Analysis Plan would delay field investigations.

21.1.5 Interfaces

The following describes the primary interfaces and anticipated roles during the RI:

- MMES Waste Management — To provide waste management overview and support throughout the RI process by focusing on the minimization of RI-generated wastes and providing the capability to process the wastes generated during the RI.

- MMES Technical Advisory Group — To provide technical overview support during the RI process, specifically pertaining to overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that MMES RI goals are achieved.

- FS Contractor — To provide data review support to the RI relative to its sufficiency to support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approve all primary documents.

- TDEC — To provide state (Tennessee) regulatory overview during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

21.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents the scope for performing the FS process for the Waste Pile OU. This process includes incorporating environmental concerns in an EA within the report and preparing the PP for public review and the IROD for agency approval. It is assumed that the RI Report findings and any Interim RAs required to remove any anomalies will support the decision that an FS is not required and that the EA will produce a finding of no significant impact (FONSI). Immediately following the issue of the FONSI, the PP and IROD will be issued. The risks and uncertainties and interfaces for these efforts are identified as well.

The WBS developed for performing the FS/EA and preparing the PP and IROD is presented in Fig. 21.5. The summary level schedule for these FS/EA, PP, and IROD WBS elements is shown in Fig. 21.6. The cost assessment of $1,352,000 for performing these portions of the Waste Pile remediation activities summarized by WBS activity and FY is shown in Table 21.3.

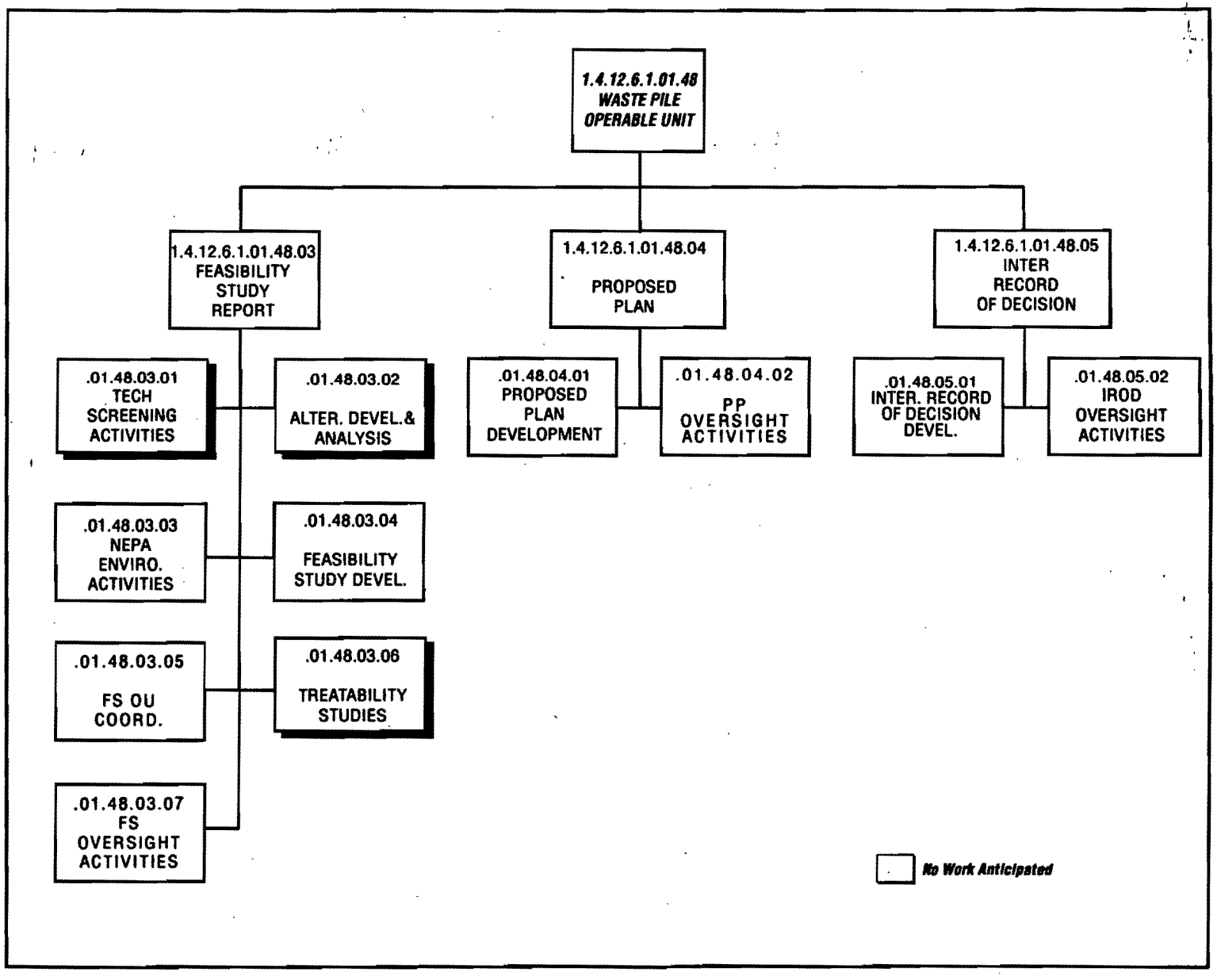


Fig. 21.5. Waste Pile OU FS/PP/IROD Work Breakdown Structure.

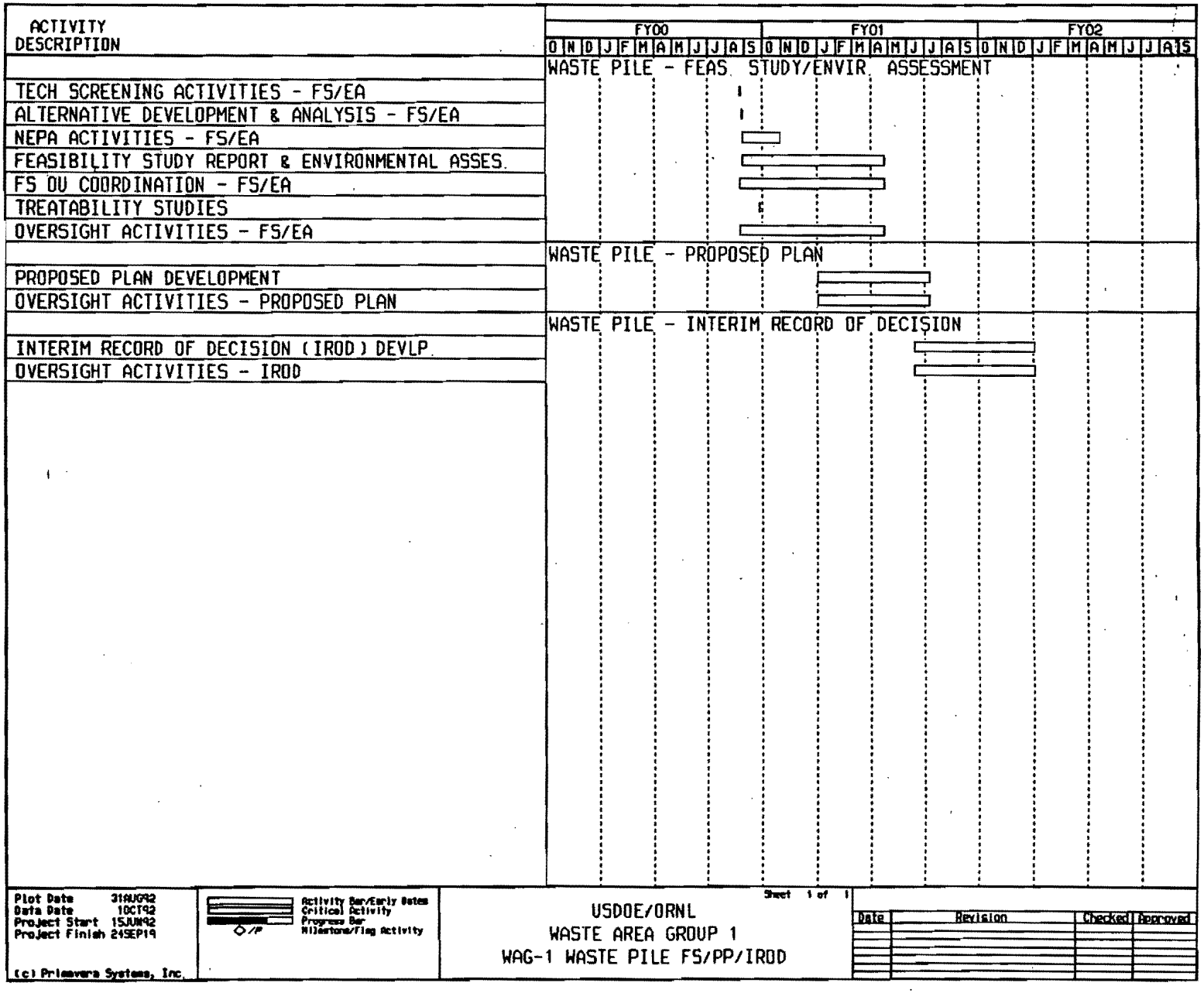


Fig. 21.6. Waste Pile OU FS/PP/IROD Summary Level Schedule.

TABLE 21.3
WAG 1 Oper Unit 08 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2000	2001	2002	2003	2004	TOTAL
Technology Screening	0	0	0	0	0	0
Alternatives Develop./Analysis	0	0	0	0	0	0
NEPA/Environmental Activities	36	36	0	0	0	72
Feasibility Study Development	147	442	0	0	0	589
FS OU Coordination	50	150	0	0	0	200
Treatability Study	0	0	0	0	0	0
FS Oversight	65	195	0	0	0	260
SUBTOTALS FS	298	823	0	0	0	1,122
PP Development	0	102	0	0	0	102
PP Oversight Activities	0	32	0	0	0	32
SUBTOTALS PP	0	135	0	0	0	135
IROD Development	0	34	34	0	0	67
IROD Oversight Activities	0	14	14	0	0	29
SUBTOTALS IROD	0	48	48	0	0	96
TOTALS	298	1,006	48	0	0	1,352

21.2.1 Scope and Assumptions

The scope for the Waste Pile OU FS process considers the debris that has been buried on the site. The OU is poorly defined at this time, and the contents and composition of the waste onsite are undefined. Remedial activities associated with elements of the FS process are based on the following assumptions.

The FS Contractor will be responsible for developing and completing the Waste Pile OU FS process and for preparing and developing the environmental document to justify the NFA. The FS process will ultimately produce (1) documentation of the process used to examine the environmental (NEPA) considerations that results in the FONSI and NFA for the site to satisfy DOE orders; (2) the PP, a summary document for outlining the RI Report findings and determination that NFA is required at the site and for describing the monitoring plan; and (3) the IROD, the legal document stating that the statutory and regulatory requirements have been met during the FS process that results in the FONSI and establishing the monitoring plan and schedule for the Waste Pile. The FS preparation will consist of the following principal WBS elements. Descriptions of the scope of each activity and the assumptions used for preparing the cost assessment are presented below.

- NEPA Environmental Activities
- Feasibility Study Operable Unit Coordination
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities

21.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA are presented in the following sections. The FS Report will generally follow the format presented in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, October 1988 (USEPA 1988).

Based on the RI Report findings regarding waste- and site-specific conditions, it is anticipated that technical screening, alternatives development and analysis, and FS development are not required. A technical memorandum summarizing the findings will be issued to DOE.

21.2.2.1 Technology Screening Activities (6.1.01.48.03.01)

No additional work is anticipated for this WBS element.

21.2.2.2 Alternatives Development and Analysis (6.1.01.48.03.02)

No additional work is anticipated for this WBS element.

21.2.2.3 NEPA Environmental Activities (6.1.01.48.03.03)

To comply with the DOE policy that NEPA criteria be considered during remedial activities, the impact of the screened remedial alternatives on the environment must be evaluated. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives and any Interim RAs required will be considered an integral component of the evaluation and selection process. It is anticipated that a FONSI can be issued for the Waste Pile which will lead directly to the PP and IROD.

21.2.2.4 Feasibility Study Development (6.1.01.48.03.04)

No additional work is anticipated for this WBS element.

21.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.48.03.05)

Technical support and oversight will be provided to ensure that the EA Memorandum is prepared within project quality, cost, and scheduling goals. Engineering and technical resources are required to support quality control efforts, provide project management, and coordinate project activities to ensure that these goals are achieved. Monthly progress reports on the FS process will be issued to DOE and the FS team.

21.2.2.6 Treatability Studies (6.1.01.48.03.06)

No additional work is anticipated for this WBS element.

21.2.2.7 Feasibility Study Oversight Activities (6.1.01.48.03.07)

The objective of FS oversight activities is to provide technical input and oversight of the FS Contractor during the FS/EA process to ensure that the data and information obtained during the RI is appropriately incorporated into the FS/EA Report and that the FS/EA Report is technically

complete and sufficient to support the preferred remedial alternative(s) for the PP and the development of an IROD and the RD. FS oversight activities begin with the screening of remedial technologies and are complete upon final approval of the FS/EA Report.

A brief description of the scope of the responsibilities of each participant involved in the FS oversight follows:

- RI Subcontractor — Provides a technical review of the FS/EA Report to ensure that the conclusions and determined risks in the RI Report have been properly presented in the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the alternatives considered and the remedial technologies evaluated are sufficient and consistent with the RI Report conclusions, remedial objectives, and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are compatible and consistent with the RA methodology and can be implemented at the site.

- MMES Planning/Coordination — Provides technical support and review FS/EA progress and draft deliverables to ensure that the FS/EA is being developed in a timely and efficient manner.

- MMES Technical Advisory Group — Provides technical support to the FS Team by furnishing technical expertise by necessary disciplines to support the effort. Provides an independent technical review of FS/EA.

21.2.3 Proposed Plan

21.2.3.1 Proposed Plan Development (6.1.01.48.04.01)

The PP will be prepared using the NFA Decision Document prepared during EA activities as a basis and using input from the regulatory agencies and the public. The PP will document the investigation process during EA activities, administrative and regulatory actions, and monitoring activities and schedule necessary to monitor for the migration of contamination after the Interim RA.

21.2.3.2 Proposed Plan Oversight Activities (6.1.01.48.04.02)

The objective of oversight activities during the PP process is to provide technical input and oversight of the FS Contractor to ensure that the data and information presented and the RA(s) selected in the FS/EA Report are appropriate and are incorporated and documented in the PP and to ensure that the PP is technically complete and sufficient to support the development of the IROD. PP oversight activities begin when the FS Contractor begins its development and are complete upon final approval of the PP by the regulatory agencies.

21.2.4 Interim Record of Decision

21.2.4.1 Interim Record of Decision Development (6.1.01.48.05.01)

The FS Contractor will prepare the IROD using the NFA Decision Document prepared during EA activities and PP as the basis and using input from the regulatory agencies and the public. The Waste Pile IROD will contain (1) the statement that the investigation process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a Decision Summary outlining the nature and extent of the contamination and the associated risks at the Waste Pile, the evaluation and analysis of the EA and NFA Decision Document, and an explanation of how the NFA will meet statutory requirements; and (3) a Responsiveness Summary addressing the public comments obtained during the public review period and public examination of the administrative record. The draft IROD will be issued to DOE and the regulatory agencies for review. The final Waste Pile OU IROD is a milestone document required by the FFA.

21.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.48.05.02)

The objective of oversight activities during the IROD process is to provide technical input and oversight of the FS Contractor to ensure that the IROD appropriately incorporates and documents the data and information presented in the FS Report and the PP and that it is technically complete and sufficient to support the development of the IROD and the RD. IROD oversight activities begin when the FS Contractor begins IROD development after approval of the PP and are complete upon final approval and signing of the IROD by the regulatory agencies and DOE.

21.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the Waste Pile FS/PP/IROD process are the scheduling and the scoping of the activities. Minor changes in scheduling will have significant impacts on the labor and materials/equipment cost of the project. If the schedule is modified, resulting in an extended total duration of the project, the total cost will increase substantially. The scope of the project will have a direct impact on labor allocations. If additional investigations are required, the total cost of the project will increase. Other factors that increase the uncertainty of the cost assessments in this report include the following:

- Regulators contesting the NFA decision and FONSI.
- Extended review cycles initiated by the regulators.
- Program funding limitations across the DOE system.

21.2.6 Interfaces

Completion of the Waste Pile FS/PP/IROD process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.
- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.
- NEPA — Provides regulations that set the policies and goals for protecting environmental quality and that establish the procedures to examine the impact that decisions on remediating may have on the environment.
- TDEC — Provides regulatory overview for Tennessee.
- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.
- Public Factions — Require access, review, and response for the public review of the administrative record and any proposed RA.
- ORNL Groundwater Program.
- DOE TRU Waste Management — Provides for the management and retrieval of TRU waste stored at DOE facilities for eventual packaging at WHPP and storage at WIPP.
- RD Contractor — Drafts the RD Work Plan.

21.2.7 Contingent Action

The contingent action identified in the workshop for the Waste Pile is containment in place.

22.0 WAG 1 CONTAMINATED SOILS OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the WAG 1 Contaminated Soils OU activities: RI, FS/PP, IROD, RD, and RA. Figure 22.1 presents the WBS developed for the Contaminated Soils OU and Fig. 22.2 the summary level schedule. The cost assessment of $109,189,000 for the Contaminated Soils OU is presented by remediation phase and FY in Table 22.1.

22.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives for the Contaminated Soils OU. The risks and uncertainties and interfaces for the RI are identified as well.

Figure 22.3 presents the WBS developed for performing the RI, and Fig. 22.4 provides the summary level schedule for these RI WBS elements. Table 22.2 presents a cost assessment of $4,245,000 for performing this portion of the WAG 1 Contaminated Soils OU remediation activities by WBS activity and FY. These estimates were prepared using TCFs, which permits the correlation of the scope of the RI efforts for this OU to the scope of the RI efforts for a reference WAG (WAG 5). Appendix F presents a discussion of the development of this methodology.

22.1.1 Scope and Assumptions

The primary assumption for the RI effort for OU9 is that in the implementation of the observational approach, additional RI data will be required to support the development of the Feasibility Study.

The WAG 1 Contaminated Soils response actions and their RI activities are as follows:

- Containment — geophysical surveys, geotechnical properties (soils), and perimeter soils sampling.
- Excavation (removal) — soils sampling.

The following assumptions have significant roles specific to the schedule for implementation of the RI process.

- All primary documentation will undergo a concurrent MMES and DOE review. Additionally, the review process for these documents will follow the "Accelerated Review Cycle," which defines review times for each step in the review process.

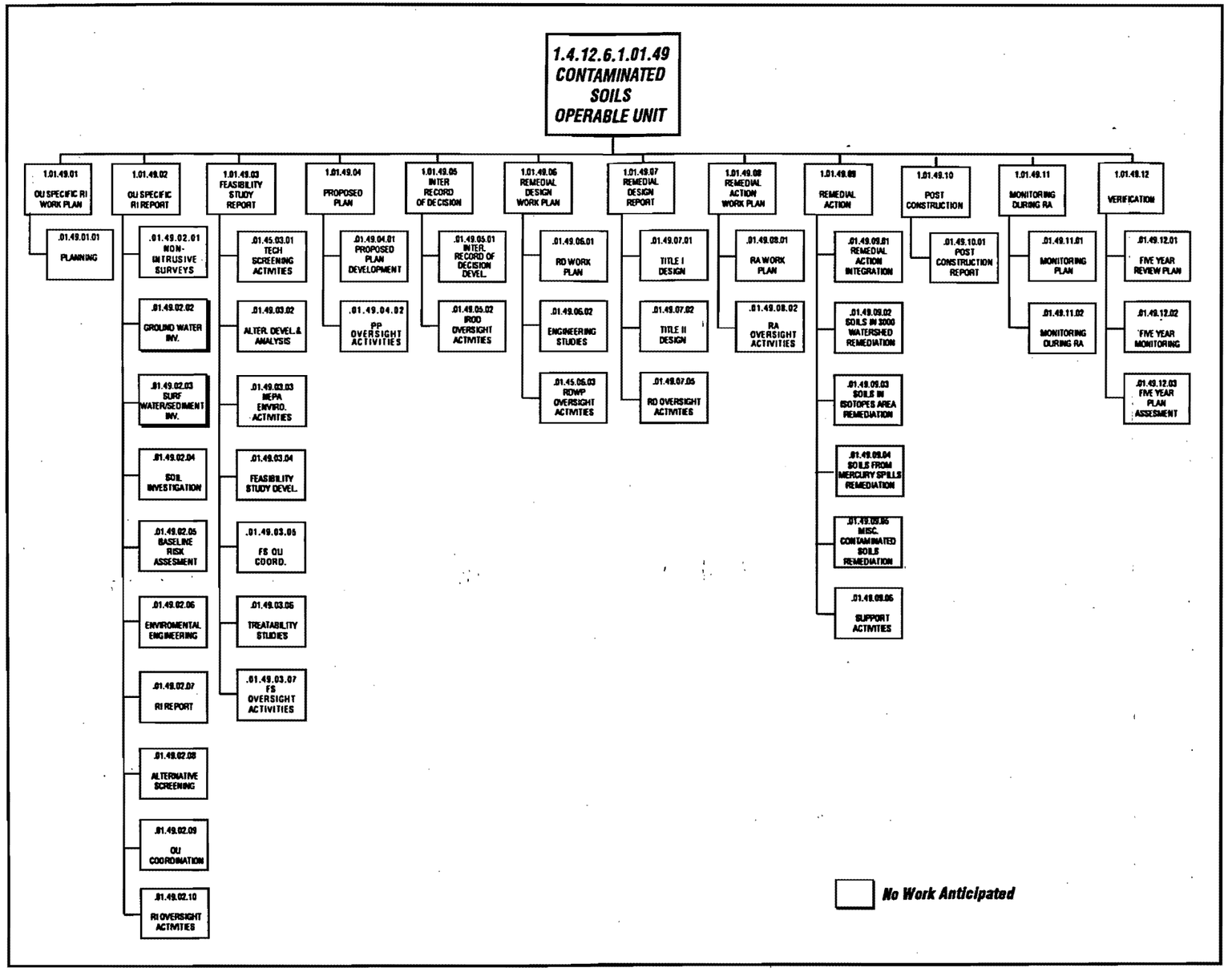


Fig. 22.1. Contaminated Soils OU Work Breakdown Structure.

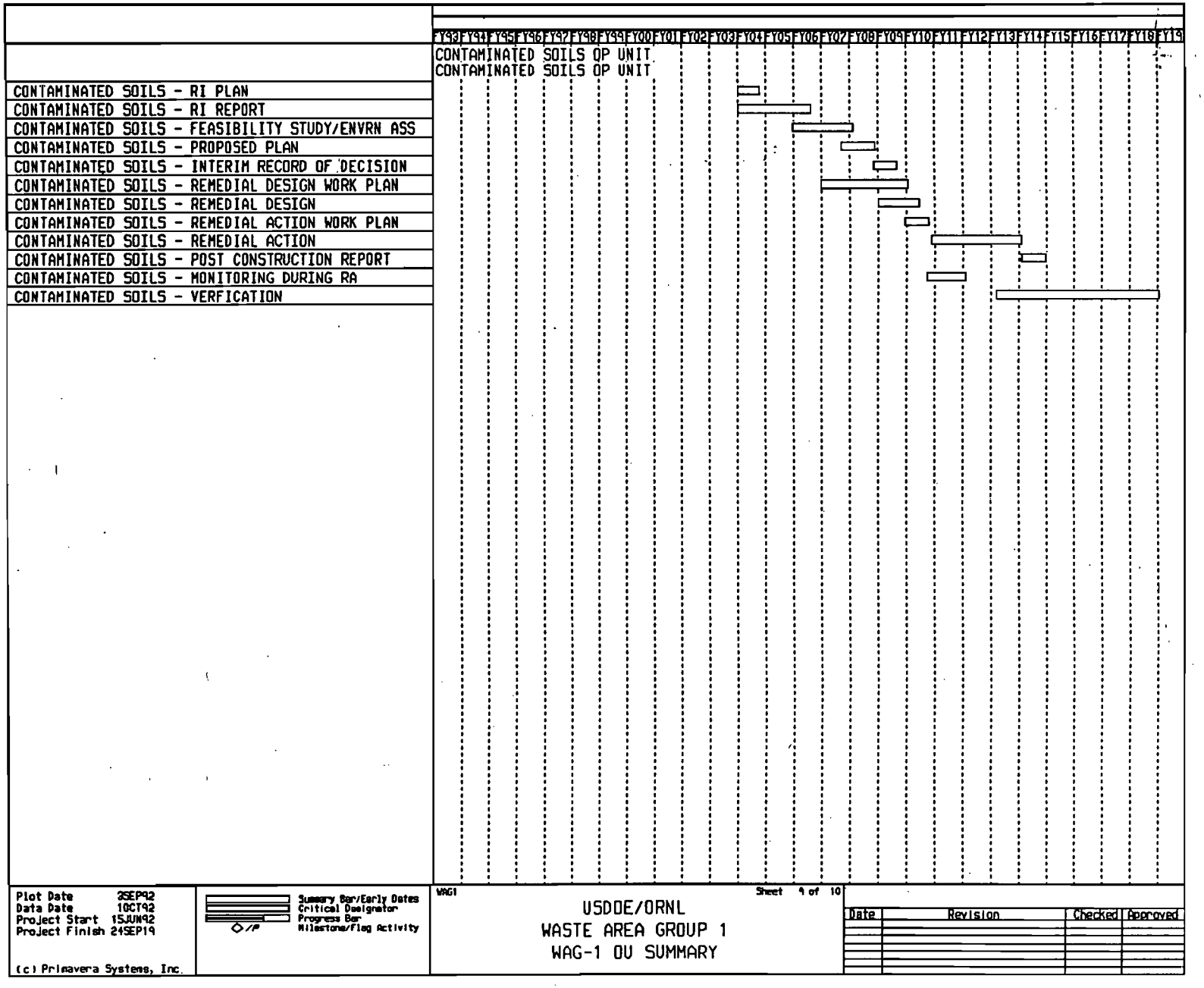


Fig. 22.2. Contaminated Soils OU Summary Level Schedule.

TABLE 22.1
WAG 1 Oper. Unit 09 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																	
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
Remedial Investigation	0	1,140	2,297	808	0	0	0	0	0	0	0	0	0	0	0	0	0	4,245
Feasibility Study/IROD	0	0	542	2,101	772	315	92	0	0	0	0	0	0	0	0	0	0	3,822
Remedial Design	0	0	0	0	0	50	22,205	6,444	0	0	0	0	0	0	0	0	0	28,699
Remedial Action	0	0	0	0	0	0	42	2,222	15,262	20,909	28,743	3,310	411	411	411	555	144	72,422
TOTALS	0	1,140	2,840	2,909	772	364	22,340	8,667	15,262	20,909	28,743	3,310	411	411	411	555	144	109,189

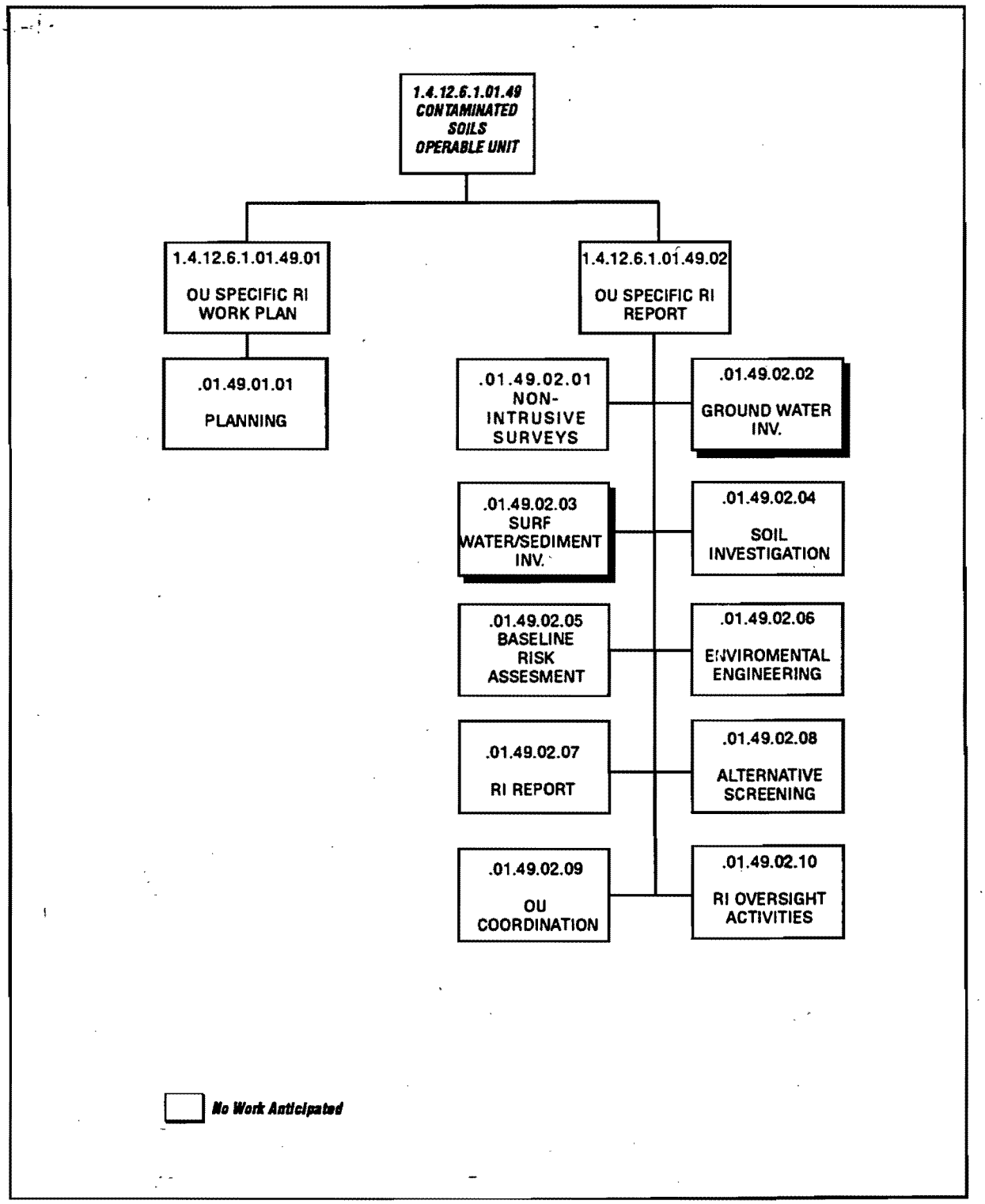


Fig. 22.3. Contaminated Soils OU RI Work Breakdown Structure

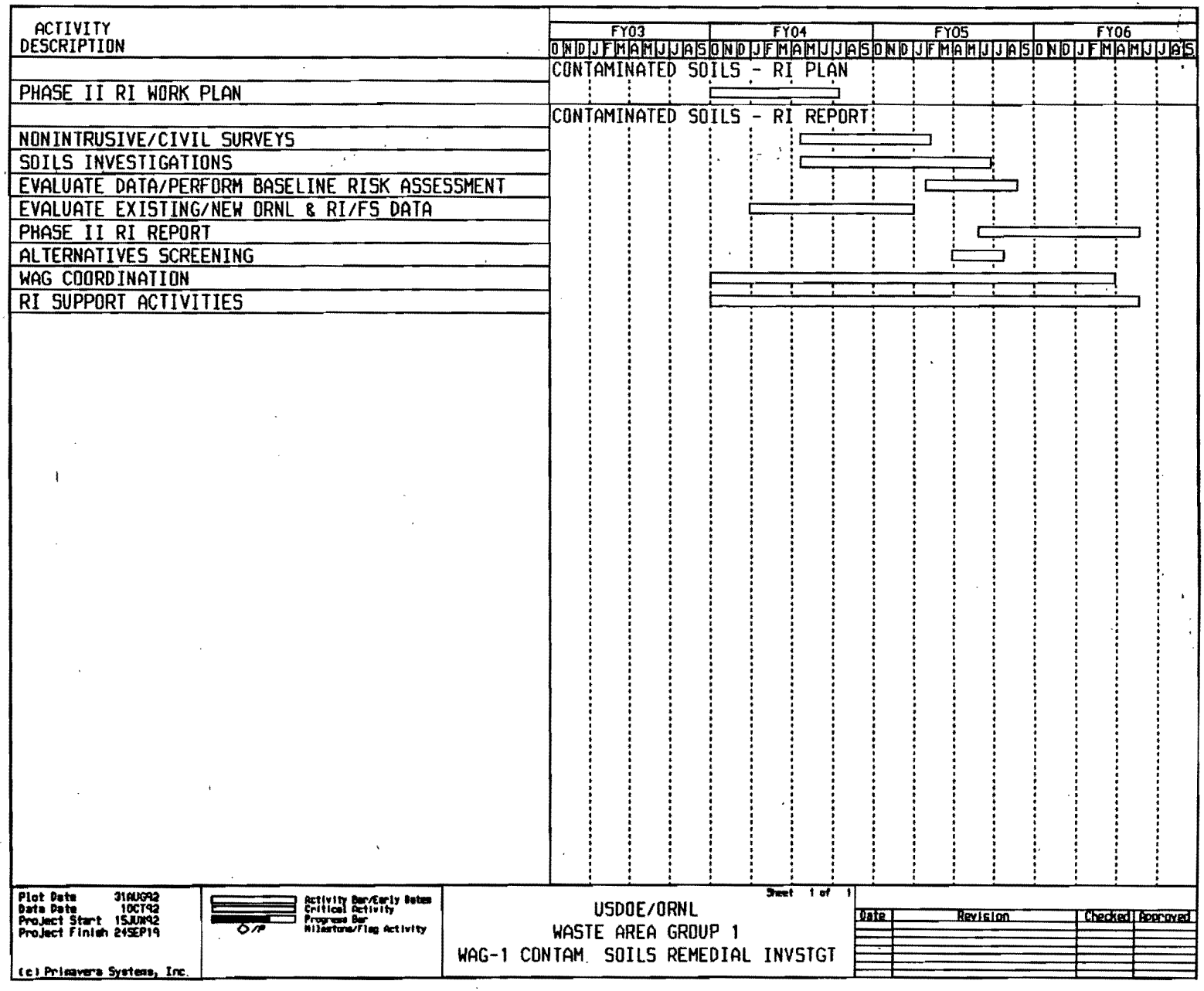


Fig. 22.4. Contaminated Soils OU RI Summary Level Schedule.

TABLE 22.2
WAG 1 Oper. Unit 09 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	2004	2005	2006	2007	TOTAL
Planning	153	0	0	0	153
Nonintrusive Surveys	9	13	0	0	22
GW Investigation	0	0	0	0	0
SW/SED Investigation	0	0	0	0	0
Soil Investigation	223	680	0	0	903
Baseline Risk Assess.	0	465	0	0	465
Environ. Engineering	176	21	0	0	197
RI Report	0	146	446	0	592
Alternative Screening	0	24	0	0	24
RI OU Coordination	225	593	96	0	914
RI Oversight Activities	355	355	266	0	976
TOTALS	1,140	2,297	808	0	4,245

- Sufficient coordination with the regulators will occur throughout the RI process. It is anticipated that any comments received on primary documentation will not require additional sampling, major revision of these documents, or application of the disputes resolution process.

- Nonintrusive surveys will be authorized by the regulators and may be initiated within 1 week subsequent to transmittal of the draft RI Work Plan to the regulators.

- Intrusive investigations will be authorized by the regulators and may be initiated upon completion of regulatory review of the draft RI Work Plan.

22.1.2 Operable Unit Specific Remedial Investigation Work Plan

22.1.2.1 Planning (6.1.01.49.01.01)

The RI Work Plan provides an overall technical strategy and management approach for performing the RI for WAG 1. The RI Work Plan defines the scope and objectives for the RI activities and provides a mechanism for planning the investigation. A project management strategy is provided in the management section of the RI Work Plan. The RI Work Plan documents scoping activities and includes a summary and interpretation, as appropriate, of available environmental information. The Work Plan addresses the potential federal and state ARARs, TBC guidance, and establishment of Data Quality Objectives (DQOs) and provides specific rationale for all field and analytical work. The RI Work Plan addresses the proposed technical approach, timing for implementation, schedules, and decision points where appropriate. The RI Work Plan is prepared according to provisions of applicable EPA and TDEC guidance documents.

Because of the need to review data reported as part of the WAG 1 Phase I RI effort and to incorporate changes in project approach, a supplement to the WAG 1 RI Work Plan and associated documents will be developed as needed.

22.1.3 Operable Unit Specific Remedial Investigation Report

22.1.3.1 Nonintrusive Surveys (6.1.01.49.02.01)

The following nonintrusive surveys will generally be conducted before initiation of media-specific sampling.

Civil surveying will be performed as needed to support Contaminated Soils investigation activities including as-built surveys, construction surveys, topographic surveys, and establishing monitoring well and sampling locations.

22.1.3.2 Groundwater Investigation (6.1.01.49.02.02)

No additional work is anticipated for this element; however, the results of the Phase I groundwater investigation associated with WAG 1 Contaminated Soils will be made available to the Groundwater WAG Team in order to facilitate site-wide groundwater remediation assessments. It is conceivable that as the groundwater investigation proceeds, additional data needs will be identified by the Groundwater WAG Team, which will result in additional requirements being placed on the WAG 1 Contaminated Soils groundwater investigation. No allowance for additional investigation requirements is included in the scope of effort for the WAG 1 Contaminated Soils RI. Continuing interface between WAG 1 Contaminated Soils and the Groundwater WAG Team will be required throughout the RI process.

22.1.3.3 Surface Water and Sediment Investigations (6.1.01.49.02.03)

No additional work is anticipated for this WBS element.

22.1.3.4 Soils Investigation (6.1.01.49.02.04)

Soil sampling activities will focus on delineating contamination within the WAG 1 area and defining specific contaminant sources. Samples will be collected to the depth required to discern the extent of vertical migration.

Forty shallow borings will be drilled within the Contaminated Soils OU. Three vertically-composited samples will be collected from each boring. An additional 20 surface soil samples, composited to a maximum depth of 1 ft, will be collected throughout the WAG 1 area.

Samples from soils investigation activities will be sent to the close support laboratory and to an offsite subcontractor laboratory for analysis of TCL/TAL, radiological constituents, and geotechnical parameters. Samples will be analyzed using EPA methods, where available, and prescribed QC levels depending upon the DQOs for the particular situation under investigation. Data validation using EPA-prescribed methods will be performed on all samples to be included in risk assessments and other instances where data of known quality are required.

22.1.3.5 Baseline Risk Assessment (6.1.01.49.02.05)

The Contaminated Soils OU Baseline Risk Assessment consists of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with the Contaminated Soils OU for current and future exposure scenarios. The objectives of the environmental evaluation are to determine whether or not the Contaminated Soils OU poses a current or potential future risk to environmental resources in the absence of any remediation and to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

The human health evaluation will be performed in accordance with EPA's *Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual (Part A)* (1989). The work will include an evaluation of chemical and radiological data collected prior to and during the Contaminated Soils OU RI. An exposure assessment, a toxicity assessment, and a risk characterization will be conducted with the information used to compute human health risks. The average annual concentrations of radionuclides and chemicals in the surface water, groundwater, soils, and sediments for current and future time periods at OU locations will be estimated using a surface/subsurface model.

The environmental evaluation will be performed to meet the requirements of Section 121 (b)(1) and (d) of CERCLA and other statutes that mandate protection of wildlife, fisheries, threatened and endangered species, and sensitive environments. Guidelines for conducting this evaluation are provided by EPA in *Risk Assessment Guidance for Superfund, Volume II, Environmental Evaluation Manual* (1989). The evaluation will be a quantitative and qualitative appraisal of the actual or potential effects of this waste site on plants and animals other than humans and domestic species.

22.1.3.6 Environmental Engineering (6.1.01.49.02.06)

An environmental engineering analysis will be performed on all data generated from Contaminated Soils OU RI field activities. These data will be tabulated for use in writing the technical memorandums and technical bulletins and will be reviewed with respect to implementation of remedial alternatives. This task is iterative in nature and consists of the following steps: (1) summarized RI/FS data are reviewed as they become available; (2) the preliminary remedial alternatives scenario is refined, if necessary; (3) data needs are re-evaluated based on the new alternatives scenario; and (4) data collection efforts are altered to meet any new data needs.

22.1.3.7 Remedial Investigation Report (6.1.01.49.02.07)

The OU RI Report will serve as documentation of data collection and analyses in support of the OU FS. The results of the OU RI are presented as an analysis of site characteristics and the risk associated with such characteristics (see element definition for the Baseline Risk Assessment) and a summary of potentially feasible remedial actions (see element definition for Alternatives Screening). The evaluation of site characteristics will focus on the site physical characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Prior to the issuance of the draft Contaminated Soils OU RI Report, a draft determination of the ARARs will be submitted to EPA and TDEC. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to the Contaminated Soils OU remediation.

The draft Contaminated Soils OU RI Report will be produced for review by ORNL, DOE, EPA, and TDEC. The OU RI report will consolidate available, appropriate, and applicable data on the Contaminated Soils OU and will summarize technical work completed on the project. In addition

to the field work (Phase II) proposed for this OU, the primary basis or reference for the Contaminated Soils OU RI Report will be the WAG 1 Site Characterization Summary Report.

22.1.3.8 Alternatives Screening (6.1.01.49.02.08)

The objectives of the alternatives screening are to develop preliminary RA goals, develop a range of alternatives, and perform a screening level alternatives evaluation.

Preliminary development and screening of remedial alternatives will be performed according to the EPA *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, October 1988 (USEPA 1988). The effort consists of the following steps:

1. Develop RA objectives specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed.

2. Develop general response actions for each medium of interest that may be taken to satisfy the remedial action objectives for the site.

3. Identify volumes or areas of media where general response actions might be applied.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the site.

5. Identify and evaluate technology process options to select a representative process for each technology type retained for further consideration.

6. Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

22.1.3.9 Operable Unit Coordination (6.1.01.49.02.09)

Activities include Contaminated Soils RI quality control and project management and coordination. These activities will ensure that Contaminated Soils RI quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple WAGs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, database management, and databases interface with MMES. QA/QC will be performed using the home office and field office staff necessary to perform and manage Contaminated Soils QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, close support laboratory coverage, and other general QA/QC activities.

Field support needed to manage and direct Contaminated Soils RI field activities will be performed including decontamination operations, waste handling and analysis, field subcontract administration, and operation of close support laboratory facilities. This activity also includes providing required field equipment, spare parts, and other field materials and supplies.

22.1.3.10 Remedial Investigation Oversight Activities (6.1.01.49.02.10)

This element provides technical support, input, and oversight during the RI to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon issuance of the revised SCSR to the regulators.

The following briefly describes the oversight roles of the various participants:

- FS Contractor — Provides technical oversight to ensure that the nature and extent of contamination and the associated risks developed and presented in the SCSR are consistent with the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the data and information obtained and the nature and extent of contamination developed during the RI are adequate and are presented in a manner consistent with the RD approach and design requirements.

- MMES Field Maintenance — Provides support for health and safety, environmental compliance and waste management as a part of conducting the RI field activities.

- Sample Validation Subcontractor — Provides support to perform validation of chemical sampling performed during the RI.

- MMES Environmental Sciences Division — Provides support for geophysical surveys and drilling.

- MMES Planning/Coordination — Provides necessary permits for RI field activities.

22.1.4 Risks and Uncertainties

The following describes the areas of risk and uncertainty associated with the performance of the RI:

- Areal extent of contamination is not fully defined. This would require additional investigation and study to determine remedial alternatives.

- New regulatory requirements may result in changes to the level of effort required for the risk assessment and alternatives screening.

- Lack of approval for the RI Work Plan would delay field investigations and would require additional work to incorporate regulatory concerns into the RI.

22.1.5 Interfaces

The following describes the primary interfaces and anticipated roles during the RI:

- MMES Waste Management — To provide waste management overview and support throughout the RI process by focusing on the minimization of RI generated wastes and providing the capability to process the wastes generated during the RI.

- MMES Technical Advisory Group — To provide technical overview support during the RI process, specifically pertaining to overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that MMES RI goals are achieved.

- FS Contractor — To provide data review support to the RI relative to its sufficiency to support the FS/IROD process.

- EPA — To provide regulatory overview during the RI process and approve all primary documents.

- TDEC — To provide state (Tennessee) regulatory overview during the RI process.

- DOE — To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

22.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents in more detail the efforts necessary to perform the FS/PP/IROD process for the Contaminated Soils OU. The FS process will include incorporating environmental concerns as an EA within the FS Report. To comply with the FFA, the process will also require preparation of the regulatory decision documents, the PP, and the IROD. The associated risks and uncertainties and the interfaces for the FS/PP/IROD effort are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is presented in Fig. 22.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig. 22.6. The cost assessment of $3,822,000 for performing the FS, PP, and IROD process is presented by WBS element and FY in Table 22.3.

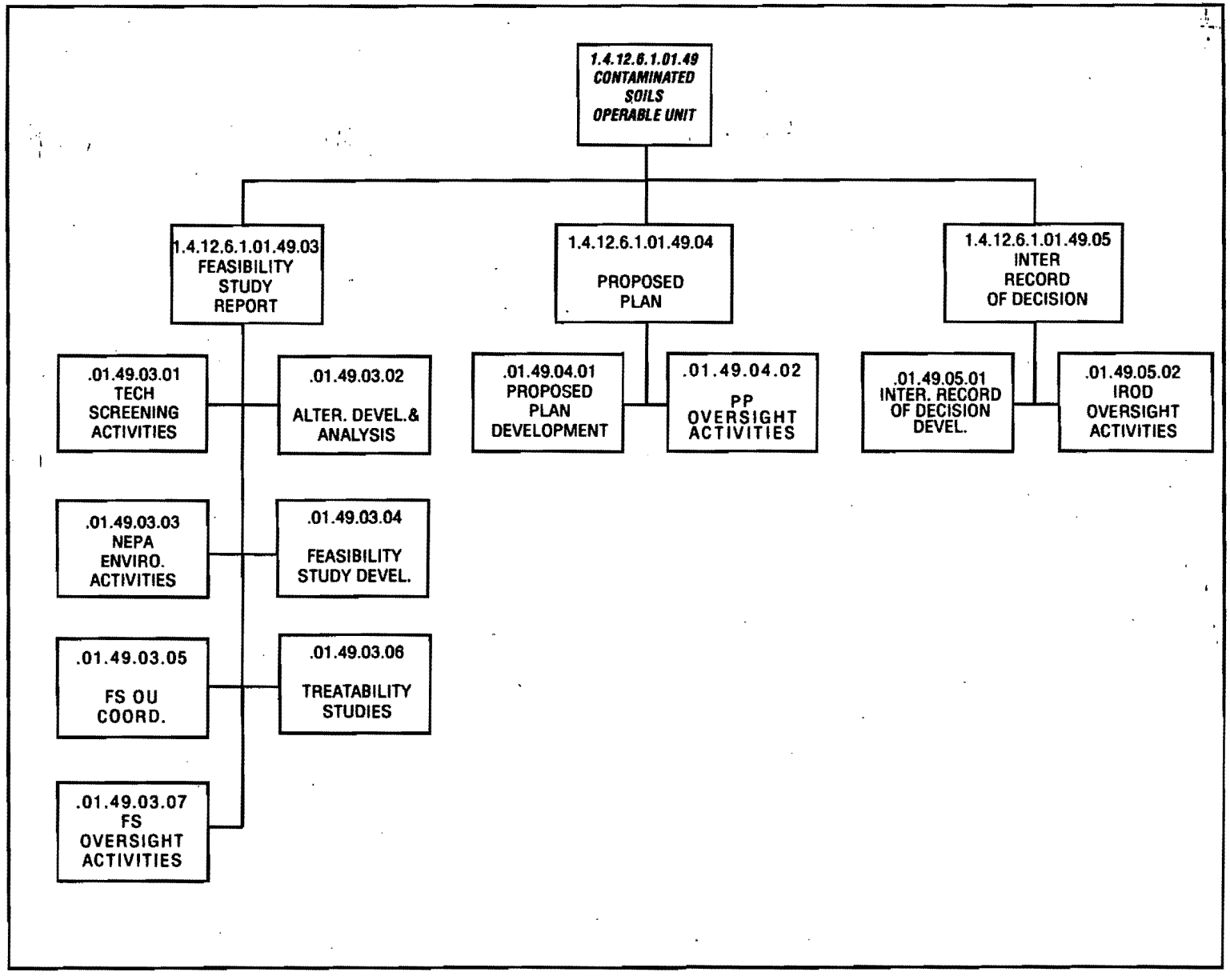


Fig. 22.5. Contaminated Soils OU FS/PP/IROD Work Breakdown Structure.

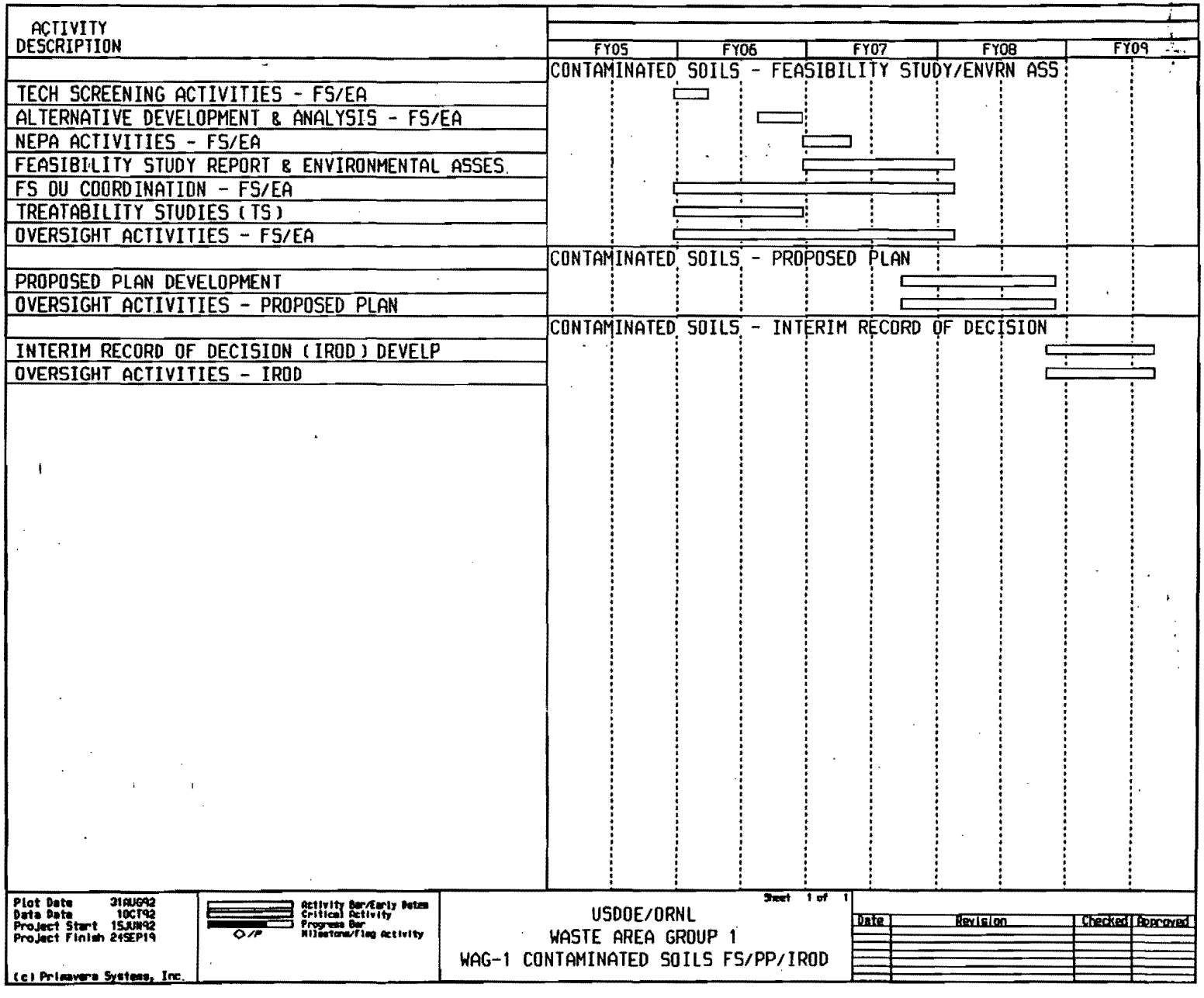


Fig. 22.6. Contaminated Soils OU FS/PP/IROD Summary Level Schedule.

TABLE 22.3
WAG 1 Oper Unit 09 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2005	2006	2007	2008	2009	TOTAL
Technology Screening	115	115	0	0	0	230
Alternatives Develop./Analysis	0	154	0	0	0	154
NEPA/Environmental Activities	0	24	48	0	0	72
Feasibility Study Development	0	98	393	98	0	589
FS OU Coordination	20	80	80	20	0	200
Treatability Study	359	1,437	0	0	0	1,796
FS Oversight	48	192	192	48	0	480
SUBTOTALS FS	542	2,101	713	166	0	3,522
PP Development	0	0	34	68	0	102
PP Oversight Activities	0	0	25	50	0	74
SUBTOTALS PP	0	0	59	118	0	177
IROD Development	0	0	0	17	50	67
IROD Oversight Activities	0	0	0	14	42	56
SUBTOTALS IROD	0	0	0	31	92	123
TOTALS	542	2,101	772	315	92	3,822

22.2.1 Scope and Assumptions

The purpose of Contaminated Soils OU FS/PP/IROD activities is to identify, organize, and examine remedial alternatives; to mitigate the risks identified in the RI Report; to justify selection of a preferred remedial alternative or a set of alternatives; and to prepare the regulatory required decision documents summarizing the situation and examination process, outlining the selected remediation method(s), and establishing the remediation schedule.

The FS Contractor will be responsible for completing the Contaminated Soils OU FS/PP/IROD process. This process will require the preparation of the following milestone documents: (1) the FS Report, which documents the process used to examine the remedial technologies and select the preferred remedial alternative(s) and which incorporates the environmental (NEPA) considerations in an EA segment to satisfy administrative requirements; (2) the PP, a summary plan for implementing the selected remedial alternative(s); and (3) the IROD, the legal document that declares that the selected remediation method(s) meets statutory and regulatory requirements and establishes the schedule for remediating WAG 1. To implement this process and to ensure that WAG 1 remediation is completed according to the process, the FS Contractor will have oversight responsibilities during the RI and RD processes. The WAG 1 FS/PP/IROD process will be accomplished by the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities
- Feasibility Study Development
- Feasibility Study Operable Unit Coordination
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities.

Descriptions of the scope of each activity and the assumptions used for preparing the cost assessment are presented below.

22.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA Report are presented in the following sections. The FS/EA Report will generally follow the format in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, October 1988 (USEPA 1988).

The cost assessments made for the FS WBS elements were based on the following assumptions:

- The RI Report and FS process will be completed as scheduled.
- The RI Report results are representative of the actual site conditions and adequately characterize the extent and amount of contamination in WAG 1.

22.2.2.1 Technology Screening Activities (6.1.01.49.03.01)

Based on the remedial objectives established under the ER Program, the RI Report findings regarding waste- and site-specific conditions, and a literature search, the FS Contractor will identify applicable remedial technologies from the available common and innovative technologies for initial evaluation. These technologies will be screened to eliminate those judged too difficult to implement based on unproven technologies, judged not able to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Those technologies judged to have a reasonable chance of success for remediating the specific waste or site conditions will be carried forward for more detailed development and analysis. A technical memorandum summarizing the findings of this task will be issued to DOE.

22.2.2.2 Alternatives Development and Analysis (6.1.01.49.03.02)

The FS Contractor will develop the screened technologies for analysis by arranging them into general RA alternatives. These alternatives will then be evaluated, either individually or as combinations of technologies, to eliminate those alternatives with costs significantly higher than similar alternatives, that fail to provide adequate protection of public health and safety and/or that may adversely impact the environment. A list of alternatives that meet the remedial objectives and contribute to the protection of public health, safety, and the environment will be formulated for further study. A technical memorandum summarizing the findings of this task will be issued to DOE for regulatory compliance assessment.

The following are assumptions considered in the development of the cost assessment for alternative development and analysis.

- Working group meetings will be held as needed with the regulatory agencies to discuss progress. Input and feedback from these meetings can be considered as consistent with the formal agency response.

- The regulatory agencies concur with the working group meetings and the results of the technology screening memo.

22.2.2.3 NEPA Environmental Activities (6.1.01.49.03.03)

To comply with DOE policy that NEPA criteria be considered during remedial activities, the remedial alternatives will be evaluated for their impact on the environment. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

The cost assessment for this element was based on the following assumptions:

- An EA of the site will be completed in order to evaluate the environmental effects of the RA.

- The Baseline Risk Assessment in the RI Report presents the primary contaminant and exposure pathways of concern and is complete enough to ensure that the results are compatible with the alternatives risk calculation methodology selected for the FS Report.

- All ecological risk assessment sampling activities are completed on schedule and are representative of the actual site conditions.

22.2.2.4 Feasibility Study Development (6.1.01.49.03.04)

The FS Contractor will use the format presented in the CERCLA FS guidance document to develop the FS, with exceptions and modifications for the specific wastes and conditions in the Contaminated Soils OU. The FS development will be based on the information obtained from the RI, the alternatives screening and analysis process, and the EA considerations. Using the list of applicable remedial alternatives, the FS will be developed in sufficient detail to allow the selection of a preferred alternative(s) that meets the remedial objectives of mitigating release of contaminants. Criteria will be developed to assess the ability of the alternatives to meet the remedial objectives and to comply with administrative and regulatory requirements. The FS is intended to perform a detailed evaluation of the alternatives to provide an informed risk management decision and the legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE and EPA for review. The final FS/EA Report is a milestone document required by the FFA.

22.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.49.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to support QC efforts, provide project management, and coordinate project activities to ensure that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS oversight participants.

22.2.2.6 Treatability Studies (6.1.01.49.03.06)

Treatability studies are to be conducted for the following technologies:

- Mercury Removal from Soils — Treatability Studies will be conducted to examine the effectiveness of mercury roasting for mercury-contaminated soils. The Y-12 Plant is proposing to construct facilities that may be also capable of processing ORNL contaminated soils.

- In-place stabilization of soils/sediments — Treatability studies will be required to properly evaluate the effectiveness of possible grout mixtures and to properly estimate the quantities and characteristics of stabilization agents and the equipment requirements for mixing.

22.2.2.7 Feasibility Study Oversight Activities (6.1.01.49.03.07)

The objective of FS oversight activities is to provide technical input and oversight during the FS/EA to ensure that the data and information obtained during the RI are incorporated properly into the FS/EA Report and that the report is adequate to prepare a PP and support the development of an IROD and a subsequent RD. FS oversight activities begin with the technology screening and are completed upon final approval of the FS/EA Report.

The following is a brief description of the responsibilities of each participant involved in FS oversight activities:

- RI Subcontractor — Provides technical oversight to assess whether or not the technologies considered and the remedial alternatives to be developed and evaluated are consistent with the RI report conclusions and determined risks.

- A-E Contractor — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RD approach and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial alternatives evaluated are consistent with the RA approach and are implementable at ORNL.

- MMES — Provides technical support and reviews the FS/EA process. Reviews progress reports and preliminary deliverables to ensure that the FS/EA is proceeding as scheduled.

- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of FS/EA activities, technical advice, and an independent technical review of the FS/EA Report.

22.2.3 Proposed Plan

22.2.3.1 Proposed Plan Development (6.1.01.49.04.01)

The PP to remediate the site will be prepared using the preferred remediation alternative(s) to mitigate release of contaminants as selected in the FS/EA Report and using input from the regulatory agencies and the public. The PP documents the investigation process, administrative and regulatory actions, and the actions and schedule necessary to implement the remediation alternative(s) and to monitor performance. The PP is a primary milestone document that is subject to public review and response and to administrative and regulatory reviews.

The cost assessment for this element was based on the following assumptions:

- The FS process will be completed as scheduled in Fig. 22.6.

- The regulatory review cycle will meet the schedule shown in Fig. 22.6.

22.2.3.2 Proposed Plan Oversight Activities (6.1.01.49.04.02)

The purpose of the PP oversight activities is to provide technical input and oversight during the development of the PP and to ensure that it is in compliance with applicable regulations and policies.

During the generation of the PP, the RI Subcontractor, A-E, and MMES will assess whether or not the preferred remedial alternative(s) to be proposed is consistent with the RI conclusions, Baseline Risk Assessment, and FS process. Progress reports and preliminary deliverables will be reviewed by the participants mentioned in Section 22.2.2.7 to ensure that the PP is proceeding as scheduled.

22.2.4 Interim Record of Decision

22.2.4.1 Interim Record of Decision Development (6.1.01.49.05.01)

The final step in the planning process to remediate WAG 1 Contaminated Soils OU will be the preparation of the IROD, the legal document that formally declares that the preferred remediation method(s) in the PP will mitigate releases and establishes the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a Decision Summary outlining the nature and extent of the contamination and the associated risks at WAG 1, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements; and (3) a Responsiveness Summary addressing the public comments obtained during the public review period and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency for review. The final IROD is a milestone document required by the FFA.

22.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.49.05.02)

During the development of the IROD document, MMES and the A-E Contractor will provide technical input and independent technical review to ensure that the IROD document is prepared in accordance with the FFA and in compliance with CERCLA. The technical review and oversight will also include the assessment of the IROD document's consistency with the RI Report conclusions, Baseline Risk Assessment, and FS/EA.

22.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the WAG 1 process are the scheduling and scoping of the activities. Minor changes in scheduling will have significant impacts on the labor cost of the project. If the schedule is modified, resulting in an extended total duration of the project, the total cost will increase significantly. The scope of the project will have a direct impact on labor allocations. If additional IRODs are required, the total cost of the WAG 1 project will increase. Other factors that increase the uncertainty of the budgetary assessments in this report include the following:

- Requirements for additional sampling activities.
- Extended review cycles initiated by the regulators.
- Program funding limitations across the DOE system.

22.2.6 Interfaces

Completion of the Contaminated Soils OU process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.
- DOE Orders — Provide for the management and regulation of hazardous wastes at DOE facilities.
- NEPA — Provides regulations that set the policies and goals for protecting environmental quality and establish the procedures to examine the impact that decisions on remediating may have on the environment.
- TDEC — Provides regulatory overview for Tennessee.
- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.

22.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the Contaminated Soils OU: an RD Work Plan, engineering studies as required, a Title I 30% design package, Title II 60% and 90% design packages, and final design reports. The risks and uncertainties and interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 22.7 , and the summary level schedule for these RD WBS elements is shown in Fig. 22.8. The cost assessment of $28,699,000 for performing this portion of the Contaminated Soils remediation activities summarized by WBS activity and FY is shown in Table 22.4.

22.3.1 Scope and Assumptions

The scope of the RD work for the remediation of the Contaminated Soils OU is the preparation of necessary design and supporting documents required for approval from DOE-OR, DOE-HQ, TDEC, and EPA and for implementation of all RA activities.

Details on the scope of work and assumptions associated with the RD work breakdown elements that the A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the Contaminated Soils RA are described in Chapter 4.0.

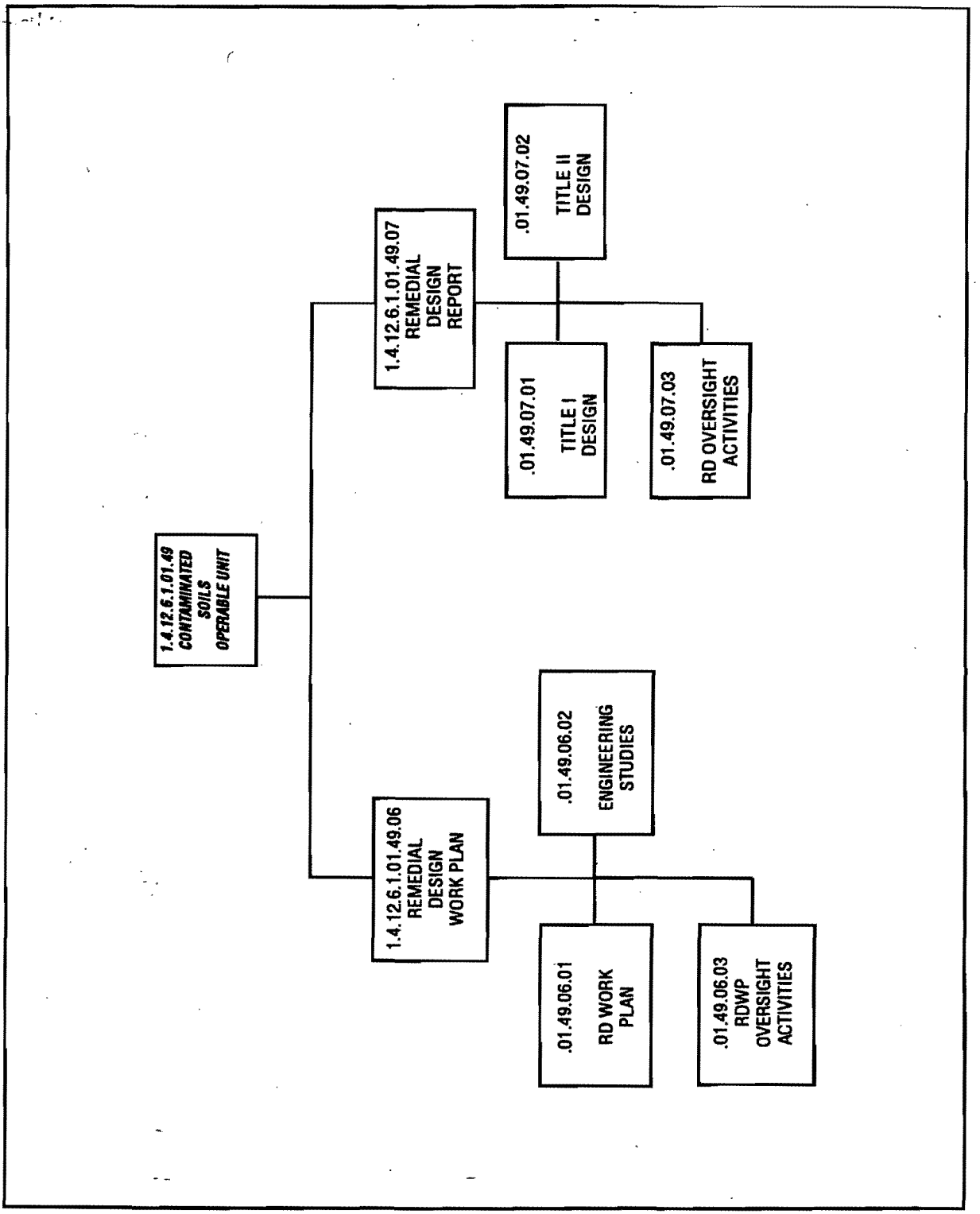


Fig. 22.7. Contaminated Soils OU RD Work Breakdown Structure.

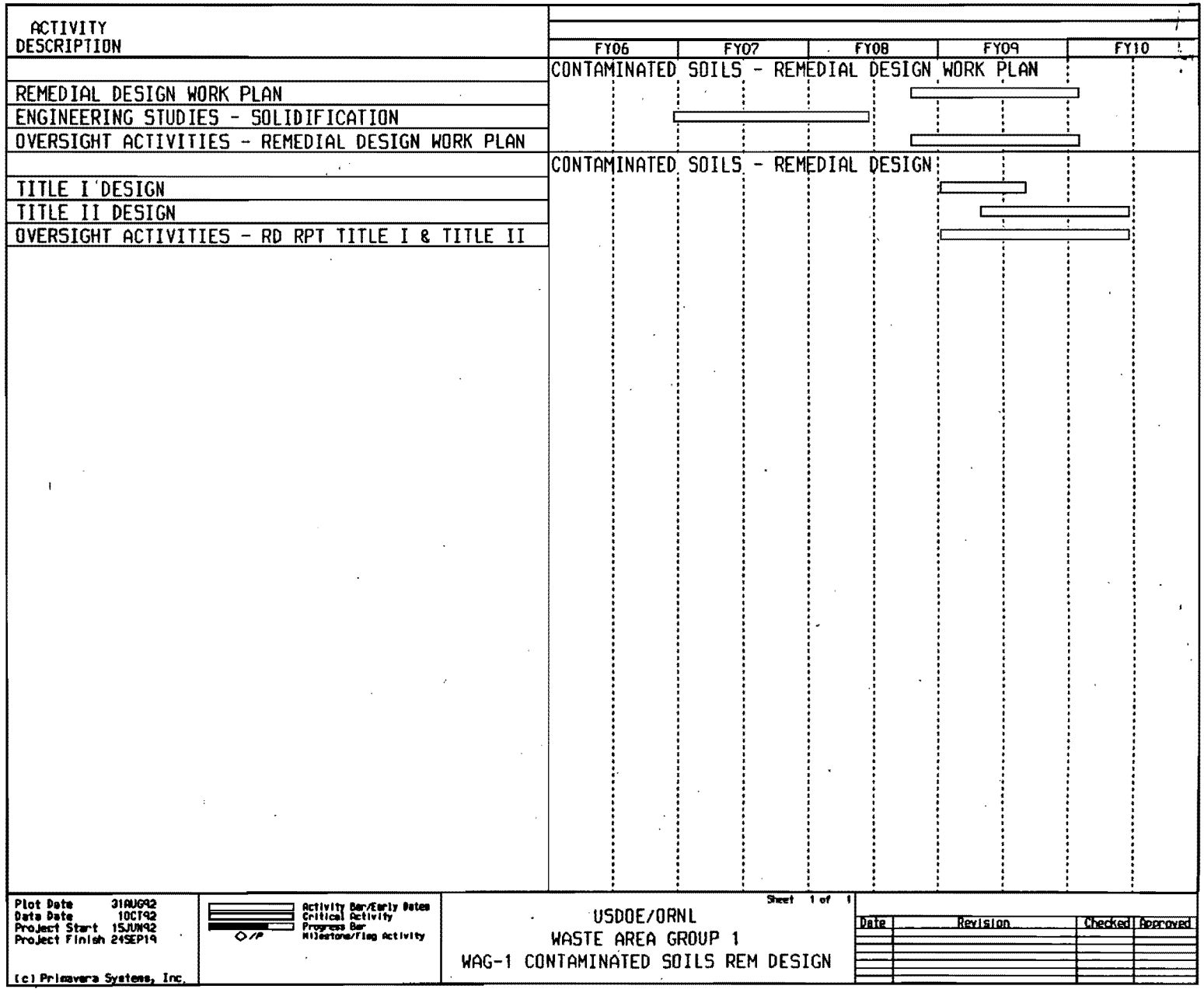


Fig. 22.8. Contaminated Soils OU RD Summary Level Schedule.

TABLE 22.4
WAG 1 Oper Unit 09 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2008	2009	2010	2011	2012	TOTAL
Remedial Design Work Plan	35	139	35	0	0	208
Engineering Studies	0	0	0	0	0	0
RD WP Oversight Activities	15	59	15	0	0	89
SUBTOTALS RD WP	50	198	50	0	0	297
Remedial Design Phase I Title I	0	12,027	0	0	0	12,027
Remedial Design Phase I Title II	0	6,930	5,097	0	0	12,027
Remedial Design Phase II Title I	0	0	0	0	0	0
Remedial Design Phase II Title II	0	0	0	0	0	0
RD Oversight Activities	0	3,050	1,298	0	0	4,348
SUBTOTALS RD	0	22,007	6,395	0	0	28,402
TOTALS	50	22,205	6,444	0	0	28,699

Figure 22.9 depicts the scheduling logic for completion of the RD effort required to support a construction start 15 months from IROD approval.

22.3.2 Remedial Design Work Plan

22.3.2.1 Remedial Design Work Plan (6.1.01.49.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The A-E will prepare a draft RD Work Plan based on the scope and design criteria specified in the PP and IROD documents. The RD Work Plan will include the following detailed design process activities:

- In situ stabilization of radiologically contaminated soils to provide institutional control and decay of intermediate-lived fission and activation products.
- Removal and treatment of mercury-contaminated soils.

22.3.2.2 Engineering Studies (6.1.01.49.06.02)

Prior to and during Title I design, research into recent advancements in remedial technologies and construction techniques and/or engineering studies on new equipment performance and effectiveness will be conducted as outlined in the RD Work Plan. These studies of various vendors and equipment available in the environmental market are required in order to narrow equipment options and select the most economical and technically superior methodologies that can achieve the remedy selected in the IROD for incorporation into the Title I and Title II designs.

22.3.2.3 Remedial Design Work Plan Oversight Activities (6.1.01.49.06.03)

Technical input will be provided during the preparation of the RD Work Plan to ensure that the design does not violate the intent of the IROD and will comply with the administrative and regulatory requirements. The RD Work Plan will be drafted by the RD Contractor with review being conducted by the FS Contractor, MMES, and DOE. Based on the logic shown in Fig. 22.9, the design effort will start after the RD Work Plan is prepared and will be nearly completed prior to EPA approval. Section 22.3.4 discusses risks and uncertainties associated with this strategy.

22.3.3 Remedial Design Report

22.3.3.1 Title I Design (6.1.01.49.07.01)

Based on information available from the RI/FS, the A-E Contractor will prepare preliminary (30%) design documents showing the extent of remedial activities, site plan details, and an outline of specifications for the work involved. A detailed cost estimate for the construction will be submitted with the 30% design document to MMES for their review, comments, and approval.

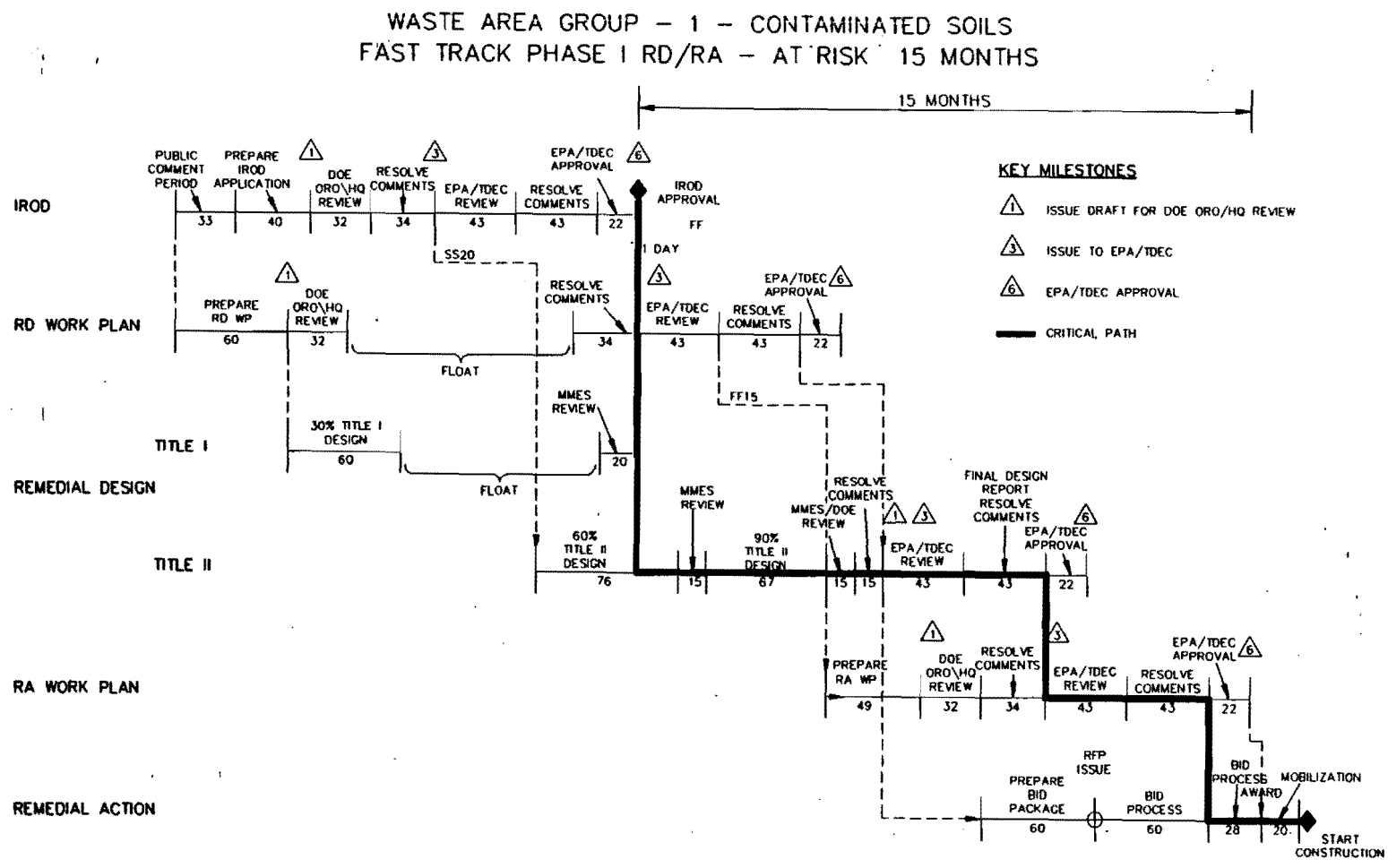


Fig. 22.9. Contaminated Soils OU Phase I Schedule Logic.

In order to support construction start within 15 months of IROD approval, Title I design must begin during the IROD preparation and approval process.

22.3.3.2 Title II Design (6.1.01.49.07.02)

Upon approval of the Title I design document, the A-E Contractor will prepare detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction; construction drawings; technical specifications; and cost estimates.

All the documents will be submitted to MMES for their comments at 60% completion. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and DOE. Upon resolution of these comments, the 100% design package will be issued to TDEC and EPA for further review, comment, and approval. Upon resolution of MMES, DOE, TDEC, and EPA comments, a Design Report for remedial activities will be prepared and issued for construction CFC.

The cost assessment for the Title I and Title II designs was developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Any additional design or permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Support facilities are available for personnel and equipment decontamination.
- A consolidation area (or other disposal facility) is available for disposal of wastes generated during remediation.

22.3.3.3 Remedial Design Oversight Activities (6.1.01.49.07.03)

Oversight will be provided throughout the remedial design process to ensure that the design does not violate the intent of the FFA, FS/EA, PP, or IROD. Reviews will be conducted by the FS Contractor, MMES, and DOE at the 30%, 60%, and 90% completion stages to provide assurance that the design complies with administrative policies and regulatory requirements.

22.3.4 Risks and Uncertainties

The primary risks and uncertainties associated with RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the remedial design and, therefore, cost.

- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have significant impact on RD and remediation work.

- The findings and conclusions in the final RI and FS/EA documents may impact the scope of RD work.

- Title II design is completed prior to approval of the RD Work Plan by EPA. EPA comments concerning the RD Work Plan could adversely impact completion of RD.

- Title II design begins prior to IROD approval by EPA. The risk is lessened by the fact that comments should be resolved prior to start of Title II design.

22.3.5 Interfaces

The RD documents required for the remediation of contaminated soils in WAG 1 will necessitate the coordination and close interface with the following:

- EPA — To provide regulatory overview during the RD process and approve all primary documents.

- TDEC — To provide state (Tennessee) regulatory overview during the RD process.

- DOE — To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management — To provide waste management overview of design considerations for waste generation, handling, and storage/disposal.

- MMES Technical Advisory Group — To provide technical overview support during the RD process, specifically pertaining to engineering studies and design criteria.

- Groundwater WAG Team.

- ORNL Groundwater Program.

- MMES ES&H — To provide input and overview for the ES&H aspects for implementation of design.

- RA Construction Manager — To provide constructibility reviews of design.

22.4 REMEDIAL ACTION

This section presents the scope of the RA activities required to implement in situ stabilization and capping of contaminated soils in WAG 1. The risks and uncertainties and interfaces for the remedial activities are identified as well.

The WBS developed for performing the RA is presented in Fig. 22.10, and the summary level schedule for these RA WBS elements is shown in Fig. 22.11. The cost assessment of $72,422,000 for performing this portion of the WAG 1 OU9 remediation activities summarized by WBS activity and FY is shown in Table 22.5.

22.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan, construction management, Title III services, RD construction, construction support, and independent certification and verification that includes monitoring and a 5-year review.

22.4.2 Remedial Action Work Plan

22.4.2.1 Remedial Action Work Plan (6.1.01.49.08.01)

The RA Construction Manager will prepare the draft RA Work Plan, which defines the scope and objectives of the RA based on the IROD and Final Remedial Design; documents the specific construction components of the RA; and presents the RA schedule, subcontracting strategy, QA Plan, Health and Safety Plan, and RA Monitoring Plan.

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

22.4.2.2 Remedial Action Work Plan Oversight Activities (6.1.01.49.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA Work Plan. During the preparation of the draft RA Work Plan, MMES and the A-E responsible for the approved design report will provide necessary coordination and review the Work Plan to ensure that the proposed construction efforts will implement the IROD as presented in the final RD reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

22.4.3 Remedial Action

22.4.3.1 Remedial Action Integration (6.1.01.49.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E and construction support as required.

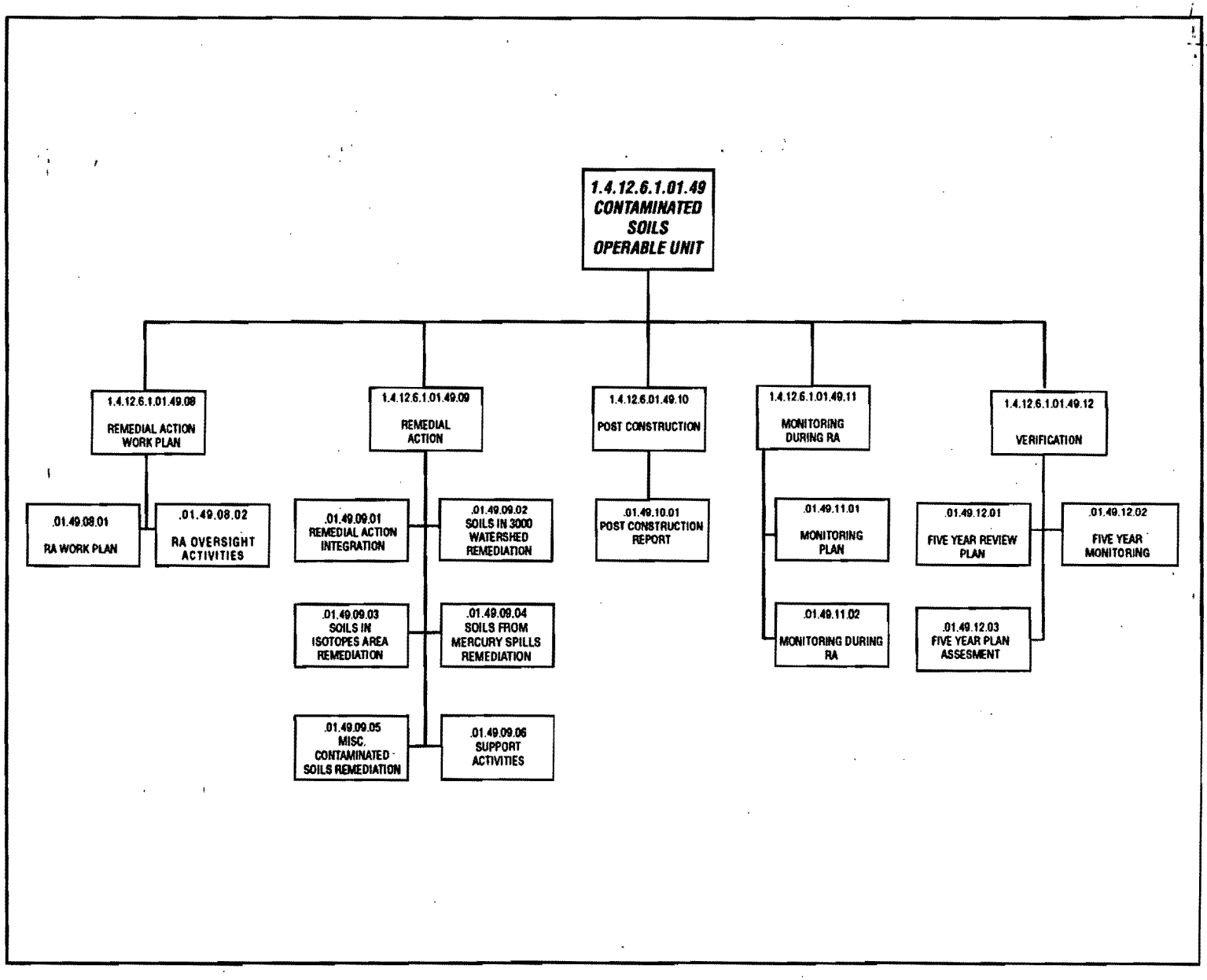


Fig. 22.10. Contaminated Soils OU RA Work Breakdown Structure.

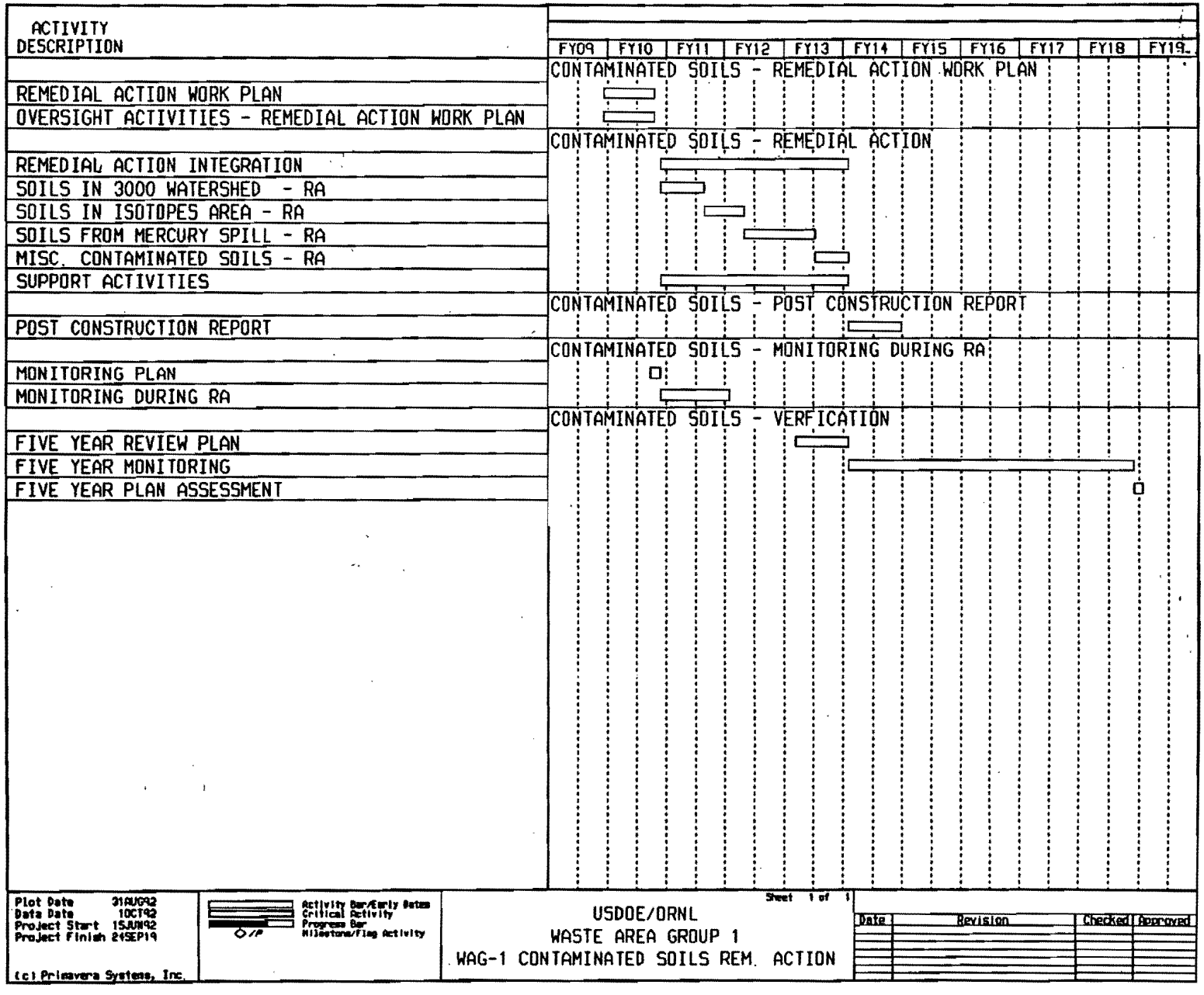


Fig. 22.11. Contaminated Soils OU RA Summary Level Schedule.

TABLE 22.5
WAG 1 Oper Unit 09 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)											
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	TOTAL
RA Work Plan	27	422	0	0	0	0	0	0	0	0	0	450
RA WP Oversight Activities	15	161	0	0	0	0	0	0	0	0	0	176
SUBTOTALS RA WP	42	583	0	0	0	0	0	0	0	0	0	625
RA Integration	0	713	3,270	4,130	3,725	718	0	0	0	0	0	12,556
Remedial Action	0	816	11,733	16,714	24,941	2,076	0	0	0	0	0	56,280
Post Construction Report	0	0	0	0	0	85	0	0	0	0	0	85
Monitoring During RA	0	110	259	65	0	0	0	0	0	0	0	434
Verification	0	0	0	0	78	431	411	411	411	555	144	2,442
SUBTOTALS RA	0	1,639	15,262	20,909	28,743	3,310	411	411	411	555	144	71,797
TOTALS	42	2,222	15,262	20,909	28,743	3,310	411	411	411	555	144	72,422

RA integration for remedial activities includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

22.4.3.2 Soils in 3000 Watershed (6.1.01.49.02)

The 3000 Watershed Soils Area within the Contaminated Soils OU consists of the soils in the central portion of the WAG, from the northern edge of WAG 1 to the southern edge, bounded by Third Street to the west, and extending one block to the east. The soils are contaminated with various radionuclides from suspected leaks and/or spills, as indicated by radiological survey data. The remedial action assumed by the Observational Approach Workshop for this portion of the Contaminated Soils OU is containment and consolidation. This cost assessment assumes that a percentage of the soils within the 3000 Watershed be treated in situ by grouting, followed by placement of a single-layer cap. The cap will reduce infiltration of precipitation and, therefore, will lessen the potential for contaminant migration. Since a number of buildings are within this area, substantial coordination with D&D activities within the main plant area is required.

Stabilization of the contaminated soils could be achieved by mixing an estimated 10% grout mixture in-place using a mixing device suspended from an overhead crane. The process is similar to that discussed earlier for the Surface Impoundments OU, and treatment of soils will enhance the immobilization of radiological contaminants and, therefore, will lessen hydrologic transport to other environmental media.

22.4.3.3 Soils in Isotope Circle Area (6.1.01.49.03)

The Isotope Circle Area is located in a two-block area just east of the North Tank Farm and is occupied by a number of buildings. Soils are believed to be contaminated primarily with ^{137}Cs, ^{90}Sr, and uranium isotopes from various isotope research programs within the surrounding buildings. The remedial action assumed by the Observational Approach Workshop is the same for this area as for the soils in the 3000 Watershed Area. The cost assessment assumes that a percentage of contaminated soils will be stabilized by grouting, followed by placement of a single-layer cap. Coordination with D&D activities is required as remediation progresses.

22.4.3.4 Soils from Mercury Spills (6.1.01.49.04)

This portion of the Contaminated Soils OU currently consists of four distinct locations in the southeastern corner of WAG 1 where spills of mercury have occurred. Two of the spill areas are beneath occupied buildings, thus requiring close coordination with D&D activities. The cost assessment assumes that the mercury-contaminated soils are removed after the buildings have been decommissioned and removed from the site. Other scenarios, such as removal of mercury-contaminated soils from beneath buildings with the buildings remaining in their current location, were not considered in the cost assessment; but they provide possible alternatives to building removal. Two other spill areas are isolated from the above areas, one located along the south side of Building 3592 and the other beneath the roadway just south of Building 3503. Other areas of significant mercury contamination (taken from concentration maps contained in the draft SCSR) were assumed to require removal and treatment as well. As the RI proceeds, additional mercury-contaminated areas may be located and added to the areas discussed above. Some uncertainty exists as to whether or not the mercury-contaminated soils are co-contaminated with isotopes containing fission products.

Mercury-contaminated soils will be excavated, placed in B-25 boxes, and transported to the Y-12 facility for treatment. The treatment process is assumed to be low temperature thermal desorption, which will volatilize and remove mercury contained within the soils. The cost assessment assumes that a facility at Y-12 (termed a Mercury Roaster) is constructed and has adequate capacity to treat the mercury-contaminated soils at ORNL. The facility at Y-12 currently does not plan to process soils co-contaminated with fission products, so the soil is assumed to undergo a process of fission product removal at the Waste Examination Assay Facility located at SWSA 5 prior to thermal desorption treatment. After treatment at Y-12, the soils would be returned to ORNL and disposed along with the residue from the fission product removal process in the WAG 1 consolidation facility. Areas where contaminated soils were removed would be backfilled with clean soil and capped.

22.4.3.5 Miscellaneous Contaminated Soils (6.1.01.49.05)

This portion of the Contaminated Soils OU represents a "catch-all" for those contaminated soils remaining after the other portions of this OU are performed. These soils are located in the northwest corner of WAG 1, are scattered along the northwestern border and western half of WAG 1, and are located in the south central area east of the Surface Impoundments. A number of facilities may have contributed to soil contamination within this area, and these include steel tanks and existing process buildings. The remedial action assumed by the Observational Approach Workshop is the same for this area as for the soils in the 3000 Watershed Area. The cost assessment assumes that a percentage of contaminated soils will be stabilized by grouting, followed by placement of a single-layer cap. Coordination with D&D activities is required as remediation progresses.

Additional activities assumed for the cost assessment for all portions of this OU include removal and disposal of pavement and sidewalk, equipment decontamination, erosion control, revegetation, and PPE. Additional costs have been included for radiologically contaminated soil

assay for material accountability prior to extraction of fission products. It should be noted that site characterization is currently ongoing, and there is uncertainty regarding the volume of contaminated soil estimated for this cost assessment.

22.4.3.6 Support Activities (6.1.01.49.06)

During the RA activities, MMES will provide the necessary staff and support to operate and maintain the personnel and equipment decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities and leachate from the Consolidation Area to the PWTP for further treatment.

22.4.4 Post Construction

22.4.4.1 Post Construction Report (6.1.01.49.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, completion of construction activities, and effectiveness of selected remedies. MMES and the Construction Manager will be responsible for the following activities to prepare the Post Construction Report.

- Conduct a site inspection with EPA and TDEC to determine whether or not the RA is complete and consistent with the agency-approved remedies and to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

  - brief re-cap of site description, chronology of major events, and the selected remedies;

  - explanation of construction activities, modifications, performance standards, and QC; and

  - explanation of operation and maintenance, including monitoring to be undertaken at the site.

22.4.5 Monitoring During Remedial Action

22.4.5.1 Monitoring Plan (6.1.01.49.11.01)

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program to determine the impact of construction activities and the effectiveness of the remediation conducted.

22.4.5.2 Monitoring During Remedial Action (6.1.05.49.11.02)

MMES will implement an Environmental Monitoring Program that will accomplish the following:

- Start 1 month prior to start of construction in order to establish the baseline.
- Be conducted during the various RA activities to document the impacts of remedial activities.
- Continue until the RA is completed to assess the effectiveness of the remedies implemented and provide data for the Post Construction Report and Five-Year Review Plan.
- Generate routine monitoring reports with analytical results.

22.4.6 Verification

22.4.6.1 Five-Year Review Plan (6.1.05.49.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s), then, in accordance with CERCLA and the FFA, an RA Assessment Plan is required in order for the EPA and TDEC to review the RA no less than once every 5 years after the initiation of the final RA(s) to ensure that human health and the environment are protected by the RA(s) being implemented. Because contaminants will remain after remediation, the A-E Contractor and MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity and status of the RA(s) implemented.

22.4.6.2 Five-Year Monitoring (6.1.05.49.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program, to determine the impact of construction activities and the effectiveness of remediation. The results shall be documented in the monitoring reports, which will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of ORNL.

22.4.6.3 Five-Year Plan Assessment (6.1.05.49.12.03)

The data obtained during the 5 years of monitoring will be analyzed. The status of the RA(s) implemented will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, the Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether or not the RA(s) implemented are still

complying after 5 years with the intent and criteria established in the IROD and current regulations and policies.

22.4.7 Risks and Uncertainties

- It is uncertain if the grouting process of contaminated soils will be obstructed by the complex network of underground utilities and LLW transfer lines. If stabilization is not completed thoroughly, hydrologic pathways may still exist, providing a means for radiological transport.

- Remedial action levels for in situ stabilization need to be reexamined to determine risk levels of possible off-site migration to protect human health and the environment.

- The LLW Lines and LLW Storage Tanks that have had leakage have contaminated soil. Additional sampling should extensively characterize waste classifications to determine waste type (radioactive, mixed, or hazardous chemical waste). Co-contaminated waste may have been generated by underground pathways which may require alternative treatment technologies.

- It is assumed that the mercury-contaminated soil may contain radionuclides, which require extraction prior to thermal desorption.

- The thermal desorption process for mercury removal is assumed to be a effective treatment alternative. This process is laboratory-tested and has not yet been successfully field-tested.

- Any changes in the RD due to the risks and uncertainties mentioned in Section 22.3.4 will have a direct effect on remediation cost.

- Costs for remediating mercury-contaminated soils do not include capital costs for a new mercury roasting facility, nor are any costs assumed for upgrades of any existing facility to meet air regulations. The cost of $84/ton assumes a unit capable of processing 750,000 yd^3 of material. The amount of material estimated for WAG 1 mercury-contaminated soil is approximately one order of magnitude less than 750,000 yd^3. It is therefore assumed that the processing facility will be available to process contaminated soil from other DOE plants in Oak Ridge and that the $84/ton cost is valid for this estimate.

- Additional remediation will be needed if the RA proves unsuccessful.

22.4.8 Interfaces

During remediation activities, interface and coordination with the following agencies will be necessary:

- EPA — To provide regulatory overview during the RA process, approve all primary documents, and conduct routine inspections.
- TDEC — To provide state (Tennessee) regulatory overview during the RA process and conduct routine inspections.
- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES D&D — To provide input and overview for the decontamination and decommissioning of radioactive-handling facilities.
- MMES Waste Management — To provide waste management overview and support throughout the RA process by focusing on the minimization of RA-generated wastes, providing the capability to process the wastes generated, and providing support for process treatment of contaminated soils.
- MMES Technical Advisory Group — To provide technical overview support during the RA process, specifically pertaining to monitoring and field change requests.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H — To provide input and overview for the ES&H aspects of conducting the RA.
- MMES Construction Support.
- MMES Title III Services (includes Inspection Services).
- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.
- Independent Certification Contractor.

22.4.9 Contingent Action

The contingent action discussed in this section is assumed in the event that the base action discussed in this chapter cannot be implemented due to technical, regulatory, or political constraints. The contingent action would be the excavation of soils and disposal as mixed waste.

23.0 WAG 1 STEEL TANK SYSTEMS OPERABLE UNIT

This chapter presents the scope and assumptions, risks and uncertainties, and interfaces for the Steel Tank Systems OU activities: RI, FS/PP, IROD, RD, and RA. The WBS developed for the Steel Tanks OU is presented in Fig. 23.1. The summary level schedule for the WAG 1 Steel Tanks OU is shown in Fig. 23.2. The cost assessment of $12,347,000 for the Steel Tanks OU is presented by remediation phase and FY in Table 23.1. TCFs were used to estimate the costs for the RI/FS, as discussed in Chapter 14.0.

23.1 PHASE II REMEDIAL INVESTIGATION

This section presents the scope of the RI activities required to prepare an RI Work Plan, conduct the field investigations, analyze data, perform a Baseline Risk Assessment, prepare an RI Report, and perform a preliminary screening of alternatives for the 16 inactive tanks in the Steel Tank Systems. The risks and uncertainties and interfaces for the RI are identified as well.

The WBS developed for performing the RI is presented in Fig. 23.3. The summary level schedule for the RI WBS elements is shown in Fig. 23.4. The cost assessment of $1,240,000 for performing the RI is presented by WBS activities and FY in Table 23.2.

23.1.1 Scope and Assumptions

The primary assumption for the additional RI effort is that only an RI Report and an evaluation of alternatives is required to provide for the evaluation of the potential impact to human health and the environment specific to this OU. The Steel Tanks OU consists of the following inactive waste storage tanks located within WAG-1: H-209, T-30, TH-2, W-19, W-20, WC-1, W-15, WC-17, 3001-B, 3001-S, 3002-A, 3003-A, 3004-B, and 3013. Therefore, no additional RI data will be collected, so no RI tasks associated with field investigation are required.

23.1.2 Operable Unit Specific Remedial Investigation Work Plan

No additional work is anticipated for this WBS element.

23.1.2.1 Planning (6.1.01.50.01.01)

No additional work is anticipated for this WBS element.

23.1.3 Operable Unit Specific Remedial Investigation Report

No additional work is anticipated for this WBS element.

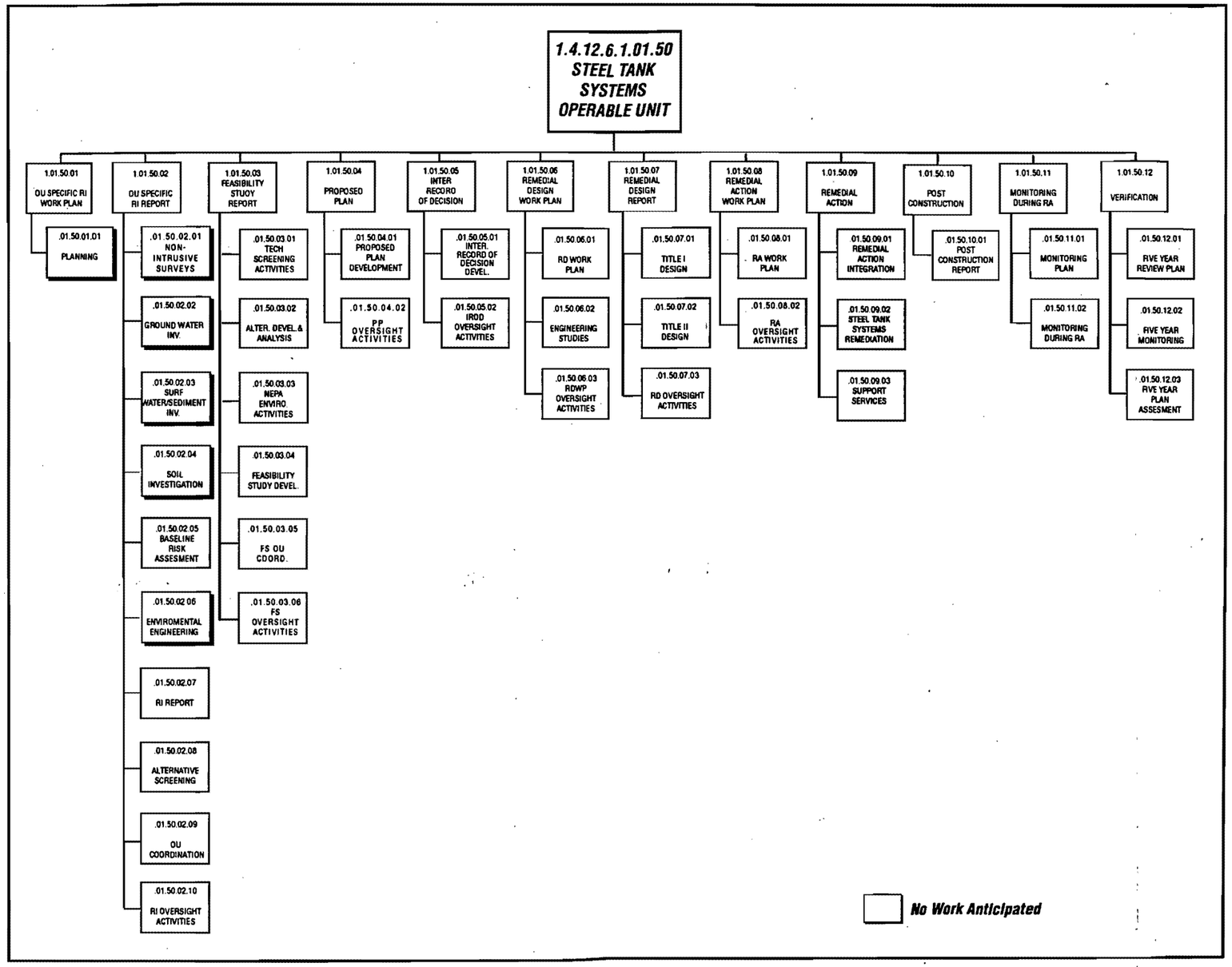


Fig. 23.1. Steel Tanks OU Work Breakdown Structure.

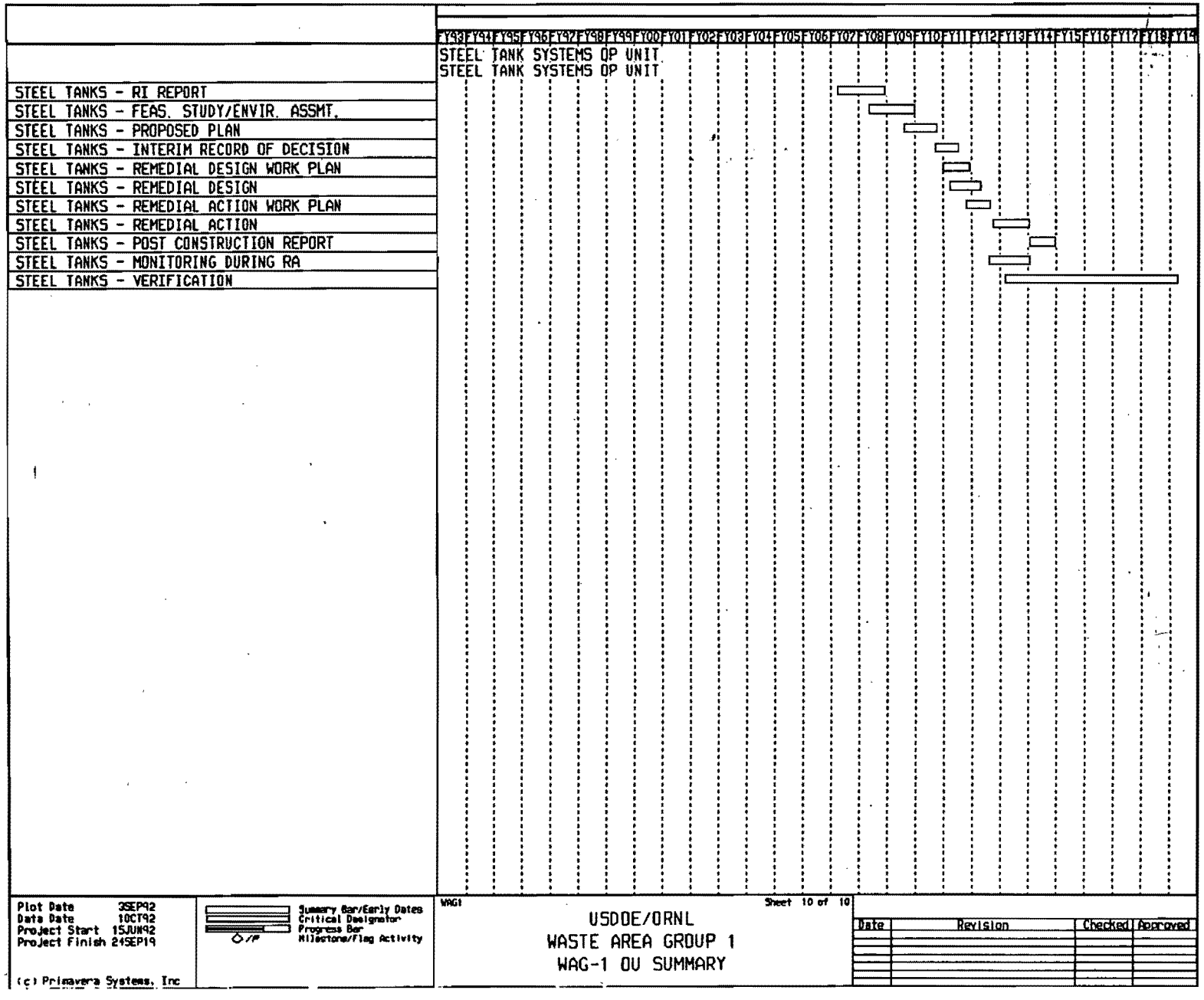


Fig. 23.2. Steel Tanks OU Summary Level Schedule.

TABLE 23.1
WAG 1 Oper. Unit 10 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)														
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Remedial Investigation	550	690	0	0	0	0	0	0	0	0	0	0	0	0	1,240
Feasibility Study/IROD	0	780	856	334	65	0	0	0	0	0	0	0	0	0	2,036
Remedial Design	0	0	0	0	1,704	189	0	0	0	0	0	0	0	0	1,893
Remedial Action	0	0	0	0	58	782	3,990	726	313	313	313	313	367	0	7,178
TOTALS	550	1,471	856	334	1,827	971	3,990	726	313	313	313	313	367	0	12,347

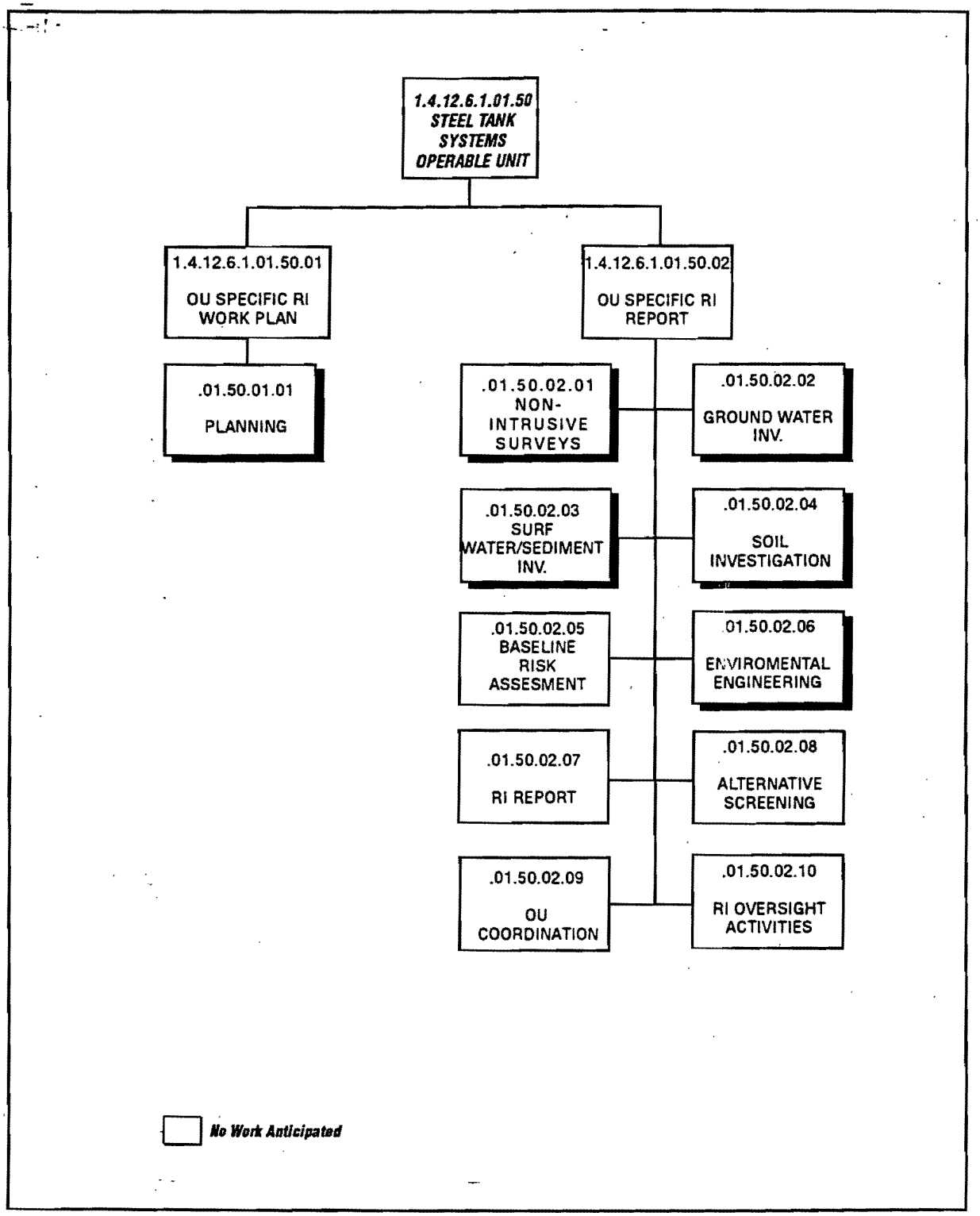


Fig. 23.3. Steel Tanks OU RI Work Breakdown Structure.

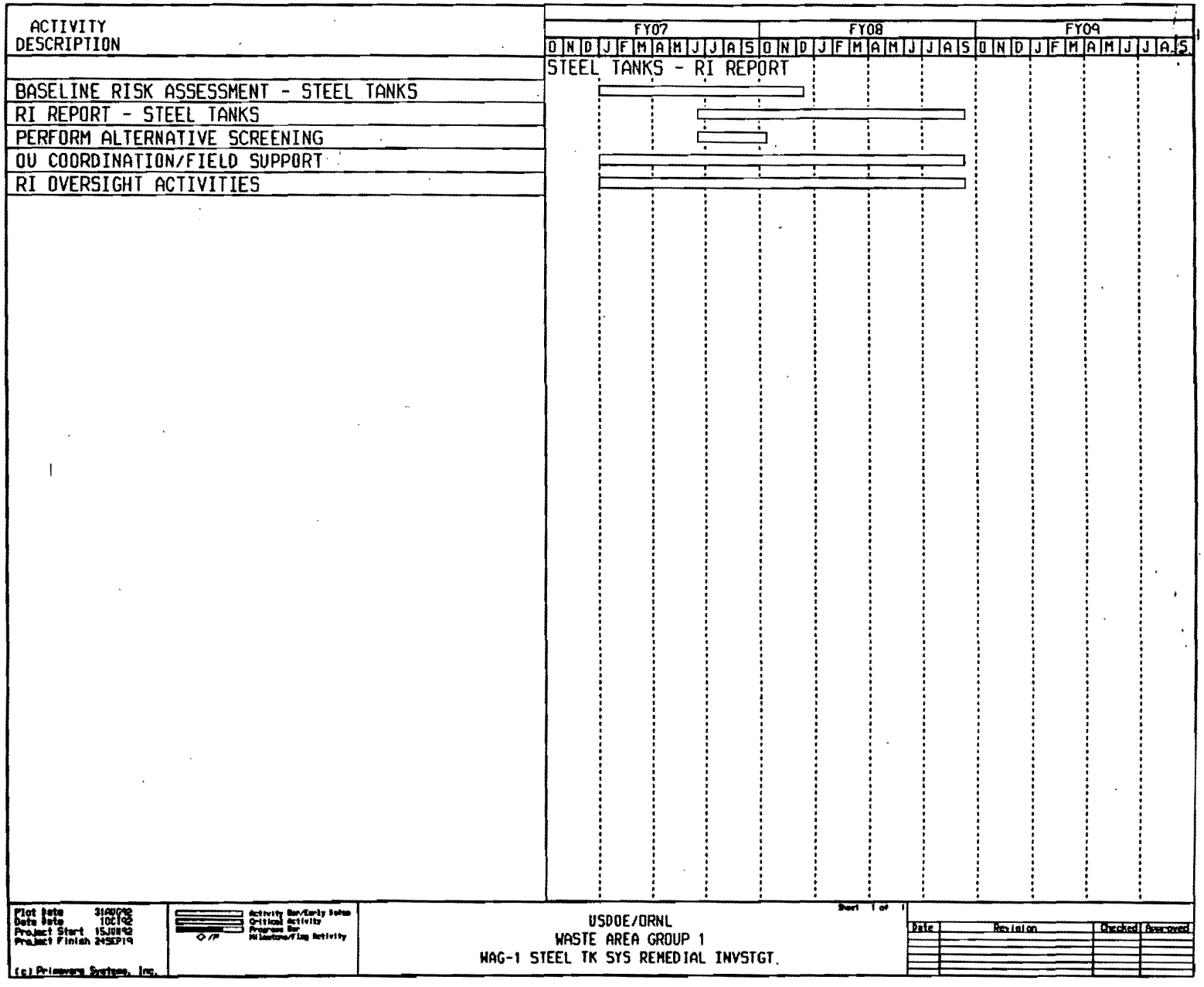


Fig. 22.4. Steel Tanks OU RI Summary Level Schedule.

TABLE 23.2
WAG 1 Oper. Unit 10 RI Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	2007	2008	2009	2010	TOTAL
Planning	0	0	0	0	0
Nonintrusive Surveys	0	0	0	0	0
GW Investigation	0	0	0	0	0
SW/SED Investigation	0	0	0	0	0
Soil Investigation	0	0	0	0	0
Baseline Risk Assess.	87	29	0	0	116
Environ. Engineering	0	0	0	0	0
RI Report	82	164	0	0	247
Alternative Screening	13	7	0	0	20
RI OU Coordination	173	231	0	0	405
RI Oversight Activities	194	259	0	0	453
TOTALS	550	690	0	0	1,240

23.1.3.1 Nonintrusive Surveys (6.1.01.50.02.01)

No additional work is anticipated for this WBS element.

23.1.3.2 Groundwater Investigation (6.1.01.50.02.02)

No additional work is anticipated for this WBS element.

23.1.3.3 Surface Water and Sediment Investigations (6.1.01.50.02.03)

No additional work is anticipated for this WBS element.

23.1.3.4 Soils Investigation (6.1.01.50.02.04)

No additional work is anticipated for this WBS element.

23.1.3.5 Baseline Risk Assessment (6.1.01.50.02.05)

A Screening-Level Risk Assessment for the Steel Tanks will be performed and will consist of two elements: a human health evaluation and a baseline environmental evaluation. The human health evaluation will provide an assessment of potential human health risks associated with the Steel Tanks for current and future exposure scenarios. The objectives of the environmental evaluation are to determine whether or not the Steel Tanks OU poses a current or potential future risk to environmental resources in the absence of any remediation and to provide information to evaluate the relative environmental impacts of remedial alternatives on the environment.

The Screening-Level Risk Assessment will be submitted as a secondary document for EPA and TDEC review and then will be presented as a section of the Steel Tanks OU RI Report.

23.1.3.6 Environmental Engineering (6.1.01.50.02.06)

No additional work is anticipated for this WBS element.

23.1.3.7 Remedial Investigation Report (6.1.01.50.02.07)

The Steel Tanks RI Report will serve as documentation of data collection and analyses in support of the Steel Tanks FS. The results of the RI are presented as an analysis of site characteristics and the risk associated with such characteristics (see element definition for Screening-Level Risk Assessment) and a summary of potentially feasible RAs (see element definition for Alternatives Screening). The evaluation of site characteristics will focus on the site physical characteristics, the source characteristics, the current nature and extent of contamination, and important fate and transport mechanisms that can be used to predict contaminant concentrations at potential exposure points.

Prior to the issuance of the draft Steel Tanks RI Report, a draft determination of the ARARs will be submitted to EPA and TDEC. These agencies shall confer with DOE to identify and propose all potential ARARs pertinent to the Steel Tanks remediation.

The draft Steel Tanks RI Report will be produced for review by ORNL, DOE, EPA, and TDEC. The RI report will consolidate available, appropriate, and applicable data on the Steel Tanks OU and will summarize technical work completed to-date on the project.

Since no additional (Phase II) field work is proposed for this OU, the primary basis or reference for the RI Report will be the WAG 1 Site Characterization Summary Report to be issued in September 1992.

23.1.3.8 Alternatives Screening (6.1.01.50.02.08)

Preliminary development and screening of remedial alternatives will consist of the following steps:

1. Develop RA objectives specifying the contaminants and media of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed.

2. Develop general response actions for each medium of interest that may be taken to satisfy the RA objectives for the site.

3. Identify volumes or areas of media to which general response actions might be applied.

4. Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the site.

5. Identify and evaluate technology process options to select a representative process for each technology type retained for further consideration.

6. Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

23.1.3.9 Operable Unit Coordination (6.1.01.50.02.09)

Activities include quality control and project management and coordination. These activities will ensure that quality, cost, and scheduling goals are achieved. The activity coordination does not include those activities that support multiple OUs that are tracked through the project support work element. These activities include project management, project control, and administration support.

Data Management Services will be provided including general report programming, database management, and database interface with MMES. QA/QC will be performed using the home office staff necessary to perform and manage QA/QC activities. This effort includes project audits, responses to MMES audits, procedural reviews, training records, and other general QA/QC activities.

23.1.3.10 Remedial Investigation Oversight Activities (6.1.01.50.02.10)

This element provides technical support, input, and oversight to ensure that the data and information obtained during the field investigation are adequate to perform the FS/EA, RD, and RA. RI oversight activities begin with the field investigation and are completed upon final approval of the associated technical memoranda.

The following briefly describes the oversight roles of the various participants:

- FS Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the FS/EA.
- A-E Contractor — Provides technical oversight to ensure that the engineering data are developed in a manner consistent with the RD approach and design requirements.
- MMES Field Maintenance — Provides support for health and safety, environmental compliance, and waste management as a part conducting the RI field activities.
- MMES Environmental Sciences Division — Provides support for drilling.
- MMES Planning/Coordination — Provides necessary permits for RI field activities.
- MMES Technical Advisory Group — Provides technical support by appropriate disciplines for oversight of RI activities.

23.1.4 Risks and Uncertainties

Delays in the review of the WAG 1 Site Characterization Report and OU Strategy Document is an area of risk and uncertainty associated with the performance of the RI that would impact the initiation of the risk assessment and screening of alternatives.

23.1.5 Interfaces

The following describes the primary interfaces and anticipated roles during the RI:

- MMES Technical Advisory Group — To provide technical overview support during the RI process, specifically pertaining to overall approach, validity of data collected, and calculation of risks.

- MMES Project Management — To provide overall project management support during the RI process to ensure that MMES RI goals are achieved.

- FS Contractor — To provide data review support to the RI relative to its sufficiency to support the FS/ROD process.

- EPA — To provide regulatory overview during the RI process and approve all primary documents.

- TDEC — To provide state (Tennessee) regulatory overview during the RI process.

- DOE - To provide NEPA regulatory oversight, agency (DOE) management support, appropriate fiscal funding support, and program direction.

23.2 FEASIBILITY STUDY/PROPOSED PLAN/INTERIM RECORD OF DECISION

This section presents the scope for performing the FS/PP/IROD process for the Steel Tank Systems OU, which currently contains 16 inactive waste storage tanks dispersed throughout WAG 1. This process includes incorporating environmental concerns into an EA within the FS Report. The associated risks and uncertainties and the interfaces for the FS efforts are also identified.

The WBS developed for performing the FS/EA and for preparing the PP and IROD is shown in Fig 23.5. The summary level schedule for the FS/PP/IROD WBS elements is shown in Fig 23.6. The cost assessment of $2,036,000 for performing the FS, PP, and IROD process is presented by WBS element and FY in Table 23.3.

23.2.1 Scope and Assumptions

The purpose of FS/PP/IROD conducted for the Steel Tanks OU activities is to identify, organize, and examine remedial alternatives; to mitigate the risks identified in the RI Report; to justify selection of a preferred remedial alternative or a set of alternatives; and to prepare the regulatory required decision documents summarizing the situation and examination process, outlining the selected remediation method(s), and establishing the remediation schedule.

The FS Contractor will be responsible for developing and completing the Steel Tanks OU FS/EA process, with initial support from the RI Subcontractor. The RI Subcontractor will be responsible for screening and developing groups of applicable remediation technologies and analyzing the various alternatives to provide a list of technologies deemed appropriate for further study. The FS Contractor will provide oversight of the RI Subcontractor during these activities to ensure that the screened and developed technologies are adequate and appropriate for use in the FS/EA. The FS/EA process will produce the following milestone documents: (1) the FS Report, which documents the process used to examine the remediation technologies and select the preferred remedial alternative(s) and which incorporates the environmental (NEPA) considerations into the EA portion

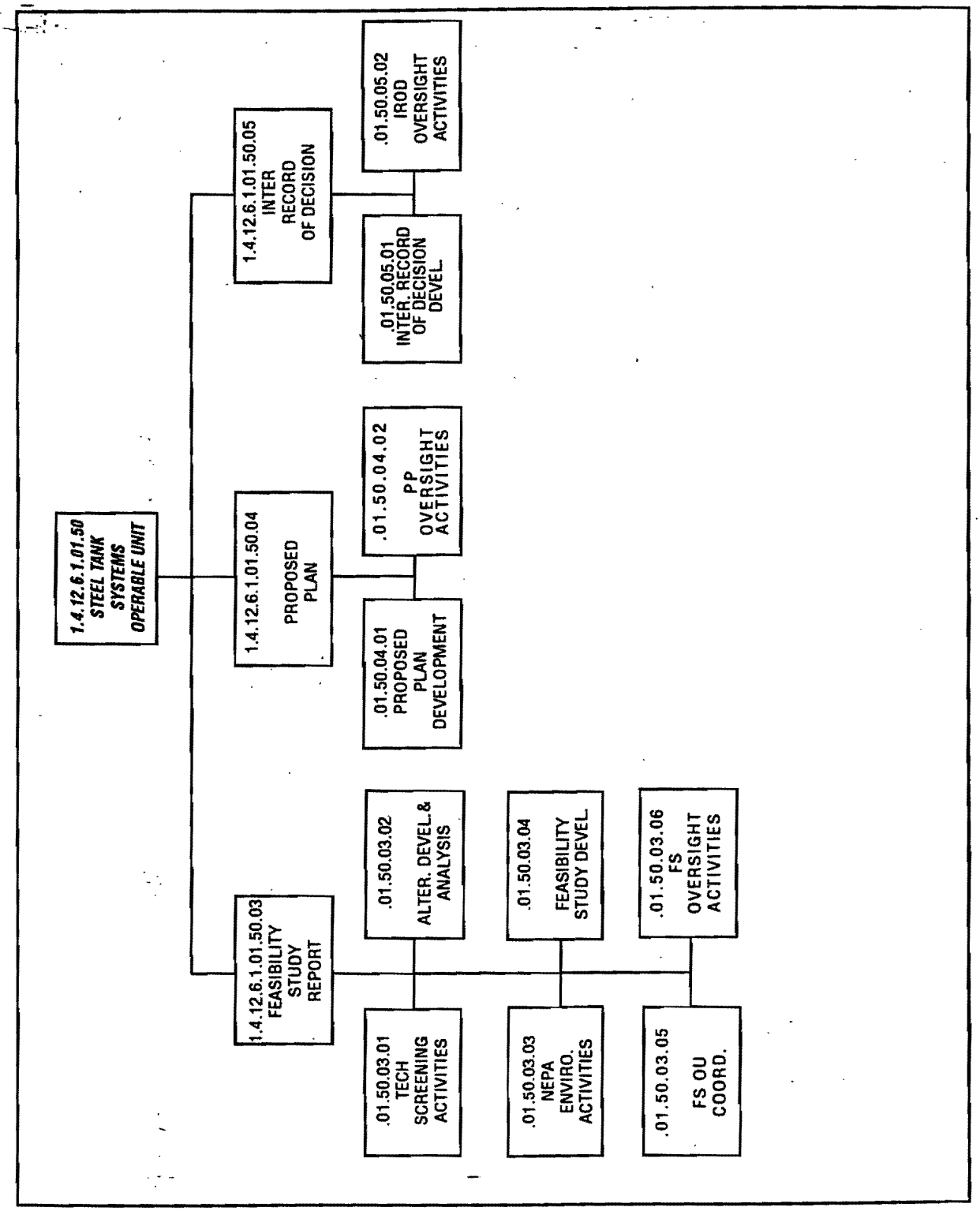


Fig. 23.5. Steel Tanks OU FS/PP/IROD Work Breakdown Structure.

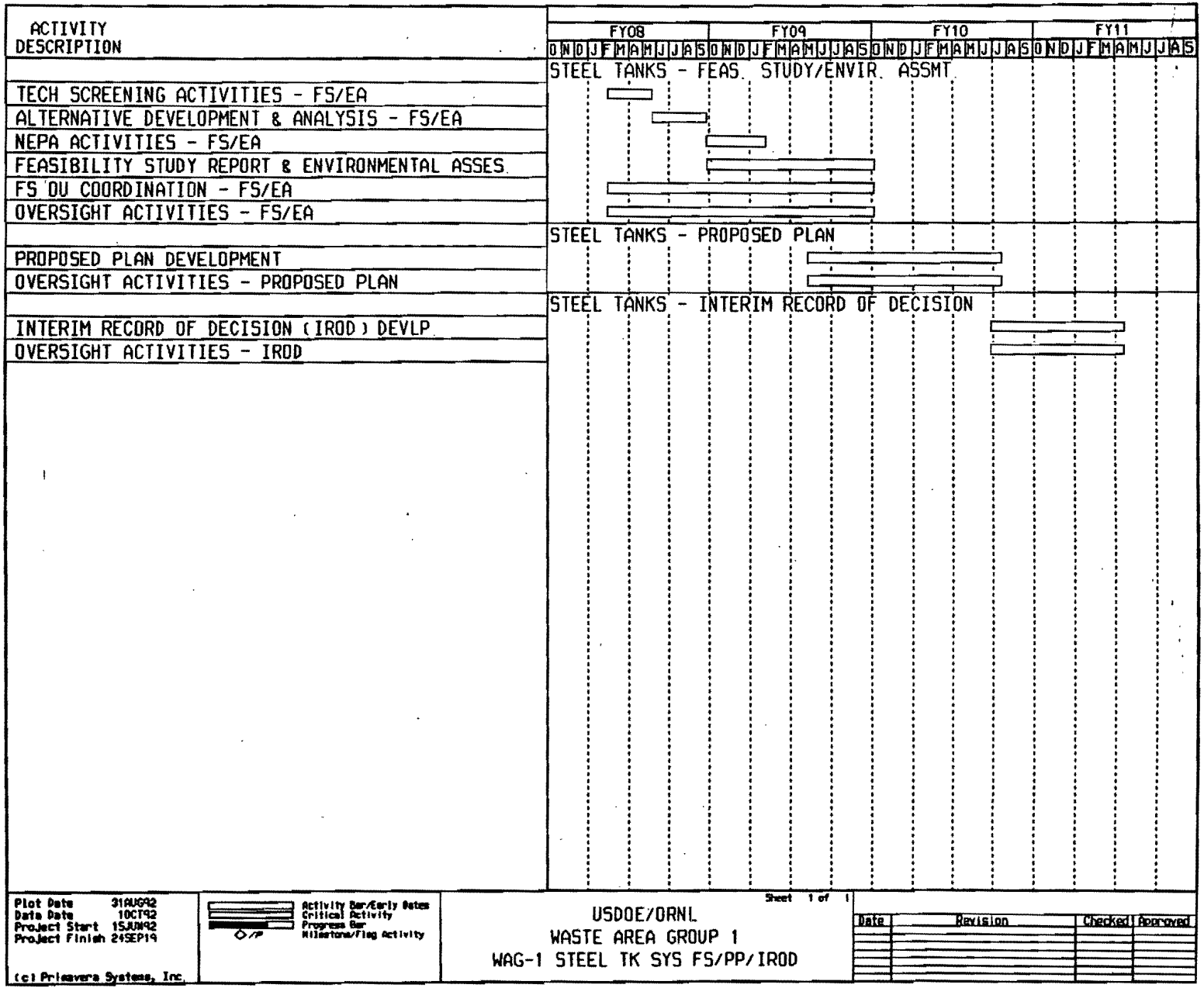


Fig. 23.6. Steel Tanks OU FS/PP/IROD Summary Level Schedule.

TABLE 23.3
WAG 1 Oper Unit 10 FS/PP/IROD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)					
	2008	2009	2010	2011	2012	TOTAL
Technology Screening	230	0	0	0	0	230
Alternatives Develop./Analysis	154	0	0	0	0	154
NEPA/Environmental Activities	24	48	0	0	0	72
Feasibility Study Development	98	393	98	0	0	589
FS OU Coordination	75	100	25	0	0	200
Treatability Study	0	0	0	0	0	0
FS Oversight	198	264	66	0	0	529
SUBTOTALS FS	780	806	189	0	0	1,775
PP Development	0	34	68	0	0	102
PP Oversight Activities	0	17	34	0	0	50
SUBTOTALS PP	0	51	102	0	0	153
IROD Development	0	0	27	40	0	67
IROD Oversight Activities	0	0	16	24	0	41
SUBTOTALS IROD	0	0	43	65	0	108
TOTALS	780	856	334	65	0	2,036

of the report to satisfy DOE orders; (2) the PP, a summary plan for implementing the selected remedial alternative(s) for the Steel Tank Systems OU; and (3) the IROD, the legal document stating that the selected remedial method(s) meets statutory and regulatory requirements and establishing the remediation schedule for this OU. The FS/EA preparation will consist of the following principal WBS elements:

- Technology Screening Activities
- Alternatives Development and Analysis
- NEPA Environmental Activities
- Feasibility Study Development
- Feasibility Study Operable Unit Coordination
- Feasibility Study Oversight Activities
- Proposed Plan Development
- Proposed Plan Oversight Activities
- Interim Record of Decision Development
- Interim Record of Decision Oversight Activities

Descriptions of the scope of each activity and the assumptions used for preparing the cost assessment are presented below.

23.2.2 Feasibility Study Report

The tasks necessary to conduct and produce the FS/EA are presented in the following section. The FS/EA Report will generally follow the format presented in the EPA document titled *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA,* October 1988 (USEPA 1988).

The cost assessments made for the elements were based on the following assumptions:

- The RI Report and FS process will be completed as scheduled.
- The RI Report results are representative of the actual site and tank conditions and adequately characterize the extent and amount of contamination at the Steel Tank Systems OU.

23.2.2.1 Technology Screening Activities (6.1.01.50.03.01)

Based on the remedial objectives established under the ER Program and RI Report findings regarding waste- and site-specific conditions, the RI Subcontractor will research and identify the applicable common and innovative remediation technologies available for preliminary consideration. These technologies will be screened to eliminate those judged too difficult to implement (based on unproven technologies), judged unable to remediate the site within a reasonable time period, and/or judged to have limited application for the specific waste or site conditions. Only those technologies judged to have a reasonable chance of success for remediating the tanks and the site will be carried forward to the next stage of the FS process. The RI Subcontractor will issue a technical memorandum to DOE to summarize these findings and document the research and the screening criteria and methodology. The FS Contractor will oversee these activities to ensure that the identification and screening activities conducted and the findings presented are adequate for regulatory compliance and are consistent with the proposed FS approach.

23.2.2.2 Alternatives Development and Analysis (6.1.01.50.03.02)

The RI Subcontractor will then develop the screened technologies and arrange them into general remedial alternatives, which may be an individual technology or combinations of technologies, for further analysis. These alternatives may then be grouped or considered singularly for qualitative evaluation to eliminate those with costs significantly higher than similar alternatives, that are judged inadequate to protect public health and safety, and/or that may adversely impact the environment. Those alternatives that meet the remedial objectives and offer protection of public health and safety will be advanced for final study in the FS process. The RI Subcontractor will issue a technical memorandum to DOE, summarizing this task so that regulatory compliance can be confirmed. The FS Contractor will oversee these activities to ensure that the development and analysis activities and the findings presented are adequate for regulatory compliance and are consistent to support the proposed FS approach.

23.2.2.3 NEPA Environmental Activities (6.1.01.50.03.03)

To comply with the DOE policy that NEPA criteria be considered during remedial activities, the impact of the screened remedial alternatives on the environment must be evaluated. NEPA establishes public policies and goals for protecting environmental quality and mandates procedural requirements to be considered when implementing decisions that may impact the environment. Specifically, NEPA dictates that environmental information be made available to the public for review and comment during the decision-making process. DOE Order 5400.4 requires that NEPA and CERCLA be integrated to the maximum extent possible to avoid duplicate efforts and minimize conflicts of remediation efforts that might slow the process. NEPA issues to be addressed include rare and endangered species, archaeological review, wetlands, and flood plains. The environmental impacts of the alternatives will be considered an integral component of the evaluation and selection process.

23.2.2.4 Feasibility Study Development (6.1.01.50.03.04)

In general, the FS Contractor will use the format presented in the CERCLA FS guidance document to develop the FS, with exceptions and modifications for the specific wastes at the Steel Tank Systems OU, as required. The FS will be based on the information obtained from (1) the RI findings, (2) the technologies screening process, (3) the alternatives screening and evaluation process, and (4) the EA considerations. The FS Contractor will use the remedial alternatives presented in the technical memorandum approved by administrative and regulatory review to perform a detailed evaluation of the alternatives to select a preferred remedial alternative(s) that meets the program objective of mitigating contaminant releases. The FS Contractor will develop criteria to assess the ability of the alternatives to meet the remedial objectives and to comply with administrative and regulatory requirements. The FS must be developed in sufficient detail to provide an informed risk management decision and the legal documentation to justify the selection of a preferred alternative(s). The draft FS/EA Report will be issued to DOE, TDEC, and EPA for review. The final FS/EA Report, a milestone document required by the FFA, will be issued for approval to EPA.

23.2.2.5 Feasibility Study Operable Unit Coordination (6.1.01.50.03.05)

Technical support and oversight will be provided to ensure that the FS/EA Report is prepared within project quality, cost, and scheduling goals. The FS Contractor will provide engineering and technical resources to support quality control efforts, provide project management, and coordinate project activities to ensure that these goals are achieved. Monthly progress reports on the FS/EA process will be issued to DOE and the FS team.

23.2.2.6 Feasibility Study Oversight Activities (6.1.01.50.03.06)

The objective of FS oversight activities is to provide technical input and oversight of the FS Contractor during the FS/EA process to ensure that the data and information obtained during the RI is appropriately incorporated into the FS/EA Report and that the FS/EA Report is technically complete and sufficient to support the preferred remedial alternatives for the PP and the development of an IROD and the RD. FS oversight activities begin with the screening of remedial technologies and are complete upon final approval of the FS/EA Report.

A brief description of the scope of the responsibilities of each participant involved in the FS oversight follows:

- RI Subcontractor — Provides a technical review of the FS/EA Report to ensure that the conclusions and determined risks in the RI Report have been properly presented in the FS/EA.

- A-E Contractor — Provides technical oversight to ensure that the alternatives considered and the remedial technologies evaluated are sufficient and consistent with the RI Report conclusions, remedial objectives, and design requirements.

- Construction Manager — Provides technical oversight to ensure that the technologies and remedial technologies evaluated are compatible and consistent with the RA methodology and can be implemented at the site.

- MMES Planning/Coordination — Provides technical support and reviews FS/EA progress and draft deliverables to ensure that the FS/EA is being developed in a timely and efficient manner.

- MMES Technical Advisory Group — Provides technical support to the FS Team by furnishing technical expertise by necessary disciplines to support the effort. Provides an independent technical review of FS/EA.

23.2.3 Proposed Plan

23.2.3.1 Proposed Plan Development (6.1.01.50.04.01)

The PP will be prepared using the preferred remedial alternative(s) presented in the FS/EA Report as a basis for the recommended interim actions and with input from the regulatory agencies and the public. The PP will document the investigation process (the RI and FS/EA Reports), administrative and regulatory actions, monitoring activities, and scheduling necessary to monitor for the migration of contamination after the IRA.

23.2.3.2 Proposed Plan Oversight Activities (6.1.01.50.04.02)

The objective of oversight activities during the PP process is to provide technical input and oversight of the FS Contractor to ensure that the data and information presented and the RA(s) selected in the FS/EA Report are appropriate and are incorporated and documented in the PP and that the PP is technically complete and sufficient to support the development of the IROD and the RD. PP oversight activities begin when the FS Contractor begins its development and are complete upon final approval of the PP by the regulatory agencies.

23.2.4 Interim Record of Decision

23.2.4.1 Interim Record of Decision Development (6.1.01.50.05.01)

The final step in the planning process to remediate the Steel Tanks OU will be preparation of the IROD, the legal document that formally declares that the preferred remediation method(s) in the PP will mitigate releases and establishes the remediation schedule and monitoring plan for the site. The IROD will contain (1) the statement that the selection process was accomplished in accordance with the statutory requirements of CERCLA and applicable federal and state regulations; (2) a Decision Summary outlining the nature and extent of the contamination and the associated risks due to the Steel Tanks OU, the evaluation and analysis of the RA alternatives considered, and an explanation of how the selected alternative(s) will meet statutory requirements; and (3) a Responsiveness Summary addressing the public comments obtained during the public review period

and public examination of the administrative record. The FS Contractor will issue the draft IROD to DOE and the regulatory agency for review. The final IROD is a milestone document required by the FFA.

The cost assessment of this element was based on the assumption that the FS/EA and PP schedules were followed.

23.2.4.2 Interim Record of Decision Oversight Activities (6.1.01.50.05.02)

The objective of oversight activities during the IROD process is to provide technical input and oversight of the FS Contractor to ensure that the IROD appropriately incorporates and documents the data and information presented in the FS/EA Report and the PP and that it is technically complete and sufficient to support the development of the IROD and the RD. IROD oversight activities begin when the FS Contractor begins IROD development after approval of the PP and are complete upon final approval and signing of the IROD by the regulatory agencies and DOE.

23.2.5 Risks and Uncertainties

The primary risks and uncertainties associated with the Steel Tanks OU FS/PP/IROD process are the scheduling and scoping of the defined activities and the approval of the FS/EA after public and regulatory review and comment.

Minor scheduling changes will significantly impact the labor and material/equipment cost of the project. Schedule delays caused by funding, the availability of skilled labor, and/or the lack of proven remedial technologies could increase the total project cost greatly as the duration of the project is extended.

Even minor interruptions in the review cycle changes may impact the schedule and the labor cost. Although the total project cost will not increase substantially, any delays in approval of the PP and the IROD will impact the total project duration.

If additional IRODs or EAs are required in the Steel Tanks, the total cost of the project will increase. Others factors that increase the uncertainty of the cost assessments in this report include the following:

- Administrative requirements and/or regulatory decisions that prevent TRU waste sludges from remaining in the tanks.

- The chemical composition of the sludge in the Steel Tanks, which may severely restrict any remediation options and require more expensive solidification technologies and the installation of physical barriers to prevent migration.

- The structural integrity of the tanks, which may require extensive repairs and/or installation of barriers to protect and isolate the tanks.

- Requirements to increase ALARA guidelines for the ORNL personnel in nearby facilities, which would significantly increase costs and impact the schedule.

- Requirements for additional sampling activities.

- Extended review cycles initiated by the regulators.

- Program funding limitations across the DOE system.

23.2.6 Interfaces

Completion of the Steel Tanks OU FS/EA process will require close interface and coordination with the following agencies/regulations:

- RCRA — Serves as an ARAR under CERCLA.

- DOE Orders — Provides for the management and regulation of hazardous wastes at DOE facilities.

- NEPA — Provides regulations that set the policies and goals for protecting environmental quality and establish the procedures to examine the impact that decisions on remediating may have on the environment.

- TDEC — Provides regulatory overview for Tennessee.

- EPA — Provides regulatory overview for compliance with federal regulations.

- MMES Waste Management — Provides for the management of waste and waste facilities at ORR.

- ORNL Office of Radiation Protection — Provides for radiation monitoring and environmental surveillance for WAG 1.

- DOE TRU Waste Management — Provides for the management and retrieval of TRU wasted stored at DOE facilities for eventual packaging at WHPP and storage at WIPP.

- Public Factions — Require access, review, and response for the public review of the administrative record and any proposed RA.

- ORNL Groundwater Program.

23.3 REMEDIAL DESIGN

This section presents the scope of the RD effort required to prepare the following documentation for the Steel Tanks OU: an RD Work Plan, engineering studies as required, Title I and Title II design packages, and final design reports for the Remediation Package and the Phase II Remediation Package. The risks and uncertainties and interfaces for the RD work are identified as well.

The WBS developed for performing the RD is presented in Fig. 23.7. The summary level schedule for these RD WBS elements is shown in Fig. 23.8. The cost assessment of $1,893,000 for performing this portion of the Steel Tank Systems Remediation activities summarized by WBS activity and FY is shown in Table 23.4.

23.3.1 Scope and Assumptions

The scope of the RD work for the remediation of these tanks is to prepare necessary design and supporting documents required for approval from DOE-OR, DOE-HQ, TDEC and EPA and for implementation of all RA activities.

Details on the scope of work and assumptions associated with the RD work breakdown elements that the A-E Contractor will perform in developing the RD Work Plan, engineering studies, and Title I and Title II design services are presented in the following sections. RD efforts for the support facilities associated with the Steel Tank Systems RA are described in Chapter 4.0.

23.3.2 Remedial Design Work Plan

23.3.2.1 Remedial Design Work Plan (6.1.01.50.06.01)

The RD Work Plan will provide the overall technical and management approach for the RD work. The A-E will prepare a draft RD Work Plan based on the scope and design criteria specified in the PP and IROD documents. The RD Work Plan will include the detailed design process and schedule for the design effort for the remediation activity of grouting in place all of the tanks in the Steel Tank Systems. These tanks are assumed to contain no sludge. Some remote cleaning and decontamination is assumed to be performed prior to grouting.

Figure 23.9 depicts the schedule logic for completion of the RD effort required to support a construction start 15 months from IROD approval.

23.3.2.2 Engineering Studies (6.1.01.50.06.02)

Some engineering studies may be necessary to help determine the best technologies available for the remote decontamination portion of this project. However, no development work should be required, and engineering studies should be minimal.

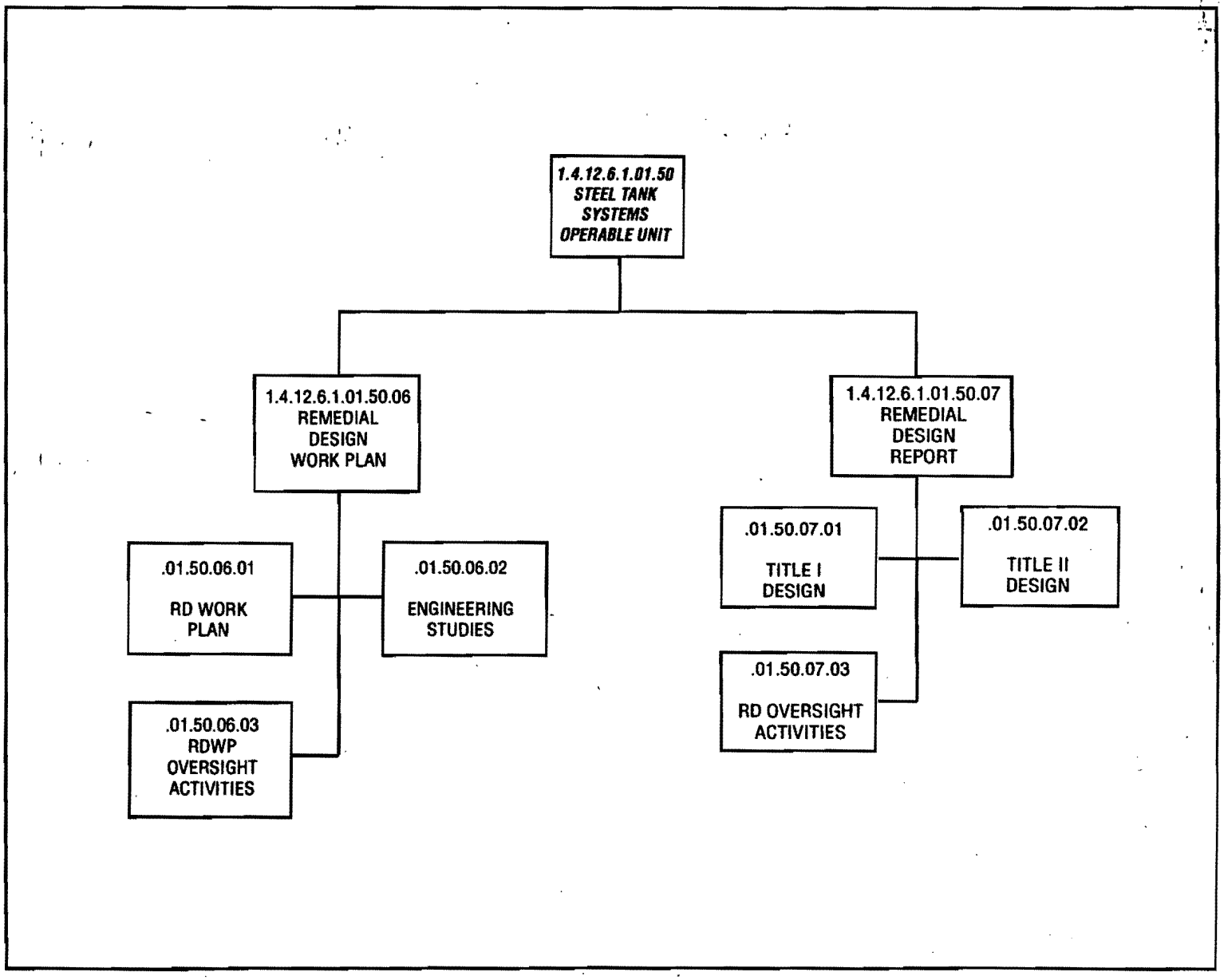


Fig. 23.7. Steel Tanks OU RD Work Breakdown Structure.

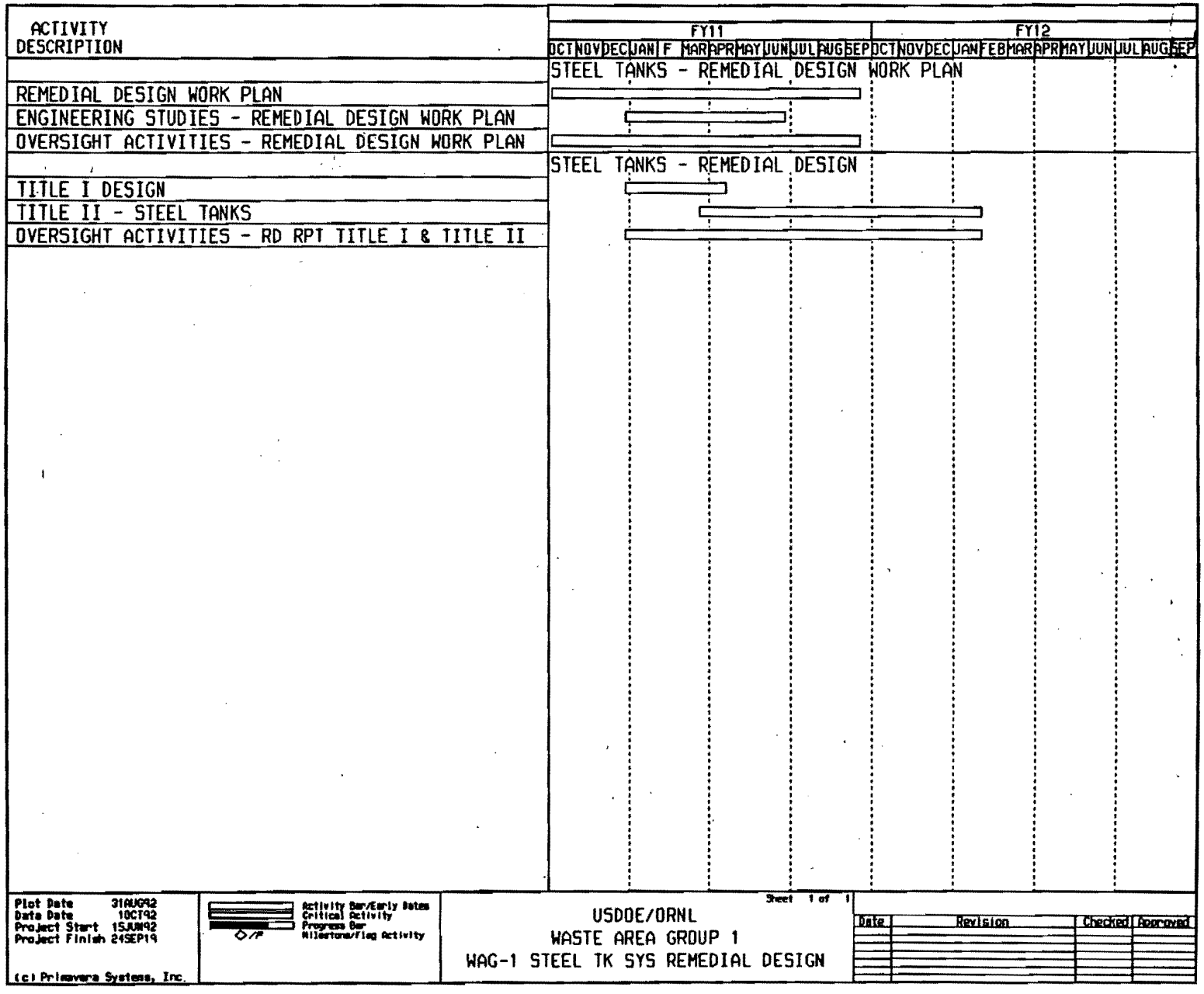


Fig. 23.8. Steel Tanks OU RD Summary Level Schedule.

TABLE 23.4
WAG 1 Oper Unit 10 RD Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)				
	2011	2012	2013	2014	TOTAL
Remedial Design Work Plan	208	0	0	0	208
Engineering Studies	652	0	0	0	652
RD WP Oversight Activities	358	0	0	0	358
SUBTOTALS RD WP	1,218	0	0	0	1,218
Remedial Design Phase I Title I	161	0	0	0	161
Remedial Design Phase I Title II	163	120	0	0	283
Remedial Design Phase II Title I	0	0	0	0	0
Remedial Design Phase II Title II	0	0	0	0	0
RD Oversight Activities	162	69	0	0	230
SUBTOTALS RD	485	189	0	0	674
TOTALS	1,704	189	0	0	1,893

23.3.2.3 Remedial Design Work Plan Oversight Activities (6.1.01.50.06.03)

Technical input will be provided during the preparation of the Work Plan to ensure that the design does not violate the intent of the IROD and will comply with the administrative and regulatory requirements. The Work Plan will be drafted by the RD contractor with review being conducted by the FS Contractor, MMES, and DOE. Based on the logic shown in Fig. 23.9, the design effort will start after the RD Work Plan is prepared and will reach 90% completion prior to EPA approval of the RD Work Plan. Section 23.3.4 discusses risks and uncertainties associated with this strategy.

23.3.3 Remedial Design Report

23.3.3.1 Title I Design (6.1.01.50.07.01)

Based on the engineering studies and other information available from the RI/FS, the A-E Contractor will prepare a preliminary (30%) design document showing the extent of remedial activities, site plan details, and an outline of specifications for the work involved. Since the work is to be performed remotely, a major portion of the design effort will be devoted to design and specification of components to be used in performing the remedial action. In order to support construction start within 15 months of IROD approval, Title I design must begin during the IROD preparation and approval process.

23.3.3.2 Title II Design (6.1.01.50.07.02)

Upon approval of the Title I design document, the A-E Contractor will prepare detailed engineering designs, analyses, and calculations required for all civil, structural, mechanical, and electrical construction drawings; technical specifications; and cost estimates.

All the documents will be submitted to MMES for their comments at 60% completion. Upon resolution of comments, the 90% design package will be prepared and submitted to MMES and DOE. Upon resolution of these comments, the 100% design package will be issued for TDEC and EPA for further review, comment, and approval. Upon resolution of TDEC and EPA comments, the Design Report will be prepared and issued CFC.

The cost assessment for the Title I and Title II design was developed based on the following assumptions:

- The technical approach used as the basis for design for the remedial work will meet all the CERCLA requirements.
- Any additional design/permitting work related to environmentally sensitive habitat or vegetation will not be necessary.
- Remote techniques used to perform the remedial action are commercially available.

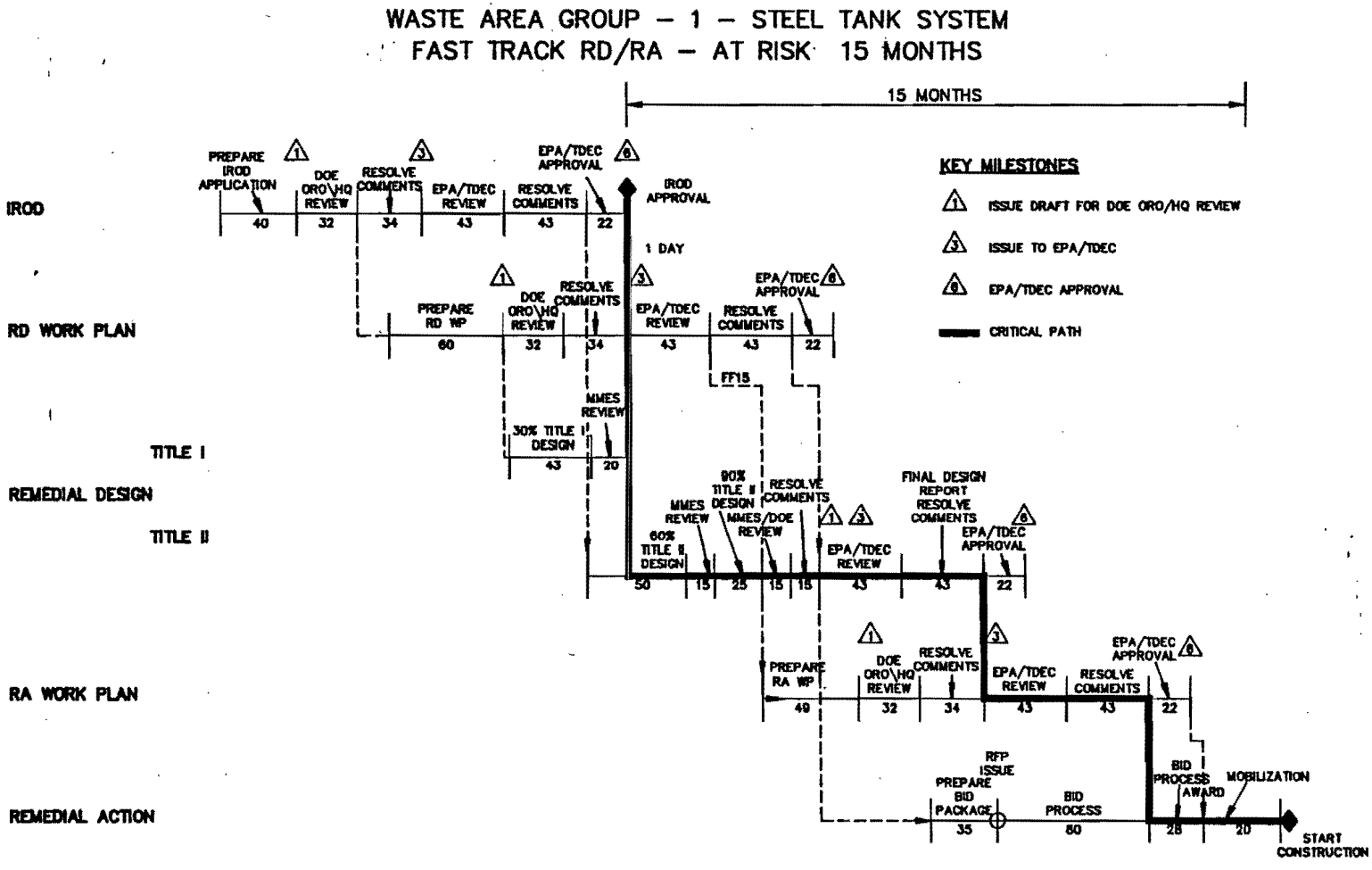


Fig. 23.9. Steel Tanks Phase I Schedule Logic.

- Other support facilities are available for personnel and equipment decontamination.

- A consolidation area (or other disposal facility) is available for disposal of LLW generated during remediation activities.

23.3.3.3 Remedial Design Oversight Activities (6.1.01.50.07.03)

Oversight will be provided throughout the RD process to ensure that the design does not violate the intent of the FFA, FS/EA, PP, or IROD. Reviews will be conducted by the FS Contractor, MMES, and DOE at the 30%, 60%, and 90% completion stages to provide assurance that the design complies with administrative policies and regulatory requirements.

23.3.4 Risks and Uncertainties

The findings and conclusions in the final RI and FS/EA documents may impact the scope of engineering studies and development work. It is assumed that the remote equipment to be used for the RA will be commercially available. If not, the development of new equipment will impact schedule and cost and will increase the difficulty of starting remediation within 15 months of the IROD.

The primary risks and uncertainties associated with RD are as follows:

- Any change in EPA/TDEC regulations at the time of the design phase may impact the RD and, therefore, cost.

- The scope of the RD work has been derived from the Life Cycle Costing Workshop. Any change in the assumed remediation scenarios will have significant impact on RD and remediation work.

- The findings and conclusions in the final RI and FS/EA documents may impact the scope of RD work.

- Title II design is completed prior to approval of the RD Work Plan by EPA. EPA comments on the RD Work Plan could adversely impact completion of RD.

- Title II design is started prior to IROD approval by EPA. The risk is lessened by the fact that comments on the IROD should be resolved prior to start of Title II design.

23.3.5 Interfaces

The RD documents required for the remediation of the Steel Tanks OU will require the coordination and close interface with the following:

- EPA — To provide regulatory overview during the RD process and approve all primary documents.
- TDEC — To provide state regulatory overview during the RD process.
- DOE — To provide regulatory and engineering oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview of design considerations for waste generation, handling, and storage/disposal.
- MMES Technical Advisory Group — To provide technical overview support during the RD process, specifically pertaining to engineering studies and design criteria.
- MMES D&D Program — To provide input and overview for the decontamination of radioactive handling facilities.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H — To provide input and overview for the ES&H aspects for implementation of design.
- RA Construction Manager — To provide constructibility reviews of design.
- RD Contractor — To draft the RD Work Plan.

23.4 REMEDIAL ACTION

This section presents the scope of the activities required to implement the remedial actions. The RA work involves decontaminating the tanks and filling them with grout. The risks and uncertainties and interface issues for the remedial activities are identified as well.

The Life Cycle Costing Workshop identifies cleaning and in situ grouting for half of the tanks in this OU and removal and disposal for the other half. This estimate is based on cleaning and in situ grouting of all the tanks. The cost for removal and disposal would be higher because of high disposal costs of contaminated soil and for the tank.

The WBS developed for performing the RA is presented in Fig. 23.10. The summary level schedule for these RA WBS elements is shown in Fig. 23.11. The cost assessment of $7,178,000 for performing this portion of the Steel Tanks OU remediation activities summarized by WBS activity and FY is shown in Table 23.5.

23.4.1 Scope and Assumptions

The scope of the RA includes the RA Work Plan, construction management, Title III services, construction of the six remediation design packages, construction support, independent certification, and verification that includes monitoring and a 5-year review.

23.4.2 Remedial Action Work Plan

23.4.2.1 Remedial Action Work Plan (6.1.01.50.08.01)

The RA Construction Manager will prepare the draft RA Work Plan, which defines the scope and objectives of the RA based on the IROD and final RD; documents the specific construction components of the RA; and presents the RA schedule, subcontracting strategy, QA Plan, Health and Safety Plan, and RA Monitoring Plan.

Once DOE, EPA, and TDEC review comments on the draft RA Work Plan are incorporated, the final RA Work Plan will be prepared for approval and implementation.

23.4.2.2 Remedial Action Work Plan Oversight Activities (6.1.01.50.08.02)

The purpose of this activity is to provide technical input and oversight during the preparation of the RA Work Plan. During the preparation of the draft RA Work Plan, MMES and the A-E responsible for the approved design report will provide necessary coordination and review the Work Plan to ensure that the proposed construction efforts will implement the IROD as presented in the final RD reports. The oversight activities will also ensure that the bid process and implementation plans comply with administrative and regulatory requirements.

23.4.3 Remedial Action

23.4.3.1 Remedial Action Integration (6.1.01.50.09.01)

The objective of this element is to provide construction management, independent certification, Title III services, and A-E and construction support as required.

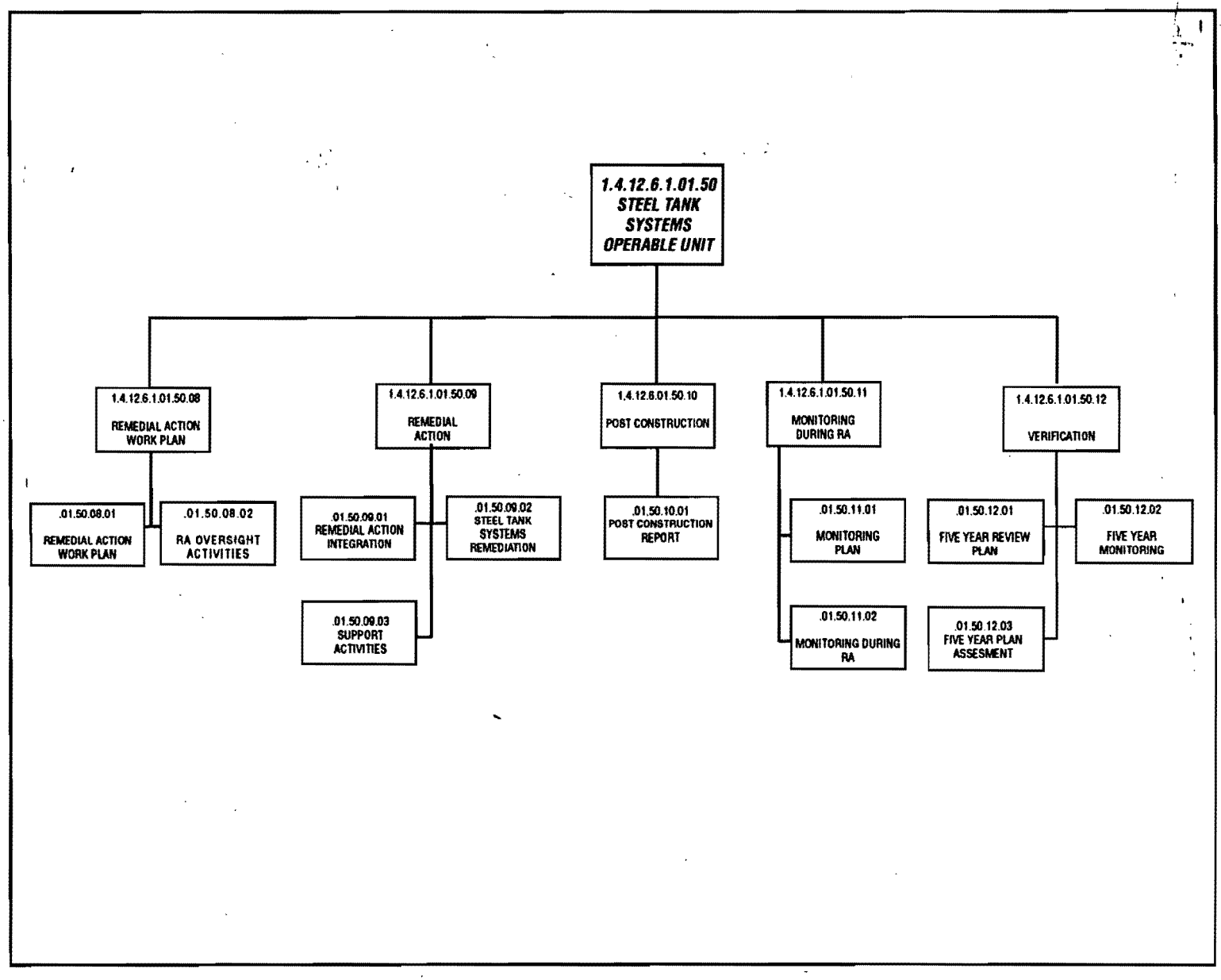


Fig. 23.10. Steel Tanks OU RA Work Breakdown Structure.

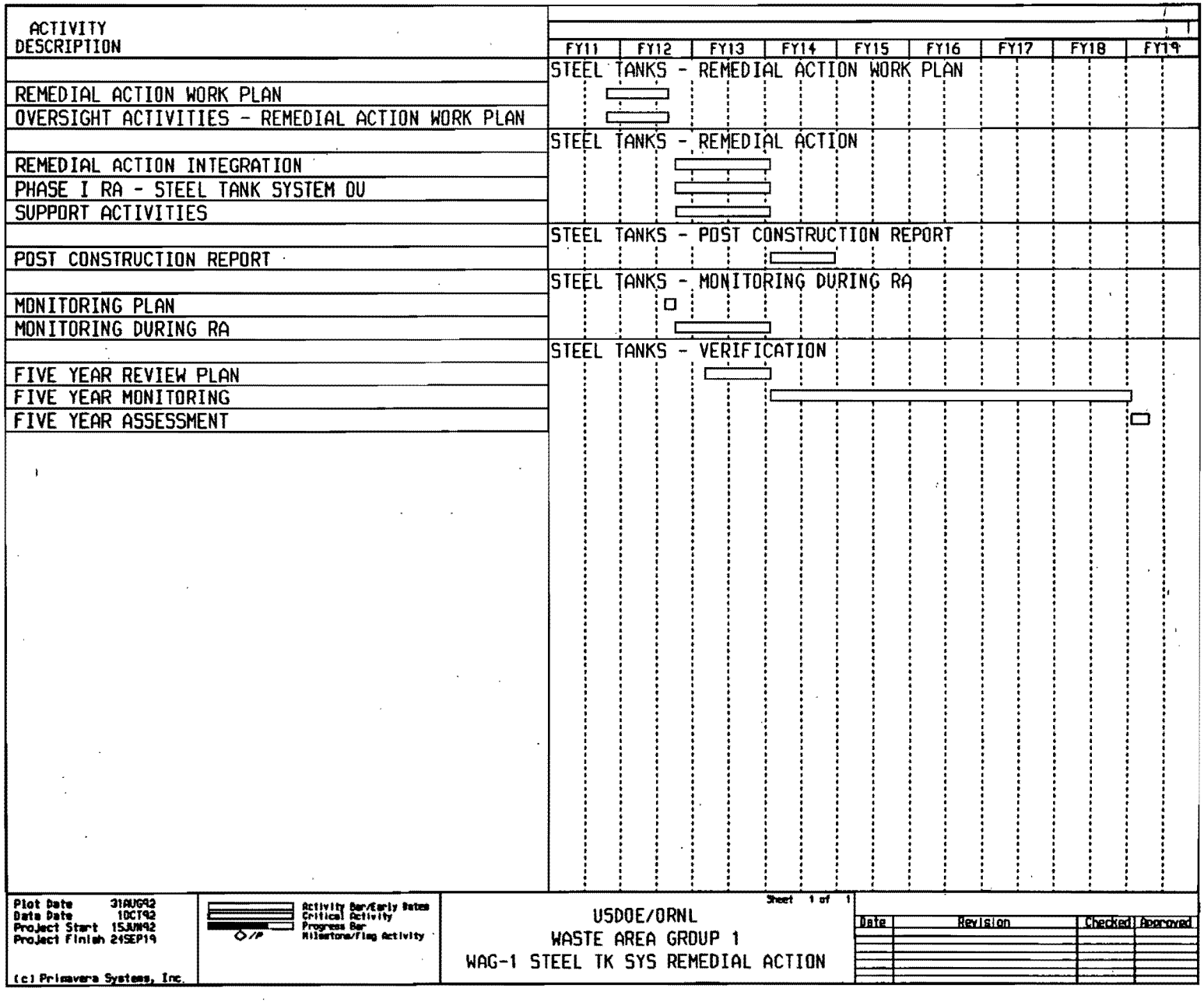


Fig. 23.11. Steel Tanks OU RA Summary Level Schedule.

TABLE 23.5
WAG 1 Oper Unit 10 RA Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)										
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
RA Work Plan	42	408	0	0	0	0	0	0	0	0	450
RA WP Oversight Activities	17	124	0	0	0	0	0	0	0	0	141
SUBTOTALS RA WP	58	532	0	0	0	0	0	0	0	0	590
RA Integration	0	23	633	42	0	0	0	0	0	0	698
Remedial Action	0	109	3,014	200	0	0	0	0	0	0	3,323
Post Construction Report	0	0	0	85	0	0	0	0	0	0	85
Monitoring During RA	0	119	292	73	0	0	0	0	0	0	483
Verification	0	0	51	326	313	313	313	313	367	0	1,998
SUBTOTALS RA	0	250	3,990	726	313	313	313	313	367	0	6,588
TOTALS	58	782	3,990	726	313	313	313	313	367	0	7,178

RA integration for remedial activities includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests as applicable, and ensure that construction is accomplished according to final design requirements.

- Prepare detailed Quarterly Progress Reports that EPA will use to monitor the remedial construction activities.

23.4.3.2 Steel Tank Systems Remediation (6.1.01.50.09.02)

The 16 tanks in this OU are H-209, T-30, TH-1, TH-2, TH-3, W-19, W-20, WC-1, WC-15, WC-17, 3001-B, 3001-S, 3002-A, 3003-A, 3004-B, and 3013. Tank locations are scattered throughout the main plant area.

All of the tanks in this OU, with the exception of 3003-A, are made of stainless steel and have relatively small capacities (less than 3300 gal). Tank 3003-A is made of reinforced concrete and has a capacity of 16,000 gal. All of the tanks are outside and, with the exception of T-30, are apparently buried under a well-tamped earth cover. Tank T-30 is inside a below-grade concrete vault and is covered by a variety of lead and concrete shielding. Currently available data show only tank TH-3 having above-grade access sufficient for equipment installation (12-in. diameter or greater). Little information is available about tank 3001-S. For this estimate it has been assumed that 3001-S is an underground stainless steel tank with a capacity of 2000 gal.

Since contents removal is an Early Action for these tanks, the RA will only address cleaning and grouting. The following RA description applies to all tanks except for T-30 and TH-3.

The first RA step will be the installation of a riser from the tank manhole to the ground surface. Remote operated decontamination spray equipment with a camera and lights system attached will be installed in the tank through the riser utilizing a bag in/out procedure to maintain secondary containment. The tank will be sprayed until sufficiently clean. Existing suction lines will be used intermittently to remove liquid wastes resulting from decontamination efforts. Operators will connect waste tanker vacuum lines at connection points located inside valve pits adjacent to the waste tanks. When the decontamination is complete and the liquids have been removed, the decontamination equipment and viewing system will be bagged out and decontaminated, and routine equipment maintenance will be performed on them.

After tank decontamination, all of the tank penetration lines will be plugged or capped. A grout nozzle will be installed in the riser, and the tank will be filled with grout supplied by the grout facility. The grout nozzle will then be removed and decontaminated and the riser capped.

Tank T-3 has an existing 16-in. diameter aboveground access, so no riser installation will be required. The remaining RA for T-3 will be the same as described above.

Installation of a riser from T-30 would require removal of most of the shielding from above it and manned access at the top of the tank. Radiation levels in the T-30 vault may prohibit riser installation, so the baseline approach will be to use an existing jet nozzle in the tank for decontamination. Decontamination liquids will be removed using existing suction lines. If sufficient cleaning is accomplished this way, then all tank penetration lines will be plugged or capped and the tank filled with grout.

Upon completion of tanks remediation, soils around the tank will be remediated as required and the area capped as part of the Contaminated Soils OU.

The following assumptions were made in developing this remediation scenario and the subsequent cost estimate and schedule:

- No external secondary confinement will be required.
- Bag-in/bag-out procedures will provide sufficient confinement during equipment installation and removal.
- Evaporator facility capacity will be sufficient to process the liquids resulting from this remediation.
- All liquids from the tanks and decontamination facilities will go to the evaporator facility and not the process waste treatment plant.
- Groundwater leakage to and from tanks will be eliminated by Early Actions.

23.4.3.3 **Support Activities** (6.1.01.50.09.03)

During the RA activities, MMES will provide the necessary staff and support to operate and maintain the personnel and equipment decontamination facilities. Staff will also be required to transport leachate generated during decontamination activities to the evaporator for further treatment.

23.4.4 Post Construction

23.4.4.1 Post Construction Report (6.1.01.50.10.01)

The Post Construction Report will serve as documentation for the implementation of the RA Plan, completion of construction activities, and effectiveness of selected remedies. MMES and the Construction Manager will be responsible for the following activities to prepare the Post Construction Report:

- Conduct a site inspection with EPA and TDEC to determine whether or not the RA is complete and consistent with the agency approved remedies and to review monitoring reports.

- Upon satisfactory completion of the site inspection, prepare a Post Construction Report that includes the following information:

  - brief re-cap of site description, chronology of major events, and the selected remedies;

  - explanation of construction activities, modifications, performance standards, and QC; and

  - explanation of operation and maintenance, including monitoring to be undertaken at the site.

23.4.5 Monitoring During Remedial Action

23.4.5.1 Monitoring Plan (6.1.01.50.11.01)

A site-specific Monitoring Plan will be developed in order to implement the Environmental Monitoring Program and to determine the impact of construction activities and the effectiveness of the remediation conducted.

23.4.5.2 Monitoring During Remedial Action (6.1.01.50.11.02)

MMES will implement an Environmental Monitoring Program that will accomplish the following:

- Start one month prior to start of construction in order to establish the baseline.

- Be conducted during the various RA activities to document the impacts of remedial activities.

- Continue 1 year after the RA is completed to assess the effectiveness of the remedies implemented and provide data for the Post Construction Report and Five-Year Review Plan.

- Generate routine monitoring reports with analytical results.

23.4.6 Verification

23.4.6.1 Five-Year Review Plan (6.1.01.50.12.01)

If hazardous contaminants remain at the site as a result of the selected RA(s), then, in accordance with CERCLA and the FFA, an RA Assessment Plan is required in order for the EPA and TDEC to review the RA no less than once every 5 years after the initiation of the final RA(s) to ensure that human health and the environment are protected by the RA(s) being implemented. Because tanks will remain after remediation, the A-E Contractor and MMES will develop a Five-Year Review Plan that identifies the assessment and monitoring activities required to verify the integrity/status of the RA(s) implemented.

23.4.6.2 Five-Year Monitoring (6.1.01.50.12.02)

Monitoring of the environmental media will be performed for 5 years, in accordance with the Environmental Monitoring Program, to determine the impact of construction activities and the effectiveness of remediation. The results shall be documented on the monitoring reports, which will include analytical data. MMES shall conduct the monitoring activities identified in the Five-Year Review Plan, document the impact of construction, assess the effectiveness of the remedies implemented, and provide data for the Five-Year Plan Assessment. Subsequent monitoring will be the responsibility of ORNL.

23.4.6.3 Five-Year Plan Assessment (6.1.01.50.12.03)

The data obtained during the 5 years of monitoring will be analyzed. The status of the RA(s) implemented will then be assessed using the guidelines set forth in the Five-Year Review Plan. MMES, the Construction Manager, the A-E Contractor, and the Assessment Subcontractor shall determine, according to the Five-Year Review Plan, whether or not the RA(s) implemented are still complying after 5 years with the intent and criteria established in the IROD and current regulations and policies.

23.4.7 Risks and Uncertainties

- Additional remediation may be needed if RA is unsuccessful.

- There is a possibility that the decontamination spray used to clean the walls and dome of Tank 3003-A might cause damage to the gunite. Additionally, the cleaning effort

may have limited effectiveness since available data from similar tanks indicate that the walls may be permeated from continuous exposure to LLLW.

- Any changes in the RD due to the risks and uncertainties mentioned in Section 23.3.4 will have a direct effect on remediation cost.

23.4.8 Interfaces

During remediation activities, interface and coordination with the following agencies will be necessary:

- EPA — To provide regulatory overview during the RA process, approve all primary documents, and conduct routine inspections.
- TDEC — To provide state regulatory overview during the RA process and conduct routine inspections.
- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.
- MMES Waste Management — To provide waste management overview and support throughout the RA process by focusing on the minimization of RA-generated wastes and providing the capability to process these wastes.
- MMES Technical Advisory Group — To provide technical overview support during the RA process, specifically pertaining to monitoring and field change requests.
- MMES D&D Program — To provide input and overview for the decontamination of radioactive handling facilities.
- Groundwater WAG Team.
- ORNL Groundwater Program.
- MMES ES&H — To provide input and overview for the ES&H aspects of conducting the RA.
- MMES Construction Support.
- MMES Title III Services (includes Inspection Services).

- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

- Independent Certification Contractor.

23.4.9 Contingent Action

The workshop did not identify a contingent action for the Steel Tank OU.

24.0 WAG 1 GUNITE TANK CLOSURE

This chapter presents the scope of Gunite Tank Closure activities. The Titles I and II design efforts, categorical exclusion, construction activities, operations, and monitoring are described. The risks and uncertainties are identified as well.

The WBS developed for designing and constructing the closure is presented in Fig. 24.1. The summary level schedule for the Gunite Tank Closure WBS elements is shown in Fig. 24.2. The cost assessment of $123,106,000 for performing activities associated with the gunite tank closure is presented by WBS activities and FY in Table 24.1.

24.1 SCOPE AND ASSUMPTIONS

Under this scenario, the waste contained in the gunite tanks within the Tank Farm OU would be removed and packaged as remote-handled (RH) TRU waste, and closure of the tanks would then be implemented. Additional closure activities are assumed to include temporary storage of waste at the ORR and eventual shipment to an off-site underground disposal facility for TRU waste. The cost assessment includes costs for packaging and temporary storage at ORR, and costs for transportation and disposal at an off-site underground facility are not included in this estimate.

24.1.1 Support Facilities Design

24.1.1.1 Title I and Title II Design (6.1.01.90.01.01 and 6.1.01.90.01.02)

The RD A-E will perform Title I and Title II design work for the following activities in support of gunite tank closure:

- Modifications to tank domes to permit equipment entry.
- Design of a cutter head system to remove solidified waste from tanks.
- Development and design of microwave decontamination device.
- Design of facility to temporarily house TRU waste removed from the gunite tanks.

The cost assessment was developed with the following assumptions:

- The structural integrity of the gunite tanks has been assessed prior to removal, and removal of waste and tank decontamination can be accomplished without causing tank collapse.

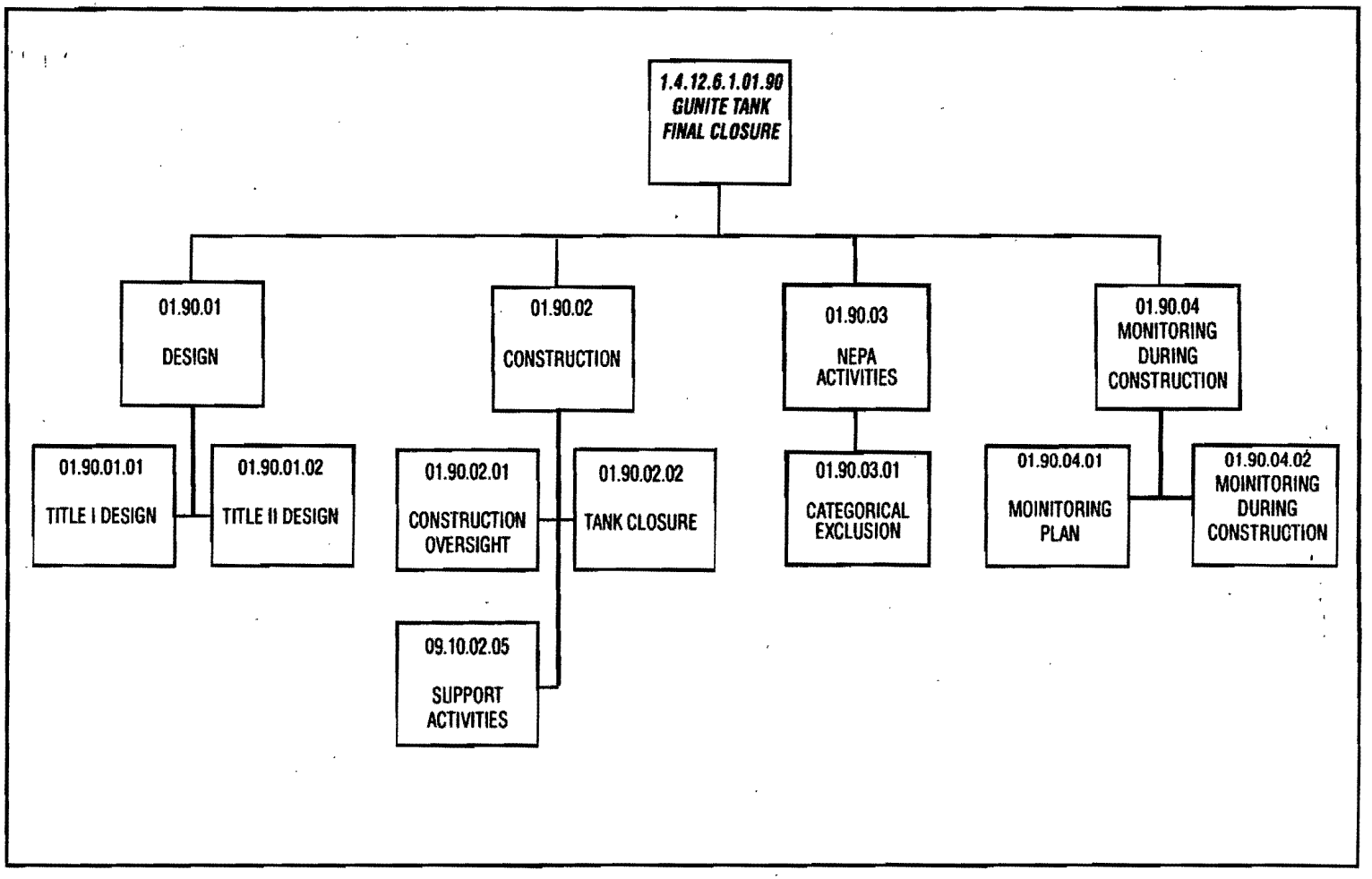


Fig. 24.1. Gunite Tank Closure Work Breakdown Structure.

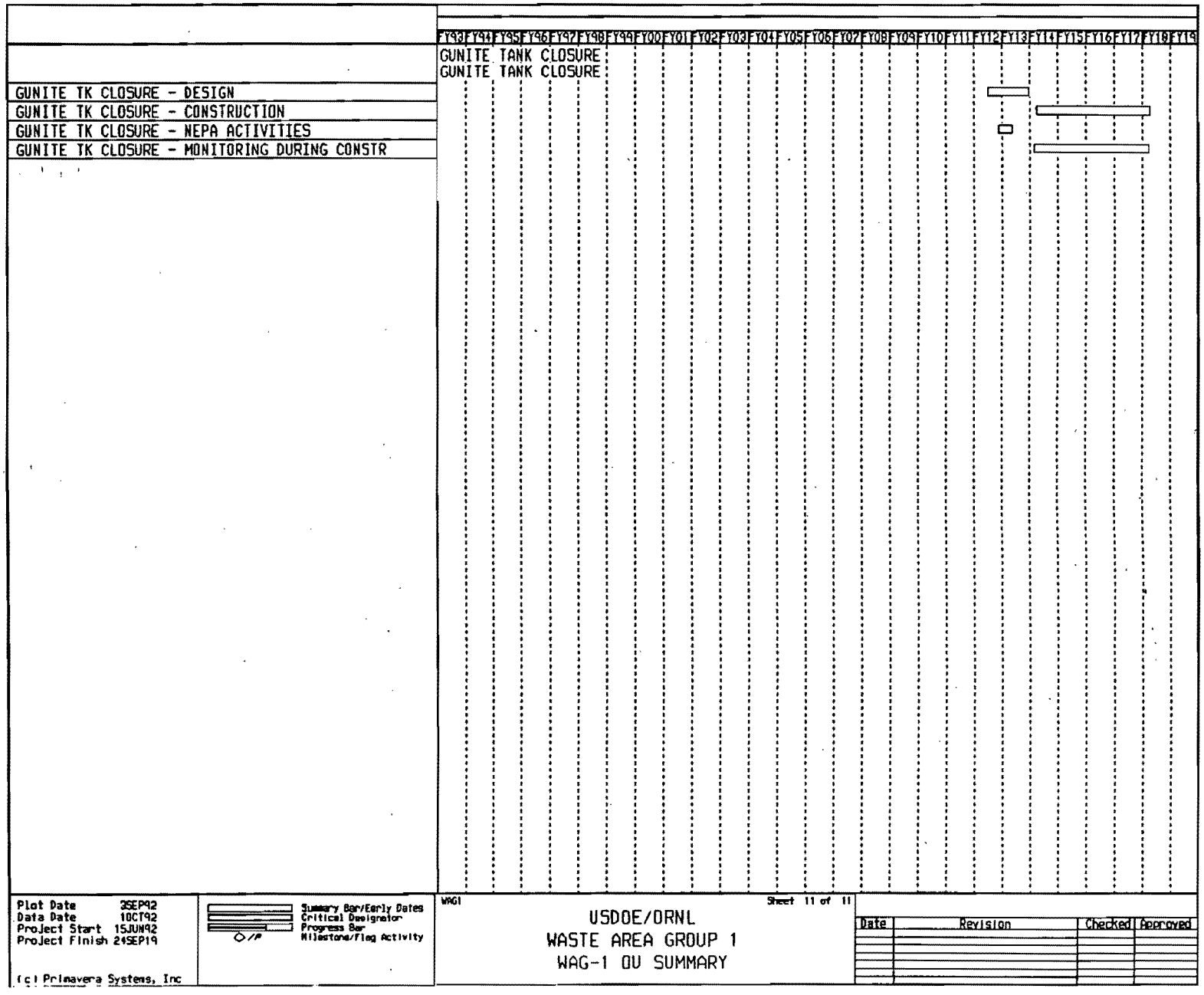


Fig. 24.2. Gunite Tank Closure Summary Level Schedule.

TABLE 24.1
WAG 1 GUNITE TANK CLOSURES

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)							
	2012	2013	2014	2015	2016	2017	2018	TOTAL
Title I Design	4,995	0	0	0	0	0	0	4,995
Title II Design	381	7,468	0	0	0	0	0	7,849
Construction Oversight	0	0	1,108	4,292	7,358	5,047	382	18,186
Gunite Tank D & D	0	0	11,535	43,250	34,822	840	0	90,447
Support Activities	0	0	17	67	115	79	6	285
Categorical Exclusion	31	169	128	0	0	0	0	328
Monitoring During Construction	0	0	162	198	235	271	149	1,015
TOTALS	5,406	7,638	12,950	47,808	42,530	6,237	537	123,106

- Modifications to the robotics system developed for in situ treatment of tank waste can be accomplished with a minimum of effort.

24.1.2 Gunite Tank Closure Construction

24.1.2.1 Construction Oversight (6.1.01.90.02.01)

The objective of this WBS element is to provide technical input and oversight during the construction of support facilities. During the preparation of the support facilities construction plan, MMES, the A-E Contractor, and the independent contractor responsible for certification will provide the necessary technical input and oversight to ensure that the proposed construction efforts, bid process, and implementation plans comply with administrative and regulatory requirements.

24.1.2.2 Construction of Tank Closure (6.1.01.90.02.02)

Construction activities for gunite tank closure include the following:

- Modifications will be made to the tank dome to accept removal equipment. This includes enlargement of existing center manways to allow removal equipment to reach the area near the dome/wall interface.

- A manipulator (robot arm) will be inserted into the tank along with cutter head tools using a bag-in/out procedure to maintain secondary containment.

- Waste material will be removed from the tank using a remote-operated cutter head attached to the robot arm.

- Waste material will be repackaged as RH-TRU.

- Approximately 2 in. of inner wall (assumed to be contaminated) will be removed using a microwave removal tool attached to the existing manipulator and will be repackaged as RH-TRU. The microwave decontamination system consists of three components; the microwave generator, the waveguide/applicator, and the positioning system. The microwave generator operates at a specific frequency of about 18 Gigahertz (GHz) at a power of 15 kilowatts (kW). The frequency can be adjusted so that the concrete can be spalled in front or behind the existing reinforcement. The waveguide transfers the microwave energy to the applicator and is designed so that the concrete spalled from the surface can be recovered in a vacuum system.

- The wall will be strengthened by applying additional gunite.

- RH-TRU waste will be placed into the temporary storage facility constructed to house the repackaged TRU waste.

- Decontaminated tanks will be filled with clean grout supplied by the grout facility.

24.1.2.3 Support Activities (6.1.01.90.02.03)

During the construction associated with tank closure activities, MMES field maintenance will provide the necessary staff to maintain and operate the Personnel Decontamination Facility, Equipment Decontamination Facility, and Consolidation Area.

24.1.3 NEPA Activities

24.1.3.1 Categorical Exclusion (6.1.01.90.03.01)

A NEPA review is required for undertakings proposed by government agencies pursuant to 40 CFR 1501.2 and 10 CFR 1021.200. MMES NEPA compliance at ORNL is coordinated by the Environmental Review and Documentation Section (ERDS), who performs (1) the screening of actions for NEPA compliance and requirements, (2) the preparation and distribution of NEPA assessments for proposed actions, and (3) the preparation and submittal of the appropriate level of NEPA documentation to DOE-OR for approval.

The appropriate NEPA documentation for closure of the gunite tanks is suggested to be a categorical exclusion (CX) in accordance with DOE NEPA Implementing Procedures; Final Rule, 57FR 15122, Subpart D, Appendix B, p. 15154, B1.15 (1992). A typical CX preparation, review, and approval cycle requires approximately 4 to 5 months. However, when an existing approved CX is applicable, the cycle time is reduced to approximately 1 to 1.5 months.

24.1.4 Monitoring During Construction

24.1.4.1 Monitoring Plan (6.1.01.90.04.01)

A monitoring plan will be developed by ER Planning to implement the monitoring of the environmental media around the perimeter of the gunite tanks in order to determine the impact of construction activities in contaminated and uncontaminated areas.

24.1.4.2 Monitoring During Construction (6.1.01.90.04.02)

Based on the environmental plan developed by ER Planning, MMES field maintenance personnel will conduct the monitoring. The monitoring activity will start 1 month prior to start of construction in order to establish the baseline.

24.2 RISKS AND UNCERTAINTIES

Major risks and uncertainties include the following:

- Proposed modifications to the gunite tanks discussed above (construction of access hole in dome and removal of 2-in. wall thickness) may involve special precautions to prevent collapse of the structure. It is also possible that the modifications cannot be implemented if structural analysis of the modifications reveals that structural collapse is likely.

- The microwave system for removal of a portion of the tank wall does require additional development work, and some uncertainty exists in scheduling the development activity due to the new technology involved.

- Waste removed from the gunite tanks can be accepted for underground disposal, and sufficient capacity exists at the facility.

- Removal of waste from the gunite tanks using a remote-operated cutter head system could damage the tank walls and cause tank collapse.

25.0 WAG 1 PROCESS WASTE TREATMENT PLANT SURGE CAPACITY UPGRADE

This chapter presents the scope and assumptions, planning, design, implementation, risks and uncertainties, and interfaces for the PWTP Surge Capacity Upgrade project. The WBS developed for this activity is presented in Fig. 25.1. The cost assessment of $ 3,333,000 is estimated for this activity. The work is expected to occur during FY 1993 and 1994.

25.1 SCOPE AND ASSUMPTIONS

WAG 1 RI, RA, and Early Action activities are expected to generate large quantities of liquid process waste. Chapters 10.0 and 11.0 discuss Early Actions associated with Core Hole Eight and Boundary Interception, respectively. The current plan for both Early Actions is to construct French drains to collect contaminated groundwater and pump it to the PWTP. The estimated volume of water to be collected depends on annual rainfall, as well as the length of the French drain. Assumptions were made for the cost assessment regarding the length of French drains, as well as the flow rate of water generated as a result of French drain construction, in order to establish a basis for PWTP loading. A series of upgrades planned by the Waste Management organization will increase the PWTP capacity so that it should be able to accommodate the projected WAG 1 process waste generated. However, surge capacity prior to completion of this action may be insufficient during periods of heavy rainfall or due to other demands placed on the waste management system by the ER Program.

25.2 PLANNING

Planning will involve preparation of engineering studies or a CDR, as appropriate, to support Title I and II design. Documentation will be of sufficient detail to support engineering design and will include cost/schedule information, technical design criteria, and regulatory information.

25.3 DESIGN

The Title I and II concept will be developed, including MMES and DOE comments, into a final design report. The Title I design will be reviewed at the 30% completion stage, and the Title II design will be reviewed at the 60% and 90% stages. The 90% documents will contain engineering designs, drawings, specifications, test plans, and construction cost estimates in complete form for MMES and DOE final review. Upon comment resolution, final design reports will be issued CFC.

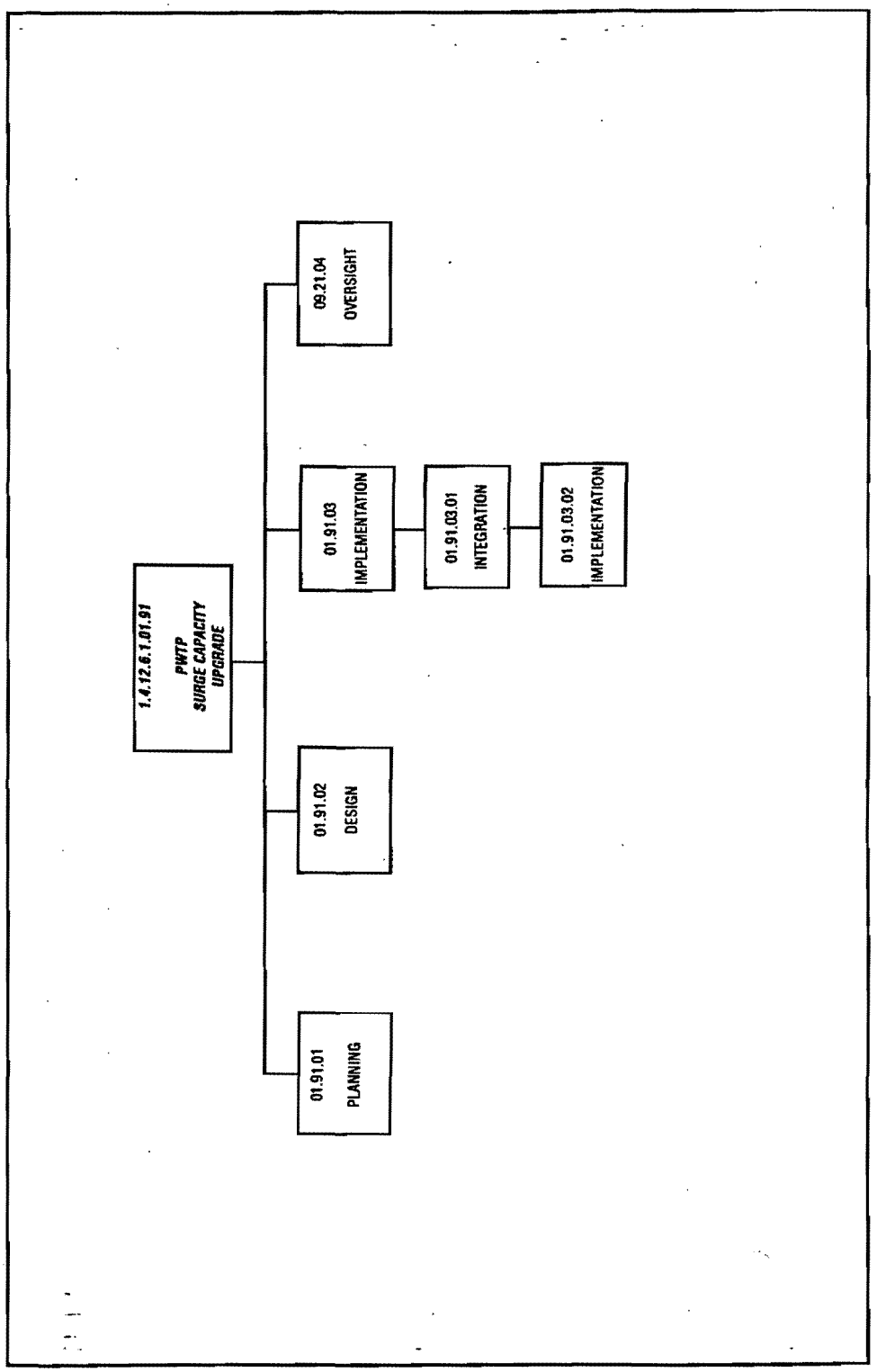


Fig. 25.1. PWTP Surge Capacity Upgrade Work Breakdown Structure.

25.4 IMPLEMENTATION

25.4.1 Integration

The objective of this element is to provide construction management, Title III services, and A-E construction support as required. Integration of construction activities to support this action includes the following tasks:

- Ensure that subcontractor and subcontracted labor work is performed on schedule; in accordance with all technical requirements; and in compliance with the ES&H Program, the QA Program, the Waste Management Program, and the Security Program.

- Perform all field inspections, provide as-built drawings, approve Design Change Notices and Field Change Requests, as applicable, and ensure that construction is accomplished according to design requirements.

25.4.2 Implementation

Due to the anticipated increase in waste generated from early remedial activities planned for WAG 1, a 500,000-gal capacity surge tank will be constructed for the ORNL PWTP, since the present capability to handle surge is limited. The additional tank capacity would enable ER activities to continue without interruption at times when the PWTP is functioning at peak capacity.

25.5 OVERSIGHT

Oversight will be provided throughout the planning, design, and construction phases of the proposed action. Reviews will be provided by MMES and DOE, as appropriate, to ensure that the action complies with technical and administrative requirements. Construction will be monitored by MMES and the A-E Contractor.

25.6 RISKS AND UNCERTAINTIES

- The volume of contaminated groundwater generated by the Core Hole Eight and Boundary Interception Early Actions is uncertain at this time. The volume estimate is dependent on a number of factors, and refinement of the estimate is needed for planning purposes.

- Changes to the schedule for the Core Hole Eight and Boundary Interception Early Actions will affect the schedule for implementation of this action.

- If funding is not available for implementation of this action, the schedule may not maintained.

25.7 INTERFACES

During remediation activities, interface and coordination with the following agencies will be necessary:

- DOE — To provide regulatory and construction oversight, management support, appropriate fiscal funding support, and program direction.

- MMES Waste Management — To provide waste management overview and the capability to process the wastes generated and to provide interface with PWTP/NRWTP operations and upgrade projects.

- MMES ES&H — To provide input and overview for the ES&H aspects of conducting the RA.

- MMES Construction Support.

- MMES Title III Services.

- A-E Contractor — To provide support with field change requests, as-built drawings, and Title III services.

26.0 WAG 1 RISKS AND UNCERTAINTIES SUMMARY

26.1 CONTINGENCY IN THE ESTIMATE

DOE Order 4700.1 defines contingency as the sum of funds included within an estimate to cover materials, labor, conditions, and risk situations that are an intrinsic part of the presently intended scope of work but that are not specifically allowed for elsewhere in the estimate due to uncertainty concerning their existence, nature, likelihood of occurrence, or magnitude of effect. Such items and situations are likely to occur in the course of every project but in uncertain combinations and magnitudes. Contingency provides allowance for error in the estimate. Contingency funds are meant to cover only the scope of work as it is presently conceived; they are not intended to provide for additions to scope or to require reduction of scope.

26.2 COST CONTINGENCY ANALYSIS

A contingency analysis was conducted according to DOE-HQ guidance provided by a William Heffelfinger memorandum, "Cost Estimating Guide for Application of Contingency," dated June 18, 1985.

A midrange contingency of 25% for planning/feasibility level of estimate is based on this referenced guidance. The midrange was adjusted by evaluation of the completeness of design and complexity of construction for each major PSWBS element. The adjusted midrange contingency for this project is 31.55%.

Design completeness adjustment factors typically range from 0.7 to 1.5, with 1.0 being the "average" completeness of design at the conceptual level. An adjustment factor of more than 1.0 would indicate a "less-than-average" completeness of design.

The degree of complexity adjustment factor typically ranges from 0.7 to as much as 1.5 for extreme conditions. An adjustment factor of 1.0 would indicate a degree of complexity common at the level of a Conceptual Design Report, with normal uncertainty as to procurement cost or installation complexity. On the other hand, a 1.5 adjustment factor would indicate a one-of-a-kind design or, for example, the uncertainty associated with the disposal of a highly toxic or highly contaminated material or with high levels of radiation in work areas.

Variations from the normal degree of complexity were applied by the baseline project team based on professional judgment.

26.3 RISKS AND UNCERTAINTIES

The RA phase of a Baseline Report is difficult to estimate accurately. Often only limited data are available concerning the nature and extent of contamination, and changes may be promulgated in regulatory requirements. In addition, field conditions or other site-specific constraints may require that a more costly alternative be implemented. These kinds of risk and uncertainty are not addressed in the contingency analysis.

Other DOE programs have attempted to address risk and uncertainty by incorporating a statistical probability that a contingent action may be required. If the base (planned) action fails, the cost assessment documented herein will increase due to the implementation of the contingent action. This dollar amount is then included in the estimate as risk and uncertainty.

This document does not address a quantitative assessment of risks and uncertainties because the basis for assessing these has been provided by project phase (i.e., RI, FS/PP/IROD, RD, RA). It has been assumed that the costs assessment for risks and uncertainties will be addressed in an ER Program-level document, which will integrate this information for the entire program at ORNL.

27.0 WAG 1 SCHEDULE SUMMARY

Figure 27.1 presents the WAG 1 summary schedule for remediation. This schedule is based on detailed network logic schedules that have been prepared for the remediation phases presented in Chapters 3.0 through 25.0. All durations are expressed in working days (5 days per week).

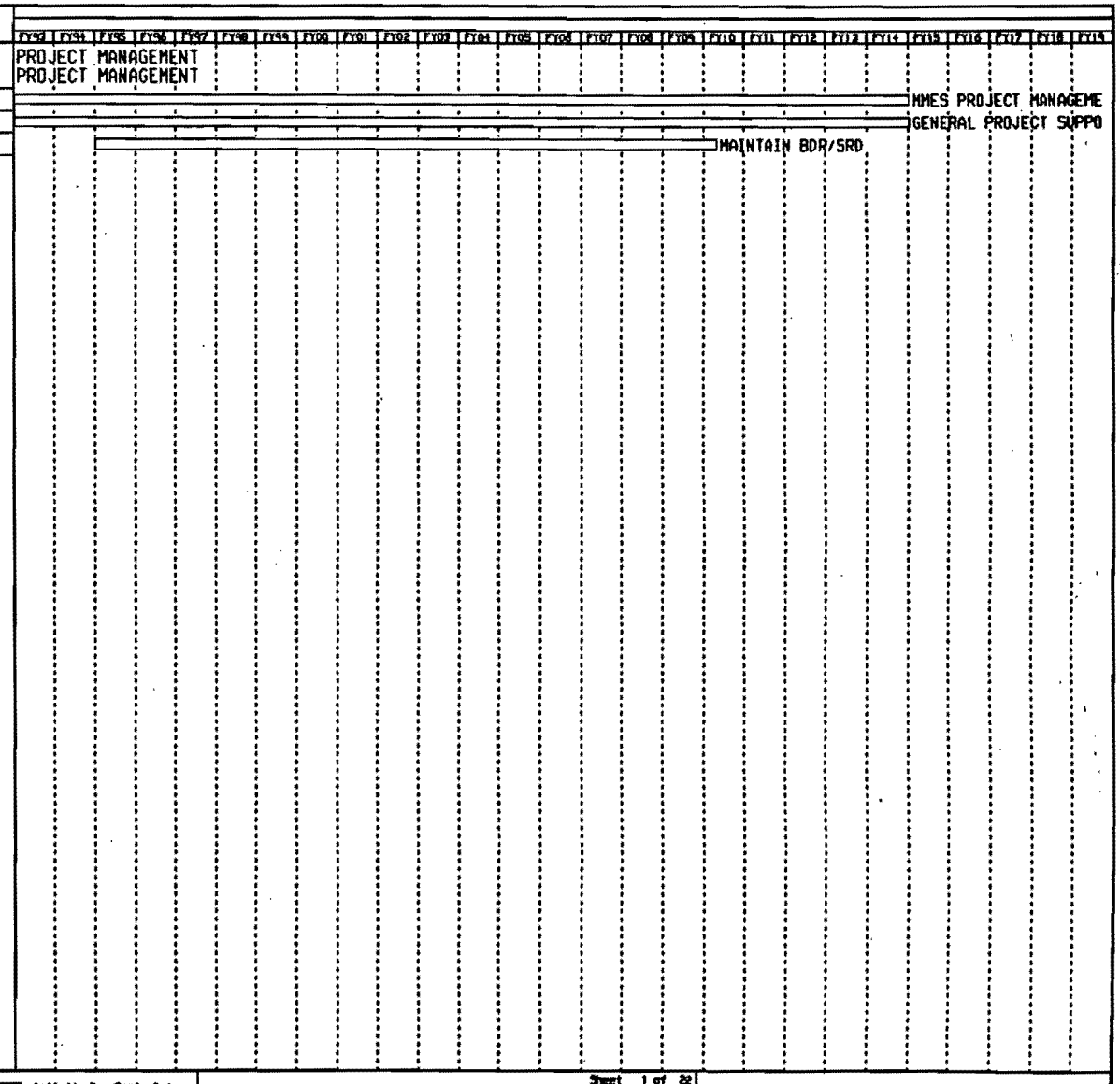
Appendix B contains the following schedules:

- Detailed bar charts with interim FFA milestones, actual work activities, review cycles, support activities, and activity durations.
- Logic diagrams that depict activity relationships, critical path, and total float for nonsupport activities of the entire project.
- Time-scaled logic diagrams that depict activity relationships through time for nonsupport activities of the entire project.

In order to start the RA 15 months after the IROD is signed, the following schedule assumptions were made and incorporated into the base schedule:

- Accelerated review cycles will be incorporated as outlined in Fig. 27.2 for all the FFA primary documents.
- The RD and RA activities for OU 1 will be split between a Phase I Fast Track effort and a subsequent Phase II scope. Other OUs only have single-phase logic for RD/RA activities.
- DOE-OR and DOE-HQ will participate on an ongoing basis during the RD efforts and will conduct concurrent accelerated reviews (15 days) with MMES.
- Preliminary work on the RD Work Plan, Title I and Title II design reports, and RA Work Plan will begin prior to the receipt of final regulatory approval of the IROD by EPA.
- A Fast Track schedule (as required) for each OU approach will be presented in the respective OU chapters.
- Due to the additional bid process and Title II design duration for the Tank Farm OU, a greater degree of risk will be incurred because Title II design begins before DOE HQ reviews the IROD application. The Contaminated Soils OU entails slightly less

ACTIVITY ID	EARLY START	EARLY FINISH
W1010101	10CT92	14OCT14
W1010102	10CT92	14OCT14
W1010103	30CT94	29JAN10



Plot Date 30AUG92
Data Date 10CT92
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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

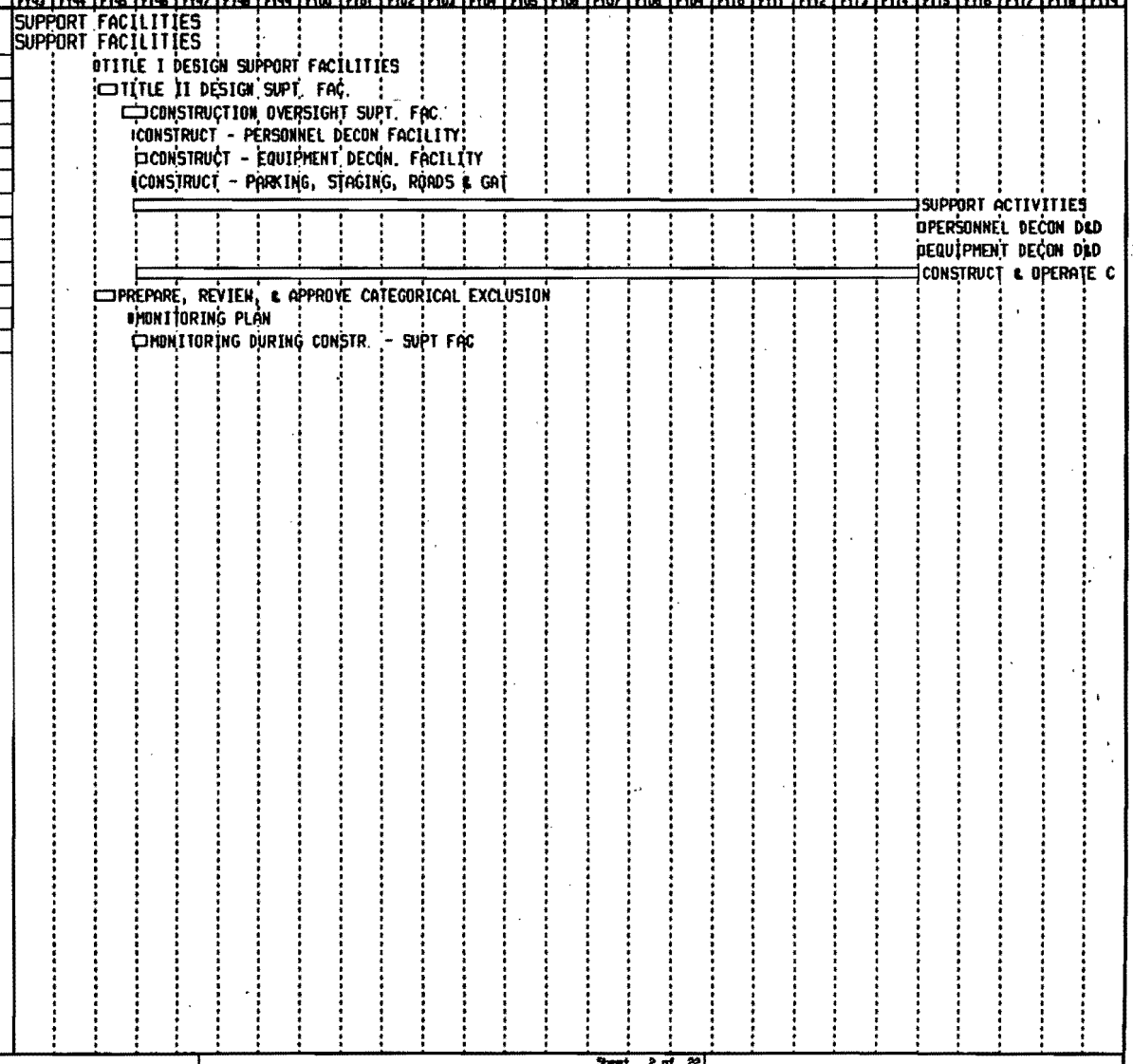
Sheet 1 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule.

ACTIVITY ID	EARLY START	EARLY FINISH
W1100101	3OCT94	8NOV94
W1100102	9NOV94	14APR95
W1100201	5JUN95	8JAN96
W1100202	4SEP95	8SEP95
W1100203	2OCT95	8JAN96
W1100204	4SEP95	29SEP95
W1100205	4SEP95	14OCT14
W1100206	15OCT14	8DEC14
W1100207	15OCT14	28NOV14
W1100208	20CT95	14OCT14
W1100301	3OCT94	27MAR95
W1100401	4AUG95	15SEP95
W1100402	4SEP95	8JAN96



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Critical Activity
Progress Bar
Milestone/Flag Activity

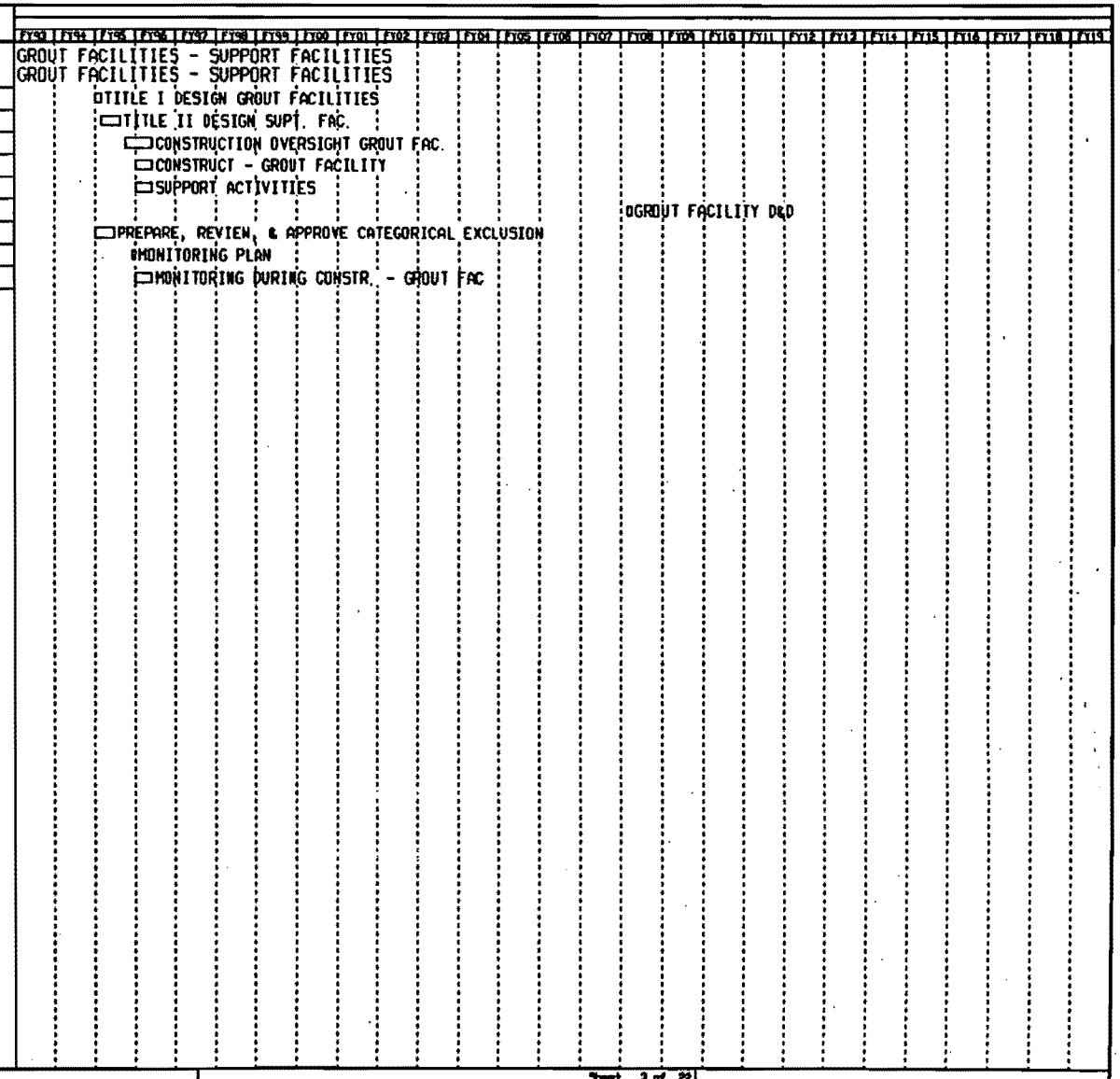
Sheet 2 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1110101	30CT94	22NOV94
W1110102	23NOV94	17MAY95
W1110201	6JUL95	4MAR96
W1110202	5OCT95	4MAR96
W1110203	5OCT95	4MAR96
W1110204	22NOV07	26DEC07
W1110301	30CT94	27MAR95
W1110401	6SEP95	4OCT95
W1110402	5OCT95	4MAR96



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Critical Activity
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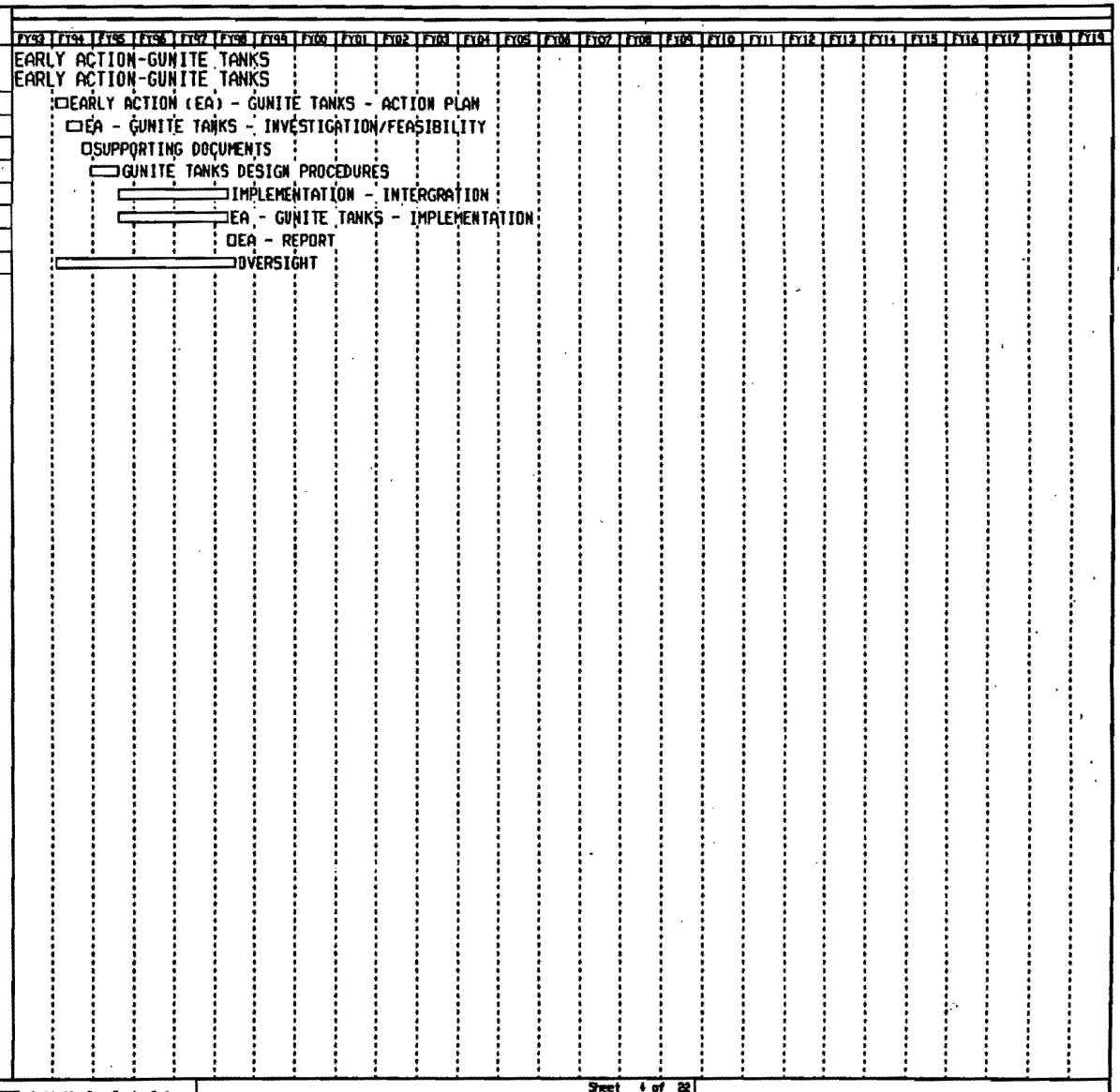
Sheet 3 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1200101	1NOV93	11FEB94
W1200102	14FEB94	24JUN94
W1200103	27JUN94	9SEP94
W1200201	12SEP94	22MAY95
W1200301	23MAY95	29JAN98
W1200302	23MAY95	29JAN98
W1200401	30JAN98	2APR98
W1200501	1NOV93	2APR98



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

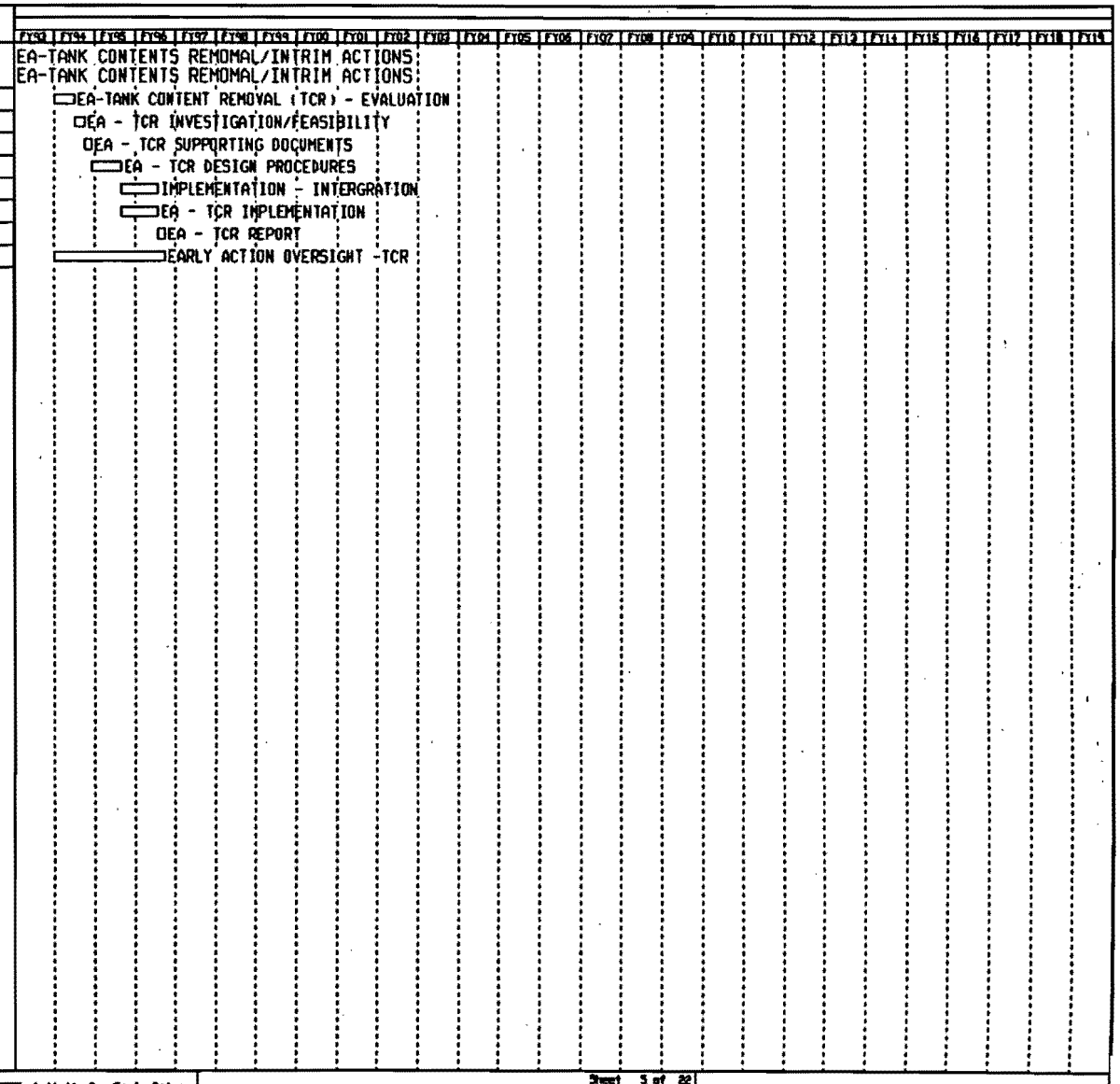
Sheet 4 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1210101	1OCT93	31MAR94
W1210102	1APR94	30JUN94
W1210103	1JUL94	1SEP94
W1210201	2SEP94	30MAY95
W1210301	31MAY95	25APR96
W1210302	31MAY95	25APR96
W1210401	26APR96	27JUN96
W1210501	1OCT93	27JUN96



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Critical Activity
Progress Bar
Milestone/Flag Activity

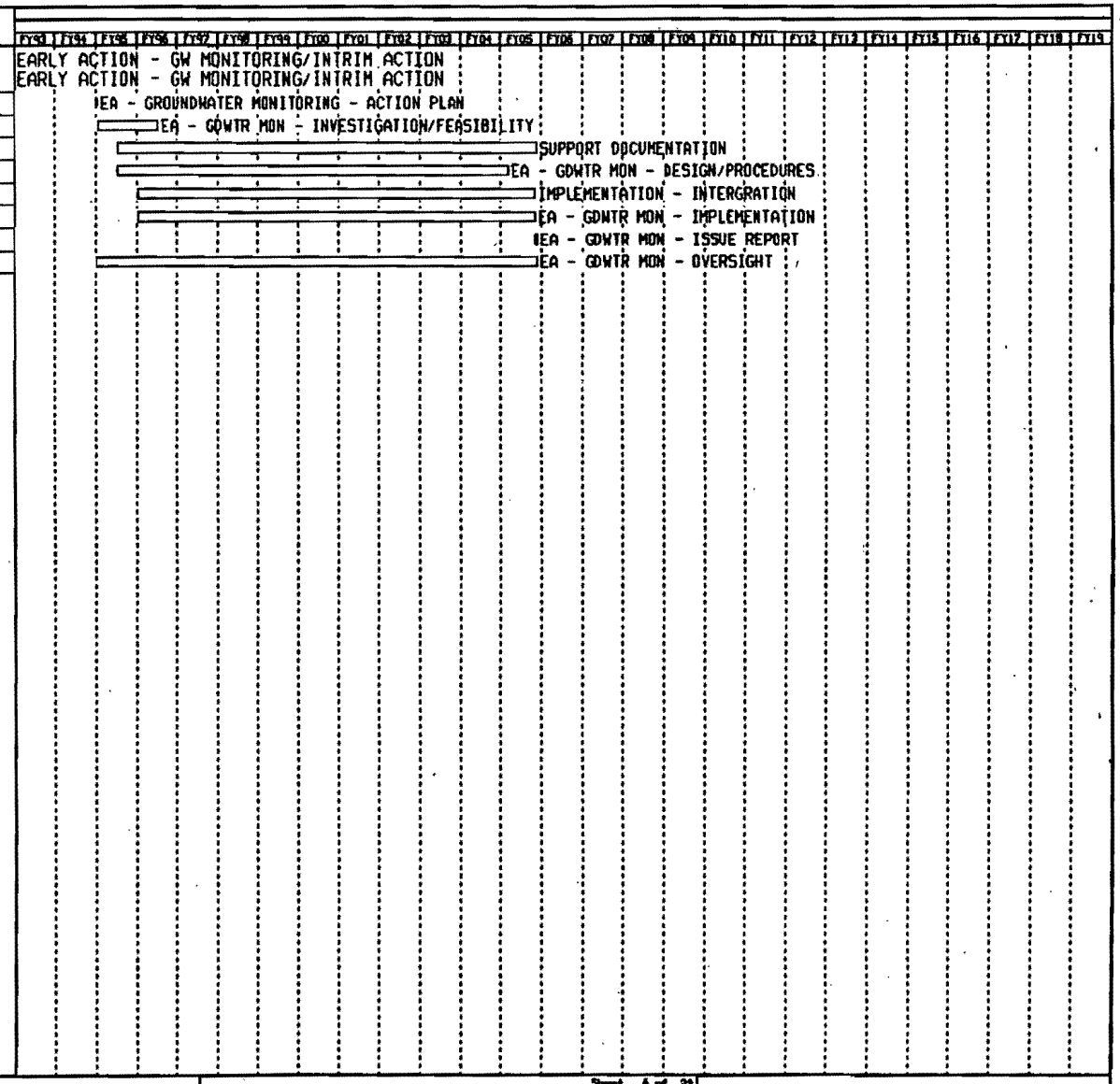
Sheet 5 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1220101	30CT94	14OCT94
W1220102	17OCT94	12APR96
W1220103	17APR95	22AUG05
W1220201	17APR95	10DEC04
W1220301	16OCT95	8AUG05
W1220302	16OCT95	8AUG05
W1220401	9AUG05	22AUG05
W1220501	30CT94	22AUG05



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Activity Bar/Early Dates
Critical Activity
Progress Bar
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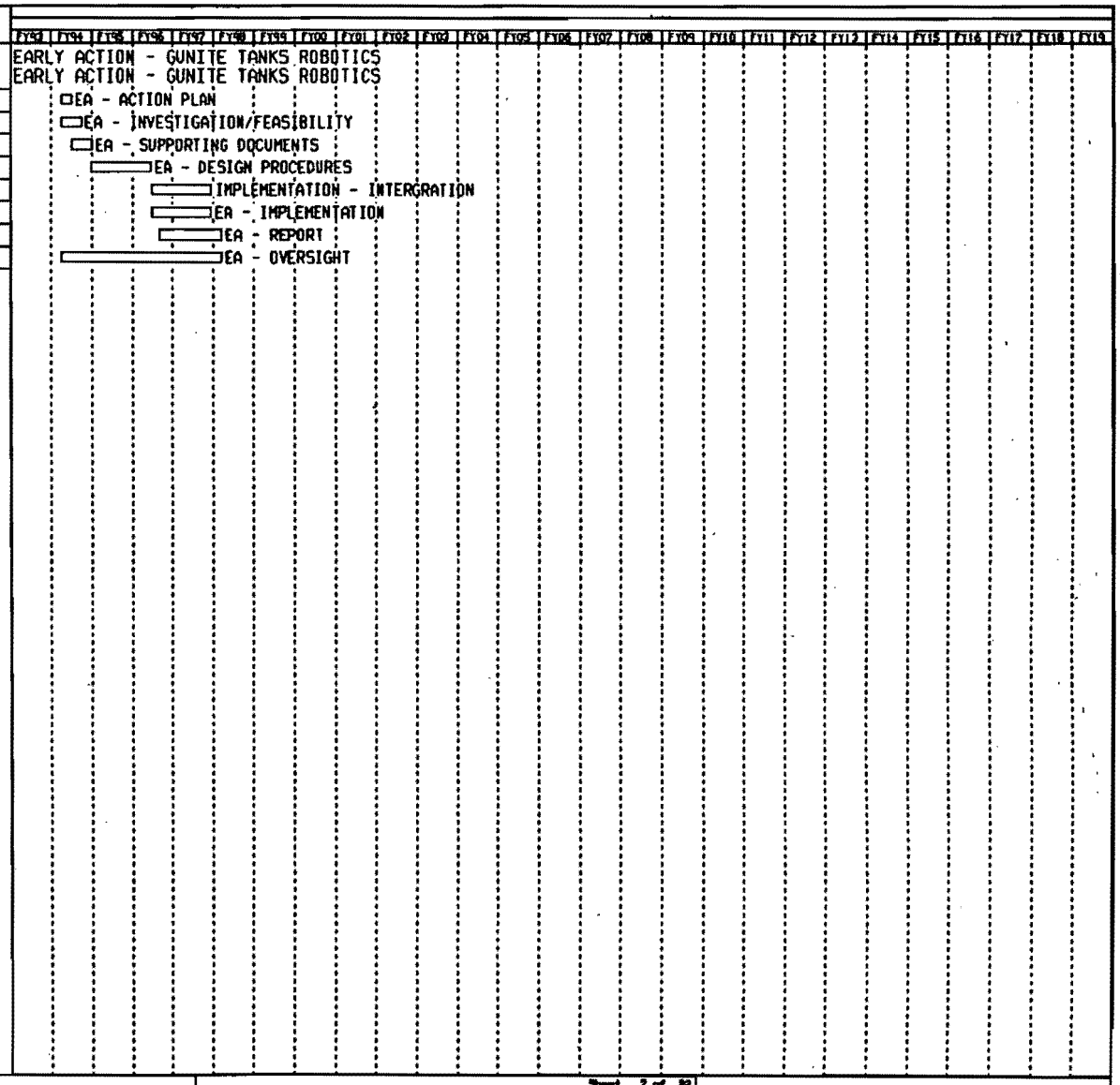
Sheet 6 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1240101	3JAN94	1APR94
W1240102	3JAN94	1JUL94
W1240103	4APR94	30CT94
W1240201	26SEP94	22MAR96
W1240301	25MAR96	17SEP97
W1240302	25MAR96	17SEP97
W1240401	4JUN96	15DEC97
W1240501	3JAN94	15DEC97



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

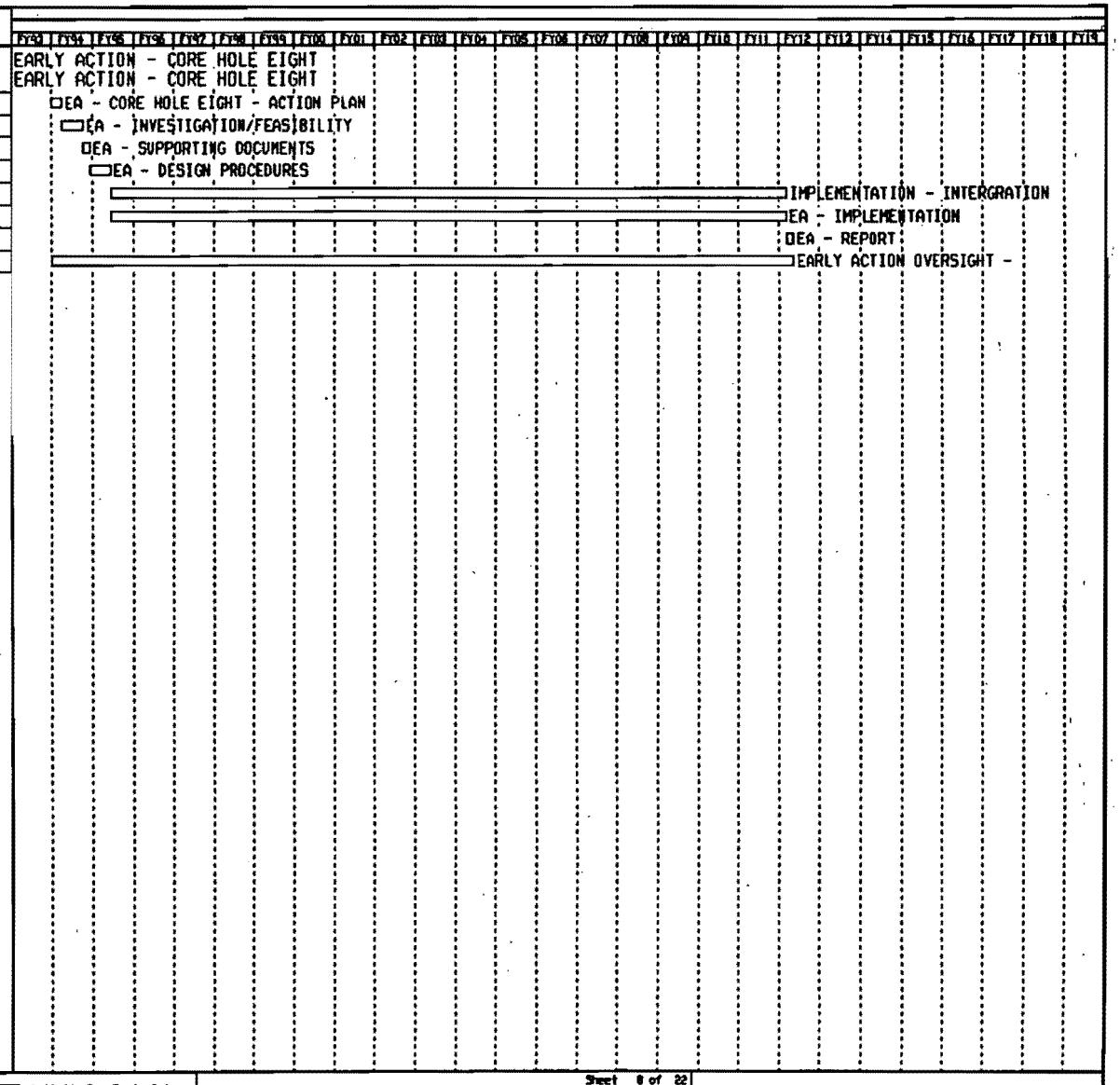
Sheet 7 of 82

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1250101	10CT93	30DEC93
W1250102	31DEC93	11JUL94
W1250103	12JUL94	12SEP94
W1250201	13SEP94	15MAR95
W1250301	16MAR95	12DEC11
W1250302	16MAR95	12DEC11
W1250401	13DEC11	13FEB12
W1250501	10CT93	13FEB12



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Critical Activity
Progress Bar
Milestone/Flag Activity

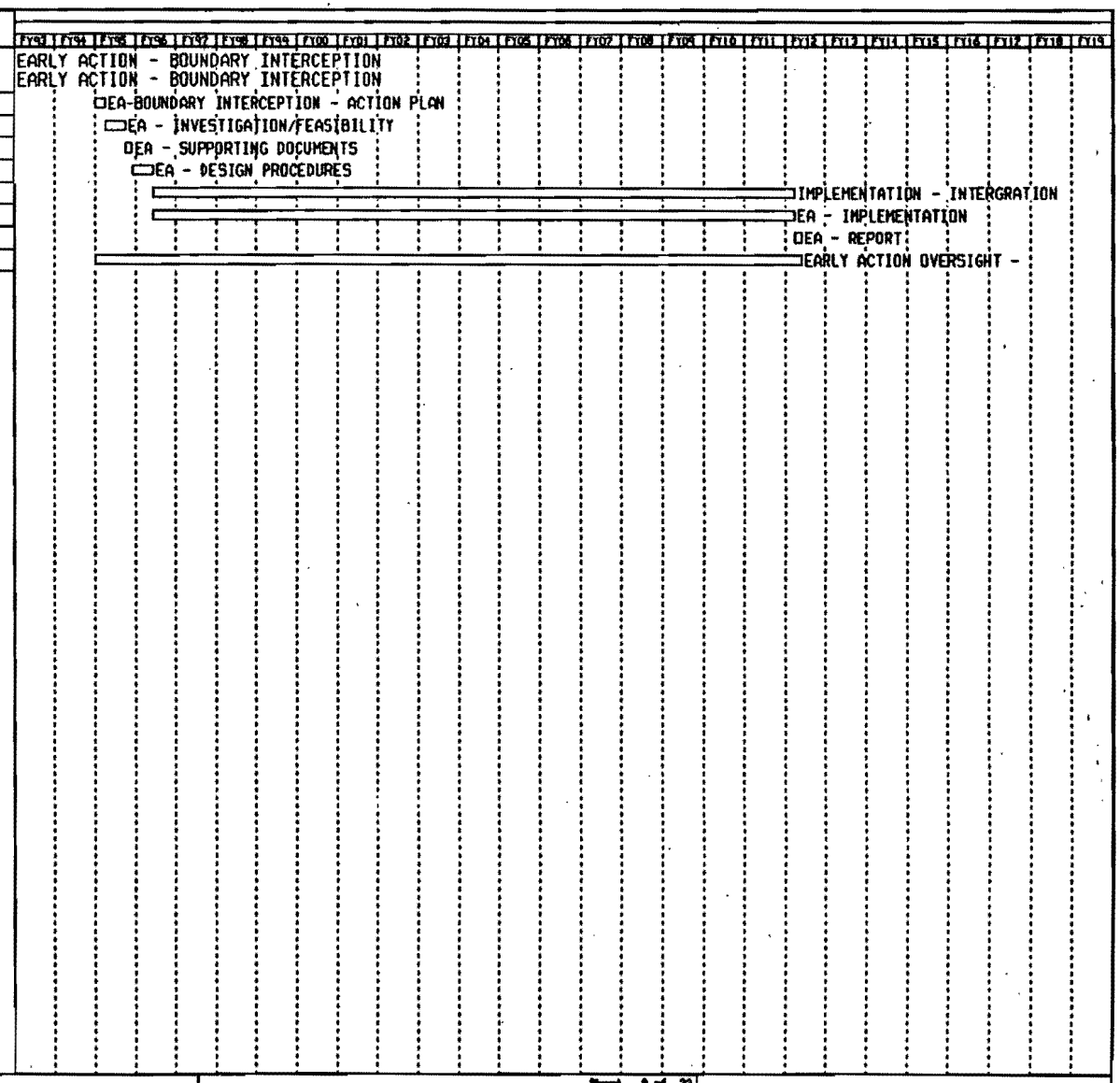
Sheet 8 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1260101	30CT94	30DEC94
W1260102	2JAN95	30JUN95
W1260103	3JUL95	15EP95
W1260201	4SEP95	5MAR96
W1260301	6MAR96	23DEC11
W1260302	6MAR96	23DEC11
W1260401	26DEC11	24FEB12
W1260501	30CT94	24FEB12



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Critical Activity
Progress Bar
◇/P Milestone/Flag Activity

Sheet 4 of 22

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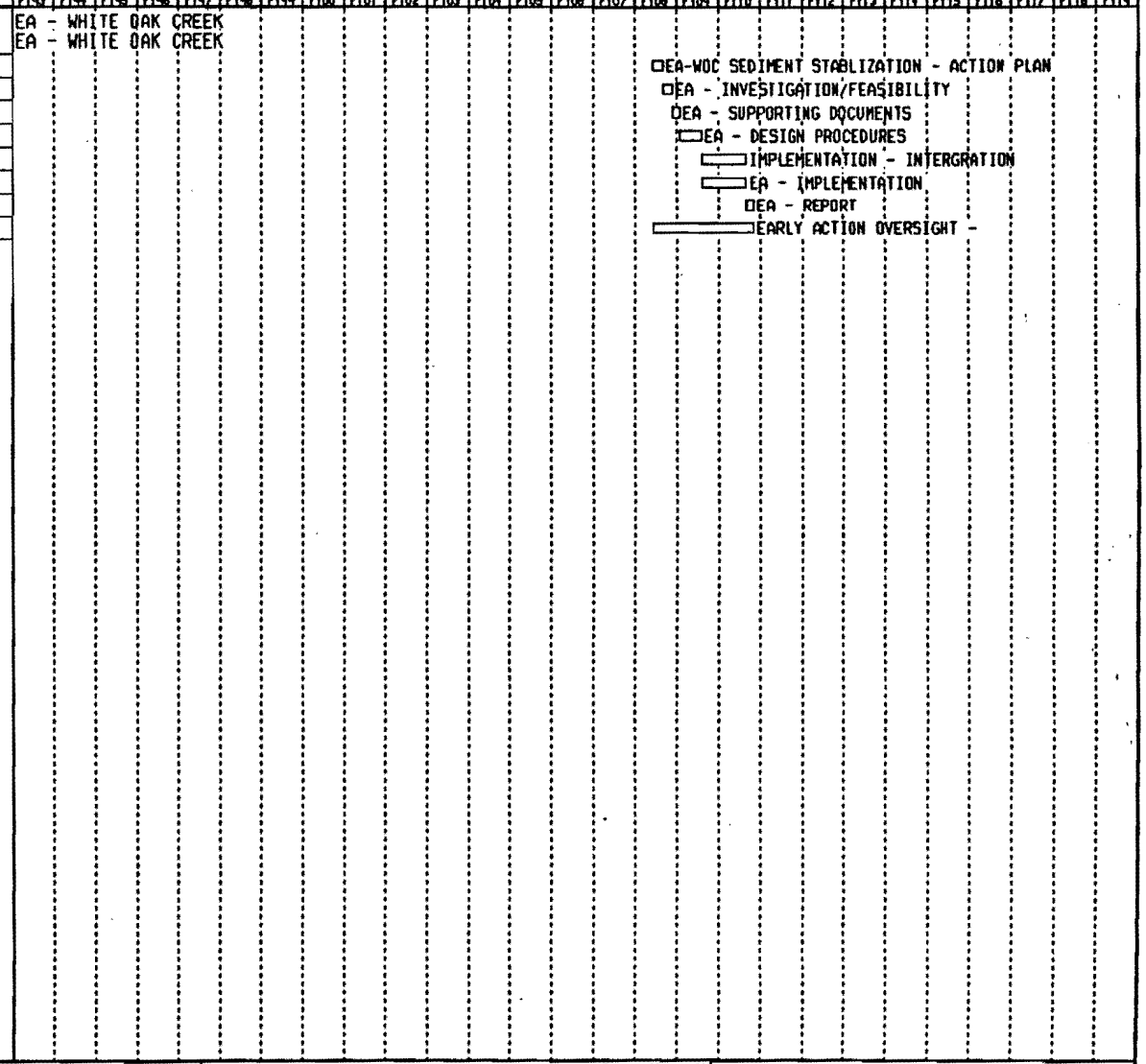
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1270101	3MAR08	30MAY08
W1270102	2JUN08	26AUG08
W1270103	27AUG08	28OCT08
W1270201	29OCT08	8MAY09
W1270301	11MAY09	3JUN10
W1270302	11MAY09	3JUN10
W1270401	4JUN10	5AUG10
W1270501	3MAR08	5AUG10



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Critical Activity
Progress Bar
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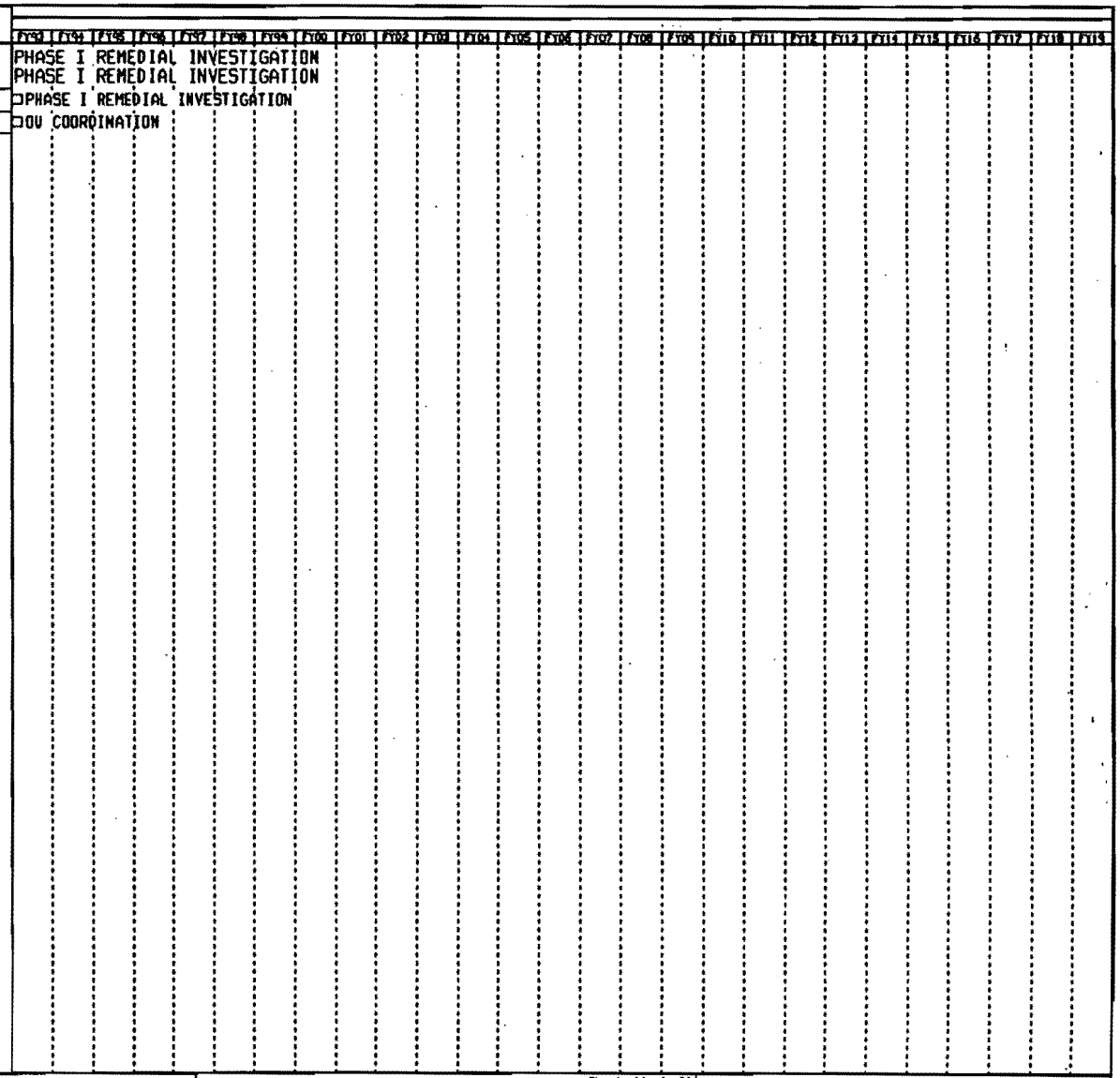
Sheet 10 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1400207	10CT92	7JAN93
W1400209	10CT92	7JAN93



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Critical Activity
Progress Bar
Milestone/Flag Activity

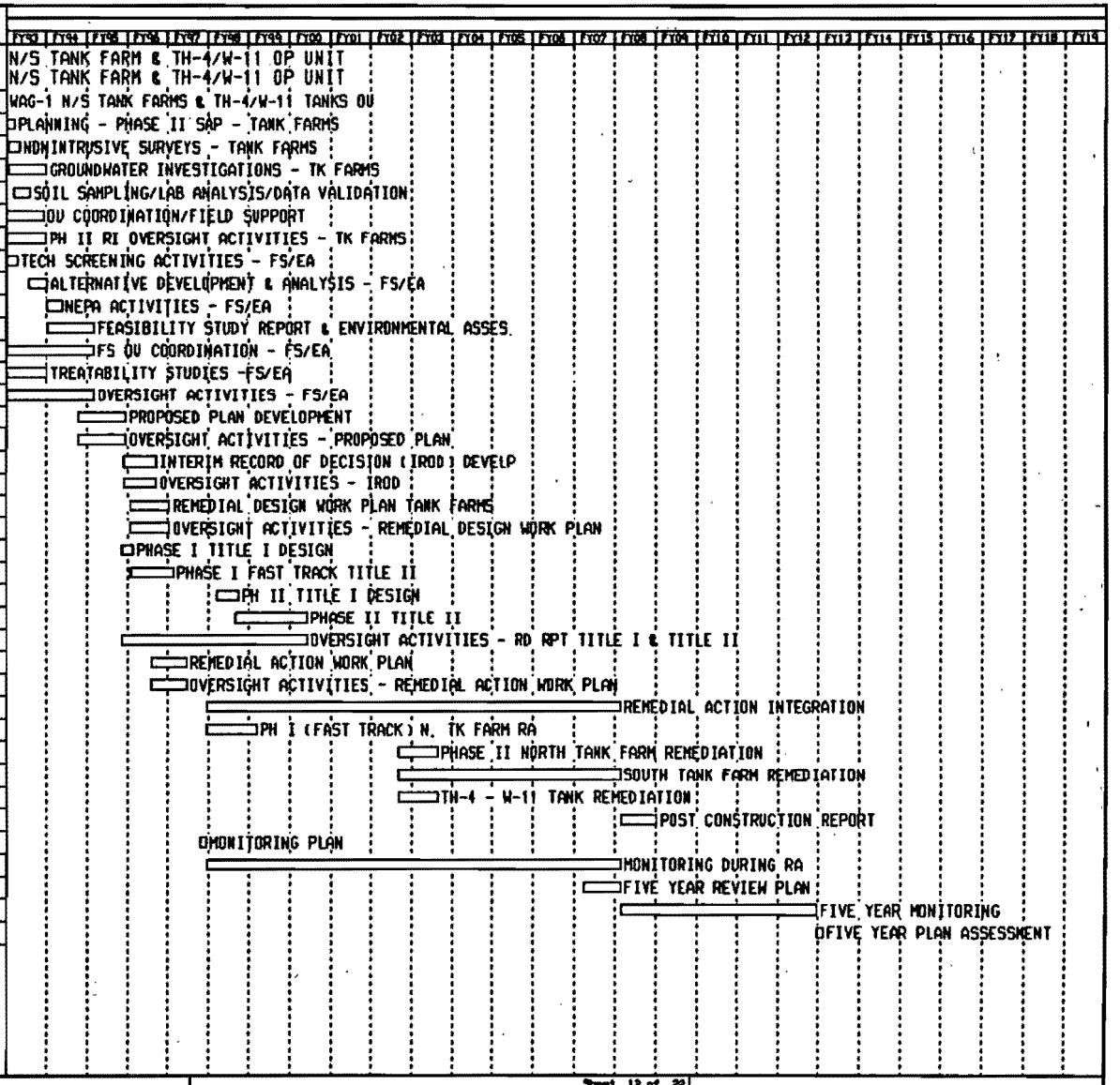
Sheet 11 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W14101	10CT92	10CT92
W1410101	10CT92	18DEC92
W1410201	22OCT92	3FEB93
W1410202	22OCT92	29SEP93
W1410204	11DEC92	5MAY93
W1410209	10CT92	7SEP93
W1410210	10CT92	29SEP93
W1410301	10CT92	8JAN93
W1410302	26APR93	8OCT93
W1410303	11OCT93	21FEB94
W1410304	11OCT93	8DEC94
W1410305	10CT92	8DEC94
W1410306	10CT92	6OCT93
W1410307	10CT92	8DEC94
W1410401	12JUL94	20SEP95
W1410402	12JUL94	20SEP95
W1410501	28AUG95	20JUN96
W1410502	28AUG95	20JUN96
W1410601	23OCT95	18OCT96
W1410603	23OCT95	18OCT96
W1410701	7AUG95	24NOV95
W1410702	30OCT95	19NOV96
W1410703	16DEC97	29JUN98
W1410704	2JUN98	3MAR00
W1410705	7AUG95	3MAR00
W1410801	6MAY96	19MAR97
W1410802	6MAY96	19MAR97
W1410901	12SEP97	21NOV07
W1410902	12SEP97	10DEC98
W1410903	30MAY02	28MAY03
W1410904	30MAY02	21NOV07
W1410905	30MAY02	28MAY03
W1411001	22NOV07	14OCT08
W1411101	16JUL97	11SEP97
W1411102	15SEP97	21NOV07
W1411201	29DEC06	21NOV07
W1411202	22NOV07	19SEP12
W1411203	20SEP12	14NOV12



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

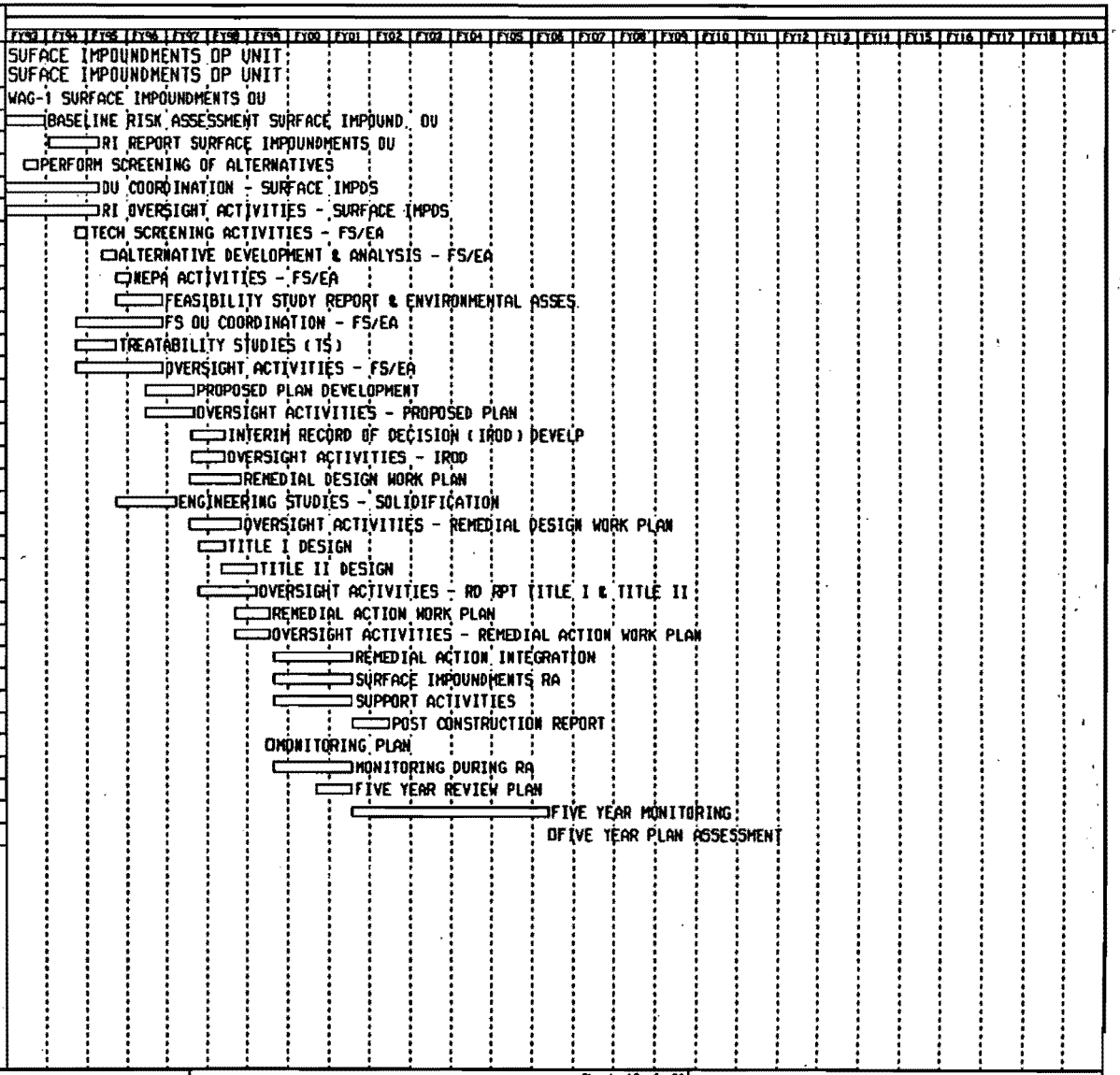
Sheet 12 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W14201	10CT92	10CT92
W1420205	10CT92	15SEP93
W1420207	26OCT93	20JAN95
W1420208	18MAR93	13JUL93
W1420209	10CT92	20JAN95
W1420210	10CT92	20JAN95
W1420301	23JUN94	5OCT94
W1420302	20FEB95	21JUN95
W1420303	22JUN95	2NOV95
W1420304	22JUN95	20AUG96
W1420305	23JUN94	20AUG96
W1420306	23JUN94	21JUN95
W1420307	23JUN94	20AUG96
W1420401	22MAR96	2JUN97
W1420402	22MAR96	2JUN97
W1420501	8MAY97	3MAR98
W1420502	8MAY97	3MAR98
W1420601	17APR97	31JUL98
W1420602	22JUN95	18DEC96
W1420603	17APR97	31JUL98
W1420701	10JUL97	3MAR98
W1420702	2FEB98	16DEC98
W1420705	10JUL97	16DEC98
W1420801	8JUN98	15APR99
W1420802	8JUN98	15APR99
W1420901	24MAY99	24APR01
W1420902	24MAY99	24APR01
W1420903	24MAY99	24APR01
W1421001	25APR01	18MAR02
W1421101	25MAR99	21MAY99
W1421102	24MAY99	24APR01
W1421201	1JUN00	24APR01
W1421202	25APR01	21FEB06
W1421203	22FEB06	18APR06



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Critical Activity
Progress Bar
Milestone/Flag Activity

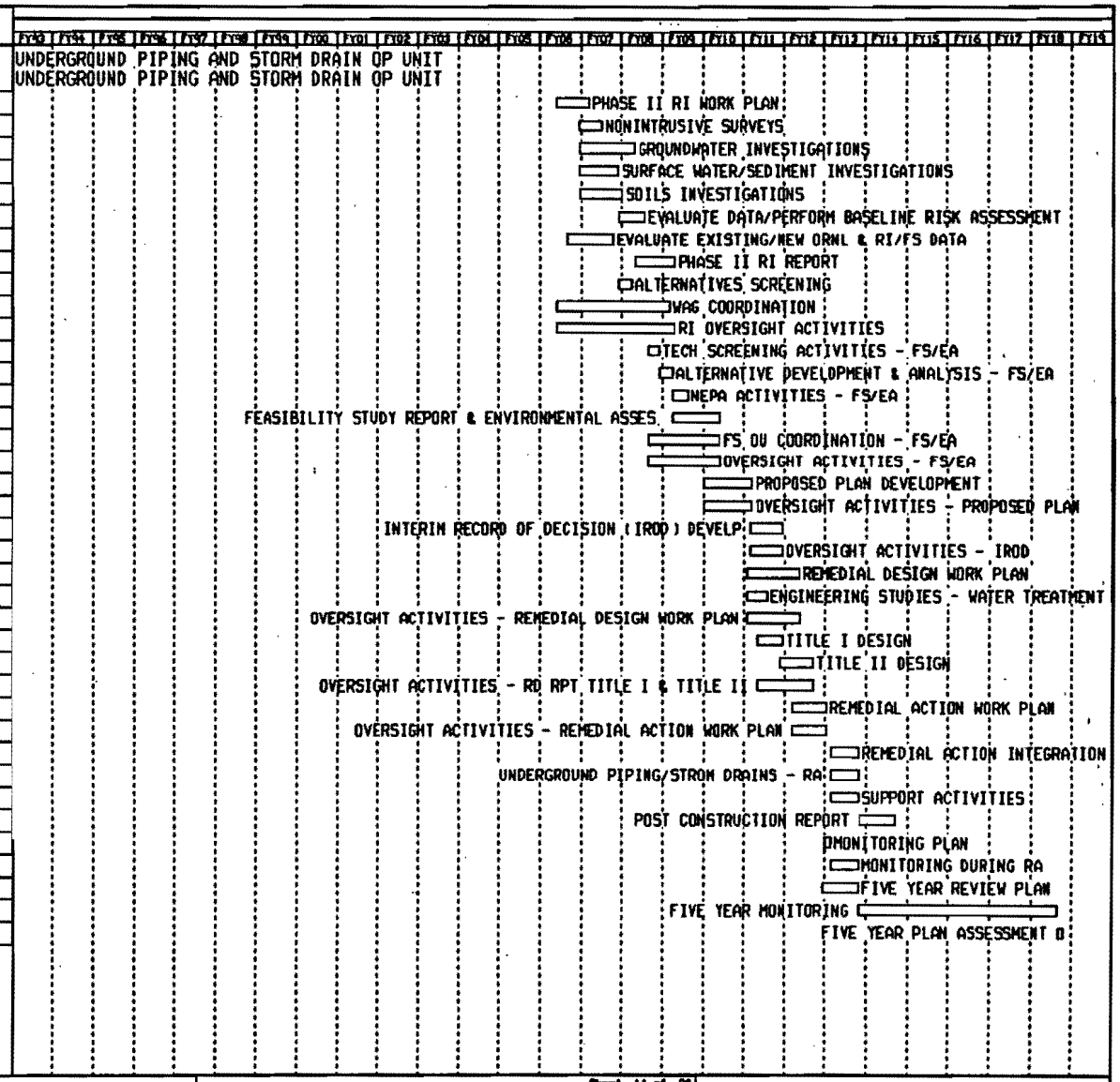
Sheet 13 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
		UNDERGROUND PIPING AND STORM DRAIN OP UNIT
		UNDERGROUND PIPING AND STORM DRAIN OP UNIT
W1430101	1MAR06	13DEC06
W1430201	19SEP06	11APR07
W1430202	19SEP06	28JAN08
W1430203	19SEP06	3SEP07
W1430204	19SEP06	10OCT07
W1430205	4SEP07	24APR08
W1430206	29MAY06	20JUL07
W1430207	29JAN08	22JAN09
W1430208	4SEP07	28DEC07
W1430209	1MAR06	2DEC08
W1430210	1MAR06	22JAN09
W1430301	26MAY08	2SEP08
W1430302	3SEP08	2JAN09
W1430303	5JAN09	18MAY09
W1430304	5JAN09	4MAR10
W1430305	26MAY08	4MAR10
W1430307	26MAY08	4MAR10
W1430401	6OCT09	15DEC10
W1430402	6OCT09	15DEC10
W1430501	22NOV10	15SEP11
W1430502	22NOV10	15SEP11
W1430601	1NOV10	14FEB12
W1430602	1NOV10	29APR11
W1430603	1NOV10	14FEB12
W1430701	24JAN11	15SEP11
W1430702	17AUG11	15JUN12
W1430705	24JAN11	15JUN12
W1430801	7DEC11	15OCT12
W1430802	7DEC11	15OCT12
W1430901	21NOV12	26JUL13
W1430902	21NOV12	26JUL13
W1430903	21NOV12	26JUL13
W1431001	29JUL13	19JUN14
W1431101	24SEP12	20NOV12
W1431102	21NOV12	26JUL13
W1431201	4SEP12	26JUL13
W1431202	29JUL13	25MAY18
W1431203	28MAY18	20JUL18



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

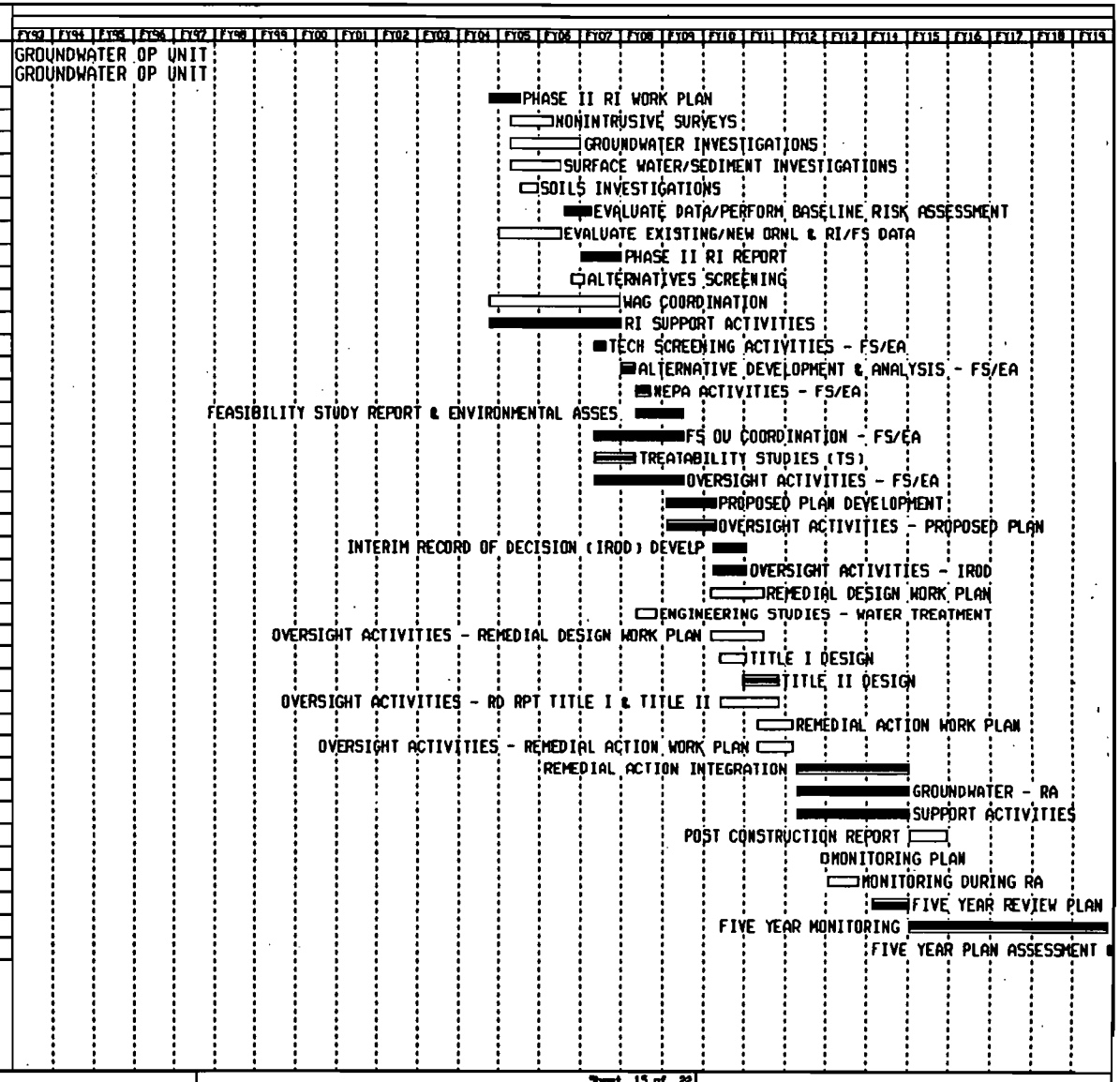
Sheet 14 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1440101	5JUL04	18APR05
W1440201	21JAN05	6FEB06
W1440202	21JAN05	16OCT06
W1440203	21JAN05	21APR06
W1440204	19APR05	19SEP05
W1440205	23MAY06	11JAN07
W1440206	30SEP04	19APR06
W1440207	17OCT06	11OCT07
W1440208	20JUL06	14NOV06
W1440209	5JUL04	28SEP07
W1440210	5JUL04	11OCT07
W1440301	12FEB07	22MAY07
W1440302	10OCT07	8FEB08
W1440303	11FEB08	23JUN08
W1440304	11FEB08	9APR09
W1440305	12FEB07	9APR09
W1440306	12FEB07	8FEB08
W1440307	12FEB07	9APR09
W1440401	11NOV08	20JAN10
W1440402	11NOV08	20JAN10
W1440501	28DEC09	21OCT10
W1440502	28DEC09	21OCT10
W1440601	7DEC09	22MAR11
W1440602	11FEB08	8AUG08
W1440603	7DEC09	22MAR11
W1440701	1MAR10	21OCT10
W1440702	22SEP10	9AUG11
W1440705	1MAR10	9AUG11
W1440801	28JAN11	7DEC11
W1440802	28JAN11	7DEC11
W1440901	13JAN12	14OCT14
W1440902	13JAN12	14OCT14
W1440903	13JAN12	14OCT14
W1441001	15OCT14	7SEP15
W1441101	20AUG12	16OCT12
W1441102	17OCT12	19JUL13
W1441201	21NOV13	14OCT14
W1441202	15OCT14	6AUG19
W1441203	7AUG19	24SEP19



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

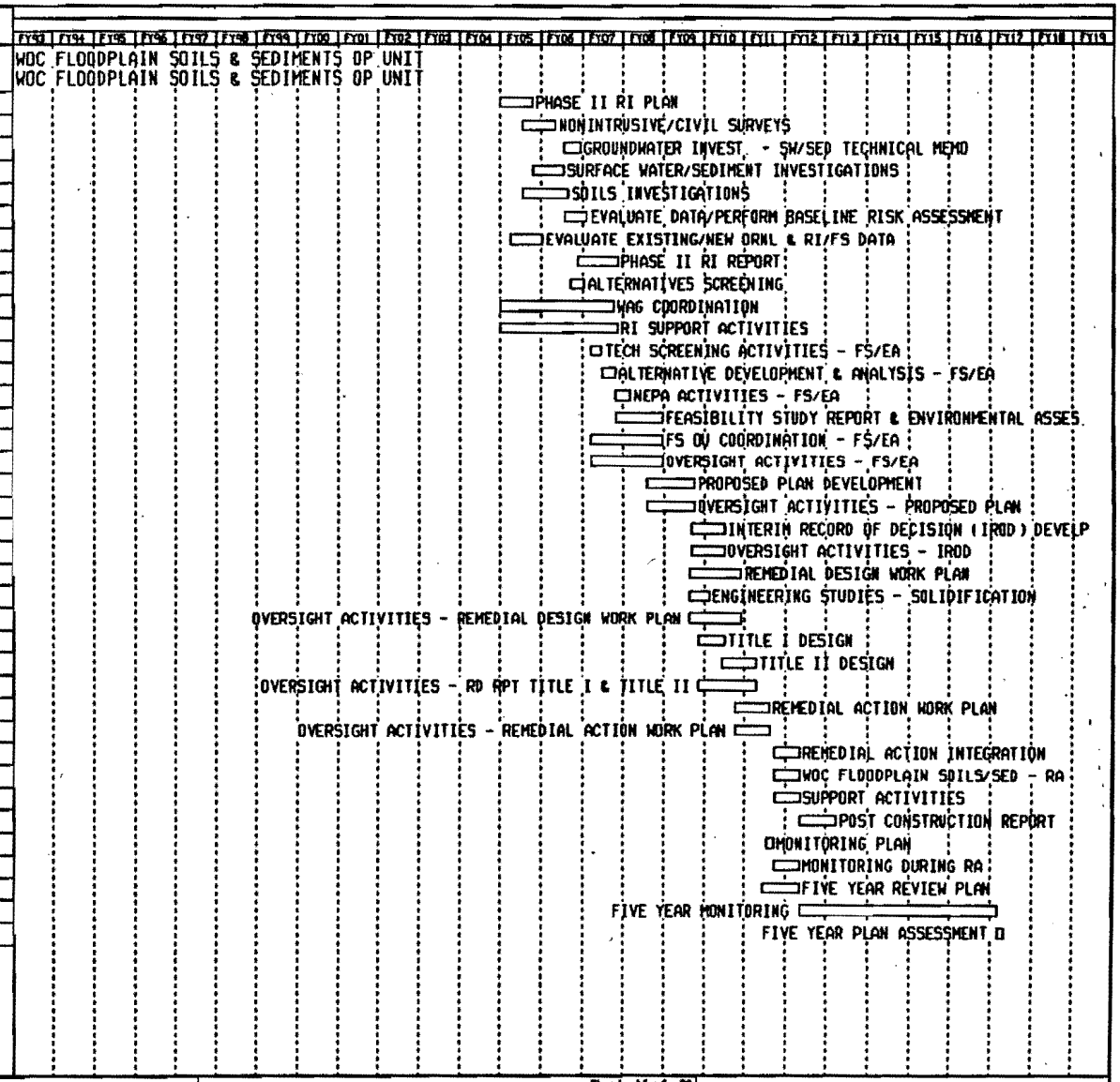
Sheet 15 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
		WOC FLOODPLAIN SOILS & SEDIMENTS OP UNIT
		WOC FLOODPLAIN SOILS & SEDIMENTS OP UNIT
W1450101	10CT04	15JUL05
W1450201	21APR05	8FEB06
W1450202	24APR06	15SEP06
W1450203	18JUL05	21APR06
W1450204	21APR05	29MAY06
W1450205	24APR06	14NOV06
W1450206	29DEC04	11OCT05
W1450207	18AUG06	14AUG07
W1450208	21JUN06	16OCT06
W1450209	10CT04	5JUL07
W1450210	10CT04	14AUG07
W1450301	14DEC06	23MAR07
W1450302	26MAR07	25JUL07
W1450303	26JUL07	6DEC07
W1450304	26JUL07	23SEP08
W1450305	14DEC06	23SEP08
W1450307	14DEC06	23SEP08
W1450401	25APR08	6JUL09
W1450402	25APR08	6JUL09
W1450501	11JUN09	6APR10
W1450502	11JUN09	6APR10
W1450601	21MAY09	3SEP10
W1450602	21MAY09	18NOV09
W1450603	21MAY09	3SEP10
W1450701	13AUG09	6APR10
W1450702	8MAR10	14JAN11
W1450705	13AUG09	14JAN11
W1450801	7JUL10	16MAY11
W1450802	7JUL10	16MAY11
W1450901	22JUN11	7FEB12
W1450902	22JUN11	7FEB12
W1450903	22JUN11	7FEB12
W1451001	8FEB12	31DEC12
W1451101	25APR11	21JUN11
W1451102	22JUN11	7FEB12
W1451201	17MAR11	7FEB12
W1451202	8FEB12	6DEC16
W1451203	7DEC16	31JAN17



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

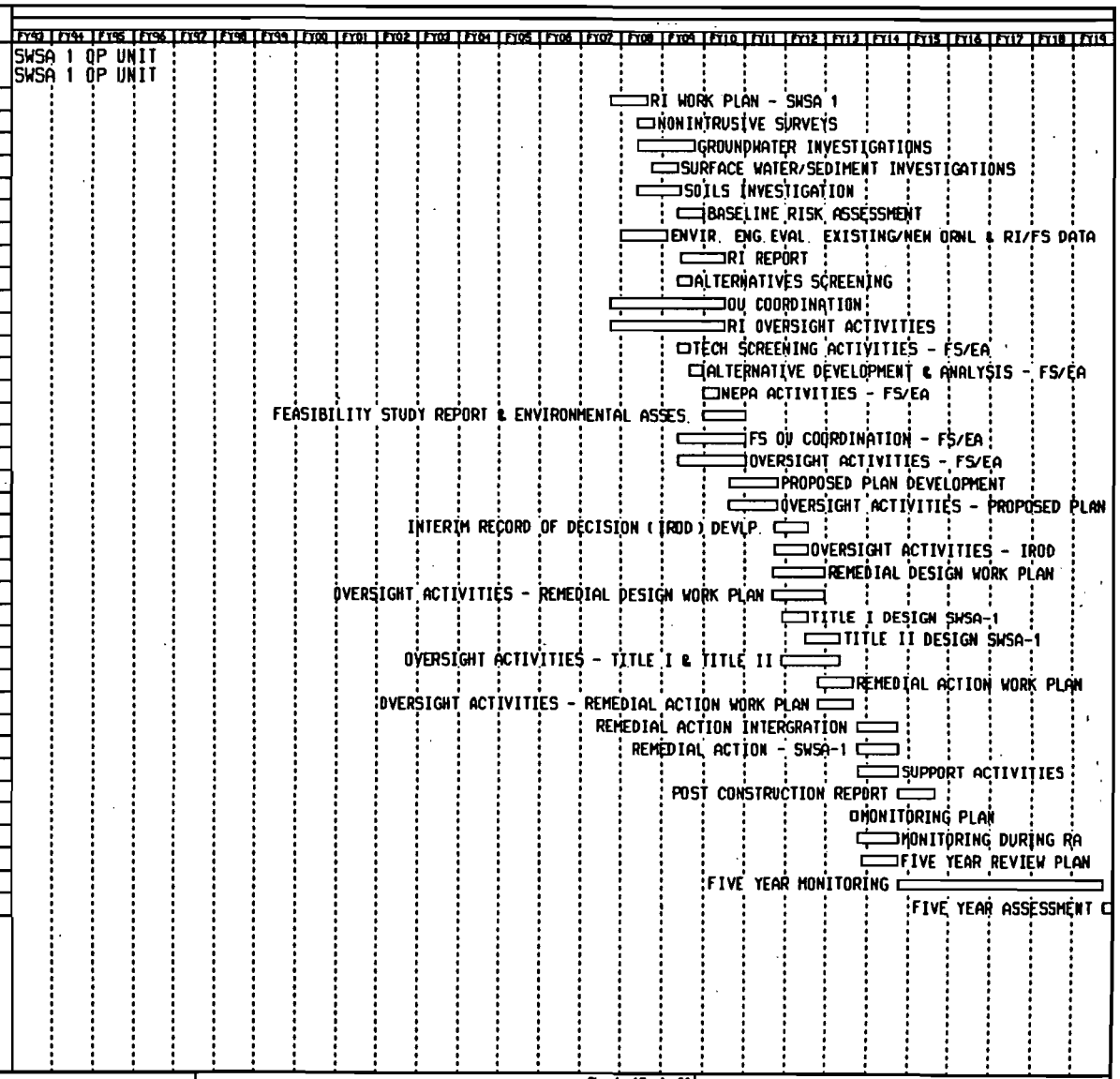
Sheet 16 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1460101	2JUL07	23MAY08
W1460201	28FEB08	23JUL08
W1460202	28FEB08	13JUL09
W1460203	30JUN08	16FEB09
W1460204	28FEB08	20MAR09
W1460205	17FEB09	8OCT09
W1460206	27SEP07	19NOV08
W1460207	18MAR09	7APR10
W1460208	17FEB09	12JUN09
W1460209	2JUL07	7APR10
W1460210	2JUL07	7APR10
W1460301	17FEB09	27MAY09
W1460302	28MAY09	28SEP09
W1460303	29SEP09	9FEB10
W1460304	29SEP09	11OCT10
W1460305	17FEB09	11OCT10
W1460307	17FEB09	11OCT10
W1460401	13MAY10	22JUL11
W1460402	13MAY10	22JUL11
W1460501	29JUN11	23APR12
W1460502	29JUN11	23APR12
W1460601	8JUN11	20SEP12
W1460603	8JUN11	20SEP12
W1460701	31AUG11	23APR12
W1460702	23MAR12	5FEB13
W1460705	31AUG11	5FEB13
W1460801	27JUL12	5JUN13
W1460802	27JUL12	5JUN13
W1460901	12JUL13	4JUL14
W1460902	12JUL13	4JUL14
W1460903	12JUL13	4JUL14
W1461001	7JUL14	28MAY15
W1461101	17MAY13	11JUL13
W1461102	12JUL13	4JUL14
W1461201	13AUG13	4JUL14
W1461202	7JUL14	28JUN19
W1461203	1JUL19	20SEP19



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Data Date 10CT92
Project Start 15JUN92
Project Finish 24SEP19

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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

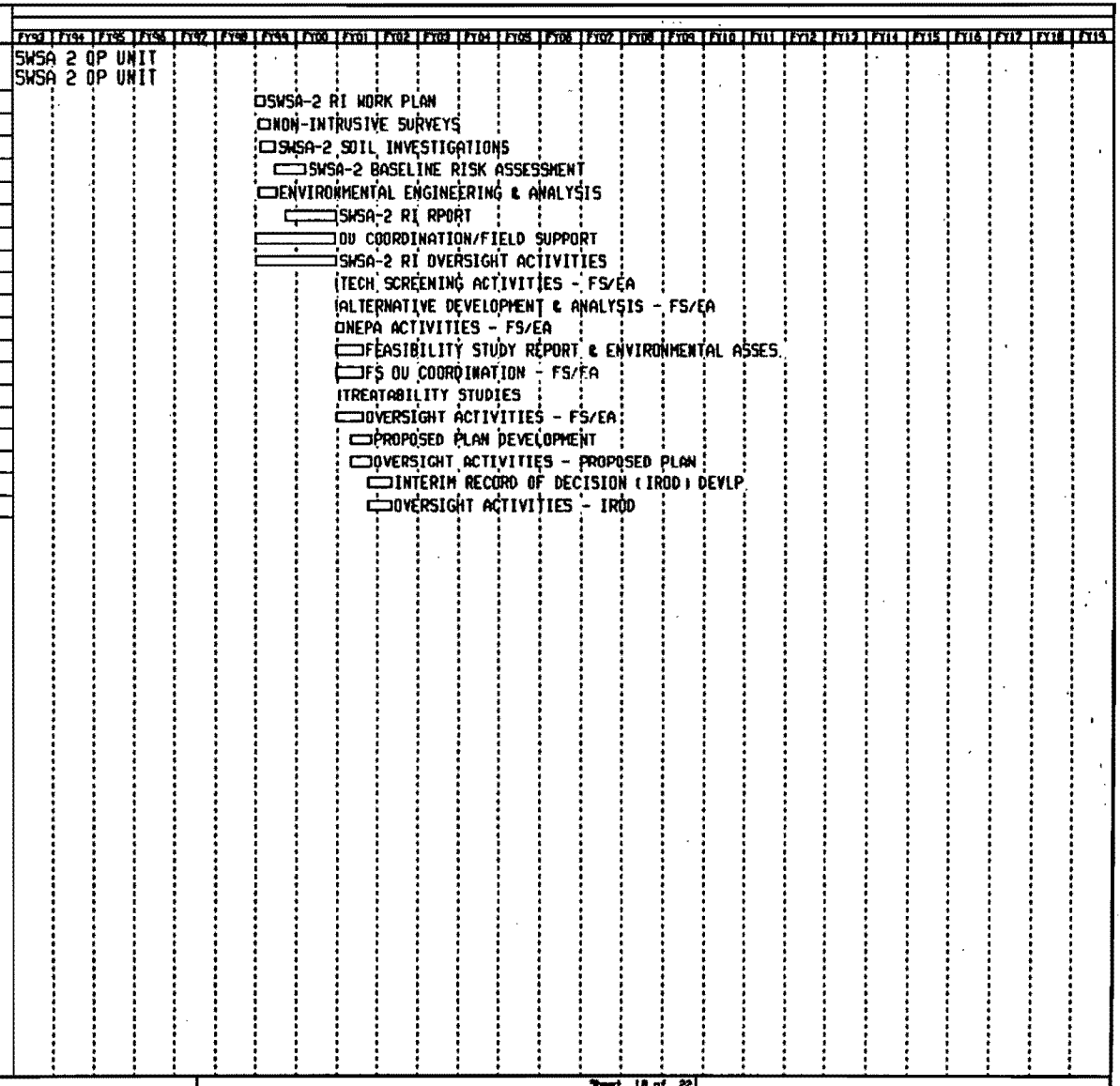
Sheet 17 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1470101	10CT98	18DEC98
W1470201	22OCT98	3FEB99
W1470204	10NOV98	23MAR99
W1470205	24MAR99	22DEC99
W1470206	22OCT98	7APR99
W1470207	24JUN99	19SEP00
W1470209	10CT98	18SEP00
W1470210	10CT98	19SEP00
W1470301	20SEP00	20SEP00
W1470302	21SEP00	21SEP00
W1470303	22SEP00	23NOV00
W1470304	22SEP00	17MAY01
W1470305	20SEP00	17MAY01
W1470306	20OCT00	20OCT00
W1470307	20SEP00	17MAY01
W1470401	29JAN01	2AUG01
W1470402	29JAN01	2AUG01
W1470501	10JUL01	29JAN02
W1470502	10JUL01	29JAN02



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Data Date 10CT92
Project Start 15JUN92
Project Finish 24SEP19

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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

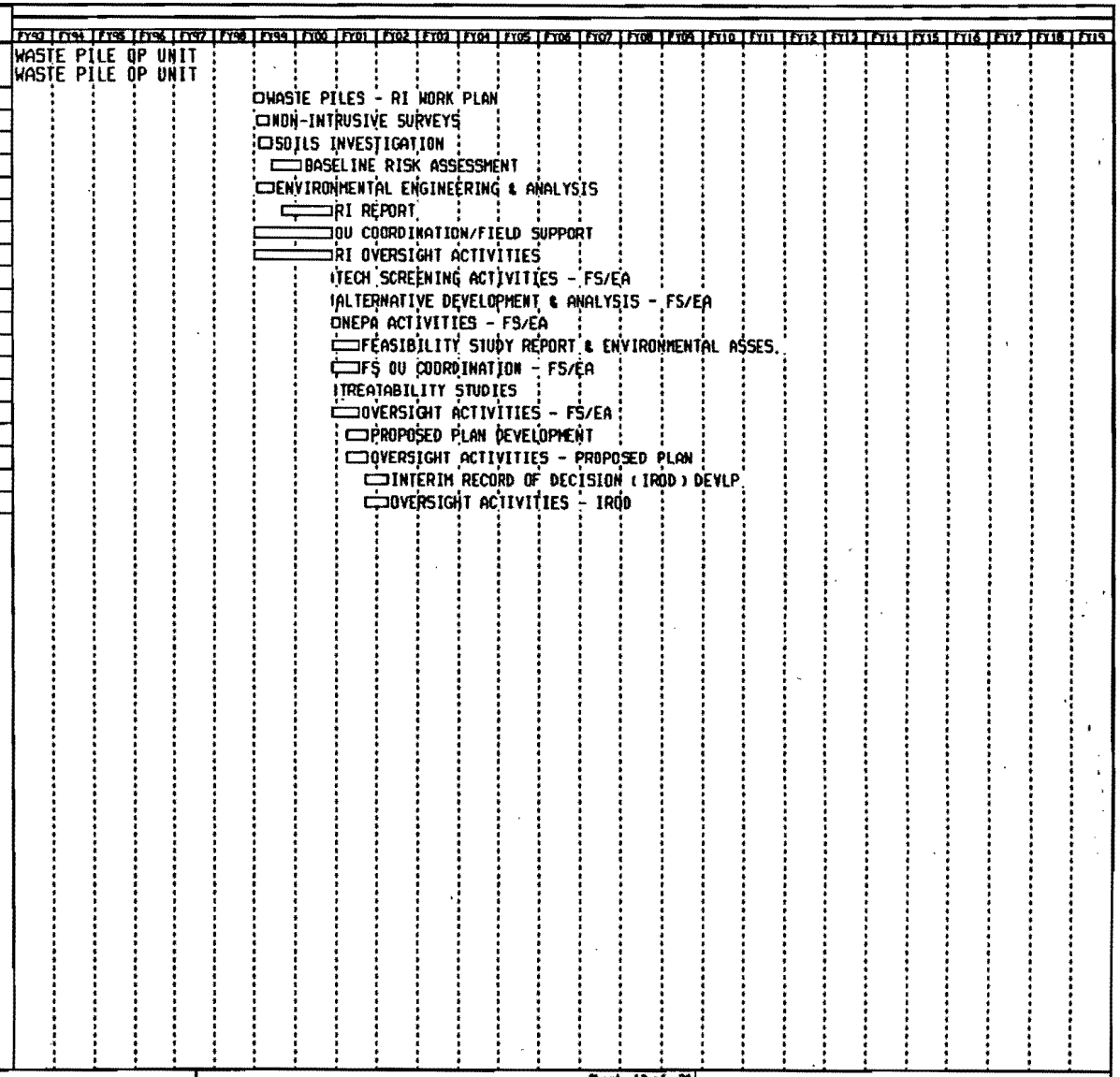
Sheet 18 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1480101	1OCT98	18DEC98
W1480201	22OCT98	3FEB99
W1480204	10NOV98	2MAR99
W1480205	3MAR99	26NOV99
W1480206	22OCT98	17MAR99
W1480207	31MAY99	24AUG00
W1480209	1OCT98	24AUG00
W1480210	1OCT98	24AUG00
W1480301	25AUG00	25AUG00
W1480302	28AUG00	28AUG00
W1480303	29AUG00	30OCT00
W1480304	29AUG00	23APR01
W1480305	25AUG00	23APR01
W1480306	26SEP00	26SEP00
W1480307	25AUG00	23APR01
W1480401	3JAN01	9JUL01
W1480402	3JAN01	9JUL01
W1480501	14JUN01	3JAN02
W1480502	14JUN01	3JAN02



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

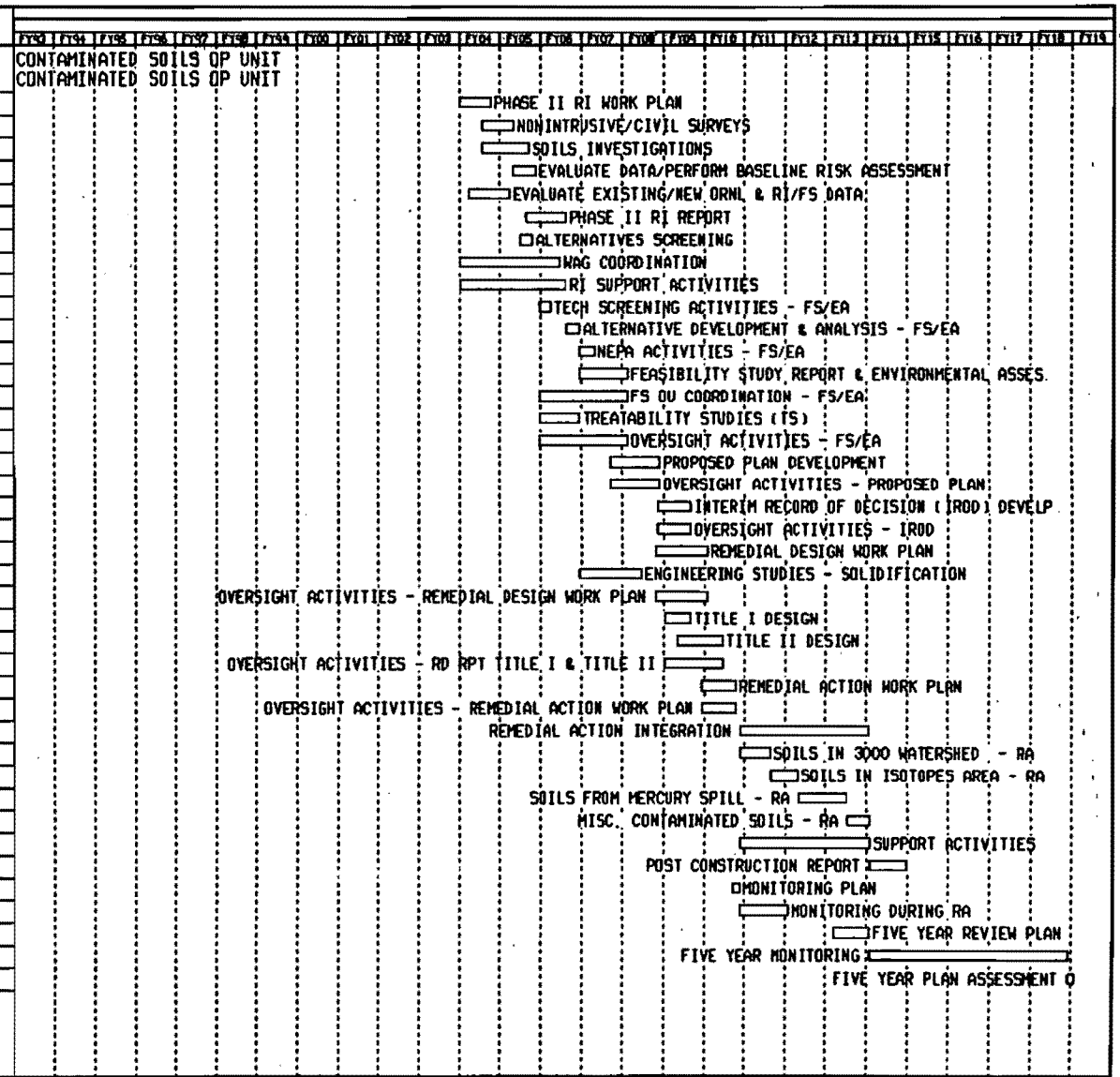
Sheet 19 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
		CONTAMINATED SOILS OP UNIT
		CONTAMINATED SOILS OP UNIT
W1490101	1OCT03	14JUL04
W1490201	20APR04	7FEB05
W1490204	20APR04	23JUN05
W1490205	28JAN05	22AUG05
W1490206	29DEC03	31DEC04
W1490207	26MAY05	22MAY06
W1490208	29MAR05	22JUL05
W1490209	1OCT03	28MAR06
W1490210	1OCT03	22MAY06
W1490301	21SEP05	29DEC05
W1490302	19MAY06	19SEP06
W1490303	20SEP06	31JAN07
W1490304	20SEP06	19NOV07
W1490305	21SEP05	19NOV07
W1490306	21SEP05	19SEP06
W1490307	21SEP05	19NOV07
W1490401	21JUN07	29AUG08
W1490402	21JUN07	29AUG08
W1490501	6AUG08	1JUN09
W1490502	6AUG08	1JUN09
W1490601	16JUL08	29OCT09
W1490602	20SEP06	18MAR08
W1490603	16JUL08	29OCT09
W1490701	8OCT08	1JUN09
W1490702	29JAN09	18MAR10
W1490705	8OCT08	18MAR10
W1490801	8SEP09	16JUL10
W1490802	8SEP09	16JUL10
W1490901	24AUG10	31OCT13
W1490902	24AUG10	26MAY11
W1490903	27MAY11	30JAN12
W1490904	31JAN12	9APR13
W1490905	10APR13	31OCT13
W1490906	24AUG10	31OCT13
W1491001	1NOV13	24SEP14
W1491101	25JUN10	23AUG10
W1491102	24AUG10	1NOV11
W1491201	10DEC12	31OCT13
W1491202	1NOV13	30AUG18
W1491203	31AUG18	25OCT18



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

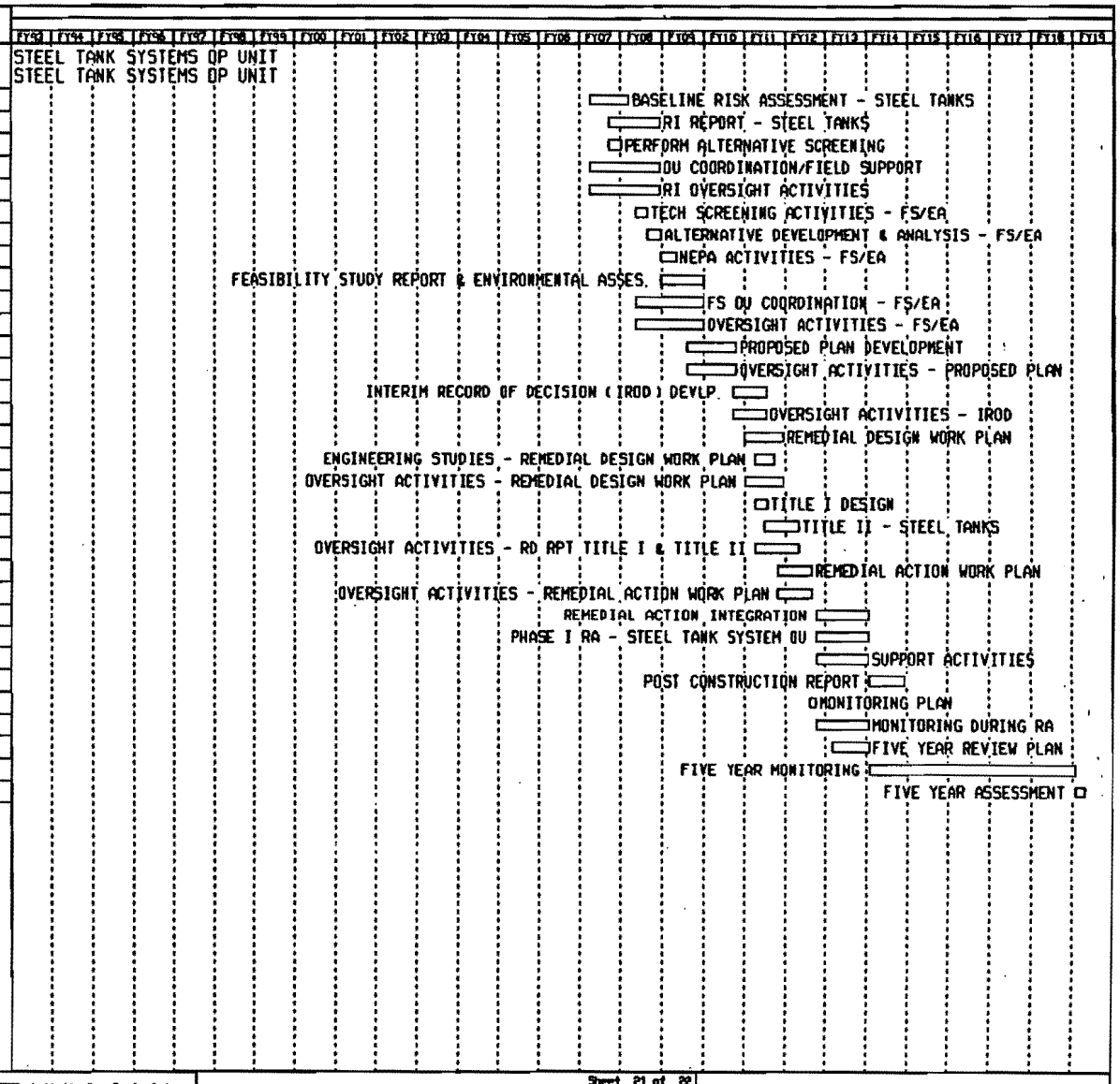
Sheet 20 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
		STEEL TANK SYSTEMS OP UNIT
		STEEL TANK SYSTEMS OP UNIT
W1500205	1JAN07	14DEC07
W1500207	18JUN07	11SEP08
W1500208	18JUN07	11OCT07
W1500209	1JAN07	10SEP08
W1500210	1JAN07	11SEP08
W1500301	13FEB08	22MAY08
W1500302	23MAY08	23SEP08
W1500303	24SEP08	4FEB09
W1500304	24SEP08	6OCT09
W1500305	13FEB08	6OCT09
W1500307	13FEB08	6OCT09
W1500401	8MAY09	19JUL10
W1500402	8MAY09	19JUL10
W1500501	24JUN10	19APR11
W1500502	24JUN10	19APR11
W1500601	4OCT10	16SEP11
W1500602	27DEC10	24JUN11
W1500603	4OCT10	16SEP11
W1500701	27DEC10	19APR11
W1500702	21MAR11	1FEB12
W1500705	27DEC10	1FEB12
W1500801	25JUL11	31MAY12
W1500802	25JUL11	31MAY12
W1500901	9JUL12	28OCT13
W1500902	9JUL12	28OCT13
W1500903	11JUL12	28OCT13
W1501001	29OCT13	19SEP14
W1501101	14MAY12	6JUL12
W1501102	9JUL12	28OCT13
W1501201	5DEC12	28OCT13
W1501202	29OCT13	22OCT18
W1501203	23OCT18	14JAN19



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

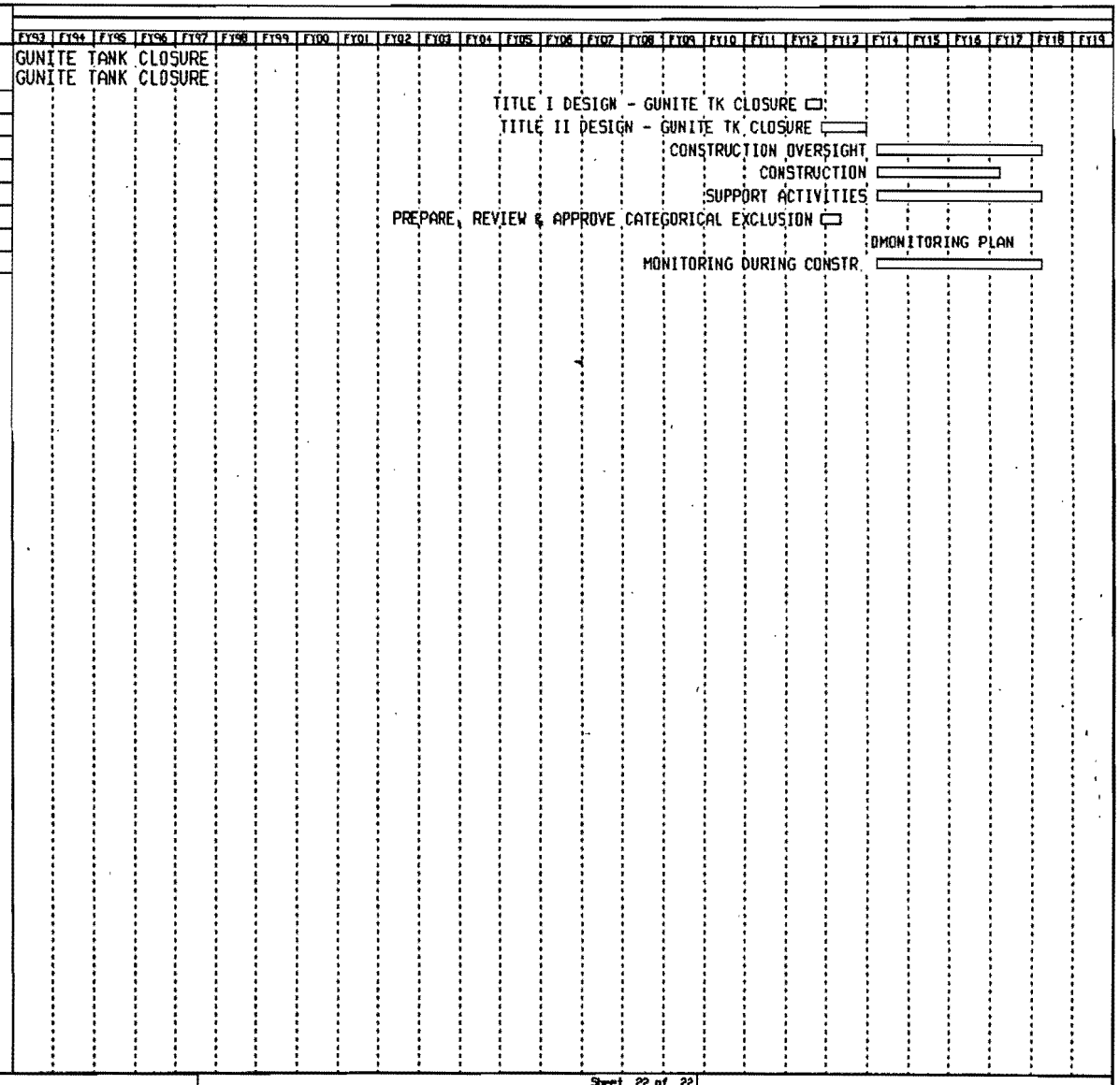
Sheet 21 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

ACTIVITY ID	EARLY START	EARLY FINISH
W1900101	2APR12	21AUG12
W1900102	22AUG12	27SEP13
W1900201	30DEC13	4JAN18
W1900202	30DEC13	30DEC16
W1900203	30DEC13	1JAN18
W1900301	22AUG12	13FEB13
W1900401	29NOV13	27DEC13
W1900402	30DEC13	1JAN18



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Activity Bar/Early Dates
Critical Activity
Progress Bar
Milestone/Flag Activity

Sheet 22 of 22

USDOE/ORNL
WASTE AREA GROUP 1
WAG-1 SUMMARY SCHEDULE (WBS)

Date	Revision	Checked	Approved

Fig. 27.1. WAG 1 Summary Schedule (continued).

Remedial Action Plan Review Cycle

MMES/DOE-OR/DOE-HQ Review Cycle		
DESCRIPTION	CALENDAR DAYS	WORK DAYS
MMES Submits to DOE-OR/HQ 1	0	0
DOE-OR/HQ Review Comments	43	32
MMES Resolves Comments and DOE-OR Transmits to EPA/TDEC	47	34
SUBTOTAL DAYS	90	66
EPA/TDEC Review Cycle		
Document submitted to EPA/TDEC (Primary Milestone) P/FFA 3	0	0
EPA/TDEC Review & Comment	30	22
DOE/Prime Contractor Receive EPA/TDEC Comments	0	0
DOE/Prime Contractor Resolve Comments DOE-OR Transmits to EPA/TDEC for Final Approval	70	50
DOE-OR Transmits to EPA/TDEC Final 5	0	0
EPA/TDEC Review and Approve Document	15	11
EPA and TDEC Approve Document 6	0	0
Public Comments	45	33
SUBTOTAL DAYS	160	116
ACCELERATED REVIEW CYCLE TOTAL	250	182

Accelerated Review Cycle

MMES/DOE-OR/DOE-HQ Review Cycle		
DESCRIPTION	CALENDAR DAYS	WORK DAYS
MMES Submits to DOE-OR/HQ 1	0	0
DOE-OR/HQ Review Comments	43	32
MMES Resolves Comments and DOE-OR Transmits to EPA/TDEC	47	34
SUBTOTAL DAYS	90	66
EPA/TDEC Review Cycle		
Document submitted to EPA/TDEC (Primary Milestone) P/FFA 3	0	0
EPA/TDEC Review and Comment	60	43
DOE/Prime Contractor Receive EPA/TDEC Comments	0	0
DOE/Prime Contractor Resolve Comments DOE-OR Transmits to EPA/TDEC for Final Approval	60	43
DOE-OR Transmits to EPA/TDEC Final 5	0	0
EPA/TDEC Review and Approve Document	30	22
EPA and TDEC Approve Document 6	0	0
SUBTOTAL DAYS	150	108
ACCELERATED REVIEW CYCLE TOTAL	240	174

Fig. 27.2. Accelerated Review Cycle.

risk because Title II design begins after DOE comments are resolved for the IROD application. The remaining non-NFA OUs have the Title II design start after the EPA/TDEC comments are resolved for the IROD application.

Additional assumptions are as follows:

- FS/EA technical screening will begin once RI data are validated.
- Preliminary FS/EA activities will begin once the draft RI Report is sent to DOE-OR and DOE-HQ for review.
- Preparation of the draft PP will begin once the FS Report is sent to EPA.
- MMES will require 15 days to prepare a CFC package for support facilities and the RA activities.
- The Five-Year Review Plan will be completed prior to the completion of RA.
- The 5-year monitoring period will begin once the RA is completed.
- General Project Support will be completed once the 5-year monitoring begins.
- The decontamination facilities will be completed prior to implementation of the Tank Farm Remedial Actions.
- Grout Facilities design starts at the same time as Support Facilities design. The grout facility will be completed prior to RA of North Tank Farms, with D&D occurring later.
- Funding will not constrain implementation of the WAG 1 scope of work.
- Ongoing discussions with DOE, EPA, and TDEC will preclude implementation of the dispute resolution process for primary documents as provided in the FFA.
- Approvals from regulators will be received to allow initiation of succeeding phases of work (e.g., nonintrusive surveys, intrusive surveys, RD Work Plan, RA Work Plan, RD, etc.) in a timely manner.

28.0 WAG 1 COSTS ASSESSMENT SUMMARY

Table 28.1 presents a summary of the WAG 1 Baseline Costs Assessment. Appendix C provides the detailed Baseline Costs Assessments and backup for the remediation phases presented in Chapter 6.0, and Table 28.2 presents a summary of the AES Phase/Participant costs assessment.

The assumptions and basis of estimate for the WAG 1 Baseline Costs assessment are presented below:

A. The typical assumptions for the basis of the estimate for construction in noncontaminated areas are as follows.

   1. Construction work performed in noncontaminated areas is assumed to be at Level D work conditions. Labor is based on one 8.0-h shift. An additional 12.5% has been added to compensate for nonproductive work time such as portals to and from the work area, breaks, and donning and doffing protective clothing.

   2. Construction work performed in contaminated areas is assumed to be at Level C work conditions and will require appropriate personnel protection. An additional 25% has been added to compensate for nonproductive work time for these conditions, except for WBS 43 and 44 to which 50% has been added.

B. Labor rates are from the ER Oak Ridge Standard Value File, dated June 1992, as furnished by MMES.

C. Fixed-price construction (Participant #51) labor rates include base pay, taxes, health and welfare, pension, workman's compensation, and payroll burden.

D. Production rates are based on historical data files and have been adjusted as noted above to conform to specific job descriptions.

E. For the balance of the participants, the standard value file rates approved by ORNL are used except where prevailing conditions dictate otherwise.

F. Not included in this estimate are the following:

   1. The PEIS for which the Notice of Intent is being reviewed by DOE-HQ.

   2. Costs for the RI and Program Integration activities performed before October 1992.

G. All contaminated soils, trees, personnel protective equipment, and construction debris are to be disposed of in the low areas of SWSA 3 under standard operating requirements.

TABLE 28.1
Overall WAG 1 Baseline Cost Assessment

WBS ACTIVITIES	FISCAL YEARS ($ x 1000 unescalated)																											
	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Project Integration	1,423	1,444	1,669	2,047	2,537	3,180	3,892	4,700	5,570	6,457	7,192	7,600	7,663	7,462	6,953	5,966	4,958	4,295	3,768	3,139	2,253	1,658	385	0	0	0	0	0	96,211
Support Facilities 01	0	0	7,672	6,395	195	344	520	732	957	1,195	1,444	1,696	1,932	2,090	2,136	2,055	1,865	1,595	1,270	817	381	123	619	0	0	0	0	0	36,033
Support Facilities 02	0	0	876	7,402	0	0	0	0	0	0	0	0	0	0	0	217	0	0	0	0	0	0	0	0	0	0	0	0	8,495
Early Action 01	0	340	3,603	6,120	8,999	1,057	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	20,119
Early Action 02	0	218	1,780	3,449	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,446
Early Action 03	0	0	753	844	1,080	2,059	3,186	4,325	5,123	4,901	3,759	1,968	710	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	28,707
Early Action 04	0	197	6,764	12,028	21,042	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40,038
Early Action 05	0	178	417	61	116	183	266	354	446	538	628	692	707	670	587	475	330	158	47	44	0	0	0	0	0	0	0	0	6,898
Early Action 06	0	0	404	1,428	144	284	453	650	859	1,087	1,310	1,501	1,597	1,552	1,384	1,137	817	392	112	60	0	0	0	0	0	0	0	0	15,172
Early Action 07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	276	1,827	3,891	0	0	0	0	0	0	0	0	0	0	5,995
Phase I Remed. Investig.	54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54
Operable Unit 01	3,157	1,188	897	3,602	1,174	4,213	2,463	902	792	2,572	6,838	3,676	4,862	4,213	1,674	221	312	564	539	270	176	0	0	0	0	0	0	0	44,306
Operable Unit 02	289	1,086	2,114	3,109	374	1,798	814	3,177	2,300	168	351	643	494	330	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17,046
Operable Unit 03	0	0	0	0	0	0	0	0	0	0	0	0	0	2,218	5,135	4,041	1,950	547	1,939	2,218	8,480	475	411	411	411	596	0	0	28,834
Operable Unit 04	0	0	0	0	0	0	0	0	0	0	0	334	4,353	6,910	4,701	1,832	616	1,633	2,493	1,080	4,022	3,695	723	411	411	411	699	0	34,325
Operable Unit 05	0	0	0	0	0	0	0	0	0	0	0	0	742	1,365	1,941	906	334	1,861	3,347	3,583	433	411	411	411	390	0	0	0	16,136
Operable Unit 06	0	0	0	0	0	0	0	0	0	0	0	0	0	0	312	1,512	2,385	1,817	451	781	790	3,180	393	329	329	329	534	0	13,142
Operable Unit 07	0	0	0	0	0	0	1,174	1,193	938	61	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,367
Operable Unit 08	0	0	0	0	0	0	1,526	1,968	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,542
Operable Unit 09	0	0	0	0	0	0	0	0	0	0	0	1,140	2,840	2,909	772	364	22,340	8,667	15,262	20,909	28,743	3,310	411	411	411	555	144	0	109,189
Operable Unit 10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	550	1,471	856	334	1,827	971	3,990	726	313	313	313	313	367	0	12,347
Gunite Tank Closure	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,406	7,638	12,950	47,808	42,530	6,237	537	0	0	123,106
PWTP Surge Capacity Upgrade	0	2,193	1,140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3,333
SUBTOTALS	4,924	6,844	28,090	46,484	35,661	13,125	14,295	18,002	17,032	16,979	21,523	19,249	25,901	29,718	26,146	20,472	38,592	25,752	31,056	39,279	56,906	26,529	51,474	44,818	8,504	2,742	1,744	0	671,841
Contingency	1,302	1,222	7,008	13,935	11,346	4,092	4,354	5,512	5,237	5,212	6,521	5,886	8,228	9,610	8,382	6,389	13,865	8,675	10,471	13,346	19,250	8,316	15,518	13,561	2,674	942	571	0	211,426
SUBTOTALS	6,225	8,065	35,098	60,419	47,007	17,217	18,649	23,514	22,270	22,191	28,044	25,135	34,129	39,329	34,528	26,861	52,457	34,427	41,527	52,625	76,155	34,845	66,993	58,379	11,178	3,684	2,316	0	883,268
Contingent Action																													34,447
TOTAL																													917,714

TABLE 28.2
WAG 1 AES Phase/Participant Summary Unescalated Dollars ($1000s)

AES PHASE	PARTICIPANTS						
	MMES	RI CONTR	FS CONTR	RD A-E	FP	MK-F	TOTAL
Remedial Investigation	9,916	32,102	894	1,610	2,394	0	46,916
Interim Corrective Meas.	44,792	0	0	10,898	24,588	605	80,882
Feasibility Study/IROD	5,103	358	13,389	900	5,500	326	25,576
Remedial Design	13,382	0	1,196	54,745	0	1,314	70,637
Remedial Action	170,561	0	0	9,358	88,126	23,167	291,211
D & D Implementation	285	0	0	0	0	0	285
Interim IROD	21,983	0	0	0	19,315	18,825	60,123
Project Integration	78,954	0	8,261	4,501	0	4,495	96,211
	0	0	0	0	0	0	0
	0	0	0	0	0	0	0
SUBTOTALS	344,976	32,461	15,479	77,511	139,923	44,236	671,841
					Contingency		211,426
					TOTAL		883,268

H. General construction considerations.

1. The following areas are considered to be located within contamination zones:

   a. North and South Tank Farms (NTF and STF, respectively), Tanks TH-4 and W-11;

   b. Inactive Tanks H-209, W-19, W-20, WC-15, WC-17, 3001-B, 3001-5, 3002-A, 3003-A, 3004-B, and 3013;

   c. Groundwater Monitoring Wells;

   d. Inactive Liquid Low Level Waste Tanks System;

   e. Core Hole Eight;

   f. Interception of Groundwater from Core Hole Eight Plume;

   g. Groundwater Interception Trenches;

   h. Boundary Interception of Contaminants along First Creek;

   i. Equipment Decontamination Facility;

   j. Boundary Interception of Contaminants along White Oak Creek;

   k. Surface Impoundments, Waste Holding Basin 3513, 3524, 3539, and 3540;

   l. Underground Piping and Storm Drain Systems;

   m. Extensions of French drain along White Oak Creek;

   n. Extension of French drain at Core Hole Eight;

   o. Flood Plain Soils and Sediment Areas;

   p. SWSA 1;

   q. 300 Wastershed Soils;

   r. Steel Tank Systems.

2. The following areas are to be considered located within noncontaminated areas:

   a. Grout Facility Area,

   b. Robotics Development Area,

   c. SWSA 2,

   d. Waste Pile.

3. No treatment systems or remedial techniques include provisions for radioactive waste materials of sufficient quantity to cause criticality problems during handling or storage.

I. Construction methods and techniques.

1. WBS 10. Support facilities for North/South Tank Farms.

   a. Personnel decon facility:
      1. Setup pre-fabricated building module 40 ft x 16 ft self-contained. Includes change room, break room, airlock, locker room, and lavatories.

      2. Tied into utilities, water, sewer, and waste systems.

   b. Equipment decon building 30 ft x 16 ft x 20 ft ht:
      1. Str. exc., foundations, slab, sumps.

      2. Erected structural steel building; bridge crane 5 ton; monorail crane 5 ton; with architectural, mechanical and electrical.

   c. Site work
      1. Rough grading, access driveways, gravel surfacing, parking curb stops.

   d. Demolition and decontamination of facilities:
      1. Personnel and equipment decon facilities.

2. Developed Consolidation Area.

   a. Site preparation:
      1. Finegrade, fill depressions with imported clay, spread and compact 36-in. clay layer.

2. 80-mil high-density polyethylene (HDPE) liner over 36-in. clay layer and covered with 12-in. layer of crushed rock, including 2-in. diameter schedule 80 SS pipe drain system.

3. Finished with the following covers over crushed rock: 1st geotextile fabric, 2nd 80-mil HDPE, 3rd geotextile fabric, and 4th 12-in. layer of crushed rock with 2-in. diameter SS pipe drain system.

4. Installed leachate collection sump and 5000-gal tank.

b. Landfill cover:
   1. Constructed in the following order: 36-in. clay cover, 80-mil HDPE, geotextile fabric, 12-in. crushed rock, geotextile fabric, 24-in. vegetative soil layer.

   2. Constructed clay berms to control runoff.

   3. Seeded and mulched area.

3. WBS 11. Set and Erected Grout Facility (30 times per h).

   a. Site preparation:
      1. Grading, 6-in. aggregate base surface and developed parking area.

   b. Foundations for equipment:
      1. Str. exc., concrete foundations, rebar set anchor bolts.

   c. Erection:
      1. Setup equipment, electrical, grout pipeline to site, dust collectors, conveyors, calibrated and certified weighting devices.

4. WBS 20. North Tank Farm, South Tank Farm, and TH-4 Enclosures.

   a. NTF enclosure building 160 ft x 100 ft x 60 ft ht. Steel building with metal siding and deck, roofing, insulation, architecture, heating and ventilating system, 20-ton bridge crane, electrical.

   b. STF enclosure building 210 ft x 155 ft x 60 ft.
      1. Same as for NTF except due to width of 155 ft installed two 20-ton bridge cranes x 77.5 ft span.

   c. Tank TH-4 enclosure building 50 ft x 30 ft x 40 ft.
      1. Same as for NTF except will have one 5-ton bridge crane x 30 ft span.

d. Installed LLLW pipe from NTF and STF allowing 1000 ft to intercept man hole structure on existing LLLW line.
   1. 2-in. interior line jacket with 4-in. exterior line. All pedigreed pipe installed. Includes exc. (boxed in B-25 boxes), imported backfill (work performed under contaminated conditions).

   2. Constructed and installed sump with equipment.

5. WBS 21. Removal of liquid from nine underground tanks.

   a. Allowed for accessing tanks. Included str. exc., backfill, removal of obstructions (equipment, piping), demolition, and restoration (concrete, pipe equipment).

   b. Developing of portable pumping and pipe skid.

   c. Connected skid, vacuum truck and pumped liquids from tanks. Removed connections and support equipment.

6. WBS 22. Groundwater Monitoring Wells.

   a. Consists of drilling and installing of 60 wells and handling contaminated waste.

7. WBS 25. Interception of Groundwater/Core Hole Eight plume.

   a. Installed precast sumps:
      1. Str. exc., install precast sump and backfill.

   b. Install french drain trench:
      1. Str. exc., 6-in. layer sanol/bentonite bedding, (4-in. perforated pipe, filter fabric, crushed drain rock), and clay backfill to surface.

   c. Install trench blocks (prevent leakage at pipe interceptions):
      1. Str. exc., bentonite/soil backfill and clay backfill to top of trench.

8. WBS 26. Boundary Interception of contaminants along First Creek.

   a. Install precast sumps:
      1. Same as for Groundwater/Core Hole Eight plume (I.7.).

   b. Install French drain trench:
      1. Same as for I.7.b.1.

c. Install trench blocks (prevent leakage at pipe interceptions):
   1. Same as for I.7.c.1.

9. WBS 27. White Oak Creek Flood Plain soils and sediments.

   a. Removal of mercury-contaminated soils:
      1. Install erosion control, silt fence, and riprap check dams.

      2. Divert water in creek around areas contaminated using sheet piling, culvert pipe to bypass water.

      3. Remove contaminated flood plain soils, exc., load into B-25 boxes, transfer to site storage area (roasting and final storage in WBS 4-9).

   b. Removal of radiologically and mercury-contaminated soils.
      1. Same as for I.9.a.1 and I.9.a.2.

      2. Remove contaminated flood plain soils, exc., load into B-25 boxes, assay and transfer to site storage area (roasting and final storage in WBS 49.)

10. WBS 41. NTF, STF, and misc. Underground Steel and Gunite Tanks.

   a. Access into tanks will require all or some of the actions listed below.

      1. Move and set up existing equipment support bridges at STF (gunite tanks).

      2. Exc., break access into tank, backfill.

      3. Install HEPA ventilation system on tanks.

      4. Plug inlets and outlets.

      5. Modify pump and piping arrangements at bridge STF (for removal of liquids).

      6. Fabricate mobile pump and piping skid for removal of liquids.

      7. Install camera and lights in tank openings.

      8. Install suction pump equipment into tanks and remove liquid test and send LLLW to treatment plant.

      9. Install remote-control spray equipment into tank spray inside, pump (repeat) LLLW to treatment plant.

10. Install robotics into tank, clean and break up sludge, mix grout and sludge.

11. Mix grout with sludge (from grout facility) in EA WBS 11.

12. Fill tank or remainder of tank above (sludge and grout mixture/required) (from grout facility).

13. Various equipment will be used in different tanks and may be installed or removed, (reinstalled, packaged, or deconed) in a series of operations.

11. WBS 42. Surface Impoundments Basin, 3513, 3524, 3539 and 3540.

a. Remove leachate from ponds and stabilize sediments:
   1. Pump, transport leachate to PWTP via vacuum trucks.

   2. Stabilize sediments by in-place grouting using an auger-type mixing device (grout furnished from grout facility).

b. Cover stabilized sediment with cap:
   1. Consists of 24-in. clay layer; 30-mil HDPE; and 18-in. vegetative soil, seed and mulch.

c. Construct diversion dike:
   1. Composite geonet and clay.

12. WBS 43. Underground piping and storm drains.

a. Expose piping and storm drains:
   1. Remove ashaltic concrete surfacing, curb, sidewalk where required, str. exc. and backfill; seeding and mulching where required; box soil in B-25 boxes, replace surfacing, sidewalks, curb.

b. Piping and storm drain:
   1. Remove pipe, cut into sections, and box in B-25 boxes, grout and plug ends of pipe.

13. WBS 44. Extension of French drain along White Oak Creek.

a. Same as for I.8, "Boundary Interception of contaminants along First Creek."

14. WBS 45. Flood plain soils and sediments.

    a. Diversion of water in work area:
        1. Silt fence, riprap check dams, sand bag check dams, sheet piling and culvert.

    b. Dewatering where required:
        1. Jetting, well points, pump and discharge lines.

    c. Radioactive sediments:
        1. Remove top 6 in., box in B-25 boxes, send from Y-12 to WEAF Facility, and return to Y-12.

    d. Install revetment mat of area:
        1. Install 4-in. unimat with baffles seeding and mulching.

15. WBS 46. Solid Waste Storage Area 1 (SWSA1).

    a. Earthwork:
        1. Clear and grub, demolish and remove existing asphaltic paving, reroute roadway, drainage.

    b. Slurry wall and RCRA cap:
        1. Construct 3 wide x 900 ft slurry trench.

        2. Construct RCRA cap, clay 24-in. layer, geonet filter fabric, flexible membrane liner, 18-in. vegetative soil cover, diversion ditches, seeding and mulching.

16. WBS 49. In-place treatment of contaminated soils.

    a. 3000 Watershed soils, isotope area, misc. areas:
        1. Remove existing asphaltic paving, sidewalk.

        2. Cap area with 6-in. asphaltic concrete pavement.

    b. Soils from mercury spills:
        1. Same as for I.9, "White Oak Flood Plain soils and sediments."

17. WBS 50. Steel Tank Systems remediation.

    a. Access Tanks:
        1. Str. exc. Bound Steet viser, backfill.

    b. Install and operate equipment:

1. Remote operated spray equipment with lights, repeat spray and vacuum pumping liquids until clean.

c. Grout Tank:
   1. Plug tank penetrations.

   2. Place slurry grout furnished from grout facility.

18. WBS 91. Gunite Tank D&D.

a. Access:
   1. Modify existing access for conveyance system, str. exc., 30-in. steel cassion, backfill.

   2. Setup equipment support bridges at STF.

b. Remove solidified grout slurry from tanks:
   1. Robotic with rotating mining head, conveyance systems to surface, minings place in SS drums.

c. Remove 2 in. from interior walls and invert of tank with 15kW micro system:
   1. Install micro system into tank on robotic arm, remove 2 in. and convey to surface, place in SS drums.

d. Strengthen wall of gunite:
   1. Place 2 in. of gunite on invert and interior walls of tank using gunite equipment and robotics.

c. Grout tanks:
   1. Place slurry grout into tanks furnished from grout facility.

19. Secondary Waste Handling.

a. Miscellaneous construction debris waste volume has been calculated at 6.5 ft^3 per month per worker, and this waste be disposed of in SWSA 3.

b. Personnel protective equipment waste volume has been calculated at 0.092 ft^3 per workhour of personnel protective equipment use, and this waste be disposed of in SWSA 3.

c. All contaminated soils and trees will be disposed of in SWSA 3.

d. Wastewater from sewage, showers, and personnel decontamination is based on an assumption of 756 gal per month per worker. Of this volume, 680.4 gal will be processed at the Sewage Treatment Plant at no cost, 75.6 gal will be processed at the PWTP for $.011 per gal, and 7.56 gal will be processed at LLLW for $10 per gal. All transportation of these liquids will be by MMES personnel.

e. Wastewater from equipment decontamination has been estimated for each type of equipment used. Frequency of decontamination of equipment was determined by the number of times the equipment left the contamination zone, with additional consideration for maintenance of equipment. Ninety percent of these liquids will be processed at PWTP for $0.11 per gal, and the remaining 10% will be processed at LLLW for $10.00 per gal. All transportation of these liquids will be by MMES personnel.

J. Program Integration and Engineering.

1. Program Integration and Engineering costs are based on the following percentages of construction cost.

a. Support Facilities and 91.

b. A-E Title I (Support Facility) 6%.

c. A-E Title II (Support Facility) 9%.

d. MMES Title I (Support Facility) 1%.

e. MMES Title II (Support Facility) 2%.

h. MMES A-E Support (Support Facility) 4%.

i. MMES Construction Support (Support Facility) 8%.

j. Early Action (see Table 28.3).

k. Operable Units (see Table 28.4).

2. All Bechtel, Radian, and nonMMES engineering costs were furnished by those firms.

3. Both MMES and A-E Titles I and II engineering costs are subject to change as the scope of the estimate is better defined.

K. Utility and services.

Table 28.3.
Early Action - Program Integration and Engineering - Construction Cost %

WBS EA LOST ELEMENT		20%	21%	22%	24%	25%	26%	27%
RD Title I & II	MMES Title I & II	-	-	-	-	-	-	-
	A-E Title I & II	20.0	25.0	25.0	25.0	15.0	15.0	15.0
	MMES A-E Support	4.0	2.0	2.0	-	2.0	2.0	2.0
	MMES Project Services	4.0	2.0	2.0	4.0	3.0	2.0	2.0
	MK-F Planning	2.0	0.5	0.5	0.5	0.5	0.5	0.5
RA Integration	MMES Title III	8.0	3.5	3.5	5.0	3.5	3.5	3.5
	A-E Title III	10.0	5.0	5.0	-	5.0	5.0	5.0
	MMES A-E Support	4.0	2.0	2.0	-	2.0	2.0	2.0
	MMES Project Services	10.0	6.0	6.0	-	6.0	6.0	6.0

Table 28.4.
Operable Unit - Program Integration and Engineering - Construction Cost %

WBS OU LOST ELEMENT		41%	42%	43%	44%	45%	46%	47%	48%	49%	50%
RD Title I & II	A-E Title I	9.0	9.0	30.0	30.0	30.0	9.0	NFA	NFA	30.0	7.5
	A-E Title II	16.0	16.0	3.0	30.0	30.0	16.0	NFA	NFA	30.0	13.0
RD Oversight	MMES Support	2.0	2.0	2.0	2.0	2.0	2.0	NFA	NFA	2.0	2.0
	MMES Project Services	3.0	3.0	3.0	3.0	3.0	3.0	NFA	NFA	2.0	2.0
	MK-F Planning	0.5	0.5	0.5	0.5	0.5	0.5	NFA	NFA	0.5	0.5
	MMES Planning Coordination	-	-	2.0	2.0	2.0	0	NFA	NFA	2.0	-
RA Integration	MMES Title III	4.5	4.5	4.5	4.5	4.5	3.5	NFA	NFA	4.5	4.5
	A-E Title III	6.0	6.0	6.0	6.0	6.0	5.0	NFA	NFA	6.0	6.0
	MMES Support	2.0	2.0	2.0	2.0	2.0	1.0	NFA	NFA	2.0	2.0
	MMES Project Services	7.0	7.0	7.0	7.0	7.0	6.0	NFA	NFA	7.0	7.0

K. Utility and services.

1. No electric and water costs are included.

2. No maintenance/repair/replacement cost is included in any treatment systems.

3. Support facility operations personnel will be supplied by MMES field maintenance.

4. No costs are estimated for development of the Health Physics Research Reactor borrow site.

L. GPA and GPS markups have been included in the estimate (Participant 99 for each WBS). These markups include 8.6% of all participant cost except MMES, RD Contractor, and FS Contractor, and 52% of MMES participant costs.

29.0 WAG 1 REFERENCES

Algermissen, S. T., et al., "Probabilistic Estimates of Maximum Acceleration and Velocity in the Contiguous United States," *U. S. Geological Survey. Open-File Report 82-1033, 1982.*

Autrey, J. W., et al., *Sampling and Analysis of the Inactive Waste Storage Tank Contents at ORNL*, ORNL/RAP-53, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1989.

Bechtel National, Inc., *Remedial Investigation Plan for the ORNL Waste Area Group 1, Revision 1*, ORNL/RAP/Sub-87/99053/4&R1, August 1989.

Bechtel National, Inc., CH_2M Hill, Ogden, and PEER, *Operable Unit Strategy Document for Waste Area Grouping 1 at Oak Ridge National Laboratory, Oak Ridge, Tennessee,* (Draft), ORNL/ER-133, ORNL/ER/Sub-87/99053/61, Oak Ridge, Tennessee, June 1992.

Boegly, W. J. Jr., et al., *Environmental Data Package for the Main Plant Area (WAG 1)*: ORNL/RAP-13, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1987.

Boyle, J. W., *Environmental Analysis of the Operation of the Oak Ridge National Laboratory*, ORNL-5870, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1982.

de Laguna, W., et al., "Disposal of High-Level Radioactive Liquid Wastes in Terrestrial Pits," *A Sequel, Proceedings of International Conference on Peaceful Uses in Atomic Energy,* 1958.

Federal Facility Agreement for the Oak Ridge Reservation, Appendix C, Docket No. 89-04-FF, December 1991.

Huff, D. D., *Summary of Dry-Weather Dye Tracing Activities*, ORNL/RAP/LTR-85/75, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1985.

Ketelle, R. H., et al., *1986 Groundwater System Characterization*, ORNL/RAP/LTR-86/75, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1986.

McMaster, W. M., and H. D. Waller, *Geology and Soils of White Oak Creek Basin, Tennessee*, ORNL TM-108, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1965.

Nix, C. E., et al., *CERCLA Phase 1 Report: Identification and Preliminary Assessment of Inactive Hazardous Waste Disposal Sites and Other Contaminated Areas at ORNL*, ORNL/TM-9989, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1986.

Nix, C. E., Personal communication to J. T. Kitchings, June 1989.

Oakes, T. W., and K. E. Shank, *Subsurface Investigation of the Energy Systems Research Laboratory Site at ORNL*, ORNL/TM-5695, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1977.

Oak Ridge National Laboratory, *RCRA Facilities Assessment — Oak Ridge National Laboratory*, ORNL/RAP-12/V4, Oak Ridge, Tennessee, 1987.

Stockdale, P. B., *Geologic Conditions at the Oak Ridge National Laboratory (X-10) Area Relevant to the Disposal of Radioactive Waste*, ORO-58, U. S. Atomic Energy Commission, Oak Ridge, Tennessee, 1951.

Stueber, A. M., and D. A. Webster, *An Investigation of Radionuclide Release from Solid Waste Disposal Area 3, Oak Ridge National Laboratory*, ORNL/TM-7323, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1981.

U. S. Environmental Protection Agency, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, EPA/540/G-89/004, Washington, D.C., 1989.

Webster, D. A., *A Review of Hydrologic and Geologic Conditions Related to the Radioactive Solid-Waste Burial Grounds at Oak Ridge National Laboratory, Oak Ridge, Tennessee*, Open-File Report 76-727, U. S. Geological Survey, Washington, D. C., 1976.

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