

Area IV Santa Susana Field Laboratory

Environmental Impact Statement (Area IV SSFL EIS)

Text



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Contents

Executive Summary

Section 1 - Introduction

1.1	Organization of Area IV SSFL Data Gap Analysis Report	1-1
1.2	Area IV SSFL Site Description and History	1-3
1.3	Stakeholders	1-5
1.4	Regulatory and Legal Drivers.....	1-7
1.4.1	Atomic Energy Act	1-7
1.4.2	Comprehensive Environmental Response, Compensation, and Liability Act.....	1-8
1.4.3	Resource Conservation and Recovery Act.....	1-8
1.4.4	California Radioactive Material Regulations.	1-8
1.4.5	National Environmental Policy Act.....	1-8
1.4.6	Clean Water Act.....	1-8
1.4.7	Safe Drinking Water Act	1-9
1.4.8	EPA's Office of Radiation and Indoor Air.	1-9
1.4.9	Endangered Species Act	1-9
1.5	Relationship of NEPA and CERCLA	1-9
1.6	Data Gap Study Objectives.....	1-10
1.6.1	Risk-Based Decision.	1-10
1.6.2	Multi-Chemical/Radionuclide and Pathway Assessment	1-11
1.6.3	Senate Bill 990 Consideration.	1-11
1.6.4	Ecological Risk Concerns	1-11
1.6.5	Groundwater.....	1-11
1.6.6	Building Materials.....	1-11
1.7	Data Gap Analysis Approach	1-12
1.7.1	Media of Interest	1-12
1.7.2	Data Base Development	1-12
1.7.3	Development of Screening Criteria.....	1-12
1.7.4	Screening of Data Base and Identification of Contaminants of Interest	1-13
1.7.5	Soil Data Evaluation.....	1-14
1.7.5.1	Evaluation of the Distribution of Soil Contaminants of Interest	1-14
1.7.5.2	MARSSIM-Based Approach and Limitations for Radionuclides in Soil	1-14
1.7.6	Bedrock	1-16
1.7.7	Groundwater.....	1-16
1.7.8	Seeps.....	1-16

1.7.9	Surface Water and Sediment.....	1-16
1.7.10	Air Data.....	1-17
1.7.11	Biota.....	1-17
1.7.12	Building Data.....	1-18
1.8	Relationship of the Data Gap Analysis and the RCRA Facility Investigation.....	1-18
1.9	Initial Field Sampling Program Definition.....	1-19
Exhibit 1-1	Data Gap Evaluation Process Summary for Soils	
Figure 1-1	SSFL Location	
Figure 1-2	Santa Susana Field Laboratory Layout	
Figure 1-3	Location of Area IV Exposure Units	
Figure 1-4	Example Survey Unit Delineation	

Section 2 – Area IV Background and Description

2.1	Location	2-1
2.2	Operational Background and Ownership.....	2-1
2.3	Physical Setting.....	2-2
2.3.1	Topography and Drainage.....	2-2
2.3.2	Geology and Hydrogeology	2-2
2.3.2.1	Geology.....	2-3
2.3.2.2	Hydrogeology.....	2-4
2.3.3	Climate.....	2-6
2.3.4	Biological Setting	2-6
2.4	Sources of Data.....	2-7
Figure 2-1	SSFL Area IV Topography and Drainage	
Figure 2-2	Geologic Map of The Chatsworth Formation at The SSFL	
Figure 2-3	Location of Perched and Continuous Near-Surface Groundwater	
Figure 2-4	Shallow Groundwater Potentiometric Surface	
Figure 2-5	Chatsworth Formation Groundwater Potentiometric Surface	
Figure 2-6	Geologic Cross Section H-H'	
Figure 2-7	Geologic Cross Section I-I'	
Figure 2-8	BAF Study Sampling Locations – Aquatic Invertebrate	
Figure 2-9	BAF Study Sampling Locations – Aquatic Plants	
Figure 2-10	BAF Study Sampling Locations – Fish	
Figure 2-11	BAF Study Sampling Locations – Terrestrial Invertebrate	
Figure 2-12	BAF Study Sampling Locations – Terrestrial Plants	
Figure 2-13	BAF Study Sampling Locations – Terrestrial Vertebrate	
Table 2-1	SSFL Area IV Sources of Radionuclide Data	

Section 3 – Data Gaps Analysis Method

3.1	Data Gap analysis Approach	3-1
3.1.1	Establishment of Data Quality Objectives	3-1

3.1.2	Develop Conceptual Site Models.....	3-1
3.1.3	Database Formatting.....	3-1
3.1.4	Screening Criteria Development	3-2
3.1.5	Document Review for Chemical and Process History	3-2
3.1.6	Database Screening	3-2
3.1.7	Document of Exposure Units.....	3-2
3.1.8	Determination of Risk Assessment Data Needs	3-2
3.1.9	Determination of Extent of Contamination Data Needs.....	3-2
3.1.10	Determination of Data Gaps	3-3
3.1.11	Reconciliation with RCRA Facility Investigation Data.....	3-3
3.2	Data Quality Objectives for Data Gap Analysis.....	3-3
3.2.1	Step 1 – State the Problem	3-4
3.2.2	Step 2 – Identify the Goal of the Study.....	3-4
3.2.3	Step 3 – Identify Information Inputs	3-5
3.2.4	Step 4 – Define the Boundaries of the Study	3-6
	3.2.4.1 Spatial Boundary	3-6
	3.2.4.2 Vertical Sub-Boundaries	3-7
	3.2.4.3 Horizontal Sub-Boundaries.....	3-7
	3.2.4.4 Temporal Boundary	3-8
3.2.5	Step 5 – Develop the Analytical Approach.....	3-8
3.2.6	Step 6 – Specify Performance for Acceptance Criteria	3-9
	3.2.6.1 Derived Concentration Guideline	3-9
	3.2.6.2 Null Hypothesis.....	3-9
	3.2.6.3 Confidence Interval:	3-9
	3.2.6.4 Statistical Test.....	3-9
	3.2.6.5 Measurement Quality Objectives (MQOs).....	3-10
3.2.7	Step 7 – Develop the Plan for Obtaining Further Data	3-11
3.3	Area IV Conceptual Site Models	3-11
3.3.1	Human Health Risk Assessment.....	3-11
	3.3.1.1 Potential Receptors.....	3-12
	3.3.1.2 Potential Exposure Pathways.....	3-13
3.3.2	Ecological Risk Assessment	3-16
3.4	Screening Criteria.....	3-17
3.4.1	Background.....	3-17
	3.4.1.1 Chemical.....	3-17
	3.4.1.2 Radionuclides	3-19
	3.4.1.3 Ecological Background Data.....	3-21
3.4.2	Human Health Risk-Based Preliminary Remedial Goals	3-21
	3.4.2.1 EPA Region 9 Residential PRGs for Chemical Contaminants.....	3-21
	3.4.2.2 Rural Residential PRGs for Chemical Contaminants.....	3-22
	3.4.2.3 Radiological PRGs.....	3-22
3.4.3	Ecological PRGs (Radionuclides) and ESLs (Chemical)	3-23

	3.4.3.1	Ecological PRGs for Radiological COIs.....	3-24
	3.4.3.2	Ecological Screening Levels for Chemicals	3-24
	3.4.4	Groundwater Maximum Contaminant Levels.....	3-26
3.5		Evaluated Media.....	3-26
	3.5.1	Soil.....	3-27
	3.5.2	Groundwater.....	3-27
	3.5.3	Seeps.....	3-27
	3.5.4	Soil Vapor.....	3-27
	3.5.5	Surface Water.....	3-28
	3.5.6	Sediment.....	3-28
	3.5.7	Biota (Ecological).....	3-28
	3.5.8	Air.....	3-28
	3.5.9	Building Surfaces.....	3-28
	3.5.10	Walkover Radiation Surveys.....	3-29
	3.5.11	Bedrock.....	3-29
3.6		Human Health Soil Media.....	3-29
	3.6.1	Review of Existing Documents.....	3-29
	3.6.1.1	Review of the RCRA Program Documents	3-29
	3.6.1.2	Review of Historical Site Assessment Document.....	3-30
	3.6.2	Selection of Exposure Units.....	3-32
	3.6.3	Radionuclide Data Assessment.....	3-32
	3.6.3.1	Definition of Survey Units.....	3-32
	3.6.3.2	Application of Process Knowledge of Drawing of Survey Unit Boundaries (Radionuclides)	3-33
	3.6.4	Screening of Refined Dataset.....	3-34
	3.6.5	Selection of Soil Contaminants of Interest	3-34
	3.6.5.1	Results of Screening for Soil Chemical COI Identification.....	3-35
	3.6.5.2	Process History Confirmation of Chemical COIs.....	3-37
	3.6.5.3	Radiological Contaminants of Interest.....	3-37
	3.6.6	Determination of Required Number of Samples	3-38
	3.6.6.1	Radionuclide Sample Number for Risk Assessment and Delineation Based on MARSSIM	3-38
	3.6.6.2	Chemicals Sample Number for Risk Assessment.....	3-40
	3.6.6.3	Determination of Sample Numbers for Extent Delineation.....	3-40
	3.6.7	Calculation of the Soil Sample Analytical Data Gaps	3-40
	3.6.8	Gamma Walkover Survey Data Gap Analysis Methodology	3-41
3.7		Groundwater.....	3-42
	3.7.1	Identification of Groundwater COIs.....	3-42
	3.7.2	Statistical Evaluation of COI Distribution.....	3-42
	3.7.3	Characterization of Groundwater and Contaminant Migration.....	3-43

3.7.3.1	Review of Groundwater CSM	3-43
3.7.3.2	Data Evaluation	3-43
3.7.4	Evaluation of Efficacy of Groundwater Monitoring Network	3-43
3.8	Surface Water and Sediment	3-44
3.9	Radiological Air Data Analysis Methodology and Conclusions	3-44
3.10	Ecological Receptors	3-45
3.10.1	Data Relevant to the Ecological Risk Assessment	3-45
3.10.2	Selection of Preliminary CPECs	3-45
3.11	Building Data Gaps Analysis Methodology	3-46
3.12	Soil Vapors	3-46
3.12.1	Review the Existing Data	3-46
3.12.2	Identification of Soil Vapor Data Gaps	3-47
3.13	Bedrock	3-47
Exhibit 3-1a	Data Gap Evaluation Process for Soils	
Exhibit 3-1b	Data Gap Evaluation Process for Soils	
Exhibit 3-1c	Data Gap Evaluation Process for Soils	
Figure 3-1	Site Conceptual Exposure Model for Human Health	
Figure 3-2	SSFL Area IV Preliminary Conceptual Model for Ecological Receptors	
Figure 3-3	Location of Samples Included in Radiological Background Screening	
Figure 3-4	Location of Area IV Exposure Units	
Figure 3-5	Location of Existing Chemical COI Samples	
Figure 3-6	Location of Existing Radiological Samples	
Table 3-1	SSFL Area IV Soil Background Comparison Values for Metals and Dioxins	
Table 3-2	SSFL Off-Site Radiological Data Summary Statistics and Screening Levels	
Table 3-3	Radionuclide Soil Human Health PRGs	
Table 3-4	Terrestrial Ecological PRGs for Radionuclides	
Table 3-5	Aquatic Ecological PRGs for Radionuclide	
Table 3-6	Chemicals Analyzed But Not Detected In Area IV Soil	
Table 3-7	Chemicals Detected in Area IV Soil	
Table 3-8	Selection of Chemicals of Interest in Area IV Soils	
Table 3-9	Chemicals of Interest In Area IV Soil	
Table 3-10	Previous Assessment Potential Radionuclides of Concern	
Table 3-11	Radiological Contaminants of Interest	
Table 3-12	Groundwater Chemicals of Interest	
Table 3-13	Number of Existing Soil Vapor Samples by Depth	
Table 3-14	Summary Statistics of Chemicals Detected in Soil Vapor in Area IV	

Section 4 – Data Gaps Analysis Results

4.1	Soil	4-1
4.1.1	Chemical Data Gaps.....	4-1
	4.1.1.1 Statistical Approach.....	4-1
	4.1.1.2 Characterization and Extent of Contamination Approach.....	4-2
4.1.2	Radionuclide Analysis Data Gap	4-8
	4.1.2.1 Surface Soils	4-8
	4.1.2.2 Near Surface and Subsurface Soils.....	4-9
	4.1.2.3 Gamma Walkover Survey Data Gap	4-9
4.2	Groundwater.....	4-15
4.2.1	Groundwater COI Statistics.....	4-15
4.2.2	Distribution of Prevalent Groundwater COIs.....	4-16
4.2.3	Soil and Soil Vapor Concentrations.....	4-17
4.2.4	Data Gaps in Groundwater Monitoring Network.....	4-17
4.3	Groundwater Seeps	4-20
4.4	Soil Vapor	4-21
4.5	Surface Water.....	4-21
4.6	Sediment.....	4-21
4.7	Ecological Receptors.....	4-21
4.7.1	Data Gaps Results for Ecological Risk Assessment-Chemicals	4-21
4.7.2	Data gaps Results for Ecological Risk Assessment – Radionuclides	4-22
	4.7.2.1 Soil in Area IV	4-22
	4.7.2.2 Surface Water and Sediment in Area IV.....	4-23
	4.7.2.3 Seep Water/Shallow Groundwater	4-23
	4.7.2.4 Offsite Surface Water and Sediment	4-23
	4.7.2.5 Offsite Soil.....	4-23
4.7.3	Results of the Screen for Radionuclides and Chemicals of Potential Ecological Concern.....	4-24
4.7.4	Comparison of Ecological and Human Health Radiological PRGs	4-26
4.7.5	Data Gaps Related to Biological Tissues	4-26
	4.7.5.1 Ecological Survey Data	4-27
4.7.6	Identified Ecological Risk Data Gaps	4-27
	4.7.6.1 Proposed Abiotic and Biological Sampling for Ecological Risk Assessment.....	4-27
	4.7.6.1.1 Purpose of Sampling	4-27
	4.7.6.1.2 Exposure Areas and Related Assumptions.....	4-28
	4.7.6.1.3 Numbers and Types of Samples	4-28
4.8	Air.....	4-30
4.8.1	Effluent Air Monitoring.....	4-31
4.8.2	Ambient Air Data	4-32

4.8.3	NESHAPs	4-34
4.8.4	Conclusions	4-34
4.9	Buildings.....	4-35
4.10	Surface Soil, Subsurface Soil, and Bedrock Background.....	4-35
4.11	Bedrock.....	4-35
Figure 4-1	Locations of Existing Gamma Walkover Surveys	
Figure 4-2	Groundwater Conceptual Site Model	
Figure 4-3	Maximum Tritium Concentrations in Shallow Groundwater 2003-2007	
Figure 4-4	Maximum Tritium Concentrations in Chatsworth Formation 2003-2007	
Figure 4-5	Maximum TCE Concentrations in Shallow Groundwater 2003-2007	
Figure 4-6	Maximum TCE Concentrations in Chatsworth Formation 2003-2007	
Figure 4-7	Maximum Cis-1,2-DCE Concentrations in Shallow Groundwater 2003-2007	
Figure 4-8	Maximum Cis-1,2-DCE Concentrations in Chatsworth Formation 2003-2007	
Figure 4-9	Maximum 1,1-DCE Concentrations in Shallow Groundwater 2003-2007	
Figure 4-10	Maximum 1,1-DCE Concentrations in Chatsworth Formation 2003-2007	
Figure 4-11	Non-Radiological COIs Exceeding DCGL in Soil (0-2 ft bgs)	
Figure 4-12	Non-Radiological COIs Exceeding DCGL in Soils (2-10 ft bgs)	
Figure 4-13	Maximum TCE Concentrations in Soil Vapor and Shallow Groundwater 2003-2007	
Figure 4-14	Maximum TCE Concentrations in Soil Vapor and Chatsworth Formation Wells 2003-2007	
Figure 4-15	Proposed Monitoring Well Locations	
Figure 4-16	Location of Existing Radiological Samples	
Figure 4-17	Plant and Ground Animal Observations	
Figure 4-18	Avian Observations	
Table 4-1	Summary of Chemical Data Gaps for Soil Media	
Table 4-2	Radiological Soil Data Gap Summary	
Table 4-3	Radionuclide Soil Data Gap Summary By Survey Unit	
Table 4-4	Gamma Walkover Survey Coverage Summary	
Table 4-5	Groundwater Summary and COI Screening Value Comparison	
Table 4-6	Preliminary Selection of Surface Water CPECs for Ecological Receptors	
Table 4-7	Preliminary Selection of Groundwater Seep CPECs for Ecological Receptors	
Table 4-8	Preliminary Selection of Sediment CPECs for Ecological Receptors	
Table 4-9	Preliminary Selection of Soil (0 to 2 ft bgs) CPECs for Ecological Receptors	

Table 4-10	Preliminary Selection of Soil (2 to 4 ft bgs) CPECs for Ecological Receptors
Table 4-11	Preliminary Selection of Soil (4 to 6 ft bgs) CPECs for Ecological Receptors
Table 4-12	Preliminary Selection of Sump Soil CPECs for Ecological Receptors
Table 4-13	Preliminary Selection of Sump Water CPECs for Ecological Receptors
Table 4-14	Preliminary Selection of Soil Gas CPECs for Ecological Receptors
Table 4-15	Comparison of Ecological Terrestrial and Aquatic Radionuclide Preliminary Remediation Goals to Human Health Preliminary Remediation Goals
Table 4-16	Proposed Sampling Areas for Ecological Risk Assessment
Table 4-17	Remaining Buildings Data Gap Analysis

Section 5 – Summary of Data Gap Findings

5.1	Soil	5-2
5.1.1	Chemical Analysis Data Gap	5-2
5.1.2	Radionuclides Gap Analysis Approach	5-3
5.2	SSFL Area IV Gamma Walkover Survey	5-4
5.3	Groundwater	5-4
5.4	Groundwater Seeps	5-5
5.5	Soil Vapor	5-5
5.6	Surface Water	5-5
5.7	Sediment	5-5
5.8	Ecological Receptors	5-5
5.9	Air	5-6
5.10	Buildings	5-6
5.11	Background Values	5-7
5.12	Bedrock	5-7
Figure 5-1	Internal Drainages and Ponds Considered for Biota Sampling Program	
Table 5-1	Summary of Data Gap Analysis Findings	

Section 6 – References

Appendices

<i>Appendix A</i>	SSFL Area IV General Chemical Use Overview
<i>Appendix B</i>	Historical Site Assessment Summary
<i>Appendix C</i>	Radionuclide Background Sources
<i>Appendix D</i>	Statistical Evaluation of Radiological Background Distribution
<i>Appendix E</i>	Supporting Information for Ecological Risk: Parameters Required to Calculate Biota Concentration Guides and Data Usability Screening Tables for Radionuclides
<i>Appendix F</i>	Chemical and Radionuclide Contaminants of Interest Distribution Maps
<i>Appendix G</i>	Radionuclide Surface Soil Data Gaps Detail
<i>Appendix H</i>	Update of Chemical PRGs
<i>Appendix I</i>	Chemical Data Gap Analysis Results for Soil

Attachment A	Working Draft RFI Program Groups 5 and 7 Sampling Location Maps
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List of Appendices, Exhibits, Figures, Tables, Attachment

Appendices

<i>Appendix A</i>	SSFL Area IV General Chemical Use Overview
<i>Appendix B</i>	Historical Site Assessment Summary
<i>Appendix C</i>	Radionuclide Background Sources
<i>Appendix D</i>	Statistical Evaluation of Radiological Background Distribution
<i>Appendix E</i>	Supporting Information for Ecological Risk: Parameters Required to Calculate Biota Concentration Guides and Data Usability Screening Tables for Radionuclides
<i>Appendix F</i>	Chemical and Radionuclide Contaminants of Interest Distribution Maps
<i>Appendix G</i>	Radionuclide Surface Soil Data Gaps Detail
<i>Appendix H</i>	Update of Chemical PRGs
<i>Appendix I</i>	Chemical Data Gap Analysis Results for Soil

Exhibits

Exhibit 1-1	Data Gap Evaluation Process Summary for Soils
Exhibit 3-1a	Data Gap Evaluation Process for Soils
Exhibit 3-1b	Data Gap Evaluation Process for Soils
Exhibit 3-1c	Data Gap Evaluation Process for Soils

Figures

Figure 1-1	SSFL Location
Figure 1-2	Santa Susana Field Laboratory Layout
Figure 1-3	Location of Area IV Exposure Units
Figure 1-4	Example Survey Unit Delineation
Figure 2-1	SSFL Area IV Topography and Drainage
Figure 2-2	Geologic Map of the Chatsworth Formation at the SSFL
Figure 2-3	Location of Perched and Continuous Near-Surface Groundwater
Figure 2-4	Shallow Groundwater Potentiometric Surface
Figure 2-5	Chatsworth Formation Groundwater Potentiometric Surface
Figure 2-6	Geologic Cross Section H-H'
Figure 2-7	Geologic Cross Section I-I'
Figure 2-8	BAF Study Sampling Locations – Aquatic Invertebrate
Figure 2-9	BAF Study Sampling Locations – Aquatic Plants
Figure 2-10	BAF Study Sampling Locations – Fish
Figure 2-11	BAF Study Sampling Locations – Terrestrial Invertebrate
Figure 2-12	BAF Study Sampling Locations – Terrestrial Plants
Figure 2-13	BAF Study Sampling Locations – Terrestrial Vertebrate

Figure 3-1	Site Conceptual Exposure Model for Human Health
Figure 3-2	SSFL Area IV Preliminary Conceptual Model for Ecological Receptors
Figure 3-3	Location of Samples Included in Radiological Background Screening
Figure 3-4	Location of Area IV Exposure Units
Figure 3-5	Location of Existing Chemical COI Samples
Figure 3-6	Location of Existing Radiological Samples
Figure 4-1	Locations of Existing Gamma Walkover Surveys
Figure 4-2	Groundwater Conceptual Site Model
Figure 4-3	Maximum Tritium Concentrations in Shallow Groundwater 2003-2007
Figure 4-4	Maximum Tritium Concentrations in Chatsworth Formation 2003-2007
Figure 4-5	Maximum TCE Concentrations in Shallow Groundwater 2003-2007
Figure 4-6	Maximum TCE Concentrations in Chatsworth Formation 2003-2007
Figure 4-7	Maximum Cis-1,2-DCE Concentrations in Shallow Groundwater 2003-2007
Figure 4-8	Maximum Cis-1,2-DCE Concentrations in Chatsworth Formation 2003-2007
Figure 4-9	Maximum 1,1-DCE Concentrations in Shallow Groundwater 2003-2007
Figure 4-10	Maximum 1,1-DCE Concentrations in Chatsworth Formation 2003-2007
Figure 4-11	Non-Radiological COIs Exceeding DCGL in Soil (0-2 ft bgs)
Figure 4-12	Non-Radiological COIs Exceeding DCGL in Soils (2-10 ft bgs)
Figure 4-13	Maximum TCE Concentrations in Soil Vapor and Shallow Groundwater 2003-2007
Figure 4-14	Maximum TCE Concentrations in Soil Vapor and Chatsworth Formation Wells 2003-2007
Figure 4-15	Proposed Monitoring Well Locations
Figure 4-16	Location of Existing Radiological Samples
Figure 4-17	Plant and Ground Animal Observations
Figure 4-18	Avian Observations
Figure 5-1	Internal Drainage and Ponds Considered for Biota Sampling Program

Tables

Table 2-1	SSFL Area IV Sources of Radionuclide Data
Table 3-1	SSFL Area IV Soil Background Comparison Values for Metals and Dioxins
Table 3-2	SSFL Off-Site Radiological Data Summary Statistics and Screening Levels
Table 3-3	Radionuclide Soil Human Health PRGs
Table 3-4	Terrestrial Ecological PRGs for Radionuclides

Table 3-5	Aquatic Ecological PRGs for Radionuclide
Table 3-6	Chemicals Analyzed But Not Detected In Area IV Soil
Table 3-7	Chemicals Detected in Area IV Soil
Table 3-8	Selection of Chemicals of Interest in Area IV Soils
Table 3-9	Chemicals of Interest In Area IV Soil
Table 3-10	Previous Assessment Potential Radionuclides of Concern
Table 3-11	Radiological Contaminants of Interest
Table 3-12	Groundwater Chemicals of Interest
Table 3-13	Number of Existing Soil Vapor Samples by Depth
Table 3-14	Summary Statistics of Chemicals Detected in Soil Vapor in Area IV
Table 4-1	Summary of Chemical Data Gaps for Soil Media
Table 4-2	Radiological Soil Data Gap Summary
Table 4-3	Radionuclide Soil Data gap Summary By Survey Unit
Table 4-4	Gamma Walkover Survey Coverage Summary
Table 4-5	Groundwater Summary and COI Screening Value Comparison
Table 4-6	Preliminary Selection of Surface Water CPECs for Ecological Receptors
Table 4-7	Preliminary Selection of Groundwater Seep CPECs for Ecological Receptors
Table 4-8	Preliminary Selection of Sediment CPECs for Ecological Receptors
Table 4-9	Preliminary Selection of Soil (0 to 4 ft bgs) CPECs for Ecological Receptors
Table 4-10	Preliminary Selection of Soil (2 to 4 ft bgs) CPECs for Ecological Receptors
Table 4-11	Preliminary Selection of Soil (4 to 6 ft bgs) CPECs for Ecological Receptors
Table 4-12	Preliminary Selection of Sump Soil CPECs for Ecological Receptors
Table 4-13	Preliminary Selection of Sump Water CPECs for Ecological Receptors
Table 4-14	Preliminary Selection of Soil gas CPECs for Ecological Receptors
Table 4-15	Comparison of Ecological Terrestrial and Aquatic Radionuclide Preliminary Remediation Goals to Human Health Preliminary Remediation Goals
Table 4-16	Proposed Sampling Areas for Ecological Risk Assessment
Table 4-17	Remaining Buildings Data gap Analysis
Table 5-1	Summary of Data Gap Analysis Findings

Attachment A	Working Draft RFI Program Groups 5 and 7 Sampling Location Maps
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Abbreviations and Acronyms

AEC	Atomic Energy Commission
AI	Atomic International
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
BAF	Bioaccumulation Factor
BBI	Brandies-Bardin Institute
BCG	Biota Concentration Guide
BCR	Biological Conditions Report
bgs	Below Ground Surface
CalEPA	California Environmental Protection Agency
CDM	CDM Federal Programs Corporation
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMS	Corrective Measures Studies
COC	Contaminant of Concern
COI	Contaminant of Interest
COPC	Contaminant of Potential Concern
CPEC	Contaminant of Potential Ecological Concern
cpm	Counts Per Minute
CSM	Conceptual Site Model
CV	Coefficients of Variation
DCGL	Derived Concentration Guideline Level
DCGLW	Derived Concentration Guideline Level Average
DOD	Department of Defense
DOE	Department of Energy
DQO	Data Quality Objective
DTSC	Department of Toxic Substances Control
EA	Environmental Assessment
EPA	U.S. Environmental Protection Agency
ERA	Ecological Risk Assessment
ESL	Ecological Screening Level
ETEC	Energy Technology Engineering Center
EU	Exposure Unit
FONSI	Findings of No Significant Impact
FSDF	Former Sodium Disposal Facility
FUSRAP	Formerly Utilized Sites Remedial Action Program
GWS	Gamma Walkover Survey
HSA	Historical Site Assessment
Kcs	Chatsworth Formation
LBGR	Lower Bound of the Gray Region
LLD	Lower Limit of Detection
LMEC	Liquid Metal Engineering Center
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

MCLG	Maximum Contaminant Level Goal
MCL	Maximum Contaminant Level
MDA	Minimum Detectable Activity
MDC	Minimum Detectable Concentration
MDL	Method Detection Limit
mg/kg	Milligrams Per Kilogram
MPC	Maximum Permissible Concentration
MQO	Measurement Quality Objective
NAA	North American Aviation
NAD	North American Datum
NASA	National Aeronautics and Space Administration
NDPES	National Pollutant Discharge Elimination System
NEPA	National Environmental Policy Act
NESHAP	National Emission Standard for Hazardous Air Pollutants
NRWQC	National Recommended Water Quality Criteria
NSGW	Near-Surface Groundwater
OEHHA	Office of Environmental Health Hazard Assessment
OU	Operable Unit
PAH	Polynuclear Aromatic Hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCB	Polychlorinated Biphenyl
pCi/g	Picocuries Per Gram
pCi/L	Picocuries Per Liter
PRG	Preliminary Remediation Goal
QA/QC	Quality Assurance/Quality Control
RAD	Radionuclide
RAGS	Risk Assessment Guidance for Superfund
RAIS	Risk Assessment Information System
RCRA	Resource Conservation and Recovery Act
REL	Reference Exposure Level
RFI	RCRA Facility Investigation
RIHL	Rockwell International Hot Laboratory
RMHF	Radioactive Materials Handling Facility
SAIC	Science Applications International Corporation
SAP	Sampling and Analysis Plan
SB	State Bill
SRAM	Standardized Risk Assessment Methodology Work Plan
SRC	Site Related Contaminant
SRE	Sodium Reactor Experiment
SSFL	Santa Susana Field Laboratory
SSL	Soil-to-groundwater Screening Level
SU	Survey Unit
SVOCs	Semi-Volatile Organic Compound
SWMU	Solid Waste Management Unit
TBC	To Be Considered
TIC	Tentatively Identified Compound
TOC	Total Organic Carbon

TRV	Toxicity Reference Value
Tsu	Santa Susana Formation
UTL95	Upper Threshold Limit at 95% Confidence
VOC	Volatile Organic Compound
VSI	Visual Site Inspection
μCi/mL	Microcuries Per Milliliter
μg/L	Micrograms Per Liter
μg/m ³	Micrograms Per Cubic Meter

Glossary

Abiotic – nonliving, or not associated with living organisms.

Ambient – of the surrounding environment.

Analyte – a chemical for which a sample (e.g., water, soil) is tested.

Applicable or Relevant and Appropriate Requirements (ARARs) - requirements, including cleanup standards, standards of control, and other substantive environmental protection requirements and criteria for hazardous substances as specified under Federal and State law and regulations, that must be met when complying with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

Aquifer – rock or sediment in a formation or part of a formation that is saturated and sufficiently permeable to transmit economic quantities of water to wells and springs.

Bio-uptake – The uptake of contaminants by plants and animals.

Biota – plants and animals in an environment.

Biotic – of or having to do with living organisms.

Categorical exclusion – as defined by NEPA, a categorical exclusion is a category of actions which do not individually or cumulatively have a significant effect on the human environment and for which neither an environmental assessment nor an environmental impact statement is required.

CERCLA process - The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) process provides a comprehensive framework to deal with past or abandoned hazardous materials. CERCLA provides for liability, compensation, cleanup, and emergency response for hazardous substances released into the environment that could endanger public health, welfare, or the environment. If a site meets the CERCLA requirements for designation, it is ranked along with other "Superfund" sites and listed on the National Priorities List. This ranking and listing is the U.S. Environmental Protection Agency's way of prioritizing sites for cleanup. The CERCLA process uses risk-based evaluations for cleaning up sites contaminated with hazardous materials.

Characterization – site or facility sampling and analysis activities to determine the extent and nature of pollutant releases. Characterization provides the basis for acquiring the necessary technical information to develop, screen, analyze, and select appropriate cleanup techniques.

Coefficient of Variation – a coefficient of variation (C_v) is a statistical measure of the dispersion of a data points around the mean in a probability distribution. It is defined as the ratio of the standard deviation (σ) to the mean (μ): $C_v = \sigma / \mu$ and is used to compare the degree of variation from one data set to another.

Complete Exposure Pathway – see exposure pathway.

Confidence Level – the probability that the confidence interval used to estimate a population parameter from sample data will capture that population parameter (e.g., mean, median or percentile) in repeated sampling.

Congener - a member of the same kind, class, or group as another; also, an organism belonging to the same genus as another organism.

Contaminant of Concern – a chemical or radionuclide that is present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Data Quality Objective – qualitative and quantitative requirements to ensure that data of known, documented, and appropriate quality are obtained to support a decision. Developing DQOs is the first step in planning a site investigation before any data is collected.

Data Filters – Screening criteria (background, PRGs, MCLs, ESLs) used to assess overall usability of the data.

Data Sensitivity – sensitivity relates to using sampling and analysis methods that have detection limits below the selected action levels for any given analyte.

Decontamination – removal of harmful substances such as noxious chemicals or radioactive materials from exposed individuals, rooms and furnishings in buildings, or exterior environments.

Derived Concentration Guideline Level - a radionuclide-specific radioactivity level related to a concentration or dose or risk criterion. The DCGL is usually specified by a regulator.

Detection Limit - the lowest concentration of a chemical in a medium (e.g., soil, air, water) that can be distinguished reliably, through laboratory testing, from a concentration of zero.

Exposure Pathway – the route a substance takes from its source (where it began) to its end point (where it ends), and how people and/or organisms can come into contact with (or get exposed) to it. An exposure pathway has five parts: a source of contamination; an environmental media and transport mechanism; a point of exposure; a route of exposure; and a receptor population. When all five parts are present, the exposure pathway is termed a completed exposure pathway. An incomplete exposure pathway is missing one or more parts of the pathway. Direct and indirect exposure pathways refer to the method in which a receptor is exposed to the contaminant; either direct (such as external gamma radiation) or indirectly (such as ingestion).

Direct Exposure Pathway – see exposure pathway.

Environmental assessment – a concise public document prepared by or for a Federal agency, required by NEPA, briefly providing sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact (FONSI). An environmental assessment includes brief discussions of the need for the proposal, possible

alternative actions, the environmental impacts of the proposed action and alternatives, and a listing of agencies and persons consulted.

Environmental Impact Statement (EIS) – an EIS is a detailed public document prepared by or for a Federal agency, required by NEPA. An environmental impact statement is a more in-depth and thorough environmental impacts evaluation of a proposed action and alternatives as compared to an environmental assessment. The primary purpose of an environmental impact statement is to serve as an action-forcing device to insure that NEPA policies and goals are infused into the ongoing programs and actions of the Federal Government. An EIS provides full and fair discussion of significant environmental impacts and is used to inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. An EIS is used by Federal officials in conjunction with other relevant material to plan actions and make decisions.

Exposure Routes – ways in which human or environmental receptors may be exposed to contaminants, including inhalation, ingestion or direct (gamma) exposure.

Finding of No Significant Impact (FONSI) – a FONSI is a document prepared by a Federal agency briefly presenting the reasons why an action analyzed in an environmental assessment would not have a significant effect on the human environment and for which an environmental impact statement therefore will not be prepared. It includes the environmental assessment or a summary of the environmental assessment.

Fugitive Dust – dust released when soil or other materials are disturbed. Fugitive dust is commonly released during construction operations or any operations where soil or materials are being moved.

Gamma Radiation - gamma radiation is high-energy, short wavelength electromagnetic radiation (a packet of energy) emitted from the nucleus of an atom. Gamma radiation frequently accompanies alpha and beta emissions and always accompanies fission. Gamma radiation is very penetrating and can travel several hundred feet in air. Gamma radiation requires a thick wall of concrete, lead, or steel to stop it.

Gross alpha/beta – the total radioactivity due to alpha or beta particle emissions as inferred from measurements on a dry sample.

Groundwater – water beneath the earth's surface located between soil particles and between rock surfaces. For the purposes of this data gap analysis, ecological risk will consider seeps and springs as part of the groundwater system; whereas, the human health risk scenarios only consider groundwater in deep and/or shallow aquifers.

Half-life - the amount of time it takes for half the atoms of a particular radioactive substance disintegrate to another nuclear form. Measured half-lives vary from a fraction of a second to billions of years.

Hydraulic conductivity – a coefficient of proportionality describing the rate at which water can move through a permeable medium.

Incomplete Exposure Pathway – see exposure pathway.

Indirect Exposure Pathway - see exposure pathway.

Linearity – following a straight line.

Long-lived Radionuclide – a radionuclide with a very long half-life, possibly extending to thousands of years.

Minimum Detectable Activity - The lowest radioactivity level that can be distinguished reliably from a radioactivity level of zero.

NEPA process – The National Environmental Policy Act process requires Federal agencies to evaluate environmental impacts as part of a decision making process for proposed agency actions. The agency evaluation may result in a categorical exclusion, or reported in an environmental assessment or an environmental impact statement.

Non-detects – an analyte concentration that falls below the laboratory reporting limit. The non-detect result means the analyte is not detected at or above the laboratory reported concentration (qualified with “U”) or the laboratory reported estimated concentration (qualified with “UJ”).

Null Hypothesis – an initial proposition or theory set forth as an explanation for a specified phenomenon or observation. Collected data are then used to prove or disprove the null hypothesis. In the statistical language of hypothesis testing, the baseline condition is called the null hypothesis.

Outlier – a data point that is not numerically similar to the other data points in a data set or that lies outside the range of most of the data.

Potentiometric surface – the surface to which water in an aquifer can rise by hydrostatic pressure.

Preliminary Remediation Goal – initial clean-up goals developed early in the cleanup selection process based on readily available information. The PRGs are modified to reflect results of the baseline risk assessment. They also are used during analysis of remedial alternatives in a CERCLA remedial investigation/feasibility study (RI/FS).

Probability Plots – the outcome of a technique that utilizes the entire range of input data to develop a probability distribution of exposure or risk rather than a single point value. The input data can be measured values and/or estimated distributions. Values for these input parameters are sampled thousands of times through a modeling or simulation process to develop a distribution of likely exposure or risk. Probabilistic models can be used to evaluate the impact of variability and uncertainty in the various input parameters, such as environmental exposure levels, fate and transport processes, etc.

Qualitative Study/Evaluation – an evaluation or study based on non-quantitative knowledge and facts. For example, knowledge of the locations of previous spills or processes that could result in environmental contamination is part of a qualitative study or evaluation. A qualitative study or evaluation guides where quantitative data should be obtained.

Quantitative Study/Evaluation – an evaluation or study based on numerical results such as concentrations of contaminants.

Radionuclide – any radioactive isotope (form) of any element.

Radionuclide of Potential Ecological Concern (RPEC) – a radionuclide that is present at levels that might cause harmful (adverse) effects in animals or plants.

Radionuclide Ratio Characterization – Determination/characterization of the percentage (ratio) of total radioactivity that is the result of a given radionuclide. The information will be used in risk assessments to determine the percentage of the gross alpha or gross beta activity that is the result of a specific radionuclide.

Radioactive Materials – materials that emit ionizing radiation.

Receptor – people or organisms that could come into contact with hazardous substances.

Risk - the expected frequency or probability of undesirable effects resulting from exposure to known or expected stressors.

Risk Assessment – a process which estimates the likelihood that exposed people may have health effects.

Risk-based evaluation – evaluations based on protecting human health and environmental quality taking into account the expected frequency or probability of undesirable effects resulting from exposure to chemical or radiological contaminants.

Risk-based cleanup criteria – remediation goals developed by determination of 1×10^{-6} site specific point of departure as set out in the NCP and movement off the point of departure based on CERCLA criteria.

Risk range – the CERCLA carcinogenic risk range is the cumulative carcinogenic risk from 1×10^{-6} to 1×10^{-4} (i.e., one cancer in one million individuals exposed to one cancer in ten-thousand exposed individuals) based on the relative maximum exposure.

Sample Density – number of samples per unit of area, such as number of samples per acre.

Screening criteria – criteria that must be met to meet specified requirements.

Sediment – topsoil, sand, and minerals washed from the land into water, usually after rain or snow melt.

Seep – a small spring, pool, or other place where ground water trickled out of the earth.

Short-lived Decay product – degraded radioactive materials, often referred to as "daughters" or "progeny" with a very short half-life.

Soil Gas/Vapor – the gaseous elements and compounds (e.g., volatile organic compounds) in the small spaces between particles of soil that can be moved or driven out under pressure. Vapor is the gas driven off by substances that are solids or liquids at ordinary atmospheric pressures and temperatures.

Spring – a pool of water that forms where groundwater flow extends above the ground surface.

Surface water – water on the surface of the earth, such as lakes, rivers, streams, ponds, and springs.

Surface Soil – for purpose of this gap analysis and risk assessment, soil that is located vertically from 0 to 6 inches below the ground surface.

Subsurface Soil – for purpose of this gap analysis and risk assessment, soil that is located vertically at depths greater than 6 inches below the ground surface.

To-Be-Considered Guidelines -- guidance, advisories, or criteria that are not promulgated (and therefore cannot be considered ARARs), but that may be used to establish protective Superfund remedies.

Transport Mechanisms – methods by which contaminants may be moved through the environment, typically air, surface water, groundwater, and uptake by plants through the soil.

Type I Error – the statistical term for false rejection decision error, which occurs when a decision maker rejects the baseline condition (null hypothesis) when it actually is true.

Normal Distribution - a theoretical frequency distribution for a set of variable data points. Also called Gaussian distribution and generally represented by a bell-shaped curve symmetrical about the mean or average value.

Type II Error – the statistical term for false acceptance decision error which occurs when a decision maker accepts the baseline condition (null hypothesis) when it actually is false.

TRIAD Approach – an integrated approach of systematic planning, dynamic work plans, and real-time measurement technologies to plan and implement data collection and technical decision-making at hazardous waste sites. The triad approach focuses on overall decision quality as the overarching goal of project quality assurance, requiring careful identification and management of potential causes for errors in decision-making (i.e., sources of uncertainty).

Volumetric Sampling – an area or volume of soil is the unit of measure rather than a concentration measure. Normally an increment of surface area is used as the sampling unit and

is excavated to a designated depth. Results of volumetric sampling are reported as mass per unit area (mg/m^2) or mass per unit volume (mg/m^3).

Executive Summary

This document presents the results of a data gap analysis conducted to determine whether existing data and information for Area IV of the Santa Susana Field Laboratory (SSFL) are adequate for the purpose of developing and evaluating risk-based cleanup alternatives in an Environmental Impact Statement (EIS). This data gap analysis addresses the media of surface and subsurface soil, gamma walkover surveys of soil, groundwater, groundwater seeps, soil vapor, surface water, sediment, biota, air, buildings, and bedrock. The data gap analysis addresses all of Area IV and evaluates adequacy of chemical and radionuclide data.

Area IV of the SSFL was used by the Department of Energy (DOE) and its predecessor agencies for nuclear energy development and liquid metals research and related activities. Although cleanup of portions of Area IV has occurred since the early 1960s, primary cleanup work was initiated in 1988 when DOE's nuclear energy research development mission ended at Area IV. Some responsibilities for investigation and cleanup of portions of Area IV have been assigned to the Boeing Company, as it was to its predecessor companies.

In 2003 DOE issued an Environmental Assessment (EA) to address the decommissioning and demolition of its remaining facilities within Area IV. The Findings of No Significant Impact were challenged in Federal Court and the U.S. District Court Northern California District judge ruled that DOE had failed to comply with the National Environmental Policy Act (NEPA) by not preparing an EIS. Based on the judge's ruling, DOE initiated steps for preparing the EIS, including development of this data gap study intended to support the EIS alternatives evaluation.

Scope of Data Gaps Analysis

The data gap analysis involved the assessment of a GIS data base developed by Boeing for SSFL including Area IV for soil and groundwater, the stormwater compliance data, building survey data, prior gamma walkover survey data, and air quality data. It also included the review of numerous reports and documents providing historical and sampling information for Area IV. In all more than 30,000 analytical data records and 200 reports were reviewed.

The Boeing GIS data base was formatted to allow data queries by individual chemicals and radionuclides (termed contaminants of interest or COIs for this study) by media, screening criteria, location, and other factors. For soil, screening criteria included method detection limits for all COIs, preliminary remediation goals (PRGs) for human health, ecological screening levels (ESLs) for biota (also termed ecological receptors), and background concentrations for metals, dioxins, and radionuclides. The PRGs developed for the screening were based on unrestricted land uses that address open space and rural residential considerations. For water (groundwater and surface water) results, method detection limits, tap water maximum contaminant levels (MCLs), and ESLs formed the screening criteria.

The screening criteria were used to identify those data in the GIS data base that met the requirements for conducting human health and ecological risk assessments consistent with that used under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). To identify data that would indicate the presence of chemicals and radionuclides at concentrations above screening levels, analytical detection limits were checked versus PRGs, MCLs, ESLs, and background. Data with detection limits above the screening criteria became a potential data gap because they could not be used to define nature and extent of contamination at the location where the samples were collected.

The GIS data base was also queried to determine what chemicals and radionuclides had been detected in Area IV, the frequency of detection, and the number of samples exceeding the PRG, MCL, and ESL screening criteria. This evaluation of the data base was used to identify the initial list of COI for the evaluation of data needs for the EIS alternatives evaluation. The list of COIs was also screened to determine which of the identified chemicals and radionuclides posed the greatest toxicological risk based on either concentrations or inherent toxicity of the chemical or radionuclide.

The evaluation of the suitability of the radionuclide data was conducted under principles stated in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The MARSSIM principles were developed to assist investigators and decision makers in determining the adequacy of radionuclide data for defining radionuclide contamination cleanups. To evaluate the spatial distribution of soil sample results, Area IV was separated into sixteen exposure units (EUs) per MARSSIM. Through the determination of process history as documented in numerous reports and the distribution of samples exhibiting soil contamination, the sixteen EUs were further subdivided into survey units (SU)s that formed the basis of determining soil sampling requirements for radionuclides.

To identify the data needed to conduct human health risk and ecological risk assessments consistent with CERCLA, three conceptual site models were developed. Two of the models addressed soil pathway risks to human and ecological receptors and the third model addressed the exposure transport and fate considerations for groundwater.

Regarding Area IV chemical contamination, investigation of some chemical use areas of Area IV are ongoing under the SSFL Resource Conservation Recovery Act (RCRA) compliance program. Four RCRA facility investigations (RFIs) are in various stages of implementation for portions of Area IV. Data collected under the RFIs that meet the objectives of the data gap study will be incorporated into this data gap analysis when available to address some of the data concerns identified as part of this effort. This data gap study was conducted independently of the RFI program and any data collected under the RFI will still be considered as a data gap until the data are demonstrated to meet the needs of the data gap study.

Upon completion of the Area IV data gap analysis, a field sampling investigation will be developed and implemented to collect data and information needed for the EIS. Data sampling objectives and requirements will be presented in a Field Sampling and Analysis Plan outlining how the data gaps will be addressed.

Data Gap Findings

Table ES-1 provides a summary of the data gap analysis findings. The text that follows provides summary details of the data needs.

Table ES-1 Summary of Data Gap Analysis Findings

Media Evaluated	Data Gap
Soil	Additional chemical and radionuclide data are required for determining risks to human health and ecological receptors. Data are also required for characterization and delineation of the extent of contamination for analysis of risk-based alternatives in the <i>SSFL Area IV EIS</i> .
Gamma Walkover Survey	The data gap proposal is to conduct a 100% gamma walkover survey of all accessible portions of Area IV, adjacent areas identified to be impacted, drainages down gradient of Area IV, and groundwater seeps.
Groundwater	Data are needed to define horizontal and vertical extent of contamination, both for areas where extent is not adequately defined and in areas with no groundwater sampling data. Data on the hydrologic properties of the aquifers are also needed for evaluation of alternatives in the EIS.
Groundwater Seeps	Radionuclide and chemical data are needed to understand the fate and transport of groundwater contaminants and assess human and ecological receptor exposure pathways. Seeps will be sampled if water is available during the field sampling program. Regardless of the presence of water during the field effort, a gamma walkover survey will be performed.
Soil Vapor	While additional data are not required for the EIS per se, additional soil gas data may be considered in the Field Sampling Program to optimize the location of groundwater monitoring wells and to support the human health and ecological risk assessments.
Surface Water	Surface water quality for Area IV is currently being assessed under the SSFL's National Pollutant Discharge Elimination System (NPDES) permit. For the most part, this data is adequate for EIS purposes. Surface water chemical and radionuclide data from ponds and drainages internal to Area IV are required for assessment of risk to ecological receptors. Surface water

Table ES-1 Summary of Data Gap Analysis Findings

Media Evaluated	Data Gap
	characterization and confirmation samples will be collected during field sampling, if it is present.
Sediment	Sediment chemical and radionuclide data from ponds and drainages internal to Area IV are required for assessment of surface soil risk to human health and risk to ecological receptors.
Ecological Receptors	Biological tissue chemical and radionuclide data are required for assessment of risk to ecological receptors.
Air	No data gaps for air were identified.
Buildings	Radionuclide data for building surfaces are incomplete. Additional data for buildings are required for human health risk assessment.
Bedrock	Chemical and radionuclide analytical data, including aquifer physical and natural chemistry data are required.
Background	Accepted background data for radionuclides are needed for surface, near surface soil, and subsurface soil; metals and dioxin in subsurface soil; and radionuclides, metals and dioxin in sediment, surface water, groundwater and bedrock. These data should be collected from media in both geologic formations found at the site.

Soil - Chemicals

The screening of the existing data was performed on an individual constituent (chemical and radionuclide) by constituent basis. Existing data for many constituents at each study location were found to be adequate for the purpose of use in either a risk assessment or defining contamination extent. However, because some individual constituents did not pass screening criteria, many of the locations evaluated required some additional sampling due to the “data gap” introduced by specific COIs. In addition, because there is limited subsurface soil data, defining vertical contamination depth is a gap for locations with identified surface soil contamination.

For chemicals, a statistical analysis was performed for each of the 16 EUs to determine the minimum number of samples required for a risk assessment consistent with CERCLA. The number of existing valid samples was subtracted from the required number, to determine the data gap (the number of additional samples required). To determine the nature of contamination for each EU, prior data and reports were reviewed to establish chemical use areas. To evaluate the data required to determine extent of contamination, the results of the prior investigation were plotted on site maps, color coded as to whether the results exceeded background or PRGs. The plots were reviewed to determine whether the area of contamination had been bounded by data meeting the criteria. Locations that were not bounded were targeted for

additional sampling. The data gap was determined to be the difference between the statistically determined requirement and the existing data that met screening criteria. Because this approach involved evaluating a large number of use areas, this approach resulted in identification of a greater number of samples than did the risk assessment approach.

The specific requirements for collecting samples to fill the data gap will be specified in the Field Sampling and Analysis Plan to be developed for the proposed field sampling investigation of Area IV. It is expected that as part of development of the Field Sampling and Analysis Plan, proposed sample locations and depths will be refined. Sample numbers are also expected to change as part of sampling investigation development as refinements between chemical use and SU data needs are identified, overlaps in data requirements between adjacent areas are determined, and the final evaluation of data to define extent of contamination is made.

Soil – Radionuclides

The processes for screening of samples and data gap determination for radionuclides was similar to that of the soil chemical COIs, with the exception that MARSSIM principles were used to guide the effort. For surface soil, the MARSSIM delineation used the EUs and SUs as a basis for determining the number of required samples. Under MARSSIM, the total number of samples required per SU was statistically calculated based on SU classification. The screening of the existing data determined what portions of the existing data were usable to address the sample needs and the difference between the required data and available data became the data gap. To verify that the existing data were properly located for purposes of the EIS analyses, the distribution of the results was also reviewed. The MARSSIM analysis determined that approximately 600 samples would be required to define the extent of contamination for all SUs.

SSFL Area IV Gamma Walkover Survey

Gamma walkover surveys (GWS) are a part of the MARSSIM recommended site investigation approach for radionuclides. The GWS involves passing over the ground an instrument capable of detecting gamma emissions from radioactive materials. A GWS is performed as a field screening tool to locate areas with radionuclide contamination above background levels that then can be target areas for soil sampling. Nearly 100% of the accessible portions of Area IV have been subject to some level of ground survey in support of building removals. However, several of the surveys were not performed to MARSSIM guidelines or using recommended detection instrumentation. As part of the evaluation of existing data, reports describing the prior GWS were reviewed for compliance with MARSSIM principles. Areas with completed and acceptable surveys were identified. The data gap analysis then focused on the location of process areas where radioactive materials were used that lacked or had insufficient coverage. To date, MARSSIM-compliant walkover surveys have been completed for a total of about 9 acres. Although MARSSIM guidelines specify 100% coverage of impacted areas only (impacted areas are defined as locations with known or suspected radionuclide contamination), due to a level of

uncertainty regarding past activities within Area IV overall, the recommendation from the data gap study is to perform a 100% GWS of all accessible portions of Area IV that lack MARSSIM compliant surveys.

Groundwater

To determine groundwater COIs, existing groundwater data were sorted by detected COIs and screened against human health MCLs (background data for groundwater do not exist) and analytical detection limits compared to the MCLs. Based on the data base screening, tritium was the most frequently observed radionuclide and the solvents TCE, 1, 2-DCE, and 1,1-DCE the chemicals most frequently observed in groundwater.

The groundwater data gap evaluation then focused on the known extent of groundwater contamination, both vertically and horizontally. Included in this evaluation was a review of process and chemical use areas and locations where solvents were reported in soil gas. Locations where groundwater contamination extent did not appear to be bounded by the existing well network or where no wells are present to identify groundwater contamination were targeted as potential data gaps. Existing hydrogeologic data were also reviewed for use in completing groundwater characterization for both nature and extent and for understanding aquifer properties necessary to evaluate groundwater cleanup alternatives in the EIS. Based on the reviews, the data gap analysis supported recommendations for site investigative well point, new monitoring wells, and collection of aquifer properties (bedrock and water chemistry) data. The data gap recommendation will be refined during development of the FSAP.

Groundwater Seeps

Data collected at groundwater seeps can aid in determining the fate and transport of contaminants in groundwater and to assess the potential human health and ecological exposure pathways for the respective risk assessments. However, most seeps exhibit water during and immediately following the rainy season and thus data for seeps are limited. The requirement to sample seeps will be incorporated into the field sampling investigation designed to address the overall data gaps presented in this report. Therefore, all identified seep locations will be visited during the field program and sampled for radionuclide and chemical COIs should sufficient water be present. All seep locations will also be subject to a gamma walkover survey to assess the presence of any radionuclides above background.

Soil Vapor

Concentrations of volatile chemicals in soil (termed soil vapor) can aid investigators in locating soil and groundwater contamination sources, and volatiles chemicals in soil are a risk assessment concern due to migration of the chemicals into indoor air space. Soil vapor data exist as part of the RCRA investigations of chemical release sites which also can be used to identify chemical release locations and sources for solvents in groundwater. Investigation of some chemical use areas continues under

the SSFL RCRA investigation study. Existing and new data will be reviewed during development of the proposed field sampling investigation to evaluate whether any additional soil gas data would be required for EIS risk assessment and cleanup alternative evaluation purposes.

Surface Water

Surface water sampling for drainages discharging from Area IV is being conducted under the SSFL NPDES permit program. Data collected under the NPDES program is deemed sufficient for site characterization for the discharge points of Area IV. However, there are internal Area IV drainages leading to ponds in other SSFL areas with limited or no data becoming a data gap. If present during the field sampling program, surface water will be collected and analyzed for radionuclide and chemical COIs. Any body of water receiving runoff from Area IV will also be proposed for sampling under the field sampling investigation. Also, to collect data on the complete list of the data gap program COIs, NPDES monitoring points will also be sampled should sufficient rainfall occur during the field sampling investigation.

Sediment

The extent of sediment contamination associated with NPDES-monitored drainages appears to be bounded by existing sample results. However, there are internal drainages within Area IV that lack sediment data. These drainages become a data gap and will require sampling for radionuclide and chemical COIs to address both human health (as surface soil) and ecological risks.

Ecological Receptors

Similar to the approach applied to soils for the human health risk assessment data evaluation, the existing soil data base was reviewed for chemical and radionuclide data collected from soil, sediment, surface water, groundwater seep, sump soil, and soil gas. Three screens of the data were performed including comparisons of analytical detection limits with ESLs. Chemicals and radionuclides of potential ecological concern were identified by comparing maximum concentrations in the GIS data base with ESLs. The third screening involved the comparison of ESLs with human health PRGs. This was done to evaluate the applicability of the human health soil gap requirements in addressing the ecological risk assessment needs. This third evaluation determined that the soil sampling effort proposed for the human health risk assessment would be sufficient for use in the ecological risk assessment.

The evaluation of the other media for ERA purposes indicated chemical and radionuclide data are needed for on-site drainages (water and sediment) and ponds that received runoff leaving Area IV. Data for radionuclides are also needed from groundwater seeps downgradient from Area IV to assess this pathway and risk to ecological receptors.

Biological tissue data does not exist for Area IV. To address the ecological risk evaluation of COI uptake and bioaccumulation, the ecological data gap analysis identified a need to collect biological tissue samples. This includes the need to

analyze biota tissue samples with a full range of chemical and radionuclide COIs. A total of 10 samples per biological media are recommended. These include terrestrial and aquatic plant, terrestrial and aquatic invertebrate, fish, lizard and small mammal samples. As with the proposed soil and groundwater field sampling investigation to address their respective data gaps, the data requirements will be described in the Field Sampling and Analysis Plan.

Air

The review of air monitoring data indicates that sufficient ambient data exist for Area IV. To assess risks for the EIS relative to decommissioning and demolishing of buildings and removal of soil, building data and soil data collected during the proposed field sampling investigation will be used. Therefore no additional air sampling is proposed at this time. This finding does not include the possible need to sample air in the breathing zone of site workers involved in the field sampling investigation.

Buildings

Reports containing data for building radionuclide characterization were reviewed to evaluate the history of use and investigation of remaining site buildings. This review determined that a limited data gap exists. This data gap consists of a need for building surface contamination data (i.e., fixed point measurements, radiological scan surveys, and removable contamination data) for about 17 buildings or structures. In addition, isotopic ratios to be applied to contaminant levels as an integral part of the preparation of human health risk assessments are not generally available for remaining buildings. The buildings to be sampled and sampling protocols will be specified in the FSAP.

Bedrock

The analysis of bedrock sample results in the database determined that very little bedrock data have been collected to date for chemical and radionuclide COI characterization. In addition, bedrock aquifer properties are needed for groundwater cleanup remedy evaluations. Therefore bedrock data are a data gap for completing Area IV site characterization. Bedrock samples will be required at locations where chemical and radionuclide vertical extent of contamination is needed and from borings for wells drilled into bedrock. The locations and evaluations of bedrock samples will be described in the Field Sampling and Analysis Plan.

Background

Background values for metals and dioxin in soil have been agreed upon by regulatory agencies for SSFL, although there is not a similar set of background values for subsurface soil. The radionuclide background used for this data gap analysis was based on existing offsite surface soil data. These data may be useful for establishment of agreed upon future radionuclide background values. However, establishment of separate background values for each of the two geological formations is desirable and additional surface soil data may be useful for that purpose. Also, there currently is no

background data for radionuclides at depth for near surface and subsurface soils, sediment, rocks, surface water, and groundwater. Therefore, the data gaps include additional background sample analysis for radionuclides and chemicals for these matrices.

Section 1

Introduction

This Area IV Santa Susana Field Laboratory (SSFL) *Data Gap Analysis Report* was prepared by CDM, A Joint Venture (CDM) under U.S. Department of Energy (DOE) Contract No. DE-AM09-05SR22404, Task Order No. DE-AT30-08CC60021/ET17. Technical support was provided to CDM in the preparation of this report by Science Applications International Corporation (SAIC).

The primary objective of the Area IV SSFL data gap analysis is to identify the data necessary to evaluate a full range of risk-based alternatives in an Environmental Impact Statement (SSFL Area IV EIS) that will address the final decommissioning, demolition, and environmental cleanup of Area IV. Data requirements to conduct human health and ecological risk assessments will be addressed in a subsequent field investigation and sampling program. The scope of the data gap analysis incorporates all media: surface and subsurface soil, surface water, groundwater, air, biota (ecological), and structural (building) material.

1.1 Organization of Area IV SSFL *Data Gap Analysis Report*

This report contains the following sections and information describing the processes used to develop and evaluate the Area IV database for conducting human health and ecological risk assessments for ultimate evaluation of a range of cleanup alternatives in the SSFL Area IV EIS.

Section 1 – Introduction

Section 1 of the *Data Gap Analysis Report* provides a description and history of the site; discusses stakeholders, regulatory drivers, objectives of the study; the overall approach to the gap analyses; and the organization of the document.

Section 2 – Area IV Background and Description

Section 2 presents details on the location and physical setting of Area IV and summaries of past and ongoing investigations in Area IV. This section also describes the sources of data used in evaluating data adequacy for Area IV.

Section 3 – Data Gap Analysis Methodology

Section 3 describes the methodology used to evaluate the existing database for adequacy and the overall Data Quality Objectives for the data gap study. This section includes human health and ecological conceptual site models and the origins of the screening criteria used in the initial evaluation of the data. It also defines the overall data gap approach, media evaluated, screening process, development of exposure units, and methods used to identify data gaps for each media.

Section 4 – Data Gap Study Results

Section 4 presents the results of the data gap study by media: soil, groundwater, ecological receptors, buildings, and air.

Section 5 – Summary and Conclusions

Section 5 summarizes the findings of the data gap analysis, identifies data needs, and introduces the sampling requirements for the proposed field sampling program.

Section 6 – References

Section 6 presents the references used to develop this report.

Appendix A – Area IV General Chemical Use Overview

Appendix A provides a summary of past and current Resource Conservation and Recovery Act (RCRA) (42 U.S. Code [U.S.C.] 6901 *et seq.*) facility investigations addressing chemical contamination associated with several of the current and past Area IV facilities. Appendix A Table A-1 was used to support an understanding of process history and current conditions relative to chemical contamination in Area IV.

Appendix B – Historical Site Assessment Summary

Appendix B provides a summary of the historical use and current conditions of buildings and facilities that once were used in Area IV. This information was used to establish an understanding of the process history and likelihood of contamination at any of the 200 facilities that once were present in Area IV, particularly in relation to radionuclides.

Appendix C – Radionuclide Background Sources

Appendix C provides a discussion of the natural and manmade sources of background radionuclides in Area IV. This information is used to support derived background screening values for radionuclides.

Appendix D – Statistical Evaluation of Radiological Background Distribution

Appendix D provides Statistical P plots that demonstrate the distribution of background levels of radionuclides in Area IV. This information is used in support of derived background screening values for radionuclides.

Appendix E – Ecological Risk Data Gap

Appendix E contains tables with parameter values for radionuclides used to determine the internal and external radiological dose to ecological receptors. These parameters are used to calculate ecological preliminary remediation goals (PRGs) for radionuclides, which are used as screening benchmarks. Appendix E also contains the results of screening of soil by depth versus ecological PRGs.

Appendix F – Chemical Contaminant of Interest Distribution Maps

Appendix F provides chemical distribution maps for each contaminant of interest (COI) chemical class (e.g., metals, volatiles, PCBs, etc.) in each exposure unit. These maps were used to evaluate the required number of additional samples needed to characterize and delineate known or potentially contaminated soil in Area IV.

Appendix G – MARSSIM Radionuclide Evaluation Results

Appendix G presents the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)-based statistical evaluation of Area IV. The MARSSIM provides the standard protocols for conducting radiological surveys as would be required for a final site status survey. This Appendix is being provided for informational purposes only and the findings do not represent what is necessary to conduct risk based evaluation of alternatives in the SSFL Area IV EIS.

Appendix H – Update to PRGs

Appendix H provides the calculations used to update the EPA Region 9 generic risk-based PRGs to account for CalEPA toxicity values. In addition, residential PRGs were updated to incorporate the exposure pathway of ingestion of homegrown fruits and vegetables that was identified for residents in the site conceptual model (Section 3.0).

Appendix I - Chemical Data Gap Analysis Results for Soil

Appendix I provides tables summarizing and detailing the results of the chemical data gap analysis for soil. The data gaps (or difference between the minimum number of samples required and sample results meeting screening criteria) required for a risk-based approach (evaluated at an exposure unit level) are shown in the tables for two exposure use scenarios (residential and rural residential) for two soil intervals (0 to 2 feet and 2 to 10 feet). The appendix also includes the data gap determined after review of contaminant distribution maps to identify the locations of additional samples needed to adequately characterize and determine the lateral and vertical extent of contamination for use in an EIS evaluation of alternatives.

1.2 Area IV SSFL Site Description and History

The SSFL is located in southeastern Ventura County, California, and consists of approximately 1,153 hectares (2,850 acres) near Simi Valley (**Figure 1-1**). The SSFL is separated into four administrative areas (**Figure 1-2**). The Boeing Company (Boeing) owns all of Area I, except for 42 acres that are owned by the National Aeronautics and Space Administration (NASA). Area II is owned by NASA and operated by Boeing; and Boeing owns and operates Areas III and IV (DTSC 2008). Areas I, II, and III were used by predecessors of Boeing, NASA, and the Department of Defense (DOD) for rocket engine and laser testing. Environmental contamination resulting from those activities is the responsibility of Boeing and NASA and is not part of the scope of the data gap analysis. A 90-acre portion of Area IV is leased by DOE and is the subject of this data gap study. The proposed SSFL Area IV EIS will address all 290 acres of Area IV and any adjacent areas impacted by Area IV activities.

Until its closure, DOE was responsible for operation of the Energy Technology Engineering Center (ETEC) located in Area IV. As ETEC did not have specific boundaries within Area IV, it represented a group of facilities owned by DOE and used for nuclear research and other experimental activities.

From the mid-1950s until the mid-1990s, DOE and its predecessor agencies were engaged in or sponsored nuclear operations including the development, fabrication, disassembly, and examination of nuclear reactors, reactor fuel, and other radioactive materials. Associated experiments included large-scale sodium metal testing for fast breeder reactor components. Nuclear operations at ETEC included 10 nuclear research reactors, 7 critical facilities, the Hot Laboratory, the Nuclear Materials Development Facility, the Radioactive Materials Handling Facility (RMHF), and various test and radioactive material storage areas. In addition to the handling and processing of radioactive materials, these DOE facilities also used non-radioactive chemicals and other hazardous materials (e.g., polychlorinated biphenyls [PCBs], solvents, and lead-based paints) in their operations.

All nuclear research in Area IV was terminated in 1988, when DOE shifted its focus at SSFL from research to decontamination and decommissioning activities. Decontamination and decommissioning of the sodium test facilities started in 1996, when DOE determined that the entire ETEC facility was surplus to its mission. At that time, DOE began formal closure of its facilities in Area IV and began cleanup activities in preparation for returning the property to Boeing. Under contract with DOE, Boeing is responsible for decontamination and demolition of the ETEC buildings.

Prior to 2000, DOE used its authorities under the Atomic Energy Act of 1954 to decontaminate and demolish DOE structures and facilities in Area IV, and used a categorical exclusion under the National Environmental Policy Act (NEPA) (42 U.S. Code [U.S.C.] 4321 *et seq.*) to address the environmental impacts of cleanup and removal of the structures. In 2000, DOE changed its policy regarding NEPA coverage of its actions and elected to prepare an Environmental Assessment (EA).

In January 2002, DOE issued the *Draft Environmental Assessment for Cleanup and Closure of the Energy Technology Engineering Center (ETEC EA)*. DOE received comments on the *ETEC EA* from the U.S. Environmental Protection Agency (EPA), the State of California, local communities, and local citizens. Primary issues raised by the commentors were: the cleanup of Area IV should address Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S. Code [U.S.C.] 9601 *et seq.*) risk-based considerations, Area IV had not been adequately characterized for purposes of remedy evaluation and selection, and DOE should prepare an EIS addressing environmental effects.

The DOE determined that the *ETEC EA* adequately addressed the environmental effects, prepared a Finding of No Significant Impact (FONSI) based on its analyses,

and issued the Final *ETEC EA* in March 2003. The DOE then reinitiated decontamination and demolition activities for the remaining facilities.

In October 2004, environmental groups and the City of Los Angeles challenged the FONSI in Federal court, and the court ruled in favor of the plaintiffs (DTSC 2008). In May 2007, the U.S. District Court of Northern California ruled that DOE's decision to issue a FONSI and conduct cleanup and closure on the basis of the *ETEC EA* was in violation of NEPA. In compliance with the judge's ruling, DOE initiated steps for preparing the SSFL Area IV EIS and elected to stop demolition of structures until completion of the EIS process. As part of this decision, DOE also elected to conduct a data gap analysis to evaluate the existing database and data necessary to address CERCLA risk-based considerations for evaluation of cleanup alternatives.

Although DOE has discontinued decontamination and demolition of the remaining facilities, it will continue surveillance, maintenance, monitoring and investigation activities, including investigation of soil and groundwater, as required under State of California Department of Toxic Substances Control (DTSC) regulations, until completion of the SSFL Area IV EIS.

1.3 Stakeholders

Stakeholders involved in the review of Area IV SSFL cleanup decisions, the cleanup approval process, or who have a strong interest in the outcome of the cleanup decision, include: Boeing, NASA, EPA, certain American Indian Tribes and Tribal organizations, the State of California, local communities, public interest groups, and individual members of the public.

Boeing

Boeing owns the land on which the DOE facilities are situated. Following decontamination, demolition, and cleanup, surface use of the land will be returned to Boeing. Boeing's mission in Area IV is in its final months, and Boeing is in the planning process of removing unnecessary facilities. Following the overall cleanup of Area IV of the SSFL, Boeing has indicated plans to transfer the land to the State of California for use as open space.

NASA

This agency is in the process of investigating and cleaning up contamination on land it owns in Areas I and II under RCRA and administered by DTSC. NASA, like Boeing, is in the final days of its mission at SSFL and is evaluating removal of unnecessary facilities.

EPA

The EPA is the Federal agency responsible for enforcing Federal hazardous waste laws, including rules promulgated under CERCLA. In addition, EPA has primary responsibility for the review of NEPA decisions made by other Federal agencies, thereby giving it a role in review of DOE decisions related to Area IV of the SSFL.

Though it does not have lead regulatory authority over radiological cleanup at the site, in 1989 (at the request of local community members and elected officials), the EPA became involved in the investigation of radiological soil contamination at SSFL (DTSC 2008). In 2003, EPA evaluated the ETEC site in Area IV for inclusion on the National Priority or “Superfund” list and decided conditions did not warrant the action. However, in 2007, following another evaluation, EPA recommended to the Governor of California that the entire SSFL site be placed on the Superfund list. The final decision is still pending (DTSC 2008). In addition, the California Secretary for Environmental Protection has requested that the U.S. EPA take the lead role in the EPA/DOE radiological characterization survey, provide technical assistance to DTSC in radiological contamination evaluation at the site and in its comprehensive study to establish background values for chemical and radiological contaminants at the site, and other related activities (DTSC 2008).

Under Congressional HR 2764, DOE and EPA have been instructed to develop and implement a joint radionuclide investigation of Area IV. Both agencies are currently in technical discussions regarding the scope of the investigation and the roles of each agency in conducting the investigation.

American Indian Tribes and Tribal Organizations

Tribes will be notified and consulted with as appropriate under applicable laws and regulations and in compliance with DOE’s *American Indian & Alaska Native Tribal Government Policy*.

The Chumash Indians were the original inhabitants of Simi Valley, as long as 10,000 to 20,000 years ago (DTSC 2008). A number of sites in the area, including the Burro Flats Cave and surrounding property, have cultural significance to the Chumash and other Tribes. This site and others in the San Fernando Valley area are also of interest to Tribal groups such as the Native American Heritage Commission. Boeing is working with these organizations to identify cultural sites and concerns (Rowe 2008). In addition, Burro Flats has been placed in the Federal and California State historical registers by a number of documents (Rowe 2008). For example, on July 5, 1976, Burro Flats Painted Cave was registered with the California Office of Historic Preservation (CAOHP 2008).

State of California

At present, Boeing and the State of California are conducting discussions regarding future land use and transfer of SSFL following cleanup. The State at present is the most likely recipient of the land following cleanup. The SSFL Area IV EIS will consider transfer of the land to the State as open space (parkland) as one of the remedial action scenarios.

California Department of Toxic Substances Control

DTSC has regulatory authority over chemical waste investigations at SSFL including the authority to enforce the Federal RCRA requirements in California. It has the

responsibility for oversight and approval of RCRA-related cleanup actions, including those necessary for Area IV.

California Department of Public Health

The California Department of Public Health (CDPH) is the state agency with responsibility for oversight of radioactive material cleanup and monitoring at non-DOE facilities. California is an “Agreement State” and has assumed regulatory responsibility over certain byproduct, source, and small quantities of radioactive materials. This authority was conveyed to the State by the U.S. Nuclear Regulatory Commission (NRC) under Section 274b of the Atomic Energy Act of 1954, as amended, which also mandates that Agreement States administer radiation control programs that provide adequate protection of public health and safety in a manner compatible with NRC’s regulatory programs. Because the predecessor company to Boeing licensed radioactive materials with the state, CDPH has been involved in oversight of cleanup actions. The DOE has requested CDPH concurrence on the release of former nuclear facilities in Area IV.

Local Communities

Local communities in the vicinity of the site including Simi Valley, Chatsworth, Canoga Park, and West Hills have strong interests in the cleanup of Area IV. In addition to the condition of the land following cleanup, their concerns include risks during cleanup, including the transport of materials through their communities.

Public Interest Groups

In addition to local citizenry and their elected officials, several local and national public interest groups have expressed an interest in issues related to the cleanup of Area IV, including, but not limited to: Cleanup Rocketdyne, Committee to Bridge the Gap, National Resources Defense Council, Rocketdyne Cleanup Coalition, Rocketdyne Watch, Save Open Space, and Southern California Federation of Scientists (DTSC 2008).

1.4 Regulatory and Legal Drivers

The investigation, decontamination, demolition, and cleanup of Area IV must comply with many Federal and state rules and regulations. The relationship of these rules and regulations, and the manner in which DOE complies with them, will be described in detail in the SSFL Area IV EIS. The following subsections summarize the basic relationship of applicable rules and regulations to the data gap analysis.

1.4.1 Atomic Energy Act

The Atomic Energy Act (42 *U.S. Code* [U.S.C.] 2011 *et seq.*) provides DOE with the authority for establishing a comprehensive health, safety, and environmental management program for its facilities. The DOE Orders relative to this act establish DOE’s policies, programs, and procedures for the investigation, cleanup, and final transfer of excess DOE property.

1.4.2 Comprehensive Environmental Response, Compensation, and Liability Act

Administered by EPA, CERCLA provides broad Federal authority to directly respond to actual or threatened releases of hazardous substances that may endanger public health and the environment. The Act establishes policies and procedures for the cleanup of contaminated historic or inactive sites, or sites where contamination occurred prior to enactment of RCRA that require the application of risk-based cleanup criteria as the basis for conducting cleanup actions protective of human health and the environment. Federal agencies typically follow CERCLA when conducting cleanup activities. As agreed upon in a Memorandum of Agreement signed by EPA and DOE in May 1995, it is DOE's policy to conduct cleanup of its facilities in a manner consistent with CERCLA.

1.4.3 Resource Conservation and Recovery Act

The Resource Conservation and Recovery Act governs the management of chemicals from their creation through disposal and the cleanup of chemical (non-radioactive) contamination at active facilities. California DTSC has been granted authority by EPA to implement RCRA within the State. In August 2007, DTSC issued a Consent Order to DOE, Boeing, and NASA for investigation and cleanup of chemical contamination throughout the SSFL facility under RCRA. DOE managed RCRA-permitted facilities and is in the process of closing those facilities in accordance with RCRA. In addition, four RCRA groupings (Groups 5, 6, 7, and 8) in Area IV are part of the Consent Order and are under investigation by Boeing. Cleanup of chemical wastes associated with DOE facilities in Area IV will need to comply with California RCRA procedures.

1.4.4 California Radioactive Material Regulations

As an Agreement State under the provisions of the Atomic Energy Act, CDPH has oversight authority of the cleanup of radioactive materials. Cleanup and release of facilities with radioactively-contaminated materials must be performed in accordance with California regulatory standards. The DOE must consider these standards as part of the decontamination and decommissioning of Area IV facilities.

1.4.5 National Environmental Policy Act

This Act provides for the disclosure to the public of environmental effects resulting from a decision being made by a Federal agency. It requires public participation in the identification of alternatives to a proposed action, discussion of the effects, and evaluation of mitigation measures to reduce adverse effects. Alternative development, identification of a proposed action, and public involvement aspects of NEPA are similar to those of CERCLA. The EPA, through the Council for Environmental Quality, has authority for review of implementation of NEPA.

1.4.6 Clean Water Act

The Clean Water Act (33 U.S. Code [U.S.C.] 1251 *et seq.*) establishes criteria for the protection of surface water, groundwater, and drinking water, including criteria for

stormwater runoff. Cleanup of Area IV must consider water quality criteria. The CDPH is responsible for protection of drinking water supplies. The Los Angeles Regional Water Quality Control Board (Board) is responsible for regulating surface water discharges at the SSFL overall, including Area IV. Under the National Pollutant Discharge Elimination System (NDPES), the Board has set the maximum limits for contaminants in stormwater discharges from the SSFL, including monitoring and reporting requirements.

1.4.7 Safe Drinking Water Act

The Safe Drinking Water Act (42 U.S. Code [U.S.C.] 300(f) *et seq.*) establishes, among a number of requirements, Maximum Contaminant Levels (MCLs) for concentrations of organic and inorganic chemicals in drinking water. Because groundwater is a source of drinking water for many areas of the country, MCLs are a consideration for assessing groundwater quality relative to contaminant concentrations and CERCLA remedy evaluations.

1.4.8 EPA's Office of Radiation and Indoor Air

The EPA is the lead agency responsible for enforcing provisions of the National Emission Standards for Hazardous Air Pollutants (NESHAPs) related to radionuclides. Although Area IV is no longer used for nuclear research, decontamination, demolition, and cleanup of Area IV must be conducted in compliance with NESHAPs.

1.4.9 Endangered Species Act

The Endangered Species Act of 1973 (ESA) (16 U.S. Code [U.S.C.]1531 *et seq.*) protects endangered or threatened species through conservation of their ranges and the ecosystems on which they depend. Specifically, the ESA authorizes the listing of species as threatened or endangered and prohibits the taking, possession, sale, or transport of listed species without authorization. In addition, the ESA requires the federal government to establish critical habitats for all listed species. Critical habitats are those defined as being specific areas occupied by a species at the time it is listed that have an important resource or areas that could be essential for conservation. The site must be evaluated to determine if any endangered or threatened species are or could be present on the site or if any portion of the site has been designated as critical habitat for one or more listed species.

1.5 Relationship of NEPA and CERCLA

The National Environmental Policy Act was established to allow public review and input on any Federal decision that could affect the quality of the human and natural environments. In a NEPA document such as the one proposed for Area IV, impacts resulting from the proposed project, and alternatives to the proposed project, are analyzed in relation to the purpose and need for the project. This assessment focuses on the implementation, effectiveness at addressing the purpose and need, and the impacts of the project. The NEPA process includes an extensive public comment program that includes input during the scoping phase of the project, alternatives,

impacts, and final decision regarding the project. The *SSFL Area IV EIS* will also serve to address the components of a CERCLA feasibility study, as described below.

As stated earlier, CERCLA was established to address the cleanup of chemically-contaminated sites, particularly sites that did not have a solvent responsible party that could finance the cleanup. CERCLA establishes the process for cleanup from discovery, investigations, cleanup standard and remedy evaluation, identification and implementation of the protective cleanup action, and finally through Final Closeout reporting. The evaluation of remedy alternatives is similar in some aspects to a NEPA alternative assessment in terms of effectiveness and implementability although NEPA typically does not address the costs of a proposed project. CERCLA remedy alternative evaluations are focused on the protectiveness of the alternatives relative to cleanup standards, and impacts are addressed through compliance of the action with environmental regulations. The remedy evaluations are presented in a document called the feasibility study. Similar to NEPA, CERCLA incorporates a public involvement program during which the Proposed Plan (the description of the proposed cleanup action and alternatives) is presented to the public, giving them an opportunity to comment on the proposed CERCLA action.

A significant difference between the CERCLA feasibility study evaluation of a project and the NEPA impact analysis of a project is that NEPA requires a more detailed analysis of the effects of an action on the physical, natural, and human environments, including addressing socioeconomic effects. Although implementation of a CERCLA action must comply with rules and regulations, the NEPA document provides greater detail on how compliance is achieved including an evaluation of mitigation measures that would reduce environmental impacts.

1.6 Data Gap Study Objectives

The most important objective of the data gap study is the identification of radiological and chemical data necessary for the evaluation of a full range of cleanup alternatives in the *SSFL Area IV EIS*. The data gap study reflects concerns and comments received on the *ETEC EA*. These comments and their relevance to the data gap analysis are summarized below.

1.6.1 Risk-Based Decision

The cleanup alternatives evaluated in the *ETEC EA* were derived through a dose evaluation using 15 millirem/year and 0.05 millirem/year as the risk-based standard. Comments received on the *ETEC EA* indicated that DOE should be using a CERCLA-based risk evaluation incorporating media concentrations and the CERCLA 1×10^{-4} to 1×10^{-6} risk range, with 1×10^{-6} being the departure point for cleanup decisions. DOE has agreed to change the risk basis for cleanup alternatives evaluation to reflect CERCLA. This requires media concentration data for surface soil, subsurface soil, bedrock, surface water, groundwater, air, building material, and biota. The purpose of the data gap analysis is to evaluate existing Area IV data for adequacy in performing a risk assessment consistent with CERCLA and to identify data that is

lacking. The DOE has determined that its cleanup of Area IV would address, among a range of alternatives, unrestricted reuse of property it once occupied. Therefore, existing data and new data must be compatible with unrestricted land use risk criteria.

1.6.2 Multi-Chemical/Radionuclide and Pathway Assessment

Commentors noted that the risk assessment needs to incorporate the potential risks of the combined exposure to chemicals and radionuclides via multiple exposure pathways. Pathways include contact with soil, soil consumption, inhalation of soil particles, consumption and use of groundwater, and consumption of fruits and vegetables grown at the site. The multi-chemical and multi-pathway assessment requires an evaluation of all chemicals and radionuclides of concern and all media.

1.6.3 Senate Bill 990 Consideration

California Senate Bill (SB) 990 prohibits the sale, lease, sublease, or transfer of land associated with the SSFL (including Area IV) until the Director of the DTSC certifies that the land has undergone complete remediation pursuant to the applicable standard. The standard identified in SB 990 is cleanup to agricultural land reuse. The SSFL Area IV EIS will evaluate a rural residential risk assessment scenario [incorporating locally grown fruits and vegetables as a portion of the resident's diet] to address this land use consideration. Therefore, soil, plant uptake, and animal tissue data are needed to assess that risk pathway.

1.6.4 Ecological Risk Concerns

Comments received on the *ETEC EA* stated that it did not address risk to ecological receptors and endangered species from decontamination and demolition activities. Baseline data for assessing the risk to ecological receptors in or using Area IV do not exist and thus become a data gap for the SSFL AREA IV EIS evaluations.

1.6.5 Groundwater

The alternatives considered in the *SSFL Area IV EIS* will be evaluated for effectiveness of cleanup and its impact on all Area IV media, including groundwater. Comments received by DOE indicate that groundwater may not be sufficiently characterized to support the evaluation of cleanup alternatives. Another objective of the data gap analysis is to review existing groundwater data for chemicals and radionuclides of concern and determine what additional data are necessary for cleanup evaluations in the *SSFL Area IV EIS*.

1.6.6 Building Materials

Commentors stated that risks of demolition and transport of buildings containing radionuclides were not adequately addressed in the *ETEC EA*. An additional objective of the data gap analysis is to review existing radiation level data for Area IV structures and to identify any additional information for buildings needed to address this potential risk in the *SSFL Area IV EIS*.

1.7 Data Gap Analysis Approach

Two approaches were used in the evaluation of data needs for determining the CERCLA risk assessment and remedy evaluation requirements for the *SSFL Area IV EIS*. These approaches are illustrated in **Exhibit 1-1**. The first approach involved identifying the data needed for identification of the nature and extent of contamination (i.e., identification of COIs, distribution of COIs, and volume of media affected) throughout Area IV and the data needed to evaluate remedial actions (e.g., groundwater properties) in the *SSFL Area IV EIS*. In addition to assessing adequacy of the data to perform a CERCLA risk assessment, the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)¹ approach was followed to provide a statistical basis for radionuclide sample number and density. The evaluation of existing Area IV data and information for use in a CERCLA risk assessment was a multi-step process with some steps being implemented concurrently. The processes used to assess existing data adequacy and the data needed to conduct the CERCLA risk assessment evaluations in the *SSFL Area IV EIS* are summarized below.

1.7.1 Media of Interest

Throughout the body of this text, various media are discussed including, but not limited to: surface soil, shallow subsurface soil, subsurface soil, rock, weathered bedrock, sediment, sump media, seep water, stormwater, surface water, groundwater, terrestrial biota, aquatic biota, air, structural building materials, and building surfaces. The specific description and definition used is subject-specific and dependent on the target medium to be sampled, the exposure pathway, etc. For example, for human health risk analysis, Area IV (onsite) sediment is generally regarded indistinguishable from soil. This may not be the case for biota that may be more prone to exposure to temporary, seasonal, or highly localized sediment deposits in and surrounding Area IV.

1.7.2 Database Development

The Area IV data used to conduct the data gap analysis for soil and groundwater were provided by Boeing in an electronic database or in data reports. The data received from Boeing were reviewed for consistency and completeness of fields. Some reformatting of the data was necessary for use in the data gap analysis. Air and building data were compiled from reports. The data included results for samples analyzed for radionuclides and chemicals (inorganics and organics) collected from Area IV as part of investigation and cleanup activities.

1.7.3 Development of Screening Criteria

Following the reformatting of the database for consistency of fields, screening criteria were developed to determine the applicability of the data for human and ecological risk assessments. The purpose of the screening criteria was to identify portions of the

¹ The MARSSIM approach was developed to identify the data requirements supporting closure and transfer of a facility that used radioactive materials. The approach may over estimate the numbers of samples required for a CERCLA risk assessment. See Appendix G for further details.

existing data that would be directly applicable for defining nature and extent of contamination consistent with CERCLA risk assessment guidelines.

Human health and ecological conceptual site models were developed to identify pathways and receptors to be addressed in the risk assessments and for which screening criteria are needed. Screening criteria included human health PRGs developed by EPA (with some modifications to address California criteria), MCLs for drinking water, ecological screening values for biological resources, and background concentrations for radionuclides and inorganic chemicals.

Screening criteria for background came from two sources. Background concentrations for radionuclides were derived from the background database developed by Boeing [see Appendices C and D]. For the screening of radionuclides against background, the background dataset developed by Boeing was statistically evaluated to remove outliers and any samples collected within the SSFL and adjacent buffer zone. The remaining values were incorporated into the background dataset. Background for inorganics was derived from the *Soil Background Report for SSFL*, dated September 2005, that was approved by DTSC as Appendix D of the *Standard Risk Assessment Methodology (SRAM) Work Plan Revision 2, Final* (September 2005).

1.7.4 Screening of Database and Identification of Contaminants of Interest

The Area IV database contains thousands of records for a wide range of analytes (radionuclides, inorganic chemicals and metals, and organic chemicals). All analytes in the Area IV database and some analytes that may be present based on process knowledge (but are not explicitly named in the database) are identified initially in this data gap analysis as COIs. A COI is a chemical or radiological analyte that potentially could contribute to contamination of any identified medium regardless of whether it was actually detected. The SSFL Area IV EIS will utilize the existing COI data, and any data collected as a result of the pending field effort, to identify contaminants of potential concern (COPCs), eventually leading to a list of contaminants of concern (COCs) that will be the focus of risk assessments and the subject of the cleanup decision-making process. All potential chemicals and radionuclides were subjected to the review performed under this data gap analysis regardless of adverse human health or environmental exposure potential.

The next step of the data gap analysis was comparing the formatted Boeing data with the screening criteria. The first screening included all data for Area IV. The database was queried to identify all analytes that exceeded any of the screening criteria or background levels. Any analyte exceeding a screening criterion was considered a COI for further evaluation and investigation as part of the data gap analysis.

Part of the screening effort was an evaluation of detection limits for analytes reported in the database versus the screening criteria. Sample results for any analyte that was not detected at a level above its respective screening criteria was not considered valid for use in the data gap analysis. Therefore, any analyte with an elevated detection

limit above the screening level, the result was not used as evidence that the analyte was not present at the location sampled. Screening was performed for soil and groundwater data.

1.7.5 Soil Data Evaluation

1.7.5.1 Evaluation of the Distribution of Soil Contaminants of Interest

Area IV has been divided into 16 EUs ranging between 17 and 20 acres that were based on process history, land use, and other characteristics (**Figure 1-3**). The list of chemical and radionuclide COIs developed as part of the initial screening effort was used to identify the distribution of the COIs across Area IV based on the 16 exposure units. Sorting the database by EU and plotting the data aided in displaying the density of prior sampling and the locations where COIs exceeded screening criteria. This was the first step in identifying areas exhibiting contamination and the amount of available data defining the extent of contamination. This evaluation also included the relative depth at which the sample was collected (i.e., surface or subsurface).

1.7.5.2 MARSSIM-Based Approach and Limitations for Radionuclides in Soil

The MARSSIM provides detailed guidance for planning, implementing, and evaluating the results of environmental and facility radiological surveys that have been conducted to demonstrate compliance that remedial objectives have been met (DOE et al. 2000). The MARSSIM was designed to apply to final status surveys, but the principles may be adapted and used as guidance for application to site characterization surveys. MARSSIM principles were adapted and used in this gap analysis for evaluating soil, water, and building radiological data requirements necessary for the evaluation of risk-based alternatives in the SSFL Area IV EIS.

The exposure units described above were further subdivided into survey units (SUs) based on MARSSIM definitions for Class 1, Class 2, and/or Class 3 areas. The review of existing data and process history was used to support the classifications. A Class 1 designation was used for areas with the highest potential for exhibiting levels of contamination exceeding risk-based cleanup criteria based on existing data or known process history (i.e., known history of radioactive material use). A Class 2 designation was used for areas with potential process use, but with a lower potential to exhibit contamination above risk-based cleanup criteria. Finally, a Class 3 designation is used for areas that, based on land use records and environmental data, would have limited potential to exhibit soil or water contamination. See **Figure 1-4** for an example of SU delineation for one EU within Area IV.

The MARSSIM utilizes a graded approach that focuses on radiation surveys and volumetric sampling in the areas with the highest contamination potential. That is, radiation surveys are more intense and sample densities are highest when the potential for contamination is also the highest. Data quality objectives and statistical parameters (such as the standard deviation of residual concentrations) are used to determine the number of samples required for the investigation. MARSSIM then

suggests limits on the investigation area (e.g., in acres) over which the number of samples is applied to help focus the investigation.

Since MARSSIM was applied in this data gap analysis as a tool for the design of a characterization survey for the SSFL Area IV EIS, and not as a final status survey for property transfer determination, some modifications to the MARSSIM process were incorporated into the data gap evaluation. A characterization survey is a detailed radiological environmental investigation focused on determining whether cleanup may be necessary. The primary objectives of a characterization survey according to MARSSIM are to:

- determine the nature and extent of the contamination
- collect data to support evaluation of remedial alternatives and technologies
- support Remedial Investigation/Feasibility Study requirements (for CERCLA) or Facility Investigation/Corrective Measures Study requirements (for RCRA).

Therefore, the MARSSIM-recommended size limitations and resulting sample density were modified by using a sample density that is a factor of four lower for Class 1 and Class 2 areas than would be defined by MARSSIM by survey unit size limits for final status survey. This sample density was determined appropriate to collect the required data for conducting a risk assessment for a representative exposure area. This adaptation of MARSSIM allows the sample density to continue to be proportional to the potential for contamination and sufficiently conservative to address CERCLA risk assessment data needs requirements.

The data gap analysis assessed the quantity and quality of radiation surveys and sampling data in these SUs. Recommendations as a result of this gap analysis, collection of additional data, if any, for the evaluation of risk-based alternatives in the SSFL Area IV EIS have been identified.

The MARSSIM recommends gamma walkover surveys (GWS) for the purpose of delineation of the extent of contamination and identifying elevated areas of contamination for sampling. The GWS coverages recommended by MARSSIM include a target of 100 percent coverage for Class 1 areas and 10 to 100 percent for Class 2 areas. The MARSSIM does not identify a GWS density for Class 3 areas.

Existing site buildings were also subject by this approach per MARSSIM guidelines. Classification is possible based on process history alone (and some analytical data). For the purposes of the SSFL Area IV EIS, data for the buildings will be needed to analyze risks resulting from building demolition, soil excavation, and waste transportation. Building data needs were evaluated per MARSSIM guidelines, to the extent practicable.

The MARSSIM guidelines apply to surface media and are not necessarily intended for use with subsurface contamination (i.e., subsurface soils cannot be field screened

using standard GWS instrumentation because the overlying surface soil absorbs the subsurface emissions) (DOE et al. 2000). However, the MARSSIM SU classification can still be used for assessing the potential for contamination. Therefore, sampling requirements for subsurface soils were evaluated based on SU process history especially where existing data was limited.

1.7.6 Bedrock

The GIS database was reviewed for data providing information on chemicals and radionuclides in bedrock. Bedrock data were determined to be limited and thus evaluation of bedrock related to process areas and hydrogeologic properties was determined to be a data gap for purposes of defining nature and extent of contamination at SSFL Area IV.

1.7.7 Groundwater

Although the screening of the groundwater data was a process similar to that used for screening soil data (i.e., use of screening criteria including MCLs, tap water PRGs, and detection limits to identify COIs and usable data), a different process was used to determine the adequacy of the database for use in the cleanup alternative evaluation. The well network was evaluated in terms of distribution, defining plume extent and relationship to potential sources. Soil and soil gas data were considered as part of the groundwater contaminant source evaluation. The site hydrogeologic model developed by Boeing was reviewed and assessed in relation to the understanding of contaminant fate and transport mechanisms. Hydrogeologic information such as pump test data was also reviewed as part of the data assessment in order to determine groundwater remedy evaluation needs for the SSFL Area IV EIS.

1.7.8 Seeps

Groundwater seeps have been identified by prior investigators at locations downslope from Area IV. Some seeps have been sampled and data exists for water quality. The origin of the seeps as to whether they are expressions of shallow groundwater resulting from rainfall or are connected to deeper groundwater is not known. This data gap analysis involved a cursory review of the seep data and locations and seep definition remains a data gap concern. It is important to note that because the investigation record indicates that seeps are only present in the rainy season, sampling of seeps, like surface water, is an opportunistic activity. Other investigative measures, such as borings into bedrock, may be necessary to determine any connection between seeps and Area IV groundwater.

1.7.9 Surface Water and Sediment

The entire SSFL, including Area IV, is subject to the requirements of the Clean Water Act provisions to control stormwater releases that may contain water quality pollutants. The stormwater control program, governed by the NPDES permit process is administered by the Los Angeles RWQCB. The NPDES permit for SSFL has established discharge (water quality) limits that require monitoring and reporting to the RWQCB on a regular basis (quarterly and annually). This monitoring includes

water chemistry, organic and inorganic chemicals, and radionuclide testing of stormwater collected at each outfall location. Sampling is required whenever rain events produce greater than 0.1 inches of rain in a 24-hour period. Bioassessment tests are also required annually in accordance with permit requirements.

Sampling of storm water has occurred since 1976 when the first permit (CA001309) was issued. The permit has been updated and renewed several times, with the most recent revision in December 2007. Revisions have changed monitoring analytes and discharge limits. Therefore a significant amount of storm water quality data have been produced for Area IV.

A number of best management practices (BMPs) are utilized to control storm water pollutants and improve water quality. These include the use of hydromulching, placement of straw wattles, straw bales and silt fences, the use of gravity fed three stage filters (sand, granular activated carbon, and zeolite) and a pump and treat system. The BMPs vary by location and water quality control requirements. In addition, Boeing under RWQCB Order R4-2007-0056 is evaluating engineered natural treatments for remote outfalls.

Given that there are no perennial streams within Area IV and that flow in drainages only occurs during the rainy season and only after rainfall events of sufficient magnitude to produce runoff, surface water flows for Area IV typically reflect stormwater events. Thus, monitoring data reflect stormwater permit conditions and the timing of actual storm events.

As part of the data gap analysis, the stormwater NPDES data were reviewed for applicability in use for human health and ecological risk assessment purposes. In addition, the location and distribution of drainage sediment were evaluated for adequacy in defining location and extent of any sediment contamination. The conclusion of the stormwater analyses was to use the available monitoring data to evaluate human health and ecological concerns, and collect sediment data at locations with no data.

1.7.10 Air Data

Air monitoring for radioactive elements has been conducted at SSFL since the late 1950s. The extensive air database was reviewed for adequacy as part of the data gap analysis. However, it was concluded that because this data reflects historical air quality conditions and that the risk assessment will need to evaluate future actions, the risks to workers, the public, and ecological receptors during demolition will be assessed using soil particulate data and soil concentrations and not on the existing air quality database. Additional air monitoring data is not being proposed at this time.

1.7.11 Biota

The evaluation of the existing data and subsequent data collection requirements for assessing risks to ecological receptors differed from that of the human health risk evaluation. Area IV was not subdivided into EUs and data for the entire site was

considered to establish COIs for ecological receptors. An ecological receptor conceptual site model was developed to identify pathways and receptor species or categories to be addressed in the ecological risk assessment. Because biota samples have not been collected within Area IV, the assessment addressed the types of biota samples needed along with abiotic media quality data that would support a contaminant uptake model for the site. Data proposed for the ecological risk assessment would, in some cases, also be applicable for the human health rural residential land use assessment.

1.7.12 Building Data

Radiological characterization data from existing buildings were reviewed for completeness for both gross radiation surface measurements and volumetric samples for radionuclide ratio characterization. This review indicated that data for some remaining buildings will need to be collected to assess risks to site workers, the public, and ecological receptors during building demolition and waste transportation. This data gap analysis identified the buildings requiring additional surveys.

1.8 Relationship of the Data Gap Analysis and the RCRA Facility Investigation

Boeing, NASA, and DOE are under a consent order from DTSC to investigate all locations of SSFL, including Area IV, where chemicals regulated under RCRA may have been used, stored, treated, or disposed (collectively termed “chemical use areas” for the purposes of this data gap analysis). The entire SSFL has been divided into ten RCRA groups based on testing and experimental activities that occurred within those groupings. Each RCRA group is being subject to a separate RCRA Facility Investigation (RFI) for evaluation of the presence of chemical contamination in soil and groundwater. Area IV includes all or parts of RFI Groups 5, 6, 7, and 8.

The database used for this data gap analysis includes RFI data collected for Groups 6 and 8. Investigations of Groups 5 and 7 are ongoing. The data gap analysis findings reported in this document were developed independently of the current Group 5 and 7 RFI activities. That is, the review of prior chemical use history and the identification of COIs by location using the existing data was conducted without considering the approach presented in the Group 5 and 7 RFI work plans. During the data gap analysis, additional sampling needs were identified for chemical use areas based on the independent review of the samples proposed for collection in the work plans.

Following this independent review, the recommendations derived from the data gap analysis were compared with the sampling and analytical objectives for the Groups 5 and 7 RFI field sampling plans. In most instances the data gap findings agreed closely with the objectives of the RFI sampling program which included proposed RFI sampling locations, the basic RFI target analytes, and analytical protocols. However, the findings of the data gap analysis differed from the RFI objectives in two areas. The data gap analysis is focused on data required to perform a risk assessment consistent with CERCLA and the resultant COI list was larger than the RFI objectives;

therefore, not all of the analytes required for the risk assessment are being addressed under the RFI program. This was due in part to the RFI program screening of samples for the presence of petroleum hydrocarbons before analyzing the samples for petroleum chemical constituents. Soil screening data typically are not permissible in a risk assessment and the concentrations of the petroleum chemical constituents will need to be addressed.

Another difference between the data gap objectives and the RFI was in regards to a limited potential for subsurface soil and bedrock data to be collected under the RFI sampling program. Both types of data are important for the risk assessment, fate and transport, and alternatives evaluation in the SSFL Area IV EIS.

Although it was recognized in the data gap analysis process that the RFI sampling programs could meet some of the data needs for the EIS, the data gap findings and recommendations for additional sampling stated in this report has not been changed based on the RFI work. The samples identified as being required for the SSFL Area IV EIS will remain data gaps until either valid data (i.e., data meeting the requirements of the risk assessment) are produced by the RFI program or the samples are collected as part of the data gap field program. Prior to implementation of the data gap field program (introduced in the following subsection) data produced under the RFI sampling program will be closely reviewed for use in the risk assessment consistent with CERCLA. If determined to be applicable, then those data will not be recollected. However, it is expected that some RFI locations may require re-sampling so that the data gap and risk assessment objectives can be met.

1.9 Initial Field Sampling Program Definition

The overall objective of the data gap analysis is to identify COIs and approximate locations for a subsequent field sampling investigation that will address data needed for the EIS. Upon acceptance of DOE's data gap approach, the next step in this process will be to formalize the field sampling program through the development of a *Work Plan* that will include the *Field Sampling and Analysis Plan*, *Quality Assurance Project Plan*, and *Health and Safety Plan*. Although this *Data Gap Analysis Report* indicates the general locations for sample requirements, a large portion of the effort to develop the *Work Plan* will be the refinement and identification of specific locations for collection of samples for each media. Included in that effort will be the evaluation of the acceptability of the RFI data to determine that it addresses the data gap need.

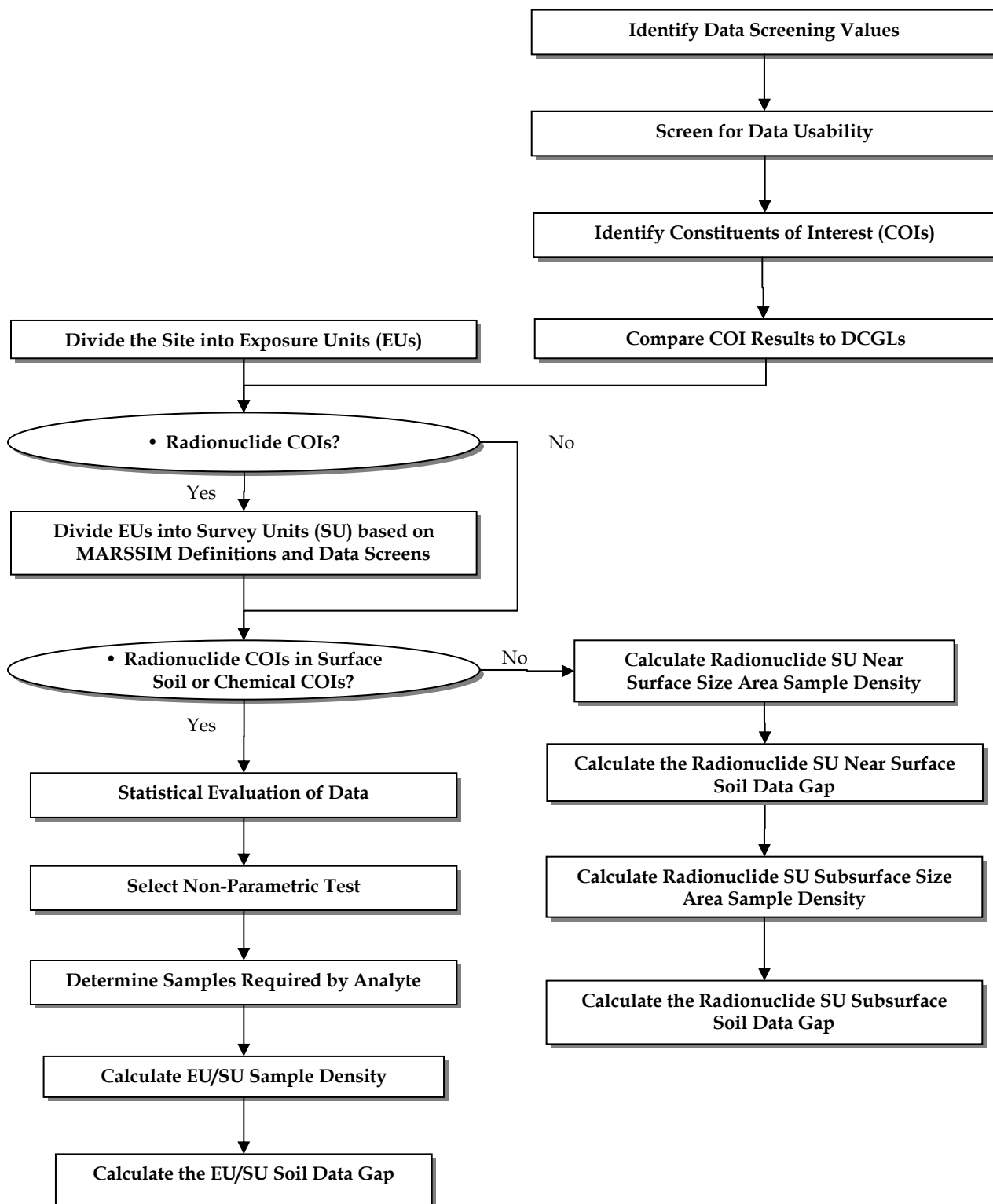
The evaluation of nature and extent of contamination at any site exhibiting contamination is typically an iterative process involving more than one sampling event. This process has been ongoing at the SSFL for more than 30 years and continues today under several RFI sampling programs. Although the goal of the data gap field sampling program is to collect final site characterization data for SSFL Area IV EIS purposes, elements of EPA's TRIAD approach to site investigation will be incorporated as applicable. The TRIAD method generally consists of systematic planning, dynamic work strategies, and real-time or rapid turnaround measurement systems. The approach allows for modifications of work plans during the course of

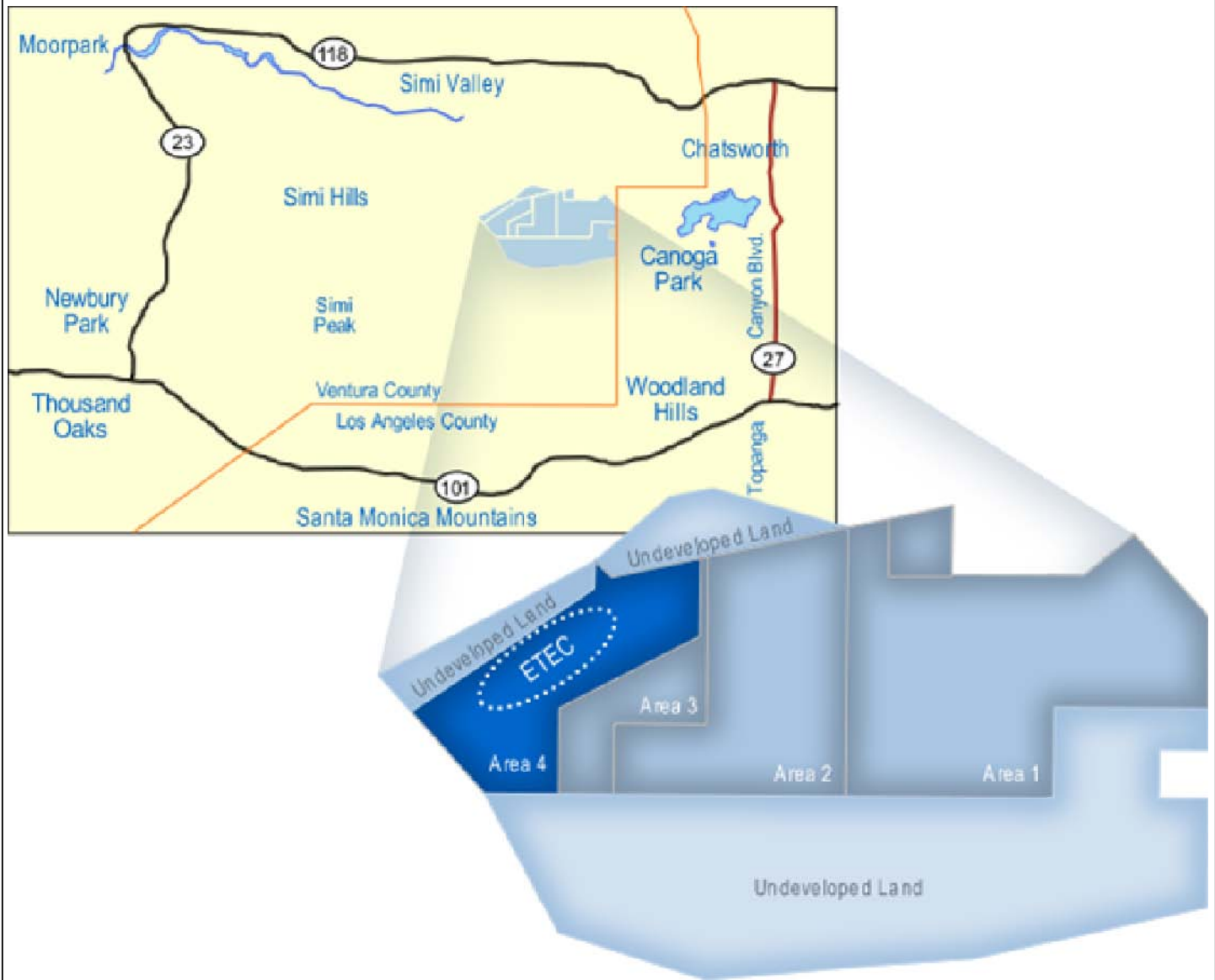
field investigations to address actual field conditions. By adapting sampling to respond to data as it is being collected, a single sampling event is much more likely to provide data that meet the objectives of conducting the risk-based alternatives evaluation in the EIS.

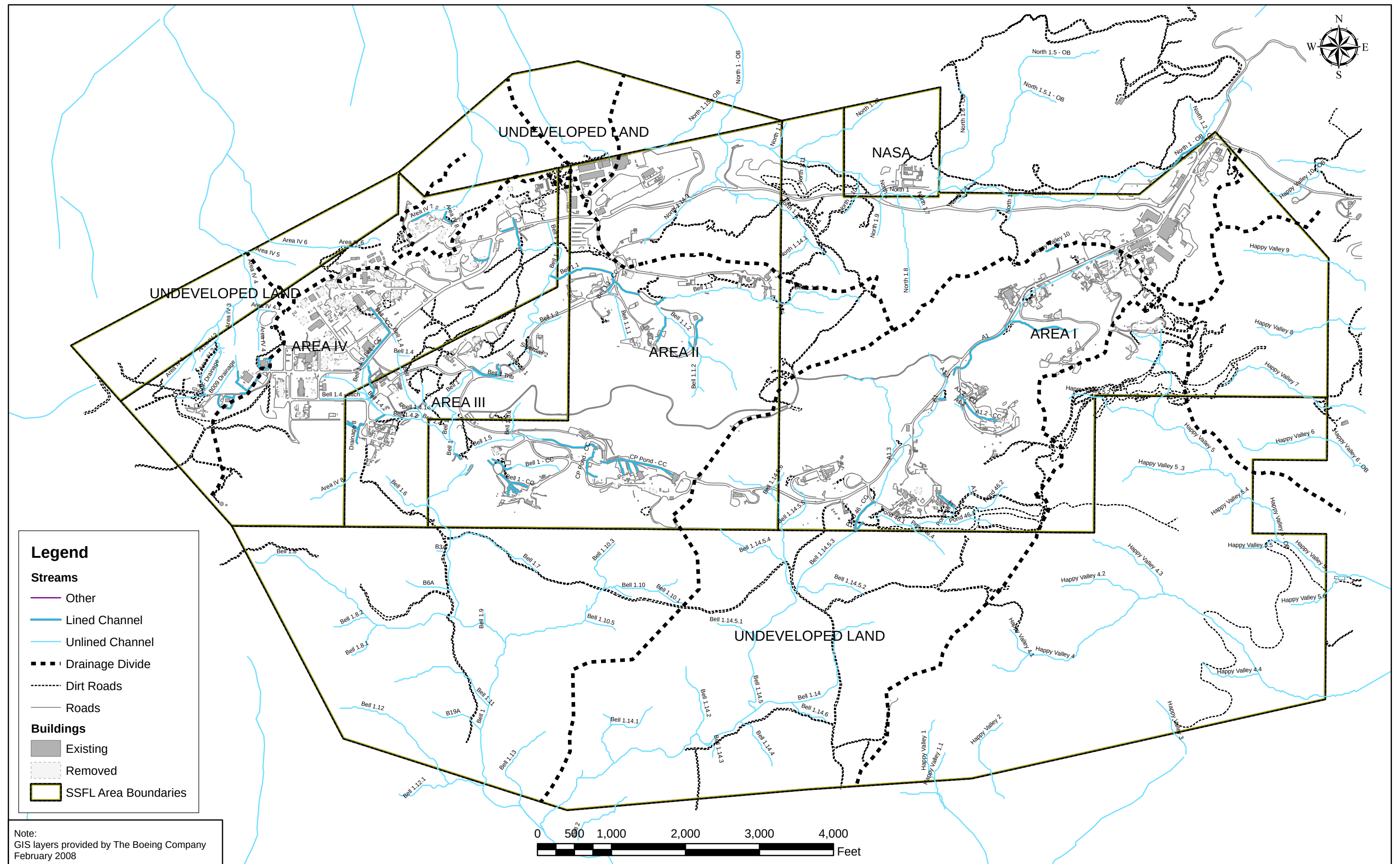
TRIAD methods will be considered for use in the field program during radiological walkover surveys and sampling of groundwater through well points. The walkover survey will be used to identify any locations with elevated radiological readings where soil sampling will be targeted. Well point results will be used to identify proposed locations for new monitoring wells or collection of groundwater samples from well points.

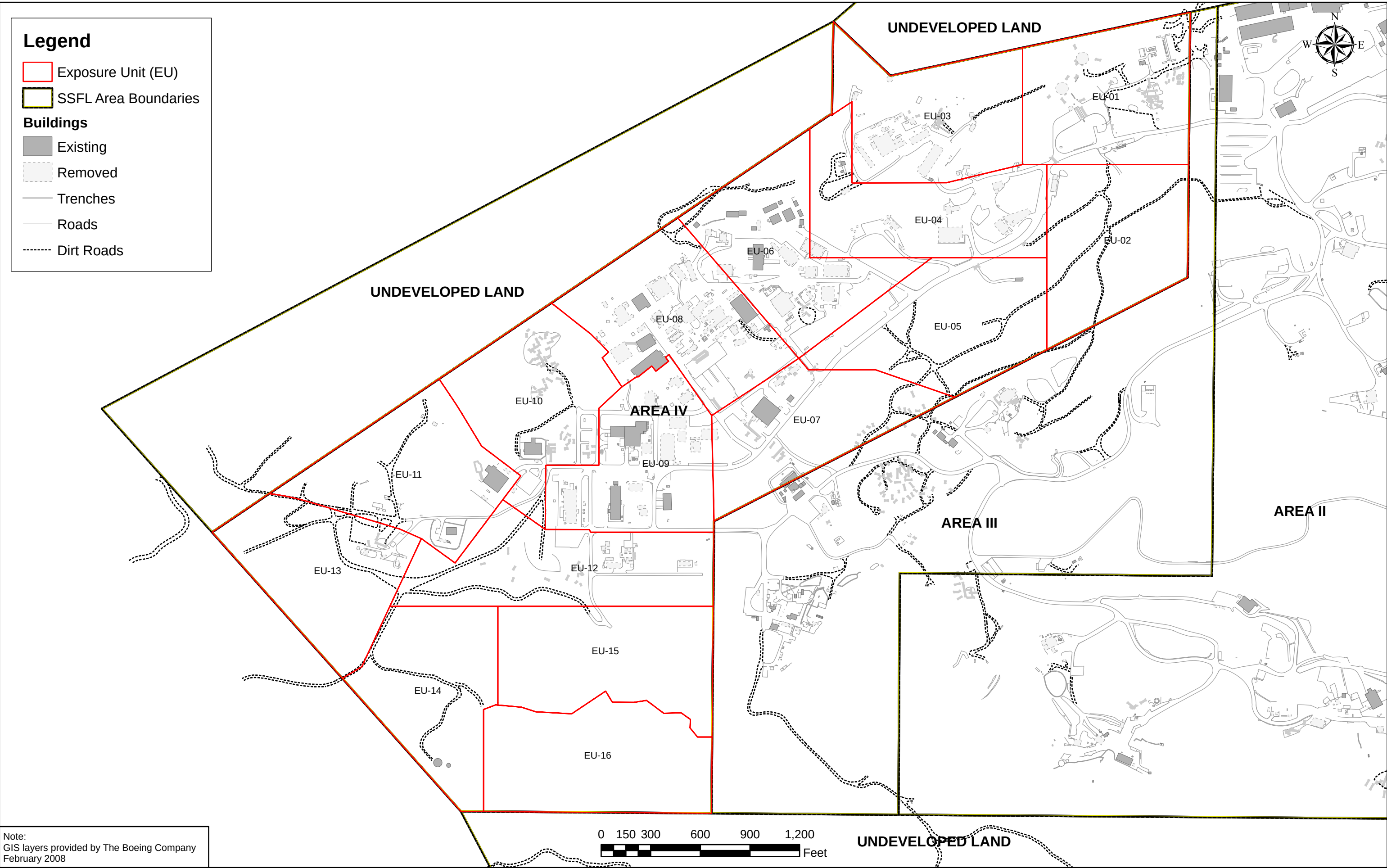
Upon completion of the field sampling investigation, the results will be combined with existing data to define the nature and extent for alternatives analysis in the SSFL Area IV EIS. The *Field Sampling Report* will describe the environmental conditions for Area IV and provide the results of the CERCLA baseline risk assessment combining radionuclide and chemical data.

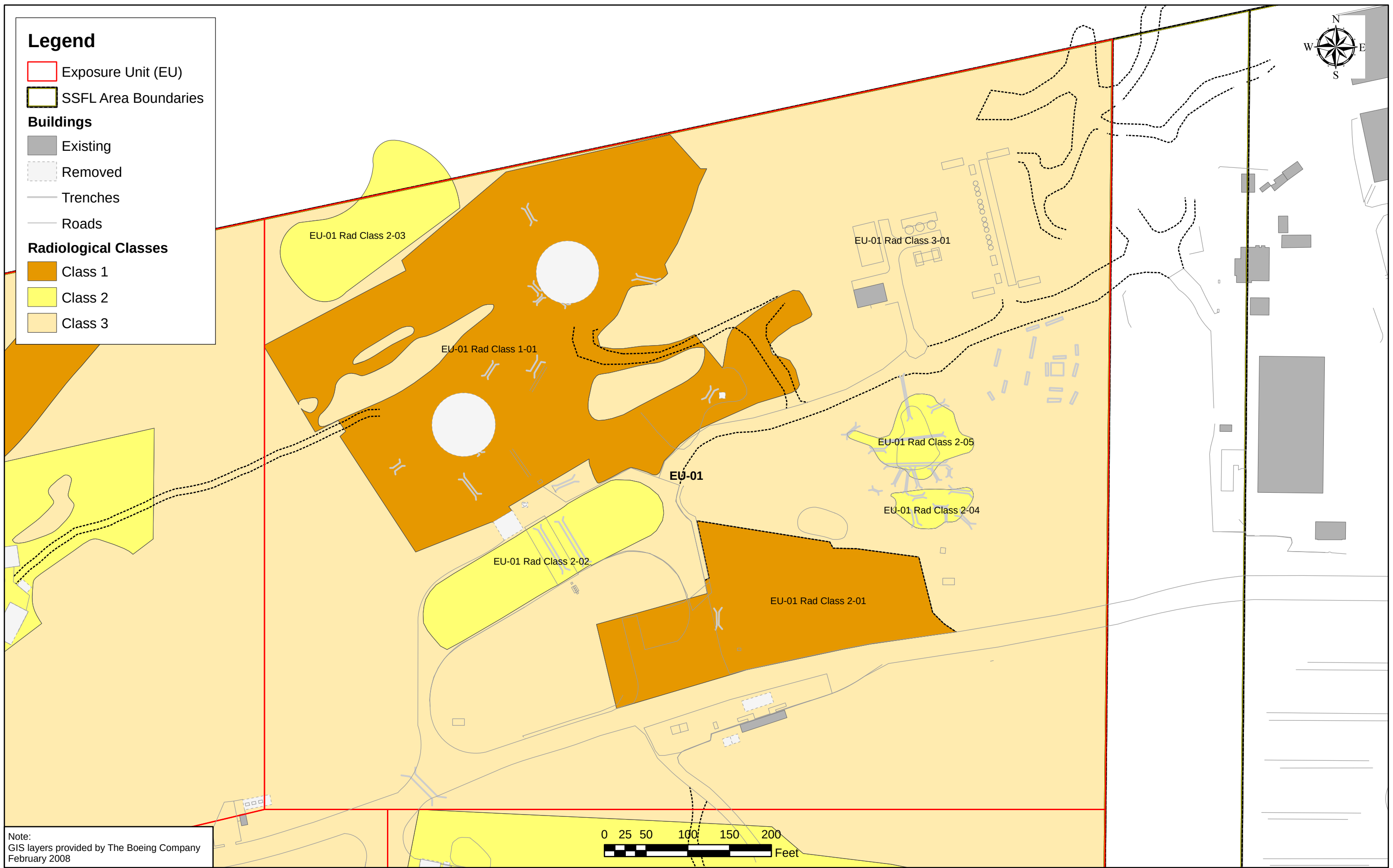
Data Gap Evaluation Process Summary for Soils











Section 2

Area IV Background and Description

2.1 Location

The SSFL is situated on a range of hills between the Simi and San Fernando Valleys in Ventura County, California, about 2 miles south of the City of Simi Valley, and about 30 miles northwest of Los Angeles (Figure 1-1). The SSFL is comprised of approximately 2,850 acres that has been divided into four administrative areas and surrounding undeveloped land. Area IV is the westernmost of the four Areas and consists of 117 hectares (290 acres). It is bound on the north and south by undeveloped land owned by Boeing and to the west by property owned by the Brandeis-Bardin Institute. Area IV is bound on the east by Area III of the SSFL (Figure 2-1).

2.2 Operational Background and Ownership

The SSFL has been in operation since 1947 when rocket testing activities were first conducted. Beginning in 1953, Area IV of the SSFL was used by the Atomic Energy Commission, the predecessor agency to the DOE, and various U.S. Government contractors for energy-related research and development. Originally owned by North American Aviation (NAA), Area IV was established for the purposes of nuclear energy research. A division of NAA, Atomic International (AI), conducted operations in Area IV. Work for DOE conducted by AI in Area IV consisted of two distinct types of research: civilian nuclear energy research, and research and testing of liquid metals in non-nuclear components.

The nuclear energy research activities became increasingly active from 1953 through the late 1960s. After that time, activities declined until 1988, when most nuclear operations ceased. The RMHF, Fuel Storage Facility, and Radiation Instrument Calibration Laboratory, remained active beyond 1988. Starting in the early the 1990s and continuing to the present, DOE has been performing decommissioning and decontamination activities of the nuclear facilities in Area IV.

The Government-owned, Liquid Metal Engineering Center (LMEC) was started in 1966 and operated by AI (later Rocketdyne) to conduct component testing for the Atomic Energy Commission's Liquid Metals Fast-Breeder Reactor Program. The components were generally pumps and sodium water heat exchangers, with the liquid metal typically being sodium.

In 1996, Boeing acquired the aerospace divisions of Rockwell. Currently, Area IV is owned by Boeing and portions are leased to DOE, which owned all of the building that comprised ETEC.

The many contractor and Government operations that have been active in Area IV are documented in reports generated under RCRA and the Historical Site Assessment (HSA; Sapere Consulting, Inc., 2005) performed by Boeing and DOE. Chemical use

and operations have been thoroughly described in reports and plans generated as part of the SSFL RCRA Program, including the *RCRA Facility Assessment (RFA) Report* (MWH 1994) and various *RCRA Facility Investigation (RFI) Reports* and work plans (Boeing 2008, Hill 2008, MWH 2004, MWH 2006, and MWH 2007). The chemical use and process information presented in the RFA and RFI documents are summarized in **Appendix A**. The radiological operations have been documented in the HSA. Chemical and radiological operational and process information derived from multiple sources of information to develop the HSA are summarized in **Appendix B**. The HSA provided a primary basis for the understanding of site process history and the identification of initial COIs based on the process history.

2.3 Physical Setting

The physical characteristics of the site are key elements potentially affecting the distribution and transport of contaminants through the environment. These characteristics, including topography, drainage, geology, hydrogeology, climate, and biological setting are described in this section.

2.3.1 Topography and Drainage

The SSFL is located on a ridge within the Transverse Ranges physiographic province. The facility is about 259 meters (850 feet) above the valleys to the north and south. While the laboratories and other facilities within Area IV are generally located on relatively flat ground, local relief can be up to 183 meters (600 feet).

In Area IV, the highest elevation (655 meters [2,150 feet] above mean sea level [MSL]) is along the southern boundary (Figure 2-1). Along the northwest boundary, the land slopes steeply away to undeveloped land. The relatively flat area in the southern part of Area IV is called “Burro Flats.”

Drainage in the northern portion of Area IV flows north into Meier Canyon, Arroyo Simi, and then west to the Pacific Ocean. Drainage in the southern portion of Area IV flows to the southeast into Area III and then the Bell Creek drainage system. Bell Creek is a tributary of the Los Angeles River. The main northeast-southwest trending drainage divide in Area IV is shown on Figure 2-1. Given the topographic divide and topographical rises to the east and west of Area IV, there is no drainage directly to the west or east from Area IV.

Drainage within Area IV is through man-made and natural ditches and swales that lead to natural streambeds. The drainage from some operational areas is directed through various settling and process ponds. The locations of the NPDES outfalls within Area IV are also shown on Figure 2-1.

2.3.2 Geology and Hydrogeology

The most dominant geologic feature at the SSFL is fractured sedimentary rocks that dip to the northwest with beds exposed at the land surface in many areas. The rock is overlain by a thin discontinuous unconsolidated unit. The nonextensive thin veneer

contains water in some areas, and the fractured bedrock provides a complex hydrogeologic framework.

2.3.2.1 Geology

The SSFL is located in the Transverse Ranges of southern California. This area is under north-south compression. Geologic structures, such as faults and folds, strike predominantly east-west. The SSFL is located on the south flank of an approximately east-west striking, westward plunging syncline.

The geology of Area IV is presented in **Figure 2-2**. The primary geologic units underlying Area IV are the Quaternary alluvium and colluvium, the Triassic Santa Susana Formation, and the Cretaceous Chatsworth Formation. The Quaternary alluvium and colluvial deposits are not laterally continuous across the site. Where present they are relatively thin, approximately 1.5 to 4.5 meters (5 to 15 feet) thick, and occur in topographic lows and along ephemeral drainages. Native soils are typically weathered Chatsworth Formation and consist of fine-grained silty sand.

The Santa Susana Formation outcrops at the extreme southwest edge of Area IV. This formation comprises a mudstone and fractured claystone, interbedded with sandstone and conglomerate. The unit underlies approximately 20 percent of Area IV.

The Chatsworth Formation is a deep sea turbidite consisting primarily of sandstone interbedded with lesser amounts of shale, siltstone, and conglomerate. Beds within the Chatsworth Formation strike about N70°E and dip 25° to 35° northwest.

The Burro Flats Fault places the Chatsworth Formation in structural contact with the Santa Susana Formation in Area IV. The Burro Flats Fault strikes predominantly east to west in the study area.

Area IV is primarily underlain by the Sandstone 2 Unit of the upper Chatsworth Formation. This unit is the younger part of the formation. The formation increases in age to the southwest. The stratigraphic sequence, in decreasing age, in the upper Chatsworth Formation is:

- Shale 2 at the base of the upper Chatsworth Formation consists of thin bedded shale, siltstone, and sandstone. There is a sandstone unit in the middle of Shale 2 that extends throughout the site and separates the upper and lower fine-grained units. Shale 2 ranges in thickness from 46 to 53 meters (150 to 175 feet) thick.
- Sandstone 2 includes three coarser-grained members separated by two finer-grained members. These members, in increasing age, are:
 - Silvernale member: primarily medium-grained sandstone with minor siltstone and sandstone units, 33.5 to 49 meters (110 to 160 feet) thick.

- o SPA member: interbedded fine- and medium-grained sandstone, siltstone, and shale, 4.5 to 9 meters (15 to 30 feet) thick and poorly exposed. The surface trace of this member is approximately congruent with the Area IV west boundary line that trends northeast to southwest.
- o Lower Burrow Flats member: primarily medium-grained sandstone that contains significant siltstone and shale interbeds, 91 to 113 meters (300 to 370 feet) thick.
- o Expendable Launch Vehicle (ELV) member: fine-grained sandstone, siltstone, and shale; shale and siltstone make up more than 50 percent of the total thickness of the formation, 4.5 to 12 meters (15 to 40 feet).
- o Upper Burro Flats member: primarily medium-grained sandstone with minor siltstone and shale interbeds, about 152 meters (500 feet) thick. The Lot bed is the single finer-grained unit defined in the Upper Burro Flats member.
- Shale 3 is the upper unit in the Chatsworth Formation and consists of interbedded medium-grained sandstone and finer-grained units comprised of thin-bedded fine- to medium-grained sandstone, siltstone, and shale. Near the western end of Area IV, the middle and upper finer-grained beds of Shale 3 are 38 meters (125 feet) and 23 meters (75 feet) thick, respectively (MWH 2007).

Fractures and joints are widespread in the Chatsworth Formation and are important conduits for groundwater and contaminant movement. Fractures are oriented parallel to bedding and dip 25° to 30° to the northwest and strike N70°E. Steeply dipping joints are also present in the formation, and some cut across bedding planes. The openings are well interconnected vertically and horizontally (Cherry et al. 2007).

2.3.2.2 Hydrogeology

Groundwater in Area IV occurs as “near surface groundwater” (NSGW) in the alluvium/colluvium and/or weathered bedrock, and as “Chatsworth Formation groundwater” in the unweathered bedrock. The depth to groundwater varies across Area IV, but is commonly reported to be in the range of approximately 8 to 23 meters (25 to 75 feet) below ground surface (BGS), except in the south-central portion of Area IV. The depth to water is typically greatest in the higher elevations and lower in the lower elevations. In the east-central part of Area IV, NSGW, where present, is vertically continuous with the Chatsworth Formation groundwater (MWH 2006). Depth to NSGW groundwater ranges from approximately 2 to 14 meters (7 to 45 feet).

The NSGW is discontinuous across the site and occurs as perched groundwater in some areas and in other areas is connected to groundwater in the underlying Chatsworth Formation. **Figure 2-3** illustrates the areas where the shallow water is perched and where shallow water is continuous with the bedrock groundwater. **Figure 2-4** presents the contoured potentiometric surface of the NSGW. The NSGW

gradient is to the southeast, which is the direction of the topographic gradient in this part of the site.

In other parts of Area IV, NSGW is typically perched at discrete locations. The largest perched NSGW measures approximately 366 meters by 122 meters (1,200 feet by 400 feet) and is located in the southwest end of Area IV. Depth to water ranges from 2 to 6 meters (7 to 21 feet). Groundwater flow is to the northeast, and the gradient is 0.11 feet/foot.

Figure 2-5 presents the contoured potentiometric surface in May 2003 for the Chatsworth Formation. As shown in the figure, a groundwater divide trends southwest to northeast. East of the divide, the gradient is to the southeast toward the drainage ways. West of the divide, the gradient is to the west toward the valley. Groundwater elevations vary in the Chatsworth Formation due to steep topography, the occurrence of fine grained beds and deformation bands, and spatial variation in bulk hydraulic conductivity (MWH 2007a). Steep topography can reduce local recharge and host seeps and springs.

The downward vertical groundwater gradient can be inferred from the cross sections presented in **Figures 2-6 and 2-7** (between wells RD-55A and RD-55B on Figure 2-6 and the three-well cluster on Figure 2-7). As shown in the sections, the vertical gradients are downward. The section locations were chosen since the distribution of wells, water levels, and contaminant concentrations is the most comprehensive for the area. Downward vertical gradients are typically measured in other areas of Area IV also. Since a groundwater divide (potentiometric high) is mapped through Area IV, downward vertical gradients are expected.

The overview of the groundwater conceptual site model developed by Boeing states that recharge at the site is low with only 2 to 12 percent of annual rainfall (46 centimeters [18 inches]) infiltrating to the water table (Cherry et al. 2007). Also, site-wide recharge is estimated to be 2 centimeters (0.95 inches) per year (about 5 percent of 46 centimeters [18 inches]) using the chloride mass balance method (MWH 2007a).

In summary, the saturated zone is slowly recharged throughout Area IV, with higher recharge rates in areas that have shallow topographic gradient and undeveloped surfaces. After reaching the saturated zone, groundwater migrated under the prevailing gradients. Generally, on the western half of Area IV, groundwater moves downward and to the west-northwest, and on the eastern half of Area IV, groundwater moves downward and to the east-southeast. The migration of groundwater is slow, with interconnected fractures defining groundwater movement. The groundwater gradient is downward. In areas where the potentiometric surface intersects land surface and a pathway is available, groundwater can emerge at the surface as spring seeps.

2.3.3 Climate

The SSFL has a Mediterranean climate with monthly mean temperatures of 50 degrees Fahrenheit (F°) during winter, to 70°F during summer. The mean annual precipitation, as measured at a U.S. weather station located in the northeastern part of the SSFL, is 46 centimeters (18 inches). Ninety-five percent of the precipitation (mostly rain, but some snow) falls between November and April. From April to October, northwesterly winds, from 5 to 10 knots, occur in the afternoon (SAIC 1994).

2.3.4 Biological Setting

Surveys were conducted by MWH and AMEC on behalf of Boeing to identify sensitive biological resources at the SSFL. According to the *Biological Conditions Report* (BCR) (Ogden, 1998) and the Addendum to the BCR (MWH and AMEC, July 2003/September 2005), there are 16 habitat types, including marsh, woodland, grassland, and several scrub habitats. According to the surveys described in the BCR, the SSFL has several sources of water, open spaces and natural areas surrounding the facility, and varied habitat types supporting numerous and diverse plant and animal species.

During the surveys, several sensitive plant species were observed, including the Susana tarplant located throughout the facility; the southern California black walnut primarily located in the Burro Flats area and the west end of the SSFL; Braunton's milk vetch (*Astragalus brauntonii*) noted south of the Former Sodium Disposal Facility at the western edge of the property; and the Plummer's mariposa lily (*Calochortus plummerii*) located along the Happy Valley drainage at the SSFL property line and on the slopes adjacent to the drainage at the stream division. Several sensitive species of plants may be present at the SSFL, including two species of *Dudleya*, Lyon's pentachaeta (*Pentachaeta lyonii*), and the California orcutt grass (*Orcuttia californica*). The San Fernando Valley spineflower (*Chorizanthe parryi* var. *fernandina*), a plant previously thought to be extinct, was identified in the vicinity of the SSFL.

Numerous species of birds, mammals, fish, reptiles, and amphibians were observed. The most frequently observed bird species include scrub jay (*Aphelocoma coerulescens*), yellow-rumped warbler (*Dendroica coronata*), turkey vulture (*Cathartes aura*), red shouldered hawk (*Buteo lineatus elegans*), northern flicker (*Colaptes auratus*), California quail (*Callipepla californica*), and red-winged blackbird (*Agelaius phoeniceus*). Mammal species present at the SSFL included mule deer (*Odocoileus hemionus*), bobcat (*Felis rufus*) and San Diego black-tailed jackrabbit (*Lepus californica bennettii*). Catfish (probably bullhead, *Ameiurus* sp.) and goldfish (*Carassius auratus*) were observed in the ponds located on the SSFL property. Observed reptiles included western whiptail (*Cnemidophorus tigris multiscutatus*) and side-blotched lizard (*Uta stansburiana*) and observed amphibians included the California slender salamander (*Batrachoseps attenuatus*), Pacific tree frog (*Hyla regilla*), and California toad (*Bufo boreas haliophilus*).

Several sensitive wildlife species or biological signs of their presence were observed at the SSFL, including the two-striped garter snake (*Thamnophis hammondi*), great blue heron (*Ardea herodias herodias*), loggerhead shrike (*Lanius ludovicianus*), and southern

California rufous-crowned sparrow (*Aimophila ruficeps canescens*). In addition, several raptors were observed flying above the SSFL and collectively are considered sensitive species for several reasons, including a lone sharp-shinned hawk (*Accipiter striatus velox*), a roosting Cooper's hawk pair (*Accipiter cooperii*), fledgling red-shouldered hawk (*Buteo lineatus elegans*), several red-tailed hawks (*Buteo jamaicensis*), and several roosting turkey vultures (*Cathartes aura*). Sensitive mammal species observed at the SSFL included the bobcat (*Felis rufus*), mule deer (*Odocoileus hemionus*), and the San Diego black-tailed jackrabbit (*Lepus californica bennettii*).

Several other sensitive bird, mammal, amphibian, and reptile species have been historically observed on the site, in the vicinity of the site, or may be present on the site given the suitable habitat types and prey species present at the SSFL and in the surrounding area. Birds potentially present at the SSFL include the golden eagle (*Aquila chrysaetos canadensis*), least Bell's vireo (*Vireo bellii pusillus*), and southwestern willow flycatcher (*Empidonax trailii extimus*). Mammals potentially present at the SSFL include the ringtail cat (*Bassariscus astutus*), American badger (*Taxidea taxus jeffersoni*), mountain lion (*Felis concolor*), San Diego desert woodrat (*Neotoma lepida intermedia*), and dusky-footed woodrat (*Neotoma fuscipes*). An amphibian species potentially present at the SSFL is the arroyo southwestern toad (*Bufo microscaphus californicus*). Reptiles potentially present at the SSFL include the San Diego horned lizard (*Phrynosoma coronatum blainvillei*), coastal rosy boa (*Lichanura trivirgata roseofusca*), coast horned lizard (*Phrynosoma coronatum blainvillei*), southern rubber boa (*Charina bottae umbratica*), southern Pacific rattlesnake (*Crotalis viridis helleri*), and coast patch-nosed snake (*Salvadora hexalepis virgultea*). Other species that may be present at the SSFL include the Quino checkerspot butterfly (*Euphydryas editha quino*) and the San Diego fairy shrimp (*Branchinecta sandiegoensis*).

2.4 Sources of Data

The primary source of chemical and radionuclide data used in this data gap analysis was provided by Boeing in its GIS database. This database required reformatting for use in the data gap analysis.

The data and reports reviewed for the data gap analysis were those made available to the CDM Team prior to January 30, 2008. It is recognized that investigations of portions of Area IV are ongoing under the RCRA RFI for Groups 5 and 7. The results of those efforts will be considered during development of the field investigation that will result from the data gap analysis.

Numerous previous environmental investigations have been conducted at the SSFL, including Area IV. Many of these provided the data and information that was reviewed for this data gap analysis. Although they are not described in detail, the various investigations and their status (completed or ongoing) are listed on **Table 2-1**. Appendix A provides a summary of information taken from SSFL documents considered as part of the understanding of chemical usage by facility within Area IV, and Appendix B provides a summary of the HSA.

Much of the chemical analytical data reviewed and assessed as part of the data gap analysis were reported in various documents produced as part of the SSFL RCRA Program, including the *RCRA RFA Report* (1994) and the various *RCRA RFI Reports* and work plans. A summary review of the findings in these documents are included in Appendix A.

The radiological soil and groundwater data used in this analysis are from the Boeing GIS database. The HSA was used as the primary source for understanding Area IV process history. Appendix B provides a summary of the review of the HSA. In addition, documents listed in Table 2-1 were reviewed for facility status and process knowledge.

Stormwater data used in this assessment came from Annual Stormwater Reports to the RWQCB. Air sampling data for radionuclides, provided in the annual *Site Environmental Reports* formed the basis for the air quality data review.

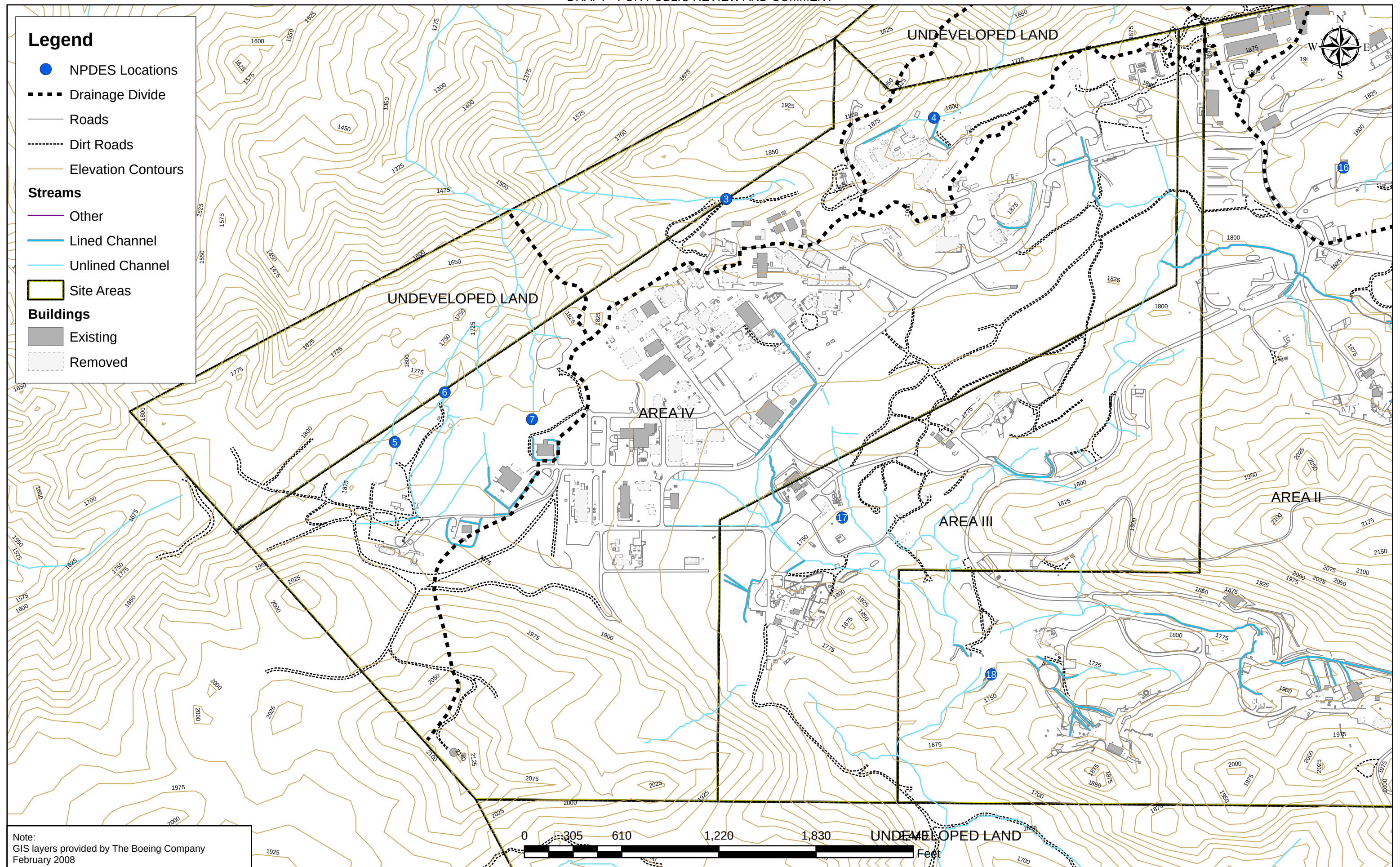
The requirements for conducting additional radioactivity surveys of buildings were assessed through the review of the HSA and the buildings remaining in Area IV.

To assess the requirements for GWSs, the following documents were reviewed.

- *Final Status Report: Characterization and Final Status Survey Radioactive Materials Handling Facility Perimeter*, Cabrera Services, March, 2006 (eight SUs located north and west of the RMHF);
- *Final Status Survey Report: Final Status Survey Post Historical Site Assessment Sites, Block 1*, Cabrera Services, March, 2007 (Sites 4023, 4028, 4030, 4363 and 4583, as noted in the report);
- *Characterization and Final Status Survey Report: Radioactive Materials Handling Facility Holdup Pond* (Site 4614);
- *Confirmatory Radiological Survey of the L-85 Reactor Facility, Final Report*, Oak Ridge Associated Universities Radiological Site Assessment Program, December, 1986;
- *Area 4064, Final Status Survey Report*, Release Date April 13, 1999;
- *Area IV Radiological Characterization Survey, Final Report, Volume I*, Santa Susana Field Laboratory, August 15, 1996; and
- *Historical Site Assessment of Area IV, Santa Susana Field Laboratory, Ventura County, California*, Sapere Consulting, Inc., and the Boeing Company, May 2005.
- *Building 4059 Final Status Survey Report (Phase A and Phase B)*, July 2005 with Revision February 2008 and associated *Building 4059 Final Status Survey Procedure Procedure*, September 2004;

- *17th Street Drainage Final Status Survey Report, March 2000; and*
- *Verification Survey for the Land Area Formerly Supporting the Hot Laboratory (4020), December 2000 , in conjunction with Area 4020 MARSSIM Final Status Survey Report (includes Building 4468) (August 2000) and the Area 4020, Final Status Survey Procedure (August 1999)*

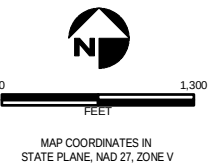
Chemical concentration data for biota tissue samples in the SSFL database were collected in 2000 to validate exposure models for higher trophic level receptors and to develop site-specific bioaccumulation factors (BAFs) for selected groups or types of ecological receptors. Site-specific BAFs were used to develop ecological screening levels (ESLs) for selected media. These tissue data are described and published in the *Standardized Risk Assessment Methodology Work Plan* (SRAM WP) (MWH 2005). The sampling and analysis plan (SAP) for the validation study describes the types of biota sampled, sample locations and the methods used to collect and analyze biota samples (Ogden 2000). Chemical concentration data for biota are available for SSFL locations outside of Area IV. Aquatic invertebrate (**Figure 2-8**), aquatic plant (**Figure 2-9**), fish (**Figure 2-10**), terrestrial invertebrate (**Figure 2-11**), terrestrial plant (**Figure 2-12**), and terrestrial vertebrate (**Figure 2-13**) samples were collected. No biota samples were collected from locations within Area IV of the SSFL, including background locations. Also, there are no concentration data for radionuclides in the existing biota sample database, however, there may be usable biota sample data existing in hardcopy reports and will be reviewed, evaluated and if deemed usable will be discussed in the field sampling plan.

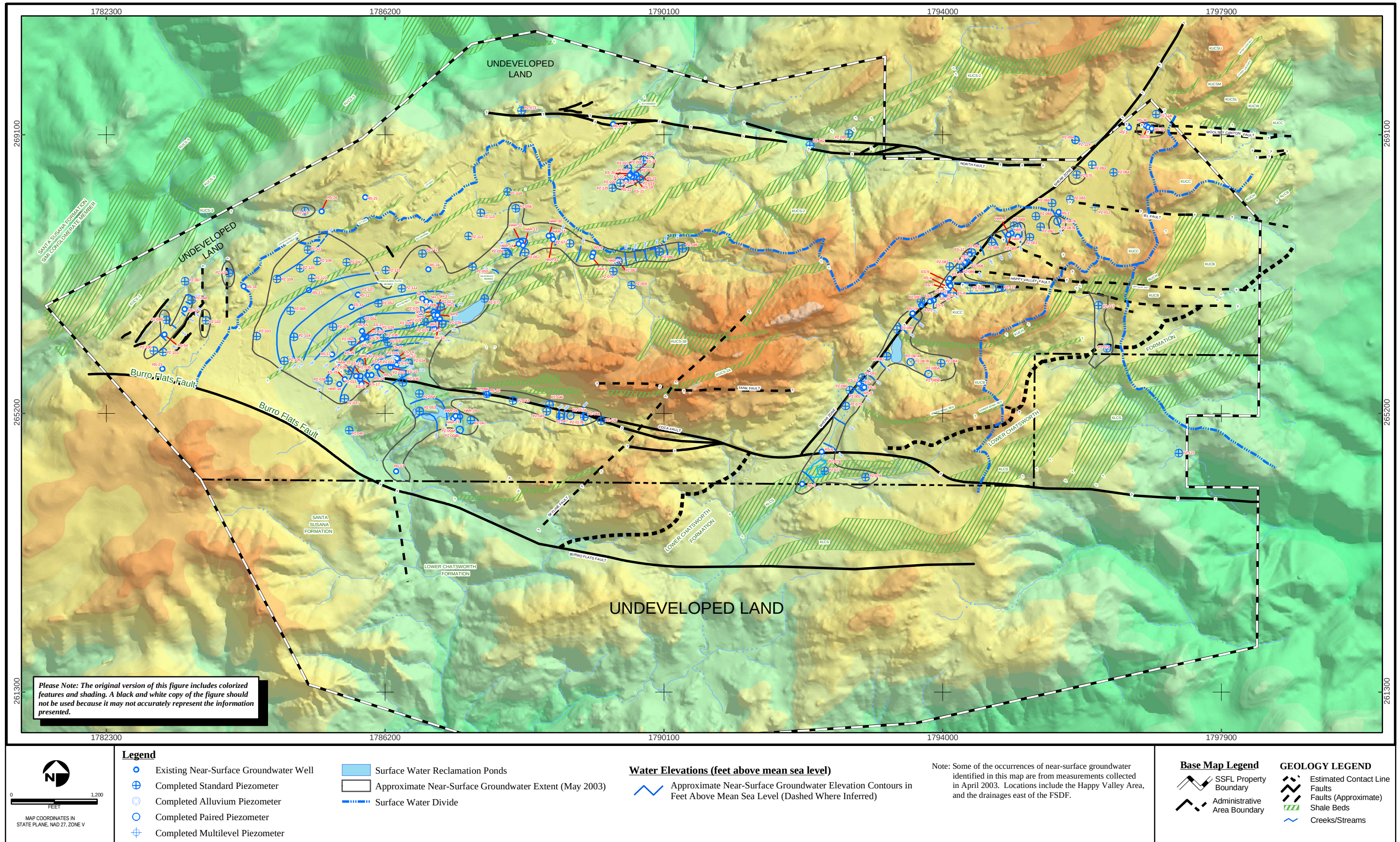


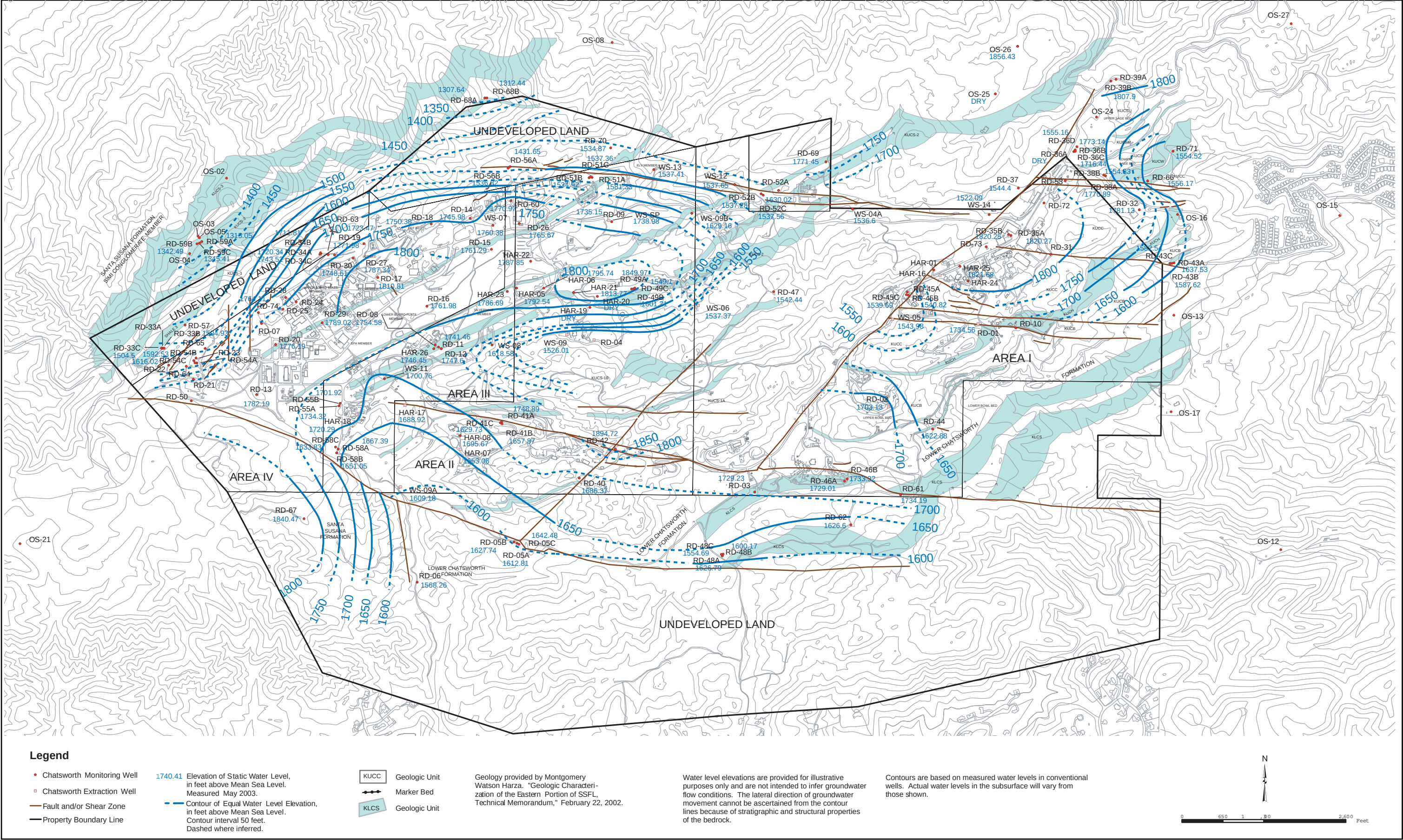


Santa Susana Field Laboratory Area IV
Ventura County, California

Figure 2-2
Geologic Map of The Chatsworth
Formation at The SSFL



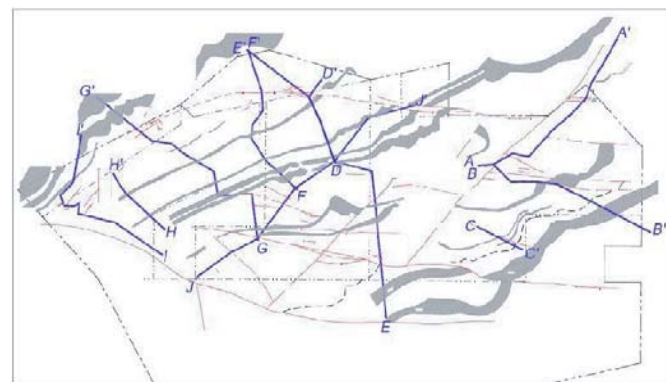
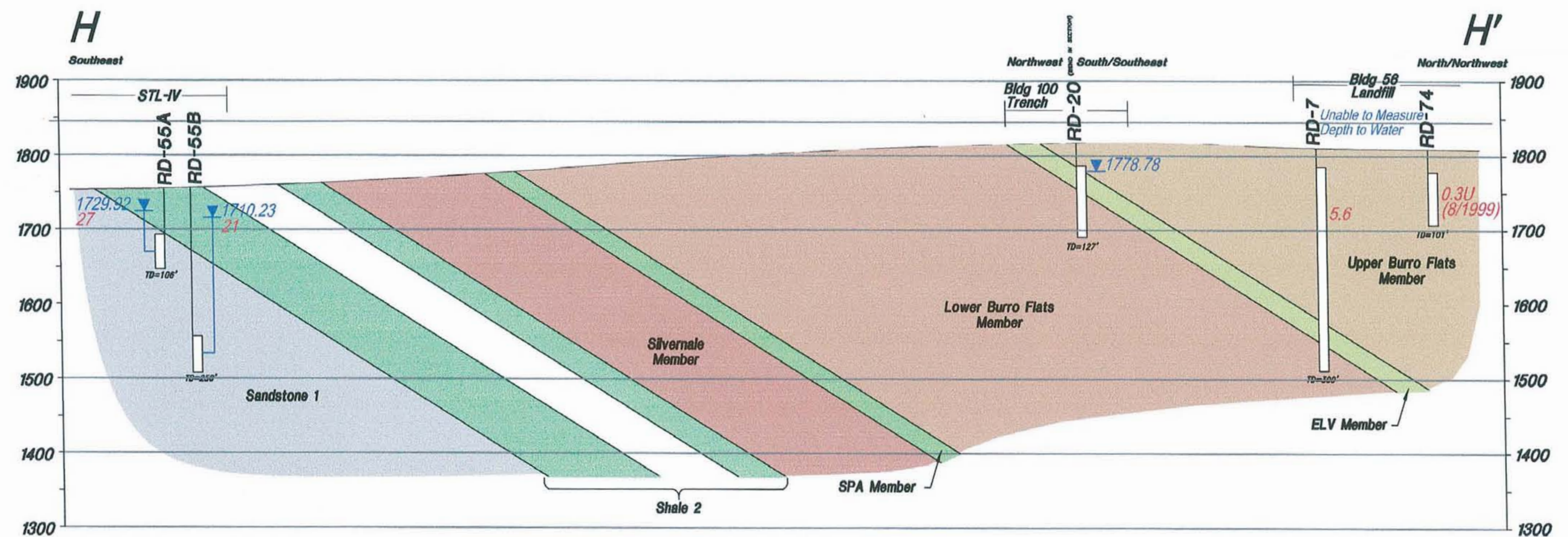




Note: Original files obtained from the H&A - Report on Annual Groundwater Monitoring 2006.

Santa Susana Field Laboratory Area IV
Ventura County, California

Figure 2-5
Chatsworth Formation Groundwater
Potentiometric Surface

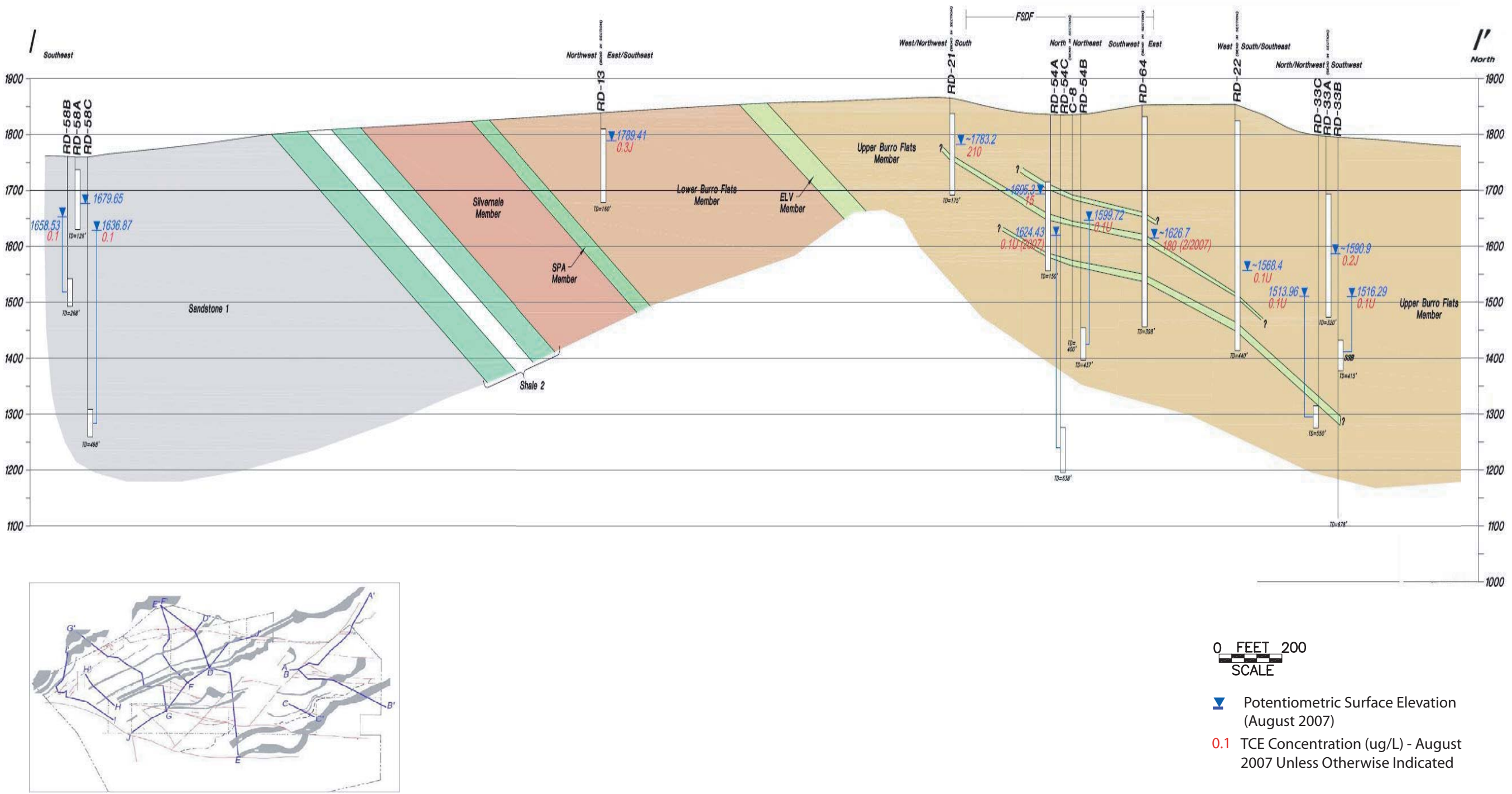


0 FEET 200
SCALE

- ▼ Potentiometric Surface Elevation (August 2007)
- 0.1 TCE Concentration (ug/L) - August 2007 Unless Otherwise Indicated

Santa Susana Field Laboratory Area IV
Ventura County, California

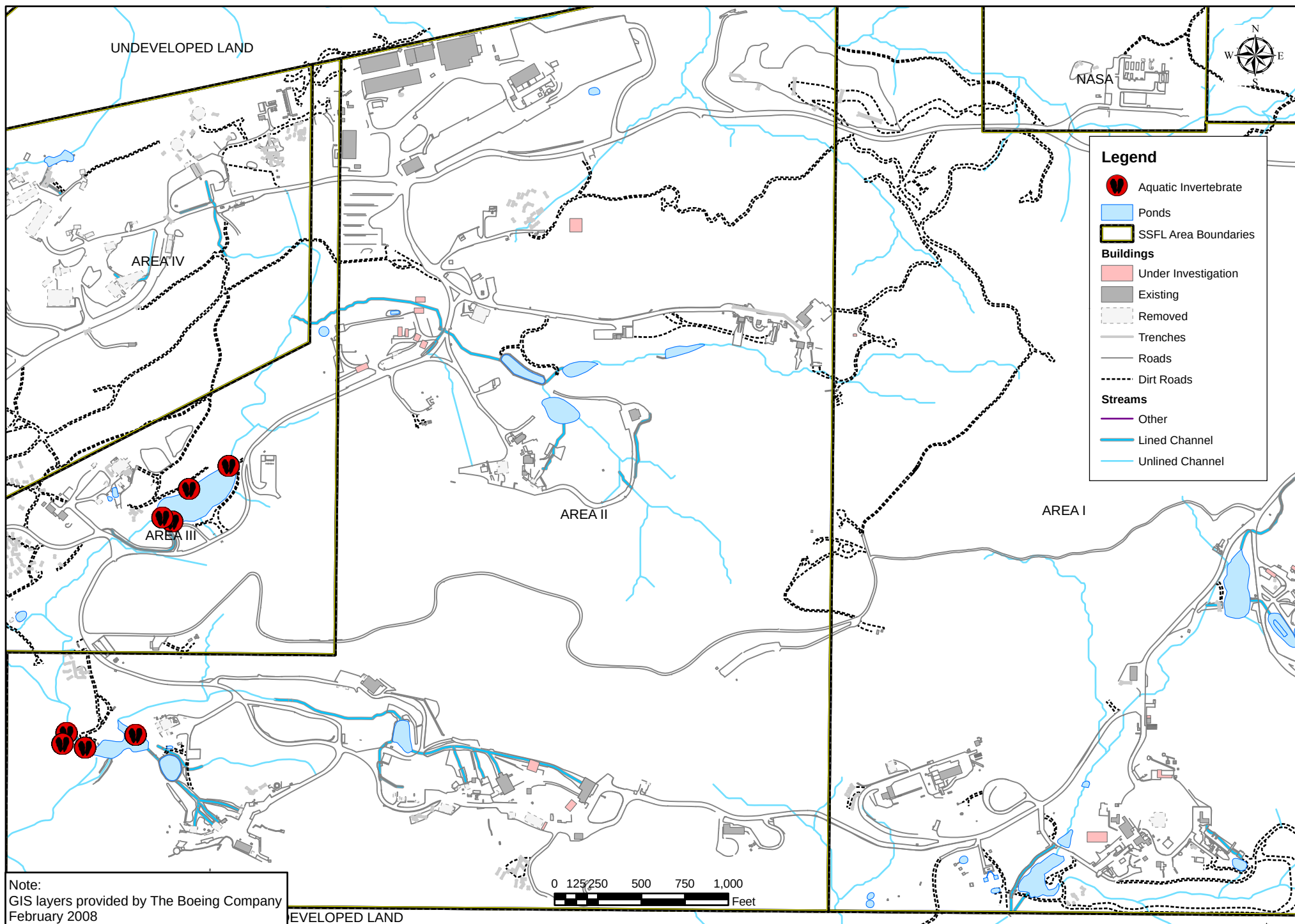
Figure 2-6
Geologic Cross Section H-H'



Note: Original files obtained from the MWH - Work Plan Sitewide Groundwater Characterization 2008.

Santa Susana Field Laboratory Area IV
Ventura County, California

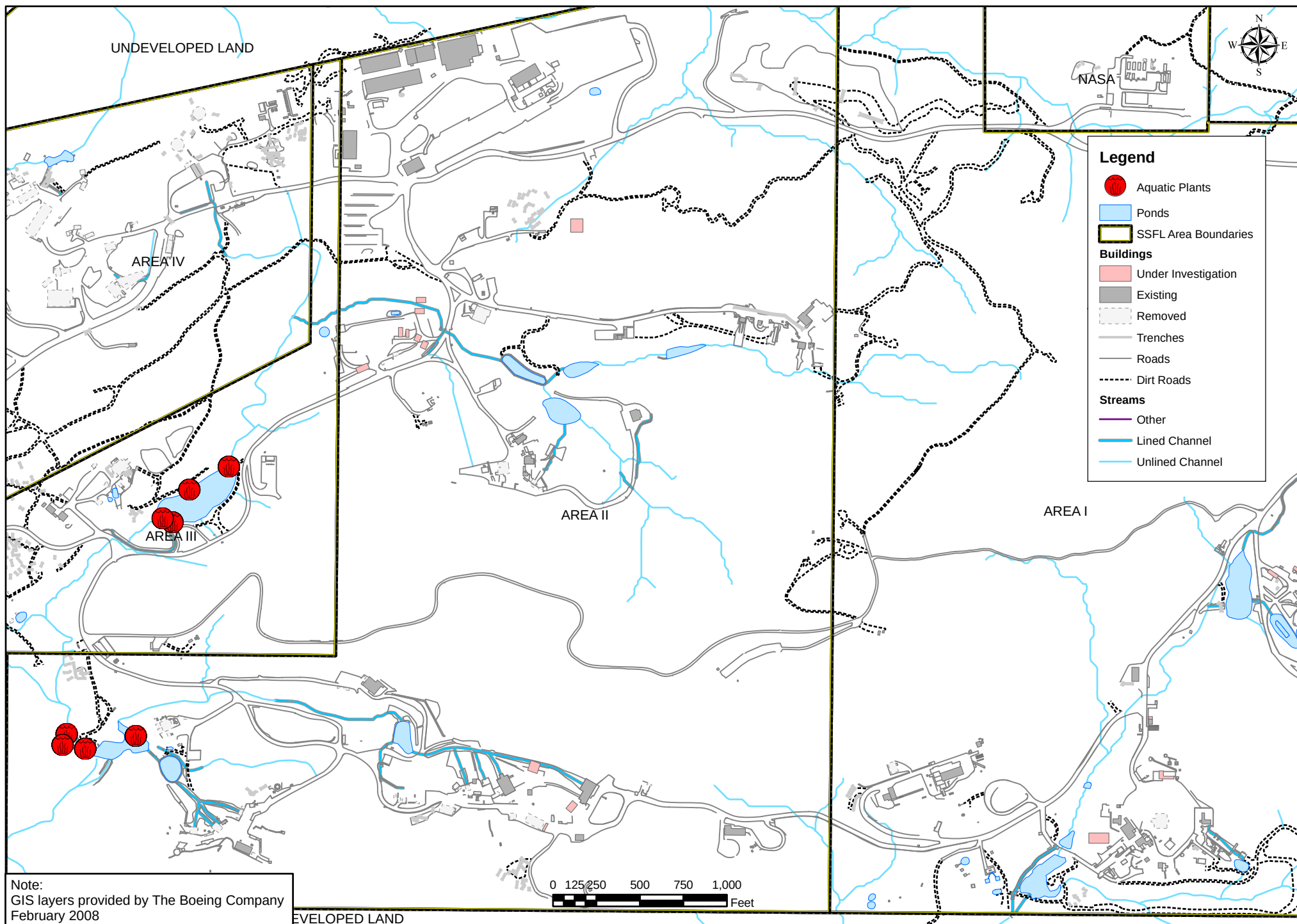
Figure 2-7
Geologic Cross Section I-I'

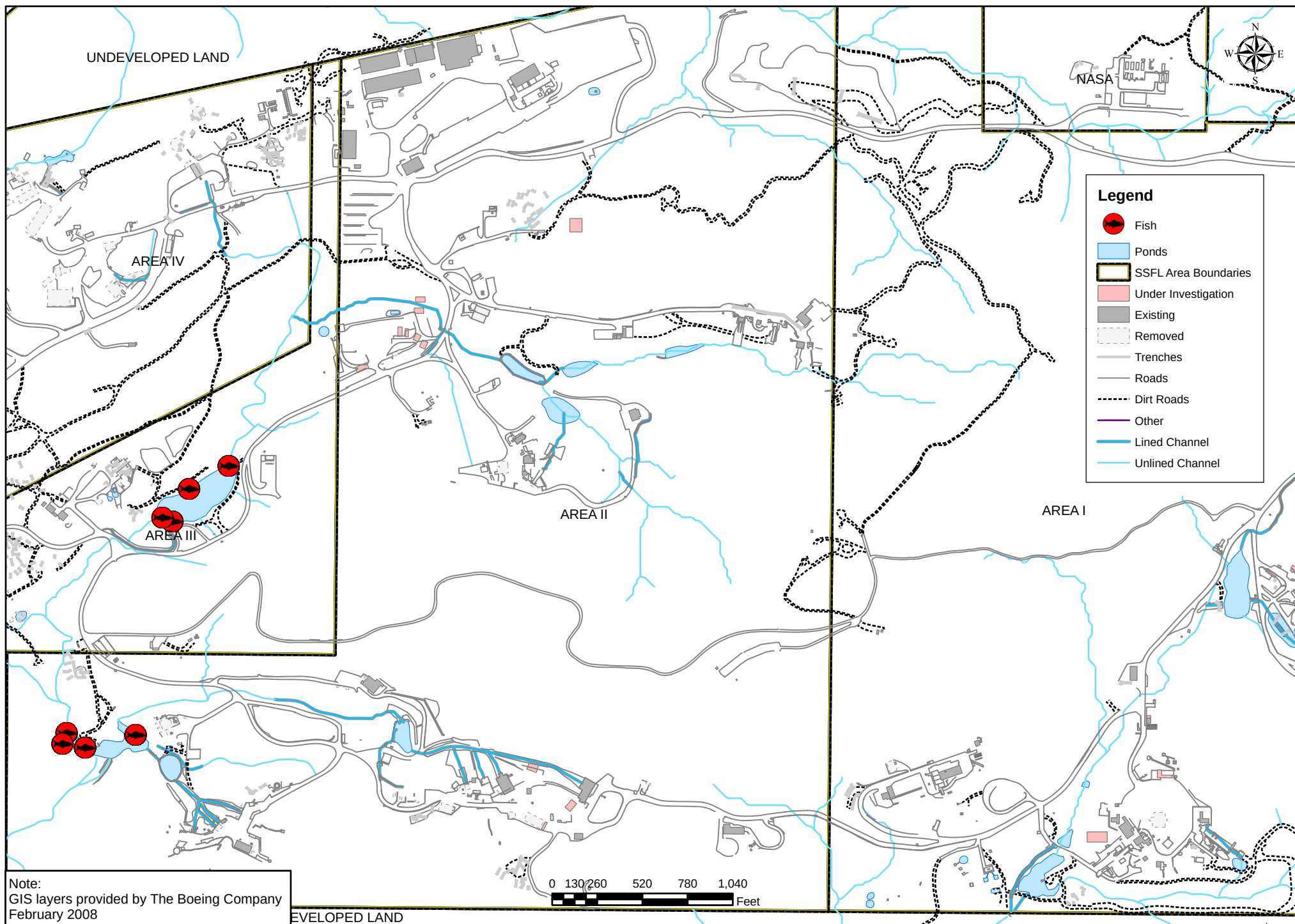


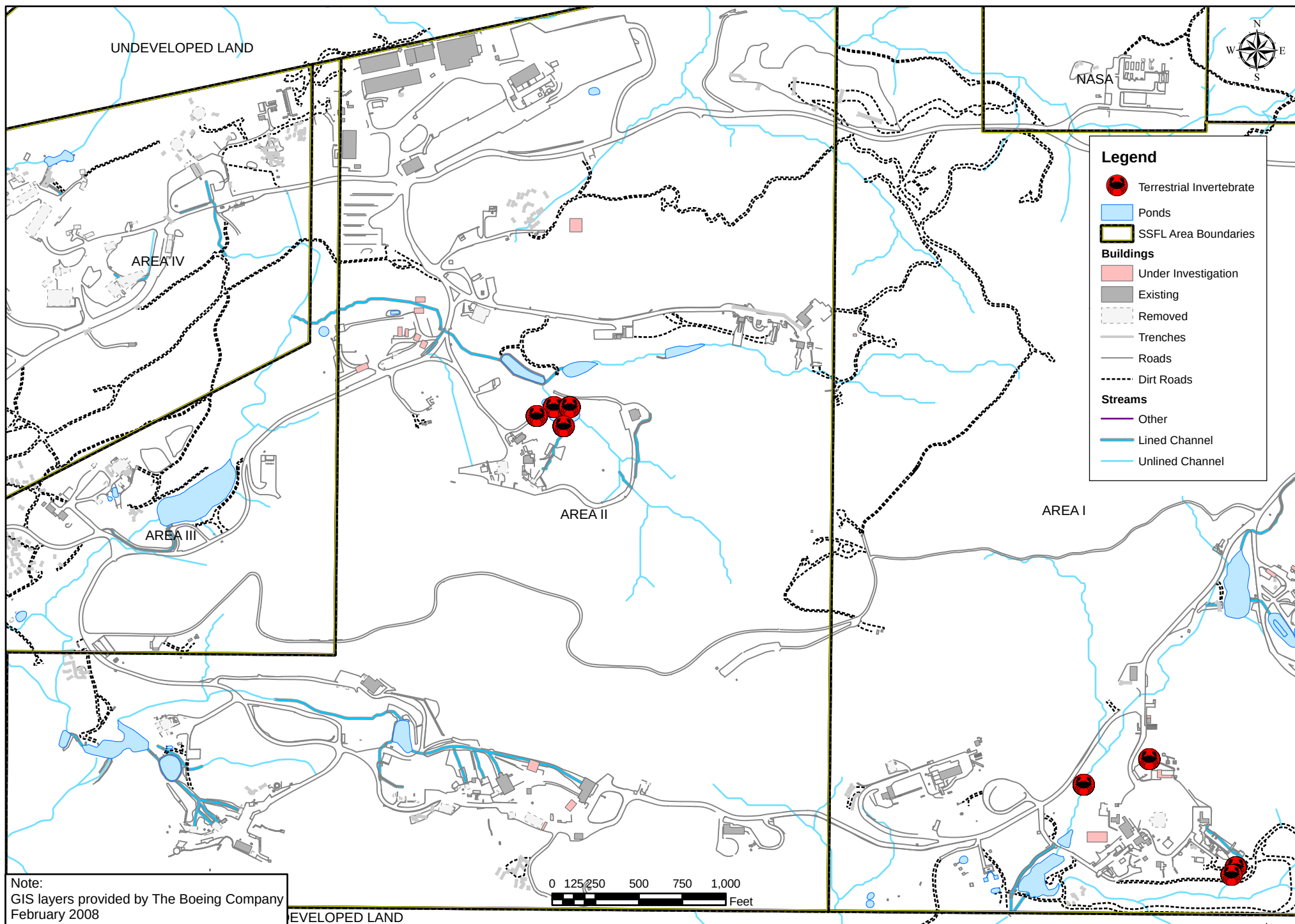
EVELOPED LAND

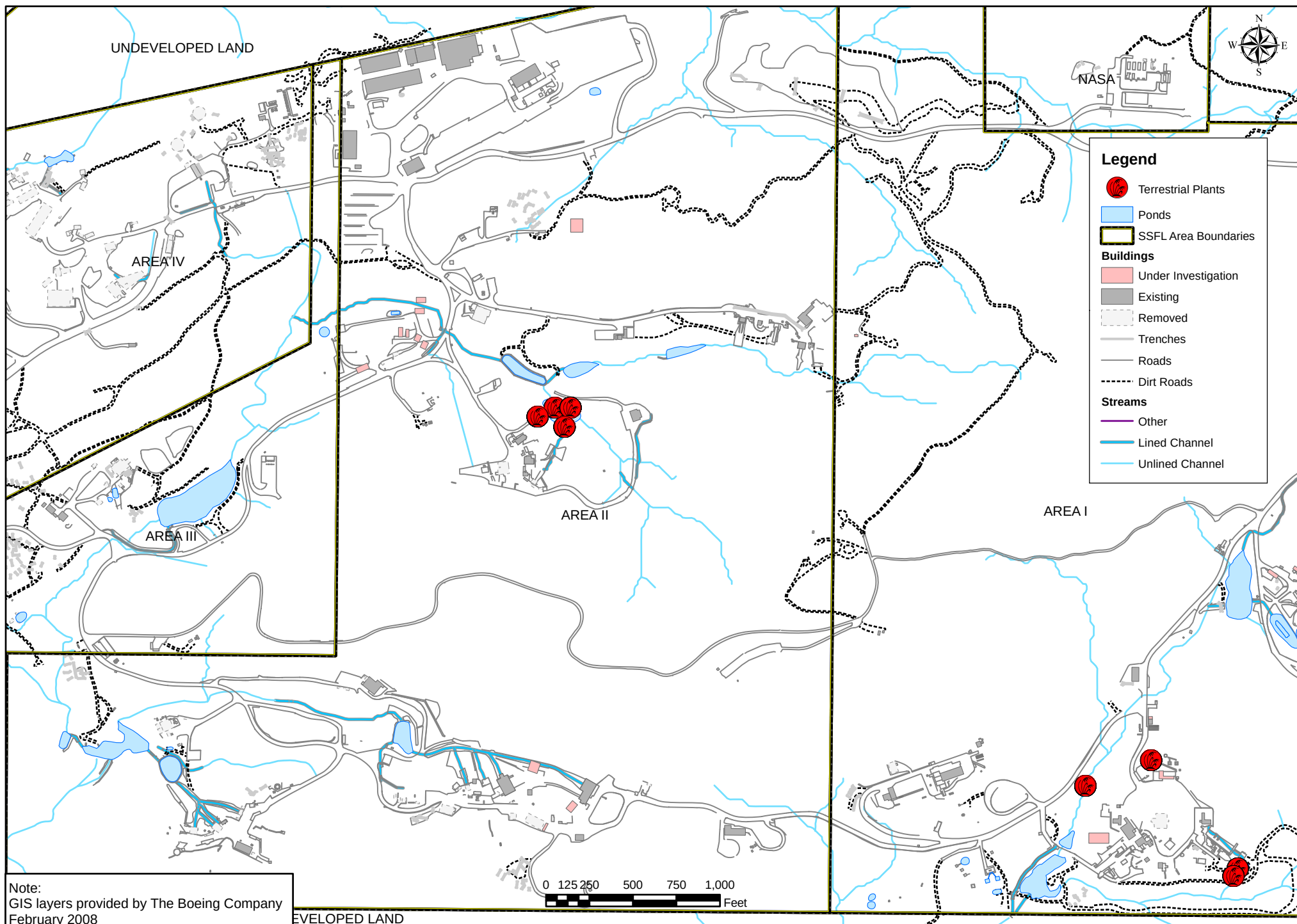
Santa Susana Field Laboratory Area IV
Ventura County, California

Figure 2-8
BAF Study Sampling Locations - Aquatic Invertebrate









Santa Susana Field Laboratory Area IV
Ventura County, California

Figure 2-12
BAF Study Sampling Locations - Terrestrial Plants

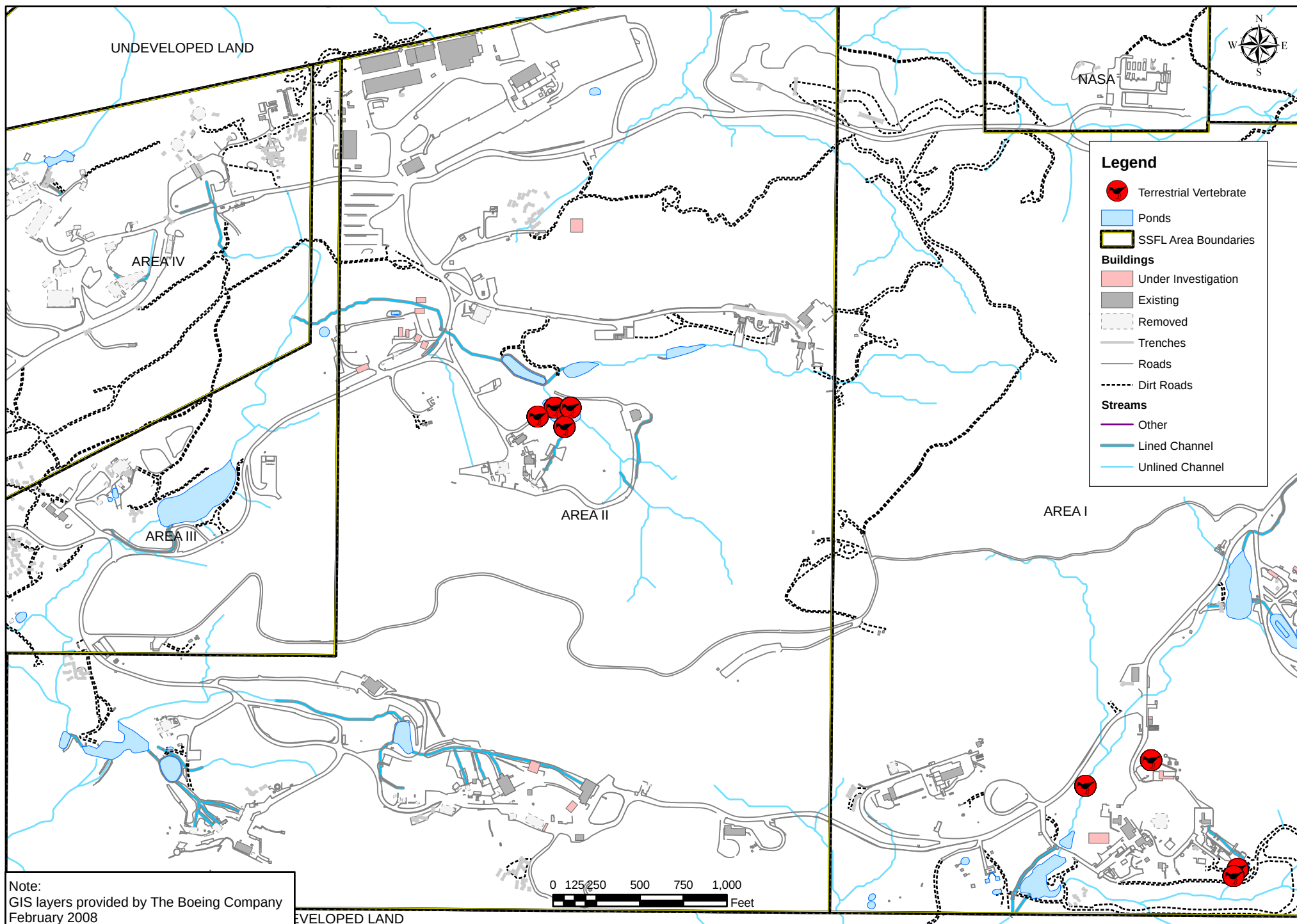


Table 2-1 SSFL Area IV Sources of Radionuclide Data

Study	Date	Status	Description
Radiological Survey Plan, Support of D&D Program Operations at T143 (SRE)	1975	Complete	Describes the requirements for radiological survey data of the SRE area.
STIR Facility D&D Final Report	1976	Complete	Decontamination and disposition activities, techniques used, specific problems and resolutions, as well as the radiological surveillance and survey results, summarized for facilities in Building 028, Shield Test Irradiation Reactor (STIR) facilities.
Final Radiation Survey – Building 028	1976	Complete	Results of the final radiation survey conducted at Building 028.
KEWB Facilities D&D Final Report	1976	Complete	Decontamination and disposition activities, techniques used, specific problems and resolutions, as well as the radiological surveillance and survey results, summarized for the KEWB facilities and Buildings 073, 643, 123, and 793.
SRE Activity Requirement No. 29, Final Closeout of the SRE Facility	1977	Complete	Describes the procedures for performing a comprehensive radiological survey of the SRE area.
SRE Site Survey Plan for Release to Unrestricted Use	1978	Complete	Describes the approach and methods for performing a radiological survey of the SRE area.
Radiological Survey Results – Release to Unrestricted Use, SRE Region I	1978	Complete	Results and analysis of the final radiological survey conducted in Region I (Building 724) of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region II	1978	Complete	Results and analysis of the final radiological survey conducted in Region II (Building 163, Box Shop) of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region IV	1978	Complete	Results and analysis of the final radiological survey conducted in Region IV (West Parking Lot) of the SRE. Data analysis indicates that Building 133 and adjacent area may be released to unrestricted use. The areas adjacent to T654 and T041 are conditionally released.
Radiological Survey Results – Release to Unrestricted Use, SRE Region V	1978	Complete	Results and analysis of the final radiological survey conducted in Region V (Gas Storage Vault) of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region VI	1978	Complete	Results and analysis of the final radiological survey conducted in Region VI (Water Tank Area) of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Report of Radiation Survey of the FCEL Reactor Facility	1980	Complete	Results and analysis of a radiological survey conducted in the FCEL facility after decontamination and dismantling activities.
Final Radiological Inspection of the Below-Grade Areas in the SRE Prior to Release for Unrestricted Use	1981	Complete	Describes the monitoring techniques, data collection, and analysis activities for radiological surveying of the below-grade areas of the SRE.
SRE Decommissioning Environmental Evaluation Report	1982	Complete	Summary of the radiological surveys of environmental media at the SRE site.
SRE Decommissioning Final Report	1982	Complete	Decontamination and disposition activities, techniques used, specific problems and resolutions, as well as the radiological surveillance and survey results, summarized for the SRE site.
Radiological Survey Results – Release to Unrestricted Use, SRE, Building 041	1982	Complete	Results and analysis of the final radiological survey conducted in Building 041 of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE, Building 163	1982	Complete	Results and analysis of the final radiological survey conducted in Building 163 of the SRE. Data analysis indicates that the area may be released to unrestricted use.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (continued)

RMHF Leach Field Decontamination Final Report	1982	Complete	Decontamination and disposition activities, techniques used, specific problems and resolutions, as well as the radiological exposure results, summarized for facilities in the RMHF.
RMDF Lead Field Environmental Evaluation Report	1982	Complete	Description of environmental consequences of releasing the RMHF Leach Field to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region III	1983	Complete	Results and analysis of the final radiological survey conducted in Region III of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region VII	1983	Complete	Results and analysis of the final radiological survey conducted in Region VII of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region VIII	1983	Complete	Results and analysis of the final radiological survey conducted in Region VIII of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region IX	1983	Complete	Results and analysis of the final radiological survey conducted in Region IX of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE Region X	1983	Complete	Results and analysis of the final radiological survey conducted in Region X of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Radiological Survey Results – Release to Unrestricted Use, SRE, Building 143	1983	Complete	Results and analysis of the final radiological survey conducted in Building 143 of the SRE. Data analysis indicates that the area may be released to unrestricted use.
Plutonium Concentrations in Soil Around Drain Lines at NMDF	1985	Complete	Results of soil sample analysis of plutonium concentrations from trenches where drain lines were removed at the NMDF.
Radiation Survey for Release for Unrestricted Use – L-85 Reactor Facility	1985	Complete	Results and analysis of a radiological survey conducted at throughout the L-85 Reactor Building (093) and associated buildings (083, 074, and 453). Data analysis indicates that the facilities may be released for unrestricted use.
Interim Storage Facility Decommissioning Final Report	1985	Complete	Decontamination, disposition, and decommissioning activities, techniques used, specific problems and resolutions, as well as the radiological surveillance and survey results, summarized for the Interim Storage Facility.
Final Radiation Survey of NMDF	1986	Complete	Results and analysis of the final radiological survey conducted at the NMDF after decontamination activities.
Radiological Survey of Building 005	1987	Complete	Results and data analysis of a radiological survey conducted at Building 005 in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of Buildings T373 and T375	1988	Complete	Results and analysis of the final radiological survey conducted in Buildings T373 and T375. Data analysis indicates that the areas are not contaminated with residual radioactivity.
Radiological Survey of the Sodium Disposal Facility – T886	1988	Complete	Results and data analysis of a radiological survey conducted at the Sodium Disposal Facility in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of the Source and Special Nuclear Material Storage Vault – Building T064	1988	Complete	Results and data analysis of a radiological survey conducted at Building 064 in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of the Old Calibration Facility – Building T029	1988	Complete	Results and data analysis of a radiological survey conducted at Building 029 in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (continued)

Radiological Survey of Shipping/Receiving and Old Accelerator Area – Buildings T641 and T030	1988	Complete	Results and data analysis of a radiological survey conducted at Buildings 641 and 030 in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of the ESG Salvage Yard (Old), Rocketdyne Barrel Storage Yard, and New Salvage Yard (T583)	1988	Complete	Results and data analysis of a radiological survey conducted at in three areas used for storing salvageable materials, parts, and containers in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of the T513 Parking Lot; Old R/A Laundry Area; Plot 333; and Areas Between the SRE to RMDF, and KEWB to RMD	1988	Complete	Results and data analysis of a radiological survey conducted at in five areas (comprising 2.5-acres) used for supporting nuclear-related facilities, storing excess materials and components, parking lots, and access pathways in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of Buildings T019 and T013; An Area Northwest of T059, T019, T013 and T012; And a Storage Yard West of Buildings T626 and T038	1988	Complete	Results and data analysis of a radiological survey conducted at in four areas used for supporting the Systems for Nuclear Auxiliary Power (SNAP) program in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of the T056 Landfill; Area from 23 rd Street to Building T100; and an Area Across from Building T011	1988	Complete	Results and data analysis of a radiological survey conducted at in three areas used for supporting nuclear-related facilities, storing excess materials and components, parking lots, and access pathways in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Radiological Survey of Buildings T049, T042, T027, T032, and T025	1988	Complete	Results and data analysis of a radiological survey conducted at in five areas used for supporting the Systems for Nuclear Auxiliary Power (SNAP) program in order to identify areas requiring additional radiological inspection and/or remedial action. Describes the actions taken as a result of this survey.
Building 028 D&D Final Report	1990	Complete	After initial decontamination and decommissioning in 1976, a uranium oxide melting experiment contaminated portions of the facility. This report describes the decontamination and disposition activities in preparation for release of the site for unrestricted use.
Final Decontamination and Radiological Survey of Building 029	1990	Complete	Results and analysis of the final radiological survey conducted at Building 029. Data indicates that the building is suitable for release without radiological restrictions.
Final Decontamination and Radiological Survey of the Building 064 Side Yard	1990	Complete	Results and analysis of the final radiological survey conducted at Building 064, the fenced-in yard, and a surrounding 2-acre area. Data analysis indicates that the Side Yard and other surveyed areas surrounding Building 064 are suitable for release without radiological restrictions.
Final Decontamination and Radiological Survey of the Old Conservation Yard	1990	Complete	Results and analysis of a comprehensive radiological survey conducted in a 5-acre area storage yard area, including the Old Conservation Yard. Data analysis indicates that the area may be released to without radiological restrictions.
Building 028 Radiological Survey Procedure	1991	Complete	Description of procedures to conduct the final radiological survey for Building 028.
Final Decontamination and Radiological Survey of Building 028	1991	Complete	Results and analysis of the final radiological survey conducted at Building 028. Data indicates that the building is suitable for release without radiological restrictions.
Work Plan for Multi-Media Sampling	1992-1994	Complete	Conducted by McLaren Hart; included analysis of soil samples for metals.
Baseline Radiological Survey of the FSDF	1992	Complete	Results and analysis of a baseline beta and gamma radiological survey conducted at the FSDF.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (continued)

Preliminary Beta/Gamma Radiological Survey and Data Analysis for the Sodium Disposal Facility Closure	1992	Complete	Describes the procedures for performing a baseline Beta/Gamma radiological survey of the FSDF.
Building 023 D&D Operations Final Report	1993	Complete	Decontamination and decommissioning activities, techniques used, specific problems and resolutions summarized for Building 023.
Building 023 Final Survey Procedure	1993	Complete	Description of procedures to conduct the final radiological survey for Building 023.
Building 064 D&D Operations Final Report	1993	Complete	Summary of decontamination and dismantlement activities conducted after 1990 at Building 064.
Building T064 Interior Final Survey Procedure	1993	Complete	Description of procedures to conduct radiological surveying of Building 064.
Radiological Assessment of the Building T064 Fenced-In Yard	1993	Complete	Results and analysis of radiological survey conducted in the fenced-in yard surrounding Building 064 to assess residual radioactivity.
Final Radiological Sampling and Gamma Survey Procedures To Follow Site Remediation of the FSDF	1993	Complete	Describes the procedures for performing a final radiological survey of the FSDF, following environmental remediation and closure.
RCRA Facility Assessment (RFA)	1994	Complete	Conducted by SAIC for the USEPA under the RCRA Corrective Action Program to assess if a release has occurred at SSFL. Resulted in the identification of 125 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs), 36 of which were located in Area IV.
Final Radiological Survey Report of Building 023	1994	Complete	Results of the final radiological survey following decontamination and decommissioning activities, indicating that Building 023 may be released for use without radiological controls.
Final Radiological Survey Report of Building 064 Interior	1994	Complete	Results and analysis of the final radiological survey conducted at Building 064. Data analysis indicates that the building is suitable for use without radiological controls.
Post-Remediation Ambient Gamma Radiological Survey of the FSDF	1994	Complete	Results and analysis of ambient gamma exposure survey conducted at the FSDF.
RCRA Facility Assessment (RFA)	1994	Complete	Conducted by SAIC for the USEPA under the RCRA Corrective Action Program to assess if a release has occurred at SSFL. Resulted in the identification of 125 Solid Waste Management Units (SWMUs) and Areas of Concern (AOCs), 36 of which were located in Area IV.
RCRA Facility Investigation (RFI)	1994 Started	Ongoing	Conducted by Ogden for the USEPA under the RCRA Corrective Action Program to investigate releases identified during the RFA. (Includes the identification of at least 10 additional SWMUs and AOCs.)
D&D Plan for Building 012	1995	Complete	Description of the work plan for decontamination and disposition of Building 012.
Building 012 Final Survey Procedure	1995	Complete	Description of procedures for performing the final radiological survey of Building 012.
Building T363 Final Survey Procedure	1995	Complete	Describes the procedures for performing a final radiological survey of Building T363.
Technical Data Summary Construction, Testing and Sampling of Monitoring Wells	1995	Complete	Conducted by Groundwater Resource Consultants, Inc. Completed during 1993 and 1994. This report documents well construction details and hydraulic parameters of select wells across the SSFL.
RFI Work Plan Addendum	1996	Complete	Conducted by Ogden Environmental; included the collection of samples for metals analysis.
Final Radiological Survey Report for Building 012	1996	Complete	Results of the final radiological survey following decomposition and disposition activities, indicating that Building 012 may be released without radiological restrictions.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (continued)

Building 028 and STIR Facility D&D	1996	Complete	Description of decontamination and demolition activities, as well as survey results, for Building 028.
Final D&D Report for Building 029	1996	Complete	Description of decontamination and disposition activities for Building 029.
Building 030 Final Radiological Survey Plan	1996	Complete	Description of procedures to conduct the final radiological survey of Building 030.
Sampling and Analysis Plan for T064 and Related Areas	1996	Complete	Description of the plan to determine the presence of significant radionuclides and define the extent of contamination in exterior areas.
Final Radiological Report for Building T363	1996	Complete	Results and analysis of the final radiological survey conducted in Building T363. Data analysis indicates that the area may be released to unrestricted use.
Building T654 Supplemental Radiological Survey Plan	1996	Complete	Describes the procedures for performing a supplemental final radiological survey of the decommissioned Interim Storage Facility.
Area IV Radiological Characterization Survey – Final Report	1996	Complete	Results and data analysis of comprehensive radiological survey performed in previously unsurveyed portions of Area IV.
RFI Work Plan Addendum	1996	Complete	Conducted by Ogden Environmental; included the collection of samples for metals analysis.
D&D of Building 030	1997	Complete	Description of decontamination and decommissioning activities conducted at Building 030.
Final Radiological Survey Report for Building 030	1997	Complete	Results and analysis of the final radiological survey conducted at Building 029. Data indicates that the building is suitable for release without radiological restrictions.
Post-Remediation Soil Sampling and Analysis for the FSDF	1997	Complete	Results and analysis of soil and rock samples collected from the FSDF. Radionuclide concentrations in samples were compared to local background values.
Biological Conditions Report (BCR)	1998 (updated 2005)	Complete	Report summarizing field surveys including the presence and distribution of vegetation communities, wildlife species detected, and locations of sensitive plant and animal species. (Prepared by Ogden Environmental as part of SRAM, updated by MWH Americas, Inc.)
Bell Canyon Residence Soil Sampling Work Plan	1998	Complete	Conducted by Ogden Environmental. Included sample collection and testing for metals, general minerals and dioxins.
Final Radiological Survey Data Package for Building 011	1998	Complete	Radiation survey results of Building 011 conducted prior to demolition, as well as surveys performed on surfaces inaccessible during the original survey.
Bell Canyon Residence Soil Sampling Work Plan	1998	Complete	Conducted by Ogden Environmental. Included sample collection and testing for metals, general minerals and dioxins.
Building 064 Side Yard Core Sampling Plan	1998	Complete	Description of procedures to conduct a radiological soil contamination survey for the Building 64 Side Yard.
Bell Canyon Residence Soil Sampling Work Plan	1998	Complete	Conducted by Ogden Environmental. Included sample collection and testing for metals, general minerals and dioxins.
17 th Street Drainage Area, Final Status Survey Procedure	1999	Complete	Description of procedures to conduct the final radiological survey for the 17 th Street Drainage Area.
17 th Street Drainage Area, Final Status Survey	1999	Complete	Results of the final radiological survey following decontamination activities, indicating that the 17 th Street Drainage Area may be released for unrestricted use.
Final D&D Report for Building 4019	1999	Complete	Decontamination and dismantling activities, techniques used, specific problems and resolutions summarized for Building 4019.
Building 4019 Final Status Survey Report	1999	Complete	Results of the final radiological survey following decontamination and dismantling activities, indicating that Building 4019 may be released for unrestricted use.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (continued)

Area 4020 Final Status Survey Procedure	1999	Complete	Description of procedures to conduct the final radiological survey for Area 4020 (Hot Laboratory).
Building 4059, Phase I Final Status Survey Procedure	1999	Complete	Description of procedures to conduct Phase I of the final radiological survey of Building 4059.
Building 4059, Final Status Survey Report (Phase I)	1999	Complete	Results and analysis of Phase I of the final radiological survey conducted at Building 4059. Data indicates that the building is suitable for release for unrestricted use.
Final Report, D&D of Fuel Storage Facility, 4064	1999	Complete	Summary of decontamination and dismantlement activities conducted at the former Fuel Storage Facility, including Building 4064, fenced-in area, the Side Yard and the Surroundings.
Area 4064, Final Status Survey Report	1999	Complete	Results and analysis of the final radiological survey conducted in Area 4064. Data analysis indicates that the area is suitable for release for unrestricted use.
Final Report D&D of Interim Storage Facility 4654	1999	Complete	Updates the information regarding decontamination, disposition, and decommissioning activities, techniques used, specific problems and resolutions, as well as the radiological surveillance and survey results, at the Interim Storage Facility in the 1985 report.
Building T654 Supplemental Radiological Survey Report	1999	Complete	Results and analysis of the supplemental final radiological survey conducted in Building T654.
Building 4654 Supplemental Final Status Survey Report	1999	Complete	Results and analysis of the supplemental final radiological survey conducted in Building T654. Data analysis indicates that the area may be released for use without radiological restriction.
Final Report for D&D of FSDF	1999	Complete	Decontamination, disposition, and decommissioning activities, techniques used, specific problems and resolutions summarized for the FSDF.
Data Summary Monitor Well Drilling	1999	Complete	Conducted by Groundwater Resource Consultants, Inc. June 1997 through 1999. This report documents well construction details and hydraulic parameters of select wells across the SSFL.
RFI Standardized Risk Assessment Methodology Work Plan (SRAM)	2000	Complete	Conducted by Ogden Environmental; describes methods to be used to conduct RFI risk assessment.
Validation Sampling and Analysis Plan	2000	Complete	Prepared by Ogden Environmental for ecological validation sampling to support ecological risk assessments at SSFL. Includes biota tissue and abiotic sampling to determine site specific bioaccumulation factors.
Operations Report for 17 th Street Decontamination	2000	Complete	Summary of decontamination and survey activities for the 17 th Street Drainage Area.
Area 4020 MARSSIM Final Status Survey Report	2000	Complete	Results of the MARSSIM final radiological survey following decontamination and decommissioning activities, indicating that Area 4020 may be released for unrestricted use.
RFI Standardized Risk Assessment Methodology Work Plan (SRAM)	2000	Complete	Conducted by Ogden Environmental; describes methods to be used to conduct RFI risk assessment.
Validation Sampling and Analysis Plan	2000	Complete	Prepared by Ogden Environmental for ecological validation sampling to support ecological risk assessments at SSFL. Includes biota tissue and abiotic sampling to determine site specific bioaccumulation factors.
Hot Laboratory D&D Final Report	2001	Complete	Decontamination and decommissioning activities, techniques used, specific problems and resolutions summarized for the Hot Laboratory.
Near Surface Groundwater Characterization Report	2003	Complete	Prepared by MWH for The Boeing Company. This document reports on the data that were collected and evaluations performed in an effort to characterize the occurrence and movement of groundwater found in the unconsolidated units and weathered bedrock across the SSFL.
Building 4059 Final Status Survey Procedure	2004	Complete	Description of procedures to conduct the final radiological survey of Building 4059.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (continued)

Building 4133 Radiation Survey Report	2004	Complete	Describes the radiological survey design used on Building 4133, the HWMF, and its fenced yard, as well as summarizes the survey results.
Report of Results Phase I Northeast Investigation Area Groundwater Characterization	2004	Complete	Prepared by MWH for The Boeing Company and the U.S. Department of Energy. Volume I of III – Text, Tables, and Figures. This report documents the research on the hydrogeological characteristics of the Chatsworth Formation located at the northeast end of the SSFL (Area I).
Standardized Risk Assessment Methodology Work Plan (SRAM) (Revised)	2005	Complete	The SRAM Revision 2 was prepared by MWH Americas, Inc., describes the methods to be used to conduct human health and ecological risk assessments for chemical contamination of the Surficial Media Operable Unit (Surficial OU) and Chatsworth Formation OU (CFOU) at the Santa Susana Field Laboratory (SSFL). This document supercedes the original SRAM prepared by Ogden Environmental. This revision to the SRAM was requested by DTSC because it includes, expands on, and provides additional information to supplement the original SRAM.
Soil Background Report	2005	Ongoing	Prepared by MWH Americas, Inc. to aid site characterization and risk assessments for the ongoing RCRA Corrective Action Program at the SSFL and to guide RFI site characterization decisions.
Groundwater Comparison Data Set Report	2005	Complete	Prepared by MWH Americas, Inc. To be used as a conservative threshold to make decisions regarding the need to characterize groundwater concentrations or for risk assessment. The Groundwater Comparison Concentrations are considered to be at or below the maximum naturally occurring metals concentrations.
Building 4059 D&D Final Report	2005	Complete	Summary of decontamination and dismantlement activities conducted at Building 4059.
Standardized Risk Assessment Methodology Work Plan (SRAM) (Revised)	2005	Complete	The SRAM Revision 2 was prepared by MWH Americas, Inc., describes the methods to be used to conduct human health and ecological risk assessments for chemical contamination of the Surficial Media Operable Unit (Surficial OU) and Chatsworth Formation OU (CFOU) at the Santa Susana Field Laboratory (SSFL). This document supercedes the original SRAM prepared by Ogden Environmental. This revision to the SRAM was requested by DTSC because it includes, expands on, and provides additional information to supplement the original SRAM.
Soil Background Report	2005	Ongoing	Prepared by MWH Americas, Inc. to aid site characterization and risk assessments for the ongoing RCRA Corrective Action Program at the SSFL and to guide RFI site characterization decisions.
Groundwater Comparison Data Set Report	2005	Complete	Prepared by MWH Americas, Inc. To be used as a conservative threshold to make decisions regarding the need to characterize groundwater concentrations or for risk assessment. The Groundwater Comparison Concentrations are considered to be at or below the maximum naturally occurring metals concentrations.
Building 4059 Site Final Status Survey Report (Phase A and B)	2006	Complete	Results and analysis of Phases A and B of the final radiological survey conducted at Building 4059. Data indicates that the building is suitable for release for unrestricted use.
Final Status Survey Report: Characterization and Final Status Survey RMHF Perimeter	2006	Complete	Results and analysis of characterization and final status survey of the perimeter of the RMHF.
Group 6-Northeastern Portion of Area IV RCRA Investigation Report	2006	Complete	Prepared by MWH for The Boeing Company. Volume I – Text, Tables, and Figures. Prepared by MWH. Volume I – Text, Tables, and Figures. This report provides a characterization of the hydrogeology and contamination in the southwest portion of Area IV.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (continued)

Final Status Survey Report: Final Status Survey Post Historical Site Assessment Sites, Block 1	2007	Complete	Results of the characterization and final radiological survey following decontamination and decommissioning activities of five sites within Area IV (Block 1), including Buildings 4023, 4028, 4583, 4323, and 4030. The results of the exploratory data analysis performed on off-site laboratory data were presented. The survey results indicate release of all surveyed units to unrestricted use.
Sample and Analysis Plan for the Radiological Characterization and Confirmatory Survey of the SNAP Environmental Test Facility – Building 4024	2007	Complete	Description of procedures for radiological characterization and confirmatory surveys for Building 4024 prior to decontamination activities.
Final Status Survey Plan for the SNAP Environmental Test Facility – Building 4024	2007	Complete	Description of procedures to conduct the final radiological survey for Building 4024.
Characterization and Final Status Survey Report: RMHF Holdup Pond (Site 4614)	2007	Complete	Results and analysis of characterization and final status survey of the Holdup Pond of the RMHF.
Combined Summary Report: RMHF Building Surveys	2007	Complete	Results and analysis of the radiological surveys conducted in Buildings 4022, 4075, 4563, 4621, 4658, 4665, and 4688 of the RMHF.
Revised Source Zone Characterization at the Santa Susana Field Laboratory	2007	Complete	Prepared by Jennifer C. Hurley, Beth L. Parker, John A. Cherry, University of Waterloo, Department of Earth Sciences. This document reports on the sampling and analysis of rock core samples to determine source concentrations in the rock matrix.
Report on Annual Groundwater Monitoring, 2006	2007	Complete	Summarizes groundwater radiochemistry data collected during quarterly monitoring and new well construction activities. Report produced by Haley & Aldrich, Inc. Results of Radiological Analyses can be found in Volume II, Appendix E.
Report on Annual Groundwater Monitoring, 2006	2007	Complete	Prepared by Haley & Aldrich, Inc. for the Boeing Company and the U.S. Department of Energy. Volume I of II.
Data Gap Investigation for Radiological Constituents in Groundwater – Area IV, Boeing Santa Susana Field Laboratory, Ventura County, California	2007	Complete	Prepared by Haley & Aldrich, Inc. for the Boeing Company. Installation and sampling of thirteen wells (RD-85 through RD-97) in Area IV during 2004 through 2006.
Overview of the Site Conceptual Model for the Migration and Fate of Contaminants in Groundwater at the Santa Susana Field Laboratory	2007	Complete	Prepared by John Cherry, David McWhorter and Beth Parker, SSFL Groundwater Advisory Panel. The report provides an academic and applied summary of the distribution and movement of contaminants (mainly chlorinated VOCs) in the rock matrix
Group 4 – Southern Portion of Area II RCRA Facility Investigation Report	2007	Complete	Prepared by MWH. Volume I – Text, Tables, and Figures. The report presents as description of the hydrogeology and contamination in the south central part of the SSFL.
Group 8 – Western Portion of Area IV RCRA Facility Investigation Report	2007	Complete	Prepared by MWH. Volume I – Text, Tables, and Figures. This report provides a characterization of the hydrogeology and contamination in the southwest portion of Area IV.
Data Summary, Construction and Testing of Core Borings SB_TRI-01 and SB_TRIT-02, Boeing Santa Susan Field Laboratory, Ventura County, California	2007	Complete	Prepared by Haley & Aldrich, Inc. for the Boeing Company. Report regarding the installation and sampling of two coreholes drilled in the northwestern portion of Area IV to assess vertical distribution of tritium in core pore-water from the unsaturated and saturated Chatsworth Formation.

Table 2-1 SSFL Area IV Sources of Radionuclide Data (concluded)

Offsite Data Evaluation Report	2007	Complete	Prepared by MWH. This report provides an evaluation of constituents located in areas off of the SSFL. A regional geologic map is presented in the report.
Report of Radiological Characterization and Confirmatory Survey Results for the SNAP Environmental Test Facility – Building 4024	2008	Complete	Results of the radiological characterization and confirmatory surveys of Building 4024, prior to decontamination activities.
Report of Radiological Characterization and Confirmatory Survey Results for the SNAP Environmental Test Facility – Building 4024; Appendix A Completed Data Packages	2008	Complete	Results of the final radiological survey following decontamination and decommissioning activities in Building 4024.
Work Plan Site-Wide Groundwater Characterization	2008	Complete	Prepared by MWH. This plan provides methods and procedures that will be followed to characterize the groundwater across the SSFL. The plan also presents a reasonable summary of current known conditions.
Sampling and Analysis Plan for RFI Group 5	2008	Ongoing	Prepared by CH2M Hill. This document is a working draft. The report provides a description of data gaps in RFI Group 5 and the methods and procedures that will be used to fill the gaps.
RFI Work Plan Addendum Amendment Radioactive Materials Handling Facility RFI Site (SWMU 7.6 and Area IV AOC)	2008	Ongoing	Prepared by MWH. Presents a data gap analysis and recommendations for sampling at the Radioactive Materials Handling Facility and other areas within Group 7.
Work Plan for Proposed Groundwater Monitor Well RD-98, Former Radioactive Materials Handling Facility Leach Field, Santa Susana Field Laboratory, Ventura County, California	2008	Ongoing	Work Plan for installation and sampling of new monitoring well RD-98 to evaluate potential groundwater impacts related to reported releases of radionuclides from the former RMHF leach field.

Section 3

Data Gaps Analysis Method

3.1 Data Gap Analysis Approach

A multiple step approach was implemented in conducting the data gap analysis described in this document. The approach evaluated all areas and media of Area IV with respect to the potential risk to human health and ecological receptors. The basic steps are outlined below. The specifics on how the steps were used for each media are described in Section 3.2 through 3.13.

3.1.1 Establishment of Data Quality Objectives

Data Quality Objectives (DQO) establish the data collection and measurement purpose and criteria aimed at addressing the basic objectives of a study. The overall purpose of the SSFL Area IV EIS Data Gap Study is to define the type, location, and measurement limits of data necessary to conduct analyses of risk-based alternatives in the EIS. The DQO process was used in the gap analysis to define the data acceptability criteria, measurement objectives, and study area boundaries for data to be used in the EIS risk assessments. CERCLA guidance for conducting a risk assessment was followed to allow for a systematic approach to the data collection objectives and requirements.

3.1.2 Develop Conceptual Site Models

Separate conceptual site models (CSM) were developed to address human health and ecological receptors to soil and water contamination within Area IV. The CSMs were developed to address receptors and exposure pathways that will be assessed in the risk assessment. The CSMs were also used to identify the types of data that will need to be evaluated and collected (if determined to be a data gap) to conduct the risk assessments.

3.1.3 Database Formatting

The database provided by Boeing was developed from data and information collected by Boeing and several consultants during numerous studies. The samples reported in the database were analyzed by several laboratories. As a result, there were inconsistencies in data fields that required correction in order for data screening to occur.

The data were reviewed and consistency corrections made as necessary for the following fields: analyte name, CAS number, reporting unit (concentration), reporting limit, detection limit, or minimal detectable activity (as appropriate), sample location, sample depth, and sample type. In addition, data screening criteria, as described in the following section, were added to the database for the screening step.

3.1.4 Screening Criteria Development

Two basic screening criteria were developed for the identification of COIs for Area IV. These included background levels and human health and ecological risk criteria. Section 3.4 describes the process for developing the criteria.

3.1.5 Document Review for Chemical and Process History

Literally, hundreds of reports have been developed for Area IV by Boeing and its consultants that describe historical usages and the results of numerous sampling studies. Many of these reports were reviewed to ascertain knowledge of where chemicals and radioactive materials were used and potentially released into the environment. Table 2-1 lists and describes the reports that were reviewed in this step and Appendices A and B summarize the process history and uses of building in Area IV.

3.1.6 Database Screening

The data in the database were screened for two basic purposes. First to identify COIs, data were screened against background concentrations to identify contaminants (chemical and radionuclide) of anthropomorphic origin. That is, to identify COIs that are not of natural origin within Area IV. The development of background levels is described in Section 3.4.1. And second, to identify data that is usable in human health and ecological risk assessments, analytical detection limits were screened against background and risk criteria (PRGs, MCLs, ESLs). This screening step was used to ensure that the data can be definitely used to define the presence or absence of an analyte for risk assessment purposes. Data not meeting this criteria was not considered when the data gaps were determined.

3.1.7 Development of Exposure Units

Risk assessments require that sampling data be averages over an exposure unit representative of the most likely exposure scenario, for purposes of calculating risks by a known surface area. Chemical and process use information were used to subdivide Area IV into exposure units for the purpose of identifying what data (meeting data gap criteria) exist for the exposure unit and determining what additional data would be necessary for conducting the risk assessment and defining extent of contamination.

3.1.8 Determination of Risk Assessment Data Needs

Statistical algorithms were used to identify the quantity (numbers of samples) of data required for each exposure unit to conduct a risk assessment consistent with CERCLA requirements. This calculation was performed irrespective of the quantity of existing data.

3.1.9 Determination of Extent of Contamination Data Needs

The review of the chemical and process history was used to identify the COIs for each exposure unit. This review was performed to determine whether prior investigations

had included all potential COIs. The distribution and concentrations of COIs for each exposure unit, particularly those COIs that exceeded health or ecological risk criteria were reviewed to determine whether the existing data could be used to bound the horizontal and vertical extent of contamination. The data gap investigators used color coded maps to identify locations where additional data are warranted to define contaminant extent.

3.1.10 Determination of Data Gaps

The difference between the acceptable data produced from the database screening and the requirements for data to perform both a risk assessment and in defining extent of contamination becomes the “Data Gap”. This exercise was performed independently by each exposure unit and separately for soil and groundwater data. The total number of samples required for each exposure unit was compared with the acceptable data and the location of that data to determine the data gap. The number of required samples by analyte (COI) was tabulated and is reported in Section 4 for each of the media areas evaluated.

3.1.11 Reconciliation with RCRA Facility Investigation Data

Following all ten steps described above and the determination of data gaps for each exposure unit, the data gap recommendations were compared with ongoing and proposed RCRA RFI plans to ascertain if some data collected under the RFI would also address the CERCLA risk assessment needs. Working Draft versions of sample location maps for the Groups 5 and 7 sampling programs are located in Attachment A of this Data Gaps report. Although many sample locations within RFI Groups 5 and 7 were determined to potentially meet the data gap need, collection of that data is still deemed a data gap until the data has been demonstrated to meet the need.

3.2 Data Quality Objectives for Data Gap Analysis

Section 3.2 describes the DQO process used for developing data screening criteria and data assessment protocols for conducting the Area IV data gap analysis. The DQO process followed the 7-step EPA process. Although many different kinds of data are required to complete the SSFL Area IV EIS (e.g., socioeconomic data, physical environment, biological species presence, etc.), the DQOs developed here pertain to the analytical chemical and radionuclide data that are required to complete a risk assessment consistent with CERCLA for current conditions. The process used herein was focused on data needs for the CERCLA risk assessments, which also depend on adequate knowledge of the nature and extent of contamination including the initial determination of the number and location of samples of relevant environmental media that may be needed to meet the DQOs.

For other EIS subject-matter areas (physical, social, biological environments), the data necessary to evaluate impacts will be obtained from existing publications containing the best available information and will not be collected specifically for the EIS unless not available. A separate “data gap” analysis for information required for the impact

analysis will be conducted separately from the chemical and radionuclide analysis to determine whether any specific study may be required.

3.2.1 Step 1 – State the Problem

This first step in the DQO process is to state the problem clearly and concisely.

DOE is preparing an EIS for remediation of Area IV of the SSFL in response to a May 2007 decision by the U.S. District Court of Northern California. The court ruled that a 2003 DOE decision to prepare a FONSI and conduct remediation of Area IV on the basis of an EA, rather than prepare an EIS, violated NEPA. DOE is planning to complete remediation of Area IV to comply with applicable regulations and allow for an evaluation of a range of reasonable alternatives. Environmental data are required to evaluate nature and extent of contamination and to perform human health and ecological risk assessments to support remedial decisions. The data required include radiological and hazardous contaminants in Area IV, areas adjacent to Area IV affected by Area IV contamination, and surface water and groundwater protection in accordance with applicable requirements. The EIS will evaluate a range of reasonable alternatives, including the No Action alternative, which entails no additional remediation. Therefore, the EIS must include an evaluation of the current risk to human health and the environment (i.e., as determined by a risk assessment consistent with CERCLA guidelines). Environmental data used in the risk assessment must be of known quality and adequate for the purpose of risk determination. The data gap analysis must be designed and implemented to ultimately provide that data.

Problem Statement: The quality and quantity of existing data need to be reviewed in relation of its applicability for conducting human and ecological risk assessments. A data gap analysis must be conducted to identify any additional data necessary to evaluate risk-based alternatives in an EIS. If data are deemed inadequate, a field program must be designed to collect the required data. The data will be used to prepare an EIS for remediation of Area IV of the SSFL that includes risk assessments consistent with CERCLA and the evaluation of alternatives consistent with both CERCLA and NEPA.

3.2.2 Step 2 - Identify the Goal of the Study

The second step in the DQO process is to identify the principal study question and define alternative actions to make decision statements.

The principal study question for the data gap analysis is whether existing chemical and radionuclide data related to Area IV are adequate to support risk assessments consistent with CERCLA and cleanup remedy evaluations in the EIS. The central decision relates to the development and preparation of an EIS and evaluation of a range of reasonable cleanup alternatives.

The decisions needed to determine the adequacy of the data are:

- Are the existing chemical and radionuclide data of sufficient quantity and spatial distribution (vertical and lateral) to support human health and ecological risk assessments and the evaluation of alternatives in the EIS?
- Are the existing data of sufficient quality to support human health and ecological risk assessments?
- Does the existing site data adequately delineate nature and extent of contamination in all media as needed to evaluate cleanup alternatives in the EIS?
- Are current decommissioning and demolition (D&D) building survey data adequate to analyze alternatives in the EIS?

Alternative actions of the decision statements are:

Decision Statement 1: If the quantity of existing data in each media is sufficient to support a risk assessment to evaluate cleanup alternative for the EIS, then the risk assessment will be conducted using that data and no further action is required; otherwise, collect additional data per identified media.

Decision Statement 2: If the quality assurance and control (i.e., detection limits, and validation) of existing data is sufficient to support the risk assessment, then the risk assessment will be conducted using that data and no further action is required; otherwise, collect additional data per identified media.

Decision Statement 3: If the nature and extent of contamination is adequately delineated with existing data, including gamma walkover data, then no further data collection is required; otherwise, additional samples per media and/or gamma walkover data will be collected to adequately define the nature and extent of contamination.

Decision Statement 4: If current D&D building surveys are adequate to analyze impacts for the EIS, then no further data collection is required; otherwise, collect additional building survey data for EIS cleanup alternative analysis.

If the answer to any decision statement is no, then additional data may be necessary and the results of the data gap analysis can be used to define the type of additional data needed.

3.2.3 Step 3 - Identify Information Inputs

The objective of the third step in the DQO process is to identify the information needed to resolve the decision statements identified in Step 2. This data gaps analysis evaluates a variety of media in Area IV including soil, bedrock, sediment, groundwater (including seep water), surface water/stormwater, biota (terrestrial/aquatic), air, and building surface. To perform human health and ecological risk assessments and delineate the extent of contamination the following data and information needs to have been identified for Area IV:

- Existing available analytical and GIS data from previous site investigations:
 - Reported results and method detection limits (MDLs) for existing data to evaluate data sensitivity objectives
 - Reported background data for chemicals and radionuclides in soil, air, and groundwater
- Chemical and radionuclide COIs within Area IV based on existing data and historical process knowledge;
- Residential and rural residential PRGs/screening levels for chemical and radionuclide COIs
 - California EPA-modified EPA Region 9 chemical PRGs will be used for residential human health screening
 - Risk Assessment Information System (RAIS)/EPA Region 4 chemical PRGs for rural residential scenario human health screening incorporating fruits and vegetable consumption only and added to the Region 9 PRGs to develop a rural residential scenario PRGs
 - Default EPA radionuclide PRGs will be used for residential radiological human health screening
 - In some applications, PRGs will be compared with background concentrations and a derived concentration guideline level (DCGL) used in the screening process (see Section 3.2.6.1 for the definition of DCGL).
- Ecological PRGs will be used for radionuclides derived from *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE 2002)
- ESLs will be used for screening chemical contaminants derived from a variety of sources
- Conceptual site model defining exposure pathways for potential receptors that will be evaluated during the risk assessments.

3.2.4 Step 4 - Define the Boundaries of the Study

The fourth step in the DQO process is to specify the study boundaries. The objective of this fourth step is to define the spatial and temporal boundaries that limit the scope of the analysis.

3.2.4.1 Spatial Boundary

For the purpose of the EIS and this data gap analysis, the spatial boundary is all of Area IV and any areas down gradient that may be impacted from migration of contaminants from Area IV. For soil (surface and subsurface) and surface water the

boundaries include Area IV shown in Figure 1-2, drainage leading into Areas II and III down gradient of Area IV, and the undeveloped land north and south of Area IV. Soil background boundaries are defined as the non-impacted Chatsworth and Santa Susana Formations. Groundwater boundaries include all of Area IV and extent of groundwater plumes originating in Area IV and extending into undeveloped land and Areas II and III. Background values for groundwater have not been defined.

3.2.4.2 Vertical Sub-Boundaries

The vertical boundaries for the soil risk exposure scenarios are as follows:

Zone	Human Health		Ecological
	Radiological	Chemical	All
Surface	0 - 0.5 ft.	0 - 2 ft.	0 - 2 ft.
Near Surface	0.5 - 2 ft.	not applicable	2 - 4 ft.
Subsurface	2 - 10 ft.	2- 10 ft.	4 - 6 ft.

For delineating extent of soil contamination, the vertical boundary for soil is the depth to the top of uncontaminated soil in surface, near surface, subsurface soils, or bedrock as determined by sampling. Distinctions between surface soil, near surface soil, and subsurface soil are made because COIs and exposure pathways for receptors may be limited to these specific subsets of data. For example, exposure to radionuclides is primarily a concern in the surface soil samples (from 0 to 0.5 feet bgs) because this upper layer of soil provides some shielding from deeper soils. Shallow sub-surface soil (from 0.5 to 2 feet bgs) is distinguished because ecological receptors and human receptors primarily would be exposed to this upper layer of soil. The deeper sub-surface soil (2 to 10 feet bgs) represents the depth to which a resident or a construction worker could be exposed to the soil following or during regrading for development. Bedrock in the area is shallow – less than 5 feet bgs in areas; therefore, it may not be possible to collect soil samples to 10 feet bgs. Samples collected from depths below 10 feet bgs will not be used in the quantitative risk assessment; however, these samples will be examined to help ensure that no constituents are overlooked by not including these deeper samples.

For sediment, the boundary for ERA is the top 0.5 foot. Sediment data will be used as a soil exposure for human-health risk analysis, as well as a separate media for the ecological risk assessment.

For groundwater, the vertical boundaries will include shallow unconsolidated soil and bedrock regions. For shallow unconsolidated soil region for groundwater, the vertical boundary will be the depth to bedrock surface, or water table, whichever is shallower.

3.2.4.3 Horizontal Sub-Boundaries

For the purposes of the data gap analysis, the area within the administrative boundary of Area IV was divided into EUs. For purposes of soil and building

characterization, EUs were further sub-divided into Class 1, Class 2 or Class 3 Areas referred to as SUs. These spatial divisions were used to define the required data density using a statistical sampling approach for soil and buildings based on the guidance from Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM). The Classes are defined in Section 3.6.3.

Consistent with the MARSSIM approach, both existing data and process history were used to classify each part of Area IV into MARSSIM classes. A three-step process was used to accomplish the classification:

- The refined Area IV data set was screened against PRGs and background concentrations, and the information graphically displayed;
- Knowledge of process areas and operational history was reviewed;
- The information from both previous steps was applied to the class definitions and SU boundaries were drawn accordingly (See Section 3.6.3).

For delineating extent of soil contamination, the horizontal boundary for soil is the boundary with uncontaminated soil in surface, near surface, subsurface soils, or bedrock as determined by sampling.

3.2.4.4 Temporal Boundary

For areas that have been subject to soil removal actions, only post-remediation characterization results (or current conditions) were used as current characterization data for the data gap analysis. For the purposes of the data gap analysis, data that were available by January 28, 2008 were used in this assessment. It is recognized that Boeing is in the process of collecting additional data that will be evaluated for applicability to the data gap criteria, particularly as part of the design of the field sampling program.

3.2.5 Step 5 - Develop the Analytical Approach

The fifth step in the DQO process is to define the decision rules and develop an analytic approach that will guide analysis of the study results and drawing conclusions from the data.

For this evaluation, the gap in the existing data was evaluated for each potential COI on a constituent-by-constituent basis. Some groups of chemicals were evaluated as if they were a single chemical or representative group of chemicals, for instance, carcinogenic polycyclic aromatic hydrocarbons, dioxins/furans, and PCBs. These groups were evaluated using surrogate chemicals to represent the whole group. Justification for the choice of surrogate is provided in subsequent sections.

Similarly for radionuclides, some radionuclides can be measured by proxy by measuring a progeny radionuclide assumed to be in equilibrium. An example is the use of Actinium 228 (^{228}Ac) data obtained by gamma spectroscopy as a proxy for

Radium 228 (^{228}Ra) which has no measurable gamma emissions. Other proxies could be developed based on known ratios of related radionuclides. However, for purposes of the data gap analysis, it is assumed that known ratios other than by secular equilibrium do not exist from the current process knowledge. The data gap presented by the existing data was evaluated for each potential COI on a constituent by constituent basis. In some cases, some constituents were used as proxies for others. Those cases are defined in the following text as necessary.

3.2.6 Step 6 - Specify Performance for Acceptance Criteria

The sixth step in the DQO process is to specify error tolerances. The objective of this step is to evaluate the error tolerances that will be built into the design of characterization programs so that decision uncertainty is within tolerable limits. For purposes of the data gap analysis for soils, a MARSSIM statistical approach was used as a tool to define the sample density. Therefore, a DCGL based on an assumed cleanup criterion for soil, a null hypothesis, and confidence criteria are required. The confidence criteria can also be used to define an appropriate number of samples for risk analysis for other media.

3.2.6.1 Derived Concentration Guideline

For purposes of screening for data gap analysis for soil, an assumed remediation level defined by MARSSIM as the DCGL was set equal to the 1×10^{-6} PRG or twice the background screening value, whichever was greater. Screening against twice the background value was evaluated to assess the potential for cleaning up to background concentrations.

3.2.6.2 Null Hypothesis

By default, it was assumed that a soil concentration did not meet the DCGL unless there was a specified confidence that contaminant concentrations, averaged over the area of an exposure unit, would be lower than the DCGL.

3.2.6.3 Confidence Interval:

- alpha (false negative) = 5 percent
- beta (false positive) = 10 percent

The lower boundary of the gray region (LBGR) was set to be equal to half of the PRG. The LBGR defines the level at which the false positive evaluation is applied.

If the null hypothesis is proved false by the statistical test, it will be assumed that no further remediation would be recommended.

3.2.6.4 Statistical Test

The MARSSIM recommends the use of a Sign test (when no background comparison is made) or a Wilcoxon Rank Sum Test (when comparison to background is made) for determining the number of samples required to meet the statistical confidence

requirements. These statistical tests were used to estimate the number of samples required for each constituent to meet the confidence objectives.

3.2.6.5 Measurement Quality Objectives (MQOs)

Evaluation of Precision, Accuracy, Representativeness, Comparability and Completeness (PARCC parameters) and sensitivity (blanks) is necessary to assure quality of the data. For the COI screening and data gap analysis, an abbreviated screening assessment of only data representativeness and sensitivity was applied.

Data representativeness is the extent to which available data characterize potential exposure conditions for human or ecological receptors. Proper selection of sampling locations, consideration of potential hot spots, assessment of background concentrations, and collection of a sufficient number of samples help maximize data representativeness.

Existing data were collected over time by different contractors, and consistency in approaches was not evaluated regarding data recording and data sensitivity requirements. Therefore, some evaluation of the usability of existing datasets for the risk assessments based on sensitivity is required. The decision rules for data acceptance criteria are defined below. These acceptance criteria address the first two decision statements in Step 2.

Q1: Is a MDL available in the database? (The MDL for radionuclides was derived by dividing the MDA by 2 or multiplying the error value by 0.825.)

(N) If the answer is no, but the calculated MDL result was greater than either the PRG or background value, then the result was flagged as not meeting the objectives of the data gap analysis for data that could be used to define nature and extent of contamination.

(N) If the answer is no and the calculated MDL result is below the PRG or background value, then the result would meet the data gap objective and is usable.

(Y) If the answer is yes, a MDL is available, then go to Q2.

Q2: Is the result non-detect?

(Y) If the MDL is greater than the PRG or background value, then reject non-detect data as not usable for the data gap analysis.

(Y) If the MDL is less than the PRG or background, then accept non-detect data as an indication that the contaminant is not present at the sample location at a concentration of concern for the data gap study.

(N) If the contaminant is reported above the analytical detection limit, then use data for purposes of the data gap analysis.

Standard Quality Assurance Project Plan (QAPP) PARCC parameters requirements will be applied as MQOs for any new data that is collected. Required detection limits to the extent possible, should be equal to or less than equivalent to 1/10 the 1×10^{-6} rural residential PRG, but must at least meet the 1×10^{-6} rural residential PRG.

Acceptable historical data were used as reported without further validation. New data will be verified at 100 percent and validated at a Level IV for a minimum of 10 percent of samples collected. Problems identified in the 10 percent Level IV validation may require further review and validation of the remaining 90 percent to evaluate the extent of the problems.

Types of data needed:

- Results for radionuclides and chemicals in the defined boundaries of the study area, including background.
- Data necessary to define nature and extent of contamination and to evaluate soil and groundwater remedies.
- Reporting limits for chemicals and uncertainties for radionuclides.
- Method detection limits.

3.2.7 Step 7 - Develop the Plan for Obtaining Further Data

Additional samples will be collected if statistical and/or standard practice-based sample requirements are not met by the existing data. A Field Sampling and Analysis Plan (FSAP) will be developed to meet the need for additional site surveys and samples required to meet the DQOs. In addition to analyzing the data gap, Section 4.0 presents some additional information necessary to develop the FSAP.

3.3 Area IV Conceptual Site Models

Existing data meeting the data gap acceptability criteria and any new data proposed for collection are intended for use in evaluating the baseline risk and risk of implementing alternative cleanup actions to both human and ecological receptors. One tool used by risk assessors in determining the types of data necessary for risk assessments is the development of a conceptual site model (CSM). The CSM is a representation of ways that receptors might be exposed to contaminants present within Area IV or potentially released during site cleanup activities. The CSM describes potential sources of contamination, primary and secondary contaminated media, transport mechanisms, exposure route and receptors or receptor categories. Separate CSMs for Area IV were developed for human health risk and ecological risk, and each is described below.

3.3.1 Human Health Risk Assessment

The human health CSM describes potential exposure pathways associated with Area IV, including potential sources of contamination, transport mechanisms, exposure

routes, and potentially exposed populations. For this data gap analysis, adequacy of existing analytical data for the CERCLA-based human health risk assessment is evaluated by identifying whether additional data are needed to evaluate the potentially complete exposure pathways indicated in the CSM.

The human health CSM for Area IV is shown in **Figure 3-1**. The CSM follows the approach outlined in the *Standardized Risk Assessment Methodology Work Plan* (SRAM WP) for the SSFL (MWH 2005). Figure 3-1 depicts a diagrammatic representation of the CSM for Area IV, including contaminant sources, release mechanisms, direct and indirect exposure pathways, and potential current and future receptors. Spills and releases from reactors and support structures have resulted in chemical and radiological contamination of building surfaces, soil, ash, weathered bedrock, sediment, and groundwater in Area IV. Potential human receptors are populations potentially exposed to contaminants, either onsite or as a result of contaminant migration to offsite areas. Both current and future land use are evaluated in the selection of potential human receptors. Details of the human health CSM for Area IV are briefly described below.

3.3.1.1 Potential Receptors

Onsite Human Receptors

Current potential onsite human receptors include security, operations and maintenance personnel, and rarely, trespassers. Most of the Area IV buildings have been demolished; with minimal activity occurring in the remaining buildings. Use and inspections of the few remaining buildings by Boeing personnel are short and infrequent. Risks for these personnel should be covered by U.S. Department of Labor Occupational Safety and Health Administration (OSHA) protective standards; thus, these infrequent workers and security personnel are not considered further and are not shown on the CSM under the current scenario. In any case, industrial workers will be addressed in a potential future scenario.

Future potential receptors include onsite residents, industrial workers, construction workers and recreational visitors who might occupy the site in the event of a change in property use. Construction workers are assumed to be involved in demolition of the site as well as development of the site for its future use; thus, a separate demolition worker is not evaluated. Complete exposure pathways will be evaluated qualitatively for current receptors and quantitatively for future receptors.

Not all potential exposure pathways are complete or significant for every receptor. Some exposure pathways will be evaluated for chemicals only (e.g., dermal contact), while others pathways will be evaluated for radionuclides only (e.g., external gamma).

Offsite Human Receptors

The potential exists for offsite migration of site-related COIs with subsequent potential exposures by people during remedial actions. This potential will be qualitatively evaluated in the EIS.