Hill Air Force Base, Utah

Final Report

Hill Air Force Base Engineering Evaluation/Cost Analysis for the Operable Unit 9 Pond 3 Removal Action

Contract F41624-00-D-8021
Task Order 0163

June 2003

FINAL REPORT

Hill Air Force Base, Utah

Engineering Evaluation / Cost Analysis for the Operable Unit 9 Pond 3 Removal Action

Contract No: F41624-00-D-8021
Task Order 0163

Prepared for:

Air Force Center for Environmental Excellence
and the Environmental Management Directorate
Hill Air Force Base, Utah

Prepared by:

CH2MHILL
4001 South 700 East, Suite 700
Salt Lake City, UT 84107-2177

JUNE 2003

Executive Summary

This Engineering Evaluation/Cost Analysis (EE/CA) addresses the rationale for selecting a removal action for the storm water retention pond, Pond 3, within Operable Unit (OU) 9 at Hill Air Force Base, Utah. Portions of the pond sediments are contaminated with arsenic at levels that exceed risk-based standards. The risk-based standards used for this assessment are the OU9 residential risk-based screening levels (RBSLs), which are equal to background levels for several metals. Previous investigations conducted from 1989 through 2002 have provided adequate sediment sampling to identify the contaminants of concern and define the extent of contaminant exposure.

Contaminated pond sediments are present in four areas within Pond 3. These areas are located adjacent to the south bank in the western portion of the pond. Both lateral and vertical extent of arsenic contamination was delineated by using the analytical data from various site investigations. The vertical extent of arsenic contamination exists in the top 4 feet of sediments/soil. Approximately 200 cubic yards (cy) of sediment contaminated with arsenic above background levels would require removal and/or remediation. If excavated, the final volume of sediment is expected to bulk to approximately 260 cy.

Three alternatives are presented in this EE/CA to address the contaminated sediments: no action, contaminated sediment removal with off-site disposal, and implementation of phytoremediation for arsenic removal. Alternative 1 (no action) is included as a baseline for comparison purposes. Alternative 2 involves excavating the arsenic-contaminated sediments, placing the excavated sediments in a staging area for composite sampling, confirmation sampling to assure adequate removal, disposal of the sediments at the appropriate disposal facility, and restoration of the disturbed pond surface. Alternative 3 includes construction of a 5,000-square-foot lined treatment cell within the pond boundary, excavation of the arsenic contaminated sediments, placement of the sediments within the treatment cell, confirmation sampling, planting of phytoremediation plants to extract arsenic from the sediments, and grading/restoration of the pond.

Each alternative was evaluated against the nine criteria defined in 40 CFR 300.430(e)(9), which provide grounds for comparing the relative performance of the alternatives and identifies the advantages and disadvantages of each alternative.

Based on the EECA conducted, it is recommended that the contaminated sediments be excavated and transported off-site to an approved disposal facility. The recommended alternative includes confirmation sampling to assure adequate contaminant removal. No long-term maintenance or monitoring will be required for this alternative. A period of 5 to 7 weeks is estimated for the completion of this removal action.

THIS PAGE INTENTIONALLY LEFT BLANK

Contents

Acronyms ..... **v**
1.0 Introduction **1-1**
1.1 Purpose and Objectives 1-1
1.2 Scope of Work 1-1
1.3 Report Organization 1-2
2.0 Site Conditions **2-1**
2.1 Introduction 2-1
2.2 Project Background 2-1
2.2.1 Location 2-1
2.2.2 Site Description and History 2-1
2.3 Investigations 2-2
2.3.1 The Remedial Investigation/Feasibility Study 2-2
2.3.2 Pond 3 Inlet Investigation 2-2
2.3.3 Arsenic Delineation Investigation 2-4
2.3.4 Poly-Aromatic Hydrocarbon Investigation 2-4
2.4 Geology and Hydrogeology 2-5
2.4.1 HAFB Topography 2-5
2.4.2 Pond 3 Geology 2-5
2.4.3 Pond 3 Hydrogeology 2-6
2.5 Extent of Contamination 2-6
2.5.1 Introduction 2-6
2.5.2 Sources of Contaminants 2-6
2.5.3 Types of Contaminants 2-7
2.5.4 Contaminant Mobility 2-7
2.5.5 Risk-Based Screening Levels 2-7
2.6 Contaminated Sediment Identification and Disposal Options 2-8
2.6.1 Contaminated Sediment Identification 2-8
2.6.2 Confirmation Sampling 2-9
2.6.3 Disposal Regulations 2-9
3.0 Removal Action Objectives and Scope **3-1**
3.1 Objectives 3-1
3.1.1 Introduction 3-1
3.1.2 Specific Objectives 3-1
3.2 Scope of the Removal Action 3-1
3.3 Applicable or Relevant and Appropriate Requirements 3-1
4.0 Engineering Evaluation/Cost Analysis of Alternatives **4-1**
4.1 Introduction 4-1
4.1.1 Evaluation Criteria 4-1
4.2 Pond 3 Alternative Descriptions 4-4
4.2.1 Alternative 1—No Action 4-5
4.2.2 Alternative 2—Contaminated Sediment Removal with Off-Site Landfill Disposal 4-5

4.2.3 Alternative 3— Phytoremediation through Metal Extraction in a Treatment Cell 4-6
4.3 Detailed Analysis of Removal Alternatives 4-9
4.4 Comparative Analysis of Alternatives 4-10
4.4.1 Overall Protection of Human Health and the Environment 4-10
4.4.2 Compliance with ARARs 4-10
4.4.3 Long-Term Effectiveness and Permanence 4-11
4.4.4 Reduction of Toxicity, Mobility, and Volume through Treatment 4-11
4.4.5 Short-Term Effectiveness 4-11
4.4.6 Implementability 4-12
4.4.7 Cost 4-12
4.4.8 Comparative Analysis of Alternatives Summary 4-12
5.0 Recommended Removal Action Alternative 5-1
5.1 Recommended Alternative 5-1
5.2 Proposed Schedule 5-1
6.0 References 6-1

Tables

2-1 Samples Exceeding Residential RBSLs
2-2 Pond 3 Samples Exceeding Arsenic Background Level of 9.76 mg/kg
2-3 Contaminated Sediment Volume Estimates
4-1 Detailed Analysis of Alternatives Summary

Figures

2-1 Pond 3 Regional Location Map
2-2 Pond 3 Exploration Point Location Map
2-2a Pond 3 Exploration Point Location Map and Residential RBSL Exceedance Results
2-2b Pond 3 Exploration Point Location Map and Residential RBSL Exceedance Results
2-3 Contaminated Sediment Areas and Cross-Section Points and Locations
2-4 Pond 3 Cross-Sections
4-1 Alternative 2—Sediment Excavation Areas
4-2 Alternative 3—Phytoremediation with Metal Extraction

Appendices

A Analytical Results
B Petrographic Analyses of Asphalt-Bearing Pond Sediments Report
C Applicable or Relevant and Appropriate Requirements
D Present Worth Cost Analysis
E Regulator Comments and Response to Comments

Acronyms

AFCEE	Air Force Center for Environmental Excellence
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below the Ground Surface
CAMU	Corrective Action Management Unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic Feet per Second
COC	Chemical of Concern
cy	Cubic Yards
EE/CA	Engineering Evaluation/Cost Analysis
EGI	Energy and Geoscience Institute
EPA	United States Environmental Protection Agency
FFA	Federal Facilities Agreement
FS	Feasibility Study
ft^2	Square Feet
HAFB	Hill Air Force Base
IRP	Installation Restoration Program
IWCS	Industrial Wastewater Collection System
IWTP	Industrial Wastewater Treatment Plant
LDR	Land Disposal Restriction
mg/kg	Milligram per Kilograms
mg/L	Milligrams per Liter
MSL	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution and Contingency Plan
O&M	Operation and Maintenance
OU	Operable Unit
OU9 SI	South Area of Operable Unit 9 Site Inspection
PAH	Poly-Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
RBSL	Risk-Based Screening Levels

RCRA	Resource, Conservation, and Recovery Act
RI	Remedial Investigation
SVOC	Semi-Volatile Organic Compounds
TCLP	Toxic Characteristic Leaching Procedure
TMV	Toxicity, Mobility, or Volume
TPH	Total Petroleum Hydrocarbon
UDEQ	Utah Department of Environmental Quality
UTS	Universal Treatment Standard
VOC	Volatile Organic Compound

1.0 Introduction

1.0.0.1. This document presents an Engineering Evaluation/Cost Analysis (EE/CA) for the remediation of contaminated sediments in Pond 3 [Installation Restoration Program (IRP) Site SD023], Operable Unit (OU) 9 at Hill Air Force Base (HAFB or Base), Utah. Pond 3 is a storm water retention pond located along the southern boundary of HAFB, west of the South Gate. Portions of the pond sediments in the western portion of the pond are contaminated with arsenic at levels that exceed residential risk-based screening levels (RBSLs).

1.0.0.2. This work is being performed as part of Air Force Center for Environmental Excellence (AFCEE) Contract Number F41624-00-D-8021, Task Order 0163. This document presents several removal alternatives and a cost analysis of those alternatives. The remainder of this section describes the purpose of the document, site background, scope of work, and report organization.

1.1 Purpose and Objectives

1.1.0.1. The purpose of this report is to document the rationale for selecting and implementing a contaminated sediment removal action at Pond 3 as an EE/CA. Under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), a removal action can be implemented to mitigate a threat of release of hazardous substances. Removal actions are intended to be short-term, limited responses to a particular problem at a site. Investigators of Pond 3 have concluded that the conditions qualify for a non-time-critical removal action, for which EE/CA technical guidance applies. Non-time-critical removal actions can be implemented at sites for which the lead agency has determined that a removal action is required, but for which a planning period of more than 6 months is required.

1.1.0.2. Site investigation studies at Pond 3 have shown that sediment contamination exists in the western portion of the pond at various depths. HAFB is proposing a removal/remedial action to eliminate the potential for human exposure and protect the environment.

1.1.0.3. The objective of this report is to document existing site conditions and provide a comprehensive analysis and comparison of alternatives for remediation of the contaminated sediments within Pond 3. In addition, a cost evaluation has been performed for each proposed alternative. This document has been prepared in accordance with *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* [United States Environmental Protection Agency (EPA), 1993].

1.2 Scope of Work

1.2.0.1. To accomplish the objectives described above, the following scope of work was performed:

- Evaluation of investigative and analytical data from previous investigations
- Additional soil sampling at the western end of Pond 3 to further delineate metal contamination
- Petrographic analyses of pond sediments for detection of asphalt components
- Identification of potential removal alternatives
- Comparison of removal alternatives and cost comparison
- Preparation of this report

1.3 Report Organization

1.3.0.1. This report is organized into six sections, followed by Appendices A through E. The report sections and appendices are summarized as follows:

- **Section 1 – Introduction.** The purpose of the EE/CA, scope of work, and report organization is presented in this section.
- **Section 2 – Site Conditions.** Section 2.0 presents the site background, geology and hydrogeology, site contamination levels, and contaminated sediment characterization and disposal regulations.
- **Section 3 – Removal Action Objectives and Scope.** The removal action objectives and scope are presented in Section 3.0.
- **Section 4 – Engineering Evaluation/Cost Analysis of Alternatives.** Section 4.0 presents the identification, evaluation, and comparison of removal alternatives.
- **Section 5 – Recommended Removal Action Alternative.** Section 5.0 presents the recommended removal alternative for the contaminated sediments.
- **Section 6 – References.**
- **Appendix A – Analytical Results.** This appendix contains laboratory analytical data for soil samples obtained at Pond 3.
- **Appendix B – Petrographic Analyses of Asphalt-Bearing Pond Sediments Report.** A report by the Energy & Geoscience Institute on the analyses of Poly-Aromatic Hydrocarbons (PAHs) in the pond sediments is provided in this appendix.
- **Appendix C – Applicable or Relevant and Appropriate Requirements.** This appendix contains a summary of the Applicable or Relevant and Appropriate Requirements (ARARs) applicable to the removal alternatives.
- **Appendix D – Present Worth Cost Analysis**. Cost estimates for the removal alternatives are presented in this appendix.
- **Appendix E – Regulator Comments and Response to Comments**. Comments from the Utah Department of Environmental Quality (UDEQ) and the United States Environmental Protection Agency (EPA) as well as responses to these comments are provided in Appendix E.

2.0 Site Conditions

2.1 Introduction

2.1.0.1. This section provides a summary of the site conditions, site history, and environmental investigations that were used to develop the removal alternatives. Analytical data used to develop this section is from previous investigations as well as investigations in 2002. Also included in this section are summaries of the geological and hydrogeological conditions, extent of sediment contamination, and sediment characterization and disposal regulations.

2.2 Project Background

2.2.1 Location

2.2.1.1. HAFB is located in Northern Utah, approximately 25 miles north of Salt Lake City and 5 miles south of Ogden. HAFB occupies approximately 6,700 acres in Davis and Weber Counties. The western boundary of HAFB is formed by I-15, and the southern boundary by State Route 193. The northern and northwestern perimeters are bounded by the privately owned Davis-Weber irrigation canal. The eastern boundary is formed by undeveloped lands and the North Davis County Energy Recovery Facility. Pond 3 is located along the southern boundary of HAFB, west of the South Gate. The location of Pond 3 is presented in Figure 2-1.

2.2.2 Site Description and History

2.2.2.1. Pond 3 is designated as IRP Site SD023, which is regulated under CERCLA in accordance with the Federal Facilities Agreement (FFA). Pond 3 was designated as an IRP site because surface water runoff contained in the pond, emanated from existing and former industrial areas that have used hazardous materials and generated hazardous wastes.

2.2.2.2. Pond 3 has been a storm water retention pond since 1957. Currently it is designated as a wildlife habitat area. Pond 3 receives storm water runoff from the southern area of the Base. This area includes portions of the industrial and flight line areas. Storm runoff from a portion of the industrial area and the flight line drains into Pond 1, near the 419th Fighter Wing Area. A controlled flow is discharged from Pond 1 to Pond 3 via a 33-inch storm drain line. Pond 1 is drained as much as possible after each storm event, depending on the available capacity of Pond 3. Storm water retained in Pond 3 drains to the south through a 33-inch storm drain line to the city of Layton storm drain system, which discharges into Kay's Creek, located southeast of HAFB, and eventually flows into the Great Salt Lake. Discharge from Pond 3 is controlled in order to maintain a constant water level and preserve the wildlife habitat. The current discharge permit by the city of Layton allows for a 20 cubic feet per second (cfs) discharge during regular discharges with an allowance of

40 cfs under emergency situations (Stantec, 1999). Future use of Pond 3 is expected to remain, as it currently is; a storm water retention pond and wildlife habitat.

2.3 Investigations

2.3.0.1. A series of investigations at Pond 3 were carried out from 1989 to 2002. Four areas of soil contamination above residential RBSLs were identified. All soil sample locations from each investigation and analytical results exceeding residential RBSLs are summarized in Table 2-1 and shown in Figures 2-2, 2-2a, and 2-2b. Elevated arsenic concentrations, sample locations, and defined contaminated areas are presented in Table 2-2 and Figure 2-3. Each investigation phase is described in detail in the following sections.

2.3.1 The Remedial Investigation/Feasibility Study

2.3.1.1. The Remedial Investigation / Feasibility Study (RI / FS) process for Pond 3 began in 1989 with an evaluation of the presence / absence of contaminants in surface water and sediment which is summarized in the *Draft Final Remedial Investigation Report for Operable Unit 3* (JMM, 1992). In April of 1991, Pond 3 was added to OU3 (JMM, 1992). The nature and extent of surface water and sediment contamination was further evaluated in the *Final Phase II Remedial Investigation Report for Operable Unit 3 [IRP Sites ST04, WP05, WP06, ST18, SD23, SD34]* (*OU3 RI*) (MW, 1995). A "no action" decision for Pond 3 was concluded in the *Final Record of Decision for Operable Unit 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, SD34)* (*OU3 ROD*) (MW, 1995a).

2.3.1.2. The *OU3 RI* documented the sampling and analysis of sediments and surface water for Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), metals, hexavalent chromium, and Total Petroleum Hydrocarbons (TPHs). Sediment samples were also analyzed for cyanide. The risk assessment identified the predominant contaminant pathways as being between the contaminant sources and surface water and from surface water to pond bottom sediments. Migration of contaminants from pond bottom sediments to groundwater was considered a minor pathway, not likely to occur. Potential risks were not significant for current or future pathways. Estimated hazard indices were less than one for all current and future exposure scenarios.

2.3.1.3. The *OU3 ROD* documented the findings and conclusions of the *OU3 RI* and the risk assessments. The *OU3 ROD* concluded that the contaminants in Pond 3 surface water and sediment did not pose current or future health risks or present a threat to groundwater. Therefore, further action at Pond 3 was unnecessary.

2.3.2 Pond 3 Inlet Investigation

2.3.2.1. As mentioned above, the *OU3 ROD* concluded no further action was necessary at Pond 3. However, an unrelated investigation at Pond 1 identified contamination around the northwest Pond 1 inlet. Pond 3 is hydraulically downstream from Pond 1, connected via a 33-inch storm drain pipeline. Because of the detection of contaminants at Pond 1, it was believed that an additional investigation of the Pond 3 inlet area was warranted.

2.3.2.2. In the summer of 2000, the Environmental Restoration Division of the HAFB Environmental Management Directorate initiated a voluntary investigation of the Pond 3 sediments. Results of the investigation were presented in the *Final Analytical Data Report (ADR) for Operable Unit 9 Investigation Areas 1 May through 10 October 2000* (MW, 2001). Ten hand augured soil borings (U9-P3-700 through U9-P3-709) were performed and surface sediment/soil samples were collected near the Pond 3 inlets. Soil samples were collected at depths ranging from 1 to 4 feet below the ground surface (bgs). The samples were analyzed for VOCs, SVOCs, trace metals, and general chemistry. The analytical results indicated elevated levels of arsenic in Soil Boring U9-P3-709 from 0 to 1 feet bgs and 2 to 3 feet bgs at concentrations of 115 milligrams per kilogram (mg/kg) and 26.8 mg/kg, respectively. Benzo(a) pyrene was detected in Soil Boring U9-P3-700 from 1 to 2 feet at 0.5 mg/kg.

2.3.2.3. From October 2001 through May 2002, three sampling rounds were conducted to further verify the presence of SVOCs and arsenic near the pond inlets and around Soil Borings U9-P3-700 and U9-P3-709, which previously had elevated levels of Benzo(a) pyrene and arsenic, respectively. During the sample round in October 2001, Soil Borings U9-7644, U9-7645, U9-7646, U9-7648, U9-7649, and U9-7650 were collected near the east inlet and adjacent to the south bank at the west end of the pond. A second sample round occurred in early 2002 in which samples were collected at Soil Borings U9-7652, U9-7653, U9-7655, U9-7656, U9-7657, and U9-7659. During the third sample round in May 2002, samples were collected at nine locations (Soil Borings U9-7661 to U9-7669) and analyzed for SVOCs, PCBs, and metals in order to further define the extent of contamination near the pond inlets on the north side and west end of the pond.

2.3.2.4. The analytical results for the three rounds indicated elevated levels of PAHs, arsenic, cadmium, lead, and Deldrin. Elevated levels of PAHs were detected at Soil Borings U9-7649, U9-7650, U9-7656, U9-7657, U9-7658, U9-7661, U9-7662, U9-7664, U9-7665, and U9-7667. The elevated concentrations of PAHs are provided in Table 2-1. Arsenic concentrations above the background level of 9.76 mg/kg were detected at Soil Borings U9-7644, U9-7652, and U9-7653 at concentration levels of 13.1 mg/kg, 89.4 mg/kg, and 22.5 mg/kg, respectively. At Soil Boring U9-7667 (0 to 2 feet bgs), a cadmium concentration of 6.2 mg/kg was detected, which exceeds the background concentration of 3.58 mg/kg. Lead and Deldrin concentrations of 422 mg/kg and 0.058 mg/kg were also detected at the same location, exceeding the OU9 RBSL of 400 mg/kg and 0.04 mg/kg, respectively.

2.3.2.5. The cadmium, lead, and Deldrin concentrations at Soil Boring U9-7667 from 0 to 2 feet bgs are well above other samples taken at Pond 3. Cadmium concentrations for other locations range from 0.36 to 1.6 mg/kg, lead concentrations from 5 to 307 mg/kg, and Deldrin concentrations from 0.0004 to 0.02 mg/kg. The sample taken from 2 to 4 feet bgs at Soil Boring U9-7667 had cadmium, lead, and Deldrin concentrations of 0.58 mg/kg, 8.6 mg/kg, and 0.002 mg/kg, respectively. The elevated level of Deldrin was assumed to be a one-time occurrence isolated to this location only. No further investigation was warranted. Since the high concentrations of cadmium and lead were only detected at Soil Boring U9-7667, sampling to attempt to duplicate the analytical results was performed in December 2002.

2.3.2.6. To determine whether the elevated cadmium and lead levels at Soil Boring U9-7667 can be considered outliers, four additional samples were taken at two locations, Soil Borings U9-7857 and U9-7858 in December 2002. The highest concentration of cadmium and lead

detected in the four samples taken were 2 mg/kg and 57.3 mg/kg, respectively. Both constituents were detected well below residential RBSLs and were not comparable to the levels detected at Soil Boring U9-7667. Therefore, it can be assumed that the elevated levels of cadmium and lead detected at Soil Boring U9-7667 are elevated background levels.

2.3.3 Arsenic Delineation Investigation

2.3.3.1. In September and December 2002, additional soil sampling was performed in the western portion of Pond 3, along the south bank, for further delineation of arsenic-contaminated sediments. This investigation focused in an area where elevated arsenic was previously found, but an additional investigation was necessary to evaluate the lateral and vertical extent of elevated arsenic levels. Soil samples that contain arsenic levels that exceed background levels (9.76 mg/kg), also defined as the OU9 RBSL, are considered elevated. All sample locations with elevated arsenic levels from previous and recent investigations are summarized in Table 2-2.

2.3.3.2. In order to identify the extent of elevated arsenic, 94 sediment samples were taken from 46 locations at a depth range of 0 to 2 feet bgs, 2 to 4 feet bgs, and two locations at 4 to 6 feet bgs during the three rounds of sampling. Sample Rounds 1 and 2 were performed in September 2000 and Round 3 was performed in December 2002. The intent of the third sampling round was to further define the contaminated area as determined by evaluating the results of Rounds 1 and 2. The analytical results from the three rounds indicated the presence of elevated arsenic at ten sample locations, varying from 0 to 4 feet bgs with a concentration range of 11 to 117 mg/kg. These results indicated that pond sediments contaminated with arsenic exceeding background levels are isolated to an area along the south bank of Pond 3 as shown in Figure 2-3. Cross sections were developed depicting the vertical extent of the contamination to be isolated to the top 4 feet of sediment and native soils. The cross section locations through the contaminated area are provided in Figure 2-3 and the cross sections are provided in Figure 2-4.

2.3.4 Poly-Aromatic Hydrocarbon Investigation

2.3.4.1. The presence of PAHs near the Pond 3 inlets are not indicative of the wastes generated from operations conducted at HAFB. Therefore, further investigation was necessary to determine the origin of the PAHs. The chemical analyses of the pond sediments have identified the presence of PAHs, which are a known component of asphaltic materials. Pond 3 receives drainage from several asphalt–paved parking lots and roads.

2.3.4.2. In order to determine if the PAHs present in Pond 3 are a result of asphalt particles being transported to the pond through stormwater runoff, three soil samples from Soil Borings U9-7661, U9-7665, and U9-7667 were sent to the Energy & Geoscience Institute (EGI) for petrographic analyses. Petrographic analysis consists of dividing the soil sample into thin sections and staining half with potassium feldspar, then using x-ray diffraction to visually observe the characteristic features of the sample. Photomicrographs were taken of each sample, showing the texture and mineralogy of the soil. The report generated from EGI is provided in Appendix B.

2.3.4.3. It was concluded from the petrographic analyses that several constituents present in the sediment are components of asphalt. As shown in the photomicrographs, “all three

[samples] appear to contain a significant proportion of particles derived from asphalt aggregate" (Appendix B). The three sediment samples are similar in texture, composition, and mineralogy, and differ only in the proportion of coarse to fine material. The amorphous, orange-brown material visible in the photomicrographs is asphalt binder and the particles contained within this binder are pieces of asphalt aggregates. "The best evidence of this is textural…the lack of grain sorting, presence of extremely angular rock fragments, and cementation by the bituminous material suggests formation of these particle by non-geologic processes" (Appendix B).

2.3.4.4. From this investigation, it is concluded that the PAHs present in the pond sediments are components of asphalt particles, and therefore, will be excluded from the removal action as part of this EE/CA. Although the elevated PAHs will be shown as exceedances in Table 2-1 and in Figures 2-2, 2-2a, and 2-2b, when defining the area of contamination to be removed as discussed in Section 2.5, the PAH-contaminated sediments will be excluded from the delineation analysis.

2.4 Geology and Hydrogeology

2.4.0.1. The site characteristics and subsurface conditions for Pond 3 discussed in the sections below were compiled from several remedial investigation documents and from recent sampling events at Pond 3. The primary information resources were soil boring logs from OU3 investigations, the *OU3 RI* (MW, 1995), and the *Final Engineering/Cost Analysis for the OU9 Pond 1 Remedial Action* (CH2M HILL, 2002).

2.4.1 Hill Air Force Base Topography

2.4.1.1. HAFB is located on a delta terrace of the former Weber River Delta. The Wasatch Mountain Range is located immediately east of HAFB and rises abruptly from the valley floor to an elevation of over 9,500 feet mean sea level (MSL). The delta surface slopes to the west away from the Wasatch Mountain Range and has slight to moderate relief with elevations varying from approximately 5,045 feet MSL along the eastern boundary to 4,600 feet MSL along the western boundary of the Base. West of the Base, the terrace surface slopes toward the Great Salt Lake. The Great Salt Lake is located approximately 12 miles west of HAFB.

2.4.2 Pond 3 Geology

2.4.2.1. The near-surface geology underlying Pond 3 consists of a thin layer of pond sediments overlying the Provo and Alpine Formations. The thickness of the sediment layer varies throughout the pond with thicker sediments near the pond inlets. The pond sediments are dark sands and silts with a high organic content. The sediments are derived from materials washed into the storm drains. The organic content is from decaying plant matter from plants that grow in the pond. The Provo and Alpine Formations are found underlying the pond sediments. In this area, the younger Provo Formation overlies the Alpine Formation and consists of medium to fine sands and thin layers of silty clay and clay. The Alpine Formation is characterized by clay, silt, and fine sand. The most distinctive lithology of the Alpine Formation is a slabby, salmon pink to reddish brown well-consolidated clay. The contact between the Alpine and Provo Formations occurs

beneath Pond 3 at an approximate depth of 60 feet bgs based on the boring log of Monitoring Well U3-015. The Provo and Alpine formations were deposited with a westward dip as the delta prograded west into Lake Bonneville from the mountain front. Fluctuations of the lake level, variations in the entry point of the Weber River into Lake Bonneville, and the depositional environments of these formations combined to produce a complex stratigraphy beneath HAFB. This stratigraphy is characterized by interlaying lenticular, laterally discontinuous gravel, sand, and clay beds.

2.4.3 Pond 3 Hydrogeology

2.4.3.1. A shallow groundwater system exists below the Pond 3 area at a depth of approximately 50 to 60 feet bgs. The shallow water table is unconfined with low-permeability clays of the Alpine Formation, forming a lower barrier or aquitard. Numerous perched groundwater layers exist above the shallow water table; the layers are formed by thin clay and silt layers within the Provo Formation. Groundwater recharge of the shallow aquifer is probably from infiltration of precipitation, irrigation, pond seepage, and from groundwater underflow from the east. The water from both Pond 1 and Pond 3 likely contributes to recharge of the shallow aquifer before flowing off-Base. Groundwater in the shallow aquifer potentially discharges to low yield private wells, seeps, springs, drains, and streams located off-Base to the south.

2.4.3.2. The drinking water aquifers in the area are located approximately 500 to 600 feet bgs. Low-permeability clays of the Alpine Formation separate the shallow groundwater aquifer from the artesian drinking water aquifers. The low permeability Alpine clays are 400 to 500 feet thick in this area.

2.5 Extent of Contamination

2.5.1 Introduction

2.5.1.1. The area of contamination coincides with the Pond 3 area as shown in Figures 2-2 and 2-3. The extent of contamination was determined by the analysis of soil samples from 77 sampling points located throughout the pond area. Most of the sample points were concentrated near pond inlets with the exception of the area delineated with arsenic contamination. The locations of the sampling points are presented in Figure 2-2.

2.5.2 Sources of Contaminants

2.5.2.1. The most likely source of the contamination found in the Pond 3 sediments is the former storm drain system. Pond 1 and Berman Pond were used as the outfall for the Base storm drain system until 1956, when the Industrial Wastewater Treatment Plant (IWTP) and associated industrial sewer were constructed. The storm drain systems operated as the industrial sewer until facility connections to the industrial sewer were completed during the early 1960s. Pond 3 was connected to the storm drain system in 1957, receiving storm water from Pond 1 and other industrial areas north of Pond 3. Sources of contamination during this pre-industrial sewer period were from normal shop operations and spills in the industrial area.

2.5.2.2. As previously discussed in Section 2.3.4, the source of PAH contamination is the asphalt particles transported from paved parking lots and roads to the pond sediments by the storm drain system. The metal contamination may be contributed to the maintenance operations conducted on Base prior to the installation of the Industrial Wastewater Collection System (IWCS).

2.5.2.3. The arsenic contamination at Pond 3 is isolated near the south bank of the pond. The storm drain system is not a definite source of arsenic contamination because an inlet or outlet does not exist in close proximity to the arsenic-contaminated area. The arsenic source may be due to the dumping of arsenic-contaminated waste, soil, debris, etc. into the pond from the south bank. No record of any dumping in this area has been found. Due to this uncertainty, the source of arsenic contamination cannot be confidently determined.

2.5.3 Types of Contaminants

2.5.3.1. The principal sediment contaminants at Pond 3 are PAHs and metals. The PAHs are from asphalt particles transported from paved parking lots and roads through the storm drain system to the pond. The metal contamination is indicative of the aircraft repair and maintenance operations conducted on Base. The PAH-contaminated sediments are located near the east and west pond inlets and the metal-contaminated sediments are concentrated along the south bank, near the west end of the pond.

2.5.4 Contaminant Mobility

2.5.4.1. Contaminant mobility was evaluated in the *Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas* (MW, 2000). The evaluation indicated that arsenic and PAHs tend to adsorb to sediment particles and are relatively immobile, limiting transport in groundwater and surface water. Based on the depths of contamination, the contamination has not migrated an appreciable distance into native materials. This provides further evidence that the contaminants are relatively immobile. These compounds generally persist in the subsurface environment and are not biodegradable. As identified by sampling and shown in Figure 2-3, the contaminant concentrations that exceed background concentrations for arsenic are primarily limited to the top 4 feet of sediments. Degradation processes that may affect these compounds occur at very slow rates. Therefore, it appears that the contaminants found in Pond 3 are relatively stable and immobile.

2.5.5 Risk-Based Screening Levels

2.5.5.1. The RBSLs used for comparison in this EE/CA are the residential RBSLs that were derived in the *Final Comprehensive Data Evaluation for the South Area of Operable Unit 9 Site Inspection* (*OU9 SI)* (CH2M HILL, 2001). The RBSLs were developed within the *OU9 SI* to provide a standard to compare sediment and groundwater contamination levels throughout HAFB. Background concentrations of metals were taken into account during the calculation of the OU9 RBSLs. RBSLs were calculated for both residential and industrial applications.

2.5.5.2. For this EE/CA, the more stringent residential RBSLs have been used. Although in this case, the residential RBSL of 9.76 mg/kg is equivalent to the industrial RBSL and background level for arsenic. Depending on the selected removal alternative, the use of residential RBSLs potentially allows for site closure and unrestricted development. With the

closure of the pond, the Air Force would not continue managing the area and would not be restricted in future use of the land. All removal alternatives utilize the residential RBSLs when identifying the extent of contamination to be remediated or removed. Not all the remedial alternatives discussed in this *EE/CA* will conclude in site closure of the pond.

2.5.5.3. After comparing Pond 3 sediment contaminants to the OU9 residential RBSLs, several exceedances were observed. These exceedances were due to elevated levels of PAHs, arsenic, cadmium, lead, and Deldrin. As previously discussed PAHs are indicative of asphalt particles transported to the pond by storm water, therefore the PAHs are not considered a Chemical of Concern (COC) for this EE/CA and will be neglected when developing the removal action alternatives. As stated in Section 2.3.2, the elevated levels of cadmium and lead at Soil Boring U9-7667 are assumed to be elevated background levels. The elevated level of Deldrin at the same location is assumed to be isolated to this location only and is not considered a Chemical of Concern (COC). All sediment samples that exceeded the residential RBSLs are summarized in Table 2-1.

2.6 Contaminated Sediment Identification and Disposal Options

2.6.1 Contaminated Sediment Identification

2.6.1.1. The first step in calculating the estimated volume of sediment that requires removal or remediation consisted of plotting the sediment sample locations on a map of the pond area. The sediment samples that exceeded residential RBSLs were distinguished from the samples that did not exceed residential RBSLs (Figure 2-2). In order to delineate the areas requiring remediation, boundaries were drawn around clusters of sediment samples that exceeded residential RBSLs for arsenic only. Samples that did not exceed residential RBSLs for arsenic were used to establish a removal boundary. As shown in Figure 2-3, four areas were defined as areas requiring remediation.

2.6.1.2. Once removal boundaries were established, the square footage of the area was calculated. In order to determine the volume of soil, a depth of removal was needed. The removal depth was based on the analysis of the contamination levels with respect to depth. A series of cross sections drawn with the location of each of the sample points was plotted along with the depth of each individual sample. The cross section locations are shown in Figure 2-3. The cross sections are presented in Figure 2-4. Only the exploration points that were significant in defining the contamination boundaries are presented in the cross sections. The samples with contamination levels above residential RBSLs are plotted in red. All other samples are plotted in blue. The cross sections show that nearly all of the sample points that exceed residential RBSLs for arsenic are shallow, 0 to 4 feet bgs. The clean samples below the removal areas were used as a reference point when identifying the excavation depth for the area. For example, if a sample taken at 0 to 2 feet exceeded background levels for arsenic, but the sample taken at 2 to 4 feet at the sample location did not exceed the background level, the remedial boundary was set at 2 feet. The vertical extent of the remedial boundary for Area 1 is 2 feet bgs, Area 2 is 2 to 4 feet bgs, Area 3 is 2 to 4 feet bgs, and Area 4 is 1 foot bgs. The vertical extent, estimated surface area, and volume of each sediment removal area are presented in Table 2-3. The information in Table 2-3 was used in estimating the cost of each remedial alternative presented in Section 3.0.

2.6.2 Confirmation Sampling

2.6.2.1. Confirmation sampling is required for complete closure of Pond 3. If the confirmation sampling results are below residential RBSLs, no further action will be required and the site will be considered closed upon receiving regulatory approval. If the results continue to exceed residential RBSLs, further removal/remediation would be needed. Details of the proposed confirmation sampling are included in Pond 3 Alternatives Descriptions, Section 4.2.

2.6.3 Disposal Regulations

2.6.3.1. The sediments that are identified as exceeding the residential RBSLs will be excavated, classified, and disposed of in accordance with the ARARs that are identified in Appendix C as part of Alternatives 2 and/or 3. The first step in classifying the sediment is to determine whether the sediment contains a hazardous waste regulated under the Resource, Conservation, and Recovery Act (RCRA). This is known as the "Contained In" Policy. This policy states that environmental media such as soil are not, of themselves, hazardous wastes. However, they become subject to RCRA as a hazardous waste if the media exhibits a hazardous waste characteristic (40 CFR 261, Subpart C), or if they contain a listed hazardous waste identified in 40 CFR 261, Subpart D. If the media is classified as a hazardous waste under 40 CFR 261, they will be managed as such for treatment and disposal. It is assumed that the environmental media at Pond 3 do not contain a listed hazardous waste.

2.6.3.2. The CERCLA Off-Site Rule requires that hazardous substances, pollutants or contaminants transferred off-site for treatment, storage or disposal during a CERCLA response action be transferred to a facility operating in compliance with 3004 and 3005 of RCRA and other applicable laws or regulations. The contaminated media at Pond 3 will only be transported to a RCRA-approved facility. In order to be compliant with this rule (40 CFR 300.440), HAFB will obtain EPA approval prior to sending Pond 3 contaminated media to a disposal facility. EPA will determine the acceptability of the selected disposal facility under RCRA and other applicable laws or regulations.

2.6.3.3. Disposal Options. If the sediment is classified as a hazardous waste and removed for offsite disposal, it will be transported to a permitted RCRA Subtitle C facility for treatment and/or disposal. The hazardous sediment is also subject to the RCRA Land Disposal Restriction (LDR) program unless the sediment is managed or disposed in a Corrective Action Management Unit (CAMU). Under the LDR program, it must be determined whether the sediment meets specific treatment standards for each hazardous waste characteristic prior to offsite land disposal. The LDR program also requires the identification of any underlying hazardous constituent that could reasonably be expected in a characteristic hazardous waste (i.e., hazardous sediment). For both the toxicity characteristic and the underlying hazardous constituents, the sediments need only be treated to ten times the universal treatment standards (UTS) or reduce the contaminant concentration by 90 percent, whichever is greater (40 CFR 268.49), prior to disposal.

2.6.3.4. Prior to offsite treatment or disposal of sediments, a representative sample will be taken of the sediments and analyzed for all potential contaminants. The analytical results will be compared to ten times the UTS for each contaminant and disposal options will be determined. The UTS for each contaminant and disposal options will be determined. The

UTS for arsenic is 5 milligram per liter, determined using the Toxic Characteristic Leaching Procedure (TCLP).

2.6.3.5. The treatment cell in Alternative 3 will be considered a CAMU. The CAMU will remain within the Pond 3 boundary, therefore LDRs will not be triggered during excavation and disposal of the hazardous sediments into the treatment cell.

2.6.3.6. In summary, sediments excavated for offsite treatment or disposal that contain a hazardous waste will be sent to a Subtitle C facility. Excavated sediment that does not contain hazardous waste and is not otherwise prohibited from land disposal may be disposed offsite at a Subtitle D facility. For this EE/CA, it is assumed that any sediment removed for offsite disposal (Alternative 2), will be sent directly to a Subtitle D facility, Subtitle C facility, or stabilized and disposed at a Subtitle C facility.

TABLE 2-1
Pond 3 Samples Exceeding Residential RBSLs
HAFB Pond 3 EE/CA

Exploration Point	Analyte	Depth (feet bgs)	Concentration (mg/kg)	Residential RBSL (mg/kg)
U9-7644	Arsenic	0-1	13.1	*9.76
U9-7649	Benzo(a) Anthracene	0-2	2.2	0.88
U9-7649	Benzo(a) Pyrene	0-2	2.5	0.088
U9-7649	Benzo(b) Fluoranthene	0-2	3.4	0.88
U9-7649	Benzo(g,h,I) Perylene	0-2	1.6	0.88
U9-7649	Indeno(1,2,3-c,d) Pyrene	0-2	1.7	0.88
U9-7650	Benzo(a) Pyrene	0-2	0.95	0.088
U9-7650	Benzo(b) Fluoranthene	0-2	1.3	0.88
U9-7652	Arsenic	0-0.5	89.4	*9.76
U9-7653	Arsenic	0-0.5	22.5	*9.76
U9-7656	Benzo(a) Pyrene	0-0.5	0.3	0.088
U9-7657	Benzo(a) Pyrene	0-0.5	0.1	0.088
U9-7659	Benzo(a) Pyrene	1.5-2	0.2	0.088
U9-7661	Benzo(a) Anthracene	2-4	5.3	0.88
U9-7661	Benzo(a) Pyrene	2-4	5.1	0.088
U9-7661	Benzo(b) Fluoranthene	2-4	7.0	0.88
U9-7661	Benzo(g,h,I) Perylene	2-4	2.6	0.88
U9-7661	Dibenzo(a,h) Anthracene	2-4	0.6	0.088
U9-7661	Indeno(1,2,3-c,d) Pyrene	2-4	3.0	0.88
U9-7662	Benzo(a) Pyrene	0-2	0.2	0.088
U9-7664	Benzo(a) Pyrene	0-2	0.1	0.088
U9-7665	Benzo(a) Pyrene	0-2	0.2	0.088
U9-7667	Cadmium	0-2	6.2	*3.58
U9-7667	Lead	0-2	422.0	400
U9-7667	Deldrin	0-2	0.1	0.04
U9-7667	Benzo(a) Pyrene	0-2	0.5	0.088
U9-7817	Arsenic	2-4	11.2	*9.76
U9-7818	Arsenic	0-2	116.6	*9.76
U9-7822	Arsenic	2-4	12.2	*9.76
U9-7823	Arsenic	0-2	12.9	*9.76
U9-7831	Arsenic	0-2	35.4	*9.76
U9-7842	Arsenic	0-2	11.6	*9.76
U9-7847	Arsenic	0-2	47.2	*9.76
U9-7849	Arsenic	0-2	12.2	*9.76
U9-7852	Arsenic	0-2	24.6	*9.76
U9-7860	Arsenic	0-2	14.7	*9.76
U9-P3-700	Benzo(a) Pyrene	1-2	0.5	0.088
U9-P3-709	Arsenic	0-1	115.0	*9.76
U9-P3-709	Arsenic	2-3	26.8	*9.76

Notes: * Background Concentration
bgs = below the ground surface
mg/kg = milligrams per kilogram [parts per million (ppm)]

TABLE 2-2
Pond 3 Samples Exceeding Arsenic Background Level of 9.76 mg/kg

Location	Date Collected	Depth (feet bgs)	Arsenic Concentration (mg/kg)
U9-P3-709	10/11/00	0-1	115
U9-P3-709	10/11/00	2-3	22.5 J
U9-7644	10/17/01	0-1	13.1 B
U9-7652	3/5/02	0-0.5	89.4
U9-7653	3/5/02	0-0.5	22.5 J
U9-7817	9/20/02	2-4	11.2
U9-7818	9/24/02	0-2	116.6
U9-7822	9/20/02	2-4	12.2
U9-7831	9/20/02	0-2	35.4
U9-7823	9/20/02	0-2	12.9
U9-7842	12/6/02	0-2	11.6
U9-7847	12/6/02	0-2	47.7
U9-7849	12/6/02	0-2	12.2
U9-7852	12/6/02	0-2	24.6
U9-7860	12/6/02	0-2	14.7

Notes:
J = Estimated Value
B = Analyte is detected in an associated blank
bgs = below the ground surface
mg/kg = milligrams per kilogram
ppm = parts per million

TABLE 2-3
Contaminated Sediment Volume Estimates

Contaminated Sediment Area	Area (ft^2)	Remediation Depth (ft bgs)	Total Volume of Excavated Sediment (cy)
1	338	2	25
2	843	2	63
	289	4	43
3	183	2	14
	204	4	30
4	180	1	7
Totals	**2,037**		**182 ≅ 200 cy**

ft^2 = square feet
ft bgs = feet below the ground surface
cy = cubic yards

\\Slcdb\GIS\HAFB\OU_09\Pond-3\Map_Documents\figure2-1.mxd; 02-06-02; nds

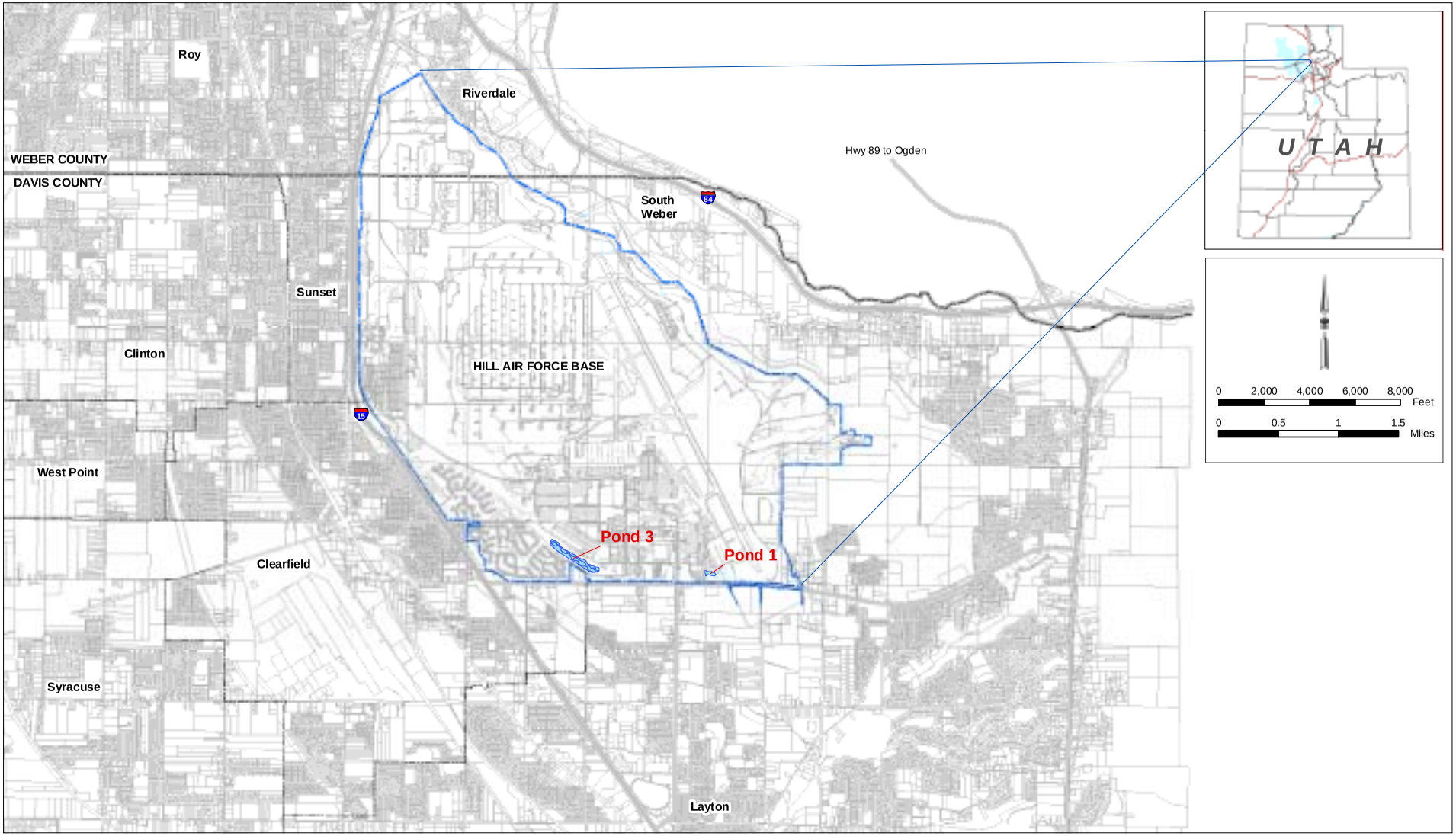


FIGURE 2-1
POND 3 REGIONAL LOCATION MAP
POND 3 EE/CA
HILL AIR FORCE BASE, UTAH
CH2MHILL

\\Slcdb\GIS\HAFB\OU_09\Pond-3\Map_Documents\figure2-2.mxd; 02-06-03; nds

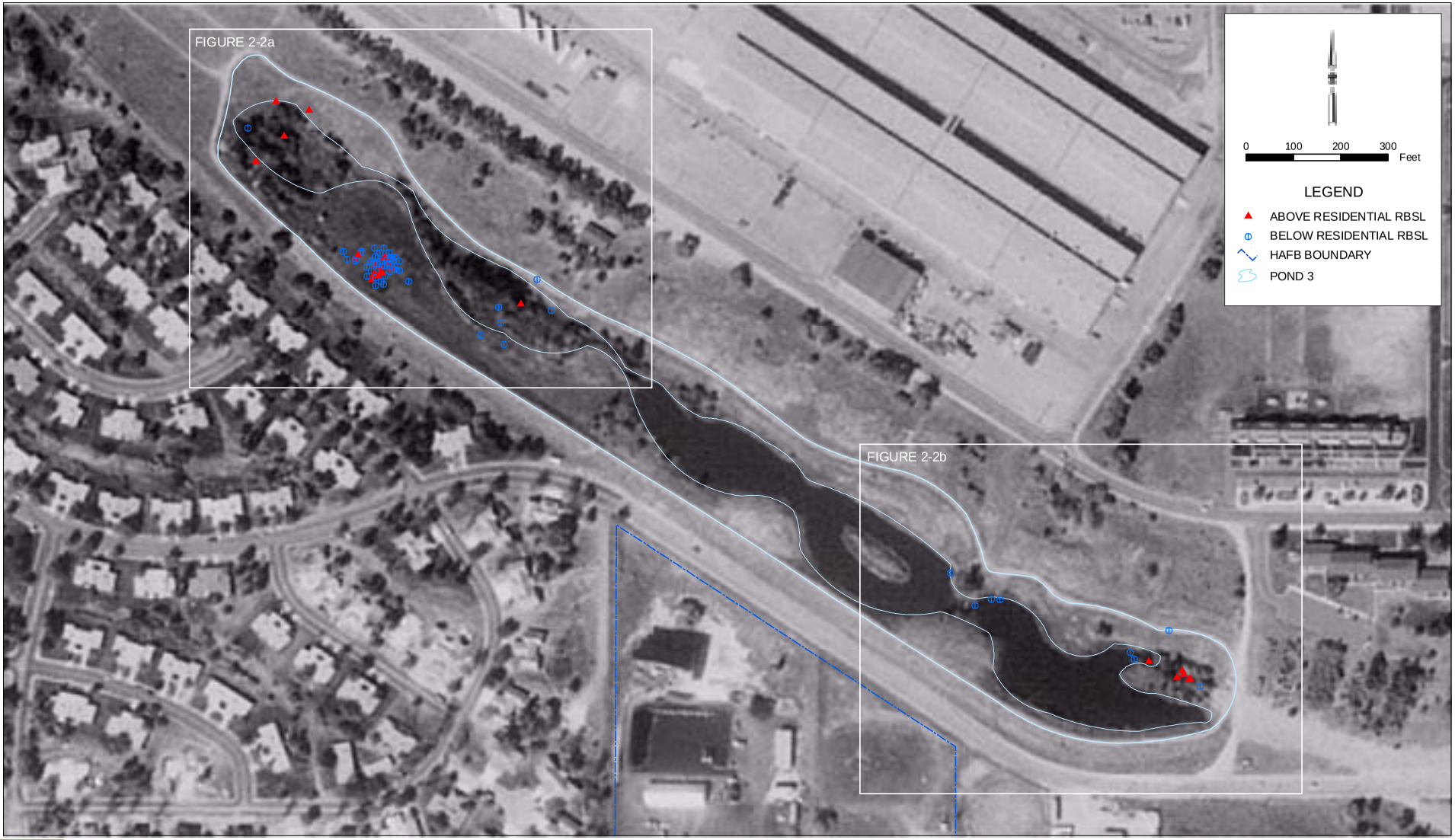
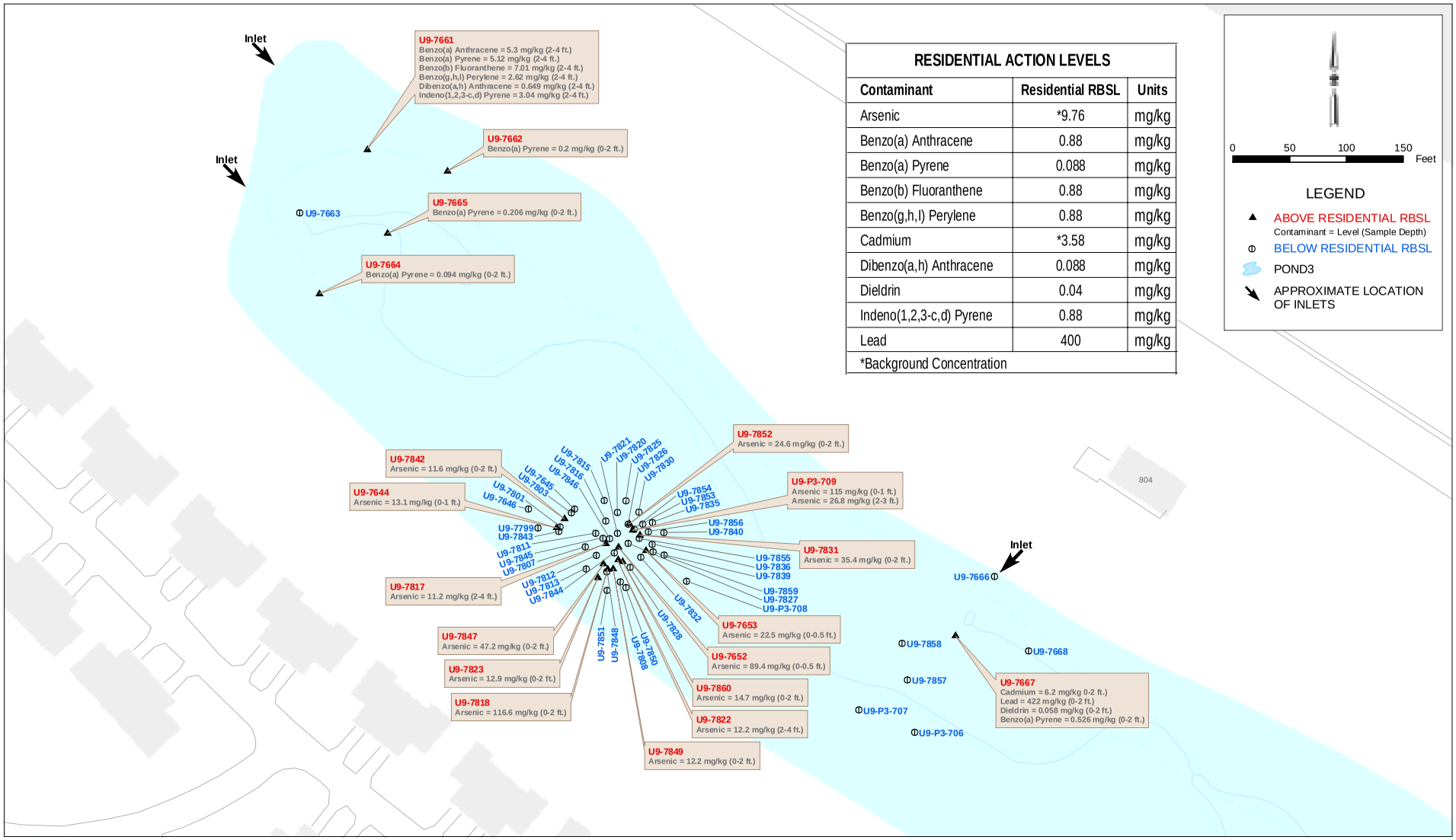


FIGURE 2-2
POND 3 EXPLORATION POINT LOCATION MAP
POND 3 EE/CA
HILL AIR FORCE BASE, UTAH
CH2MHILL

\\Slcdb\GIS\HAFB\OU_09\Pond-3\Map_Documents\figure2-2a.mxd; 02-06-03; nds



RESIDENTIAL ACTION LEVELS		
Contaminant	Residential RBSL	Units
Arsenic	*9.76	mg/kg
Benzo(a) Anthracene	0.88	mg/kg
Benzo(a) Pyrene	0.088	mg/kg
Benzo(b) Fluoranthene	0.88	mg/kg
Benzo(g,h,I) Perylene	0.88	mg/kg
Cadmium	*3.58	mg/kg
Dibenzo(a,h) Anthracene	0.088	mg/kg
Dieldrin	0.04	mg/kg
Indeno(1,2,3-c,d) Pyrene	0.88	mg/kg
Lead	400	mg/kg
*Background Concentration		

FIGURE 2-2a

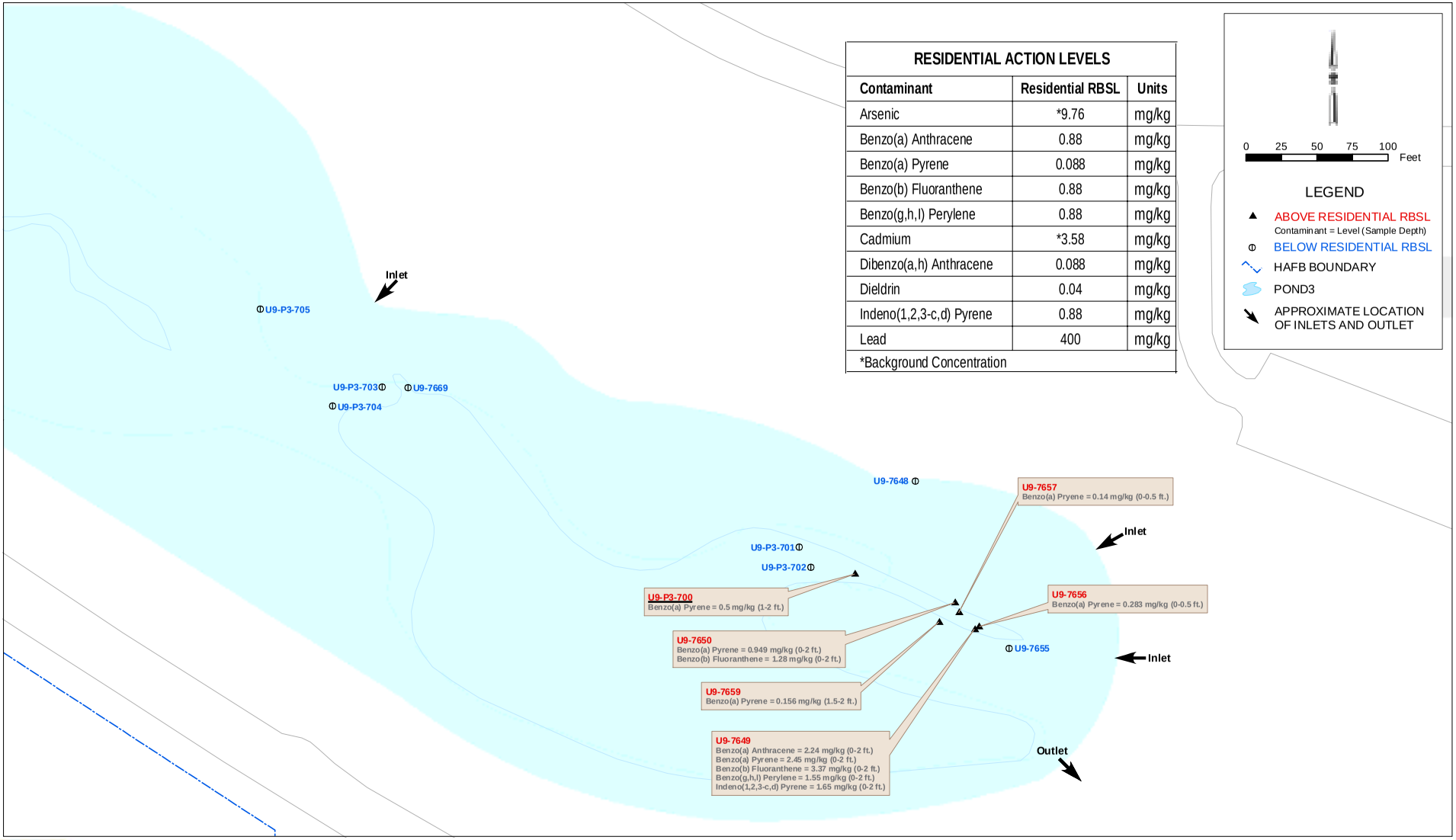
POND 3 EXPLORATION POINT LOCATION MAP AND RESIDENTIAL RBSL EXCEEDANCE RESULTS

POND 3 EE/CA

HILL AIR FORCE BASE, UTAH

CH2MHILL

\\Slcdb\GIS\HAFB\OU_09\Pond-3\Map_Documents\figure2-2b.mxd; 02-06-03; nds



RESIDENTIAL ACTION LEVELS

Contaminant	Residential RBSL	Units
Arsenic	*9.76	mg/kg
Benzo(a) Anthracene	0.88	mg/kg
Benzo(a) Pyrene	0.088	mg/kg
Benzo(b) Fluoranthene	0.88	mg/kg
Benzo(g,h,I) Perylene	0.88	mg/kg
Cadmium	*3.58	mg/kg
Dibenzo(a,h) Anthracene	0.088	mg/kg
Dieldrin	0.04	mg/kg
Indeno(1,2,3-c,d) Pyrene	0.88	mg/kg
Lead	400	mg/kg
*Background Concentration		

FIGURE 2-2b

POND 3 EXPLORATION POINT LOCATION MAP AND RESIDENTIAL RBSL EXCEEDANCE RESULTS

POND 3 EE/CA

HILL AIR FORCE BASE, UTAH

CH2MHILL

\\Slcdb\GIS\HAFB\OU_09\Pond-3\Map_Documents\figure2-3.mxd; 02-06-03; nds

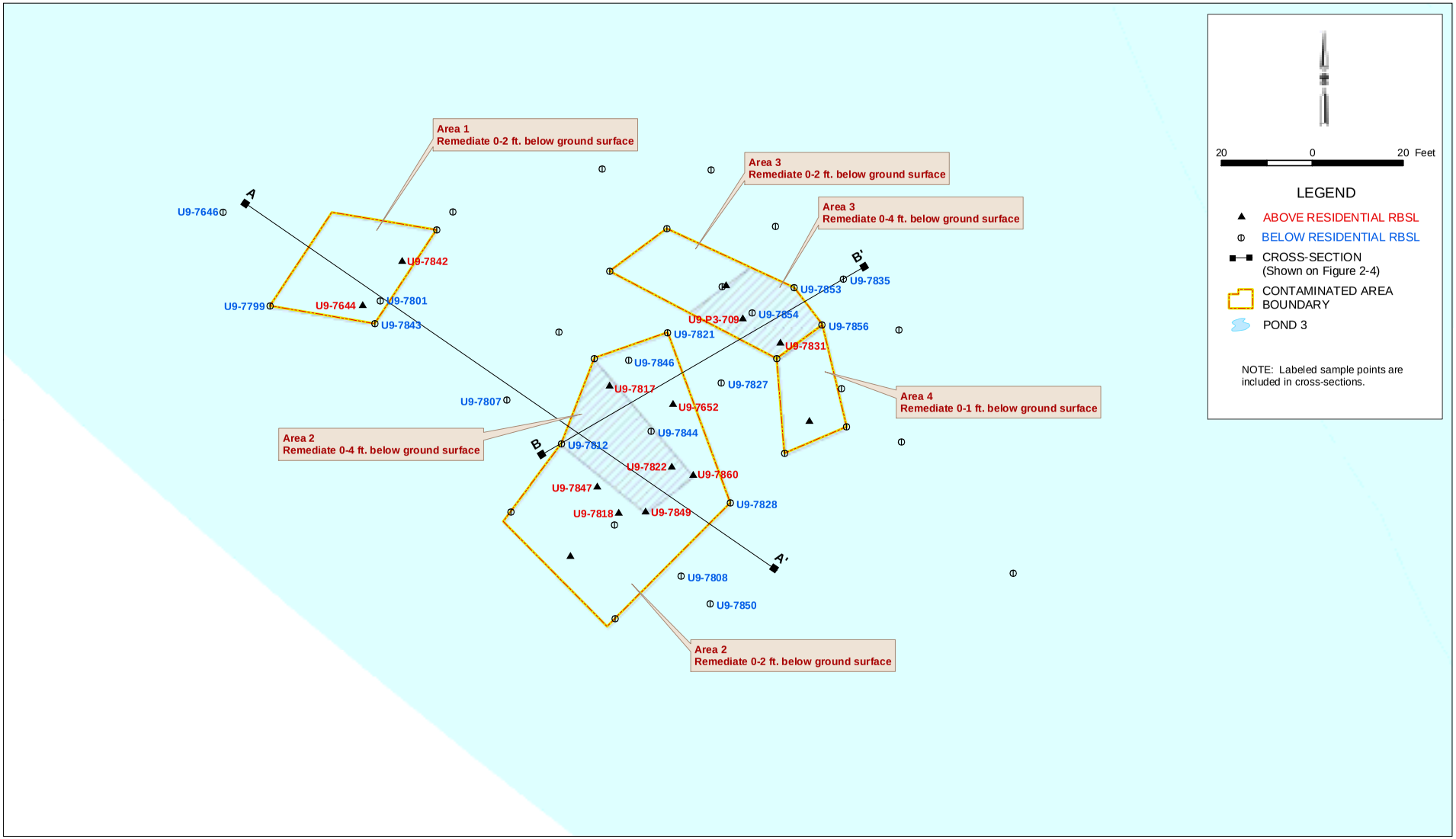


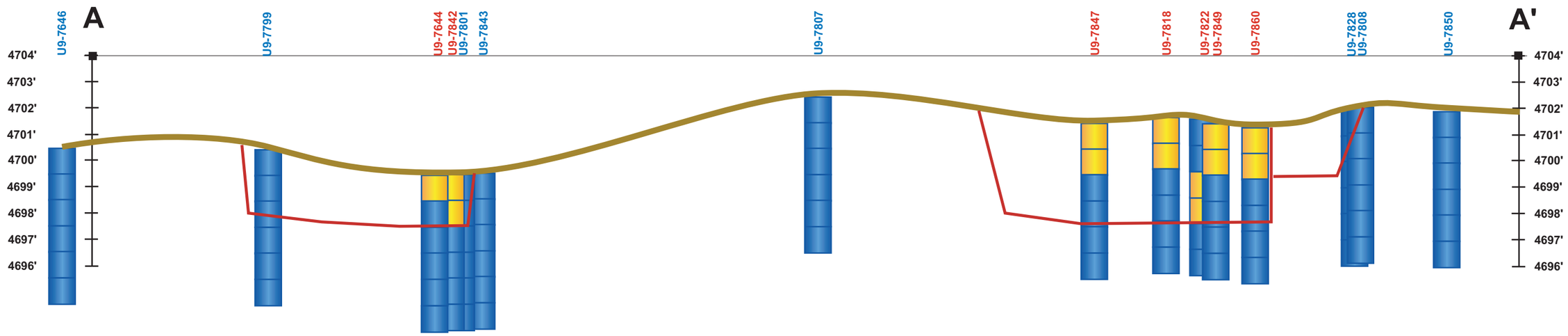
FIGURE 2-3

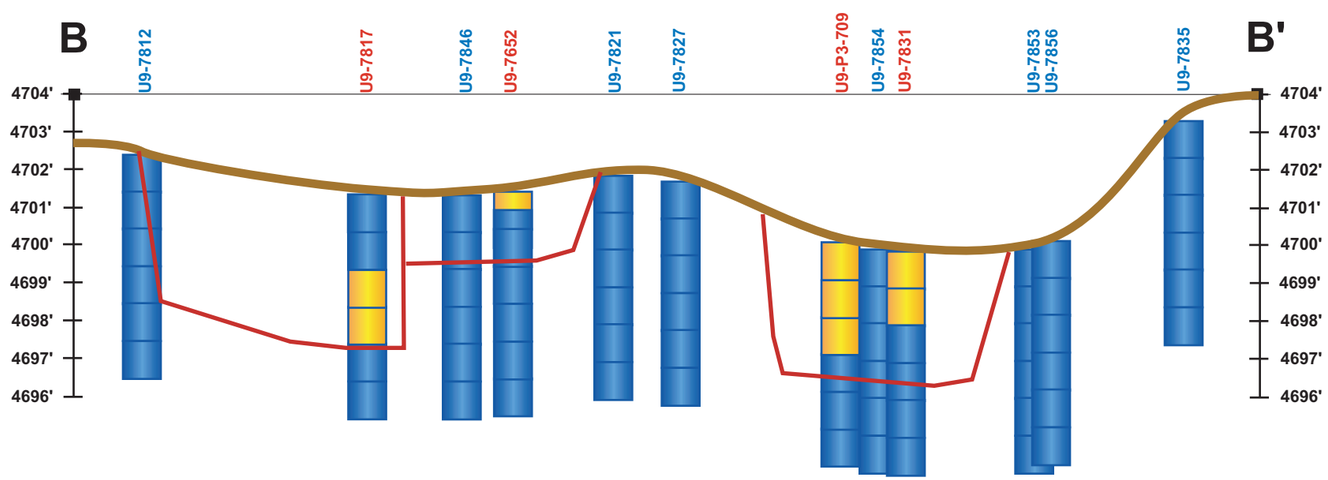
CONTAMINATED SEDIMENT AREAS AND CROSS-SECTION POINTS AND LOCATIONS

POND 3 EE/CA

HILL AIR FORCE BASE, UTAH

CH2MHILL





NOT TO SCALE

LEGEND

- ABOVE RESIDENTIAL RBSL
- BELOW RESIDENTIAL RBSL
- APPROXIMATE GROUND SURFACE
- EXCAVATION LIMIT

FIGURE 2-4
POND 3 CROSS-SECTIONS
POND 3 EE/CA
HILL AIR FORCE BASE, UTAH
CH2MHILL

3.0 Removal Action Objectives and Scope

3.1 Objectives

3.1.1 Introduction

3.1.1.1. The overall Removal Action Objective for Pond 3 is to minimize the threat of human and environmental exposure to contaminated pond sediments.

3.1.2 Specific Objectives

3.1.2.1. Excavation / extraction and / or remediation of contaminated pond sediments in the prescribed areas will eliminate the possibility of human or environmental exposure in the Pond 3 area.

3.2 Scope of the Removal Action

3.2.0.1. The scope of the removal action includes the removal and / or remediation of the contaminated sediments. The removal alternatives include:

- No action
- Sediment removal and disposal at an off-site landfill
- Phytoremediation through metal extraction in a lined treatment cell

3.2.0.2. Sediment removal and disposal at an off-site landfill involves excavating the defined contaminated areas, confirmation sampling, and transport and disposal of the contaminated sediments at an approved facility. Both the no action and phytoremediation alternatives will require long-term management, as opposed to removal and off-site disposal which closes the site to further action. However, the phytoremediation alternative does have the potential to remediate the sediments to acceptable concentration levels that could eventually lead to site closure.

3.3 Applicable or Relevant and Appropriate Requirements

3.3.0.1. The requirements in Section 121 of CERCLA generally apply only to final remedial actions. However, when a removal action involves the transfer of a hazardous substance, pollutant, or contaminant off-site, the National Oil and Hazardous Substances Pollution and Contingency Plan (NCP) requires that ARARs be identified and complied with to the greatest extent practicable pursuant to CERCLA Sections 104 and 106 [40 CFR 300.415(i)]. Removal actions must also, to the extent practicable, contribute to the efficient performance of any anticipated long-term remedial action [40 CFR 300.415(c)]. Therefore, to the extent practicable, the removal actions included in this EE / CA will comply with ARARs.

3.3.0.2. A waiver for these requirements may be invoked under 40 CFR 300.430(f)(1)(ii)(C)(1) of the NCP. An alternative that does not meet an ARAR under federal environmental,

state environmental, or facility siting laws may be selected when the alternative is an interim measure and will become part of a total remedial action that will attain the state or federal ARAR. Any ARARs waived for interim remedial actions must be re-examined in the final remedial action.

3.3.0.3. According to EPA guidance, *Superfund Removal Procedures: Guidance on the Consideration of ARARs During Removal Actions* (EPA, 1991), the following three types of ARARs exist:

- Chemical-specific ARARs set levels that are protective of human health and the environment for the COCs in the designated media, or set acceptable levels of discharge
- Location-specific ARARs set limits on activities based on the site location or other characteristics
- Action-specific ARARs establish controls on site activities that are part of removal solutions

3.3.0.4. A summary of all federal and state chemical-, location-, and action-specific ARARs identified for potential removal actions at Pond 3 is included in Appendix C.

4.0 Engineering Evaluation/Cost Analysis of Alternatives

4.1 Introduction

4.1.0.1. The detailed analysis of alternatives presents the relevant information needed to compare the removal alternatives assembled for Pond 3. The detailed analysis of alternatives follows the development and screening of alternatives, and precedes the selection of a final remedy. The extent to which alternatives are evaluated during the detailed analysis is influenced by the available data and the number and types of alternatives being analyzed.

4.1.0.2. Detailed analysis of alternatives consists of the following components:

- A detailed evaluation of each alternative against seven evaluation criteria
- A comparative analysis of the alternatives to assess the relative performance of each alternative with respect to each of the seven evaluation criteria.

4.1.1 Evaluation Criteria

4.1.1.1. In accordance with the NCP, remedial actions must:

- Be protective of human health and the environment
- Attain ARARs or provide grounds for invoking a waiver of ARARs that cannot be achieved
- Be cost-effective
- Utilize permanent solutions and alternative treatment technologies or resource-recovery technologies to the maximum extent practicable
- Satisfy the preference for treatment that reduces toxicity, mobility, or volume (TMV) as a principal element, or provide an explanation of why it does not

4.1.1.2. In addition, the NCP emphasizes long-term effectiveness and related considerations including:

- The long-term uncertainties associated with land disposal
- The goals, objectives, and requirements of the Solid Waste Disposal Act
- The persistence, toxicity, and mobility of hazardous substances and their constituents and their propensity to bio-accumulate
- The short- and long-term potential for adverse health effects from human exposure
- Long-term maintenance costs

- The potential for future remedial action costs if the selected remedial action fails
- The potential threat to human health and the environment associated with excavation, transportation, disposal, or containment

4.1.1.3. Provisions of the NCP require each alternative to be evaluated against the nine criteria listed in 40 CFR 300.430(e)(9). These criteria were published in the March 8, 1990 *Federal Register* (55 FR 8666), to provide grounds for comparing the relative performance of the alternatives and to identify their advantages and disadvantages. This approach is intended to provide sufficient information to adequately compare the alternatives and to eventually select the most appropriate alternative for implementation at the site as a remedial action. The evaluation criteria are:

- Overall protection of human health and the environment
- Compliance with ARARs
- Long-term effectiveness and permanence
- Reduction of TMV through treatment
- Short-term effectiveness
- Implementability
- Cost
- State acceptance
- Community acceptance

4.1.1.4. The nine criteria are divided into three groups: threshold, balancing, and modifying criteria. Threshold criteria must be met by a particular alternative for it to be eligible for selection as a remedial action. There is little flexibility in meeting the threshold criteria; either they are met by a particular alternative, or that alternative is not considered acceptable. The two threshold criteria are overall protection of human health and the environment, and compliance with ARARs. If ARARs cannot be met, a waiver may be obtained in situations where one of the six exceptions listed in the NCP occurs [see 40 CFR 300.430 (f)(1)(ii)(C)(1 to 6)].

4.1.1.5. Unlike the threshold criteria, the five balancing criteria weigh the trade-offs between alternatives. A low rating on one balancing criterion can be compensated by a high rating on another. The five balancing criteria are: long-term effectiveness and permanence, reduction of TMV through treatment, short-term effectiveness, implementability, and cost. The two modifying criteria are state acceptance and community acceptance. All nine evaluation criteria are briefly described below.

4.1.1.6. **Threshold Criteria.** To be eligible for selection, an alternative must meet the two threshold criteria described below, or in the case of ARARs, must justify why a waiver is appropriate.

- **Overall Protection of Human Health and the Environment.** Protectiveness is the primary requirement that remedial actions must meet under CERCLA. A remedy is protective if it adequately eliminates, reduces, or controls all current and potential risks posed by the site through each exposure pathway. The assessment against this criterion describes how the alternative achieves and maintains protection of human health and the environment.

- **Compliance with ARARs.** Compliance with ARARs is one of the statutory requirements of remedy selection. ARARs are cleanup standards, standards of control, and other substantive environmental statutes or regulations which are either “applicable” or “relevant and appropriate” to the CERCLA cleanup action [42 USC 9621 (d) (2)]. “Applicable” requirements address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. “Relevant and appropriate” requirements are those that, although not “applicable”, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to environmental or technical factors at a particular site. The assessment against this criterion describes how the alternative complies with ARARs or presents the rationale for waiving an ARAR. ARARs can be grouped into three categories:

  – **Chemical-Specific.** ARARs are health- or risk-based numerical values or methodologies which, when applied to site-specific conditions, establish the amount or concentration of a chemical that may remain in or be discharged to the environment.

  – **Location-Specific.** ARARs restrict the concentration of hazardous substances or the conduct of activities solely because they are in specific locations, such as flood plains, wetlands, historic places, and sensitive ecosystems or habitats.

  – **Action-Specific.** ARARs include technology- or activity-based requirements that set controls, limits, or restrictions on the design performance of remedial actions or management of hazardous constituents.

4.1.1.7. Appendix C presents a compilation of all the state and federal chemical-specific, location-specific, and action-specific ARARs considered for Pond 3.

4.1.1.8. Balancing Criteria. The five criteria listed below represent the criteria upon which the detailed evaluation and comparative analysis of alternatives is based.

- **Long-Term Effectiveness and Permanence.** This criterion reflects CERCLA's emphasis on implementing remedies that will ensure protection of human health and the environment in the long term as well as in the short term. The assessment of alternatives against this criterion evaluates the residual risks at a site after completing a remedial action or enacting a no action alternative and includes evaluation of the adequacy and reliability of controls.

- **Reduction of TMV through Treatment.** This criterion addresses the statutory preference for remedies that employ treatment as a principal element. The assessment against this criterion evaluates the anticipated performance of the specific treatment technologies that an alternative may employ. The criteria is specific to evaluating only how treatment reduces TMV and does not address containment actions such as capping.

- **Short-Term Effectiveness.** This criterion addresses short-term impacts of the alternatives. The assessment against this criterion examines the effectiveness of alternatives in protecting human health and the environment (i.e., minimizing any risks associated with an alternative) during the construction and implementation of a remedy until the response objectives have been met.

- **Implementability.** The assessment against this criterion evaluates the technical and administrative feasibility of the alternative and the availability of the goods and services needed to implement it.

- **Cost.** Cost encompasses all engineering, construction, and operation and maintenance (O&M) costs incurred over the life of the project. The assessment against this criterion is based on the estimated present worth of these costs for each alternative. Present worth is a method of evaluating expenditures, such as construction and O&M that occur over different lengths of time. This allows costs for remedial alternatives to be compared by discounting all costs to the year that the alternative is implemented. The present worth of a project represents the amount of money, which, if invested in the initial year of the remedy and disbursed as needed, would be sufficient to cover all costs associated with the remedial action. As stated in the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (*RI/FS Guidanc*e) (EPA, 1988), these estimated costs are expected to provide an accuracy of plus 50 percent to minus 30 percent. Appendix D provides a breakdown of the cost estimate for each of the alternatives.

4.1.1.9. The level of detail required to analyze each alternative against these evaluation criteria depends on the nature and complexity of the site, the types of technologies and alternatives being considered, and other project-specific considerations. The analysis is conducted in sufficient detail to understand the significant aspects of each alternative and to identify the uncertainties associated with the evaluation.

4.1.1.10. Modifying Criteria. As described in the *RI/FS Guidance*, the final two screening criteria are state acceptance and community acceptance. These modifying criteria are described as follows:

- **State Acceptance.** This criterion, which is an ongoing concern throughout the remedial process, reflects the statutory requirement to provide for substantial and meaningful state involvement. As a signatory to the FFA, the UDEQ has been, and currently is, involved in each step of the EE/CA process.

- **Community Acceptance.** This criterion reflects the community's preferences for, or concerns about, the remedial alternatives. A 30-day public comment period is provided for the community to ask questions and voice concerns about the remedial alternatives. A notice will be published in the local paper soliciting public comments on the final version of this document.

4.2 Pond 3 Alternatives Descriptions

4.2.0.1. This section describes the three alternatives evaluated for remediation of Pond 3 contaminated sediments. The three alternatives are considered the most plausible remediation techniques. The following three removal alternatives are described in this section:

- **Alternative 1—**No Action
- **Alternative 2—**Contaminated Sediment Removal with Off-Site Landfill Disposal

- **Alternative 3—**Phytoremediation through Metal Extraction in a Treatment Cell

4.2.1 Alternative 1—No Action

4.2.1.1. Alternative 1 consists of no action. The no action alternative is included to provide a baseline for evaluation of removal alternatives, as required by the NCP. Since the contamination levels exceed a risk-based standard, this is not an acceptable alternative.

4.2.2 Alternative 2—Contaminated Sediment Removal with Off-Site Landfill Disposal

4.2.2.1. Alternative 2 consists of contaminated sediments removal in Areas 1, 2, 3, and 4 as shown in Figure 4-1, followed by off-site treatment and/or disposal. The sediments would be excavated with standard grading equipment, such as trackhoes and front-end loaders, during a period when the western portion of the pond is dry and the sediments are unsaturated. The sediments in the contaminated area are normally unsaturated during the summer and early fall months, when limited precipitation occurs. Approximately 200 cubic yards (cy) of sediment contaminated with arsenic above background levels would be excavated from the Pond 3 area. The final volume of sediment is expected to bulk upon excavation to approximately 260 cy.

4.2.2.2. Following excavation, the sediments would be stockpiled or placed in roll-off type containers, and characterized to determine treatment and/or disposal requirements. If stockpile areas are necessary, the areas would be bermed and lined to prevent contaminating underlying soils and wind dispersion. The stockpile or soil staging locations would be west of the contaminated areas within the pond, in an area that would allow access for large trucks. The excavations would not be backfilled with fill material, but rather the area would be regraded to enhance natural drainage patterns and allow for added capacity within the pond.

4.2.2.3. Confirmation sampling of the exposed native soil would occur at the same time as the profiling of the stockpiles. Ten samples would be obtained within the excavations. If the analytical results from the confirmation sampling exceed background levels for arsenic, further investigation would occur to determine the depth to excavate. Localized excavation may occur to depths ranging from 1 to 2 feet.

4.2.2.4. If it is determined that the sediment contains a hazardous waste, (as discussed in Section 2.5), the sediments would be transported to a permitted Subtitle C facility for treatment and/or disposal. If the characterization data indicate that the hazardous waste constituents exceed the alternative LDR treatment standards of ten times the UTS, the sediments must be treated prior to disposal in a Subtitle C facility. Treatment before disposal will be conducted at the Subtitle C facility. If the sediment meets these LDR treatment standards, the sediment does not require treatment and can be directly disposed in a Subtitle C facility. However, if the characterization data indicate that sediment does <u>not contain</u> a hazardous waste, it may be disposed in a Subtitle D facility permitted and approved to accept this material. Hazardous and non-hazardous waste transportation would comply with all state and federal regulations.

4.2.2.5. Alternative 2a assumes that the sediment will be profiled as non-hazardous, allowing for disposal in a Subtitle D Facility. Alternative 2b assumes that the sediment will

be profiled as hazardous, but does not exceed the alternative LDRs. In this case, the sediment would be directly disposed in a Subtitle C Facility. In order to be conservative, Alternative 2c assumes that all the sediments will require treatment and disposal in a Subtitle C facility. This is the greatest cost scenario. It is possible that profiling may indicate otherwise and the sediment may not need to be treated before disposal or may not even be hazardous. If direct disposal in a Subtitle C facility were possible, the disposal cost would decrease by approximately $70 per ton. Direct disposal to a Subtitle D facility would be even less in cost ($30 per ton). These disposal alternatives will be evident once profiling has occurred at the time of construction.

4.2.3 Alternative 3— Phytoremediation through Metal Extraction in a Treatment Cell

4.2.3.1. Phytoremediation is the use of plant-based systems to clean or stabilize contaminated soil, sediment, and water. Phytoremediation has been utilized at a number of pilot and full-scale field demonstration sites for both metals and organic compounds. Successful application of any phytoremediation system requires a blend of many disciplines including engineering, hydrogeology, agronomy, soil science, and others. Phytoremediation is particularly well suited for the following:

- Large field sites where other methods of remediation are not cost-effective or practical
- Sites with low concentrations of contaminants where only “polishing treatment” is required over long periods
- Sites where vegetation is used as a final cap and closure
- Sites where ecological and aesthetic objectives (public relations, visibility, erosion control, endangered species habitat, etc.) are important considerations in the overall remedial strategy

4.2.3.2. Plant selection for phytoremediation of metals is more complex than for organic or nutrient contaminants. The ultimate goal of the phytoremediation system determines plant selection, in that different plants are needed for extraction than stabilization. As with other phytoremediation technologies, basic agronomic considerations such as adaptation to climate and soil characteristics also strongly influence plant selection.

4.2.3.3. Chinese brake fern (*Pteris vittata*) has become the species most notable recently for its high affinity for arsenic. *Pteris vittata* research has shown it to be one of a few known efficient arsenic hyperaccumulators by its ability to extract arsenic from soils both low (0.5 mg/kg) and high (7,500 mg/kg) in arsenic (Ma et al., 2001).

4.2.3.4. Phytoextraction Background. There are two basic phytoremediation approaches for metals in soils: phytoextraction and phytostabilization. Since the site may eventually be closed, arsenic removal using phytoextraction is the preferred option to eliminate the long-term risk to the environment from arsenic mobilization. Phytostabilization, which would leave arsenic in the soils, may not be suitable for long-term consideration since remobilization could occur if conditions change.

4.2.3.5. Vegetation Selected. Edenfern™, a proprietary form of *Pteris vittata*, is a perennial plant species that grows very rapidly in arsenic-contaminated soil. This fern species has

been shown to regenerate substantial shoot biomass within 3 weeks following harvest of the shoots, and consistently accumulates high arsenic concentrations in its roots and shoots from successive harvesting (Edenspace, 2003; Ma *et al.* 2001). Thus, Edenfern™ could provide a cost-effective, small-scale cleanup of arsenic-contaminated soil from the impacted areas.

4.2.3.6. The Edenfern™ would likely grow as an annual in the Plant Hardiness Zones 5 to 7 characteristic of Ogden, Utah's climate. To maximize the fern's impact in the soil each growing season, a planting density of one plant per square foot of treatment area is recommended in each treatment area.

4.2.3.7. Removal Capabilities. Edenfern™ is typically most effective at removing arsenic from the top 6 to 12 inches of soil. Deeper arsenic can be treated through excavation of the soil and spreading it over a liner. The time required to reduce soil arsenic by 10 mg/kg depends on the soil arsenic level and on growing conditions. Based on available data, Edenfern™ typically takes about 2 to 4 months to reduce soil arsenic by 10 mg/kg. The Edenfern™ has shown the ability to extract arsenic from soils with arsenic concentrations ranging from less than 1 mg/kg to as high as 2,500 mg/kg. Arsenic content in the leaves has been reported as high as 5,070 mg/kg (Chen et al., 2002).

4.2.3.8. Current research and field demonstrations indicate that metals are extractable from soils using plants and the use of chelates may accelerate metal uptake. However, the efficient removal of soil-bound metals is a sometimes slow process dependent on plant growth. With the removal of any soil-bound metals, associated food chain risks from metal accumulation in plant tissues must be considered in design. An example calculation for the time required for cleanup is as follows:

- Example: The method used here to calculate the time for remediation is adapted from Schnoor (1997). These data are only provided as an example and do not reflect conditions at the site. Assumptions are as follows:
  - Cleanup goal for arsenic is less than 9 mg/kg soil
  - An average beginning soil concentration of 50 mg/kg in the surface 1-foot of soil, resulting in a total mass to be removed of 3.5 g As/square foot (ft^2) soil
  - Assume removal rate of 10 mg As/kg soil per 2 month harvest period
  - Assume all soil arsenic is plant-available
  - Plant used is the Brake fern, or the Edenfern™, a proprietary form of *Pteris vittata*
  - Plant dry matter arsenic = 2.3 percent (23,000 mg/kg, Ma et al., 2001)
  - Plant dry matter yield = 688 lbs/5,000 ft^2/crop, three crops/year = 1 ton/5,000 ft^2/year

  Under these assumptions, the estimated time to cleanup is 2 years.

4.2.3.9. This cleanup period is under ideal growth conditions and should be only considered as the best possible case. The actual removal rate and achievable end point are uncertain. Generally, removal efficiencies are highest within the earliest periods after

introduction of the plant material, then removal rates level off when the least available material to the plant's roots remains. This final, recalcitrant, and non-extractable amount of arsenic could occur at or above the cleanup standard in which case, the soil remaining above cleanup standards would still be considered a hazardous waste and be handled in such a manner for disposal.

4.2.3.10. Contaminant uptake rates are a function of the concentration of the contaminant in ***pore water*** within the root zone, a plant's water uptake rate, the tendency of a contaminant to concentrate in the root, and the total plant biomass present in the target cleanup area. The feasibility of the approach depends largely upon:

- depth of contamination (12 inches maximum)
- whether the metals of interest are sufficiently bioavailable or can be made bioavailable through chelates or acidification
- total amount of metal that must be removed (determines the time required)
- risks to groundwater associated with mobilized metals that may not be captured by plant roots

4.2.3.11. Implementation of Phytoremediation. Sequestering elevated concentrations of arsenic in roots and shoot tissues away from the soil is the main objective. The plants can be left alone to prevent contaminant migration, or biomass can be harvested and disposed of for a fraction of the cost associated with traditional soil disposal. Harvesting is the preferred phytoremediation alternative to eliminate the possibility of arsenic mobility.

4.2.3.12. If site conditions are favorable, the best approach for phytoextraction at Pond 3 is to install a single treatment cell as a demonstration site with an area of approximately 5,000 ft^2 as shown in Figure 4-2. The treatment area would be constructed with a geomembrane-liner surrounded by 24-inch high temporary concrete dividers. The cell design would incorporate a leachate/irrigation system to recycle leachate if collected and prevent off-site movement of arsenic during the treatment period. High-level arsenic contaminated soil would be removed from arsenic-impacted areas in Pond 3, placed in the treatment cell, and homogenized to uniformly distribute the arsenic within the 12-inch deep soil layer in the cell as shown in the cross section in Figure 4-2. Sufficient monitoring of the soil and plant materials would occur twice per growing season and refined as needed to design parameters, assess ecological risks associated with accumulation of metals in plants, and monitor for potential leaching of metals to groundwater as a result of phytoremediation enhancements.

4.2.3.13. Site Management. New fern fronds usually grow quickly after old fronds are harvested. Harvested materials should be stored temporarily in a secure dumpster to allow the fronds to air-dry. Disposal of plant materials should be made once per year after drying has taken place. Dry material will reduce the landfilled mass without compromising exposure to the arsenic. Disposal methods should follow standard RCRA protocols for materials with hazardous content.

4.2.3.14. In a Plant Hardiness Zones of 5 to 7, cold winter temperatures will likely kill the plants. Winter protection measures may reduce the need for wide-scale replanting each

season, but design components should include replacement plantings each year in the event freezing temperatures prevent survival.

4.2.3.15. Site Monitoring. After a baseline soil, arsenic level has been established within the treatment cell, soil monitoring will occur semi-annually within the isolated treatment cell. A maximum of 20 soil cores will be collected between 0 and 12 inches bgs at random locations throughout the treatment cell. Soil sampling will occur at the beginning and end of the growing season. The samples will only be analyzed for arsenic.

4.2.3.16. Plant material will also be collected on a semi-annual basis for arsenic tissue analysis. The Edenfern™ sampling events will occur just after first flush in the spring and during the last harvesting event of the year in the fall. Ten representative samples from the fronds harvested will be collected per event for laboratory analysis of arsenic. By monitoring the plant tissue arsenic levels in addition to the soil arsenic levels, the effectiveness of the ferns can be determined. Knowledge of the effectiveness of the ferns will allow site managers the ability to make proper adjustments and recommendations for future site management.

4.2.3.17. Site Closure. Site closure at Pond 3 will occur when arsenic levels of the soil fall below an average of 9.76 mg/kg.

4.2.3.18. Cost Analysis. A description of the startup and annual costs associated with using *Pteris vittata* for arsenic phytoremediation from soils at Pond 3 are shown in Appendix D.

4.2.3.19. Phytoremediation Summary. The treatment cell would be approximately 5,000 ft^2 in size and located in the west end of the Pond 3 basin. The cell would be constructed with a lined bottom and an irrigation system to capture leachate and reuse it as irrigation water during periods of low rainfall. The 12-inch-thick soil layer of arsenic-impacted soil would be planted with *Pteris vittata*, or Chinese brake fern, on 1-foot centers. Treatment or arsenic-removal efficiencies are predicted to be approximately 10 mg/kg over a 2- to 4-month period depending upon frond growth. Fronds would be harvested every 2 months during the growing season and collected in a storage container to dry. Disposal of plant material would occur once per year at an approved RCRA facility.

4.2.3.20. For the first year, excavation of soils, construction of the bermed treatment cell, and the first fern planting would cost an estimated $94,040. In the following treatment years, O&M costs (e.g., site management, soil and plant sampling, harvesting, fertilization) would cost approximately $62,800.

4.2.3.21. It should be emphasized that with natural treatment processes, there is a measure of uncertainty with arsenic uptake rates though the current literature and research supports elevated removal efficiencies. The phytoremediation period could extend longer than the projected 2 to 4 years. Ultimately, lowering soil arsenic levels should be considered the primary objective and achieving the LDR the ultimate treatment goal for this project.

4.3 Detailed Analysis of Removal Alternatives

4.3.0.1. In order to provide a concise detailed analysis of the removal alternatives, each alternative is presented in a tabular form. The detailed analysis for each alternative in this EE/CA is included in two tables. The first table analyzes the alternatives against the seven

criteria. The second table presents the key ARARs, identifies whether the ARAR is applicable or relevant and appropriate, and indicates if and how the alternative will comply with the ARAR. The detailed analysis of alternatives is presented in Table 4-1. The evaluation of key ARARs is presented in Appendix C, Tables C-1 to C-6. The detailed evaluation is not repeated in this text to avoid redundancy. The most important aspects of the detailed evaluation are summarized in the following comparative evaluation.

4.4 Comparative Analysis of Alternatives

4.4.0.1. Based on the individual evaluation and assessment of each removal alternative, a comparative analysis is presented in this section to evaluate the relative performance of the three alternatives in relation to each specific evaluation criterion. The comparative analysis identifies the advantages and disadvantages of each alternative relative to the others so that key trade-offs can be reviewed during the decisionmaking process. The discussions are organized from the best alternatives to the worst alternatives within each criterion.

4.4.1 Overall Protection of Human Health and the Environment

4.4.1.1. All alternatives are protective of human health and the environment with the exception of Alternative 1. Alternative 2 achieves protection through the removal of the contaminated sediments, thus eliminating the risk posed through each exposure pathway. With contaminant removal, long-term monitoring and institutional controls to prevent future exposure are not required.

4.4.1.2. Like Alternative 2, Alternative 3 achieves protectiveness through the removal of the contaminated sediments and implementation of engineering controls. The means of removal is through arsenic extraction by vegetation. The exposure pathways are minimized through the placement of the contaminated sediments in a lined treatment cell. The contaminated sediments remain on-site within the plant tissue until the vegetation is harvested and disposed off-site. Alternative 3 is not a short-term solution like Alternative 2, and is projected to take approximately 2 to 4 years to extract the arsenic contamination from the pond sediments to background levels. Potential exposure to humans and the environment does exist due to the contaminated sediments and phytoextraction plants remaining within the pond.

4.4.2 Compliance with Applicable or Relevant and Appropriate Requirements

4.4.2.1. Alternative 1 would not comply with the ARARs because no remedial action is being taken. Alternatives 2 and 3 would meet ARARs by removing contaminated sediments that are a threat to human health and the environment. Although Alternative 3 is not a short-term solution, this alternative still meets ARARs during the extraction process by minimizing the exposure pathway to human health and the environment through placement of contaminated sediments in a lined treatment cell. ARARs addressing long-term monitoring would be implemented for Alternative 3 to verify that management controls of the treatment cell are in place and effective. The disposal actions taken during implementation of Alternatives 2 and 3 would be conducted to meet the action-specific ARARs. This includes meeting RCRA LDRs for characteristic waste.

4.4.3 Long-Term Effectiveness and Permanence

4.4.3.1. Alternative 2 is the most effective and permanent because the sediments are removed and disposed offsite. This alternative does not require reliance on institutional controls to prevent exposure to the contaminated sediments and requires no long-term management. Alternative 3 is effective and permanent because the sediments are removed and placed in an on-site lined treatment cell. The effectiveness of Alternative 3 is dependent of the extraction capabilities of the vegetation and whether the vegetation can remediate the sediments to background levels. Institutional controls would be required to prevent exposure to the contaminated sediments, vegetation, and leachate. Institutional controls would be imposed until the arsenic levels in the sediment reaches background levels and the vegetation has been harvested and disposed off-site at an appropriate facility. Alternative 1 is the least effective alternative. Alternatives 1 and 3 will require long-term management of institutional controls and restrictions on land use.

4.4.4 Reduction of Toxicity, Mobility, and Volume through Treatment

4.4.4.1. Alternatives 2 and 3 reduce toxicity and mobility of the contaminated sediments by excavation, but Alternative 3 results in the greatest reduction of volume in the contaminated sediments because the arsenic is extracted from the sediments by the vegetation. With Alternative 3, the toxicity of the sediments is decreased through extraction, mobility is minimized by placing the sediments in a lined treatment cell, and the volume of contaminated media to dispose is decreased. For example, approximately 390 tons of soil would be disposed of in Alternative 2, while less than 1 ton of harvested vegetation would need disposal with the implementation of phytoextraction.

4.4.4.2. In terms of the Pond 3 site, Alternative 2 reduces the TMV of the contaminated sediments through removing and disposing off-site. The TMV is eliminated at Pond 3 with the removal of the contaminated sediments, but this alternative is not considered a treatment that actually reduces the TMV of the contaminants. The contaminated sediments still exist, but have been relocated off-site to a disposal facility that manages the contaminated sediments in order to eliminate exposure pathways to humans and the environment. Alternative 1 does not reduce the TMV because no remedial action is taken to eliminate exposure to humans and the environment.

4.4.5 Short-Term Effectiveness

4.4.5.1. Short-term risks to workers, the community, or the environment are related to impacts from the construction and implementation of the remedial alternatives. Excavation and movement of contaminated sediments are associated with all alternatives except Alternative 1. Short-term risks associated with fugitive dust and direct contact with the contaminated sediments are the main risks. Adherence to a health and safety plan and material handling plan should prevent exposure of workers to contaminants. Impacts on the community and environment are not expected, but air emission monitoring, dust suppression, and implementation of an erosion control plan are necessary and should mitigate risks. Alternative 1 possesses fewer short-term risks because there is no transportation of contaminated materials off-Base. Alternative 3 possesses short-term risks during excavation, plant harvesting, and transportation off-Base, but not to the degree of

Alternative 2 which will require multiple truckloads of arsenic contaminated material to be transported off-Base.

4.4.5.2. Alternative 2 poses the most risk relative to short-term impacts. It poses short-term risks to workers, the community, and the environment. These risks are due to fugitive dust from sediment excavation. There is potential risk for injuries from construction, or transportation-related accidents due to increased truck traffic in the surrounding community from transportation of contaminated sediments to an off-Base disposal location. The risks to the community and environment from the dust, increased truck traffic, and potential spills of contaminated material could be minimized through dust abatement procedures, careful traffic routing and control during peak hours, and emergency spill mitigation procedures.

4.4.6 Implementability

4.4.6.1. Alternative 2 is considered the most implementable due to the limited construction effort as compared to Alternative 3. Alternative 2 consists of soil excavation, contaminated sediment staging, and transporting off-Base with no additional infrastructure. Alternative 3 requires construction of a lined treatment cell with a leachate collection system as well as planting of vegetation. The implementation of Alternative 3 requires greater effort than Alternative 2. A potential risk to the implementability of Alternative 3 also exists in terms of the adaptability of the vegetation to the environment and the extraction capabilities of the vegetation. Alternative 1 is not implementable because the alternative does not comply with ARARs.

4.4.7 Cost

4.4.7.1. A summary of the estimated costs for each of the alternatives is presented as part of Table 4-1. The table breaks down the estimated capital, O&M, and total present net worth cost. A detailed cost analysis is presented in Appendix D. The O&M costs are projected for a 30-year period with a 5 percent factor for inflation.

4.4.7.2. The least expensive alternative is Alternative 1. Total estimated cost for Alternative 2 ranges from $182,279 to $214,454, depending on the excavated sediment/soil characterization. Alternative 3 is the most expensive remedial option due to the extensive cost associated with constructing a lined treatment cell, and with operation, monitoring, and maintenance of the extraction plants.

4.4.8 Comparative Analysis of Alternatives Summary

4.4.8.1. In addition to the text description, the three alternatives were rated from 1 to 3, with 1 being the best alternative and 3 being the worst alternative within each criteria. The ratings are presented in Table 4-1. The ratings for each of the five balancing criteria were summed to determine the relative rank of the alternatives. The alternative with the lowest sum is considered the most appropriate for the site. The recommended alternative is further discussed in Section 5.0.

TABLE 4-1
Detailed Analysis of Alternatives Summary
HAFB Pond 3 EE/CA

Alternative Description Criteria	Alternative 1 No Action	Rating	Alternative 2 Removal and Off-Site Landfill Disposal	Rating	Alternative 3 Phytoremediation through Metal Extraction	Rating
Overall Protection of Human Health and the Environment	No protection of human health and the environment.	Threshold Criteria - Not Rated	Would eliminate direct exposure through removal of contaminated soils that pose a risk.	Threshold Criteria - Not Rated	Achieves protectiveness through the removal of the contaminated sediments and implementation of engineering controls.The exposure pathways are minimized through the placement of the contaminated sediments in a lined land farm cell.	Threshold Criteria - Not Rated
Compliance with ARARs	No compliance with ARARs.	Threshold Criteria - Not Rated	Would comply with ARARs by removal of contaminated soils that pose a risk. Materials disposed of under the LDR program for contaminated sediments.	Threshold Criteria - Not Rated	Would comply with ARARs by limiting exposure pathways to contaminated soils that pose a risk. Harvest plant tissue would be disposed of in accordance to ARARs.	Threshold Criteria - Not Rated
Long-Term Effectiveness and Permanence	No long-term effectiveness and permanence.	3	Risks mitigated by removal and disposal of contaminated sediments. Institutional controls or long-term monitoring are not required.	1	Effective and permanent because the sediments are removed and placed in an on-site lined treatment cell. Removal effectiveness dependent on extraction capability of plants. Institutional controls required to prevent exposure to the contaminated sediments and vegetation.	2
Reduction of Toxicity, Mobility, or Volume through Treatment	No reduction of Toxicity, Mobility, or Volume.	3	TMV mitigated at the Pond 3 site by removal and off-site disposal of contaminated sediments.	2	Greatest reduction in TMV. The toxicity of the sediments is decreased through extraction, mobility is minimized by placing the sediments in a lined treatment cell, and the volume of contaminated media to dispose is drastically decreased.	1
Short-Term Effectiveness	No short-term risk.	1	Significant short-term risks exist from construction and transportation of materials to the construction workers and surrounding community. Most can be limited with engineering and health and safety controls.	3	Minimal short-term risks exist from construction to the construction workers. Most can be limited with engineering and health and safety controls. Limited transportation of plant materials off Base at harvesting time.	2
Implementability	Alternative not implementable because the alternative does not comply with ARARs. No significant implementability issues identified.	3	No significant implementability issues identified.	1	Alternative 3 requires construction of a lined treatment cell with a leachate collection system as well as planting of vegetation. A potential risk to the implementability of Alternative 3 also exists in terms of the adaptability of the vegetation to the environmental elements and the extraction capabilities of the vegetation.	2
Cost	Direct Capital Costs $0 Annual O&M Costs $46,116 (30 years) Total Present Worth Costs $46,116	1	Direct Capital Costs $144,956 - $214,454 Annual O&M Costs $0 Total Present Worth Costs $144,956 - $214,454	2	Direct Capital Costs $155,166 Annual O&M Costs $244,920 (4 years) Total Present Worth Costs $400,086	3
Rating		11		9		10

Note: Lowest rating is considered the most appropriate alternative

\\Slcdb\GIS\HAFB\OU_09\Pond-3\Map_Documents\figure4-1.mxd; 02-06-03; nds

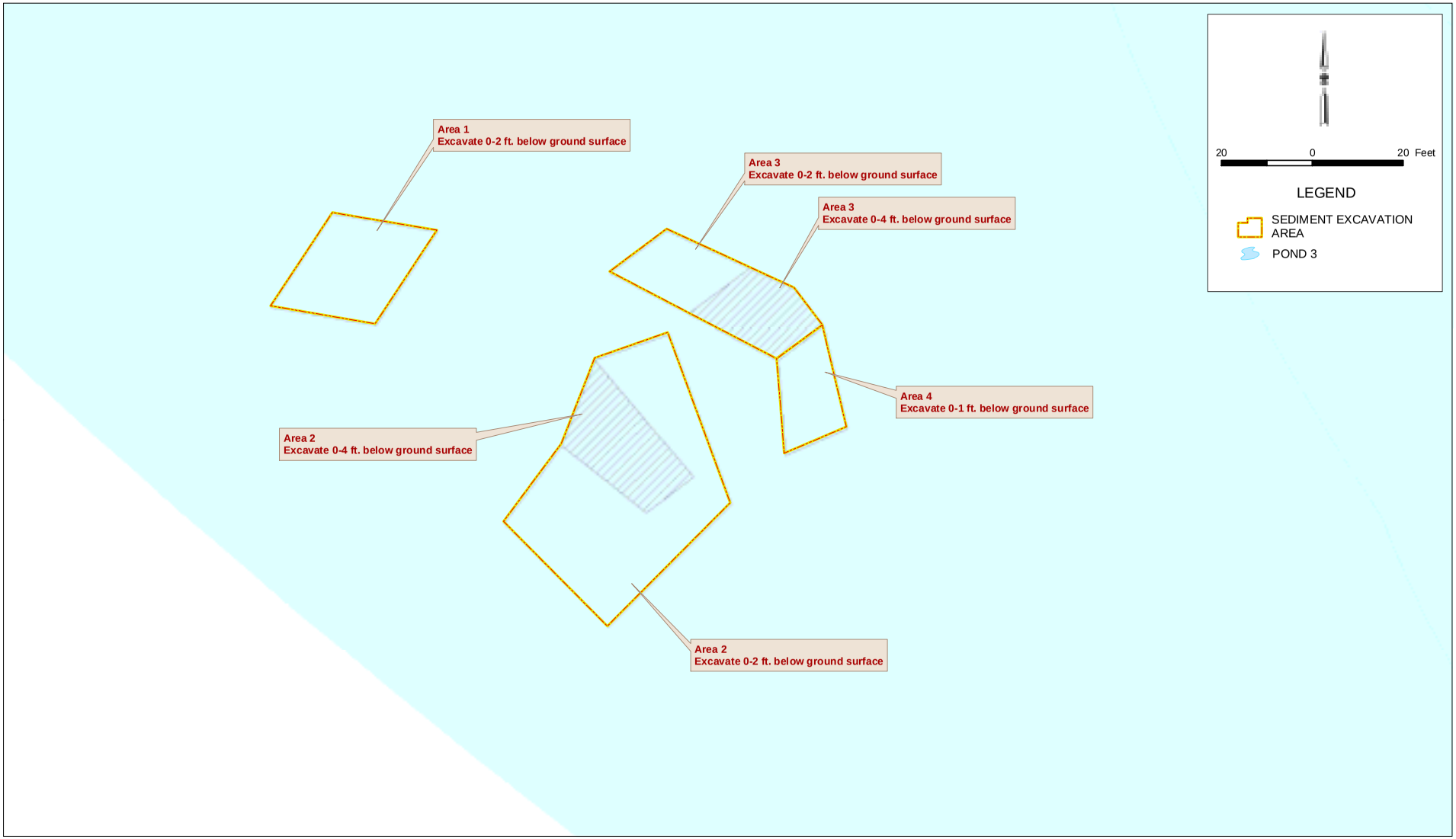
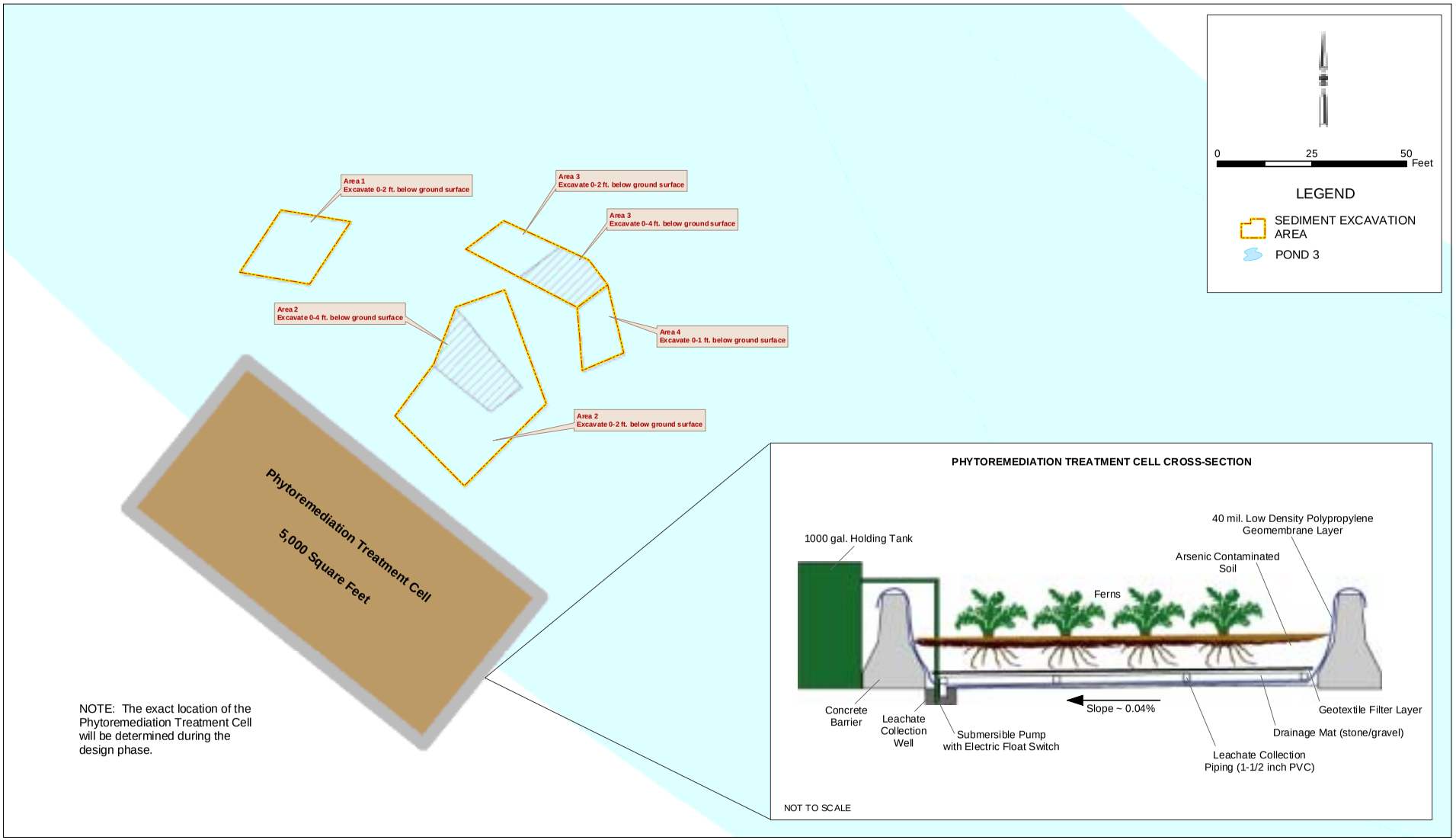


FIGURE 4-1
ALTERNATIVE 2 SEDIMENT EXCAVATION AREAS
POND 3 EE/CA
HILL AIR FORCE BASE, UTAH
CH2MHILL

\\Slcdb\GIS\HAFB\OU_09\Pond-3\Map_Documents\figure4-2.mxd; 02-06-03; nds



NOTE: The exact location of the Phytoremediation Treatment Cell will be determined during the design phase.

FIGURE 4-2

ALTERNATIVE 3 PHYTOREMEDIATION WITH METAL EXTRACTION

POND 3 EE/CA

HILL AIR FORCE BASE, UTAH

CH2MHILL

5.0 Recommended Removal Action Alternative

5.1 Recommended Alternative

5.1.0.1. Based on the EE/CA presented in Section 4.0, Alternative 2 is recommended for the remediation of Pond 3 sediments. Alternative 2 consists of excavating Areas 1, 2, 3, and 4, profiling the contaminated sediments, and disposing the sediments at an appropriate facility. Alternative 2 was selected for the following reasons:

- Threat of human or environmental exposure to contaminated sediments is mitigated
- The site can be closed upon removal of the contaminated sediments
- No long-term monitoring or institutional controls are required
- Most cost-effective alternative to mitigate site risks

5.2 Proposed Schedule

5.2.0.1. Excavation of contaminated sediments, profiling of sediments, and confirmation sampling will require approximately 3 to 4 weeks. Another 1 to 2 weeks will be needed to transport the sediments off-Base to a disposal facility and an additional week for final regrading/revegetation of the pond surface. A total of 5 to 7 weeks will be needed to complete the project. The excavation portion of the project should be completed in the summer when the pond is dry and sediments are unsaturated. The excavation portion of the project cannot be conducted while water is in the pond. Standing water in the pond during construction will be addressed as a contingency to the construction project.

THIS PAGE INTENTIONALLY LEFT BLANK

6.0 References

Chen et al., 2002. Chen, T; Wei, C.; Huang, Z.; Huang, Q.; Lu, Q.; and Fan, Z. "Arsenic hyperaccumulater Pteris vittata L. and its arsenic accumulation." Chinese Science Bulletin, 47(11):902-905.

CH2M HILL, 2001. *Final Comprehensive Data Evaluation for the South Area of Operable Unit 9 Site Inspection*. Hill Air Force Base, Utah. February 2001.

CH2M HILL, 2002. *Final Engineering/Cost Analysis for the OU9 Pond 1 Remedial Action.* Hill Air Force Base, Utah. April 2002.

Edenspace, 2003. www.edenspace.com.

Federal Register, 1990. *Federal Register* (55 FR 8666). March 8, 1990.

James M. Montgomery, Consulting Engineers, Inc. (JMM), 1992. *Draft Final Remedial Investigation Report for Operable Unit 3.* Hill Air Force Base, Utah. April 1992.

Ma et al, 2001. Ma, L. Q.; Komar, K. M., Tu, C., Zhang, W. H., Cai, Y., Kenelly, E. D. "A fern that hyperaccumulates arsenic, a hardy, versatile, fast-growing plant helps to remove arsenic from contaminated soils." Nature 409: 579.

Montgomery Watson (MW), 2001. *Final Analytical Data Report (ADR) for Operable Unit 9 Investigation Areas 1 May through 10 October 2000.* Hill Air Force Base, Utah. February 2001.

MW, 2000. *Final Data Summary Report and Preliminary Conceptual Model for Operable Unit 9 Investigation Areas.* Hill Air Force Base, Utah. October 2000.

MW, 1995. *Final Phase II Remedial Investigation Report for Operable Unit 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, SD34*). Hill Air Force Base, Utah. March 1995.

MW, 1995a. *Final Record of Decision for Operable Unit 3 (IRP Sites ST04, WP05, WP06, ST18, SD23, SD34).* Hill Air Force Base, Utah. September 1995.

Schnoor, 1997. J.L. Schnoor. "Phytoremediation." Technology Evaluation Report TE-98-01, Ground-Water Remediation Technologies Analysis Center, Pittsburgh, PA., 37 pp. http://www.gwrtac.org

Stantec, 1999. *Industrial Storm Water Hydrology Study,* Hill Air Force Base, Utah. April 1999.

EPA, 1993. *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*. United States Environmental Protection Agency. 1993.

EPA, 1991. *Superfund Removal Procedures: Guidance on the Consideration of ARARs during Removal Actions*. United States Environmental Protection Agency. 1991.

EPA, 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*. EPA Office of Solid Waste and Emergency Response, OSWER Directive 9335.3-01, EPA/540-G-89-004. United States Environmental Protection Agency. October 1988.

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX A

Analytical Results

TABLE A-1
Normal Sample Analytical Results - Pre-2002 Sampling
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-P3-700	U9-P3-700	U9-P3-701	U9-P3-701	U9-P3-702	U9-P3-702	U9-P3-703	U9-P3-703	U9-P3-704	U9-P3-704	U9-P3-705	U9-P3-705	U9-P3-706	U9-P3-706	U9-P3-707	U9-P3-707	U9-P3-708	U9-P3-708	U9-P3-709	U9-P3-709
		Sample ID:	U9-P3-700 0-1	U9-P3-700 1-2	U9-P3-701 0-1	U9-P3-701 2-3	U9-P3-702 0-1	U9-P3-702 2-3	U9-P3-703 0-1	U9-P3-703 1-2	U9-P3-704 0-1	U9-P3-704 2-3	U9-P3-705 0-1	U9-P3-705 2-3	U9-P3-706 0-1	U9-P3-706 2-3	U9-P3-707 0-1	U9-P3-707 1-2	U9-P3-708 0-1	U9-P3-708 1-2	U9-P3-709 0-1	U9-P3-709 2-3
		Date:	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000
Method	**Analyte**	**Units**																				
D2216	Percent Moisture	percent	18.6	16.1	21.8	20.9	19.6	19.6	17	15.2	16.4	14.6	22.1	15.1	15	12.3	15.2	15.2	18.2	14.3	21.1	20.2
SW6010B	Antimony	mg/kg	**TR 0.46**	**TR 0.35**	ND 0	ND 0	**TR 0.17**	**TR 0.28**	**TR 0.2**	**TR 0.58**	**TR 0.19**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	**TR 0.15**	ND 0	ND 0	ND 0	TR 0.44
SW6010B	Arsenic	mg/kg	**2.5**	**2.4**	**1.8**	**1.3**	**2.5**	**2.5**	**2**	**2.4**	**1.7**	**2.2**	**3**	**6.2**	**6**	**3.5**	**3.7**	**4.3**	**6.1**	**5.1**	**115**	**26.8**
SW6010B	Barium	mg/kg	**108**	**67.8**	**40.9**	**22.9**	**54.8**	**62.4**	**39**	**61.3**	**43.2**	**50.7**	**110**	**52.8**	**46.9**	**40.1**	**60.4**	**38.9**	**59.7**	**55.7**	**890**	**246**
SW6010B	Beryllium	mg/kg	**TR 0.055**	**TR 0.056**	**TR 0.1**	**TR 0.061**	**TR 0.043**	**TR 0.074**	**TR 0.061**	**TR 0.063**	**TR 0.12**	**TR 0.14**	**TR 0.2**	**0.27**	**TR 0.21**	**TR 0.12**	**TR 0.2**	**TR 0.12**	**TR 0.11**	**TR 0.16**	**TR 0.17**	**TR 0.12**
SW6010B	Lead	mg/kg	**15.4**	**26**	**11.5**	**5**	**12.5**	**26.6**	**12.3**	**22.5**	**7.1**	**6.5**	**20.1**	**5.5**	**8.8**	**5.8**	**5.6**	**5.7**	**12.7**	**7.7**	**307**	**42.3**
SW6010B	Nickel	mg/kg	**4.5**	**7.1**	**3.7**	**4.6**	**3.3**	**10.9**	**3.7**	**8**	**4.5**	**10.2**	**5.5**	**12.3**	**6**	**7.8**	**5.3**	**5.9**	**4.1**	**10.9**	**7.9**	**9.4**
SW6010B	Selenium	mg/kg	ND 0	ND 0	**TR 0.24**	ND 0	ND 0	ND 0	ND 0	ND 0	**TR 0.24**	ND 0	ND 0	**TR 0.46**	**TR 0.34**	**TR 0.2**	ND 0	ND 0	ND 0	TR 0.25	ND 0	ND 0
SW6010B	Zinc	mg/kg	**97.9**	**340**	**31**	**11.9**	**69.6**	**96.5**	**60.1**	**85.4**	**34.3**	**25**	**38.7**	**21.2**	**23.4**	**21.7**	**24.9**	**22.2**	**26.8**	**24.9**	**195**	**52.9**
SW7471	Mercury	mg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	**TR 0.067**	**TR 0.093**	ND 0	**TR 0.063**	ND 0	ND 0	ND 0	ND 0
SW8260B	1,1,1,2-Tetrachloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,1,1-Trichloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,1,2,2-Tetrachloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,1,2-Trichloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,1-Dichloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,1-Dichloroethene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2,3-Trichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2,3-Trichloropropane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2,4-Trichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2-Dibromo-3-chloropropane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2-Dibromoethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2-Dichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2-Dichloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,2-Dichloropropane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,3-Dichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	1,4-Dichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	2-Butanone	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	2-Hexanone	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	4-Methyl-2-pentanone	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	**TR 1**	ND 0	ND 0	ND 0	ND 0
SW8260B	Benzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Bromodichloromethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Bromoform	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Bromomethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Carbon Tetrachloride	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Chlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Chloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Chloroform	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Chloromethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	cis-1,2-Dichloroethene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	cis-1,3-Dichloropropene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Dibromochloromethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Dibromomethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Dichlorodifluoromethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Ethylbenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Hexachlorobutadiene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Methylene chloride	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Naphthalene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Styrene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Tert-Butyl Methyl Ether	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Tetrachloroethene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Toluene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	trans-1,2-Dichloroethene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	trans-1,3-Dichloropropene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Trichloroethene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Trichlorofluoromethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Vinyl chloride	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8260B	Xylenes (sum of isomers)	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0

TABLE A-1
Normal Sample Analytical Results - Pre-2002 Sampling
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-P3-700	U9-P3-700	U9-P3-701	U9-P3-701	U9-P3-702	U9-P3-702	U9-P3-703	U9-P3-703	U9-P3-704	U9-P3-704	U9-P3-705	U9-P3-705	U9-P3-706	U9-P3-706	U9-P3-707	U9-P3-707	U9-P3-708	U9-P3-708	U9-P3-709	U9-P3-709
		Sample ID:	U9-P3-700 0-1	U9-P3-700 1-2	U9-P3-701 0-1	U9-P3-701 2-3	U9-P3-702 0-1	U9-P3-702 2-3	U9-P3-703 0-1	U9-P3-703 1-2	U9-P3-704 0-1	U9-P3-704 2-3	U9-P3-705 0-1	U9-P3-705 2-3	U9-P3-706 0-1	U9-P3-706 2-3	U9-P3-707 0-1	U9-P3-707 1-2	U9-P3-708 0-1	U9-P3-708 1-2	U9-P3-709 0-1	U9-P3-709 2-3
		Date:	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000
Method	**Analyte**	**Units**																				
VOC Surrogates																						
SW8260B	1,2-Dichloroethane-d4	percent	103	100	101	102	102	103	101	102	104	100	104	104	104	104	103	105	102	103	104	108
SW8260B	4-Bromofluorobenzene	percent	101	101	100	98	99	99	98	100	100	99	99	101	98	100	98	101	101	101	101	100
SW8260B	Dibromofluoromethane	percent	104	101	105	107	105	105	105	105	107	104	107	105	107	108	107	108	106	106	108	110
SW8260B	Toluene-d8	percent	94	94	94	93	94	95	95	95	94	94	94	93	93	94	94	93	94	93	94	93
SW8270C	1,2,4-Trichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	1,2-Dichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	1,3-Dichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	1,4-Dichlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2,4,5-Trichlorophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2,4,6-Trichlorophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2,4-Dichlorophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2,4-Dimethylphenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2,4-Dinitrophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2,4-Dinitrotoluene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2,6-Dinitrotoluene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2-Chloronaphthalene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2-Chlorophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2-Methylnaphthalene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2-Methylphenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2-Nitroaniline	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	2-Nitrophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	3,3-Dichlorobenzidine	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	3-Nitroaniline	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4,6- Dinitro-2-methylphenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4-Bromophenyl phenyl ether	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4-Chloro-3-methylphenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4-Chloroaniline	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4-Chlorophenyl phenyl ether	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4-Methylphenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4-Nitroaniline	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	4-Nitrophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Acenaphthene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Acenaphthylene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Anthracene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Benz (a) anthracene	µg/kg	ND 0	**TR 610**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Benzo (a) pyrene	µg/kg	ND 0	**TR 500**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Benzo (b) fluoranthene	µg/kg	ND 0	**TR 770**	**TR 76**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Benzo (g,h,i) perylene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Benzo (k) fluoranthene	µg/kg	ND 0	**TR 430**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Bis (2-Chloroethoxy) methane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Bis(2-Chloroethyl) ether	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Bis(2-Chloroisopropyl) ether	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Bis(2-ethylhexyl) phthalate	µg/kg	ND 0	**TR 870**	ND 0	**TR 60**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Butyl benzyl phthalate	µg/kg	ND 0	**TR 500**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Chrysene	µg/kg	ND 0	**TR 670**	**TR 62**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Di-n-butylphthalate	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Di-n-octyl phthalate	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Dibenz (a,h) anthracene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Dibenzofuran	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Diethyl phthalate	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Dimethyl phthalate	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Fluoranthene	µg/kg	ND 0	**TR 1500**	**TR 91**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Fluorene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Hexachlorobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Hexachlorobutadiene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Hexachlorocyclopentadiene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Hexachloroethane	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Indeno(1,2,3-cd)pyrene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Isophorone	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0

TABLE A-1

Normal Sample Analytical Results - Pre-2002 Sampling

Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-P3-700	U9-P3-700	U9-P3-701	U9-P3-701	U9-P3-702	U9-P3-702	U9-P3-703	U9-P3-703	U9-P3-704	U9-P3-704	U9-P3-705	U9-P3-705	U9-P3-706	U9-P3-706	U9-P3-707	U9-P3-707	U9-P3-708	U9-P3-708	U9-P3-709	U9-P3-709
		Sample ID:	U9-P3-700 0-1	U9-P3-700 1-2	U9-P3-701 0-1	U9-P3-701 2-3	U9-P3-702 0-1	U9-P3-702 2-3	U9-P3-703 0-1	U9-P3-703 1-2	U9-P3-704 0-1	U9-P3-704 2-3	U9-P3-705 0-1	U9-P3-705 2-3	U9-P3-706 0-1	U9-P3-706 2-3	U9-P3-707 0-1	U9-P3-707 1-2	U9-P3-708 0-1	U9-P3-708 1-2	U9-P3-709 0-1	U9-P3-709 2-3
		Date:	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000	07/11/2000
Method	**Analyte**	**Units**																				
SW8270C	n-Nitroso-di-n-propylamine	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	n-Nitrosodiphenylamine	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Naphthalene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Nitrobenzene	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Pentachlorophenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Phenanthrene	µg/kg	ND 0	**TR 970**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Phenol	µg/kg	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SW8270C	Pyrene	µg/kg	ND 0	**TR 1700**	**TR 97**	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0	ND 0
SVOC Surrogates																						
SW8270C	2,4,6-Tribromophenol	percent	59	80	62	56	64	72	69	72	78	101	82	82	66	71	74	86	83	87	74	89
SW8270C	2-Fluorobiphenyl	percent	97	102	66	64	99	111	107	112	81	109	93	87	76	78	79	91	88	89	105	95
SW8270C	2-Fluorophenol	percent	83	99	46	54	81	99	88	94	71	93	70	79	66	68	70	81	77	75	89	81
SW8270C	Nitrobenzene-d5	percent	67	80	49	55	59	78	71	76	72	94	71	80	66	69	71	80	78	82	71	80
SW8270C	Phenol-d5	percent	87	91	70	75	71	86	77	85	94	97	97	103	88	90	95	108	89	82	79	103
SW8270C	Terphenyl-d14	percent	87	109	66	58	92	104	101	109	73	110	95	81	67	71	71	80	77	77	100	97
SW9045	pH	PH UNITS	7.71	7.89	7.17	7.62	7.33	7.65	7.84	7.67	7.65	7.69	7.84	7.64	7.32	7.83	7.06	6.91	6.97	7.33	7.12	7.43

NOTES:

mg/kg - milligrams per liter [parts per million (ppm)]

µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7801	U9-7801	U9-7644	U9-7644	U9-7645	U9-7646	U9-7648	U9-7649	U9-7650	U9-7652	U9-7653	U9-7655	U9-7656	U9-7657	U9-7659	U9-7659	U9-7661	U9-7661	U9-7662
		Sample ID:	U977801001	U977801002	U97644001	U97644002	U97645001	U97646001	U97648001	U97649001	U97650001	U97652001	U97653001	U97655001	U97656001	U97657001	U97659001	U97659002	U97661001	U97661003	U97662001
		Date:	09/16/2002	09/16/2002	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001	03/05/2002	03/05/2002	03/05/2002	03/05/2002	03/05/2002	03/05/2002	03/05/2002	05/31/2002	05/31/2002	05/31/2002
Method	**Analyte**	**Units**																			
SW6010B	Barium	mg/kg																	**68.8**	**17.2**	**239**
SW6010B	Beryllium	mg/kg																	**J 0.19**	U 0.12	U 0.13
SW6010B	Cadmium	mg/kg																	**J 1.1**	**J 0.36**	**J 1.1**
SW6010B	Chromium	mg/kg																	**B 8.3**	**B 5.5**	**B 6**
SW6010B	Iron	mg/kg																			
SW6010B	Nickel	mg/kg																	**J 5.4**	**J 2.6**	**J 2.6**
SW6010B	Selenium	mg/kg																	UJ 2.6	U 2.1	U 2.3
SW6010B	Zinc	mg/kg																	**J 91**	**49.9**	**89.3**
SW7060A	Arsenic	mg/kg	**4.4**	**2.7**	**B 13.1**	**B 2.3**	**B 8.6**	**J 4.1**				**89.4**	**J 22.5**						**2.7**	**2.5**	**1.7**
SW7421	Lead	mg/kg																	**22.5**	**35**	**10**
SW8081A	4,4'-DDD	µg/kg																	**J 3.81**	**7.43**	**J 4.48**
SW8081A	4,4'-DDE	µg/kg																	**J 4.15**	**J 3.91**	**J 3.87**
SW8081A	4,4'-DDT	µg/kg																	**J 4.11**	U 0.13	**J 4.17**
SW8081A	Aldrin	µg/kg																	UJ 0.13	U 0.11	U 0.12
SW8081A	alpha-BHC	µg/kg																	U 0.19	U 0.17	U 0.18
SW8081A	alpha-Chlordane	µg/kg																	U 0.17	**2.73**	U 0.16
SW8081A	beta-BHC	µg/kg																	UJ 0.24	U 0.21	U 0.23
SW8081A	delta-BHC	µg/kg																	U 0.45	U 0.39	U 0.43
SW8081A	Dieldrin	µg/kg																	**J 1.13**	**J 0.99**	**J 0.62**
SW8081A	Endosulfan I	µg/kg																	**J 0.58**	U 0.12	U 0.14
SW8081A	Endosulfan II	µg/kg																	U 0.14	U 0.13	U 0.14
SW8081A	Endosulfan sulfate	µg/kg																	U 0.2	U 0.17	U 0.19
SW8081A	Endrin	µg/kg																	**J 0.57**	U 0.17	U 0.19
SW8081A	Endrin aldehyde	µg/kg																	U 0.26	U 0.23	U 0.25
SW8081A	Endrin Ketone	µg/kg																	UJ 0.22	**J 9.93**	**J 9.83**
SW8081A	gamma-BHC (Lindane)	µg/kg																	U 0.24	U 0.21	U 0.23
SW8081A	gamma-Chlordane	µg/kg																	**J 3.65**	**J 7.17**	U 0.99
SW8081A	Heptachlor	µg/kg																	**J 0.22**	U 0.1	**J 0.56**
SW8081A	Heptachlor epoxide	µg/kg																	U 0.48	U 0.41	U 0.46
SW8081A	Methoxychlor	µg/kg																	**J 8.5**	U 0.2	**J 15.2**
SW8081A	Toxaphene	µg/kg																	U 14.9	U 12.9	U 14.3
SW8081A	DCB	percent																	59	50	75
SW8081A	TCMX	percent																	60	67	91
SW8082	Aroclor 1016	µg/kg																	U 1.2	U 1	U 1.1
SW8082	Aroclor 1221	µg/kg																	U 5.9	U 5.1	U 5.6
SW8082	Aroclor 1232	µg/kg																	U 3.8	U 3.3	U 3.7
SW8082	Aroclor 1242	µg/kg																	U 1.1	U 1	U 1.1
SW8082	Aroclor 1248	µg/kg																	U 0.8	U 0.7	U 0.8
SW8082	Aroclor 1254	µg/kg																	U 0.9	U 0.8	U 0.9
SW8082	Aroclor 1260	µg/kg																	U 1.5	**J 11.6**	**J 9.1**
SW8082	DCB	percent																	103	99	100
SW8082	TCMX	percent																	93	80	84
SW8270C	1,2,4-Trichlorobenzene	mg/kg							U 0.175	U 0.177	U 0.212			U 0.146	U 0.161	U 0.132	U 0.12	U 0.121	U 0.129	U 0.112	U 0.124
SW8270C	1,2-Dichlorobenzene	mg/kg							U 0.243	U 0.246	U 0.294			U 0.179	U 0.197	U 0.162	U 0.147	U 0.149	U 0.153	U 0.133	U 0.147
SW8270C	1,3-Dichlorobenzene	mg/kg							U 0.228	U 0.231	U 0.276			U 0.159	U 0.175	U 0.144	U 0.131	U 0.133	U 0.122	U 0.106	U 0.117
SW8270C	1,4-Dichlorobenzene	mg/kg							U 0.209	U 0.212	U 0.253			U 0.15	U 0.165	U 0.135	U 0.123	U 0.125	U 0.133	U 0.115	U 0.128
SW8270C	2,4,5-Trichlorophenol	mg/kg							U 0.498	U 0.504	U 0.602			U 0.351	U 0.387	U 0.317	U 0.289	U 0.293	U 0.403	U 0.349	U 0.387
SW8270C	2,4,6-Trichlorophenol	mg/kg							U 0.185	U 0.188	U 0.224			U 0.145	U 0.159	U 0.131	U 0.119	U 0.121	U 0.127	U 0.11	U 0.122
SW8270C	2,4-Dichlorophenol	mg/kg							U 0.267	U 0.271	U 0.323			U 0.17	U 0.188	U 0.154	U 0.14	U 0.142	U 0.15	U 0.13	U 0.144
SW8270C	2,4-Dimethylphenol	mg/kg							U 0.235	U 0.238	U 0.284			U 0.189	U 0.208	U 0.171	U 0.156	U 0.158	U 0.141	U 0.122	U 0.135
SW8270C	2,4-Dinitrophenol	mg/kg							U 0.33	U 0.34	U 0.4			U 0.58	U 0.64	U 0.53	U 0.48	U 0.49	U 0.38	U 0.33	U 0.36
SW8270C	2,4-Dinitrotoluene	mg/kg							U 0.234	U 0.237	U 0.283			U 0.157	U 0.173	U 0.142	U 0.129	U 0.131	U 0.167	U 0.145	U 0.16
SW8270C	2,6-Dinitrotoluene	mg/kg							U 0.211	U 0.214	U 0.256			U 0.137	U 0.151	U 0.124	U 0.113	U 0.115	U 0.15	U 0.13	U 0.144
SW8270C	2-Chloronaphthalene	mg/kg							U 0.165	U 0.167	U 0.199			U 0.13	U 0.144	U 0.118	U 0.107	U 0.109	U 0.135	U 0.117	U 0.129
SW8270C	2-Chlorophenol	mg/kg							U 0.215	U 0.218	U 0.26			U 0.132	U 0.146	U 0.12	U 0.109	U 0.11	U 0.13	U 0.112	U 0.124
SW8270C	2-Methylnaphthalene	mg/kg							U 0.264	U 0.267	U 0.319			U 0.142	U 0.156	U 0.128	U 0.117	U 0.118	U 0.148	**J 0.55**	U 0.142
SW8270C	2-Methylphenol	mg/kg							U 0.299	U 0.303	U 0.362			U 0.152	U 0.167	U 0.137	U 0.125	U 0.126	U 0.148	U 0.129	U 0.142
SW8270C	2-Nitroaniline	mg/kg							U 0.54	U 0.54	U 0.65			U 0.48	U 0.53	U 0.44	U 0.4	U 0.4	U 0.47	U 0.41	U 0.45

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7801	U9-7801	U9-7644	U9-7644	U9-7645	U9-7646	U9-7648	U9-7649	U9-7650	U9-7652	U9-7653	U9-7655	U9-7656	U9-7657	U9-7659	U9-7659	U9-7661	U9-7661	U9-7662
		Sample ID:	U977801001	U977801002	U97644001	U97644002	U97645001	U97646001	U97648001	U97649001	U97650001	U97652001	U97653001	U97655001	U97656001	U97657001	U97659001	U97659002	U97661001	U97661003	U97662001
		Date:	09/16/2002	09/16/2002	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001	10/17/2001	03/05/2002	03/05/2002	03/05/2002	03/05/2002	03/05/2002	03/05/2002	03/05/2002	05/31/2002	05/31/2002	05/31/2002
SW8270C	2-Nitrophenol	mg/kg							U 0.19	U 0.193	U 0.23			U 0.162	U 0.178	U 0.146	U 0.133	U 0.135	U 0.137	U 0.119	U 0.131
SW8270C	3,3-Dichlorobenzidine	mg/kg							U 0.23	U 0.23	U 0.28			U 0.1	U 0.11	U 0.09	U 0.09	U 0.09	U 0.336	U 0.292	U 0.323
SW8270C	3-Nitroaniline	mg/kg							U 0.51	U 0.51	U 0.61			U 0.54	U 0.59	U 0.48	U 0.44	U 0.45	U 1.34	U 1.16	U 1.28
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg							U 0.43	U 0.44	U 0.52			U 0.32	U 0.36	U 0.29	U 0.27	U 0.27	U 0.46	U 0.4	U 0.44
SW8270C	4-Bromophenyl phenyl ether	mg/kg							U 0.225	U 0.228	U 0.273			U 0.147	U 0.162	U 0.132	U 0.121	U 0.122	U 0.166	U 0.144	U 0.159
SW8270C	4-Chloro-3-methylphenol	mg/kg							U 0.27	U 0.28	U 0.33			U 0.15	U 0.17	U 0.14	U 0.12	U 0.13	U 0.153	U 0.133	U 0.147
SW8270C	4-Chloroaniline	mg/kg							U 0.21	U 0.21	U 0.25			U 0.59	U 0.65	U 0.53	U 0.49	U 0.49	U 0.871	U 0.756	U 0.837
SW8270C	4-Chlorophenyl phenyl ether	mg/kg							U 0.253	U 0.256	U 0.306			U 0.116	U 0.128	U 0.105	U 0.095	U 0.096	U 0.147	U 0.128	U 0.141
SW8270C	4-Methylphenol	mg/kg							U 0.213	U 0.215	U 0.257			U 0.121	U 0.134	U 0.11	U 0.1	U 0.101	**J 1.7**	U 0.136	U 0.15
SW8270C	4-Nitroaniline	mg/kg							U 0.66	U 0.67	U 0.8			U 0.4	U 0.44	U 0.36	U 0.33	U 0.33	U 0.44	U 0.38	U 0.43
SW8270C	4-Nitrophenol	mg/kg							U 0.51	U 0.52	U 0.62			U 0.51	U 0.56	U 0.46	U 0.42	U 0.42	U 0.39	U 0.34	U 0.37
SW8270C	Acenaphthene	mg/kg							U 0.217	U 0.22	U 0.263			U 0.143	U 0.158	U 0.13	U 0.118	U 0.12	U 0.148	**J 0.709**	U 0.142
SW8270C	Acenaphthylene	mg/kg							U 0.183	U 0.185	U 0.221			U 0.124	U 0.136	U 0.112	U 0.102	U 0.103	U 0.149	U 0.13	U 0.143
SW8270C	Anthracene	mg/kg							U 0.242	**J 0.391**	U 0.293			U 0.109	U 0.12	U 0.098	U 0.09	U 0.091	U 0.157	**1.4**	U 0.151
SW8270C	Benzo (a) anthracene	mg/kg							U 0.214	**2.24**	**J 0.747**			U 0.146	**J 0.233**	UJ 0.132	U 0.12	U 0.121	U 0.162	**5.3**	U 0.156
SW8270C	Benzo (a) pyrene	mg/kg							U 0.236	**J 2.45**	**J 0.949**			U 0.127	**J 0.283**	**J 0.14**	U 0.105	**J 0.156**	U 0.156	**5.12**	**J 0.2**
SW8270C	Benzo (b) fluoranthene	mg/kg							U 0.206	**J 3.37**	**J 1.28**			U 0.151	**J 0.262**	**J 0.14**	U 0.124	**J 0.181**	U 0.18	**7.01**	**J 0.321**
SW8270C	Benzo (g,h,i) perylene	mg/kg							U 0.182	**J 1.55**	**J 0.716**			U 0.15	U 0.165	UJ 0.136	U 0.124	**J 0.164**	U 0.147	**2.62**	U 0.141
SW8270C	Benzo (k) fluoranthene	mg/kg							U 0.207	**1.53**	**J 0.59**			U 0.129	**J 0.246**	**J 0.135**	U 0.107	**J 0.164**	U 0.168	**2.93**	U 0.162
SW8270C	Benzoic acid	mg/kg							U 0.49	U 0.5	U 0.6			U 0.57	U 0.63	U 0.51	U 0.47	U 0.48	**J 2.94**	**J 2.54**	**J 2.81**
SW8270C	Benzyl alcohol	mg/kg							U 0.248	U 0.251	U 0.3			U 0.37	U 0.407	U 0.334	U 0.304	U 0.308	U 0.127	U 0.11	U 0.122
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg							U 0.228	U 0.232	U 0.276			U 0.167	U 0.184	U 0.15	U 0.137	U 0.139	U 0.17	U 0.148	U 0.164
SW8270C	Bis(2-Chloroethyl) ether	mg/kg							U 0.207	U 0.21	U 0.25			U 0.276	U 0.304	U 0.249	U 0.227	U 0.23	U 0.136	U 0.118	U 0.131
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg							U 0.216	U 0.219	U 0.261			U 0.198	U 0.218	U 0.179	U 0.163	U 0.165	UJ 0.131	UJ 0.113	UJ 0.125
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg							U 0.277	UB 1.27	UB 1.24			**J 0.745**	**2.24**	**1.11**	**J 0.37**	**J 0.195**	**J 0.903**	**4.79**	**1.3**
SW8270C	Butyl benzyl phthalate	mg/kg							U 0.245	U 0.248	U 0.296			U 0.147	**J 0.476**	U 0.133	U 0.121	U 0.123	U 0.166	**1.41**	U 0.159
SW8270C	Chrysene	mg/kg							U 0.23	**3.2**	**1.14**			U 0.144	**J 0.409**	**J 0.184**	U 0.118	**J 0.173**	U 0.154	**5.75**	**J 0.262**
SW8270C	Di-n-butylphthalate	mg/kg							U 0.283	U 0.287	U 0.343			U 0.126	U 0.139	U 0.114	U 0.104	U 0.105	U 0.16	U 0.139	U 0.153
SW8270C	Di-n-octyl phthalate	mg/kg							U 0.248	U 0.251	U 0.3			U 0.062	U 0.068	U 0.056	U 0.051	U 0.051	U 0.13	U 0.113	U 0.125
SW8270C	Dibenz (a,h) anthracene	mg/kg							U 0.206	UJ 0.209	UJ 0.249			U 0.165	U 0.181	U 0.149	U 0.135	U 0.137	U 0.157	**J 0.649**	U 0.15
SW8270C	Dibenzofuran	mg/kg							U 0.236	U 0.239	U 0.285			U 0.139	U 0.153	U 0.125	U 0.114	U 0.116	U 0.151	**J 0.569**	U 0.145
SW8270C	Diethyl phthalate	mg/kg							U 0.271	U 0.275	U 0.328			U 0.11	**J 0.135**	U 0.099	U 0.09	U 0.091	U 0.143	U 0.124	U 0.137
SW8270C	Dimethyl phthalate	mg/kg							U 0.236	U 0.239	U 0.285			U 0.098	U 0.108	U 0.089	U 0.081	U 0.082	U 0.152	U 0.132	U 0.146
SW8270C	Fluoranthene	mg/kg							U 0.24	**5.33**	**1.66**			**J 0.156**	**J 0.47**	**J 0.237**	**J 0.133**	**J 0.287**	U 0.142	**12.6**	**J 0.379**
SW8270C	Fluorene	mg/kg							U 0.229	U 0.232	U 0.277			U 0.142	U 0.156	U 0.128	U 0.117	U 0.118	U 0.165	**J 0.71**	U 0.158
SW8270C	Hexachlorobenzene	mg/kg							U 0.217	U 0.22	U 0.262			U 0.154	U 0.17	U 0.139	U 0.127	U 0.129	U 0.162	U 0.14	U 0.155
SW8270C	Hexachlorobutadiene	mg/kg							U 0.225	U 0.228	U 0.272			U 0.2	U 0.221	U 0.181	U 0.165	U 0.167	U 0.149	U 0.129	U 0.143
SW8270C	Hexachlorocyclopentadiene	mg/kg							U 0.534	U 0.542	U 0.646			U 0.369	U 0.406	U 0.333	U 0.304	U 0.307	U 0.449	U 0.39	U 0.431
SW8270C	Hexachloroethane	mg/kg							U 0.215	U 0.218	U 0.26			U 0.183	U 0.201	U 0.165	U 0.15	U 0.152	U 0.15	U 0.13	U 0.144
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg							U 0.219	**1.65**	**J 0.74**			U 0.181	U 0.2	U 0.164	U 0.149	U 0.151	U 0.166	**3.04**	U 0.159
SW8270C	Isophorone	mg/kg							U 0.204	U 0.207	U 0.247			U 0.152	U 0.168	U 0.137	U 0.125	U 0.127	U 0.148	U 0.129	U 0.142
SW8270C	n-Nitroso-di-n-propylamine	mg/kg							U 0.244	U 0.247	U 0.295			U 0.158	U 0.175	U 0.143	U 0.13	U 0.132	U 0.149	U 0.129	U 0.143
SW8270C	n-Nitrosodiphenylamine	mg/kg							U 0.247	U 0.251	U 0.299			U 0.117	U 0.128	U 0.105	U 0.096	U 0.097	U 0.176	U 0.153	U 0.169
SW8270C	Naphthalene	mg/kg							U 0.204	U 0.207	U 0.247			U 0.137	U 0.15	U 0.123	U 0.112	U 0.114	U 0.141	U 0.122	U 0.135
SW8270C	Nitrobenzene	mg/kg							U 0.211	U 0.214	U 0.256			U 0.132	U 0.145	U 0.119	U 0.108	U 0.11	U 0.148	U 0.129	U 0.142
SW8270C	Pentachlorophenol	mg/kg							U 0.47	U 0.48	U 0.57			U 0.41	U 0.45	U 0.37	U 0.34	U 0.34	U 0.291	U 0.252	U 0.279
SW8270C	Phenanthrene	mg/kg							U 0.22	**2.5**	**J 1.01**			U 0.12	**J 0.299**	**J 0.141**	**J 0.107**	U 0.1	U 0.154	**6.26**	**J 0.216**
SW8270C	Phenol	mg/kg							U 0.228	U 0.231	U 0.275			U 0.17	U 0.187	U 0.153	U 0.14	U 0.142	U 0.152	U 0.132	U 0.146
SW8270C	Pyrene	mg/kg							U 0.241	**6.7**	**J 2.26**			**J 0.212**	**J 0.565**	**J 0.264**	**J 0.126**	**J 0.265**	U 0.214	**11.3**	**J 0.429**
SW8270C	2,4,6-Tribromophenol	percent							80	90	65			79	86	92	86	90	92	85	80
SW8270C	2-Fluorobiphenyl	percent							93	101	73			88	92	96	97	99	101	98	89
SW8270C	2-Fluorophenol	percent							78	88	63			76	84	86	84	94	93	92	85
SW8270C	Nitrobenzene-d5	percent							88	96	69			82	85	88	82	89	114	109	102
SW8270C	Phenol-d5	percent							78	87	62			78	84	85	84	91	97	94	87
SW8270C	Terphenyl-d14	percent							102	118	101			87	98	97	92	104	110	105	98

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7662	U9-7663	U9-7663	U9-7664	U9-7664	U9-7665	U9-7665	U9-7666	U9-7666	U9-7666	U9-7667	U9-7667	U9-7668	U9-7668	U9-7669	U9-7669	U9-7799	U9-7799	U9-7803	U9-7803
		Sample ID:	U97662002	U97663001	U97663002	U97664001	U97664002	U97665001	U97665002	U97666001	U97666002	U97666003	U97667001	U97667002	U97668001	U97668002	U97669001	U97669002	U97799001	U97799003	U97803001	U97803002
		Date:	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	09/16/2002	09/16/2002	09/16/2002	09/16/2002
Method	**Analyte**	**Units**																				
SW6010B	Barium	mg/kg	120	86.8	222	60.2	58.4	708	108	220	39.4	75.7	131	135	24.3	33.3	110	32				
SW6010B	Beryllium	mg/kg	J 0.32	U 0.12	J 0.14	J 0.23	J 0.34	J 0.15	J 0.52	J 0.24	U 0.17	J 0.26	J 0.28	J 0.55	J 0.16	J 0.3	J 0.17	U 0.15				
SW6010B	Cadmium	mg/kg	J 0.85	J 0.45	J 0.42	1.3	1.4	1.6	J 0.78	1.3	J 1	J 0.77	6.2	J 0.58	J 1.1	J 0.43	J 0.55	J 0.65				
SW6010B	Chromium	mg/kg	B 7.8	B 5.9	B 10.5	B 12.3	B 11.6	B 9.5	B 13.1	B 20.1	B 9.8	B 17.7	B 173	B 13.9	B 8.6	B 7	B 7.6	B 9.1				
SW6010B	Iron	mg/kg																				
SW6010B	Nickel	mg/kg	7.8	J 4.5	J 4.6	4.1	7.7	5.3	10	6.5	J 4.6	6	9.2	11.9	J 4.8	6.5	5.2	J 3.7				
SW6010B	Selenium	mg/kg	UB 4.4	U 2.2	U 2.2	U 1.8	U 2.1	U 1.8	U 2.3	U 2.4	U 3	U 2.5	U 2.4	U 2.3	U 2.5	U 2.6	U 2.3	U 2.7				
SW6010B	Zinc	mg/kg	57.8	91.9	127	81	39.2	129	36.2	215	129	201	429	40.1	130	40	214	108				
SW7060A	Arsenic	mg/kg	5.8	4	6.1	2	3.2	3.4	3	2.4	2.6	2	6.2	5.1	2.6	1.4	1.7	1.9	3.4	J 1.8	1.8	2.2
SW7421	Lead	mg/kg	16.5	19.8	27.7	25.6	16.7	52.4	9.7	144	182	105	422	8.6	37.6	10.2	16.3	15.2				
SW8081A	4,4'-DDD	µg/kg	J 0.52	J 1.16	J 1.69	J 25.18	J 1148	37.29	J 3.26	J 18.98	J 183.3	J 82.14	J 45.5	J 1.69	12.83	J 2.58	J 1.44	J 3.16				
SW8081A	4,4'-DDE	µg/kg	J 0.52	J 1.29	J 1.44	J 1.99	329.6	12.67	U 0.23	11.56	J 22.56	J 7.93	J 11.04	J 0.79	J 3.63	U 0.25	J 1.26	J 1.81				
SW8081A	4,4'-DDT	µg/kg	U 0.14	J 2.15	J 1.85	J 5.1	J 128.8	15.02	J 0.74	J 14.71	31.5	J 7.38	23.77	J 0.49	8.97	U 0.15	U 0.13	J 3.06				
SW8081A	Aldrin	µg/kg	U 0.12	U 0.11	U 0.12	U 0.1	U 0.11	J 1.04	U 0.12	J 0.65	U 0.72	U 0.25	U 0.25	U 0.12	U 0.13	J 0.27	U 0.12	U 0.13				
SW8081A	alpha-BHC	µg/kg	U 0.18	U 0.17	U 0.17	U 0.14	U 0.16	J 0.68	U 0.17	U 0.18	J 3.6	U 0.37	U 0.37	U 0.18	U 0.2	U 0.19	U 0.17	U 0.2				
SW8081A	alpha-Chlordane	µg/kg	U 0.16	J 0.23	J 0.73	J 5.78	J 156.4	8.02	J 1.49	J 14.87	51.01	J 69.78	J 17.6	J 0.66	J 2.21	J 0.79	U 0.15	U 0.18				
SW8081A	beta-BHC	µg/kg	U 0.22	U 0.21	U 0.22	U 0.18	U 0.2	9.25	U 0.22	U 0.22	J 12.08	U 0.47	U 0.47	U 0.22	U 0.25	U 0.24	U 0.22	U 0.25				
SW8081A	delta-BHC	µg/kg	U 0.42	U 0.4	U 0.41	U 0.33	J 0.61	J 3.42	U 0.41	U 0.42	J 12.15	U 0.88	U 0.88	U 0.42	U 0.47	U 0.44	U 0.41	U 0.47				
SW8081A	Dieldrin	µg/kg	U 0.13	U 0.13	U 0.13	J 0.44	20.99	J 3.03	U 0.13	J 1.65	J 12.71	12.83	58.46	J 1.57	U 0.15	U 0.14	U 0.13	J 0.95				
SW8081A	Endosulfan I	µg/kg	U 0.13	U 0.13	U 0.13	U 0.11	U 0.12	U 0.21	U 0.13	U 0.13	U 0.8	U 0.28	U 0.28	U 0.13	U 0.15	U 0.14	U 0.13	U 0.15				
SW8081A	Endosulfan II	µg/kg	U 0.14	J 0.25	U 0.13	U 0.11	U 0.12	U 0.22	U 0.13	U 0.14	U 0.81	U 0.28	U 0.28	U 0.14	U 0.15	U 0.14	U 0.13	U 0.15				
SW8081A	Endosulfan sulfate	µg/kg	U 0.18	U 0.18	U 0.18	U 0.15	U 0.17	U 0.3	U 0.18	U 0.18	U 1.11	U 0.38	U 0.38	U 0.18	U 0.21	U 0.19	U 0.18	U 0.21				
SW8081A	Endrin	µg/kg	U 0.18	U 0.17	U 0.18	U 0.15	U 0.17	J 1.57	U 0.18	U 0.18	U 1.1	J 1.15	U 0.38	U 0.18	U 0.21	U 0.19	J 0.53	U 0.21				
SW8081A	Endrin aldehyde	µg/kg	U 0.25	U 0.23	U 0.24	U 0.2	U 0.22	U 0.4	U 0.24	U 0.25	J 6.46	U 0.51	U 0.51	U 0.25	J 2	J 1.12	U 0.24	U 0.28				
SW8081A	Endrin Ketone	µg/kg	U 0.21	U 0.2	J 0.85	J 2.95	J 14.74	U 0.33	U 0.2	J 2.85	U 1.25	U 0.43	U 0.43	U 0.21	U 0.23	U 0.22	U 0.2	U 0.23				
SW8081A	gamma-BHC (Lindane)	µg/kg	U 0.22	U 0.21	U 0.22	U 0.18	U 0.2	J 2.04	U 0.21	U 0.22	J 5.16	U 0.46	U 0.46	U 0.22	U 0.25	U 0.23	U 0.21	U 0.25				
SW8081A	gamma-Chlordane	µg/kg	U 0.96	U 0.91	U 0.94	J 7.48	173.6	9.58	U 0.92	19.72	54.55	78.35	24.47	U 0.96	J 3.79	U 1.01	J 2.13	U 1.07				
SW8081A	Heptachlor	µg/kg	U 0.11	J 0.29	U 0.11	J 0.11	U 0.1	J 1.36	U 0.11	J 0.31	J 2.78	U 0.23	J 0.64	U 0.11	J 0.21	J 0.14	U 0.11	U 0.12				
SW8081A	Heptachlor epoxide	µg/kg	U 0.45	U 0.42	U 0.43	U 0.35	U 0.4	J 0.79	U 0.43	U 0.45	U 2.68	J 4.84	U 0.93	U 0.45	U 0.5	U 0.47	U 0.43	U 0.5				
SW8081A	Methoxychlor	µg/kg	U 0.2	U 0.2	J 2	J 12.6	J 16.9	U 0.4	UJ 0.2	J 22.9	U 1.4	U 0.5	U 0.5	UJ 0.2	UJ 0.3	U 0.2	U 0.2	U 0.3				
SW8081A	Toxaphene	µg/kg	U 13.9	U 13.3	U 13.6	U 11.1	U 12.6	U 22.4	U 13.4	U 13.9	U 83.9	U 29	U 29	U 13.9	U 15.6	U 14.7	U 13.4	U 15.6				
SW8081A	DCB	percent	86	66	57	J 68	J 64	J 56	J 89	J 50	J 55	J 49	J 57	J 84	J 52	J 78	J 40	J 56				
SW8081A	TCMX	percent	72	80	73	73	77	85	77	86	84	67	94	74	75	70	76	80				
SW8082	Aroclor 1016	µg/kg	U 1.1	U 1	U 1.1	U 1.8	U 4.1	U 1.8	U 2.2	U 2.2	U 2.7	U 2.3	U 2.3	U 2.2	U 2.5	U 2.4	J 3.7	U 2.5				
SW8082	Aroclor 1221	µg/kg	U 5.5	U 5.2	U 5.4	U 15.7	U 35.8	U 15.8	U 19	U 19.8	U 23.8	U 20.6	U 20.6	U 19.8	U 22	U 20.8	U 19	U 22				
SW8082	Aroclor 1232	µg/kg	U 3.6	U 3.4	U 3.5	U 2.8	U 6.4	U 2.9	U 3.4	U 3.6	U 4.3	U 3.7	U 3.7	U 3.6	U 4	U 3.8	U 3.4	U 4				
SW8082	Aroclor 1242	µg/kg	U 1.1	U 1	U 1	U 3.1	U 7.1	U 3.1	U 3.8	U 3.9	U 4.7	U 4.1	U 4.1	U 3.9	U 4.4	U 4.1	U 3.8	U 4.4				
SW8082	Aroclor 1248	µg/kg	U 0.8	U 0.7	U 0.8	U 0.7	U 1.5	U 0.7	U 0.8	U 0.9	U 1	U 0.9	U 0.9	U 0.9	U 1	U 0.9	U 0.8	U 1				
SW8082	Aroclor 1254	µg/kg	U 0.9	U 0.8	U 0.9	U 1.2	U 2.7	U 1.2	U 1.4	U 1.5	U 1.8	U 1.6	U 1.6	U 1.5	U 1.7	U 1.6	U 1.4	U 1.7				
SW8082	Aroclor 1260	µg/kg	U 1.4	J 2.3	J 3.2	72.7	373.7	J 30.9	J 4.1	J 38.3	480.4	133.9	117.9	U 2.4	135.2	U 2.5	U 2.3	J 7.8				
SW8082	DCB	percent	92	103	96	91	111	98	95	124	139	103	117	79	103	83	86	92				
SW8082	TCMX	percent	88	100	92	85	90	90	96	104	110	80	101	82	80	80	85	90				
SW8270C	1,2,4-Trichlorobenzene	mg/kg	U 0.121	U 0.115	U 0.118	U 0.098	U 0.111	U 0.099	U 0.118	U 0.123	U 0.148	U 0.128	U 0.128	U 0.123	U 0.137	U 0.13	U 0.118	U 0.137				
SW8270C	1,2-Dichlorobenzene	mg/kg	U 0.144	U 0.136	U 0.14	U 0.12	U 0.137	U 0.121	U 0.146	U 0.151	U 0.182	U 0.157	U 0.157	U 0.151	U 0.169	U 0.16	U 0.146	U 0.169				
SW8270C	1,3-Dichlorobenzene	mg/kg	U 0.114	U 0.109	U 0.111	U 0.107	U 0.122	U 0.108	U 0.129	U 0.134	U 0.162	U 0.14	U 0.14	U 0.134	U 0.15	U 0.142	U 0.129	U 0.15				
SW8270C	1,4-Dichlorobenzene	mg/kg	U 0.124	U 0.118	U 0.121	U 0.1	U 0.114	U 0.101	U 0.122	U 0.126	U 0.152	U 0.132	U 0.132	U 0.126	U 0.141	U 0.133	U 0.122	U 0.141				
SW8270C	2,4,5-Trichlorophenol	mg/kg	U 0.377	U 0.358	U 0.367	U 0.235	U 0.269	U 0.238	U 0.285	U 0.296	U 0.357	U 0.308	U 0.308	U 0.296	U 0.331	U 0.313	U 0.285	U 0.331				
SW8270C	2,4,6-Trichlorophenol	mg/kg	U 0.119	U 0.113	U 0.116	U 0.097	U 0.111	U 0.098	U 0.118	U 0.122	U 0.147	U 0.127	U 0.127	U 0.122	U 0.136	U 0.129	U 0.118	U 0.136				
SW8270C	2,4-Dichlorophenol	mg/kg	U 0.14	U 0.133	U 0.137	U 0.114	U 0.13	U 0.115	U 0.138	U 0.144	U 0.173	U 0.15	U 0.15	U 0.144	U 0.16	U 0.152	U 0.138	U 0.16				
SW8270C	2,4-Dimethylphenol	mg/kg	U 0.132	U 0.125	U 0.128	U 0.127	U 0.145	U 0.128	U 0.154	U 0.16	U 0.192	U 0.166	U 0.166	U 0.16	U 0.178	U 0.168	U 0.154	U 0.178				
SW8270C	2,4-Dinitrophenol	mg/kg	U 0.35	U 0.34	U 0.34	U 0.39	U 0.45	U 0.39	U 0.47	U 0.49	U 0.59	U 0.51	U 0.51	U 0.49	U 0.55	U 0.52	U 0.47	U 0.55				
SW8270C	2,4-Dinitrotoluene	mg/kg	U 0.156	U 0.148	U 0.152	U 0.105	U 0.12	U 0.106	U 0.128	U 0.133	U 0.16	U 0.138	U 0.138	U 0.133	U 0.148	U 0.14	U 0.128	U 0.148				
SW8270C	2,6-Dinitrotoluene	mg/kg	U 0.141	U 0.134	U 0.137	U 0.092	U 0.105	U 0.093	U 0.112	U 0.116	U 0.14	U 0.121	U 0.121	U 0.116	U 0.13	U 0.122	U 0.112	U 0.13				
SW8270C	2-Chloronaphthalene	mg/kg	U 0.126	U 0.12	U 0.123	U 0.087	U 0.1	U 0.088	U 0.106	U 0.11	U 0.133	U 0.115	U 0.115	U 0.11	U 0.123	U 0.116	U 0.106	U 0.123				
SW8270C	2-Chlorophenol	mg/kg	U 0.121	U 0.115	U 0.118	U 0.089	U 0.101	U 0.09	U 0.108	U 0.112	U 0.134	U 0.116	U 0.116	U 0.112	U 0.125	U 0.118	U 0.108	U 0.125				
SW8270C	2-Methylnaphthalene	mg/kg	U 0.138	U 0.132	U 0.135	U 0.095	U 0.109	U 0.096	U 0.115	U 0.12	U 0.144	U 0.125	U 0.125	U 0.12	U 0.134	U 0.126	U 0.115	U 0.134				
SW8270C	2-Methylphenol	mg/kg	U 0.139	U 0.132	U 0.135	U 0.102	U 0.116	U 0.103	U 0.123	U 0.128	U 0.154	U 0.133	U 0.133	U 0.128	U 0.143	U 0.135	U 0.123	U 0.143				
SW8270C	2-Nitroaniline	mg/kg	U 0.44	U 0.42	U 0.43	U 0.32	U 0.37	U 0.33	U 0.39	U 0.41	U 0.49	U 0.42	U 0.42	U 0.41	U 0.45	U 0.43	U 0.39	U 0.45				

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7662	U9-7663	U9-7663	U9-7664	U9-7664	U9-7665	U9-7665	U9-7666	U9-7666	U9-7666	U9-7667	U9-7667	U9-7668	U9-7668	U9-7669	U9-7669	U9-7799	U9-7799	U9-7803	U9-7803
		Sample ID:	U97662002	U97663001	U97663002	U97664001	U97664002	U97665001	U97665002	U97666001	U97666002	U97666003	U97667001	U97667002	U97668001	U97668002	U97669001	U97669002	U97799001	U97799003	U97803001	U97803002
		Date:	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	05/31/2002	09/16/2002	09/16/2002	09/16/2002	09/16/2002
SW8270C	2-Nitrophenol	mg/kg	U 0.128	U 0.121	U 0.125	U 0.108	U 0.124	U 0.11	U 0.132	U 0.137	U 0.164	U 0.142	U 0.142	U 0.137	U 0.152	U 0.144	U 0.132	U 0.152				
SW8270C	3,3-Dichlorobenzidine	mg/kg	U 0.315	U 0.299	U 0.307	U 0.069	U 0.079	U 0.07	U 0.084	UJ 0.087	UJ 0.105	UJ 0.091	UJ 0.091	U 0.087	UJ 0.097	U 0.092	UJ 0.084	U 0.097				
SW8270C	3-Nitroaniline	mg/kg	U 1.25	U 1.19	U 1.22	U 0.36	U 0.41	U 0.36	U 0.44	U 0.45	U 0.54	U 0.47	U 0.47	U 0.45	U 0.5	U 0.48	U 0.44	U 0.5				
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg	U 0.43	U 0.41	U 0.42	U 0.22	U 0.25	U 0.22	U 0.26	U 0.27	U 0.33	U 0.28	U 0.28	U 0.27	U 0.3	U 0.29	U 0.26	U 0.3				
SW8270C	4-Bromophenyl phenyl ether	mg/kg	U 0.155	U 0.147	U 0.151	U 0.098	U 0.112	U 0.099	U 0.119	U 0.124	U 0.149	U 0.129	U 0.129	U 0.124	U 0.138	U 0.131	U 0.119	U 0.138				
SW8270C	4-Chloro-3-methylphenol	mg/kg	U 0.143	U 0.136	U 0.139	U 0.101	U 0.115	U 0.102	U 0.122	U 0.127	U 0.153	U 0.132	U 0.132	U 0.127	U 0.142	U 0.134	U 0.122	U 0.142				
SW8270C	4-Chloroaniline	mg/kg	U 0.815	U 0.775	U 0.794	U 0.397	U 0.453	U 0.401	U 0.481	U 0.5	U 0.602	U 0.521	U 0.521	U 0.5	U 0.558	U 0.528	U 0.481	U 0.558				
SW8270C	4-Chlorophenyl phenyl ether	mg/kg	U 0.138	U 0.131	U 0.134	U 0.078	U 0.089	U 0.078	U 0.094	U 0.098	U 0.118	U 0.102	U 0.102	U 0.098	U 0.109	U 0.103	U 0.094	U 0.109				
SW8270C	4-Methylphenol	mg/kg	U 0.146	U 0.139	U 0.143	U 0.081	U 0.093	U 0.082	U 0.099	U 0.103	U 0.123	U 0.107	U 0.107	U 0.103	U 0.114	U 0.108	U 0.099	U 0.114				
SW8270C	4-Nitroaniline	mg/kg	U 0.41	U 0.39	U 0.4	U 0.27	U 0.3	U 0.27	U 0.32	U 0.34	U 0.4	U 0.35	U 0.35	U 0.34	U 0.37	U 0.35	U 0.32	U 0.37				
SW8270C	4-Nitrophenol	mg/kg	U 0.37	U 0.35	U 0.36	U 0.34	U 0.39	U 0.34	U 0.41	U 0.43	U 0.52	U 0.45	U 0.45	U 0.43	U 0.48	U 0.45	U 0.41	U 0.48				
SW8270C	Acenaphthene	mg/kg	U 0.138	U 0.131	U 0.135	U 0.096	U 0.11	U 0.097	U 0.117	U 0.121	U 0.146	U 0.126	U 0.126	U 0.121	U 0.135	U 0.128	U 0.117	U 0.135				
SW8270C	Acenaphthylene	mg/kg	U 0.14	U 0.133	U 0.136	U 0.083	U 0.094	U 0.084	U 0.1	U 0.104	U 0.125	U 0.108	U 0.108	U 0.104	U 0.116	U 0.11	U 0.1	U 0.116				
SW8270C	Anthracene	mg/kg	U 0.147	U 0.14	U 0.143	U 0.073	U 0.083	U 0.074	U 0.088	**J 0.32**	**J 0.122**	**J 0.289**	**J 0.097**	U 0.092	U 0.102	U 0.097	U 0.088	U 0.102				
SW8270C	Benzo (a) anthracene	mg/kg	U 0.151	U 0.144	U 0.148	U 0.098	U 0.111	**J 0.119**	U 0.118	UJ 0.123	UJ 0.148	**J 0.149**	**J 0.565**	U 0.123	UJ 0.137	U 0.13	UJ 0.118	U 0.137				
SW8270C	Benzo (a) pyrene	mg/kg	U 0.146	U 0.139	U 0.142	**J 0.094**	UJ 0.097	**J 0.206**	UJ 0.103	UJ 0.107	UJ 0.129	UJ 0.112	**J 0.526**	UJ 0.107	UJ 0.12	UJ 0.113	UJ 0.103	U 0.12				
SW8270C	Benzo (b) fluoranthene	mg/kg	U 0.168	U 0.16	U 0.164	**J 0.149**	UJ 0.115	**J 0.344**	UJ 0.123	**J 0.204**	UJ 0.153	**J 0.159**	**J 0.859**	UJ 0.127	UJ 0.142	UJ 0.134	UJ 0.123	U 0.142				
SW8270C	Benzo (g,h,i) perylene	mg/kg	U 0.138	U 0.131	U 0.134	UJ 0.101	UJ 0.115	**J 0.253**	UJ 0.122	UJ 0.127	UJ 0.152	UJ 0.132	UJ 0.132	UJ 0.127	UJ 0.141	UJ 0.134	UJ 0.122	U 0.141				
SW8270C	Benzo (k) fluoranthene	mg/kg	U 0.157	U 0.15	U 0.153	UJ 0.087	UJ 0.099	**J 0.127**	UJ 0.105	UJ 0.109	UJ 0.132	UJ 0.114	**J 0.361**	UJ 0.109	UJ 0.122	UJ 0.115	UJ 0.105	U 0.122				
SW8270C	Benzoic acid	mg/kg	**J 2.72**	**J 2.59**	U 0.42	U 0.38	U 0.44	U 0.39	U 0.46	**J 2.4**	**J 2.89**	**J 2.5**	U 0.5	U 0.48	U 0.54	U 0.51	U 0.46	U 0.54				
SW8270C	Benzyl alcohol	mg/kg	U 0.118	U 0.113	U 0.115	U 0.248	U 0.283	U 0.25	U 0.3	U 0.312	U 0.376	U 0.325	U 0.325	U 0.312	U 0.348	U 0.329	U 0.3	U 0.348				
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg	U 0.159	U 0.152	U 0.155	U 0.112	U 0.127	U 0.113	U 0.135	U 0.141	U 0.169	U 0.146	U 0.146	U 0.141	U 0.157	U 0.148	U 0.135	U 0.157				
SW8270C	Bis(2-Chloroethyl) ether	mg/kg	U 0.128	U 0.121	U 0.124	U 0.185	U 0.211	U 0.187	U 0.225	U 0.233	U 0.281	U 0.243	U 0.243	U 0.233	U 0.26	U 0.246	U 0.225	U 0.26				
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg	UJ 0.122	UJ 0.116	UJ 0.119	U 0.133	U 0.151	U 0.134	U 0.161	U 0.167	U 0.201	U 0.174	U 0.174	U 0.167	U 0.187	U 0.176	U 0.161	U 0.187				
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg	**J 0.6**	**5.01**	**J 0.338**	U 0.097	U 0.11	**J 0.604**	U 0.117	**J 0.236**	**J 0.478**	UJ 0.127	**J 1.36**	U 0.122	**J 0.43**	U 0.128	**J 0.38**	**1.75**				
SW8270C	Butyl benzyl phthalate	mg/kg	U 0.155	**4.69**	U 0.151	U 0.099	U 0.112	U 0.1	U 0.12	UJ 0.124	UJ 0.149	UJ 0.129	UJ 0.129	U 0.124	UJ 0.139	U 0.131	**J 0.134**	**J 0.161**				
SW8270C	Chrysene	mg/kg	U 0.144	U 0.137	U 0.141	**J 0.155**	U 0.11	**J 0.246**	U 0.117	**J 0.132**	UJ 0.146	UJ 0.126	**J 0.819**	U 0.122	UJ 0.136	U 0.128	UJ 0.117	U 0.136				
SW8270C	Di-n-butylphthalate	mg/kg	U 0.149	**0.941**	U 0.146	U 0.084	U 0.096	U 0.085	U 0.102	U 0.106	U 0.128	U 0.111	**J 0.114**	U 0.106	U 0.119	U 0.112	U 0.102	U 0.119				
SW8270C	Di-n-octyl phthalate	mg/kg	U 0.122	U 0.116	U 0.119	U 0.041	U 0.047	U 0.042	U 0.05	UJ 0.052	UJ 0.063	UJ 0.054	UJ 0.054	U 0.052	UJ 0.058	U 0.055	UJ 0.05	U 0.058				
SW8270C	Dibenz (a,h) anthracene	mg/kg	U 0.146	U 0.139	U 0.143	UJ 0.11	UJ 0.126	UJ 0.112	UJ 0.134	UJ 0.139	UJ 0.167	UJ 0.145	UJ 0.145	UJ 0.139	UJ 0.155	UJ 0.147	UJ 0.134	U 0.155				
SW8270C	Dibenzofuran	mg/kg	U 0.142	U 0.135	U 0.138	U 0.093	U 0.106	U 0.094	U 0.113	U 0.117	U 0.141	U 0.122	U 0.122	U 0.117	U 0.131	U 0.124	U 0.113	U 0.131				
SW8270C	Diethyl phthalate	mg/kg	U 0.133	U 0.127	U 0.13	U 0.074	U 0.084	U 0.074	U 0.089	U 0.093	U 0.111	U 0.096	U 0.096	U 0.093	U 0.103	U 0.098	U 0.089	U 0.103				
SW8270C	Dimethyl phthalate	mg/kg	U 0.142	U 0.135	U 0.139	U 0.066	U 0.075	U 0.066	U 0.08	U 0.083	U 0.1	U 0.086	U 0.086	U 0.083	U 0.092	U 0.087	U 0.08	U 0.092				
SW8270C	Fluoranthene	mg/kg	U 0.133	U 0.126	U 0.129	**J 0.254**	U 0.092	**J 0.312**	U 0.098	**J 0.115**	U 0.123	**J 0.225**	**1.08**	U 0.102	U 0.114	U 0.108	U 0.098	U 0.114				
SW8270C	Fluorene	mg/kg	U 0.154	U 0.147	U 0.15	U 0.095	U 0.108	U 0.096	U 0.115	U 0.12	U 0.144	U 0.124	U 0.124	U 0.12	U 0.133	U 0.126	U 0.115	U 0.133				
SW8270C	Hexachlorobenzene	mg/kg	U 0.151	U 0.144	U 0.148	U 0.104	U 0.118	U 0.105	U 0.126	U 0.13	U 0.157	U 0.136	U 0.136	U 0.13	U 0.146	U 0.138	U 0.126	U 0.146				
SW8270C	Hexachlorobutadiene	mg/kg	U 0.139	U 0.132	U 0.136	U 0.134	U 0.153	U 0.136	U 0.163	U 0.169	U 0.203	U 0.176	U 0.176	U 0.169	U 0.189	U 0.178	U 0.163	U 0.189				
SW8270C	Hexachlorocyclopentadiene	mg/kg	U 0.42	U 0.399	U 0.41	U 0.247	U 0.282	U 0.25	U 0.3	U 0.311	U 0.375	U 0.324	U 0.324	U 0.311	U 0.348	U 0.328	U 0.3	U 0.348				
SW8270C	Hexachloroethane	mg/kg	U 0.14	U 0.133	U 0.137	U 0.122	U 0.14	U 0.124	U 0.148	U 0.154	U 0.186	U 0.16	U 0.16	U 0.154	U 0.172	U 0.163	U 0.148	U 0.172				
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg	U 0.155	U 0.148	U 0.151	U 0.121	U 0.139	U 0.123	U 0.147	UJ 0.153	UJ 0.184	UJ 0.159	UJ 0.159	U 0.153	UJ 0.171	U 0.161	UJ 0.147	U 0.171				
SW8270C	Isophorone	mg/kg	U 0.139	U 0.132	U 0.135	U 0.102	U 0.116	U 0.103	U 0.124	U 0.128	U 0.154	U 0.134	U 0.134	U 0.128	U 0.143	U 0.135	U 0.124	U 0.143				
SW8270C	n-Nitroso-di-n-propylamine	mg/kg	U 0.139	U 0.132	U 0.136	U 0.106	U 0.121	U 0.107	U 0.129	U 0.134	U 0.161	U 0.139	U 0.139	U 0.134	U 0.149	U 0.141	U 0.129	U 0.149				
SW8270C	n-Nitrosodiphenylamine	mg/kg	U 0.165	U 0.157	U 0.161	U 0.078	U 0.089	U 0.079	U 0.095	U 0.098	U 0.118	U 0.102	U 0.102	U 0.098	U 0.11	U 0.104	U 0.095	U 0.11				
SW8270C	Naphthalene	mg/kg	U 0.132	U 0.125	U 0.128	U 0.092	U 0.104	U 0.092	U 0.111	U 0.115	U 0.139	U 0.12	U 0.12	U 0.115	U 0.129	U 0.122	U 0.111	U 0.129				
SW8270C	Nitrobenzene	mg/kg	U 0.139	U 0.132	U 0.135	U 0.088	U 0.101	U 0.089	U 0.107	U 0.111	U 0.134	U 0.116	U 0.116	U 0.111	U 0.124	U 0.117	U 0.107	U 0.124				
SW8270C	Pentachlorophenol	mg/kg	U 0.272	U 0.258	U 0.265	U 0.276	U 0.315	U 0.279	U 0.335	U 0.348	U 0.418	U 0.362	U 0.362	U 0.348	U 0.388	U 0.367	U 0.335	U 0.388				
SW8270C	Phenanthrene	mg/kg	U 0.144	U 0.137	U 0.14	**J 0.164**	U 0.091	**J 0.13**	U 0.097	U 0.101	U 0.121	U 0.105	**J 0.613**	U 0.101	U 0.113	U 0.106	U 0.097	U 0.113				
SW8270C	Phenol	mg/kg	U 0.142	U 0.135	U 0.138	U 0.114	U 0.13	U 0.115	U 0.138	U 0.143	U 0.172	U 0.149	U 0.149	U 0.143	U 0.16	U 0.151	U 0.138	U 0.16				
SW8270C	Pyrene	mg/kg	U 0.2	U 0.19	U 0.195	**J 0.24**	U 0.112	**J 0.383**	U 0.119	**J 0.255**	UJ 0.149	**J 0.366**	**J 1.93**	U 0.124	UJ 0.138	U 0.13	UJ 0.119	U 0.138				
SW8270C	2,4,6-Tribromophenol	percent	83	83	75	65	66	61	60	80	70	73	76	59	72	61	72	67				
SW8270C	2-Fluorobiphenyl	percent	93	91	88	84	82	81	78	90	83	87	87	78	88	77	89	78				
SW8270C	2-Fluorophenol	percent	88	87	84	83	81	80	80	86	86	82	85	73	81	73	83	76				
SW8270C	Nitrobenzene-d5	percent	109	110	103	80	75	77	78	80	78	76	78	66	74	66	76	71				
SW8270C	Phenol-d5	percent	90	90	88	85	83	81	81	87	85	84	86	72	81	72	87	77				
SW8270C	Terphenyl-d14	percent	102	102	98	99	97	114	99	146	146	139	167	108	143	111	160	126				

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7807	U9-7807	U9-7808	U9-7808	U9-7811	U9-7811	U9-7812	U9-7812	U9-7813	U9-7813	U9-7815	U9-7815	U9-7816	U9-7816	U9-7817	U9-7817	U9-7817	U9-7818	U9-7818	U9-7820
		Sample ID:	U97807001	U97807002	U97808001	U97808002	U97811001	U97811003	U97812001	U97812002	U97813001	U97813002	U97815001	U97815002	U97816001	U97816003	U97817001	U97817002	U97817006	U97818001	U97818002	U97820001
		Date:	09/16/2002	09/16/2002	09/16/2002	09/16/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/20/2002	09/20/2002	12/06/2002	09/23/2002	09/23/2002	09/20/2002
Method	**Analyte**	**Units**																				
SW6010B	Barium	mg/kg																				
SW6010B	Beryllium	mg/kg																				
SW6010B	Cadmium	mg/kg																				
SW6010B	Chromium	mg/kg																				
SW6010B	Iron	mg/kg																	**B 9010**			
SW6010B	Nickel	mg/kg																				
SW6010B	Selenium	mg/kg																				
SW6010B	Zinc	mg/kg																				
SW7060A	Arsenic	mg/kg	**5.2**	**2.8**	**7.4**	**4**	**4.2**	**2.1**	**6.8**	**3.2**	**6.4**	**6.6**	**2.3**	**6.4**	**4.7**	**J 5.4**	**6.5**	**J 11.2**	**2.9**	**116.6**	**J 3.5**	**J 6.1**
SW7421	Lead	mg/kg																				
SW8081A	4,4'-DDD	µg/kg																				
SW8081A	4,4'-DDE	µg/kg																				
SW8081A	4,4'-DDT	µg/kg																				
SW8081A	Aldrin	µg/kg																				
SW8081A	alpha-BHC	µg/kg																				
SW8081A	alpha-Chlordane	µg/kg																				
SW8081A	beta-BHC	µg/kg																				
SW8081A	delta-BHC	µg/kg																				
SW8081A	Dieldrin	µg/kg																				
SW8081A	Endosulfan I	µg/kg																				
SW8081A	Endosulfan II	µg/kg																				
SW8081A	Endosulfan sulfate	µg/kg																				
SW8081A	Endrin	µg/kg																				
SW8081A	Endrin aldehyde	µg/kg																				
SW8081A	Endrin Ketone	µg/kg																				
SW8081A	gamma-BHC (Lindane)	µg/kg																				
SW8081A	gamma-Chlordane	µg/kg																				
SW8081A	Heptachlor	µg/kg																				
SW8081A	Heptachlor epoxide	µg/kg																				
SW8081A	Methoxychlor	µg/kg																				
SW8081A	Toxaphene	µg/kg																				
SW8081A	DCB	percent																				
SW8081A	TCMX	percent																				
SW8082	Aroclor 1016	µg/kg																				
SW8082	Aroclor 1221	µg/kg																				
SW8082	Aroclor 1232	µg/kg																				
SW8082	Aroclor 1242	µg/kg																				
SW8082	Aroclor 1248	µg/kg																				
SW8082	Aroclor 1254	µg/kg																				
SW8082	Aroclor 1260	µg/kg																				
SW8082	DCB	percent																				
SW8082	TCMX	percent																				
SW8270C	1,2,4-Trichlorobenzene	mg/kg																				
SW8270C	1,2-Dichlorobenzene	mg/kg																				
SW8270C	1,3-Dichlorobenzene	mg/kg																				
SW8270C	1,4-Dichlorobenzene	mg/kg																				
SW8270C	2,4,5-Trichlorophenol	mg/kg																				
SW8270C	2,4,6-Trichlorophenol	mg/kg																				
SW8270C	2,4-Dichlorophenol	mg/kg																				
SW8270C	2,4-Dimethylphenol	mg/kg																				
SW8270C	2,4-Dinitrophenol	mg/kg																				
SW8270C	2,4-Dinitrotoluene	mg/kg																				
SW8270C	2,6-Dinitrotoluene	mg/kg																				
SW8270C	2-Chloronaphthalene	mg/kg																				
SW8270C	2-Chlorophenol	mg/kg																				
SW8270C	2-Methylnaphthalene	mg/kg																				
SW8270C	2-Methylphenol	mg/kg																				
SW8270C	2-Nitroaniline	mg/kg																				

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7807	U9-7807	U9-7808	U9-7808	U9-7811	U9-7811	U9-7812	U9-7812	U9-7813	U9-7813	U9-7815	U9-7815	U9-7816	U9-7816	U9-7817	U9-7817	U9-7817	U9-7818	U9-7818	U9-7820
		Sample ID:	U97807001	U97807002	U97808001	U97808002	U97811001	U97811003	U97812001	U97812002	U97813001	U97813002	U97815001	U97815002	U97816001	U97816003	U97817001	U97817002	U97817006	U97818001	U97818002	U97820001
		Date:	09/16/2002	09/16/2002	09/16/2002	09/16/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/17/2002	09/20/2002	09/20/2002	12/06/2002	09/23/2002	09/23/2002	09/20/2002
SW8270C	2-Nitrophenol	mg/kg																				
SW8270C	3,3-Dichlorobenzidine	mg/kg																				
SW8270C	3-Nitroaniline	mg/kg																				
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg																				
SW8270C	4-Bromophenyl phenyl ether	mg/kg																				
SW8270C	4-Chloro-3-methylphenol	mg/kg																				
SW8270C	4-Chloroaniline	mg/kg																				
SW8270C	4-Chlorophenyl phenyl ether	mg/kg																				
SW8270C	4-Methylphenol	mg/kg																				
SW8270C	4-Nitroaniline	mg/kg																				
SW8270C	4-Nitrophenol	mg/kg																				
SW8270C	Acenaphthene	mg/kg																				
SW8270C	Acenaphthylene	mg/kg																				
SW8270C	Anthracene	mg/kg																				
SW8270C	Benzo (a) anthracene	mg/kg																				
SW8270C	Benzo (a) pyrene	mg/kg																				
SW8270C	Benzo (b) fluoranthene	mg/kg																				
SW8270C	Benzo (g,h,i) perylene	mg/kg																				
SW8270C	Benzo (k) fluoranthene	mg/kg																				
SW8270C	Benzoic acid	mg/kg																				
SW8270C	Benzyl alcohol	mg/kg																				
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg																				
SW8270C	Bis(2-Chloroethyl) ether	mg/kg																				
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg																				
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg																				
SW8270C	Butyl benzyl phthalate	mg/kg																				
SW8270C	Chrysene	mg/kg																				
SW8270C	Di-n-butylphthalate	mg/kg																				
SW8270C	Di-n-octyl phthalate	mg/kg																				
SW8270C	Dibenz (a,h) anthracene	mg/kg																				
SW8270C	Dibenzofuran	mg/kg																				
SW8270C	Diethyl phthalate	mg/kg																				
SW8270C	Dimethyl phthalate	mg/kg																				
SW8270C	Fluoranthene	mg/kg																				
SW8270C	Fluorene	mg/kg																				
SW8270C	Hexachlorobenzene	mg/kg																				
SW8270C	Hexachlorobutadiene	mg/kg																				
SW8270C	Hexachlorocyclopentadiene	mg/kg																				
SW8270C	Hexachloroethane	mg/kg																				
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg																				
SW8270C	Isophorone	mg/kg																				
SW8270C	n-Nitroso-di-n-propylamine	mg/kg																				
SW8270C	n-Nitrosodiphenylamine	mg/kg																				
SW8270C	Naphthalene	mg/kg																				
SW8270C	Nitrobenzene	mg/kg																				
SW8270C	Pentachlorophenol	mg/kg																				
SW8270C	Phenanthrene	mg/kg																				
SW8270C	Phenol	mg/kg																				
SW8270C	Pyrene	mg/kg																				
SW8270C	2,4,6-Tribromophenol	percent																				
SW8270C	2-Fluorobiphenyl	percent																				
SW8270C	2-Fluorophenol	percent																				
SW8270C	Nitrobenzene-d5	percent																				
SW8270C	Phenol-d5	percent																				
SW8270C	Terphenyl-d14	percent																				

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7820	U9-7821	U9-7821	U9-7822	U9-7822	U9-7822	U9-7823	U9-7823	U9-7825	U9-7825	U9-7826	U9-7826	U9-7827	U9-7827	U9-7828	U9-7828	U9-7830	U9-7830	U9-7831	U9-7831
		Sample ID:	U97820002	U97821001	U97821002	U97822001	U97822002	U97822006	U97823001	U97823002	U97825001	U97825002	U97826001	U97826003	U97827001	U97827002	U97828001	U97828002	U97830001	U97830002	U97831001	U97831002
		Date:	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	12/06/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002
Method	**Analyte**	**Units**																				
SW6010B	Barium	mg/kg																				
SW6010B	Beryllium	mg/kg																				
SW6010B	Cadmium	mg/kg																				
SW6010B	Chromium	mg/kg																				
SW6010B	Iron	mg/kg						**B 6040**														
SW6010B	Nickel	mg/kg																				
SW6010B	Selenium	mg/kg																				
SW6010B	Zinc	mg/kg																				
SW7060A	Arsenic	mg/kg	**J 6.6**	**J 2.9**	**J 5.3**	**J 2.6**	**J 12.2**	**2.2**	**12.9**	**3.6**	**J 5.7**	**2.8**	**J 4.6**	**3.5**	**3.4**	**J 1.2**	**J 2.2**	**J 2.3**	**2.2**	U 0.8	**J 35.4**	**9.3**
SW7421	Lead	mg/kg																				
SW8081A	4,4'-DDD	µg/kg																				
SW8081A	4,4'-DDE	µg/kg																				
SW8081A	4,4'-DDT	µg/kg																				
SW8081A	Aldrin	µg/kg																				
SW8081A	alpha-BHC	µg/kg																				
SW8081A	alpha-Chlordane	µg/kg																				
SW8081A	beta-BHC	µg/kg																				
SW8081A	delta-BHC	µg/kg																				
SW8081A	Dieldrin	µg/kg																				
SW8081A	Endosulfan I	µg/kg																				
SW8081A	Endosulfan II	µg/kg																				
SW8081A	Endosulfan sulfate	µg/kg																				
SW8081A	Endrin	µg/kg																				
SW8081A	Endrin aldehyde	µg/kg																				
SW8081A	Endrin Ketone	µg/kg																				
SW8081A	gamma-BHC (Lindane)	µg/kg																				
SW8081A	gamma-Chlordane	µg/kg																				
SW8081A	Heptachlor	µg/kg																				
SW8081A	Heptachlor epoxide	µg/kg																				
SW8081A	Methoxychlor	µg/kg																				
SW8081A	Toxaphene	µg/kg																				
SW8081A	DCB	percent																				
SW8081A	TCMX	percent																				
SW8082	Aroclor 1016	µg/kg																				
SW8082	Aroclor 1221	µg/kg																				
SW8082	Aroclor 1232	µg/kg																				
SW8082	Aroclor 1242	µg/kg																				
SW8082	Aroclor 1248	µg/kg																				
SW8082	Aroclor 1254	µg/kg																				
SW8082	Aroclor 1260	µg/kg																				
SW8082	DCB	percent																				
SW8082	TCMX	percent																				
SW8270C	1,2,4-Trichlorobenzene	mg/kg																				
SW8270C	1,2-Dichlorobenzene	mg/kg																				
SW8270C	1,3-Dichlorobenzene	mg/kg																				
SW8270C	1,4-Dichlorobenzene	mg/kg																				
SW8270C	2,4,5-Trichlorophenol	mg/kg																				
SW8270C	2,4,6-Trichlorophenol	mg/kg																				
SW8270C	2,4-Dichlorophenol	mg/kg																				
SW8270C	2,4-Dimethylphenol	mg/kg																				
SW8270C	2,4-Dinitrophenol	mg/kg																				
SW8270C	2,4-Dinitrotoluene	mg/kg																				
SW8270C	2,6-Dinitrotoluene	mg/kg																				
SW8270C	2-Chloronaphthalene	mg/kg																				
SW8270C	2-Chlorophenol	mg/kg																				
SW8270C	2-Methylnaphthalene	mg/kg																				
SW8270C	2-Methylphenol	mg/kg																				
SW8270C	2-Nitroaniline	mg/kg																				

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7820	U9-7821	U9-7821	U9-7822	U9-7822	U9-7822	U9-7823	U9-7823	U9-7825	U9-7825	U9-7826	U9-7826	U9-7827	U9-7827	U9-7828	U9-7828	U9-7830	U9-7830	U9-7831	U9-7831
		Sample ID:	U97820002	U97821001	U97821002	U97822001	U97822002	U97822006	U97823001	U97823002	U97825001	U97825002	U97826001	U97826003	U97827001	U97827002	U97828001	U97828002	U97830001	U97830002	U97831001	U97831002
		Date:	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	12/06/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002	09/20/2002
SW8270C	2-Nitrophenol	mg/kg																				
SW8270C	3,3-Dichlorobenzidine	mg/kg																				
SW8270C	3-Nitroaniline	mg/kg																				
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg																				
SW8270C	4-Bromophenyl phenyl ether	mg/kg																				
SW8270C	4-Chloro-3-methylphenol	mg/kg																				
SW8270C	4-Chloroaniline	mg/kg																				
SW8270C	4-Chlorophenyl phenyl ether	mg/kg																				
SW8270C	4-Methylphenol	mg/kg																				
SW8270C	4-Nitroaniline	mg/kg																				
SW8270C	4-Nitrophenol	mg/kg																				
SW8270C	Acenaphthene	mg/kg																				
SW8270C	Acenaphthylene	mg/kg																				
SW8270C	Anthracene	mg/kg																				
SW8270C	Benzo (a) anthracene	mg/kg																				
SW8270C	Benzo (a) pyrene	mg/kg																				
SW8270C	Benzo (b) fluoranthene	mg/kg																				
SW8270C	Benzo (g,h,i) perylene	mg/kg																				
SW8270C	Benzo (k) fluoranthene	mg/kg																				
SW8270C	Benzoic acid	mg/kg																				
SW8270C	Benzyl alcohol	mg/kg																				
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg																				
SW8270C	Bis(2-Chloroethyl) ether	mg/kg																				
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg																				
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg																				
SW8270C	Butyl benzyl phthalate	mg/kg																				
SW8270C	Chrysene	mg/kg																				
SW8270C	Di-n-butylphthalate	mg/kg																				
SW8270C	Di-n-octyl phthalate	mg/kg																				
SW8270C	Dibenz (a,h) anthracene	mg/kg																				
SW8270C	Dibenzofuran	mg/kg																				
SW8270C	Diethyl phthalate	mg/kg																				
SW8270C	Dimethyl phthalate	mg/kg																				
SW8270C	Fluoranthene	mg/kg																				
SW8270C	Fluorene	mg/kg																				
SW8270C	Hexachlorobenzene	mg/kg																				
SW8270C	Hexachlorobutadiene	mg/kg																				
SW8270C	Hexachlorocyclopentadiene	mg/kg																				
SW8270C	Hexachloroethane	mg/kg																				
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg																				
SW8270C	Isophorone	mg/kg																				
SW8270C	n-Nitroso-di-n-propylamine	mg/kg																				
SW8270C	n-Nitrosodiphenylamine	mg/kg																				
SW8270C	Naphthalene	mg/kg																				
SW8270C	Nitrobenzene	mg/kg																				
SW8270C	Pentachlorophenol	mg/kg																				
SW8270C	Phenanthrene	mg/kg																				
SW8270C	Phenol	mg/kg																				
SW8270C	Pyrene	mg/kg																				
SW8270C	2,4,6-Tribromophenol	percent																				
SW8270C	2-Fluorobiphenyl	percent																				
SW8270C	2-Fluorophenol	percent																				
SW8270C	Nitrobenzene-d5	percent																				
SW8270C	Phenol-d5	percent																				
SW8270C	Terphenyl-d14	percent																				

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7832	U9-7832	U9-7835	U9-7835	U9-7836	U9-7836	U9-7839	U9-7839	U9-7840	U9-7840	U9-7842	U9-7842	U9-7843	U9-7843	U9-7844	U9-7844	U9-7845	U9-7845	U9-7846	U9-7846
		Sample ID:	U97832001	U97832002	U97835001	U97835002	U97836001	U97836003	U97839001	U97839002	U97840001	U97840002	U97842001	U97842002	U97843001	U97843002	U97844001	U97844002	U97845001	U97845002	U97846001	U97846002
		Date:	09/20/2002	09/20/2002	09/23/2002	09/23/2002	09/23/2002	09/23/2002	09/24/2002	09/24/2002	09/24/2002	09/24/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002
Method	**Analyte**	**Units**																				
SW6010B	Barium	mg/kg																				
SW6010B	Beryllium	mg/kg																				
SW6010B	Cadmium	mg/kg																				
SW6010B	Chromium	mg/kg																				
SW6010B	Iron	mg/kg											J 11500	J 5510					B 5570	B 3740		
SW6010B	Nickel	mg/kg																				
SW6010B	Selenium	mg/kg																				
SW6010B	Zinc	mg/kg																				
SW7060A	Arsenic	mg/kg	J 3.3	9.3	J 2.1	J 5.2	8.6	4.6	3.6	4.7	5.5	2.7	11.6	3.2	2.5	2.3	6.5	2.4	3.6	2.4	J 4	2.7
SW7421	Lead	mg/kg																				
SW8081A	4,4'-DDD	µg/kg																				
SW8081A	4,4'-DDE	µg/kg																				
SW8081A	4,4'-DDT	µg/kg																				
SW8081A	Aldrin	µg/kg																				
SW8081A	alpha-BHC	µg/kg																				
SW8081A	alpha-Chlordane	µg/kg																				
SW8081A	beta-BHC	µg/kg																				
SW8081A	delta-BHC	µg/kg																				
SW8081A	Dieldrin	µg/kg																				
SW8081A	Endosulfan I	µg/kg																				
SW8081A	Endosulfan II	µg/kg																				
SW8081A	Endosulfan sulfate	µg/kg																				
SW8081A	Endrin	µg/kg																				
SW8081A	Endrin aldehyde	µg/kg																				
SW8081A	Endrin Ketone	µg/kg																				
SW8081A	gamma-BHC (Lindane)	µg/kg																				
SW8081A	gamma-Chlordane	µg/kg																				
SW8081A	Heptachlor	µg/kg																				
SW8081A	Heptachlor epoxide	µg/kg																				
SW8081A	Methoxychlor	µg/kg																				
SW8081A	Toxaphene	µg/kg																				
SW8081A	DCB	percent																				
SW8081A	TCMX	percent																				
SW8082	Aroclor 1016	µg/kg																				
SW8082	Aroclor 1221	µg/kg																				
SW8082	Aroclor 1232	µg/kg																				
SW8082	Aroclor 1242	µg/kg																				
SW8082	Aroclor 1248	µg/kg																				
SW8082	Aroclor 1254	µg/kg																				
SW8082	Aroclor 1260	µg/kg																				
SW8082	DCB	percent																				
SW8082	TCMX	percent																				
SW8270C	1,2,4-Trichlorobenzene	mg/kg																				
SW8270C	1,2-Dichlorobenzene	mg/kg																				
SW8270C	1,3-Dichlorobenzene	mg/kg																				
SW8270C	1,4-Dichlorobenzene	mg/kg																				
SW8270C	2,4,5-Trichlorophenol	mg/kg																				
SW8270C	2,4,6-Trichlorophenol	mg/kg																				
SW8270C	2,4-Dichlorophenol	mg/kg																				
SW8270C	2,4-Dimethylphenol	mg/kg																				
SW8270C	2,4-Dinitrophenol	mg/kg																				
SW8270C	2,4-Dinitrotoluene	mg/kg																				
SW8270C	2,6-Dinitrotoluene	mg/kg																				
SW8270C	2-Chloronaphthalene	mg/kg																				
SW8270C	2-Chlorophenol	mg/kg																				
SW8270C	2-Methylnaphthalene	mg/kg																				
SW8270C	2-Methylphenol	mg/kg																				
SW8270C	2-Nitroaniline	mg/kg																				

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7832	U9-7832	U9-7835	U9-7835	U9-7836	U9-7836	U9-7839	U9-7839	U9-7840	U9-7840	U9-7842	U9-7842	U9-7843	U9-7843	U9-7844	U9-7844	U9-7845	U9-7845	U9-7846	U9-7846
		Sample ID:	U97832001	U97832002	U97835001	U97835002	U97836001	U97836003	U97839001	U97839002	U97840001	U97840002	U97842001	U97842002	U97843001	U97843002	U97844001	U97844002	U97845001	U97845002	U97846001	U97846002
		Date:	09/20/2002	09/20/2002	09/23/2002	09/23/2002	09/23/2002	09/23/2002	09/24/2002	09/24/2002	09/24/2002	09/24/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002
SW8270C	2-Nitrophenol	mg/kg																				
SW8270C	3,3-Dichlorobenzidine	mg/kg																				
SW8270C	3-Nitroaniline	mg/kg																				
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg																				
SW8270C	4-Bromophenyl phenyl ether	mg/kg																				
SW8270C	4-Chloro-3-methylphenol	mg/kg																				
SW8270C	4-Chloroaniline	mg/kg																				
SW8270C	4-Chlorophenyl phenyl ether	mg/kg																				
SW8270C	4-Methylphenol	mg/kg																				
SW8270C	4-Nitroaniline	mg/kg																				
SW8270C	4-Nitrophenol	mg/kg																				
SW8270C	Acenaphthene	mg/kg																				
SW8270C	Acenaphthylene	mg/kg																				
SW8270C	Anthracene	mg/kg																				
SW8270C	Benzo (a) anthracene	mg/kg																				
SW8270C	Benzo (a) pyrene	mg/kg																				
SW8270C	Benzo (b) fluoranthene	mg/kg																				
SW8270C	Benzo (g,h,i) perylene	mg/kg																				
SW8270C	Benzo (k) fluoranthene	mg/kg																				
SW8270C	Benzoic acid	mg/kg																				
SW8270C	Benzyl alcohol	mg/kg																				
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg																				
SW8270C	Bis(2-Chloroethyl) ether	mg/kg																				
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg																				
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg																				
SW8270C	Butyl benzyl phthalate	mg/kg																				
SW8270C	Chrysene	mg/kg																				
SW8270C	Di-n-butylphthalate	mg/kg																				
SW8270C	Di-n-octyl phthalate	mg/kg																				
SW8270C	Dibenz (a,h) anthracene	mg/kg																				
SW8270C	Dibenzofuran	mg/kg																				
SW8270C	Diethyl phthalate	mg/kg																				
SW8270C	Dimethyl phthalate	mg/kg																				
SW8270C	Fluoranthene	mg/kg																				
SW8270C	Fluorene	mg/kg																				
SW8270C	Hexachlorobenzene	mg/kg																				
SW8270C	Hexachlorobutadiene	mg/kg																				
SW8270C	Hexachlorocyclopentadiene	mg/kg																				
SW8270C	Hexachloroethane	mg/kg																				
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg																				
SW8270C	Isophorone	mg/kg																				
SW8270C	n-Nitroso-di-n-propylamine	mg/kg																				
SW8270C	n-Nitrosodiphenylamine	mg/kg																				
SW8270C	Naphthalene	mg/kg																				
SW8270C	Nitrobenzene	mg/kg																				
SW8270C	Pentachlorophenol	mg/kg																				
SW8270C	Phenanthrene	mg/kg																				
SW8270C	Phenol	mg/kg																				
SW8270C	Pyrene	mg/kg																				
SW8270C	2,4,6-Tribromophenol	percent																				
SW8270C	2-Fluorobiphenyl	percent																				
SW8270C	2-Fluorophenol	percent																				
SW8270C	Nitrobenzene-d5	percent																				
SW8270C	Phenol-d5	percent																				
SW8270C	Terphenyl-d14	percent																				

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7847	U9-7847	U9-7848	U9-7848	U9-7849	U9-7849	U9-7850	U9-7850	U9-7851	U9-7851	U9-7852	U9-7852	U9-7853	U9-7853	U9-7854	U9-7854	U9-7855	U9-7855	U9-7856	U9-7856
		Sample ID:	U97847001	U97847002	U97848001	U97848002	U97849001	U97849002	U97850001	U97850002	U97851001	U97851002	U97852001	U97852002	U97853001	U97853002	U97854001	U97854002	U97855001	U97855002	U97856001	U97856002
		Date:	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002
Method	**Analyte**	**Units**																				
SW6010B	Barium	mg/kg																				
SW6010B	Beryllium	mg/kg																				
SW6010B	Cadmium	mg/kg																				
SW6010B	Chromium	mg/kg																				
SW6010B	Iron	mg/kg									**6990**	**6320**										
SW6010B	Nickel	mg/kg																				
SW6010B	Selenium	mg/kg																				
SW6010B	Zinc	mg/kg																				
SW7060A	Arsenic	mg/kg	**47.2**	**3.1**	**7**	**3.6**	**12.2**	**5**	**B 5.9**	**B 3.2**	**B 4.8**	**B 2.6**	**24.6**	**4.1**	**J 2.4**	**2.9**	**2.3**	**3.9**	**2.6**	**2.3**	**3.4**	**3.2**
SW7421	Lead	mg/kg																				
SW8081A	4,4'-DDD	µg/kg																				
SW8081A	4,4'-DDE	µg/kg																				
SW8081A	4,4'-DDT	µg/kg																				
SW8081A	Aldrin	µg/kg																				
SW8081A	alpha-BHC	µg/kg																				
SW8081A	alpha-Chlordane	µg/kg																				
SW8081A	beta-BHC	µg/kg																				
SW8081A	delta-BHC	µg/kg																				
SW8081A	Dieldrin	µg/kg																				
SW8081A	Endosulfan I	µg/kg																				
SW8081A	Endosulfan II	µg/kg																				
SW8081A	Endosulfan sulfate	µg/kg																				
SW8081A	Endrin	µg/kg																				
SW8081A	Endrin aldehyde	µg/kg																				
SW8081A	Endrin Ketone	µg/kg																				
SW8081A	gamma-BHC (Lindane)	µg/kg																				
SW8081A	gamma-Chlordane	µg/kg																				
SW8081A	Heptachlor	µg/kg																				
SW8081A	Heptachlor epoxide	µg/kg																				
SW8081A	Methoxychlor	µg/kg																				
SW8081A	Toxaphene	µg/kg																				
SW8081A	DCB	percent																				
SW8081A	TCMX	percent																				
SW8082	Aroclor 1016	µg/kg																				
SW8082	Aroclor 1221	µg/kg																				
SW8082	Aroclor 1232	µg/kg																				
SW8082	Aroclor 1242	µg/kg																				
SW8082	Aroclor 1248	µg/kg																				
SW8082	Aroclor 1254	µg/kg																				
SW8082	Aroclor 1260	µg/kg																				
SW8082	DCB	percent																				
SW8082	TCMX	percent																				
SW8270C	1,2,4-Trichlorobenzene	mg/kg																				
SW8270C	1,2-Dichlorobenzene	mg/kg																				
SW8270C	1,3-Dichlorobenzene	mg/kg																				
SW8270C	1,4-Dichlorobenzene	mg/kg																				
SW8270C	2,4,5-Trichlorophenol	mg/kg																				
SW8270C	2,4,6-Trichlorophenol	mg/kg																				
SW8270C	2,4-Dichlorophenol	mg/kg																				
SW8270C	2,4-Dimethylphenol	mg/kg																				
SW8270C	2,4-Dinitrophenol	mg/kg																				
SW8270C	2,4-Dinitrotoluene	mg/kg																				
SW8270C	2,6-Dinitrotoluene	mg/kg																				
SW8270C	2-Chloronaphthalene	mg/kg																				
SW8270C	2-Chlorophenol	mg/kg																				
SW8270C	2-Methylnaphthalene	mg/kg																				
SW8270C	2-Methylphenol	mg/kg																				
SW8270C	2-Nitroaniline	mg/kg																				

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7847	U9-7847	U9-7848	U9-7848	U9-7849	U9-7849	U9-7850	U9-7850	U9-7851	U9-7851	U9-7852	U9-7852	U9-7853	U9-7853	U9-7854	U9-7854	U9-7855	U9-7855	U9-7856	U9-7856
		Sample ID:	U97847001	U97847002	U97848001	U97848002	U97849001	U97849002	U97850001	U97850002	U97851001	U97851002	U97852001	U97852002	U97853001	U97853002	U97854001	U97854002	U97855001	U97855002	U97856001	U97856002
		Date:	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002	12/06/2002
SW8270C	2-Nitrophenol	mg/kg																				
SW8270C	3,3-Dichlorobenzidine	mg/kg																				
SW8270C	3-Nitroaniline	mg/kg																				
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg																				
SW8270C	4-Bromophenyl phenyl ether	mg/kg																				
SW8270C	4-Chloro-3-methylphenol	mg/kg																				
SW8270C	4-Chloroaniline	mg/kg																				
SW8270C	4-Chlorophenyl phenyl ether	mg/kg																				
SW8270C	4-Methylphenol	mg/kg																				
SW8270C	4-Nitroaniline	mg/kg																				
SW8270C	4-Nitrophenol	mg/kg																				
SW8270C	Acenaphthene	mg/kg																				
SW8270C	Acenaphthylene	mg/kg																				
SW8270C	Anthracene	mg/kg																				
SW8270C	Benzo (a) anthracene	mg/kg																				
SW8270C	Benzo (a) pyrene	mg/kg																				
SW8270C	Benzo (b) fluoranthene	mg/kg																				
SW8270C	Benzo (g,h,i) perylene	mg/kg																				
SW8270C	Benzo (k) fluoranthene	mg/kg																				
SW8270C	Benzoic acid	mg/kg																				
SW8270C	Benzyl alcohol	mg/kg																				
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg																				
SW8270C	Bis(2-Chloroethyl) ether	mg/kg																				
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg																				
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg																				
SW8270C	Butyl benzyl phthalate	mg/kg																				
SW8270C	Chrysene	mg/kg																				
SW8270C	Di-n-butylphthalate	mg/kg																				
SW8270C	Di-n-octyl phthalate	mg/kg																				
SW8270C	Dibenz (a,h) anthracene	mg/kg																				
SW8270C	Dibenzofuran	mg/kg																				
SW8270C	Diethyl phthalate	mg/kg																				
SW8270C	Dimethyl phthalate	mg/kg																				
SW8270C	Fluoranthene	mg/kg																				
SW8270C	Fluorene	mg/kg																				
SW8270C	Hexachlorobenzene	mg/kg																				
SW8270C	Hexachlorobutadiene	mg/kg																				
SW8270C	Hexachlorocyclopentadiene	mg/kg																				
SW8270C	Hexachloroethane	mg/kg																				
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg																				
SW8270C	Isophorone	mg/kg																				
SW8270C	n-Nitroso-di-n-propylamine	mg/kg																				
SW8270C	n-Nitrosodiphenylamine	mg/kg																				
SW8270C	Naphthalene	mg/kg																				
SW8270C	Nitrobenzene	mg/kg																				
SW8270C	Pentachlorophenol	mg/kg																				
SW8270C	Phenanthrene	mg/kg																				
SW8270C	Phenol	mg/kg																				
SW8270C	Pyrene	mg/kg																				
SW8270C	2,4,6-Tribromophenol	percent																				
SW8270C	2-Fluorobiphenyl	percent																				
SW8270C	2-Fluorophenol	percent																				
SW8270C	Nitrobenzene-d5	percent																				
SW8270C	Phenol-d5	percent																				
SW8270C	Terphenyl-d14	percent																				

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7857	U9-7857	U9-7858	U9-7858	U9-7859	U9-7859	U9-7860	U9-7860
		Sample ID:	U97857001	U97857002	U97858001	U97858002	U97859001	U97859002	U97860001	U97860002
		Date:	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/06/2002	12/06/2002
Method	**Analyte**	**Units**								
SW6010B	Barium	mg/kg								
SW6010B	Beryllium	mg/kg								
SW6010B	Cadmium	mg/kg	**2**	**J 0.31**	**J 0.68**	**J 0.4**				
SW6010B	Chromium	mg/kg								
SW6010B	Iron	mg/kg								**B 5400**
SW6010B	Nickel	mg/kg								
SW6010B	Selenium	mg/kg								
SW6010B	Zinc	mg/kg								
SW7060A	Arsenic	mg/kg					**B 4.7**	**B 3.7**	**14.7**	**2.4**
SW7421	Lead	mg/kg	**92**	**7.2**	**J 48.5**	**8.9**				
SW8081A	4,4'-DDD	µg/kg								
SW8081A	4,4'-DDE	µg/kg								
SW8081A	4,4'-DDT	µg/kg								
SW8081A	Aldrin	µg/kg								
SW8081A	alpha-BHC	µg/kg								
SW8081A	alpha-Chlordane	µg/kg								
SW8081A	beta-BHC	µg/kg								
SW8081A	delta-BHC	µg/kg								
SW8081A	Dieldrin	µg/kg								
SW8081A	Endosulfan I	µg/kg								
SW8081A	Endosulfan II	µg/kg								
SW8081A	Endosulfan sulfate	µg/kg								
SW8081A	Endrin	µg/kg								
SW8081A	Endrin aldehyde	µg/kg								
SW8081A	Endrin Ketone	µg/kg								
SW8081A	gamma-BHC (Lindane)	µg/kg								
SW8081A	gamma-Chlordane	µg/kg								
SW8081A	Heptachlor	µg/kg								
SW8081A	Heptachlor epoxide	µg/kg								
SW8081A	Methoxychlor	µg/kg								
SW8081A	Toxaphene	µg/kg								
SW8081A	DCB	percent								
SW8081A	TCMX	percent								
SW8082	Aroclor 1016	µg/kg								
SW8082	Aroclor 1221	µg/kg								
SW8082	Aroclor 1232	µg/kg								
SW8082	Aroclor 1242	µg/kg								
SW8082	Aroclor 1248	µg/kg								
SW8082	Aroclor 1254	µg/kg								
SW8082	Aroclor 1260	µg/kg								
SW8082	DCB	percent								
SW8082	TCMX	percent								
SW8270C	1,2,4-Trichlorobenzene	mg/kg								
SW8270C	1,2-Dichlorobenzene	mg/kg								
SW8270C	1,3-Dichlorobenzene	mg/kg								
SW8270C	1,4-Dichlorobenzene	mg/kg								
SW8270C	2,4,5-Trichlorophenol	mg/kg								
SW8270C	2,4,6-Trichlorophenol	mg/kg								
SW8270C	2,4-Dichlorophenol	mg/kg								
SW8270C	2,4-Dimethylphenol	mg/kg								
SW8270C	2,4-Dinitrophenol	mg/kg								
SW8270C	2,4-Dinitrotoluene	mg/kg								
SW8270C	2,6-Dinitrotoluene	mg/kg								
SW8270C	2-Chloronaphthalene	mg/kg								
SW8270C	2-Chlorophenol	mg/kg								
SW8270C	2-Methylnaphthalene	mg/kg								
SW8270C	2-Methylphenol	mg/kg								
SW8270C	2-Nitroaniline	mg/kg								

TABLE A-2
Normal Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7857	U9-7857	U9-7858	U9-7858	U9-7859	U9-7859	U9-7860	U9-7860
		Sample ID:	U97857001	U97857002	U97858001	U97858002	U97859001	U97859002	U97860001	U97860002
		Date:	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/09/2002	12/06/2002	12/06/2002
SW8270C	2-Nitrophenol	mg/kg								
SW8270C	3,3-Dichlorobenzidine	mg/kg								
SW8270C	3-Nitroaniline	mg/kg								
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg								
SW8270C	4-Bromophenyl phenyl ether	mg/kg								
SW8270C	4-Chloro-3-methylphenol	mg/kg								
SW8270C	4-Chloroaniline	mg/kg								
SW8270C	4-Chlorophenyl phenyl ether	mg/kg								
SW8270C	4-Methylphenol	mg/kg								
SW8270C	4-Nitroaniline	mg/kg								
SW8270C	4-Nitrophenol	mg/kg								
SW8270C	Acenaphthene	mg/kg								
SW8270C	Acenaphthylene	mg/kg								
SW8270C	Anthracene	mg/kg								
SW8270C	Benzo (a) anthracene	mg/kg								
SW8270C	Benzo (a) pyrene	mg/kg								
SW8270C	Benzo (b) fluoranthene	mg/kg								
SW8270C	Benzo (g,h,i) perylene	mg/kg								
SW8270C	Benzo (k) fluoranthene	mg/kg								
SW8270C	Benzoic acid	mg/kg								
SW8270C	Benzyl alcohol	mg/kg								
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg								
SW8270C	Bis(2-Chloroethyl) ether	mg/kg								
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg								
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg								
SW8270C	Butyl benzyl phthalate	mg/kg								
SW8270C	Chrysene	mg/kg								
SW8270C	Di-n-butylphthalate	mg/kg								
SW8270C	Di-n-octyl phthalate	mg/kg								
SW8270C	Dibenz (a,h) anthracene	mg/kg								
SW8270C	Dibenzofuran	mg/kg								
SW8270C	Diethyl phthalate	mg/kg								
SW8270C	Dimethyl phthalate	mg/kg								
SW8270C	Fluoranthene	mg/kg								
SW8270C	Fluorene	mg/kg								
SW8270C	Hexachlorobenzene	mg/kg								
SW8270C	Hexachlorobutadiene	mg/kg								
SW8270C	Hexachlorocyclopentadiene	mg/kg								
SW8270C	Hexachloroethane	mg/kg								
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg								
SW8270C	Isophorone	mg/kg								
SW8270C	n-Nitroso-di-n-propylamine	mg/kg								
SW8270C	n-Nitrosodiphenylamine	mg/kg								
SW8270C	Naphthalene	mg/kg								
SW8270C	Nitrobenzene	mg/kg								
SW8270C	Pentachlorophenol	mg/kg								
SW8270C	Phenanthrene	mg/kg								
SW8270C	Phenol	mg/kg								
SW8270C	Pyrene	mg/kg								
SW8270C	2,4,6-Tribromophenol	percent								
SW8270C	2-Fluorobiphenyl	percent								
SW8270C	2-Fluorophenol	percent								
SW8270C	Nitrobenzene-d5	percent								
SW8270C	Phenol-d5	percent								
SW8270C	Terphenyl-d14	percent								

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-3
Field Duplicate Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7646	U9-7650	U9-7653	U9-7657	U9-7661	U9-7799	U9-7811	U9-7816	U9-7826	U9-7836	U9-7842	U9-7846	U9-7851	U9-7853	U9-7858
		Sample ID:	U97647001	U97651001	U97654001	U97658001	U97661002	U97799002	U97811002	U97816002	U97826002	U97836002	U97842003	U97846003	U97851003	U97853003	U97858003
		Date:	10/17/01	10/17/01	3/5/02	3/5/02	5/31/02	9/16/02	9/17/02	9/17/02	9/20/02	9/23/02	12/6/02	12/6/02	12/9/02	12/6/02	12/9/02
Method	**Analyte**	**Units**															
SW6010B	Barium	mg/kg					**65.8**										
SW6010B	Beryllium	mg/kg					U 0.14										
SW6010B	Cadmium	mg/kg					**J 0.71**										**J 0.83**
SW6010B	Chromium	mg/kg					**B 5.3**										
SW6010B	Iron	mg/kg											**J 7880**		**7160**		
SW6010B	Nickel	mg/kg					**J 3.3**										
SW6010B	Selenium	mg/kg					UB 4.4										
SW6010B	Zinc	mg/kg					**J 82.4**										
SW7060A	Arsenic	mg/kg	**B 3.7**		**J 9.5**		**3.3**	**3.3**	**4.7**	**3.3**	**J 1.7**	**J 8.2**	**7.8**	**J 14**	**B 5.6**	**J 2.2**	
SW7421	Lead	mg/kg					**19.2**										**J 57.3**
SW8081A	4,4'-DDD	µg/kg					**J 2.73**										
SW8081A	4,4'-DDE	µg/kg					**J 3.11**										
SW8081A	4,4'-DDT	µg/kg					**J 3.42**										
SW8081A	Aldrin	µg/kg					UJ 0.13										
SW8081A	alpha-BHC	µg/kg					U 0.19										
SW8081A	alpha-Chlordane	µg/kg					U 0.17										
SW8081A	beta-BHC	µg/kg					**J 0.76**										
SW8081A	delta-BHC	µg/kg					U 0.44										
SW8081A	Dieldrin	µg/kg					UJ 0.14										
SW8081A	Endosulfan I	µg/kg					UJ 0.14										
SW8081A	Endosulfan II	µg/kg					U 0.14										
SW8081A	Endosulfan sulfate	µg/kg					U 0.19										
SW8081A	Endrin	µg/kg					UJ 0.19										
SW8081A	Endrin aldehyde	µg/kg					U 0.26										
SW8081A	Endrin Ketone	µg/kg					**J 2.48**										
SW8081A	gamma-BHC (Lindane)	µg/kg					U 0.23										
SW8081A	gamma-Chlordane	µg/kg					UJ 1.01										
SW8081A	Heptachlor	µg/kg					UJ 0.12										
SW8081A	Heptachlor epoxide	µg/kg					U 0.47										
SW8081A	Methoxychlor	µg/kg					UJ 0.2										
SW8081A	Toxaphene	µg/kg					U 14.7										
SW8081A	DCB	percent					74										
SW8081A	TCMX	percent					79										
SW8082	Aroclor 1016	µg/kg					U 1.1										
SW8082	Aroclor 1221	µg/kg					U 5.8										
SW8082	Aroclor 1232	µg/kg					U 3.8										
SW8082	Aroclor 1242	µg/kg					U 1.1										
SW8082	Aroclor 1248	µg/kg					U 0.8										
SW8082	Aroclor 1254	µg/kg					U 0.9										
SW8082	Aroclor 1260	µg/kg					U 1.5										
SW8082	DCB	percent					96										
SW8082	TCMX	percent					92										
SW8270C	1,2,4-Trichlorobenzene	mg/kg		U 0.243		U 0.137	U 0.128										
SW8270C	1,2-Dichlorobenzene	mg/kg		U 0.337		U 0.169	U 0.151										
SW8270C	1,3-Dichlorobenzene	mg/kg		U 0.317		U 0.15	U 0.121										
SW8270C	1,4-Dichlorobenzene	mg/kg		U 0.29		U 0.141	U 0.131										
SW8270C	2,4,5-Trichlorophenol	mg/kg		U 0.691		U 0.331	U 0.397										
SW8270C	2,4,6-Trichlorophenol	mg/kg		U 0.257		U 0.136	U 0.125										
SW8270C	2,4-Dichlorophenol	mg/kg		U 0.371		U 0.16	U 0.148										
SW8270C	2,4-Dimethylphenol	mg/kg		U 0.327		U 0.178	U 0.139										
SW8270C	2,4-Dinitrophenol	mg/kg		U 0.46		U 0.55	U 0.37										

TABLE A-3
Field Duplicate Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7646	U9-7650	U9-7653	U9-7657	U9-7661	U9-7799	U9-7811	U9-7816	U9-7826	U9-7836	U9-7842	U9-7846	U9-7851	U9-7853	U9-7858
		Sample ID:	U97647001	U97651001	U97654001	U97658001	U97661002	U97799002	U97811002	U97816002	U97826002	U97836002	U97842003	U97846003	U97851003	U97853003	U97858003
		Date:	10/17/01	10/17/01	3/5/02	3/5/02	5/31/02	9/16/02	9/17/02	9/17/02	9/20/02	9/23/02	12/6/02	12/6/02	12/9/02	12/6/02	12/9/02
Method	**Analyte**	**Units**															
SW8270C	2,4-Dinitrotoluene	mg/kg		U 0.325		U 0.148	U 0.164										
SW8270C	2,6-Dinitrotoluene	mg/kg		U 0.294		U 0.13	U 0.148										
SW8270C	2-Chloronaphthalene	mg/kg		U 0.229		U 0.123	U 0.133										
SW8270C	2-Chlorophenol	mg/kg		U 0.298		U 0.125	U 0.128										
SW8270C	2-Methylnaphthalene	mg/kg		U 0.366		U 0.134	U 0.146										
SW8270C	2-Methylphenol	mg/kg		U 0.416		U 0.143	U 0.146										
SW8270C	2-Nitroaniline	mg/kg		U 0.75		U 0.45	U 0.47										
SW8270C	2-Nitrophenol	mg/kg		U 0.264		U 0.152	U 0.135										
SW8270C	3,3-Dichlorobenzidine	mg/kg		U 0.32		U 0.1	U 0.332										
SW8270C	3-Nitroaniline	mg/kg		U 0.7		U 0.5	U 1.32										
SW8270C	4,6- Dinitro-2-methylphenol	mg/kg		U 0.6		U 0.3	U 0.45										
SW8270C	4-Bromophenyl phenyl ether	mg/kg		U 0.313		U 0.138	U 0.164										
SW8270C	4-Chloro-3-methylphenol	mg/kg		U 0.38		U 0.14	U 0.151										
SW8270C	4-Chloroaniline	mg/kg		U 0.29		U 0.56	U 0.86										
SW8270C	4-Chlorophenyl phenyl ether	mg/kg		U 0.351		U 0.109	U 0.145										
SW8270C	4-Methylphenol	mg/kg		U 0.295		U 0.114	UJ 0.154										
SW8270C	4-Nitroaniline	mg/kg		U 0.92		U 0.37	U 0.44										
SW8270C	4-Nitrophenol	mg/kg		U 0.71		U 0.48	U 0.39										
SW8270C	Acenaphthene	mg/kg		U 0.301		U 0.135	U 0.146										
SW8270C	Acenaphthylene	mg/kg		U 0.254		U 0.116	U 0.147										
SW8270C	Anthracene	mg/kg		U 0.337		U 0.102	U 0.155										
SW8270C	Benz (a) anthracene	mg/kg		**J 0.667**		**J 0.258**	U 0.16										
SW8270C	Benzo (a) pyrene	mg/kg		**J 0.896**		**J 0.343**	U 0.154										
SW8270C	Benzo (b) fluoranthene	mg/kg		**J 1.39**		**J 0.324**	U 0.177										
SW8270C	Benzo (g,h,i) perylene	mg/kg		**J 0.608**		**J 0.235**	U 0.145										
SW8270C	Benzo (k) fluoranthene	mg/kg		**J 0.582**		**J 0.312**	U 0.166										
SW8270C	Benzoic acid	mg/kg		U 0.68		U 0.54	**J 3.22**										
SW8270C	Benzyl alcohol	mg/kg		U 0.344		U 0.348	U 0.125										
SW8270C	Bis (2-Chloroethoxy) methane	mg/kg		U 0.317		U 0.157	U 0.168										
SW8270C	Bis(2-Chloroethyl) ether	mg/kg		U 0.288		U 0.26	U 0.135										
SW8270C	Bis(2-Chloroisopropyl) ether	mg/kg		U 0.3		U 0.187	UJ 0.129										
SW8270C	Bis(2-ethylhexyl) phthalate	mg/kg		UB 1.99		**1.36**	**J 0.847**										
SW8270C	Butyl benzyl phthalate	mg/kg		U 0.34		U 0.139	U 0.163										
SW8270C	Chrysene	mg/kg		**J 1.1**		**J 0.425**	U 0.152										
SW8270C	Di-n-butylphthalate	mg/kg		U 0.393		U 0.119	U 0.158										
SW8270C	Di-n-octyl phthalate	mg/kg		U 0.344		U 0.058	U 0.129										
SW8270C	Dibenz (a,h) anthracene	mg/kg		UJ 0.286		U 0.155	U 0.154										
SW8270C	Dibenzofuran	mg/kg		U 0.328		U 0.131	U 0.149										
SW8270C	Diethyl phthalate	mg/kg		U 0.377		**J 0.106**	U 0.141										
SW8270C	Dimethyl phthalate	mg/kg		U 0.327		U 0.092	U 0.15										
SW8270C	Fluoranthene	mg/kg		**1.54**		**J 0.467**	U 0.14										
SW8270C	Fluorene	mg/kg		U 0.318		U 0.133	U 0.163										
SW8270C	Hexachlorobenzene	mg/kg		U 0.301		U 0.146	U 0.16										
SW8270C	Hexachlorobutadiene	mg/kg		U 0.312		U 0.189	U 0.147										
SW8270C	Hexachlorocyclopentadiene	mg/kg		U 0.742		U 0.348	U 0.443										
SW8270C	Hexachloroethane	mg/kg		U 0.299		U 0.172	U 0.148										
SW8270C	Indeno(1,2,3-cd)pyrene	mg/kg		**J 0.646**		U 0.171	U 0.164										
SW8270C	Isophorone	mg/kg		U 0.284		U 0.143	U 0.146										
SW8270C	n-Nitroso-di-n-propylamine	mg/kg		U 0.338		U 0.149	U 0.147										
SW8270C	n-Nitrosodiphenylamine	mg/kg		U 0.344		U 0.11	U 0.174										

TABLE A-3

Field Duplicate Sample Analytical Results

Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	U9-7646	U9-7650	U9-7653	U9-7657	U9-7661	U9-7799	U9-7811	U9-7816	U9-7826	U9-7836	U9-7842	U9-7846	U9-7851	U9-7853	U9-7858
		Sample ID:	U97647001	U97651001	U97654001	U97658001	U97661002	U97799002	U97811002	U97816002	U97826002	U97836002	U97842003	U97846003	U97851003	U97853003	U97858003
		Date:	10/17/01	10/17/01	3/5/02	3/5/02	5/31/02	9/16/02	9/17/02	9/17/02	9/20/02	9/23/02	12/6/02	12/6/02	12/9/02	12/6/02	12/9/02
Method	**Analyte**	**Units**															
SW8270C	Naphthalene	mg/kg		U 0.284		U 0.129	U 0.139										
SW8270C	Nitrobenzene	mg/kg		U 0.294		U 0.124	U 0.146										
SW8270C	Pentachlorophenol	mg/kg		U 0.66		U 0.39	U 0.287										
SW8270C	Phenanthrene	mg/kg		**J 0.884**		**J 0.214**	U 0.152										
SW8270C	Phenol	mg/kg		U 0.316		U 0.16	U 0.15										
SW8270C	Pyrene	mg/kg		**2.22**		**J 0.537**	U 0.211										
SW8270C	2,4,6-Tribromophenol	percent		74		96	87										
SW8270C	2-Fluorobiphenyl	percent		87		98	94										
SW8270C	2-Fluorophenol	percent		78		94	90										
SW8270C	Nitrobenzene-d5	percent		83		97	109										
SW8270C	Phenol-d5	percent		75		92	93										
SW8270C	Terphenyl-d14	percent		123		114	100										

NOTES:

mg/kg - milligrams per liter [parts per million (ppm)]

µg/kg - micrograms per liter [part per billion (ppb)]

TABLE A-4
Equipment Blank Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	FIELDQC	FIELDQC	FIELDQC	FIELDQC	FieldQC	FIELDQC	FIELDQC	FIELDQC
		Sample ID:	U97647002	U97661021	U97811EB	U97816EB	U97817EB	U97842EB	U97853EB	U97858EB
		Date:	10/17/01	5/31/02	9/17/02	9/17/02	9/20/02	12/6/02	12/6/02	12/9/02
Method	**Analyte**	**Units**								
SW6010B	Barium	mg/l		U 0.0008						
SW6010B	Beryllium	mg/l		U 0.0004						
SW6010B	Cadmium	mg/l		U 0.0005						U 0.001
SW6010B	Chromium	mg/l		U 0.004						
SW6010B	Iron	mg/l						U 0.01		
SW6010B	Nickel	mg/l		U 0.008						
SW6010B	Selenium	mg/l		U 0.03						
SW6010B	Zinc	mg/l		U 0.001						
SW7060A	Arsenic	mg/l	U 0.001	U 0.001	U 0.001	U 0.001	U 0.001	U 0.001	U 0.001	
SW7421	Lead	mg/l		U 0.0005						U 0.0005
SW8081A	4,4'-DDD	µg/kg		U 0.01						
SW8081A	4,4'-DDE	µg/kg		U 0.01						
SW8081A	4,4'-DDT	µg/kg		U 0.01						
SW8081A	Aldrin	µg/kg		U 0.004						
SW8081A	alpha-BHC	µg/kg		U 0.005						
SW8081A	alpha-Chlordane	µg/kg		U 0.004						
SW8081A	beta-BHC	µg/kg		U 0.006						
SW8081A	delta-BHC	µg/kg		U 0.019						
SW8081A	Dieldrin	µg/kg		U 0.004						
SW8081A	Endosulfan I	µg/kg		U 0.003						
SW8081A	Endosulfan II	µg/kg		U 0.01						
SW8081A	Endosulfan sulfate	µg/kg		U 0.01						
SW8081A	Endrin	µg/kg		U 0.004						
SW8081A	Endrin aldehyde	µg/kg		U 0.01						
SW8081A	Endrin Ketone	µg/kg		U 0.02						
SW8081A	gamma-BHC (Lindane)	µg/kg		U 0.003						
SW8081A	gamma-Chlordane	µg/kg		U 0.004						
SW8081A	Heptachlor	µg/kg		U 0.003						
SW8081A	Heptachlor epoxide	µg/kg		U 0.004						
SW8081A	Methoxychlor	µg/kg		U 0.01						
SW8081A	Toxaphene	µg/kg		U 0.1						
SW8081A	DCB	percent		40						
SW8081A	TCMX	percent		73						
SW8082	Aroclor 1016	µg/kg		U 0.03						
SW8082	Aroclor 1221	µg/kg		U 0.22						
SW8082	Aroclor 1232	µg/kg		U 0.06						
SW8082	Aroclor 1242	µg/kg		U 0.03						
SW8082	Aroclor 1248	µg/kg		U 0.02						
SW8082	Aroclor 1254	µg/kg		U 0.02						
SW8082	Aroclor 1260	µg/kg		U 0.03						
SW8082	DCB	percent		40						
SW8082	TCMX	percent		87						
SW8270C	1,2,4-Trichlorobenzene	µg/kg	U 0.55	U 1.09						
SW8270C	1,2-Dichlorobenzene	µg/kg	U 0.54	U 1.49						
SW8270C	1,3-Dichlorobenzene	µg/kg	U 0.62	U 1.39						
SW8270C	1,4-Dichlorobenzene	µg/kg	U 0.62	U 1.39						
SW8270C	2,4,5-Trichlorophenol	µg/kg	U 2.56	U 2.09						
SW8270C	2,4,6-Trichlorophenol	µg/kg	U 0.48	U 0.6						
SW8270C	2,4-Dichlorophenol	µg/kg	U 1.22	U 1.57						
SW8270C	2,4-Dimethylphenol	µg/kg	U 0.67	U 1.72						
SW8270C	2,4-Dinitrophenol	µg/kg	U 6.13	U 4.5						
SW8270C	2,4-Dinitrotoluene	µg/kg	U 0.6	U 1.07						
SW8270C	2,6-Dinitrotoluene	µg/kg	U 0.58	U 0.6						
SW8270C	2-Chloronaphthalene	µg/kg	U 0.52	U 1.17						
SW8270C	2-Chlorophenol	µg/kg	U 0.67	U 1.66						
SW8270C	2-Methylnaphthalene	µg/kg	U 0.57	U 1.35						
SW8270C	2-Methylphenol	µg/kg	U 0.64	U 1.59						
SW8270C	2-Nitroaniline	µg/kg	U 3.64	U 2.84						
SW8270C	2-Nitrophenol	µg/kg	U 0.53	U 1.18						
SW8270C	3,3-Dichlorobenzidine	µg/kg	U 1.25	U 2.08						
SW8270C	3-Nitroaniline	µg/kg	U 2.66	U 2.63						

TABLE A-4
Equipment Blank Sample Analytical Results
Operable Unit 9 Pond 3 Engineering Evaluation/ Cost Analysis

		Location ID:	FIELDQC	FIELDQC	FIELDQC	FIELDQC	FieldQC	FIELDQC	FIELDQC	FIELDQC
		Sample ID:	U97647002	U97661021	U97811EB	U97816EB	U97817EB	U97842EB	U97853EB	U97858EB
		Date:	10/17/01	5/31/02	9/17/02	9/17/02	9/20/02	12/6/02	12/6/02	12/9/02
Method	**Analyte**	**Units**								
SW8270C	4,6- Dinitro-2-methylphenol	µg/kg	U 3.12	U 3.08						
SW8270C	4-Bromophenyl phenyl ether	µg/kg	U 1.1	U 0.59						
SW8270C	4-Chloro-3-methylphenol	µg/kg	U 0.64	U 1.35						
SW8270C	4-Chloroaniline	µg/kg	U 0.8	U 1.08						
SW8270C	4-Chlorophenyl phenyl ether	µg/kg	U 0.64	U 1						
SW8270C	4-Methylphenol	µg/kg	U 0.73	U 1.9						
SW8270C	4-Nitroaniline	µg/kg	U 2.33	U 4						
SW8270C	4-Nitrophenol	µg/kg	U 2.21	U 3.55						
SW8270C	Acenaphthene	µg/kg	U 0.35	U 0.6						
SW8270C	Acenaphthylene	µg/kg	U 0.53	U 0.56						
SW8270C	Anthracene	µg/kg	U 0.58	U 0.64						
SW8270C	Benz (a) anthracene	µg/kg	U 0.5	U 0.53						
SW8270C	Benzo (a) pyrene	µg/kg	U 1.03	U 1.03						
SW8270C	Benzo (b) fluoranthene	µg/kg	U 0.57	U 0.42						
SW8270C	Benzo (g,h,i) perylene	µg/kg	U 1.66	U 1.36						
SW8270C	Benzo (k) fluoranthene	µg/kg	U 1.07	U 0.71						
SW8270C	Benzoic acid	µg/kg	U 5.2	U 3.57						
SW8270C	Benzyl alcohol	µg/kg	U 1.27	U 1.98						
SW8270C	Bis (2-Chloroethoxy) methane	µg/kg	U 0.51	U 1.28						
SW8270C	Bis(2-Chloroethyl) ether	µg/kg	U 0.57	U 1.72						
SW8270C	Bis(2-Chloroisopropyl) ether	µg/kg	U 0.64	U 1.6						
SW8270C	Bis(2-ethylhexyl) phthalate	µg/kg	**F 2.15**	U 1.16						
SW8270C	Butyl benzyl phthalate	µg/kg	U 0.55	U 1.21						
SW8270C	Chrysene	µg/kg	U 0.44	U 0.36						
SW8270C	Di-n-butylphthalate	µg/kg	U 0.6	U 1.2						
SW8270C	Di-n-octyl phthalate	µg/kg	U 1.3	U 1.34						
SW8270C	Dibenz (a,h) anthracene	µg/kg	U 1.24	U 1.39						
SW8270C	Dibenzofuran	µg/kg	U 0.4	U 0.35						
SW8270C	Diethyl phthalate	µg/kg	U 0.64	U 1.07						
SW8270C	Dimethyl phthalate	µg/kg	U 0.56	U 0.63						
SW8270C	Fluoranthene	µg/kg	U 0.43	U 1.04						
SW8270C	Fluorene	µg/kg	U 0.64	U 0.62						
SW8270C	Hexachlorobenzene	µg/kg	U 0.63	U 0.62						
SW8270C	Hexachlorobutadiene	µg/kg	U 0.72	U 1.17						
SW8270C	Hexachlorocyclopentadiene	µg/kg	U 3.32	U 2.61						
SW8270C	Hexachloroethane	µg/kg	U 0.8	U 1.14						
SW8270C	Indeno(1,2,3-cd)pyrene	µg/kg	U 1.12	U 1.4						
SW8270C	Isophorone	µg/kg	U 0.54	U 1.21						
SW8270C	n-Nitroso-di-n-propylamine	µg/kg	U 0.57	U 1.49						
SW8270C	n-Nitrosodiphenylamine	µg/kg	U 0.82	U 0.65						
SW8270C	Naphthalene	µg/kg	U 0.61	U 1.09						
SW8270C	Nitrobenzene	µg/kg	U 1.07	U 1.34						
SW8270C	Pentachlorophenol	µg/kg	U 3.06	U 4						
SW8270C	Phenanthrene	µg/kg	U 0.52	U 0.64						
SW8270C	Phenol	µg/kg	U 0.66	U 1.63						
SW8270C	Pyrene	µg/kg	U 0.7	U 0.78						
SW8270C	2,4,6-Tribromophenol	percent	76	78						
SW8270C	2-Fluorobiphenyl	percent	83	88						
SW8270C	2-Fluorophenol	percent	78	78						
SW8270C	Nitrobenzene-d5	percent	78	91						
SW8270C	Phenol-d5	percent	78	81						
SW8270C	Terphenyl-d14	percent	91	99						

NOTES:
mg/kg - milligrams per liter [parts per million (ppm)]
µg/kg - micrograms per liter [part per billion (ppb)]

APPENDIX B

Petrographic Analyses of Asphalt-Bearing Pond Sediments Report

PETROGRAPHIC ANALYSES OF ASPHALT-BEARING POND SEDIMENTS FROM HILL AIR FORCE BASE, UTAH

Report prepared for

CH2M HILL
4001 South 700 East, Suite 700
Salt Lake City, UT 84107-2177

By

Susan Juch Lutz
Energy & Geoscience Institute
423 Wakara Way, Suite 300
Salt Lake City, UT 84108
801 585-9688
sjlutz@egi.utah.edu

August 2002

INTRODUCTION

Three samples were submitted by Gary Colgan of CH2M HILL to EGI -University of Utah for thin-section analyses. The samples consist of sediments collected from a pond ((Hill AFB Pond 3) at the Hill Air Force Base in northern Utah. The objective of this study was to determine if particles of asphalt or asphalt aggregate are present in the pond sediment samples. Chemical analyses of the organic material in the pond sediments had identified the presence of poly-aromatic hydrocarbons (PAH) that are indicative of asphaltic compounds. The pond occurs in the drainage of several asphalt-paved parking lots, and the sediment samples were collected near the inlet of the pond.

METHODS AND PROCEDURES

Petrographic Analysis

Because of the friable and fine-grained nature of the unconsolidated material provided for petrographic analysis, the samples were impregnated with clear epoxy before being prepared as thin-sections. Standard sized thin-sections were made and half of each were stained for potassium feldspar. Idaho Petrographics of Grangeville, Idaho prepared the thin-sections. The petrographic analyses were performed at EGI's X-ray Diffraction and Petrographic Lab in Salt Lake City, Utah. Photomicrographs were taken of characteristic features in the three samples. Appendix A contains these images and a short description of each.

PETROGRAPHIC DESCRIPTIONS

Sample: U97661003
Sample Type: Pond sediment

Texture and Mineralogy

This sample is predominately (60 to 70 %) composed of granule-sized lithic grains that are approximately 3.0 to 4.5 mm in diameter. These larger grains are mostly quartz-rich quartzite and granitic rock fragments, and their dominantly subrounded shape suggests that these are detrital grains with a long history. Minor amounts of limestone, pelite, chert and gneissic rock fragments occur in this size category and are also subrounded. Most of the granules appear to be derived from metamorphic rocks. Some chert granules contain rounded (0.15 mm) fossils that suggest their origin as silicified, fossiliferous limestones. The gneiss granules contain coarse-crystalline biotite, feldspar, amphibole, garnet and kyanite. A few of the quartzite grains contain veins of epidote. One quartzite grain in the sample is about 8 mm long and can be classified as a pebble (using a Wentworth scale; as in Scholle, 1979).

About 30% of the grains in this sample are between 0.25 and 1 mm in size (medium to coarse sand, or between U.S. Standard sieve mesh numbers 60 and 18). The smaller clasts in

this size fraction are often single quartz crystals. The lithologies represented in these sand-sized grains are generally similar to those of the granule-sized grains, but in marked contrast to the granules, the sand-sized grains are much more angular in shape. Many appear to be broken fragments of the larger grains, suggesting that they may have been crushed to make a fine aggregate.

A few of the granules and many of the sand grains are coated and/or stuck together with a dark orange-brown amorphous material. The brown material coats the granules and infills areas with irregular borders along the exterior of the granules. This coating is most prevalent on coarsely crystalline limestone or dolomite clasts where the periphery of the clast is not smooth, and can be observed to penetrate fractures and crystal boundaries along the clast margin. The brown material commonly contains small (0.1 mm) angular quartz fragments embedded within it; these fragments are matrix-supported by the brown material. Separate small (1 –2 mm wide) irregularly-shaped particles of dark brown material with fine broken quartz crystals are also present (see images). The matrix of these particles is dark under crossed nichols and indicates that the dark material is amorphous.

The thin-section also contains one 2mm cellular plant fragment.

Evaluation of the Presence of Asphalt Aggregate

The amorphous, orange-brown material is interpreted as asphalt binder, and the particles containing this binder are interpreted as pieces of asphalt aggregate. The best evidence for this is textural. The lack of grain sorting, presence of extremely angular rock fragments and cementation by the bituminous material suggests formation of these particles by non-geologic processes. The rounded granules, angular sand-sized rock fragments, and orange-brown matrix may represent the three major constituents of a man-made asphalt aggregate; that is, the coarse aggregate (original quartz-rich river gravel), the fine aggregate (crushed and probably, sieved equivalent of the latter), and the asphalt binder matrix, respectively.

Sample: U97665001
Sample Type: Pond sediment

Texture and Mineralogy

This sample is similar to Sample U97661003. It contains the same types of clastic grains with the same general lithologies represented. The biggest difference is in the particle size distribution; in general, it is finer-grained. In this sample, 10 to 20 percent of the clastic grains are between 2.0 and 4.0 mm in diameter (granule-size) and the other 90 to 80 percent are between 0.1 and 0.3 mm wide (very fine to fine sand sized). A few large quartzite pebbles up to 13 mm long are also present in this sample.

As in the last sample, the granules are rounded to subrounded and are dominated by quartzite. Other lithologies represented as clasts in this size range include limestone, meta-siltstone, pelitic rock, chert, granite and gneiss. One clast consists of a mafic volcanic.

Many of the fine sand grains consist of single quartz crystals. Some of the sand grains appear to be quartzite or granitic rock fragments. All of the fine sand-sized grains are angular and the quartz crystals appear to be fractured or broken.

Orange-brown asphalt coats just a few of the rounded granules but more of the fine angular sand with irregular grain boundaries. As a rough estimate, about 5 to 10 percent of the particles are coated with or contain some asphaltic material. The asphalt binder appears to stick better to clay-rich lithologies (such as pelite), and irregularly-shaped coarsely crystalline metamorphic and limestone grains than to the dense, rounded quartzite clasts. The original quartz grains in the quartzite granules are completely overgrown and cemented with quartz, and there is no visible intragranular porosity. In places, there appear to be air bubbles between the granule borders and the asphalt aggregate (see images in the photomicrographs). In more porous clasts, the brown asphalt binder appears to have penetrated into the grain along pores, crystal boundaries, and fractures (see images). The asphalt aggregate contains 0.1 mm angular fragments of quartz (fine aggregate) embedded in orange-brown binder.

There are a few cellular plant fragments in the thin-section, as well as one piece of rusted metal.

Sample: U97667001
Sample Type: Pond sediment

Texture and Mineralogy

This sample is much finer-grained than the last two and contains abundant plant material as well as possibly, organic-rich clayey pond sediment. One separate woody plant fragment is 3 mm long but most of the plant debris admixed with clastic material is less than a mm in length. There are a few larger clastic grains in the thin-section. These are 8 mm rounded pebbles of chert and granite, and smaller coarse sand- to granule-sized clasts with quartz-rich metamorphic and granitic lithologies. One quartzite clast has abundant hematite cement and some of the metamorphic rocks contain magnetite and other mafic minerals. The combination of the presence of abundant organic material and the dark metamorphic minerals may contribute to the generally dark color of this sediment sample.

The sample is dominated by irregularly shaped, wispy to fibrous particles that contain cellular plant debris and fine sand- to silt- sized quartz, potassium feldspar, and magnetite grains in a dark brown matrix (see photomicrographs). It is difficult to determine whether this material is actual pond sediment, or plant and other clastic debris cemented with asphalt binder. However, the presence of fine-grained magnetite mixed with the plant material suggests that this fine-grained material could represent iron-rich and/or organic-rich pond sediment with the dark brown color of the matrix attributable to a combination of iron oxides from the weathering

of magnetite and the high organic content of the sediment. The abundance of detrital magnetite in this sample suggests the concentration of heavy minerals by normal sedimentological processes. In addition, the silt-sized clastic grains are generally subangular to subrounded and don't have the fractured character of the quartz fragments in the asphalt aggregate.

There are particles in this sample that do resemble the asphalt aggregate observed in the previous two samples. One of these is a large granitic gneiss clast that has a rim of orange-brown asphalt binder with embedded angular quartz grains (see photomicrograph images). Although the exact proportion of in-situ pond sediment to introduced asphalt aggregate is not known, it appears that both kinds of particles are present in this sample. The dark color is likely due to the heavy mineral and organic content of the pond sediment, rather than an abundance of asphalt.

SUMMARY

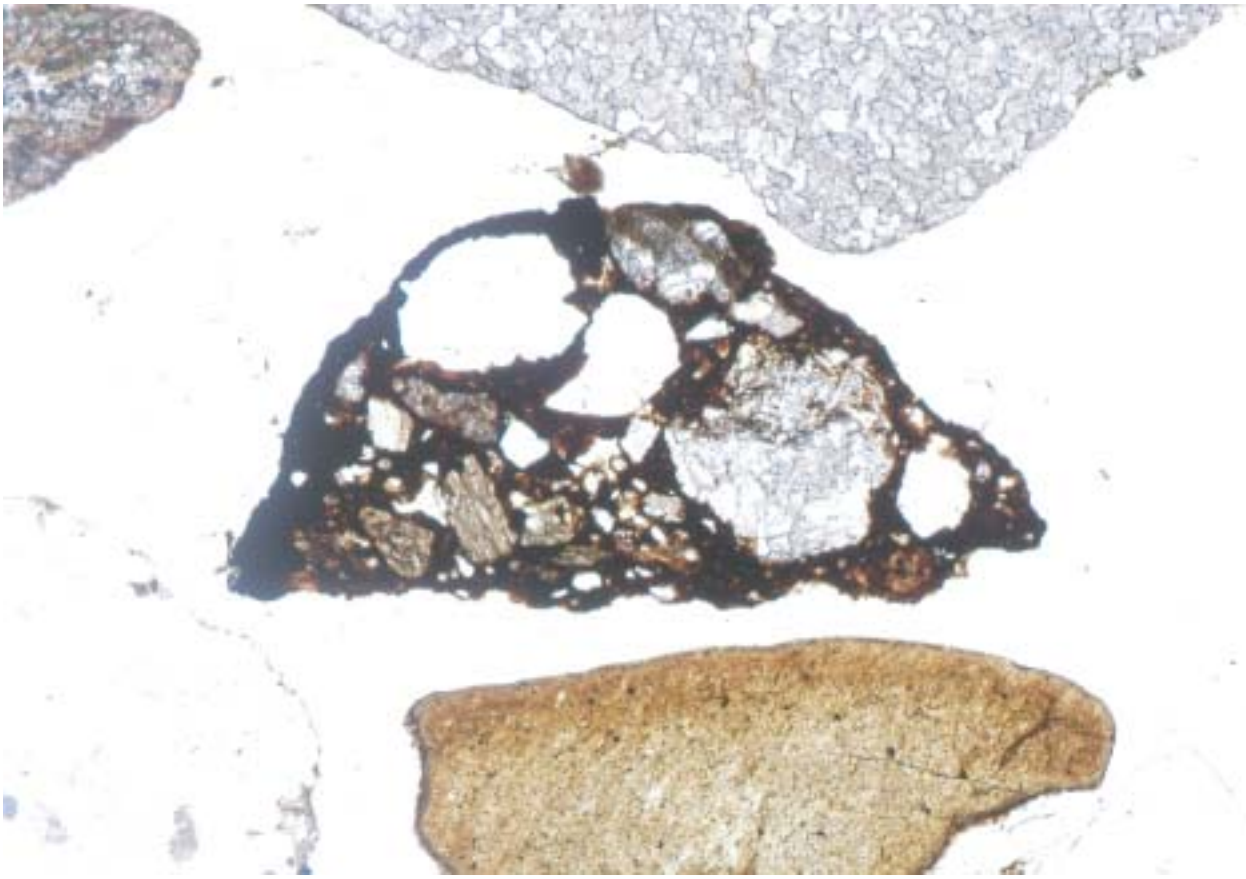
The three sediment samples from Hill AFB Pond 3 are similar to each other in texture, composition and mineralogy, and differ only in the proportion of coarse to fine material. All three appear to contain a significant proportion of particles derived from asphalt aggregate, of which the surrounding parking lots are likely composed. Since the lithologic composition of the detrital clasts and the asphalt-coated clasts is similar, it is difficult to determine the relative proportion of pavement-derived sediment compared to indigenous clastic material (gravel, sand and silt from the Weber River Delta and/or associated alluvial sediments).

References:

Scholle, P.A., 1979, Constituents, Textures, Cements, and Porosities of Sandstones and Associated Rocks, American Association of Petroleum Geologists Memoir 28, 201p.

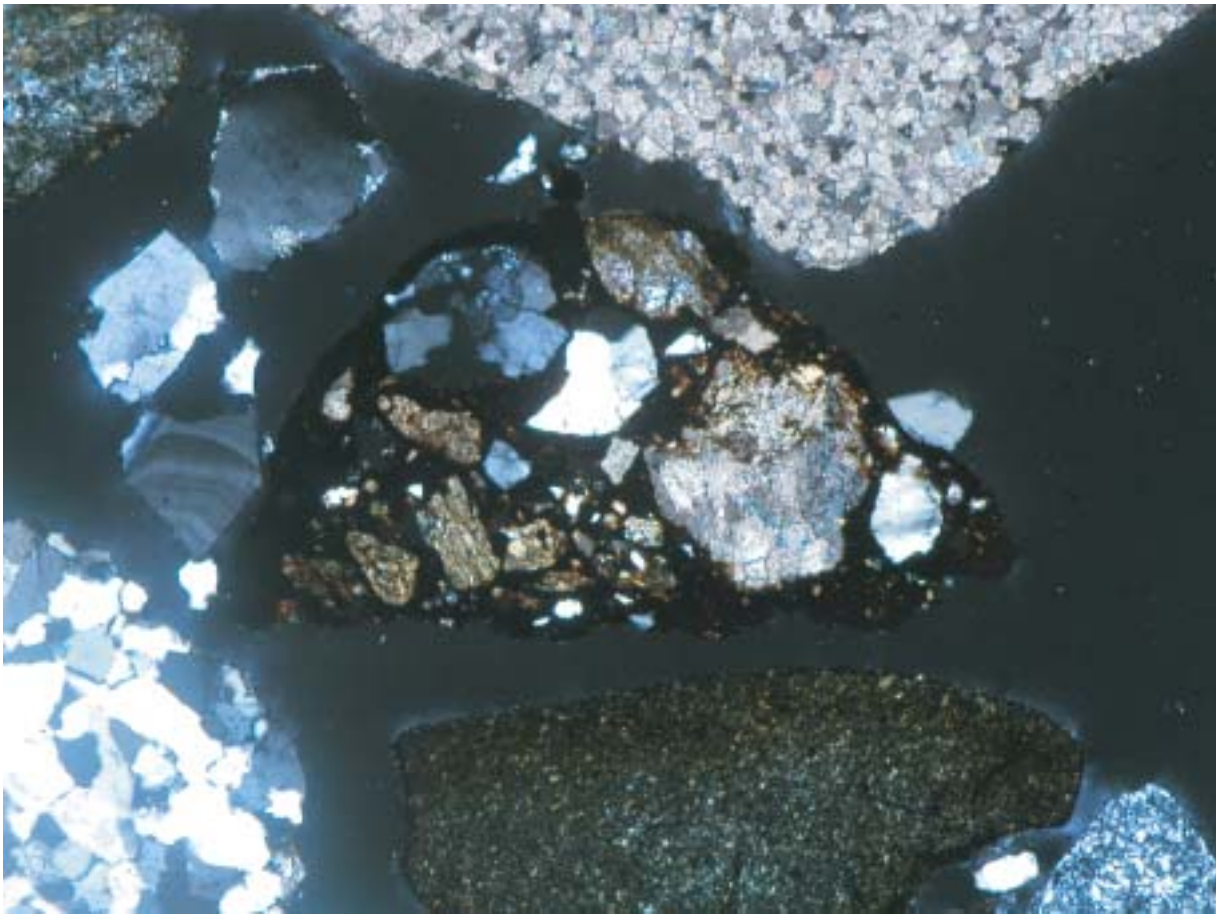
APPENDIX A

Photomicrographs/images of asphalt-bearing pond sediments from Hill Air Force Base, Utah



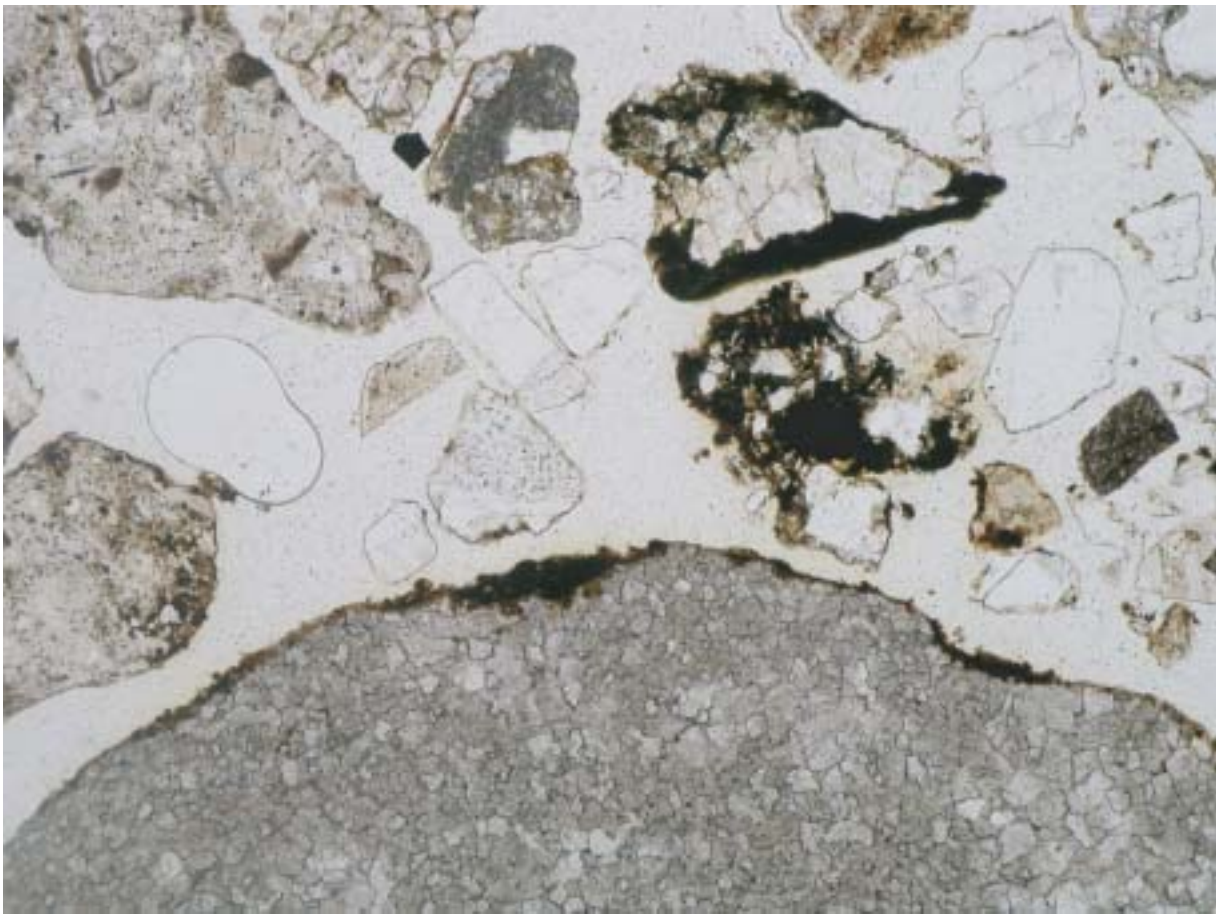
Sample U97661003
Plain light, Field of view = 3250 um = 3.25 mm

Dark-colored particle in center of image is likely a fragment of asphalt aggregate. The aggregate consists of angular fragments of quartz, granite, and pelite embedded in a dark orangish brown asphalt binder matrix. The rock fragments in the asphalt are fine to medium sand-sized.
Other particles in the field of view include a limestone clast (top of image), a pelitic rock fragment (bottom of image), and a quartzite clast (lower left).



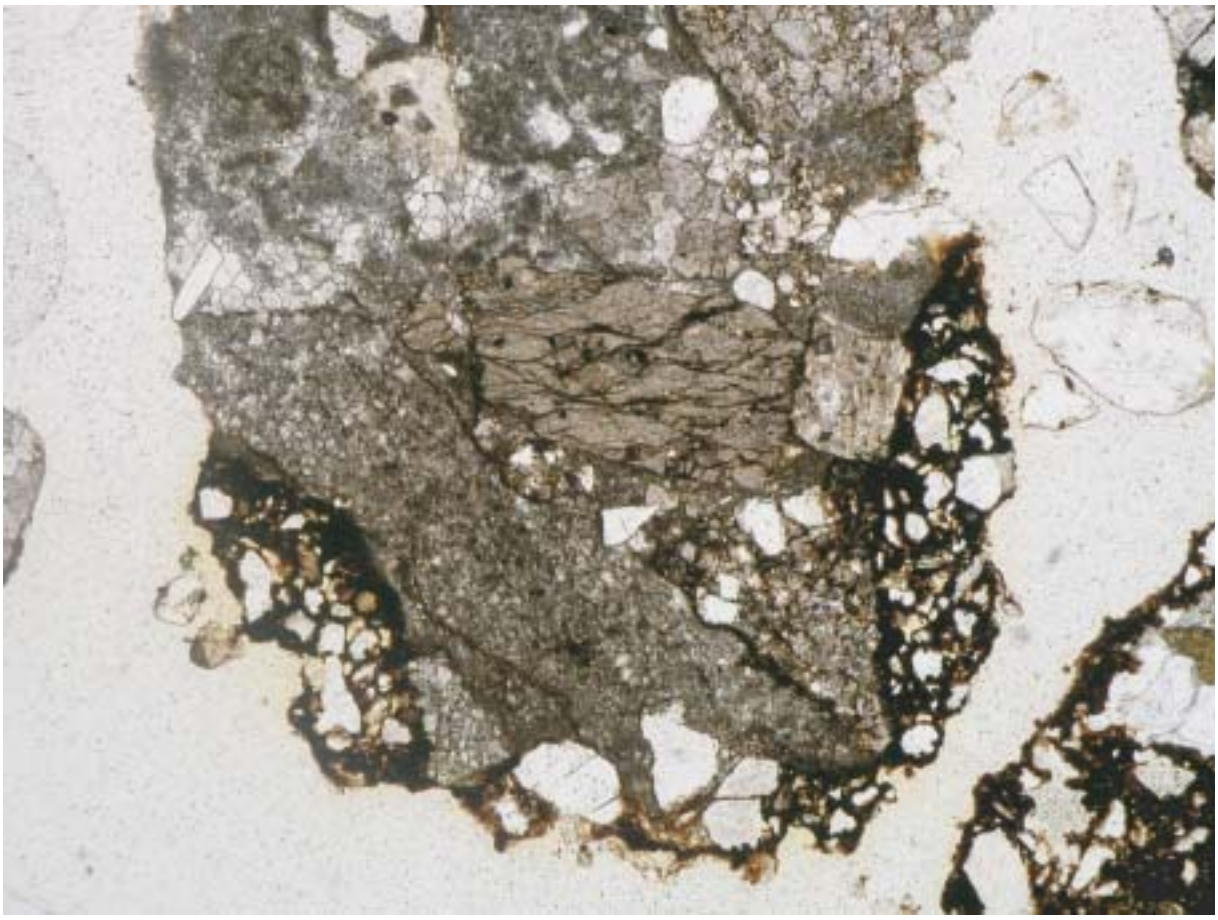
Sample U97661003
Crossed nichols, Field of view = 3250 um = 3.25 mm

Same view as previous image. The matrix of the asphalt aggregate is dark under crossed nichols, which indicates that the matrix material is amorphous (i.e., not composed of crystalline minerals). Tarry residues, asphalt compounds, and other bituminous hydrocarbons are all amorphous.



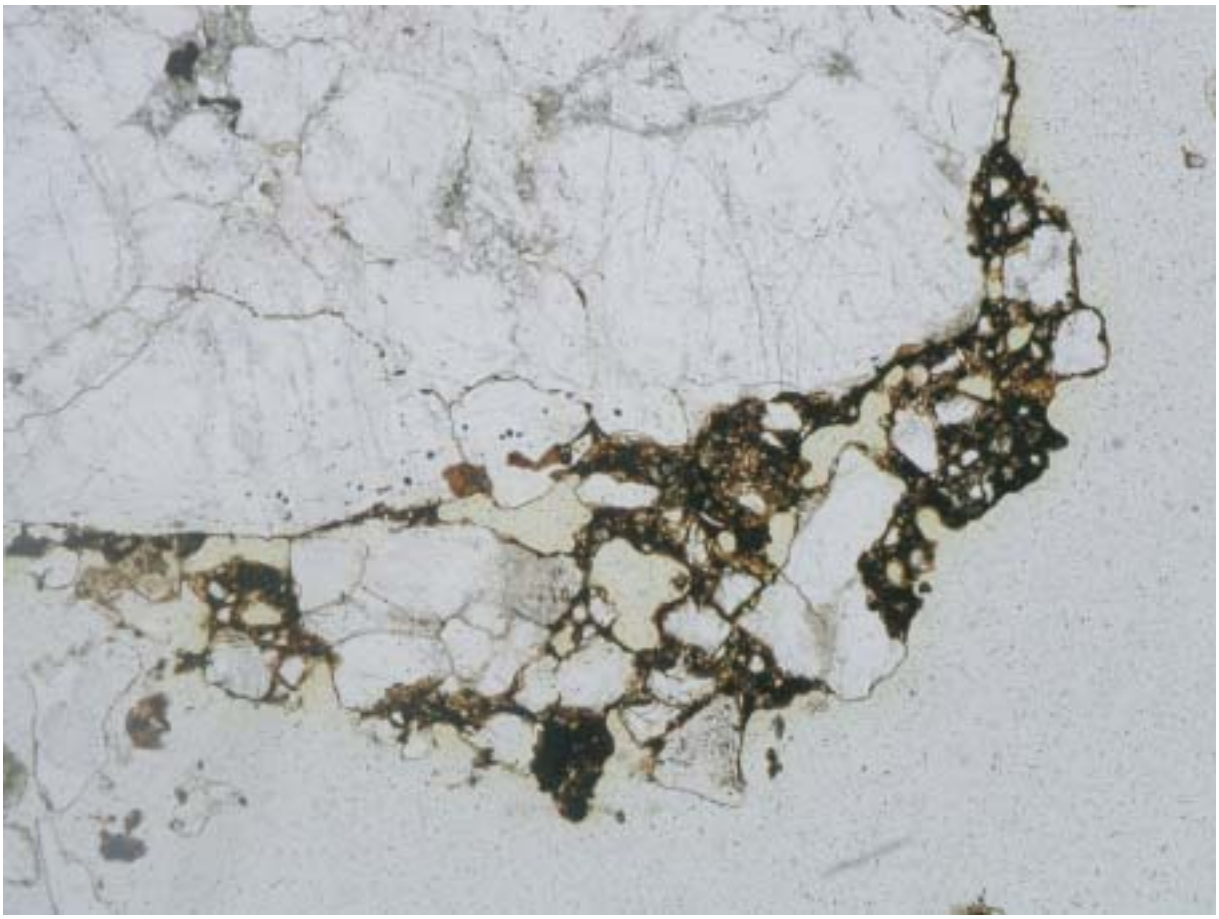
Sample U97661003
Plain light, Field of view = 3250 um = 3.25 mm

Dark asphaltic material coats two particles in this image and forms the binding matrix for another particle. Even though the limestone grain (bottom of image) is rounded, the coarsely crystalline character of the limestone appears to make an irregular exterior that the asphalt can easily adhere to. The irregularly shaped particle in the right center of this image is asphalt aggregate containing angular silt to fine sand-sized quartz grains. The asphalt-coated quartz grain above this particle is characteristically broken and brecciated. The fracturing of the quartz suggests that it may have formed from the anthropogenic crushing of larger pebbles or cobbles with a quartz-rich lithology (such as granite or quartzite), in order to make a fine aggregate for the asphalt aggregate.



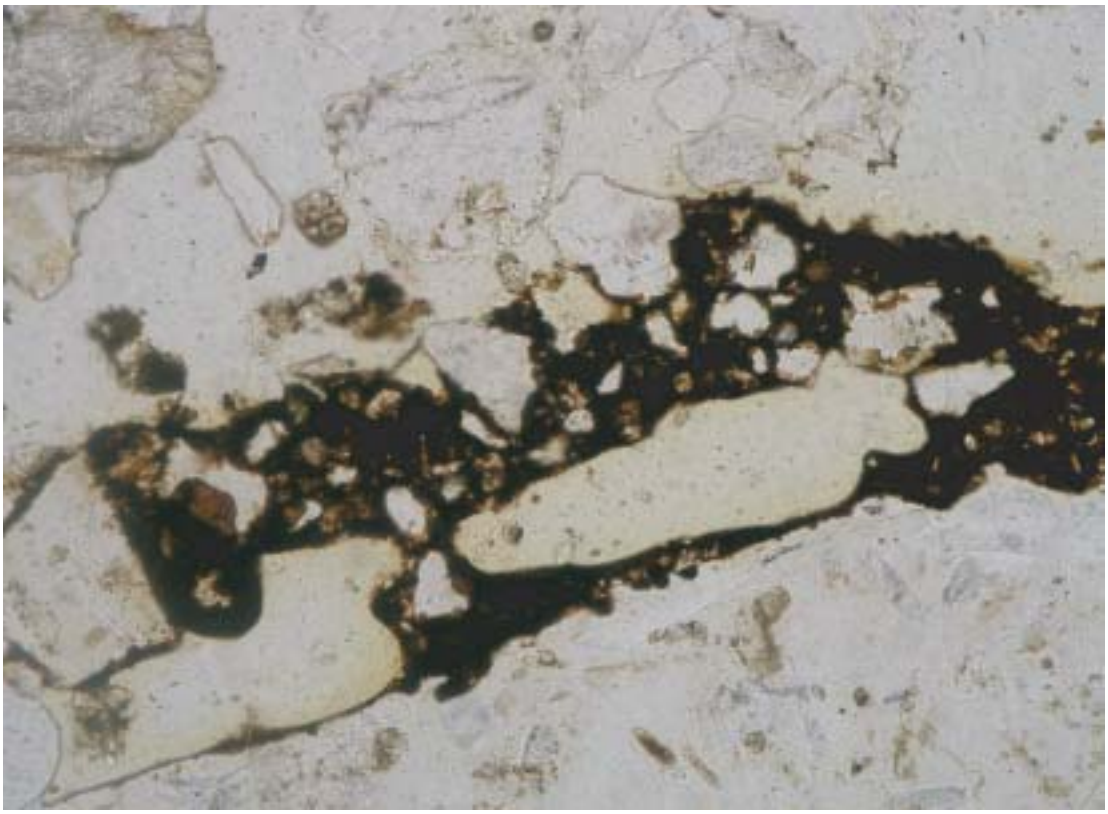
Sample U97661003
Plain light, Field of view = 3250 um = 3.25 mm

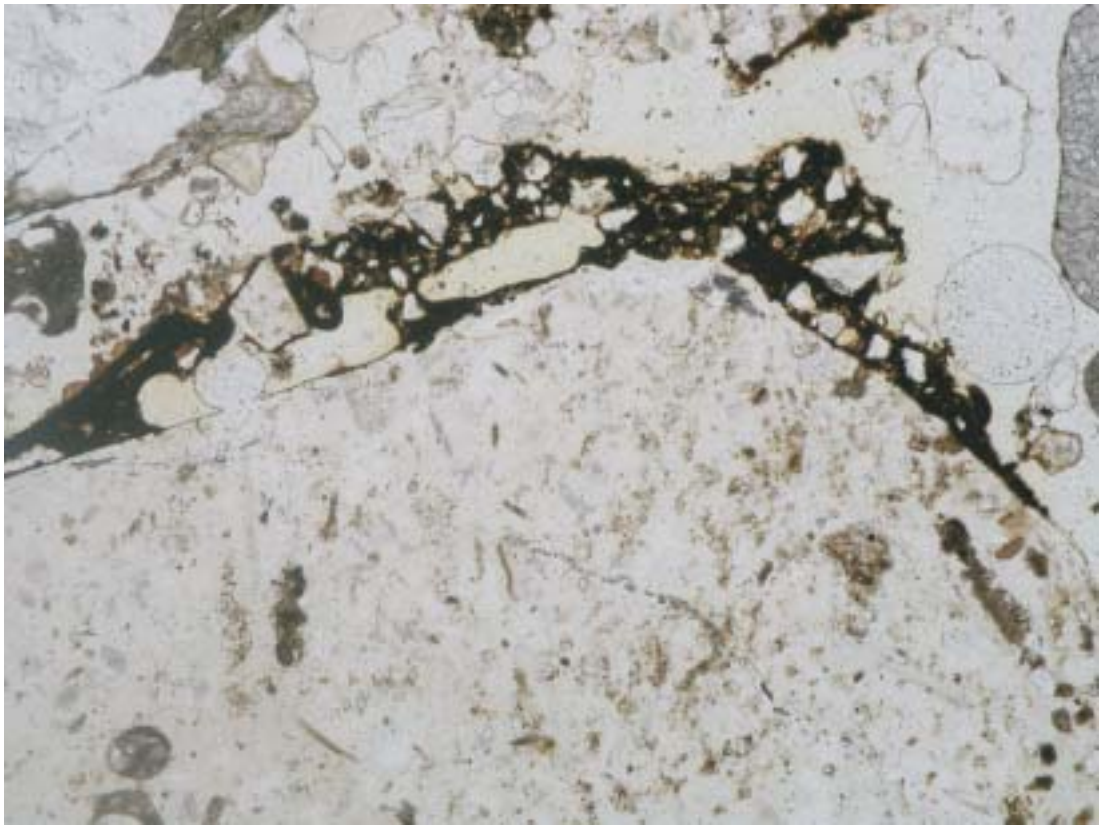
This view shows an irregularly-shaped, granule-sized limestone breccia clast that has asphalt aggregate stuck to both sides of it. Note the angularity and fine sand to silt-sizing of the quartz fragments in the dark asphalt binder.



Sample U97661003
Plain light, Field of view = 3250 um = 3.25 mm

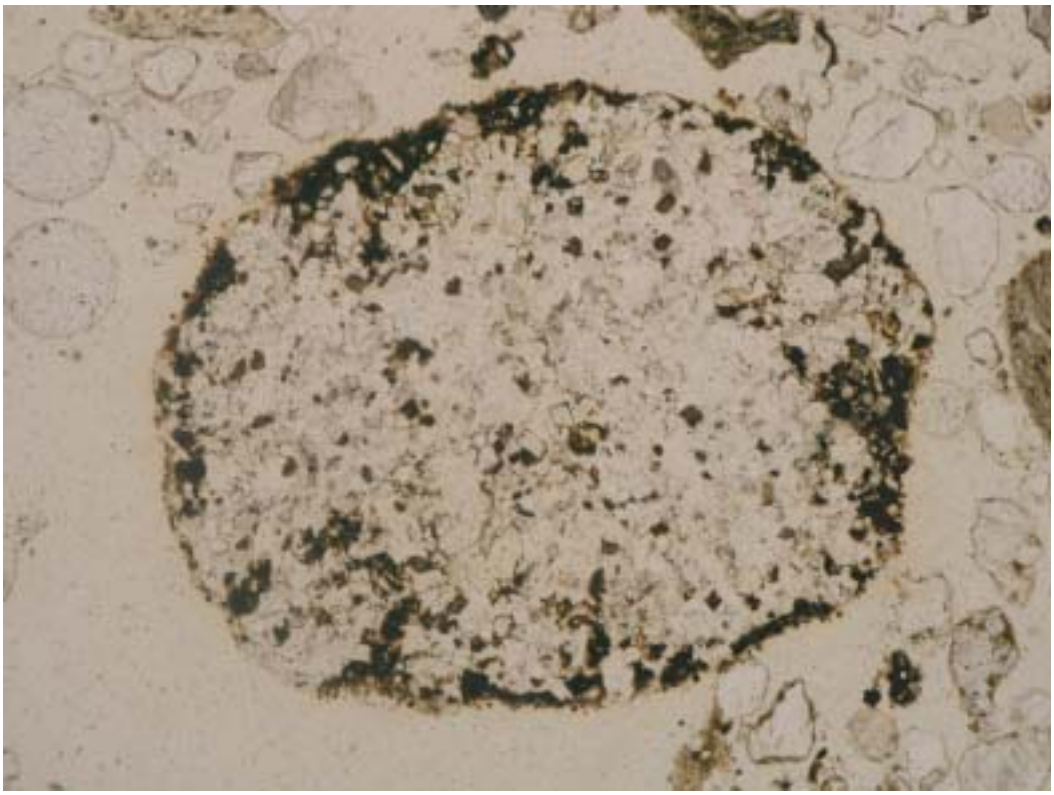
Another rounded to subrounded granule of granitic rock that has asphalt binder and aggregate stuck to it. The lithologies of the granule-sized coarse aggregate and the sand to silt-sized fine aggregate are similar. Rounded vesicles in the asphaltic binder appear to be air bubbles in the aggregate.

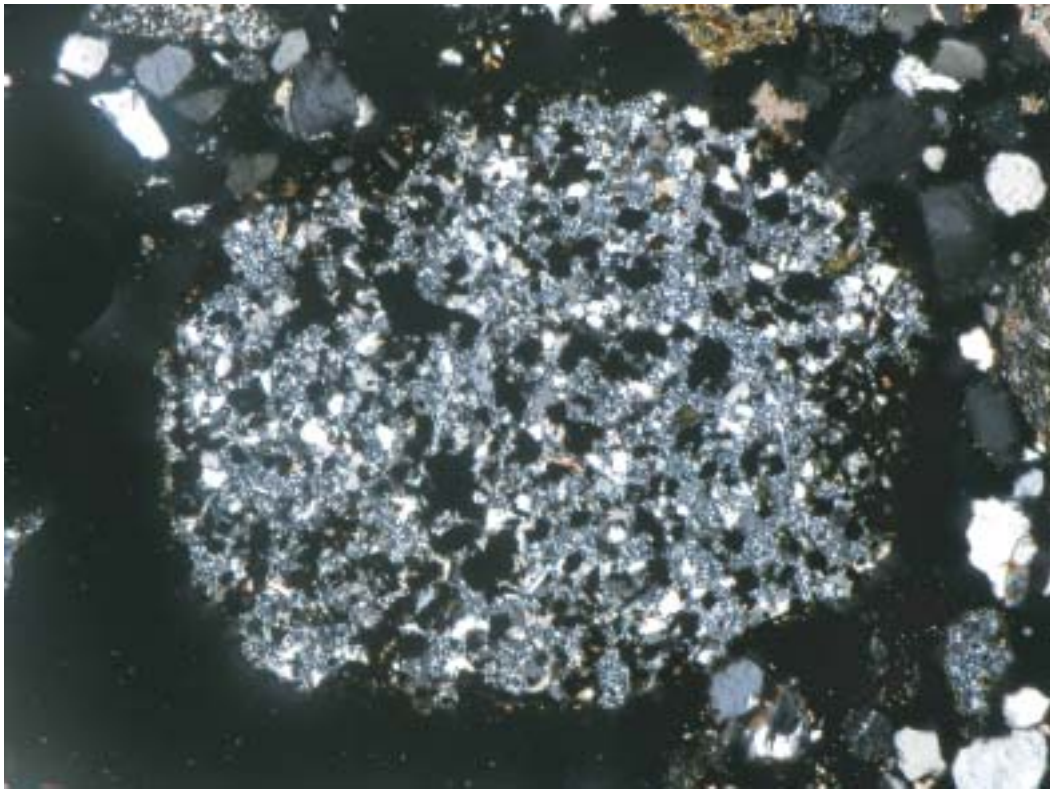




Sample U97665001
Plain light,
Field of view = 1300um = 1.30 mm (top); 3250 um = 3.25 mm (bottom)

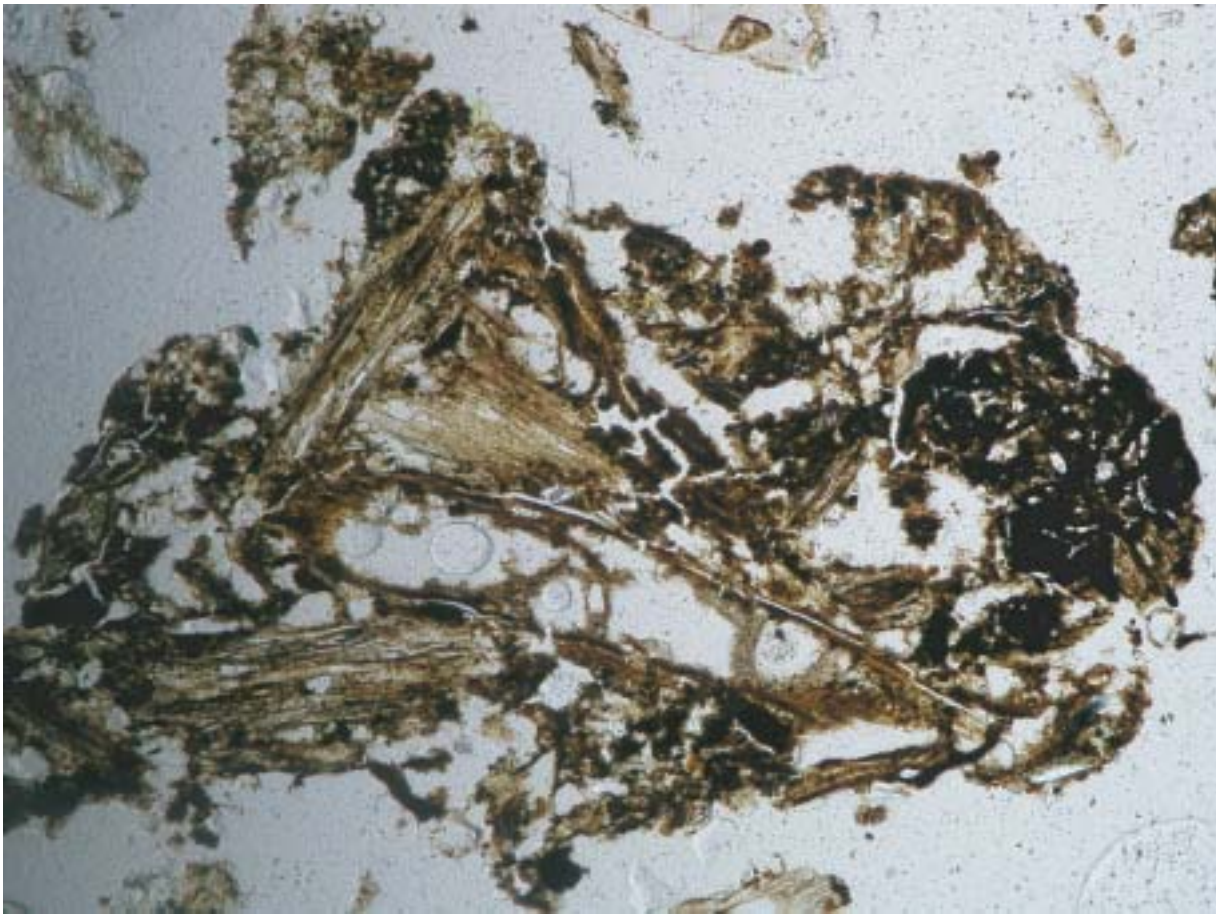
Subrounded granule composed of silicified fossiliferous limestone with rim of dark asphaltic material. Note the silt-sized angular quartz fragments as fine aggregate and the presence of rounded elongate air bubbles in the binder material in the close-up image (top).





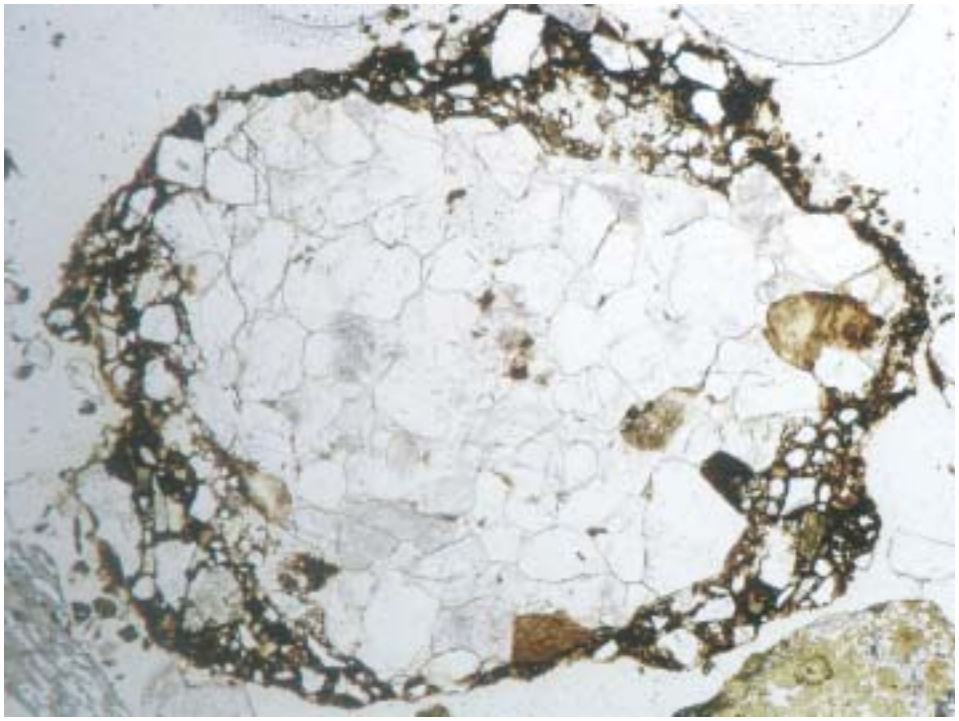
Sample U97665001
Plain light (above), Crossed nichols (below)
Field of view = 3250 um = 3.25 mm

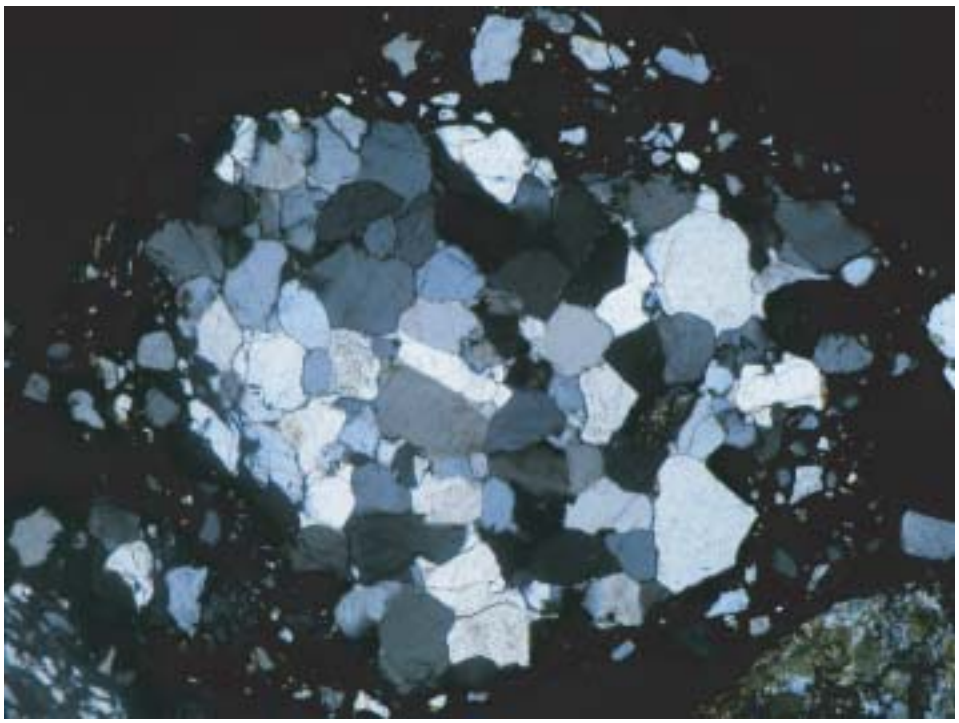
This is a rounded pelitic granule that is coated with dark-colored asphalt binder. The brown stain along the margin of the clast appears to be asphaltic material that has penetrated into the clayey matrix of the pelite.



Sample U97667001
Plain light, Field of view = 1300 um = 1.30 mm

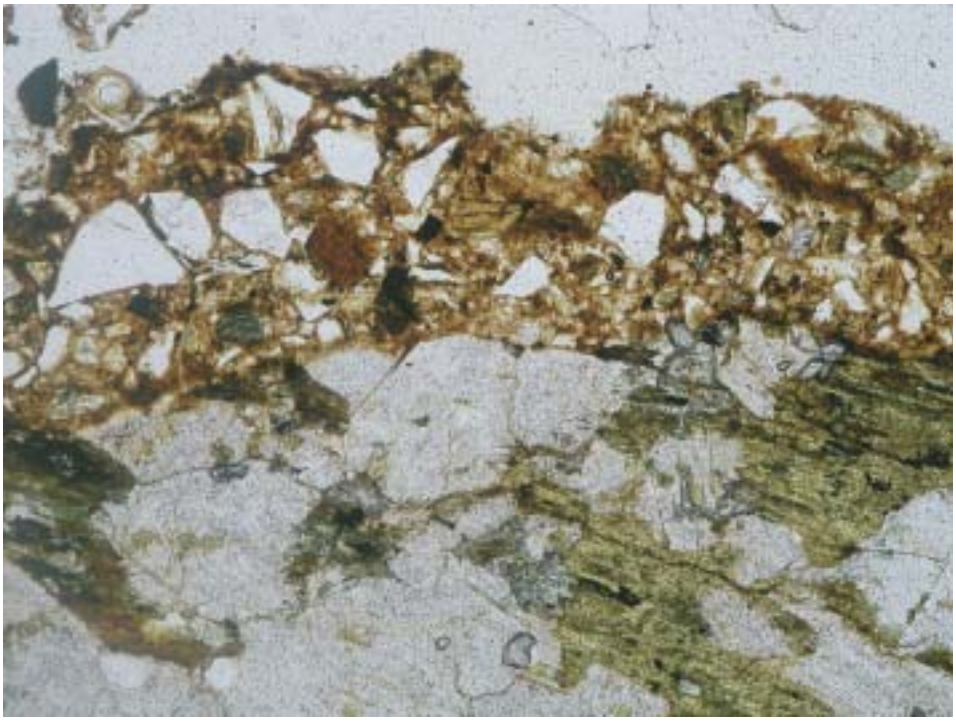
The fibrous material in this particle are fragments of cellular plants. This woody plant debris appears to be incorporated into a dark brownish matrix material. In this particle, it is not clear whether the dark matrix is asphalt binder or fine-grained organic-rich pond sediment. However, the presence of fine detrital magnetite (black minerals on right side of the particle) suggests that the dark material may represent sediments and not just asphalt.

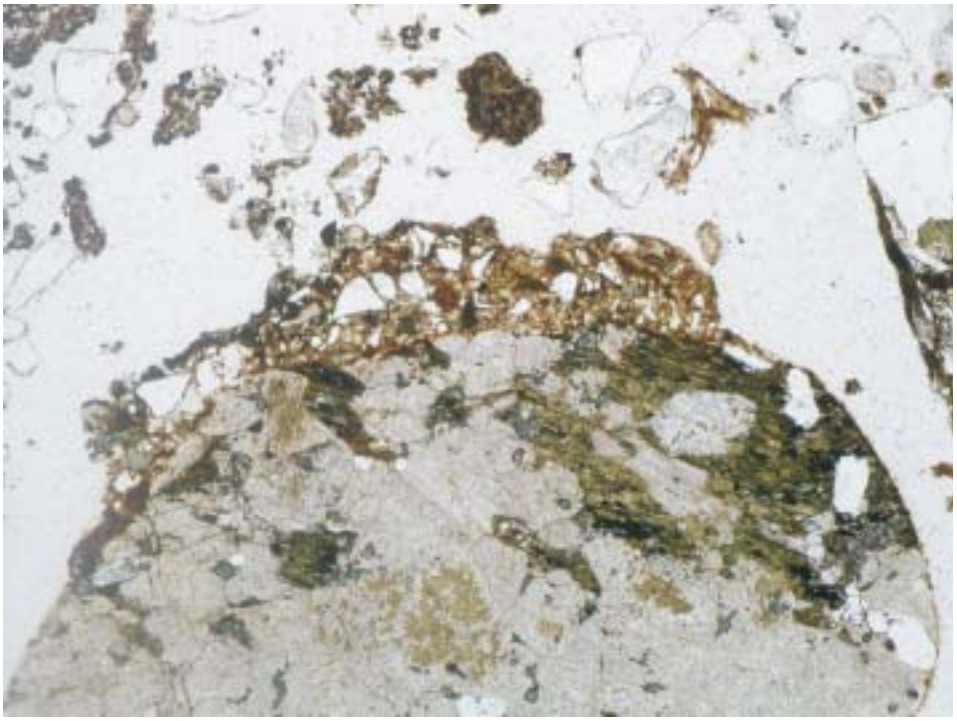




Sample U97667001
Plain light (top), Crossed nichols (bottom)
Field of view = 3250 um = 3.25 mm

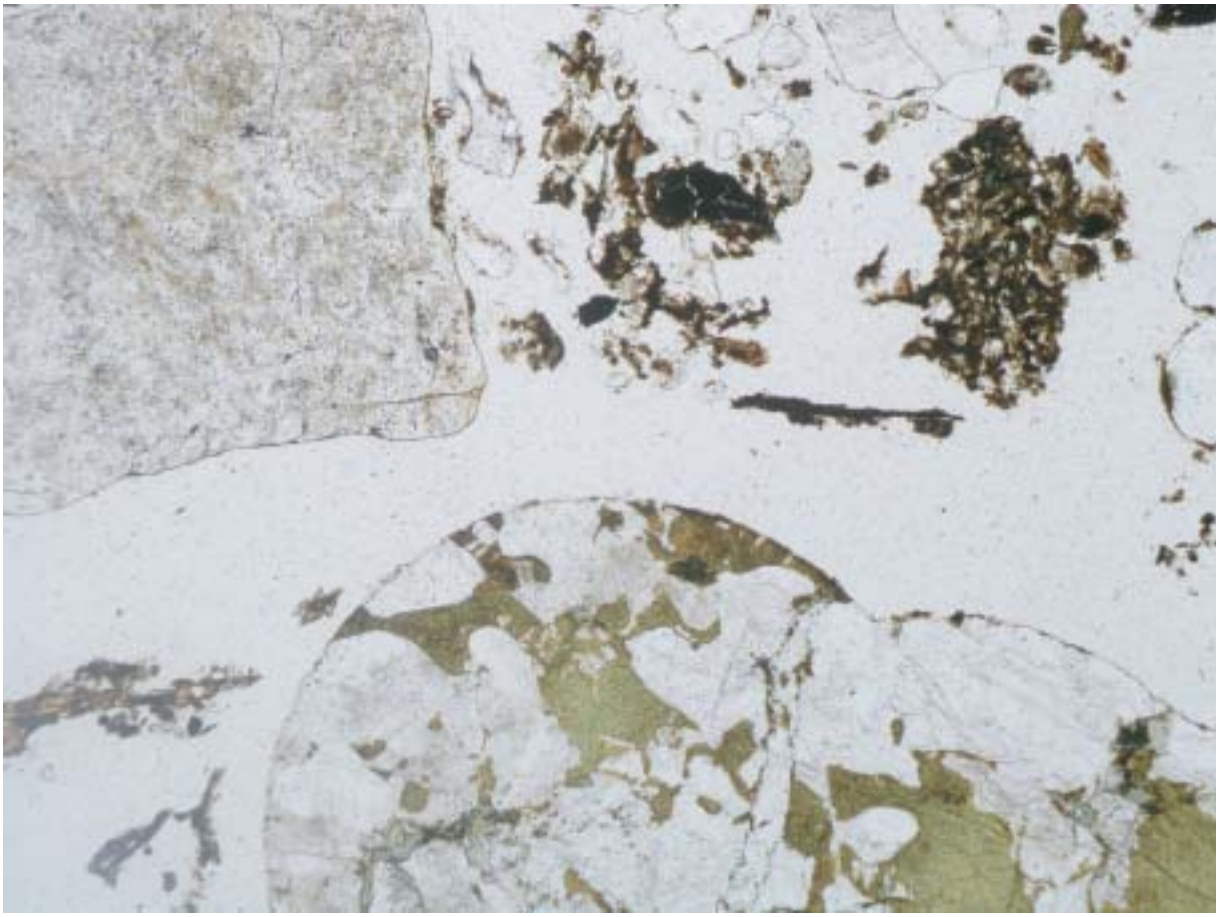
This quartzite granule is composed of rounded quartz sand grains that are cemented with quartz overgrowths; there is no visible porosity and no brown asphalt stain within the clast itself. The clast is rimmed with orangish brown asphalt aggregate containing silt- to fine-sand sized angular fragments of quartz. This is an asphalt aggregate particle containing the three standard components of asphalt aggregate, which are; 1) the coarse aggregate (quartzite granule), 2) the fine aggregate (silt-sized quartz), and 3) the asphalt binder (the brown matrix). The image taken with crossed nichols shows the amorphous character of the asphalt binder in the matrix.





Sample U97667001
Plain light
Field of view = 1300um = 1.30 mm (top); 3250 um = 3.25 mm (bottom)

The lower image illustrates a rounded gneiss granule with some asphalt aggregate stuck to it. The upper image is a close-up of the reddish brown asphalt binder with angular quartz fragments.

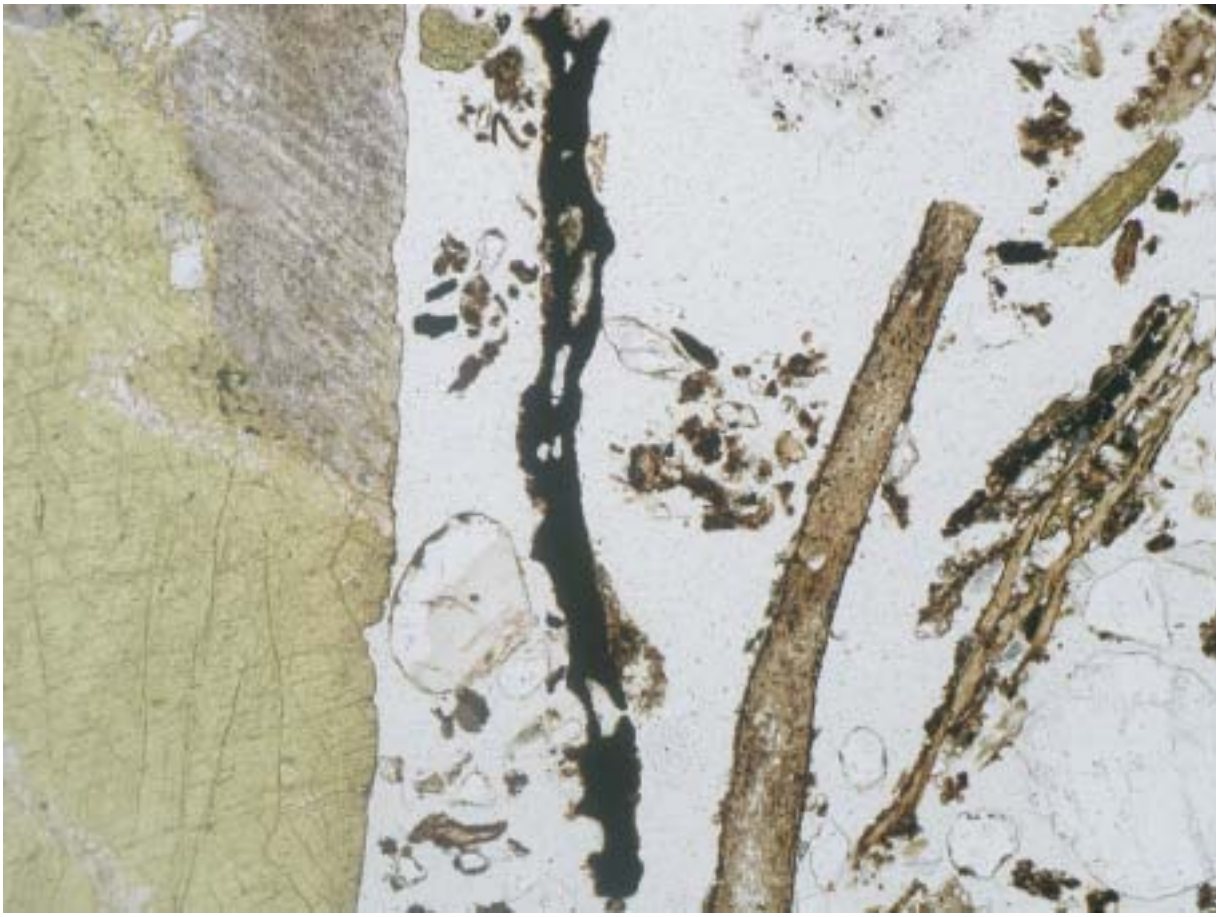


Sample U97667001
Plain light, Field of view = 3250 um = 3.25 mm

Larger view showing round granite and subangular limestone granules (both without asphalt rims), and irregularly-shaped particles of organic-rich sediment with wispy, fibrous plant fragments.

Sample U97667001
Plain light, Field of view = 3250 um = 3.25 mm

A variety of particle types in this sample: porous plant debris (left side of image), subangular granite granule (lower left corner), quartzite granule with asphalt stuck to it (right side), and smaller fine sand-sized quartz and granitic rocks fragments.



Sample U97667001
Plain light, Field of view = 3250 um = 3.25 mm

Larger particles in the sample (from left to right): granite pebble (with yellow potassium feldspar stain), strip of dark brown asphalt aggregate, light brown plant fragment (stalk), and woody plant debris with larger pores. Smaller particles are rounded granitic sand grains and organic-rich sediment.

APPENDIX C

Applicable or Relevant and Appropriate Requirements

APPENDIX C

Applicable or Relevant and Appropriate Requirements

TABLE C-1
Identification of *Federal* Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Solid Waste Disposal Act	42 USC Sec. 6901-6987			
Identification and Listing of Hazardous Waste	40 CFR Part 261	Defines those solid wastes that are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 270, 271, 124.	Yes/---	Defines the criteria for identifying hazardous wastes that may be contained in environmental media.
Land Disposal Restrictions	40 CFR 268	Establishes treatment standards prior to land disposal of hazardous wastes. 40 CFR 268.48-268.49.	Yes/Yes	Underlying hazardous constituents must also be identified; 10 X universal treatment standard allowed for soil.
Safe Drinking Water Act	42 USC Sec. 300g			
National Primary Drinking Water Standards	40 CFR Part 141	Establishes health-based standards for public water systems (maximum contaminant levels).	No/No	Would apply to groundwater cleanup, which is not addressed in this removal action.
Clean Water Act	33 USC Sec. 1251-1376			
Water Quality Criteria	40 CFR Part 131	Sets criteria for developing water quality standards based on toxicity to aquatic organisms and human health.	No/No	Would apply to groundwater cleanup, which is not addressed in this removal action.

TABLE C-1
Identification of *Federal* Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Toxic Substances Control Act	15 USC Sec. 2601-2629			
PCB Requirements	40 CFR Part 761	Establishes storage and disposal requirements for PCBs.	Yes/No	Applicable to PCBs present in soil at concentrations greater than 50 ppm.
Clean Air Act	42 USC Sec. 7401-7642			
National Primary and Secondary Ambient Air Quality Standards and National Emission Standards for Hazardous Air Pollutants	40 CFR Part 50 and 61	NAAQS establishes standards for ambient air quality to protect public health and welfare (including standards for particulate matter and lead). NESHAP sets emission standards for designated hazardous pollutants.	No/Yes	Site remediation activities must comply with NAAQS and NESHAPs. The principal application of these standards is during remedial actions resulting in exposure of fugitive dust.

TABLE C-2
Identification of *Federal* Location-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
National Environmental Policy Act Regulations, Wetlands, Floodplains	40 CFR 6.302(a)	Procedures for complying with Executive Order 11990 on wetland protection.	No/Yes	Pond 3 is a wetland. The removal of contaminated soil would provide a long term beneficial affect to the wetland.
Endangered Species Act	16 USC Sec. 1531-1543 40 CFR 6-302(h) 50 CFR Part 200 50 CFR Part 402	Requires that Federal agencies insure that any action authorised funded, or carried by the agency is not likely to jeopardise the continued existence of any threatened or endangered species or destroy or adversely modify critical habitat.	Yes/Yes---	Endangered species may frequent the Hill AFB area (e.g., Peregrine falcons, Bald Eagles). However, Pond 3 does not provide critical habitat.
Executive Order on Floodplain Management	Exec. Order 11988 40 CFR Sec. 6.302(B) and Appendix A	Requires Federal agencies to evaluate the potential effects of actions they may take in a floodplain to avoid, to the maximum extent possible, the adverse impacts associated with direct and indirect development of a floodplain.	No/No	Pond 3 is not in a floodplain.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE C-3
Identification of *Federal* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Clean Water Act Section 404	33 CFR 320-330	Authorise the Army Corps of Engineers to issue permits for the discharge of dredged or fill materials to wetlands.	Yes/---	Activity is covered under CERCLA. CERCLA activity is authorised under Nationwide Permit #38. This permit allows remediation to be performed in a wetland under CERCLA.
Clean Water Act, Storm Water Phase II Rules	40 CFR 112	Establishes best management practices and requirements to control storm water run-off from small construction activities.	Yes/---	Applicable to land disturbing activities. Applicable to Pond 3 because more than 1 acre may be disturbed during construction.
Solid Waste Disposal Act	42 USC Sec. 6901-6987			
Criteria for Classification of Solid Waste Disposal Facilities and Practices	40 CFR Part 257	Establishes criteria for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment.	No/---	Applicable to on-site landfilling of non-hazardous soils.
Standards Applicable to Generators of Hazardous Waste	40 CFR Part 262	Establishes standards for generators of hazardous waste.	Yes/--	Applicable to remedial alternatives involving excavation and generation of hazardous waste onsite.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR Part 264	Establishes minimum national standards for applicable units, which treat, store, or dispose of hazardous waste.	Yes/Yes	See discussion of specific subparts.
• General Facility Standards	Subpart B	Location standards	Yes/---	Applicable to onsite treatment or disposal of hazardous waste.
• Preparedness and Prevention	Subpart C	Specifies requirements for communications, alarm systems and coordination with local authorities.	Yes/---	Applicable to onsite hazardous waste management.

TABLE C-3
Identification of *Federal* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
• Contingency Plan and Emergency Procedures	Subpart D	Requires development of a contingency plan and designation of an emergency coordinator.	Yes/---	Applicable to onsite hazardous waste management.
• Releases from Solid Waste Management Units	Subpart F	Corrective action for releases.	No/Yes	Relevant and appropriate for units treating or disposing generated hazardous waste, and to the source areas where hazardous waste was disposed.
• Closure and Post-Closure	Subpart G	Closure performance standard, disposal or decontamination of equipment, post closure care.	Yes/ Yes	Applicable to alternatives involving onsite treatment and disposal of generated hazardous waste, and may be relevant and appropriate to the source areas where hazardous waste was disposed.
• Landfills	Subpart N	Facility standards for hazardous waste landfill.	No/---	Applicable for onsite disposal of hazardous soil in landfill. Not applicable to Pond 3.
• Corrective Action for Solid Waste Management Units	Subpart S	Establishes the corrective action program for cleaning up solid waste management units. This part of the regulation also includes provision for use of a Corrective Action Management Unit (CAMU) to facilitate waste management associated with cleanup activities. Hazardous waste moved within a CAMU is not subject to MTRs or LDRs.	Yes/Yes	Applicable to onsite soil treatment units within CAMU. Soils and wastes excavated as part of a remedial action would be treated and placed within CAMU. CAMU would be defined as the Pond 3 area.

TABLE C-3
Identification of *Federal* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Land Disposal Restrictions	40 CFR Part 268	Identifies hazardous wastes that are restricted from land disposal.	Yes/---	Applicable to storage and treatment of generated soils and plant matter containing hazardous wastes.
Clean Water Act	33 USC Sec. 1251-1376			
National Pre-treatment	40 CFR Part 403	Sets standards to control pollutants, which pass through or interfere with treatment processes in publicly-owned treatment works or which may contaminate sewage sludge.	No/Yes	Possible discharge of water if soils are saturated during excavation activities.

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE C-4
Identification of *State* Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Utah Public Drinking Water Regulations – Primary and Secondary Standards	UAC R309-103	Establishes acceptable levels for inorganic and organic chemicals and parameters.	No/No	Would apply to groundwater remediation, which is not addressed in this removal action.
Utah Ground-Water Quality Protection Regulations	UAC R317-6	Establishes groundwater quality standards for the different groundwater aquifer classes.	Yes/---	Applicable to all remedies where contaminants will remain on site that has the potential to release to groundwater.
Division of Solid and Hazardous Waste, Department of Environmental Quality	UAC R315-8-6	Groundwater protection standards for owners and operators of hazardous waste TSDFs.	Yes/--	Applicable to onsite hazardous waste treatment or disposal units where contaminants remain onsite and have the potential to release to groundwater.
• **Waste Identification**	UAC R315-2	Criteria for the Identification and Listing of Hazardous Waste.	Yes/---	Definition of hazardous waste mirrors federal definition. If wastes generated during the remediation phase are determined to contain hazardous wastes, they will be subject to these requirements.
• **Cleanup Action and Risk-Based Closure Standards**	UAC R315-101	Lists general criteria for establishing clean-up standards including compliance with MCLs in Safe Drinking Water Act and Clean Air Act. Requires removal or control of the source.	Yes/Yes	Applicable to response actions and clean-up standards established for Pond 3.
Corrective Action Clean-up Standards Policy - UST and CERCLA Sites	UAC R311-211	Lists general criteria for establishing clean-up standards including compliance with MCLs in Safe Drinking Water Act and Clean Air Act.	No/Yes	This requirement is not applicable because federal CERCLA sites are remediated under CERCLA and the NCP. It is however relevant and appropriate. Requires protective actions to be taken. Requires source removal or control of source and prevention of further degradation.

TABLE C-4
Identification of *State* Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Division of Water Quality, Department of Environmental Quality	UAC R317-2	Standards for Quality for Waters of the State.	No/Yes	The anti-degradation policy in UAC R317-2-3 is relevant and appropriate if contaminants will remain onsite and have the potential to release to groundwater.
Utah Air Conservation Regulations	UAC R307-1-3	Air Quality Standards for Control of Installations.	No/No	Regulates new installations that will or might reasonably be expected to become a source or indirect source of air pollution.
	UAC R307-1-3.1.8 (A) and (B)	Pollution Control for Emissions.	No/No	Requires that pollution control for emissions meet BACT, including those for soil venting and other projects.
	UAC R307-1-4	Emission Standards.	Yes/---	Sets emission standards for visible emissions, construction and demolition activities.
	UAC R307-12	Fugitive Emissions and Fugitive Dust.	Yes/---	Requires use of mitigative measures such as dust suppressants and foams if necessary.

TABLE C-5
Identification of *State* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Division of Solid and Hazardous Waste, Department of Environmental Quality				
Hazardous Waste Manifest Requirements	UAC R315-4	Establishes standards for manifesting hazardous waste.	Yes/---	Applicable to remedial alternatives involving offsite landfilling of hazardous soil and debris. Not applicable to offsite landfilling of non-hazardous materials.
Hazardous Waste Generator Requirements	UAC R315-5	Establishes standards for generators of hazardous waste.	Yes/---	Applicable to remedial alternatives involving generation of hazardous soil and debris. State counterpart of 40 CFR 262.
Hazardous Waste Transporter Requirements	UAC R315-6	Establishes standards for transporters of hazardous waste.	Yes/---	Applicable to remedial alternatives involving offsite landfilling of hazardous soil and debris. Not applicable to offsite landfilling of non-hazardous materials.
Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	UAC R315-8	Establishes minimum standards which define the acceptable management of hazardous waste for owners and operators of TSDFs.		See discussion for specific subparts below.
General Facility Standards	UAC R315-8-2	Describes security, inspection and personnel training.	Yes/---	Applicable to onsite treatment or disposal at onsite landfills. State counterpart of 40 CFR 264 Subpart B.
Preparedness and Prevention	UAC R315-8-3	Describes communications, alarm systems and coordination with local authorities.	Yes/---	Applicable to alternatives involving generation or disposal of hazardous waste at onsite landfills. State counterpart of 40 CFR 264 Subpart C.

TABLE C-5
Identification of *State* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Contingency Plan and Emergency Procedures	UAC R315-8-4	Requires development of a contingency plan and designation of an emergency coordinator.	Yes/---	Applicable to alternatives involving generation, treatment or disposal of hazardous waste at onsite landfills. State counterpart of 40 CFR 264 Subpart D.
Manifest System, Record-Keeping, and Reporting	UAC R315-8-5	Requires manifesting, record keeping and regular reporting.	Yes/---	Applicable to alternatives involving onsite treatment or disposal at onsite landfills. State counterpart of 40 CFR 264 Subpart E.
Groundwater Protection	UAC R315-8-6	Describes groundwater monitoring requirements for TSDFs.	Yes/Yes	Applicable to alternatives involving onsite treatment and disposal. Some requirements may be relevant and appropriate for alternatives in which contaminants will remain on site. State counterpart of 40 CFR 264 Subpart F.
Closure and Post-Closure	UAC R315-8-7	Establishes closure and post-closure performance standards and plan requirements for TSDFs.	Yes/Yes	Applicable to alternatives involving onsite treatment or disposal. Some requirements may be relevant and appropriate for alternatives in which contaminants will remain on site. State counterpart of 40 CFR 264 Subpart G.
Landfills	UAC R315-8-14	Establishes design, operation, and management requirements for landfills.	No/---	Applicable to onsite disposal of hazardous waste in a landfill.
Corrective Action for Solid Waste Management Units	UAC R315-8-21	Establishes requirements for designation of a CAMU and defines management practices.	Yes/---	Applicable to onsite soil treatment units. Soils and wastes excavated as part of a remedial action from within the CAMU. State counterpart of 40 CFR 264 Subpart S.

TABLE C-5
Identification of *State* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Land Disposal Restrictions	UAC R315-13	Identifies hazardous wastes that are restricted from land disposal.	Yes/Yes	Applicable to onsite disposal of soil that contains a hazardous waste outside the CAMU. State counterpart of 40 CFR 268.
Clean-up and Risk-Based Closure Standards	UAC R315-101	Lists general criteria to be considered in establishing clean-up standards including compliance with MCLs in Safe Drinking Water Act and Clean Air Act. Requires removal or control of the source.	Yes/Yes	Applicable to response actions and clean-up standards established for Pond 3.
Subtitle D Class I and II Landfill Closure Requirements	UAC R315-303-4	Specifies closure requirements for commercial solid waste landfills. Requires 18 inches of 1 x 10-5 cm/sec permeability or less.	---/Yes	Relevant and appropriate to onsite disposal of non-hazardous waste.
Subtitle D Industrial Solid Waste Landfill Closure Requirements	UAC R315-308	Regulates abandoned or closed industrial solid waste landfills and specifies cover requirements including 2 feet of cover soil.	No/---	Relevant and appropriate to onsite disposal of non-hazardous waste.
Division of Water Quality, Department of Environmental Quality	UAC R317-3	Sewers and wastewater treatment works.	No/No	
	UAC R317-7	Underground injection control.	No/No	Underground injection is not identified as a remedial alternative.
	UAC R317-8-8	Pretreatment.	No/No	No discharge to POTW.

TABLE C-5
Identification of *State* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Division of Air Quality, Department of Environmental Quality	UAC R307-1-2-	Utah Air Conservation Rules - General Requirements.	Yes/---	Prohibits emission of air contaminants in sufficient quantities to cause air pollution.
	UAC R307-1-3	Utah Air Conservation Rules - Control of Installations	Yes/---	Requires a degree of pollution control for emissions (including fugitive emissions and fugitive dust) to be at least BACT. Addressed through control of fugitive emissions.
	UAC R307-1-4	Utah Air Conservation Rules – Emissions Standards	Yes/---	These rules establish opacity limits for visible emissions. They require application of reasonably available control technology (RACT) to control VOC emissions in ozone non-attainment areas. Addressed through control of fugitive emissions.
	UAC R307-10	Emission Standards.	Yes/---	National Emission Standards for Hazardous Air Pollutants (NESHAP) are incorporated by reference (see 40 CFR 61 Subpart A). Addressed through control of fugitive emissions.
Fugitive Emissions and Fugitive Dust	UAC R307-12	Requires implementation of measures to control emissions of dust.	---/Yes	Applicable for excavation of soil over an area larger than 0.25 acres.
	UAC R307-14	Requirements for Ozone Nonattainment Areas and Davis and Salt Lake Counties.	No/No	Requires use of reasonably available control technology (RACT) for handling of liquid VOCs.

TABLE C-5
Identification of *State* Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARARs	Comment
Fugitive Emissions and Fugitive Dust cont.	UAC R311-211-5	Corrective Action Clean-up Standards Policy - UST and CERCLA Sites. Lists general criteria to be considered in establishing clean-up standards including compliance with MCLs in Safe Drinking Water Act and Clean Air Act. Requires action to be taken to be protective.	---/Yes	This requirement is not applicable because federal CERCLA sites are remediated under CERCLA and the NCP. It is however relevant and appropriate. Requires action to be taken to be protective. Requires source removal or control of source and prevention of further degradation. The State of Utah maintains that UAC R311-211 is "Applicable".

THIS PAGE INTENTIONALLY LEFT BLANK

APPENDIX D

Present Worth Cost Analysis

APPENDIX D

Present Worth Cost Analysis

D1.0 Overview of EE/CA Pond 3 Cost Estimates

D.1.0.0.1. This appendix contains the cost estimates performed to support evaluations of the Pond 3 EE/CA alternatives. Attached to this appendix are tables that show remedial components included in each alternative and costs of remedial components, including capital cost, annual operation and maintenance costs (as net present value calculated over 30-year period). The costs were calculated using regional labor, material, and equipment costs, and were derived from construction cost manuals, construction experience, and construction contractor quotes.

D.1.0.0.2. In accordance with EPA guidance, the cost estimates for each alternative are order-of-magnitude estimates. Estimates of this type are generally considered to be accurate within "plus 50 percent or minus 30 percent." This range implies that there is a high probability that the final project cost will fall within the range.

D.1.0.0.3. The cost estimates have been prepared for alternative evaluation and are based on the information available at the time of the estimate. The accuracy of estimates is subject to substantial variation because details about the specific design of each alternative (such as site conditions, final project scope and schedule, design details, the bidding climate and other competitive market conditions, changes during construction and operation, productivity, interest rates, labor and equipment rates, tax effects, and other variables) will not be known until the time of actual implementation of the final remedy. Each selected technology or process is intended not to limit flexibility during remedial design but to provide a basis for making alternative evaluation cost estimates. The remedial action and cost estimates will be refined during final design. As a result, the final alternative cost will likely vary from these estimates. The proximity to actual costs will depend on how close the assumptions made for this alternative evaluation match final conditions, as well as other factors such as those cited above.

D.1.0.0.4. The present worth calculated for each alternative is used to evaluate expenditures that would occur over an assumed 30-year operation period by discounting all future costs to a common base year. This allows the cost of remedial action alternatives to be compared on the basis if a single figure representing the amount of money that, if invested in the base year and disbursed as scheduled, would be sufficient to cover all costs associated with the remedial action over its planned life. A real discount rate of 5 percent (meaning that the difference between the nominal discount rate and inflation is 5 percent) and a constant value based on 2002 rates for material, expenses, and services was used in the estimates.

D.1.0.0.5. Remedial design efforts may also reveal that it is possible to reduce the original project cost estimates. Reductions in the estimated costs could be the result of value engineering conducted during remedial design. Through the value engineering process, modifications could be made to the functional specifications of the remedy to optimize

performance and reduce costs. It should be noted that this type of design variance may have a noticeable impact on the estimated cost of the remedy, but will not affect the ability of the remedy to comply with the performance standards.

D2.0 Direct Capital Costs

D.2.0.0.1. Direct capital construction costs consists of all costs required to construct a remedial component, including labor, materials, equipment, utilities, and other associated costs. Direct capital costs have been itemized for each alternative. A 30 percent contingency has been included in the direct capital cost estimate as a provision for unforeseeable, additional costs within the general bounds of the alternative scope. The contingency is used as a means to reduce the risk of possible cost overruns. The contingency in this estimate consists of two components: bid contingency and scope contingency. Bid contingency covers the unknown costs associated with constructing a given project scope, such as adverse weather conditions, strikes by material suppliers, geotechnical unknowns, and unfavorable market conditions for a particular project scope. Scope contingency covers scope changes that invariably occur during remedial design and implementation. Thirty percent for contingencies is commonly used for an estimate at the alternative evaluation level.

D3.0 Indirect Capital Costs

D.3.0.0.1. Indirect capital costs (nonconstruction and overhead) consist of engineering, financial, administration, supervision, and other services necessary to carry out a remedial action. They are not incurred as part of the actual remedial action but are ancillary to direct or construction costs. Indirect capital costs include the following items, describes in more detail in subsequent sections.

- General requirements
- Permitting and legal
- Services during construction
- Engineering design cost

D3.1 General Requirements

D.3.1.0.1. The cost estimates include an allowance of 10 percent of capital costs for general requirements to cover the costs associated with contractor mobilization and demobilization, and bonds and insurance, for example.

D3.2 Permitting and Legal

D.3.2.0.1. The cost estimates include an allowance of 5 percent of the capital cost for permitting and legal costs. Permitting and legal costs include:

- Legal and other fees for technical personnel to obtain licenses and permits
- Fees for non-environmental construction permits from federal, state, and local jurisdictions
- Fees for operating permits from federal, state, and local jurisdictions
- Legal advice to obtain licenses or negotiate construction and operating contracts

D3.3 Services During Construction

D.3.3.0.1. The cost estimates include an allowance of 10 percent of capital cost for services during construction. Services during construction include:

- Bidding and contract administration
- Construction management and onsite observation
- Change order negotiations
- Pre-purchase of equipment and expedition of deliveries
- Submittal review and office services
- Record drawings
- Additional design work during construction

D3.4 Engineering Design Costs

D.3.4.0.1. The cost estimates include an allowance of 10 percent of capital cost for engineering design costs. Engineering design costs include:

- Design and process development
- Preparation of specifications and bid documents
- Drafting

D4.0 Operation and Maintenance Costs

D.4.0.0.1. Annual operation and maintenance costs are those post-construction/installation costs necessary to ensure continued effectiveness of a remedial action and achievement of its objectives. Operation and maintenance costs include:

- Operating Labor Costs—Wages, salaries, training, overhead, and fringe benefits associated with the labor needed for post-construction operation

- Maintenance Materials and Labor Costs—Costs for labor, parts, and other resources required for routine maintenance of facilities and equipment

- Auxiliary Materials and Energy—Costs of items such as chemicals and electricity for treatment plant operation, water and sewer services, and fuel

- Disposal of Residues—Costs to treat or dispose of residuals such as sludges from treatment processes or spent activated carbon

- Purchased Services—Sampling costs, laboratory fees, and professional fees for which the need can be predicted

- Administrative Costs—Costs associated with the administration of remedial action operation and maintenance not included under other categories

- Insurance, Taxes, and Licensing Costs—Costs of items such as liability and sudden accidental insurance, real estate taxes on purchased land or rights-of-way, licensing fees for certain technologies, and permit renewal and reporting costs

- Maintenance Reserve and Contingency Funds—Annual payments into escrow funds to cover costs of anticipated replacement or rebuilding of equipment and any large unanticipated operation and maintenance costs
- Rehabilitation Costs—Costs for maintaining equipment or structures that wear out over time

D.4.0.0.2. The operation and maintenance cost estimates include a 30 percent contingency on the estimated operation and maintenance costs. As discussed above for capital costs, this contingency has been included in this estimate as a provision for unforeseeable additional costs.

TABLE D-1
Alternative 1: No Action
HAFB Pond 3 EE/CA

		Management Period (year)	Cost per year	Total Cost	Comment
Deferred Site Management Cost		30	3,000	$ 46,116	Estimated annual management cost for an OU9 deferred site for a 30 year period. Present Value i = 5% (Years 1-30)
Site Management Subtotal				**$ 46,116**	
Design & Contingency Capital Costs Subtotal				**$ -**	No Capital Cost
O&M Costs (includes 30% contingency)	0	0	$ -	$ 46,116	Present Value i = 5% (Years 1-30)
O&M Costs Subtotal				**$ 46,116**	
Total - Present Worth Costs				**$ 46,116**	

TABLE D-2

Alternative 2a: Non-Hazardous Sediment Removal with Off-Base Direct Landfill Disposal at Subtitle D Facility

HAFB Pond 3 EE/CA

Location	bcu/yds	lcu/yds	Tons		
Total	**200**	**260**	**390**		

Description	Units	Qty	Unit Cost	Total Cost	Comment
Mob/Demob Subtotal	ls	1	$ 6,000	**$ 6,000**	Includes excavator, front end loader, dump trucks, compactor, decon area, and labor hours.
Excavation/ Soil Placement in Roll-offs Subtotal	hr	32	$ 600	**$ 19,200**	Includes movement of soil by front end loader, water truck, and labor hours.
Materials Subtotal	ls	1	$ 11,289	**$ 11,289**	Includes rental of roll-off boxes, PPE, Decon liner, decon pressure washer, and temporary fencing.
Transportation Subtotal	ls	1	$ 14,665	**$ 14,665**	2 rolloff boxes transported each trip to ECDC. 25 total roll-off boxes.
Confirmation Sampling and Disposal Subtotal	ls	1	$ 23,098	**$ 23,098**	Quote from ECDC. Direct disposal @ $30/ton and includes State Disposal Fees. Ten confirmation samples and 25 composite profiling samples (1 per roll-off).
Site Restoration Subtotal				**$ 13,600**	Includes rebuilding of asphalt jogging path, reseeding, and labor hours.
Construction Subtotal				**$ 87,852**	
Engineering and Design		10%		$ 8,785	See assumptions in text
General Requirements		10%		$ 8,785	See assumptions in text
Permitting and Legal		5%		$ 4,393	See assumptions in text
Services During Construction		10%		$ 8,785	See assumptions in text
Contingency		30%		$ 26,356	See assumptions in text
Design & Contingency Capital Costs Subtotal				**$ 57,104**	
O&M Costs (includes 30% contingency)	0	0	$ -	$ -	No O&M Required for this option
O&M Costs Subtotal				**$ -**	
Total - Present Worth Costs				**$ 144,956**	

TABLE D-3
Alternative 2b: Hazardous Sediment Removal with Off-Base Direct Landfill Disposal at Subtitle C Facility
HAFB Pond 3 EE/CA

Location	bcu/yds	lcu/yds	Tons		
Total	**200**	**260**	**390**		

Description	Units	Qty	Unit Cost	Total Cost	Comment
Mob/Demob Subtotal	ls	1	$ 6,000	**$ 6,000**	Includes excavator, front end loader, dump trucks, compactor, decon area, and labor hours.
Excavation/ Soil Placement in Roll-offs Subtotal	hr	32	$ 600	**$ 19,200**	Includes movement of soil by front end loader, water truck, and labor hours.
Materials Subtotal	ls	1	$ 11,289	**$ 11,289**	Includes rental of roll-off boxes, PPE, Decon liner, decon pressure washer, and temporary fencing.
Transportation Subtotal	ls	1	$ 14,665	**$ 14,665**	2 rolloff boxes transported each trip to ECDC. 25 total roll-off boxes.
Confirmation Sampling and Disposal Subtotal	ls	1	$ 45,718	**$ 45,718**	Quote from Grassy Mountain Facility. Direct disposal @ $60/ton and includes State Disposal Fees. Ten confirmation samples and 25 composite profiling samples (1 per roll-off).
Site Restoration Subtotal				**$ 13,600**	Includes rebuilding of asphalt jogging path, reseeding, and labor hours.
Construction Subtotal				**$ 110,472**	
Engineering and Design		10%		$ 11,047	See assumptions in text
General Requirements		10%		$ 11,047	See assumptions in text
Permitting and Legal		5%		$ 5,524	See assumptions in text
Services During Construction		10%		$ 11,047	See assumptions in text
Contingency		30%		$ 33,142	See assumptions in text
Design & Contingency Capital Costs Subtotal				**$ 71,807**	
O&M Costs (includes 30% contingency)	0	0	$ -	$ -	No O&M Required for this option
O&M Costs Subtotal				**$ -**	
Total - Present Worth Costs				**$ 182,279**	

TABLE D-4

Alternative 2c: Hazardous Sediment Removal with Off-Base Treatment and Direct Landfill Disposal at Subtitle C Facility

HAFB Pond 3 EE/CA

Location	bcu/yds	lcu/yds	Tons		
Total	**200**	**260**	**390**		

Description	Units	Qty	Unit Cost	Total Cost	Comment
Mob/Demob Subtotal	ls	1	$ 6,000	**$ 6,000**	Includes excavator, front end loader, dump trucks, compactor, decon area, and labor hours.
Excavation/ Soil Placement in Roll-offs Subtotal	hr	32	$ 600	**$ 19,200**	Includes movement of soil by front end loader, water truck, and labor hours.
Materials Subtotal	ls	1	$ 11,289	**$ 11,289**	Includes rental of roll-off boxes, PPE, Decon liner, decon pressure washer, and temporary fencing.
Transportation Subtotal	ls	1	$ 14,665	**$ 14,665**	2 rolloff boxes transported each trip to ECDC. 25 total roll-off boxes.
Confirmation Sampling and Disposal Subtotal	ls	1	$ 65,218	**$ 65,218**	Quote from Grassy Mountain Facility. Treatment and disposal @ $110/ton + State Disposal Fees. Ten confirmation samples and 25 composite profiling samples (1 per roll-off).
Site Restoration Subtotal				**$ 13,600**	Includes rebuilding of asphalt jogging path, reseeding, and labor hours.
Construction Subtotal				**$ 129,972**	
Engineering and Design		10%		$ 12,997	See assumptions in text
General Requirements		10%		$ 12,997	See assumptions in text
Permitting and Legal		5%		$ 6,499	See assumptions in text
Services During Construction		10%		$ 12,997	See assumptions in text
Contingency		30%		$ 38,992	See assumptions in text
Design & Contingency Capital Costs Subtotal				**$ 84,482**	
O&M Costs (includes 30% contingency)	0	0	$ -	$ -	No O&M Required for this option
O&M Costs Subtotal				**$ -**	
Total - Present Worth Costs				**$ 214,454**	

TABLE D-5
Alternative 3: Phytoremediation with Metal Extraction in a Treatment Cel
HAFB Pond 3 EE/CA

Location	bcu/yds	lcu/yds	Tons		
Total	**200**	**260**	**390**		

Description	Units	Qty	Unit Cost	Total Cost	Comment
Mob/Demob, Excavation Costs Subtotal				**$ 6,240**	Includes excavator, front end loader, dump trucks, compactor, decon area, and labor hours.
Site Cell Setup, Lab Analysis					
Setup On-Site Cell	sq. ft	5000	$ 5.00	$ 25,000	12" deep, 200 cy capacity treatment cell.
Edenfern Plugs (5,000 ea/yr.)	ea	5000	$ 2.00	$ 10,000	5,000 plugs per year.
Lab Analysis, soil As (2x/yr)	ea	40	60.00	$ 2,400	Samples taken biannually. 40 samples total.
Lab Analysis, Plant Tissue As (2x/yr)	ea	40	60.00	$ 2,400	Samples taken biannually. 40 samples total.
Soil Sample Collection, Frond Harvesting, O/M	ls	1	32000.00	$ 32,000	Assumed for 8 months/yr., Includes O/M, Oversite
Soil Amendments (Fertilizer, etc)	ls	2	$ 500	$ 1,000	
Plant Debris Disposal (transport, treatment)	ls	1	$ 5,000	$ 5,000	Transport, treatment, and disposal.
Annual Report, Tech Memorandum	ls	1	$ 10,000	$ 10,000	
Construction and Startup Costs Year 1 Subtotal				**$ 87,800**	
Construction Subtotal				**$ 94,040**	
Engineering and Design		10%		$ 9,404	See assumptions in text
General Requirements		10%		$ 9,404	See assumptions in text
Permitting and Legal		5%		$ 4,702	See assumptions in text
Services During Construction		10%		$ 9,404	See assumptions in text
Contingency		30%		$ 28,212	See assumptions in text
Design & Contingency Capital Costs Subtotal				**$ 61,126**	
Year 2-4, (Estimated Yearly Annual Maint.)				$ 62,800	Estimated annual cost for each of the 3 years following startup.
O&M Costs (which includes 30% contingency)	yr	3	$ 81,640	$ 244,920.00	
O&M Costs Subtotal				**$ 244,920**	
Total - Present Worth Costs				**$ 400,086**	

APPENDIX E

Regulator Comments and Response to Comments

RESPONSE TO EPA REVIEW COMMENTS ON THE DRAFT REPORT

HILL AIR FORCE BASE ENGINEERING EVALUATION/COST ANALYSIS FOR THE OPERABLE UNIT 9 POND 3 REMOVAL ACTION

May 2003

General Comments:

1. Please explain how the background levels were obtained.

Response: Background levels were developed in the *Final Comprehensive Data Evaluation for the South Area of Operable Unit 9 Site Investigation* (*OU9 SI*) (CH2M HILL, 2002). Appendix E of the *OU9 SI* presents the documentation submitted to HAFB, EPA, and UDEQ concerning the establishment of background levels of metals for the North and South areas of OU9. The background levels, procedures used to calculate the background levels, and responses to EPA and UDEQ comments are presented as a memorandum in Appendix E.

2. What disposal facility will be used for Alternative 2? Hill AFB must comply with the off-site policy. For non-time-critical removals involving off-site disposal, Hill AFB must indicate that the appropriate State environmental officials have been notified and that the off-site policy has been met.

Response: It was assumed for costing purposes that ECDC Landfill in Carbon County, Utah would be used as the Subtitle D Facility and Grassy Mountain Landfill in Tooele County, Utah would be used as the Subtitle C Facility. HAFB will follow the CERCLA Off-Site Rule described in 40 CFR 300.440 when selecting a RCRA approved disposal facility and will request approval from the appropriate regulatory officials.

3. When specifically will this removal action take place?

Response: Pending funding, the removal action at Pond 3 is currently planned for the Summer/Fall of 2003.

4. The Action Memo is the critical component of the administrative record because it is the primary decision document for a removal response. The Action Memo serves as the primary decision document substantiating the need for a removal response, identifying the proposed action and explaining the rationale for the removal. When will Hill AFB prepare the Action Memorandum and who will sign it?

Response: The Action Memorandum will be prepared once the Remedial Design/Remedial Action Work Plan for the chosen remedy have been approved by EPA and UDEQ regulators. The Director of Environmental Management for Hill AFB will sign the Action Memorandum.

5. For non-time-critical removal actions, a 30-day public comment period is required on the EE/CA and any supporting documentation at the time the EE/CA is made available for public comment. The administrative record file must be made available for public inspection at the

same time the EE/CA is made available. Please state when the 30-day public comment period will begin.

Response: The 30-day public comment period will begin as soon as the Pond 3 EE/CA has been approved by the regulators. The Action Memorandum and 30-day public comment period will follow a schedule similar to the Pond 1 EE/CA.

Specific Comments:

1. Page 2-1, Section 2.2.2.2: Please describe in detail the specific types of wildlife that currently exists at Pond 3. Specifically, are there any threatened and/or endangered species present. Also describe the effects of the current contamination on the wildlife habitat at Pond 3 during wet and dry periods.

Response: Table 1 and Table 2 summarizes the bird and mammal species that may occur on HAFB and associated lands. The only bird species considered "threatened" is the bald eagle. Currently there are no known "threatened" or "endangered" mammal species inhabiting HAFB. A wildlife survey specific to Pond 3 has not been conducted for either birds or mammals. Fish species that exist in Pond 3 are largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and black bullhead (*Ameiurus melas*); none of which are "threatened" or "endangered." A survey for amphibians and reptiles has never been conducted at HAFB. The Utah Division of Wildlife Resources has the western toad (*Bufo boreas boreas*) and milk snake (*Lampropeltis triangulum*) listed as "sensitive" for Davis County.

A study of the current effects of arsenic-contaminated sediments at Pond 3 on inhabiting wildlife has not been conducted at HAFB. The following describes potential effects that arsenic may have on exposed wildlife. Since the recommended remedial action is to remove the contamination from Pond 3, the contamination will not affect the wildlife habitat.

Amphibian/Reptiles
Very few toxicological studies have been conducted for arsenic on amphibians or reptiles. The lowest available concentration found to cause 50% mortality in a 96-hr exposure (96-hr LC50) to the bullfrog tadople (*Rana catesbeiana*) was at 25 mg/L (EPA 1996).

Birds
Arsenic is found to have effects on bird that ranges from reduced growth, increased mortality, decreased egg weight to egg shell thinning. Growth rate for the mallard was reduced when they were fed 40 mg/kg-food (dry weight) over a period of 10 weeks (DOI 1998). The belted kingfisher and the blue heron are the two most relevant water fowls for aquatic habitats. The no-observed effect level (NOAEL) were 19 to 22 mg/kg wet weight for those two species based on sodium arsenite in the diet (DOI 1998).

Mammals
Arsenic is known to cause reproductive effects in many mammalian species. Mammals can be exposed to arsenic mainly through ingestion of contaminated vegetation and water. Studies on mice exposed to arsenic over a 3 generation period showed declining litter size with successive generation. The NOAEL and the lowest observed effect level (LOAEL) is determined to be at 0.126 and 1.26 mg/kg-day, respectively (Sample et al., 1996). However, chronic (long-term)

exposure to arsenic is uncommon because the detoxification and depuration of arsenic in mammals are rapid (DOI 1998).

Benthic invertebrates
A comprehensive evaluation of chemical concentrations in sediment that would elicit adverse biological effects to the benthic invertebrates was conducted (DOI 1998). It was determined that at sediment concentration of 8.2 mg/kg (dry weight) or less would not cause adverse effects; concentrations that are above 70 mg/kg (dry weight) would cause adverse biological effects. These evaluations were based on marine and estuarine sediments; nevertheless, there is no statistical difference in adverse levels between the biological response of marine and freshwater benthic invertebrates (Jones et al 1996).

2. Table 2-1: Please change the footnote for "bgs"at the bottom of the Table. I believe it should read "below ground surface" instead of "between ground surface".

Response: The footnote for Table 2-1 will be changed to read "below the ground surface."

3. Page 2-9, Section 2.6.3: Please provide discussion on compliance with the Off-Site Policy.

Response: The following paragraph will be added to Section 2.6.3.

The CERCLA Off-Site Rule requires that hazardous substances, pollutants or contaminants transferred off-site for treatment, storage or disposal during a CERCLA response action be transferred to a facility operating in compliance with 3004 and 3005 of RCRA and other applicable laws or regulations. The contaminated media at Pond 3 will only be transported to an RCRA-approved facility. In order to be compliant with this rule (40 CFR 300.440), HAFB will obtain EPA approval prior to sending Pond 3 contaminated media to a disposal facility. EPA will determine the acceptability of the selected disposal facility under RCRA and other applicable laws or regulations.

4. Page 4-5, Section 4.2.2.1: Please state the estimated time frame when the pond will be dry and the sediments unsaturated.

Response: Section 4.2.2.1. will be changed to read as follows:

4.2.2.1. Alternative2 consists of contaminated sediments removal in Areas 1, 2, 3, and 4 as shown in Figure 4-1, followed by off-site treatment and/or disposal. The sediments would be excavated with standard grading equipment, such as trackhoes and front-end loaders, during a period when the western portion of the pond is dry and the sediments are unsaturated. **The sediments in the contaminated area are normally unsaturated during the summer and early fall months, when limited precipitation occurs.** Approximately 200 cubic yards (cy) of sediment contaminated with arsenic above background levels would be excavated from the Pond 3 area. The final volume of sediment is expected to bulk upon excavation to approximately 260 cy.

5. Page 4-5, Section 4.2.2.3: According to Figure 4-1, localized excavation may occur to depths ranging from 1 to 4 feet. Please explain why the text in this section refers to depths ranging from only 1 to 2 feet.

Response: Figure 4-1 shows the initial excavation depths for each of the areas. The depth range of 1 to 4 feet bgs referenced in Figure 4-1 is the excavation depth for a portion of Area 2. The depth range of 1 to 2 feet bgs discussed in Section 4.2.2.3. refers to the additional excavation that may occur if analytical results from the confirmation sampling exceed background levels for arsenic.

6. Page 4-5, Section 4.2.2.2: Please explain in more detail how wind dispersion of the stockpile areas and the excavation area will be prevented on a daily basis.

Response: Techniques to prevent wind dispersion of the stockpiled material will be determined by the construction contractor and will be discussed in the contractor's Site Safety Plan, which will include a dust suppression plan.

7. Page 4-4, Section 4.1.1.10: Under community acceptance, please state when the 30-day public comment period will begin.

Response: The public comment period will begin once the EE/CA has been finalized. The second bullet under Section 4.1.1.10. will read as follows:

> **Community Acceptance.** This criterion reflects the community's preferences for, or concerns about, the remedial alternatives. A 30-day public comment period is provided for the community to ask questions and voice concerns about the remedial alternatives. A notice will be published in the local paper soliciting public comments on the final version of this document.

8. Page 4-12, Section 4.4.7.2: The range of cost for Alternative 2 is not consistent with the range of cost specified in Table 4-1 and Table D-2. Please change or explain the reason for the two different cost ranges.

Response: The cost range in Table 4-1 is equivalent to costs shown in Tables D-2, D-3, and D-4. The costs given for Alternative 2 in Table 4-1 show a range of $144,956 - $214,454 which is dependent on the accepting disposal facility. Table D-2 gives a cost of $144,956 for direct disposal at a Subtitle D Facility; Table D-3 gives a cost of $182,279 for direct disposal in a Subtitle C Facility; and Table D-4 gives a cost of $214, 454 for treatment and direct disposal in a Subtitle C Facility. Therefore the cost range for Alternative 2 is $144,956 - $214,454 as shown in Table 4-1.

9. Page 5-1, Section 5.2.0.1: Please further explain the last sentence which refers to a contingency for standing water in the pond. What exactly is this contingency plan for standing water? Please provide more details on the contingency plan. Has it been developed and when will it be available for appropriate review?

Response: Section 5.2.0.1. states that "standing water in the pond during construction will be addressed as a contingency to the construction project." This means that if standing water exists within the pond area where construction activities are to occur, then construction activities will be stopped until conditions are suitable to continue. This construction contingency along with a

description of suitable conditions will be outlined in the design Remedial Design/Remedial Action Work Plan. This RD/RA Work Plan will be reviewed by EPA and UDEQ regulators.

10. Page 2-9, Section 2.6.2: Please describe the process for obtaining regulatory approval of the confirmation sampling.

Response: If the analytical results of the confirmation samples are below the already regulatory approved background levels then Hill AFB will assume regulatory approval and no further excavation will be done. If confirmation sampling still shows levels above background, Hill AFB will excavate additional soils and take additional confirmation samples. The analytical results will be documented in a final report to be completed at the conclusion of construction.

11. Page 2-8, Section 2.5.5: Please discuss the risk due to the elevated levels of PAHs and metals in Pond 3. Are there any human health or environmental risks associated with leaving elevated levels of PAHs and metals in Pond 3? Please explain in more detail the rationale for excluding these from the list of Chemicals of Concern.

Response: As stated in Section 2.3.4 *Poly-Aromatic Hydrocarbon Investigation*, the PAHs are bound within asphalt matrices. Therefore no risk to human health and/or the environment exists because the PAHs are bound to the asphalt aggregates and are immobile. Elevated metal levels in the central portion of the pond (Boring U9-7667) could not be verified with four additional samples in the area (refer to Section 2.3.2.6.). The highest concentration of Cadmium and Lead detected in the four additional samples were 2 mg/kg and 57.3 mg/kg, well below the background concentrations of 3.58 mg/kg and 400 mg/kg, respectively. The Cadmium level at Boring U9-7667 is less than 2 times the background level and the Lead level slightly exceeds action levels, but appears to be confined to a very limited area. It is assumed that the elevated metals detected at Boring U9-7667 are isolated to this location and do not exist elsewhere in the pond. Therefore, the risks from the elevated metal levels are considered minimal.

Reference

CH2M HILL, 2001. *Final Comprehensive Data Evaluation for the South Area of Operable Unit 9 Site Inspection*. Hill Air Force Base, Utah. February 2001.

Department of the Interior (DOI), 1998. Guidelines for interpretation of the biological effects of selected constituents in biota, water, and sediment. National Irrigation Water Quality Program Information Report No. 3. Denver, CO.

EPA, 1996. Amphibian Toxicity Data for Water Quality Criteria Chemicals. EPA/600/R-96/124. National Health Environmental Effects Research Laboratory, Corvallis, OR.

Long, E.R., D.D. MacDonald, S.L. Smith, and F.D. Calder, 1995. Incidence of adverse biological effects within ranges of chemical concentrations in marine and estuarine sediments. Environmental Management 19: 81-97.

Sample B. E., D. M. Opresko and G. W. Sutter II. 1996. Toxicological Benchmarks for Wildlife. ES/ER/TM-86/R3. Oak Ridge National Laboratory, Oak Ridge, TN.

TABLE 1
Bird Species That May Occur at Pond 3 of Hill Air Force Base
Pond 3 EE/CA Response to EPA Comments

Common Name	Scientific Name	Common Name	Scientific Name
Double-crested Cormorant	Phalacrocorax auritus	Lark Sparrow	Chondestresgrammacus
Mallard	*Anas platyrhynchos*	Lark Bunting	*Calamospiza melanocrorys*
Redhead	*Aythya americana*	Grasshopper Sparrow	*Ammodramus savannarum*
Common Goldeneye	*Bucephala clangula*	Song Sparrow	*Melospiza melodia*
Turkey Vulture	*Cathartes aura*	White-crowned Sparrow	*Melospiza melodia*
Bald Eagle (T)	*Haliaeeatus leucocephalus*	Dark-eyed Junco	*Junco hyemalis*
Northern Harrier	*Circus cyaneus*	Red-winged Blackbird	*Agelaius phoeniceus*
Sharp-shinned Hawk	*Accipiter striatus*	Western Meadowlark	*Sturnella neglecta*
Cooper's Hawk	*Accipiter cooperii*	Brewer's Blackbird	*Euphagus cyanocephalus*
Swainson's Hawk	*Buteo swainsoni*	Brown-headed Cowbird	*Molothrus ater*
Red-tailed Hawk	*Buteo jamaicensis*	Bullock's Oriole	*Icterus bullockii*
American Kestrel	*Falco sparverius*	House Finch	*Carpodacus mexicanus*
Prairie Falcon	*Falco mexicanus*	Pine Siskin	*Carduelis pinus*
Ring-necked Pheasant	*Phasianus colchicus*	American Goldfinch	*Carduelis tristis*
Killdeer	*Charadrius volciferus*	House Sparrow	*Passer domesticu*
California Gull	*Larus californicus*	Western Scrub-Jay	*Aphelocoma californica*
Canada Goose	*Branta canadensis*	Black-billed Magpie	*Pica pica*
Rock Dove	*Columba livia*	Common Raven	*Corvus corax*
Mourning Dove	*Zenaida macroura*	Black-capped Chickadee	*Parus gambeli*
Black-chinned Hummingbird	*Archilochus alexandri*	Rock Wren	*Salpinctes obsoletus*

TABLE 1
Bird Species That May Occur at Pond 3 of Hill Air Force Base
Pond 3 EE/CA Response to EPA Comments

Common Name	Scientific Name	Common Name	Scientific Name
Broad-tailed Hummingbird	*Selasphorus platycercus*	Blue-gray Gnatcatcher	*Polioptila caerulea*
Rufous Hummingbird	*Selasphorus rufus*	American Robin	*Turdus migratorius*
Belted Kingfisher	*Ceryle alcyon*	Cedar Waxwing	*Bombycizla cedrorum*
Lewis' Woodpecker	*Melanerpes lewis*	Eropean Starling	*Sturnus vulgaris*
Downy Woodpecker	*Picoides pubescens*	Warbling Vireo	*Vireogilvus*
Northern Flicker	*Colaptes auratus*	Yellow Warbler	*Dendroica petechia*
Willow Flycatcher	*Empidonox traillii*	Yellow-rumped Warbler	*Dendroica coronata*
Western Kingbird	*Tyrannus verticalis*	Wilson's Warbler	*Wilsonia pusilla*
Horned Lark	*Eremophila alpestris*	Black-headed Grosbeak	*Pheucticus melanocephalus*
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	Larzuli Bunting	*Passerina amoena*
Bank Swallow	*Riparia riparia*	Chipping Sparrow	*Spizella passerina*
Cliff Swallow	*Hirundo pyrrhonota*	Brewer's Sparrow	Spizella breweri
Barn Swallow	*Hirundo rustica*		

Notes: (T) - Federally Listed Threatened Species (Utah Division of Wildlife Resources, 2003)

TABLE 2
Wildlife That May Occur at Pond 3 of Hill Air Force Base
Pond 3 EE/CA Response to EPA Comments

Common Name	Scientific Name	Native (N)/ Introduced (I)	Utah Status*	Habitat
Vagrant shrew	Sorex vagrans	N	C,N	mixed forest, riparian
Dusky shrew	Sorex obscurus	N	C,N	riparian, alpine
Masked shrew	Sorex cinereus	N	C,N	marsh, various woods
Water shrew	*Sorex palustris*	N	C,N	riparian, lakeshore
Big myotis	*Myotis lucifugus*	N	C,N	caves, buildings
Long-eared myotis	*Myotis myotis*	N	C,N	coniferous forest, buildings
Hairy-winged myotis	*Myotis volans*	N	C,N	forest areas
Small-footed myotis	*Myotis subulatus*	N	C,N	caves, buildings
Silver haired bat	*Lasionycteris noctivagans*	N	C,N	woods, buildings
Big brown bat	*Eptesicus fuscus*	N	C,N	caves, buildings
Hoary bat	*Lasiurus cinereus*	N	C,N	coniferous forest
Western pipistrelle	*Pipistrellus hesperus*	N	C,N	caves, desert rocky areas
White-tailed jackrabbit	*Lepus townsendii*	N	C,N	grassland, shrublands
Black-tailed jackrabbit	*Lepus californicus*	N	C,N	sagebrush-shrub upland
Snowshoe hare	*Lepus americanus*	N	C,P	alpine forest
Mountain cottontail	*Sylvilagus nuttalli*	N	C,P	sagebrush-shrub upland
Red squirrel	*Tamiasciurus hudsonicus*	N	C,N	coniferous, deciduous forest
Yellow-bellied marmot	Marmota flaviventris	N	C,N	subalpine meadows, rocky outcrops

TABLE 2
Wildlife That May Occur at Pond 3 of Hill Air Force Base
Pond 3 EE/CA Response to EPA Comments

Common Name	Scientific Name	Native (N)/ Introduced (I)	Utah Status*	Habitat
Townsend ground squirrel	*Spermophilus townsendii*	N	L,N	open sagebrush
Uinta ground squirrel	*Spermophilus armatus*	N	C,N	sagebrush, grasslands
Rock squirrel	*Spermophilus variegatus*	N	C,N	oak-juniper woodland, urban
Golden-mantled ground squirrel	*Spermophilus lateralis*	N	C,	coniferous, mixed forest
Uinta chipmunk	*Eutamias umbrinus*	N	C,N	confirous forest
Cliff chipmunk	*Eutamias dorsalis*	N	U,N	pinyon-juniper woodland
Least chipmunk	*Eutamias minimus*	N	C,N	various, desert to coniferous forest
Northern flying squirrel	Glaucomys sabrinus	N	C,N	coniferous, mixed forest
Northern pocket gopher	*Thomomys talpoides*	N	C,N	meadows, upland, urban
Great Basin pocket mouse	*Perognathus parvus*	N	C,N	arid bushy plains
Ord kangaroo rat	*Dipodomys ordii*	N	C,N	desert, sandy waste areas
Western harvest mouse	*Reithrodontomys megalotis*	N	C,N	weedy, grassy areas
Deer mouse	*Peromyscus maniculatus*	N	C,N	prairie, woodland, shrubland
Canyon mouse	*Peromyscus crinitus*	N	C,N	rocky canyons
Pinyon mouse	*Peromyscus truei*	N	C,N	pinyon-juniper woodland
Brush mouse	*Peromyscus boylii*	N	C,N	arid brushland, rocky areas
Northern grasshopper mouse	*Onychomys leucogaster*	N	U,N	desert, low valley, prairie
Desert woodrat	*Neotoma lepida*	N	C,N	pinyon-juniper woodland, desert

TABLE 2
Wildlife That May Occur at Pond 3 of Hill Air Force Base
Pond 3 EE/CA Response to EPA Comments

Common Name	Scientific Name	Native (N)/ Introduced (I)	Utah Status*	Habitat
Bushy-tailed woodrat	*Neotoma cinerea*	N	C,N	rocky areas, coniferous forest
Sagebrush vole	*Lagurus curtatus*	N	C,N	sagebrush grasslands
Red-backed vole	*Clethrionomys gapperi*	N	C,N	damp coniferous forests, riparian
Muskrat	*Ondatra zibethicus*	N	C,P	marsh, pond, lakes, riparian
Heather vole	*Phenacomys intermedius*	N	C,N	mountain meadows
Pennsylvania meadow mouse	*Microtus pennsylvanicus*	N	U,N	riparian meadows
Big-footed meadow mouse	*Microtus richardsoni*	N	C,N	riparian meadows
Montane meadow mouse	*Microtus montanus*	N	C,N	high mountain meadows
Long-tailed meadow mouse	*Microtus longicaudus*	N	C,N	dry, grassy mountain slopes
Big jumping mouse	*Zapus princeps*	N	C,N	riparian, moist wetlands
Coyote	*Canis latrans*	N	C,N	mixed forest, open plains
Red fox	*Vulpes vulpes*	N	L,P	cultivated, woodlands, brushlands
Raccoon	Procyon lotor	I	C,P	riparian, urban
Ring-tailed cat	*Bassariscus astutus*	N	C,	rocky canyons, talus slopes
Ermine	*Mustela erminea*	N	R,P	various, farm-coniferous forest
Long-tailed weasel	*Mustela frenata*	N	C,P	various, farm-coniferous forest
Badger	*Taxidea taxus*	N	C,P	open plains, farmland
Striped skunk	*Mephitis mephitis*	N	C,P	various, desert to woodlands
Porcupine	Erithizon dorsatum	N	C,N	mixed forest

TABLE 2
Wildlife That May Occur at Pond 3 of Hill Air Force Base
Pond 3 EE/CA Response to EPA Comments

Common Name	Scientific Name	Native (N)/ Introduced (I)	Utah Status*	Habitat
Norway rat	*Rattus norvegicus*	I	C,N	urban
House mouse	*Mus musculus*	I	C,N	urban
Spotted skunk	*Spilogale putorius*	N	C,P	mixed woodland, farmland, marsh
Bobcat	*Lynx rufus*	N	C,P	scrubby broken forests
Elk	*Cervus canadensis*	N	C,P	mixed forest, alpine meadow
Mule deer	*Odocoileus hemionus*	N	C,P	mountain shrub, mixed forest
Moose	*Alces alces*	N	L,P	mixed forest, alpine meadows

*Key to Utah Status:

N = not protected, species not protected by any laws in Utah

P = protected, species protected by state or federal laws in Utah

C = common, widespread and abundant

U = uncommon, widespread but not abundant

L = limited, common but restricted to a particular habitat type or use in Utah

R = rare, seldom identified during any one year

T = threatened, threatened with becoming endangered in Utah

E = endangered, endangered with extinction or extirpation from wildland in Utah

RESPONSE TO UDEQ REVIEW COMMENTS ON THE DRAFT REPORT

HILL AIR FORCE BASE ENGINEERING EVALUATION/COST ANALYSIS FOR THE OPERABLE UNIT 9 POND 3 REMOVAL ACTION

May 2003

Comment:
1. The Pond 3 EE/CA should include a community involvement section. A notice should also be published in the newspaper soliciting public comments on this document.

Response: The public comment period will begin once the EE/CA has been finalized. The second bullet under Section 4.1.1.10. will read as follows:

> **Community Acceptance.** This criterion reflects the community's preferences for, or concerns about, the remedial alternatives. A 30-day public comment period is provided for the community to ask questions and voice concerns about the remedial alternatives. A notice will be published in the local paper soliciting public comments on the final version of this document.