U.S. Department of the Interior
National Park Service
Lake Mead National Recreation Area
601 Nevada Way
Boulder City, NV 89005

Proposed Final Engineering Evaluation/Cost Analysis Report

Lake Mead National Recreation Area
Four Former Firing Range Sites
Mohave County, Arizona and Clark County, Nevada

August 21, 2014

Prepared by:

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Contract P11PD76337

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ACRONYMS AND ABBREVIATIONS

ADEQ	Arizona Department of Environmental Quality
amsl	above mean sea level
ARAR	Applicable or Relevant and Appropriate Requirement
AZGFD	Arizona Game and Fish Department
Baker	Michael Baker Jr., Inc.
BCL	Basic Comparison Level
BG	background
bgs	below ground surface
BLM	Bureau of Land Management
BTAG	Biological Technical Assistance Group
CDP	census designated place
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	conversion factor
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	constituent of potential concern
CSM	conceptual site model
DOT	Department of Transportation
DU	decision unit
ECM	Environmental Cost Management, Inc.
ED	exposure duration
EE/CA	Engineering Evaluation/Cost Analysis
EF	exposure frequency
EPC	exposure point concentration
ERA	Ecological Risk Assessment
ESA	Endangered Species Act
ET	exposure time
F	Fahrenheit
ft^3/s	cubic feet per second
ft	feet
GCL	geosynthetic clay liner
GPL	Groundwater Protection Level (Arizona)
HCP	Habitat Conservation Plan
HI	Hazard Index
HQ	hazard quotient
HSRC	Historic Sites Review Committee
IR	Ingestion Rate
ISM	Incremental Sampling Methodology
ITRC	Interstate Technology & Regulatory Council
LAKE	Lake Mead National Recreation Area

LCRS	Leachate Collection and Removal System
LCR MSCP	Lower Colorado River Multi-Species Conservation Program
LOC	Locations of Concern
MCL	maximum contaminant level
µg/g	micrograms per gram
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MI	*MULTI INCREMENT*® (sampling, see ISM)
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
ND	non-detect
NDEP	Nevada Division of Environmental Protection
NPS	National Parks Service
NTCRA	non-time critical removal action
OM&M	operation, maintenance and monitoring
PA	Preliminary Assessment
PRG	Preliminary Remediation Goal
QC	quality control
RAO	Removal Action Objective
RCRA	Resource Conservation and Recovery Act
RSV	risk screening value
SI	Site Inspection
SPLP	Synthetic Precipitation Leaching Procedure
SSC	Species of Special Concern
SSL	USEPA Site Screening Level
SSSL	site-specific screening level
TBC	To Be Considered (as an ARAR)
TCLP	toxicity characteristic leaching procedure
TAL	Target Analyte List
UCL	upper confidence limit
UNESCO	United Nations Educational, Scientific, and Cultural Organization
U.S.C.	United States Code (Laws/Statutes)
USDOI	United States Department of the Interior
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geologic Survey

EXECUTIVE SUMMARY

The United States Department of the Interior (USDOI) National Park Service (NPS) retained Environmental Cost Management, Inc. (ECM) under contract P11PD76337 to prepare an Engineering Evaluation/Cost Analysis (EE/CA) Report for the Lake Mead National Recreation Area[1] (LAKE). This EE/CA Report addresses lead impacts at two former firing range sites in Mohave County, Arizona and two former firing range sites in Clark County, Nevada. These four former firing range sites are all located within LAKE boundaries, and are collectively referred to as "the Site." Individually, the four former firing range sites are referred to by their specific names, which are the Echo Bay and Las Vegas Bay Former Firing Ranges in Nevada, and the Temple Bar and Willow Beach Former Firing Ranges in Arizona. NPS is engaging in a non-time critical removal action (NTCRA) process at the Site using their authority under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).

The four former firing ranges where used for shooting practice mainly by NPS personnel and local law enforcement officers for several years. For most of them, it is unknown when shooting practice activities began or when they stopped. It is reported that Las Vegas Bay Former Firing Range operated from 1974 until its closure in 2007 and that Echo Bay was closed in 1993.

In 2007, Michael Baker Jr., Inc. (Baker, 2009)[2] conducted a Preliminary Assessment and Site Inspection (PA/SI) report that included the Site. NPS concluded that additional work was necessary to address lead contamination. In 2013, ECM reviewed the data from the PA/SI report and prepared a Work Plan for Soil Sampling[3] (Work Plan) to perform surficial soil sampling using incremental sampling methodology (ISM) to facilitate the preparation of an EE/CA Report. ECM implemented the Work Plan activities in April 2013 and the results are presented in **Section 2.3** in this EE/CA.

Using the additional collected data, ECM completed a streamlined risk assessment (**Section 2.5**) for human and ecological receptors that indicates a risk to ecological receptors from potential exposure to concentrations of lead in surficial soils exists at the Site. The hazard quotient (HQ) for potential exposure to lead impacted surficial soil is estimated at above 1 for human health and/or for ecological receptors at four of the Site decision units (DUs). By definition, a HQ value of one or less is considered "safe" with regard to the effect of a chemical of potential concern (COPCs) to human health or for ecological receptors. Therefore, it is concluded that the lead impacted surficial soil poses a potential environmental risk, justifying a non-time critical removal action (NTCRA). ECM considered ecological soil screening benchmarks and area use factors in the refined streamlined risk assessment to calculate the Site Specific Screening Levels for each DU in soil (**Section 2.5.5**).

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[1] Lake Mead National Recreation Area is also referred to as "LMNRA" in literature and other sources. This text will use the acronym LAKE only.

[2] Michael Baker Jr., Inc. *Final Preliminary Assessment and Site Inspection Report, Lake Mead National Recreation Area, Boulder City, Nevada*. July 2009.

[3] Environmental Cost Management, Inc., *Work Plan for Additional Soil Sampling, Lake Mead National Recreation Area – Four Former Firing Range Sites, Mohave County, Arizona and Clark County, Nevada*. March 6, 2013.

The scope of removal action evaluated in this EE/CA Report focuses on the removal action objective (RAO) to prevent or reduce potential for human and ecological exposure (through inhalation, ingestion, and dermal contact) to lead in surficial soil. The lead impacts do not appear to be migrating to groundwater or local surface water bodies.

Six removal action technologies were reviewed (**Section 4**) to develop the following four removal action alternatives to meet the RAO:

- Alternative 1 – No Action
- Alternative 2 – Excavation, On-Site Disposal, Capping and Institutional Controls
- Alternative 3 – Excavation, Mechanical Soil Washing, Chemical Stabilization and Soil Replacement to Site
- Alternative 4 – Excavation and Off-Site Disposal (with optional Chemical Stabilization)

The four removal action alternatives were evaluated based on the following overall criteria (**Section 5**):

1) Effectiveness
    a) Protectiveness
    b) Level of treatment and/or containment
    c) Reduction or elimination of contaminants of concern
2) Implementability
    a) Technical feasibility
    b) Administrative and legal feasibility
    c) Ease of Implementation
3) Cost
    a) Capital cost
    b) Post removal site controls cost
    c) Present worth value / present cost
    d) Long-term operation, maintenance and monitoring (OM&M) costs

Effectiveness and implementability have been evaluated in detail in subsections presented for each alternative in **Section 5**. **Table 5-1** presents a comparative analysis for each of the four removal alternatives. The costs have been evaluated in detail and a complete break-out of estimated costs is provided in **Attachment H**.

Table 6-1 summarizes the recommended Alternative 4 for three of the four Former Firing Range sites, as the streamline risk assessment indicates that the Willow Beach Former Firing Range site does not require removal action.

Alternative 4 is the selected alternative as it is the most protective of human health, ecological, and water resources at LAKE and is less costly than Alternative 2 and of similar cost as Alternative 3.

Government funding, as authorized by the United States Congress and as available, should address the firing ranges in the following order of priority:

1. Las Vegas Bay
2. Echo Bay
3. Temple Bar

ECM also recommends additional investigation of an area south of the target area at Las Vegas Bay. Known as the “overshot area,” this area drains into a wash channel, also south of the target area.

1.0 INTRODUCTION

On behalf of the Department of Interior, National Park Service (NPS), Environmental Cost Management, Inc. (ECM) prepared this Engineering Evaluation/Cost Analysis (EE/CA) Report for the Lake Mead National Recreation Area[4] (LAKE). This EE/CA Report addresses lead impacts at two former firing range sites in Mohave County, Arizona and two former firing range sites in Clark County, Nevada. These four former firing range sites are all located within LAKE boundaries, and are collectively referred to as "the Site." Individually, the four former firing range sites are referred to by their specific names, which are the Echo Bay Former Firing Range and Las Vegas Bay Former Firing Range in Nevada, and the Temple Bar Former Firing Range and Willow Beach Former Firing Range in Arizona. The Site and the individual former firing range sites are depicted on **Figure 1-1**, below.

1.1 AUTHORITY

This EE/CA Report has been prepared in accordance with the criteria established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as well as sections of the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) as applicable to removal actions (40 Code of Federal Regulations [CFR] §300.415 [b][4][I]). The NPS has been delegated CERCLA lead agency authority by the President of the United States and the Secretary of the Interior, and is exercising this authority at the Site. The EE/CA Report is also consistent with the United States Environmental Protection Agency (USEPA) guidance document, *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (USEPA, 1993).

1.2 PURPOSE AND OBJECTIVES

This EE/CA provides an engineering evaluation to support the selection of a Non-Time-Critical Removal Action (NTCRA) for the Site. Environmental investigations at the Site have identified conditions that correspond to factors in Section 300.415(b)(2) of NCP (40 C.F.R. 300.415). These conditions indicate that a NTCRA may be necessary to abate, prevent, minimize, stabilize, mitigate, or eliminate threats to human health and the environment.

NCP discusses three types of removal actions: emergency, time critical, and non-time-critical. These designations are based on the urgency with which cleanup must be initiated to respond to a threat to human health and the environment posed by a release or potential release of hazardous substances. Emergency and time-critical removal actions are initiated to respond to a release or potential release where less than six months are available for planning the response. NPS has determined that a NTCRA should be implemented at the LAKE former firing range sites to address the known and potential threats to public health, welfare, and the environment at the Site and because the *Final Preliminary Assessment and Site Inspection Report* (Baker, 2009) did not completely characterize the nature and extent of contamination.

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[4] Lake Mead National Recreation Area is also referred to as "LMNRA" in literature and other sources. This text will use the acronym LAKE only.

Furthermore, NPS determined that more than six months are available for planning a response for the identified release.

An Approval Memorandum (**Appendix A**) authorized the preparation of this EE/CA Report. The Approval Memorandum is the first step in NTCRA process. Section 300.415(b)(4)(I) of NCP requires the development of an EE/CA with a public comment period, prior to the signing of the Action Memorandum to initiate the selected alternative for NTCRA.

The EE/CA identifies removal action objectives for protection of human health and the environment, identifies removal action alternatives, and assesses the effectiveness, implementability, and cost of the alternatives that satisfy the removal action objectives.

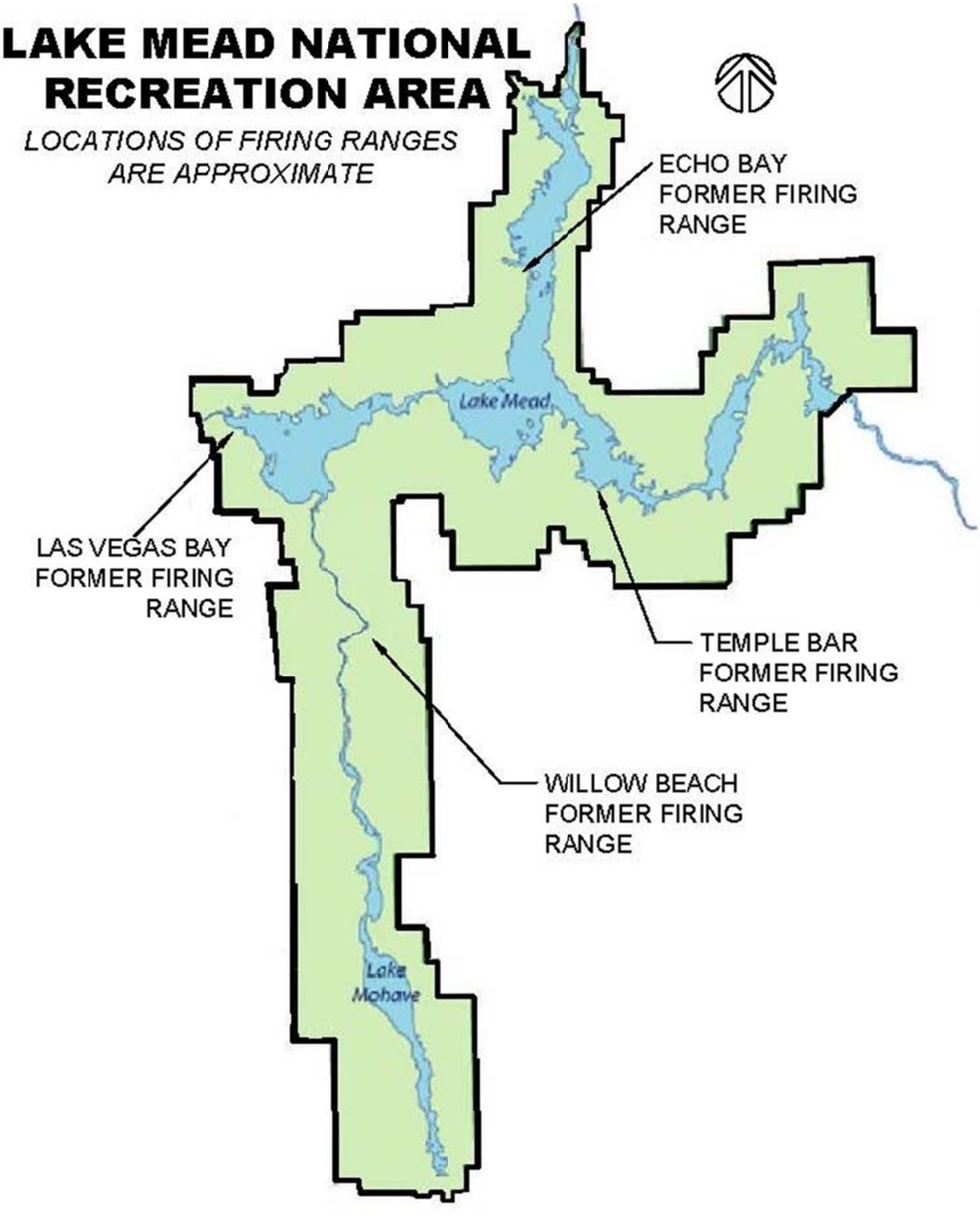
The EE/CA considers the nature of the contamination, any potential risks to human health and the environment, and how the alternatives fit into the strategy for Site remediation.

The goals of the EE/CA include:

- Evaluate historic site data and collect additional information regarding soil impacts and characteristics to fill data gaps (hereto referred to as the EE/CA Field Investigation);
- Conduct a Streamlined Risk Assessment to determine the potential threats posed by contamination originating from the Site;
- Prepare an EE/CA Report to propose removal actions and to address contamination;
- Provide a framework for the evaluation and selection of potential response actions and applicable technologies consistent with the NCP and USEPA Guidance.

Detailed site characteristics for each former firing range site and photographs of specific features encountered during the EE/CA Investigation are provided in **Appendix B**.

Figure 1-1: Four Former Firing Range Site Location Map



1.3 BACKGROUND

Lake Mead, the largest man-made lake and reservoir in the United States, is located on the Colorado River about 30 miles southeast of Las Vegas, Nevada, in the states of Nevada and Arizona. Lake Mead and Lake Mohave make up LAKE. Lake Mead is formed by water impounded by Hoover Dam, and extends 110 miles behind the dam. The water held in Lake Mead is released via aqueducts to communities in Southern California and Nevada. The lake was named after Elwood Mead, who was commissioner of the U.S. Bureau of Reclamation from 1924 to 1936 during the planning and construction of the Boulder Canyon Project that created the dam and the lake in 1935. Lake Mohave, which is a 67-mile stretch of the Colorado River below the Hoover Dam, is impounded by Davis Dam. Lake Mohave captures and delays the discharge of flash floods from side washes below Hoover Dam.

LAKE covers approximately 1.5 million acres[5], administered under the auspices of NPS. It was established in 1964. Lake Mead, Lake Mohave, the Colorado River, and other associated washes and tributaries cover approximately 186,000 acres of the total area of LAKE. The two lakes have about 700 collective miles of shoreline.

NPS manages approximately 560,000 acres of the recreation area (NPS, 2006b) as wilderness. Nine designated wilderness areas in Clark County are wholly or partially located in LAKE. Four of the nine areas are on both NPS and Bureau of Land Management (BLM) lands. These nine designated wilderness areas are:

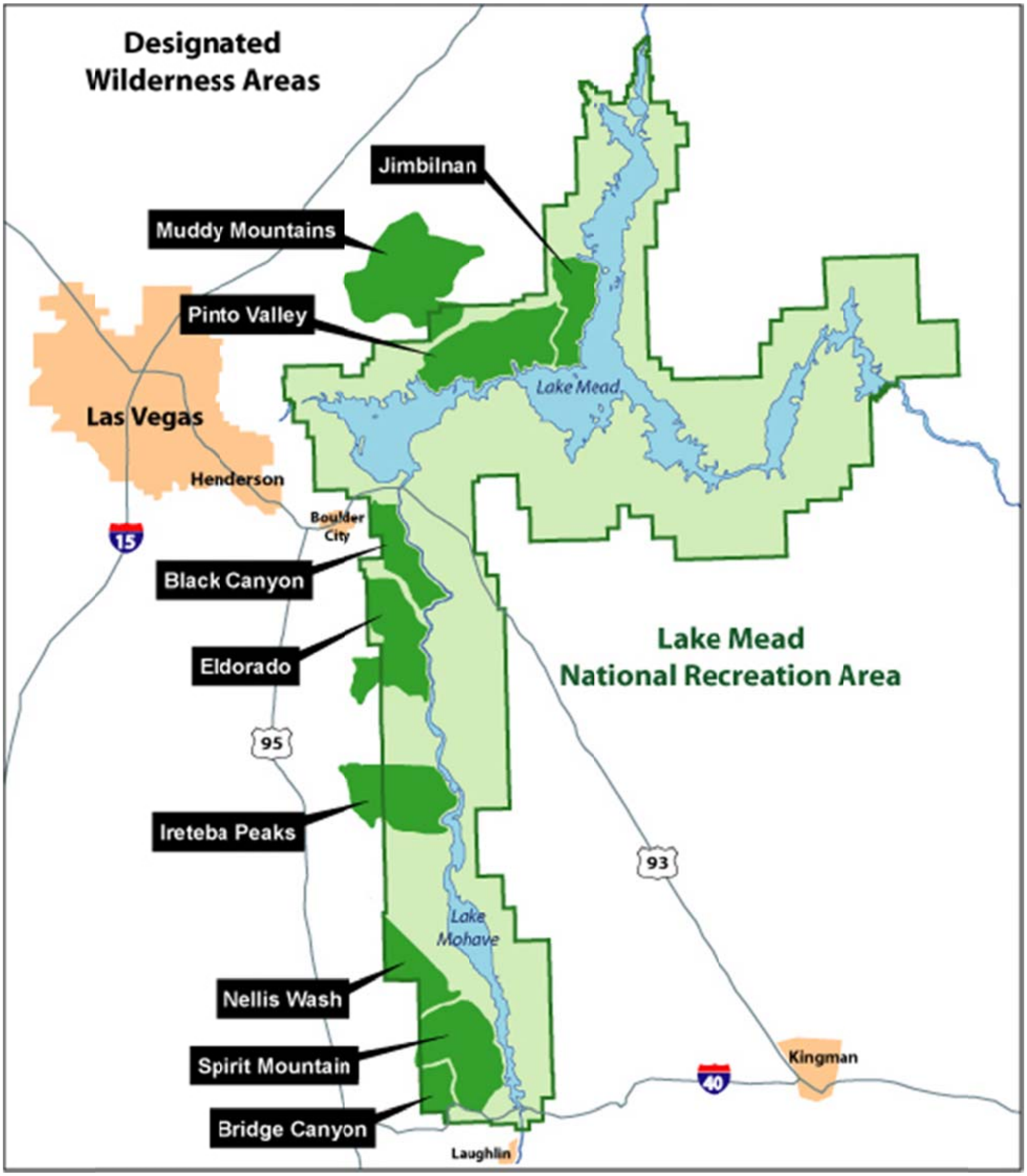
1. Muddy Mountains Wilderness
2. Pinto Valley Wilderness
3. Jimbilnan Wilderness
4. Black Canyon Wilderness
5. Eldorado Wilderness
6. Ireteba Peaks Wilderness
7. Nellis Wash Wilderness
8. Spirit Mountain Wilderness
9. Bridge Canyon Wilderness

None of the four firing ranges are located in a wilderness area.

---

[5] This **includes** 208,447 acres of lands administered by the NPS as part of the Grand Canyon-Parashant National Monument (GCPNM) in Arizona. The GCPNM was established by Presidential Proclamation on January 11, 2000. The 1,054,264-acre GCPNM is co-administered by NPS (in the aforementioned area abutting LAKE) and the Bureau of Land Management (BLM). The Former Firing Range Sites are not located within the GCPNM.

Figure 1-2: Wilderness Areas



There are six Environmental and Disposal Liability (EDL) firing range sites, four Locations of Concern (LOC) landfill/dump sites, and one LOC former mine site within LAKE (Baker, 2009). Additionally seven potential LOC sites, including five landfills, one surface dumping area, and one firing range were identified by LAKE. Historic activities at four former firing range sites have left potentially hazardous concentrations of lead at these sites. These four sites are the subject of the EE/CA Investigation and this EE/CA Report. The locations of each of the former firing range sites are presented in **Figure 1-2. Figures 1-3** through **1-6** depict the site features of the individual firing ranges. Their locations are further discussed in **Appendix B**.

Project: NPS Lake Mead

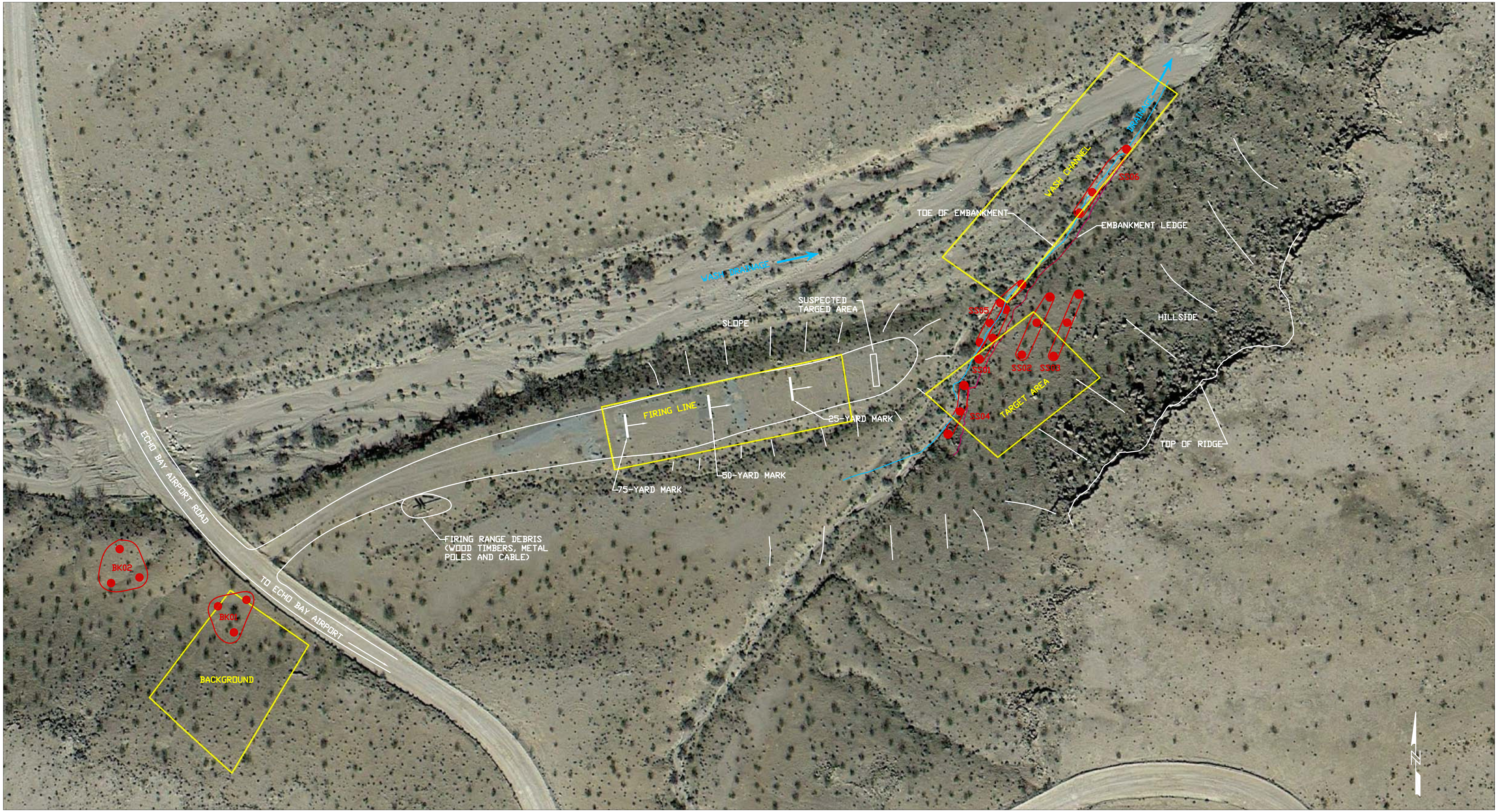
Proj. Manager: TL

Date drafted: 9/06/2012

Chkd by: TL

Drafter: JWP

File Path: B:NPS/Lake Mead



ORIGINAL DRAWING SOURCE: BAKER, FIG 7-3
SITE FEATURES AND SOIL SAMPLE LOCATION
MAP, DATED: APRIL 2007

40 0 80

1"=80'

LEGEND

● SURFACE SOIL SAMPLE LOCATION (Baker, 2007)

⬭ COMPOSITED SOIL SAMPLES

〜 DRAINAGE FEATURES

▭ DECISION UNIT EXTENTS

National Park Service
Lake Mead National Recreational Area
Boulder City, Nevada

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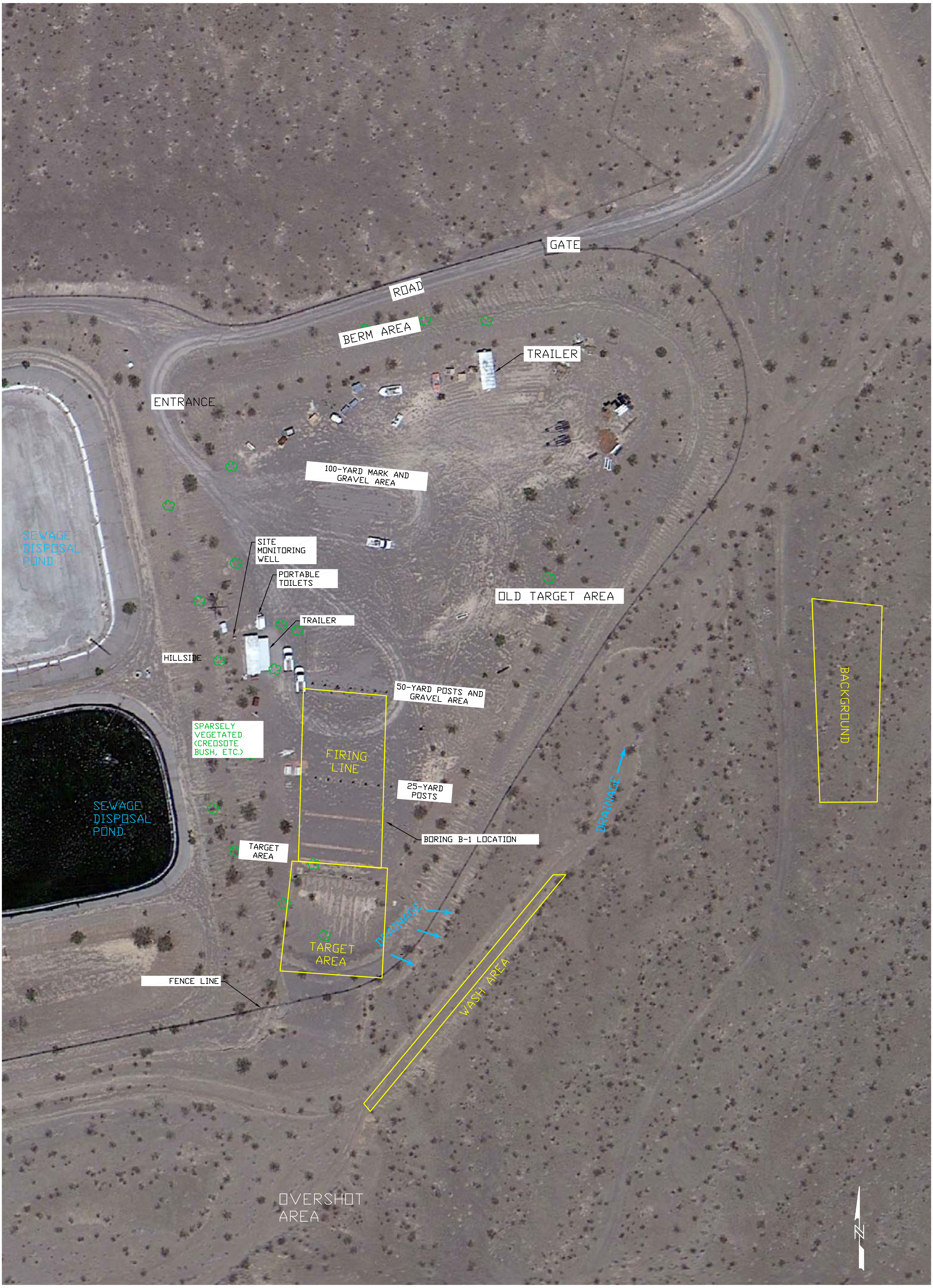
Echo Bay
Former Firing Range (EDL Site 520)

Figure

1-3



ORIGINAL DRAWING SOURCE: BAKER, FIG 9-3
SITE FEATURES ACTIVE FIRING RANGE (EDL SITE
2421) DATED: APRIL 2007

Note: Site features from Baker, Final Preliminary
Assessment and Site Inspection Report, Lake Mead
National Recreation Area, Boulder City, Nevada.
July 2009.

0 70

1"=70'

▱ DECISION UNIT EXTENTS

Project: **NPS Lake Mead**
Proj. Manager **TL**
Date drafted: **9/4/2012**
Chkd by: **TL**
Drafter: **JWP**
File Path: **B:NPS/Lake Mead**

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Las Vegas Bay
Former Firing Range (EDL Site 2421)

Figure
1-4

Project: NPS Lake Mead

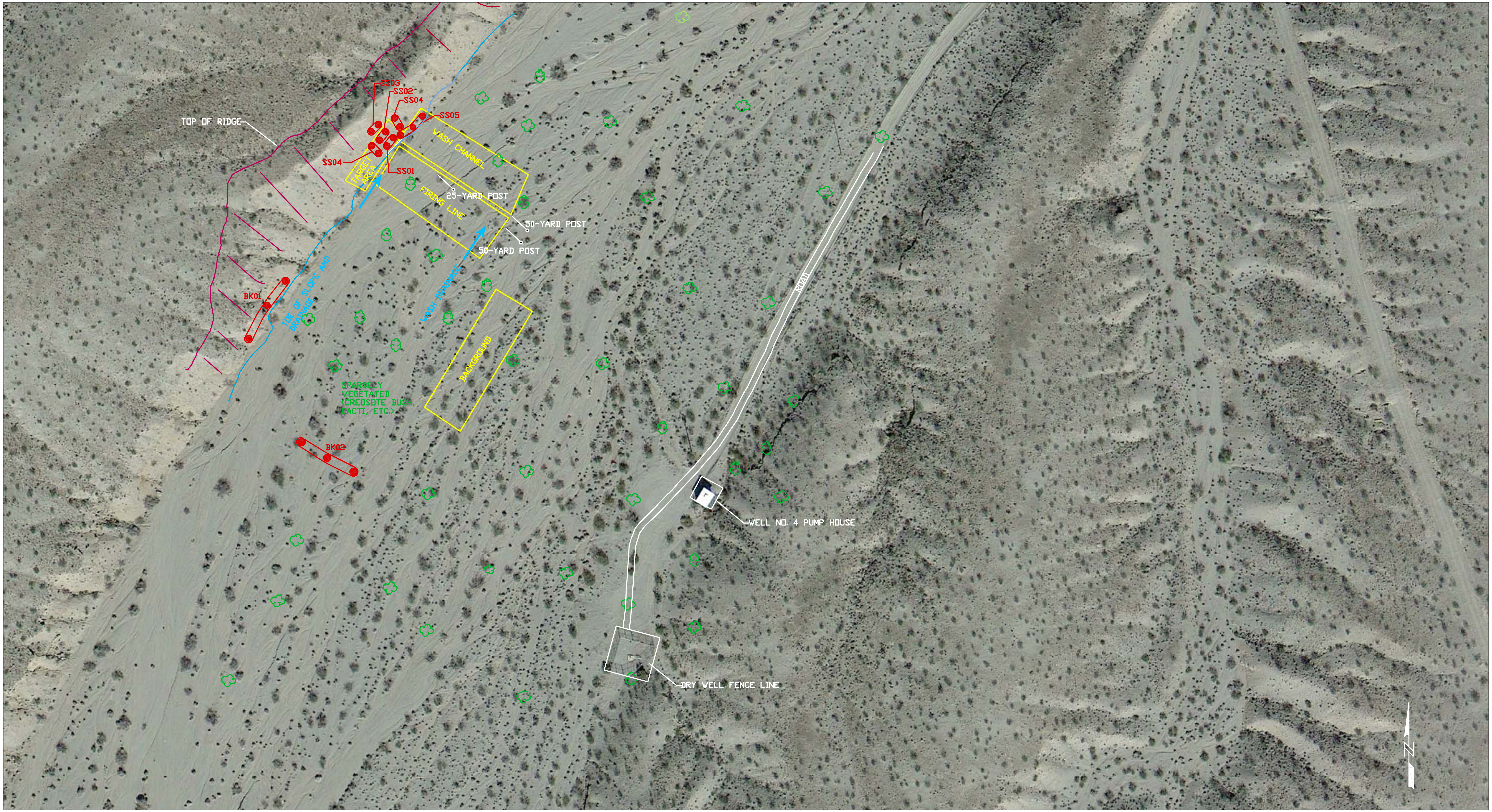
Proj. Manager TL

Date drafted: 9/06/2012

Chkd by: TL

Drafter: JWP

File Path: B:NPS/Lake Mead



ORIGINAL DRAWING SOURCE: BAKER, FIG 10-3 SITE
FEATURES AND SOIL SAMPLE LOCATION MAP, FORMER
FIRING RANGE (EDL SITE 2044) DATED: APRIL 2007

50 0 100

1"=100'

LEGEND

- ● SURFACE SOIL SAMPLE LOCATION (Baker, 2007)
- ⬭ COMPOSITED SOIL SAMPLES
- 〜 DRAINAGE FEATURES
- ▭ DECISION UNIT EXTENTS

National Park Service
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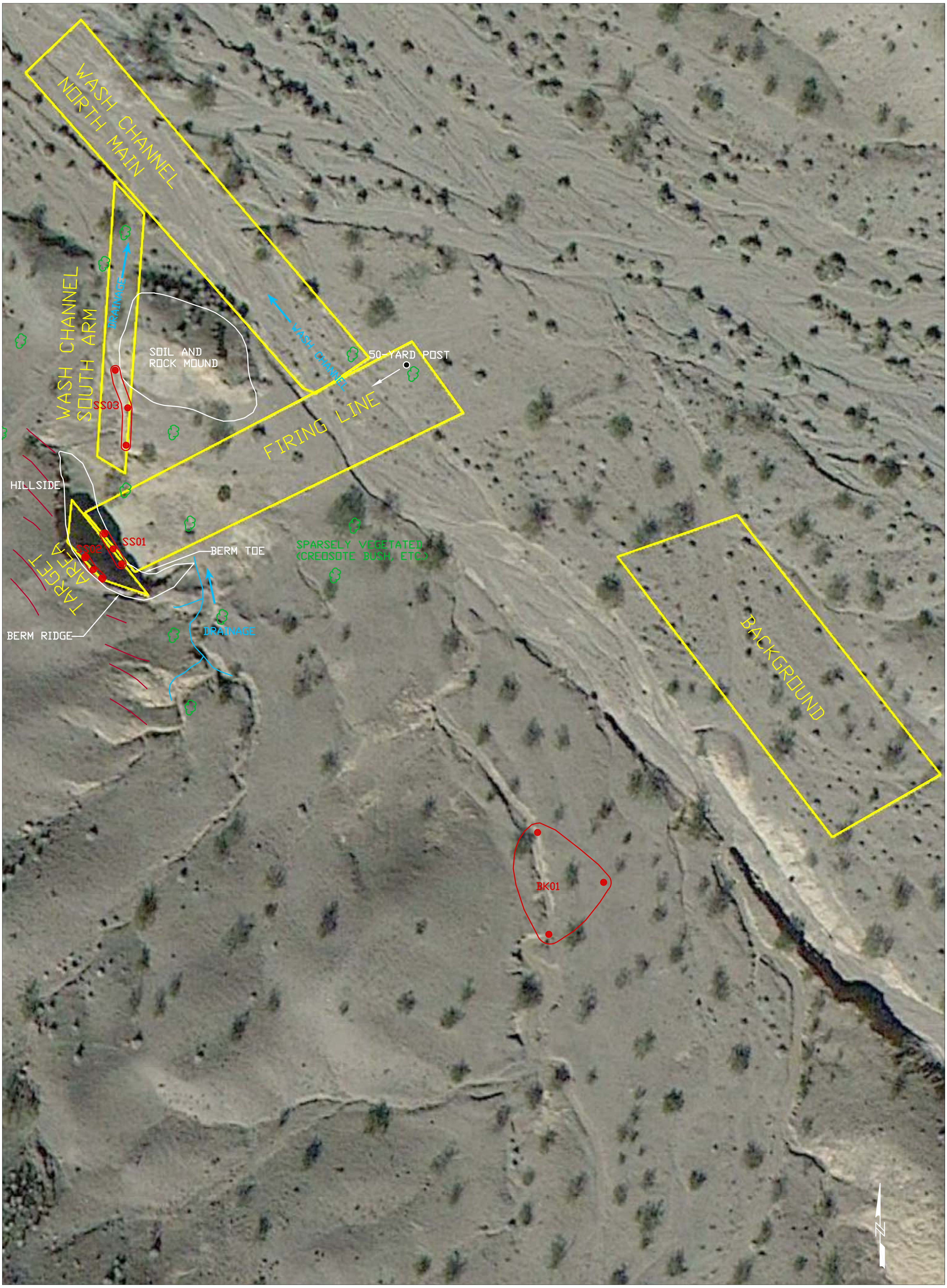
Temple Bar
Former Firing Range (EDL Site 2044)

Figure

1-5



ORIGINAL DRAWING SOURCE: BAKER, FIG 11-3 SITE FEATURES AND SOIL SAMPLE LOCATION MAP, FORMER FIRING RANGE (EDL SITE 523) DATED: APRIL 2007

20 0 40
1"=40'

LEGEND

● SURFACE SOIL SAMPLE LOCATION (Baker, 2007)
⬭ COMPOSITED SOIL SAMPLES
〰 DRAINAGE FEATURES
▭ DECISION UNIT EXTENTS

National Park Service
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Willow Beach
Former Firing Range (EDL Site 523)

Figure
1-6

Drafter: JWP
Chkd by: TL
Date drafted: 9/6/2012
Proj. Manager TL
Project: NPS Lake Mead
File Path: B:NPS/Lake Mead

2.0 SITE CHARACTERIZATION

The following sections describe characteristics analogous throughout LAKE and generally associated with all four former firing range sites. For detailed information on an individual firing range, refer to **Appendix B**, which provides current and historical land use, cultural resources, and sensitive ecosystems for each specific range.

2.1 OVERALL SITE DESCRIPTION

2.1.1 Location

LAKE is located on the Colorado River, about 20 miles southeast of Las Vegas, Nevada, and about 5 miles north of Bullhead City, Arizona, and Laughlin, Nevada (**Figure 2-1**). LAKE Headquarters are located in Boulder City, Nevada. The headquarters building is located 24 miles from McCarran Airport in Las Vegas, and 4.5 miles from the Alan Bible Visitor Center on the south shore of Lake Mead, off Highway 93.

There are nine primary access points to the lake. There are three main ways to get to western portions of the lake from the greater Las Vegas area: Lake Mead Boulevard from downtown Las Vegas, Lake Mead Parkway from Henderson, and Highway 93 from Boulder City. Access from the northwest from Interstate 15 is through Valley of Fire State Park and the Moapa River Indian Reservation via State 169 to the Overton arm of the lake. Access from the south is via Highway 93 from Kingman and State 143 to the Temple Bar area and via State 68 from Highway 93 or State 163, State 164, and State 165 from Highway 95.

Figure 2-1: Site Location Map

2.1.2 Historical Land Use

Before the existence of Lake Mead, Lake Mohave, and Hoover Dam, the area encompassing the one and a half million acres of LAKE was occupied by early desert Indian cultures, explorers, pioneers looking for cheap land and religious freedom, and prospectors seeking riches.

2.1.2.1 First Inhabitants

Archaeological evidence identifies several Native American cultures as having existed 8,000 to 10,000 years ago in the vicinity of LAKE in an environment wetter and cooler than today (NPS, 2013a). These inhabitants hunted game, gathered local edible plants and practiced farming.

Some of the early Native American groups lived in caves. In a cave near present-day Lake Mead, archaeologist Mark R. Harrington and paleontologist James Thurston discovered the remains of large mammals including: ground sloth (*Nothrotheriops shastensis*), horse (*Equus sp.*), camel (*Camelops sp.*) and mountain sheep (*Ovis canadensis*). Notches on the bones of animals in the cave show evidence that humans prepared and ate those animals.

Other groups lived in pit houses and Puebloan-type structures. Ranging from present day Davis Dam north to the Virgin and Muddy Rivers, these early farming groups grew corn, beans, squash and cotton. Their technology included pottery of the reddish-brown and gray-brown buff ware with simple black and red decoration. They ground corn and seeds with manos and metate and hunted game with spears, bows and arrows made from local or traded materials.

2.1.2.2 European's Arrival

The first non-native people in the Colorado River area were Spanish conquerors (conquistadores), who were looking for gold, silver or other wealth (USBR, 2013). Ulloa was the first to see the mouth of the Colorado in 1539. Cardenas, who traveled with Coronado from Mexico in 1540, was the first to see the Grand Canyon. Some of these Spanish soldiers stayed or returned to live in the area, which is why the Spanish language is so widely used today in California, Arizona, New Mexico, and Nevada.

Some two hundred years after the conquerors came, Spanish priests, such as Father Dominguez and Father Escalante in 1776, entered and explored parts of the Colorado River basin as they looked for routes of travel between their missions (DesertUSA, 2013). It was Father Garces, also in 1776, who named the river, Rio Colorado, "red-colored river."

2.1.2.3 Early Explorers

In 1826, Jedediah Smith and other trappers looking for animal furs for trade, encountered the early Indians who lived along the river banks (NPS, 2013a). Gold miners on the way to California followed in 1849, and Mormon settlers arrived in Las Vegas in 1855. Las Vegas, which is Spanish for "the meadows," did not become a town until 1905.

River explorers and mappers first arrived in January, 1858 under the leadership of Lt. Joseph Christmas Ives, who traveled up the Colorado by steamboat from the Gulf of California, possibly as far as Black Canyon, the eventual site of Hoover Dam. John Wesley Powell and his men floated down the river, starting on the Colorado's main tributary, the Green River. From Green River, Wyoming, he and his men rowed all the way through the Grand Canyon. Powell made a second trip down the Colorado in 1871.

2.1.2.4 Pioneers

Steamboats plied the Colorado River from the 1850s until 1904, when construction began on Laguna Dam 14 miles north of Fort Yuma, Arizona. The steamboats ran routes from the Gulf of California to the Grand Canyon.

The town of St. Thomas started as a pioneer settlement in 1865 and grew to be an established town of farms, homes and stores (NPS, 2013b). When the Hoover Dam was built, St. Thomas was inundated as the rising waters of the Colorado River slowly filled canyons and valleys, creating Lake Mead. The residents of St. Thomas sold their land, tore down homes that had been lived in for generations. On June 11, 1938, Hugh Lord rowed away from his house, the last citizen to leave.

The ruins of St. Thomas are sometimes visible when the water level in Lake Mead drops below normal. The National Park Service preserves and protects the ruins of St. Thomas. Visitors are restricted from disturbing the town's remaining artifacts.

2.1.2.5 Founding of the Park

LAKE was originally named the Boulder Dam National Recreation Area. Several attempts were made in 1933 and 1935 to authorize a Boulder Dam National Reservation, to be managed by the NPS (NPT, 2013). Because these attempts proved unsuccessful, the Bureau of Reclamation signed a cooperative agreement with the NPS in 1936 to co-manage the Boulder Dam National Recreation Area. The Hoover Dam, completed in 1935, created Lake Mead[6], and the area was renamed to the Lake Mead National Recreation Area on August 11, 1947. On October 8, 1964, President Lyndon Johnson signed the act that formally established LAKE as a park in the national park system. This act also substantially enlarged LAKE to include the future Lake Mohave. By that time, the new park boundaries encompassed over 90 miles of the westernmost Grand Canyon, including the highland area north of the Grand Canyon known as the Shivwits Plateau (NPS, 2013c). In 1974, the boundaries of LAKE were modified again when the Grand Canyon National Park was expanded to include all of Grand Canyon National Monument (which formerly existed partially within LAKE). Thus, the entire Grand Canyon was now administered under one park (Grand Canyon National Park). The Shivwits Plateau, however, remains in LAKE. The Colorado River winds more than 144 miles through LAKE, forming both Lake Mead and Lake Mohave.

2.1.3 Current Land Use

LAKE hosts approximately 8 million visitors annually. LAKE has two visitor centers: the Alan Bible Visitor Center, located off U.S. 93, four miles southeast of Boulder City near Boulder Beach, and the Katherine's Landing Visitor Center, located in the southern portion of the park at Katherine's Landing. There are five marinas on Lake Mead: Forever Resorts at Callville Bay, Echo Bay, and Temple Bar Marina; and Las Vegas Boat Harbor along with Lake Mead Marina in Hemenway Harbor which are family owned and operated.

More than 60 percent of all visitors to the recreation area use some type of motorized watercraft; peak day use on the water between Lakes Mead and Mohave can exceed 5,000 boats (National Park Service, 2002). Lakes Mead and Mohave together provide in excess of 250,000 angler days annually (National Park Service, 2010). Recreational activities include camping, hiking, mountain biking, horseback riding, boating, water skiing, kayaking, canoeing, swimming and diving, fishing, sightseeing and photography, and park-sponsored interpretive programs. Approximately 37 percent of LAKE is wilderness.

Lake Mead supplies critical storage of water supplies for more than 25 million people in three western states (California, Arizona, and Nevada). Storage within Lake Mead supplies drinking water and provides for the generation of hydropower to deliver electricity for major cities including Las Vegas, Phoenix, Los Angeles, Tucson, and San Diego. It also provides water for irrigation of more than 2.5 million acres (almost 4000 square miles or more than twice the size of the state of Delaware) of croplands.

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[6] Lake Mead was named in honor of Dr. Elwood Mead, Commissioner of Reclamation from 1924 through 1936.

2.1.4 Meteorology

2.1.4.1 Temperatures Ranges and Averages

LAKE climate is arid. Average annual rainfall in Boulder City, Nevada is approximately 5.5 inches. The average annual precipitation at Lake Mead, based on data from several weather stations around the lake, is only 5.74 inches. Although rain events are rare in the Mojave Desert, rain during the summer thunderstorm season and occasional winter rains can result in heavy precipitation that may lead to flood events.

In the winter, temperatures range from 35 to 55 degrees Fahrenheit (°F) with some wind. Summer temperatures range from about 80°F to 115°F. July is the warmest month with an average high of 106°F and an average low of 81°F. Water temperatures may range from 45°F to 85°F throughout the year.

2.1.5 Surrounding Land Use and Populations

Figure 2-2 presents a general overview of the population centers surrounding LAKE. Several towns and census designated places (CDPs) are located nearby or within LAKE. Most of the population of the CDPs are captured in the population total for the greater Las Vegas Metropolitan Area. The following table summarizes the residential areas located in close proximity to LAKE:

Table 2-1: Communities Near LAKE

Location	Distance (from)	Population[7]
Bullhead City, AZ	0 Miles (Lake Mohave)	39,540
Boulder City, NV	4 Miles (Alan Bible Visitor Center, Lake Mead)	257,729
Moapa Valley, NV (Moapa, Logandale, and Overton)	6 Miles (Lake Mead)	5,784
Henderson, NV	7 miles (Las Vegas Bay Marina, Lake Mead)	175,381
Laughlin, NV	9 Miles (Katherine Landing, Lake Mohave)	7,323
Las Vegas Metropolitan Area[8], NV	30 Miles (Hoover Dam)	1.8 Million

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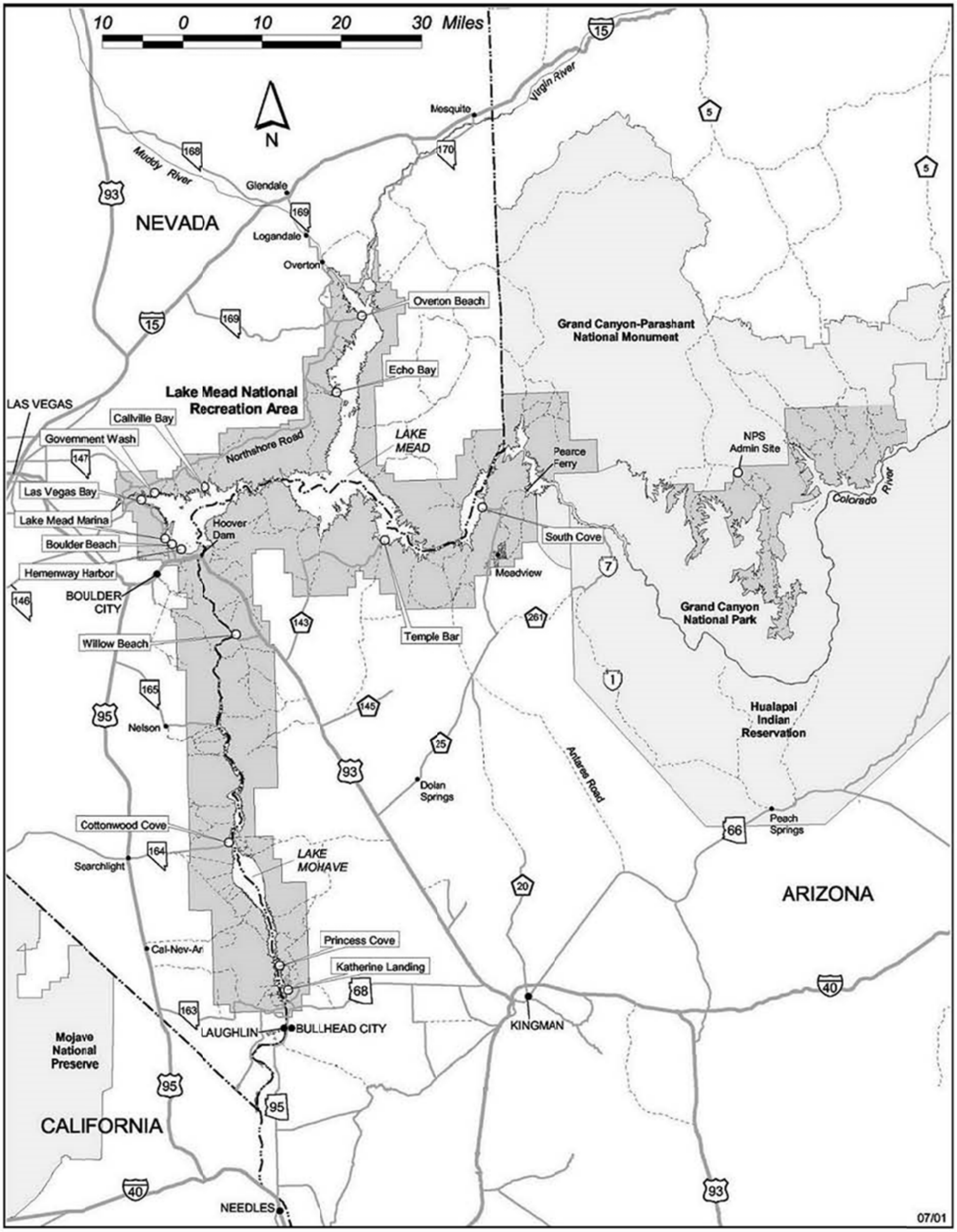
[7] 2010 United States Census

[8] Includes the City of Las Vegas and associated neighborhoods, and the CDPs of Arden, Blue Diamond, Enterprise, Paradise, Sloan, Spring Valley, Summerlin South, Sunrise Manor, Whitney, and Winchester.

Figure 2-2: Surrounding Land Use/Nearest Towns



LAKE exists within Mohave County, Arizona and Clark County, Nevada. The following table presents a demographic breakdown of these counties.

Table 2-2: Demographics of Clark County, Nevada and Mohave County, Arizona

Fact Based on 2010 Census	Clark County, NV	Mohave County, AZ
Population	1,951,269	200,186
Persons per square mile	247.3	15
Persons under 5 years	7.0%	5.3%
Persons under 18 years	24.8%	20.2%
Persons 65 years and over	11.7%	24.0%
White	73.8%	92.5%
African American	11.0%	1.2%
American Indian and Alaska Native	1.2%	2.7%
Asian	9.1%	1.2%
Native Hawaiian and Other Pacific Islander	0.8%	0.2%
Persons reporting two or more races	4.0%	2.2%
Persons of Hispanic or Latino origin	29.7%	15.2%
White persons not Hispanic[9]	47.4%	79.0%
Per capita money income in past 12 months (2011 dollars)	$27,330	$21,457
Persons below poverty level	12.9%	16.8%

The following table lists American Indian Tribes with Federally Recognized Tribal Lands and/or Indian Reservations within these two counties.

Table 2-3: Tribal Land in Clark County, Nevada and Mohave County, Arizona[10]

Tribe	Clark County, NV	Mohave County, AZ
Hualapai Tribe		X
Fort Mojave Indian Tribe		X
Chemehuevi Indian Tribe		X
The Kaibab Band of Paiute Indians		X

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[9] Individuals who responded "No, not Spanish/Hispanic/Latino" and who reported "White" as their only entry in the race question. Tallies that show race categories for Hispanics and non-Hispanics separately are also available. U.S. Department of Commerce, United States Census Bureau.

[10] Sources: USEPA Region 9 *Arizona Tribal Lands and Reservations Map.* Updated 2011 and USEPA Region 9 *Nevada Tribal Lands and Reservations Map.* Updated 2011.

Tribe	Clark County, NV	Mohave County, AZ
Moapa Band of Paiute Indians (Moapa River Tribe)	X	
Las Vegas Paiute Tribe	X	

2.1.6 Ecosystems

Three of the four North American desert ecosystems (Mojave, Great Basin, and Sonoran) merge within LAKE, resulting in widely diverse habitats and ecosystems. Approximately 900 plant species and 500 animal species inhabit LAKE. Habitats within the park are most easily related to the plant communities that support them. There are five primary vegetation complexes with numerous sub-communities (NPS, 2007). However, the composition and density of similar communities can be dramatically different between the Basin and Range (Great Basin) and the Colorado Plateau (Sonoran) (**Section 2.1.9**) portions of the park due to differences in elevation and climate. The following describes all communities represented in Lake Mead, and differences between Basin and Range and Colorado Plateau will be noted.

2.1.6.1 Creosote-Bush Community

The creosote-bush community is found in the western and central portions of the recreation area between 500 and 3,500 feet elevation. The creosote-bush community is dominant at lower elevations of the Colorado Plateau and at higher elevations in the Basin and Range. It is the most prevalent community in the Basin and Range Province (**Table 2-4**) and all of the four former firing range sites are located in this ecological community. The most extensive stands are found northeast of Lake Mead in the Twin Springs and Scanlon Wash areas. It is locally well developed on lower bajadas, alluvial fans, and playas. It may be found occasionally at higher elevations on arid, south-facing slopes. Near the Colorado River, the topography occupied by this community is especially rocky and rugged. Soils typically develop on gray alluvium and generally have high salt-alkali contents that often form caliche hardpans. This community has extreme fluctuations of daily and seasonal temperatures and precipitation. Vegetation cover is sparse in this community and dominated by creosote-bush and bursage. Other species common to this community are Mormon tea, brittlebush, range ratany, and indigo bush. Following the period of above-average precipitation, wildflowers can be observed.

Diurnal lizards and nocturnal snakes are relatively common reptiles in this community. The Gila monster reaches its northernmost range in this area, but like the chuckwalla and the desert tortoise, it is not abundant. These reptiles may be present in the vicinity of the former firing range sites. Densities of bird species are low. Gambel's quail, raven, desert sparrow, horned lark, roadrunner, and the cactus and rock wrens occur in this community. Five species of bats are common to abundant as are seven species of small rodents. The blacktail jackrabbit and the desert cottontail sometimes become locally abundant. Carnivores such as the coyote, kit fox, badger, and bobcat are relatively common, depending on the supply of smaller animals. The feral burro, wild horse, and domestic livestock graze within this community, and the desert bighorn is rarely found in rugged terrain of this community (NPS, 2007).

2.1.6.2 Blackbrush Community

The blackbrush community is similar but of greater density than the creosote-bush community (NPS, 2007). Although small in total area, it is widely scattered throughout the recreation area between 3,000 and 4,000 feet elevation. This community is also found at lower elevations within the Colorado Plateau and occasionally at higher elevations in the Basin and Range. This community is predominate in Grand Wash and is secondary in areas adjacent to the Colorado River from Callville Bay to Davis Dam. Small isolated stands are occasionally found at higher elevations. The soils of this community are generally more porous, have lower salt content, are more permeable, and have slightly higher organic contents than the soils of the creosote-bush community. Plants frequently associated with this community include blackbrush, Joshua tree, Mormon tea, rabbitbrush, matchweed, and flat-topped buckwheat. While the herbaceous composition is generally the same as the creosote-bush community, perennial grasses such as Indian rice grass and needle grass are more abundant.

Reptiles are well represented in the blackbrush community, but there are not as many as in the creosote-bush community. Sage sparrow, ladder-backed woodpecker, raven, and cactus and rock wrens are the more abundant resident birds. Most mammals that are residents of the creosote-bush community also inhabit this community. Desert bighorn graze in the upper elevations. Other grazing animals include nonnative burros, horses, and domestic cattle.

2.1.6.3 Pinyon/Juniper Community

The pinyon/juniper association is the most abundant community on the Shivwits Plateau (**Section 2.1.9**). It extends from Snap Point east to Andrus Canyon. This community is present only in the Newberry Mountains area near the southwest corner of the Basin and Range portion of the recreation area. Here it is surrounded by the blackbrush community and receives a greater amount of annual precipitation that supports the more developed community. Although the Utah juniper and pinyon pine are the dominant plants, ponderosa pine and big sagebrush stands are scattered throughout this community along major drainages. Therefore, portions of this association may vary considerably, with the typical woodland merging into a forest association of ponderosa pine or an extremely sparse stand of juniper with a dense understory of big sagebrush. Plants frequently found in this community are Gambel oak, gooseberry, squawbush, snowberry, and fleabane.

Reptiles are not as well represented here as in the communities at lower elevations, although rattlesnakes, and several lizards are some of the resident and transient wildlife. Bird species include rock wren, wild turkey, red-tailed hawk, common bushtit, western bluebird, Gambel's quail, common flicker, raven, scrub jay, Oregon junco, white breasted nuthatch. Common carnivores include bobcat, coyote, and gray fox. Other mammals include mule deer, badger, wood rat, gopher, deer mouse, cottontail, and blacktail jackrabbit. Desert bighorn, domestic livestock and feral burros have frequented and continue to use this community.

2.1.6.4 Sagebrush Community

The sagebrush community consists mainly of sagebrush and rabbitbrush and dominates large portions of the Shivwits Plateau. Other plants frequently associated with these indicators are match weed, rubberweed, cliffrose, Apache plume, and on limestone outcrops, agave. Animal species in this community are similar to the Pinyon/Juniper community.

2.1.6.5 Oak Woodland Community

Although more extensive areas of the oak woodland community are adjacent to the recreation area (Mt. Trumbull and Oak Grove Hill), some isolated stands occur in areas of limited exposure on Mt. Dellenbaugh. Southerly exposures support a sparse stand of Gambel oak with an impenetrable understory of manzanita, while northern exposures are more diverse and support Gambel oak, the New Mexico locust, pinyon and ponderosa pine, Utah juniper, barberry, and chokecherry.

The sheer cliffs that separate the Shivwits and Sanup plateaus comprise the transzonal community in the area. Vegetation and wildlife are generally rare in this community, with the exception of several species of bats and small rodents that utilize the many caves in the cliffs. Desert bighorn are known to be transient throughout the community while they range between plateaus.

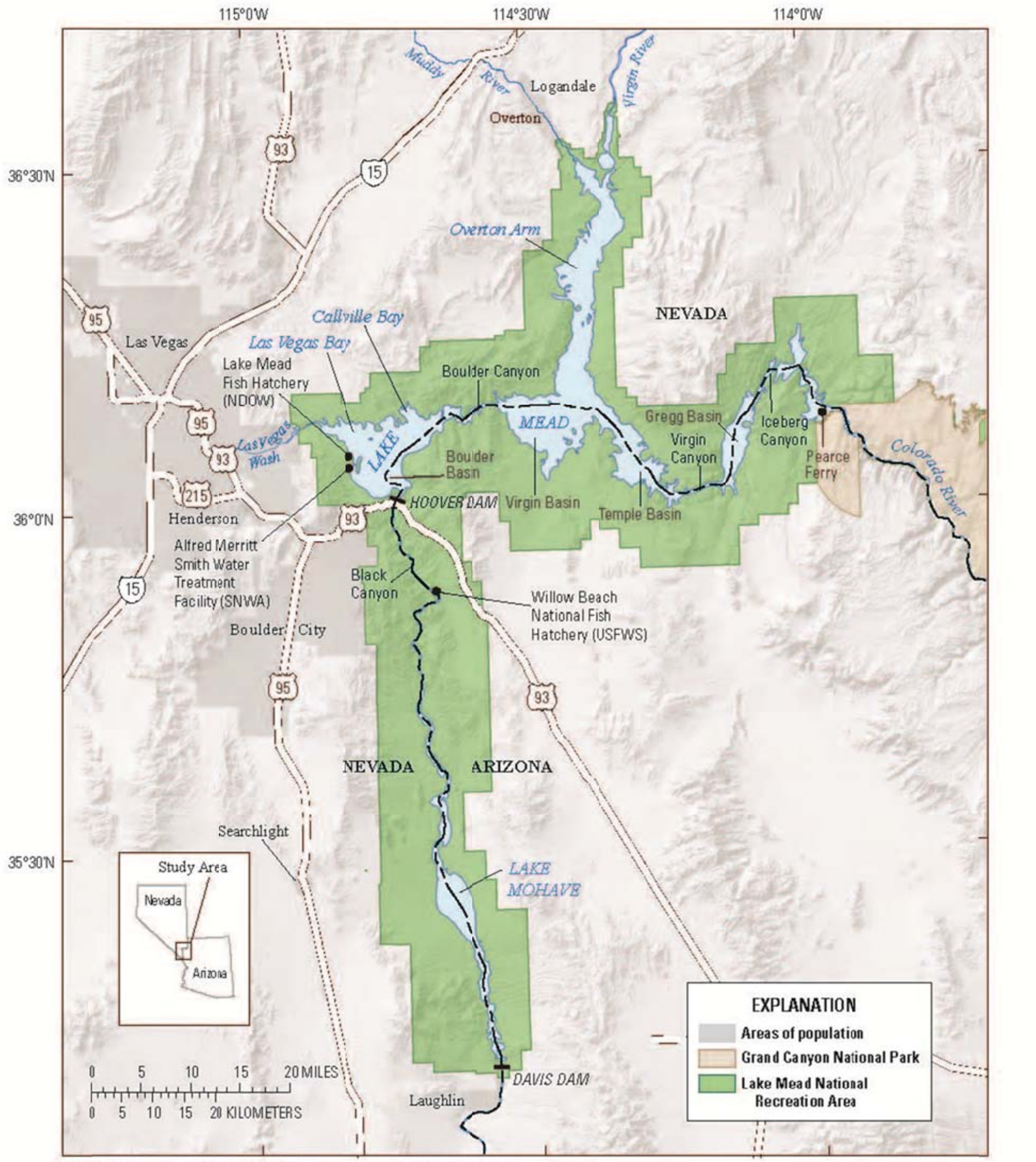
2.1.6.6 Aquatic

This complex contains four distinct communities in the recreation area: desert spring, lake, stream, and stream riparian communities (NPS, 2007). A major concentration of active springs occurs on each side of the Colorado River between Hoover Dam and Willow Beach. Many springs are thermal, and water temperatures vary slightly on an annual basis. Various aquatic plant species can be expected, and the peripheries of springs may have a number of sedges, rushes, cattails, salt grass, and salt-tolerant shrubs. Cottonwoods, mesquite, desert willow, palms, and tamarisk may also be found in these mesic soils. Formerly active springs or water catchments provided greater water availability, indicated by the presence of cottonwoods, mesquite, scrub oak, and wild grape.

Lake Mohave, with its cold upstream water temperatures, has long been known for its excellent trout fishing. The U.S. Fish and Wildlife Service plants rainbow trout from the Willow Beach Hatchery directly into Lake Mohave (**Figure 2-3**). Late each spring, the transition zone between colder uplake and warmer downlake waters provides an extremely vivid rust-to-near-orange display of algae in the Chalk Cliff to Monkey Cove area. A noticeable change in game fish composition is associated with this six-mile transition zone. Below the transition zone, one can expect fewer trout and an increasing number of largemouth bass. However, this fact is less noticeable today because of increased downlake stocking of rainbow trout and other salmonids. Although it has not been determined how striped bass entered Lake Mohave, it has been confirmed that they are now established there. This introduction may affect the trout fishing in the future. Use of the lake community by birds such as western and eared grebes, gulls, egrets, herons, several species of shorebirds, bald and golden eagles, white pelicans, and ospreys is significant. Although not all use the lake community for the basic necessities of food, shelter, or escape cover, most are closely associated to the lake, stream riparian, and stream communities.

From upstream to downstream, Lake Mead’s four large, deep, but connected basins along the historical Colorado River channel are: Gregg, Temple, Virgin, and Boulder. These four basins are ecologically distinct from one another because the waters within them retain the properties of their sources (Rosen, et. al., 2012). Four narrow canyons (Iceberg, Virgin, Boulder, and Black) and the nearly 33-mi (53.1-m) long Overton Arm, which extends south from the Virgin and Muddy Rivers to the Virgin Basin, are other important features of the lake (**Figure 2-3**).

Figure 2-3: Features of Lake Mead and Lake Mohave



Base from National Park Service and U.S. Geological Survey digital data,1 675,000
Universal Transverse Mercator projection, Zone 11
North American Datum 1983

Lake Mead provides critical habitat for the razorback sucker (Boyles, 2014) and the bonytail chub (Rosen, *et al*, 2012).

The stream community is limited to the waters of the Colorado River (upstream from Lake Mead), Muddy and Virgin rivers, and to the clear or relatively non-silted lower reaches of Las Vegas Wash and the Colorado River below Hoover and Davis dams.

The desert riparian community comprises vegetation in local desert washes, which is not dramatically different in growth-form from that of the surrounding desert shrub communities. Plants are comparable but usually occur in greater density in the desert riparian community. As a result, it is commonly recognized as a transzonal rather than distinct community. It is scattered like fingers through the landscape. Soils are usually silty to sandy but become quite rocky at the higher elevations. As expected, increased subsurface water may be available, allowing greater densities of plants. Mesquite, catclaw acacia, desert willow, cheeseweed, and non-native tamarisk give this community a slightly more developed appearance. On portions of the Colorado River upstream from Lake Mead, ocotillo can be found along the edges of this community. This transzonal complex also extends into major laterals such as Whitmore and Andrus canyons.

The stream riparian community is found along Las Vegas Wash and the Muddy, Virgin, and Colorado rivers. Narrow mesic canyons of the Newberry Mountains containing intermittent flows also support riparian vegetation. In addition, limited and scattered shoreline environments of Lakes Mead and Mohave display similar characteristics when lake elevation fluctuations are minimized. For the most part, this is not a natural situation, but rather is manipulated by man as lake levels fluctuate and exotics invade disturbed areas. Fremont poplar, willow, desert willow, cattail, mesquite, and the nonnative tamarisk might exist. Sedges, rush, monkey flower, and grasses can also be found within this community. Amphibians are represented by the spade-foot toad, the red spotted toad, the introduced bullfrog, and by the tiger salamander introduced in larval form as fishing bait. Beavers, desert bighorns, feral burros, domestic cattle, and coyotes are particularly noticeable in this community.

Table 2-4: Area of Ecological Communities, LAKE[11]

Community	Acreage	Percentage
Basin and Range Province		
Creosote-bush Community	1,040,000	70.2
Blackbrush Community	35,000	2.4
Piñon/Juniper Community	2,800	0.2
Colorado Plateau Province		
Pinyon/Juniper Community	107,000	7.2
Sagebrush Community	59,000	4.0
Blackbrush Community	30,000	2.0

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[11] NPS, 2007

Community	Acreage	Percentage
Creosote-bush Community	12,000	0.8
Oak Woodland Community	1,200	0.1
Aquatic Areas		
Reservoir(Lake) Community	186,000	12.5
Stream/Riparian Community	2,000	0.1
Springs Community	100	0.01
Other	7,300	0.5

2.1.7 Federally Listed Species and Species of Special Concern

Section 7 of the 1973 Endangered Species Act (ESA), as amended, directs all federal agencies to use their existing authorities to conserve threatened and endangered species and, in consultation with the United States Fish and Wildlife Service (USFWS), ensure that their actions do not jeopardize listed species or destroy or adversely modify critical habitat (USFWS, 2013). The thirteen (13) federally listed species known to occur within the park are listed in **Table 2-5**.

Table 2-5: LAKE Endangered/Threatened Species

Common Name	Scientific Name	Status	Habitat / Distribution
Mojave desert tortoise	*Gopherus agassizii*	Threatened	Creosote-bush, mojave yucca, and blackbrush / Expansive flats, alluvial fans, bajadas, and rocky terrain.
Relict leopard frog	Lithobates (Rana) onca	Candidate	Black Canyon/Virgin River through southern Nevada and northwestern Arizona
Razorback sucker	*Xyrauchen texanus*	Endangered	Mainstream and major tributaries of the Colorado River from Wyoming to Mexico. Historically found in middle and lower elevation rivers, tributaries, and flood-plain habitats. Presently found in small numbers in rivers and reservoirs.
Humpback chub	*Gila cypha*	Endangered	Deep canyon bound sections of river, utilizing both mainstream and tributaries / Endemic to the Colorado River Basin.
Virgin River Chub	*Gila seminude (=robusta)*	Endangered	Most common in deeper areas where waters are swift, but not turbulent, as is generally associated with boulders or other cover / Endemic to 134 miles of the Virgin River in extreme northwestern Arizona, Nevada, and Utah. Also found in the Moapa River in Nevada.
Moapa dace	*Moapa coriacea*	Endangered	Endemic to Muddy (Moapa) River and associated thermal spring systems within the Warm Springs area of Clark County, Nevada.

Common Name	Scientific Name	Status	Habitat / Distribution
Bonytail chub	*Gila elegans*	Endangered	Generally prefer backwaters with rocky or muddy bottoms and flowing pools, although they have been reported in swiftly moving water and feeds on surface / Endemic to Colorado River Basin.
Colorado pikeminnow	*Ptychocheilus lucius*	Endangered	Their usual habitat is the backwaters of the turbulent and turbid streams in the Colorado River system. According to USFWS, may not occur in LAKE area. / Endemic to Colorado River Basin.
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Endangered	Dense riparian habitats with saturated soils, standing water, or nearby streams, pools, or cienegas.
California Condor	*Gymnogyps californianus*	Endangered	The condors live in rocky shrubland, coniferous forests, and oak savannas. They are often found near cliffs or large trees, which they use as nesting sites. Individual birds have a huge range and have been known to travel up to 250 km (150 mi) in search of carrion.
Mexican Spotted Owl	*Strix occidentalis lucida*	Threatened	Found in canyon habitat dominated by vertical-walled rocky cliffs within complex watersheds, including tributary side canyons. Rock walls with caves, ledges, and other areas provide protected nest and roost sites. Canyon habitat may include small isolated patches or stringers of forested vegetation including stands of mixed-conifer, ponderosa pine, pine-oak, pinyon-juniper, and/or riparian vegetation in which owls regularly roost and forage. Owls are usually found in areas with some type of water source.
Jones cycladenia	*Cycladenia humilis var. jonesii*	Threatened	It occurs between 4,390 to 6,000 feet elevation in plant communities of mixed desert scrub, juniper, or wild buckwheat Mormon tea.
Welsh’s milkweed	*Asclepias welshii*	Threatened	On active sand dunes in sagebrush, juniper, and ponderosa pine communities, between 4700 and 6250 ft in elevation.

Sources: USFWS, 2013, 2014a, 2014b,

In addition to the threatened and endangered species, the Lower Colorado River Multi-Species Conservation Program (LCR MSCP) was created to balance the use of the Colorado River water resources with the conservation of native species and their habitats. The LCR MSCP MSCP) Habitat Conservation Plan (HCP) describes general and species-specific conservation measures for twenty-six covered species and five evaluation species. Covered species are species included under the ESA incidental take authorization and are either currently listed or proposed for listing as threatened or endangered under ESA or are protected under Arizona, California, or Nevada law; or may become listed during the 50 year LCR MSCP term that are affected by covered activities. Evaluation species are species that could become listed in the future; however, sufficient information was not available at the time the HCP was written to determine the effects of covered activities or to develop conservation measures for these species.

Wildlife of Special Concern in Arizona includes species whose occurrence in Arizona is or may be in jeopardy, or with known or perceived threats or population declines, as described by the Arizona Game and Fish Department's (AZGFD) listing of Wildlife of Special Concern in Arizona (WSCA, in prep). Species indicated on printouts as WSC are currently the same as those in **Threatened Native Wildlife in Arizona** (1988).

Table 2-6 (below) lists the animal species (Special Species of Concern) that may be found within LAKE (LCR MSCP, 2013; AZGFD, 2013). Species listed as threatened or endangered under the ESA in **Table 2-5** are not repeated here.

Table 2-6: LAKE Animal Species of Special Concern[12]

Common Name	Scientific Name	State
Bald Eagle	*Haliaeetus leucocephalus*	AZ
Gila Monster	*Heloderma suspectum*	AZ/NV
American Peregrine Falcon	*Falco peregrinus anatum*	AZ
Arizona Bell’s Vireo	*Vireo bellii arizonae*	AZ
MacNeill’s Sootywings	*Hesperopsis gracielae*	AZ
Humpback Chub	*Gila cypha*	AZ
Relict leopard Frog	*Lithobates (Rana) onca*	AZ
Desert Pocket Mouse	(*Chaetodipus penicillatus sobrinus*	NV

Table 2-7 (below) lists the plant SSC identified in the LCR MSCP and by USFWS and AZGFD.

Table 2-7: LAKE Plant Species of Special Concern

Common Name	Scientific Name	State
Sticky Buckwheat	*Eriogonum viscidulum*	NV
Threecorner Milkvetch	*Astragalus geyeri* var. *triquetrus*	NV
Bear-paw Poppy	*Arctomecon californica*	NV

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[12] Federally listed species are also State of Arizona WSCA.

Additional information regarding home range and territory for plant and animal species of concern found throughout Mohave County and Clark County, but may not be present within LAKE, is presented in **Appendix G**, Table G-1 (USFWS, 2014a, 2014b).

2.1.8 Cultural Resources

The sections below provide information on sites and/or structures near or within LAKE of cultural or archaeological interest, as listed by the Nevada State Office of Historic Preservation, the National Register of Historic Places, and the Library of Congress. Only a small portion of the recreation area has been archaeologically surveyed. However, significant prehistoric and historic resources are known to occur in the park. More than 1,200 archeological sites exist in the recreation area (NPS, 2002; Ervin, 1986). Three archeological complexes (the Grand Wash archeological district, the Pueblo Grande de Nevada, and the Grapevine Canyon petroglyphs) are listed on the National Register of Historic Places (**Section 2.1.8.3**). Historic resources related to settlement, ranching, mining, exploration, and to the construction of Hoover Dam exist in the recreation area. More than 55 structures occur on seven sites throughout the recreation area. Twenty-four of these structures are on the park's List of Classified Structures (**Table 2-8**); however, none of these structures are associated with the four former firing range sites.

Table 2-8: Cultural Resources – NPS List of Classified Structures for LAKE[13]

Structure Number	Structure Name	Significance Level
10	Lake Mead NRA Maintenance Warehouse	Contributing
118	Administration Building	Contributing
201	Cottonwood Cove Residence #201	State
202	Cottonwood Cove Residence #202	State
203	Cottonwood Cove Residence #203	State
240	Cottonwood Cove Ranger Station	State
241	Cottonwood Cove Utility Building	State
45-21847A	Boeing RB-29A Superfortress	National
HS-01A	Willow Beach Gaging Station	Local
HS-11B	Homestake Mine Machinery Foundations	Local
HS-11C	Homestake Mine Shafts	Local
HS-11D	Homestake Mine Boiler Enclosure Ruin	Local
HS-12A	Lakeshore Road Headwalls and Drainage Features	Local
HS-12B	Lakeshore Road	Local
HS-13B	Katherine Mine Mill Site Stone Foundation	Local
RR-01	U.S. Government Construction Railroad Tunnel 1	Contributing
RR-02	U.S. Government Construction Railroad Tunnel 2	Contributing

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[13] NPS, 2013d

Structure Number	Structure Name	Significance Level
RR-03	U.S. Government Construction Railroad Tunnel 3	Contributing
RR-04	U.S. Government Construction Railroad Tunnel 4	Contributing
RR-05	U.S. Government Construction Railroad Tunnel 5	Contributing
RR-06	U.S. Government Construction Railroad Grade	Contributing
RR-09	U.S. Government Railroad Grade Steel Culverts	Contributing
RR-10	U.S. Government Railroad Grade Wooden Culverts	Contributing
tbd	Cottonwood Cove Road	State

2.1.8.1 Nevada Office of Historic Preservation

The Nevada State Office of Historic Preservation encourages the preservation, documentation, and use of cultural resources through state and federal programs. The agency works to educate the public about the importance of our cultural heritage so that Nevada’s historic and archaeological properties are preserved, interpreted, and reused for their economic, educational, and intrinsic values and for future generations to appreciate. The Nevada sites are listed as Certified Local Governments, Centennial Ranch and Farm, Historical Marker, or as Nevada Register Sites. Sites may be listed on the National Register of Historic Places (**Section 2.1.8.2**) and as a State of Nevada Site.

In Clark County, the Nevada State Office of Historic Preservation lists three sites as Nevada State Register of Historic Places and one Historical Marker. State and National Register sites include districts, sites, buildings, structures, objects significant in Nevada and American History, architecture, archaeology, engineering and culture at the local state and national level. Historical Markers bring attention to events and places in Nevada's heritage. None of these sites are associated with the four former firing range sites.

Table 2-9: Cultural Resources - Nevada State Office of Historic Preservation

Place	Location	Listing
Pueblo Grande de Nevada	Located on State Route 169 two miles south of Overton, Nevada	Historical Marker (41)
LDS Moapa Stake Office Building	161 West Virginia Street, Overton	Building
Overton Gymnasium	N. Thomas Avenue off S. Anderson, Overton	Building
St. Thomas Memorial Cemetery	Magnasite Road off Moapa Valley Blvd., Overton	Site

2.1.8.2 Arizona Office of Historic Preservation

The Arizona Register of Historic Places is the state's list of districts, sites, buildings, structures, and objects worthy of preservation. Arizona has adopted the National Register criteria for evaluating eligibility for the State Register. The Arizona Historic Sites Review Committee (HSRC) is Arizona's official State and National Register of Historic Places review board as mandated by state law and federal regulations. The committee typically holds public meetings three times a year to review nominations and advise the State Historic Preservation Officer on properties that should be placed in the National and Arizona Registers of Historic Places. Once a nomination has been reviewed and approved by the Arizona Historic Sites Review Committee, the property is placed in the Arizona Register of Historic Places and forwarded to the Keeper of the National Register for a final review and listing in the National Register of Historic Places.

2.1.8.3 National Register of Historic Places

The National Register of Historic Places is the official list of United States historic places worthy of preservation. Authorized by the National Historic Preservation Act of 1966, the NPS's National Register of Historic Places is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources. The following table provides a list of the seven locations in LAKE on the National Register of Historic Places. None of the four former firing range sites are located at or near the Historic Places listed in **Table 2-10**.

Table 2-10: Cultural Resources - National Register of Historic Places

Place	Register Date	Location
Grand Wash Archeological District	February 8, 1980	Mohave County, Arizona in LAKE
Grapevine Canyon Petroglyphs	December 15, 1984	Laughlin, NV
Homestake Mine	July 17, 1985	Searchlight, NV
Horse Valley Ranch	April 12, 1984	Mohave County, AZ in LAKE
Pueblo Grande de Nevada	October 8, 1982	Located on State Route 169, two miles south of Overton, Nevada
Spirit Mountain	September 8, 1999	Laughlin, NV
Willow Beach Gauging Station	March 21, 1986	Near Boulder City, NV in LAKE

2.1.8.4 Library of Congress Structures of Cultural Significance

Since 1933, the NPS, working with the Library of Congress, has recorded structures of cultural significance in over 556,900 measured drawings, photographs, and written histories for more than 38,600 historic structures and sites dating from pre-Columbian times to the 20th century (LOC, 2013). This collection lists the following structures of cultural significance within LAKE:

Table 2-11: Library of Congress Structures of Cultural Significance

Location	Structure	City	County
Lake Mead	Alan Bible Visitor Center	Boulder City	Clark
Lake Mead	Lake Mead Lodge	Boulder City	Clark

2.1.9 Geology

LAKE spans two physiographic provinces, the Basin and Range and the Colorado Plateau. Most of LAKE, including Lake Mead and Lake Mohave, lies in the Basin and Range. The detached Arizona portion is on the Colorado Plateau and has the characteristics of the Grand Canyon. In the north part of the Nevada portion, are the Black Mountain and the Muddy

Mountains. Muddy Peak, outside the park boundary, rises to 5,432 feet above mean sea level (amsl).

In the south part of LAKE, the Colorado River and Lake Mohave lie east of the Eldorado and Newberry Mountains. Spirit Mountain in the Newberry Mountains rises to 5,639 feet amsl, and the elevation of Lake Mohave is below the 800-foot contour. North of the Grand Canyon, Andrus Point is at 5,491 feet amsl and north of Andrus Point the elevation is over 5,600 feet amsl.

The Colorado Plateau portion of LAKE lies on the Shivwits Plateau, the westernmost plateau of the Colorado Plateau physiographic province. It is physiographically and stratigraphically typical of the Grand Canyon region. The Shivwits Plateau is bounded on the east by the Hurricane Cliffs, which separates it from the Uinkaret Plateau to the east. To the west, the Shivwits Plateau is bounded by the Grand Wash Cliffs, which form the eastern border of the Basin and Range physiographic province. The Shivwits Plateau extends north to the St. George Basin in Utah and south to the Colorado River, which forms the very rugged and precipitous topography of the Grand Canyon. The Shivwits Plateau is mostly rolling dissected tableland and lava-capped buttes

The Kaibab Limestone, of Upper Permian age, caps much of the Shivwits Plateau. The stratigraphy ranges in age from Precambrian to Middle Jurassic and consists of Precambrian igneous and metamorphic rocks overlain by younger sedimentary units of limestone, sandstone, shale, and conglomerate.

The portion of Lake Mead west of the Colorado Plateau is transitional between the Grand Canyon sequence and Basin and Range volcanics and conglomerates. Most of the pre-Tertiary section is either missing or similar to formations further to the east. The Precambrian basement is composed of intrusive igneous and metamorphic rocks. Where present, the Paleozoic geologic section is represented by carbonate deposits (limestone) and the Mesozoic by subaerial deposition of fluvial and aeolian deposits (primarily sandstones). Extrusive volcanics, primarily basalt to rhyolite lava flows lie above these units or in contact with the Precambrian. The youngest units are Holocene fanglomerates, playa deposits, and alluvium that cover much of the broad desert valleys.

Lake Mead

Three different lake-floor substrates were identified on the basis of mapping completed prior to formation of Lake Mead (Longwell, 1936) and geophysical data (Twichell and Cross, 2009): rock outcrops, alluvial deposits (material that has been eroded from the rocks by water and accumulated on hill slopes as sediments), and post-impoundment sediment deposits. The rock outcrops and alluvial deposits predate the lake, while the post-impoundment sediment has accumulated since completion of Hoover Dam. Areas of rock outcrop composed of Precambrian to Tertiary-age igneous, volcanic, and metamorphic rocks make up the flanks of the narrow gorges and Tertiary-age sandstones flank parts of Overton Arm, Virgin Basin, and Boulder Basin (Longwell, 1960). Alluvial deposits are Quaternary age (less than 1 million years old) (Longwell, 1960) and occupy large parts of the flanks of Overton Arm, Virgin Basin, and Boulder Basin. The post-impoundment sediment fills the axial (central) valley of the pre-impoundment Colorado River as well as the floors of tributary valleys.

Lake Mohave

Lake Mohave was created with the completion of Davis Dam in 1950 and impoundment of the Colorado River below Hoover Dam. This region of the Colorado River Valley lies between the Black Mountains to the east and the Eldorado and Newberry Mountains to the west. Metamorphic and coarse-grained igneous rock makes up most of the exposed bedrock of these mountains. The northern section of the reservoir is constrained by the steep volcanic walls of Black Canyon (Rosen, *et al*, 2012). Below Black Canyon, Lake Mohave gradually widens with alluvial deposits bounding this section of the lake. Farther south, Lake Mohave is constricted by a local protrusion of volcanic rock at Painted Canyon (Cross et al, 2005). The lake widens again to the south, where it lies within a wider, more gently sloping alluvial basin, reaching its greatest width in the central part of this basin. Lake Mohave is constricted once again still farther to the south with increasing slope of the alluvial basin and is bounded by the steep slopes of the Newberry Mountains to the west and alluvium to the east. Davis Dam, constructed within a narrow gorge cut into Precambrian igneous rock, marks the southern end of the lake.

Several faults in the vicinity of LAKE indicate activity within the last 1.6 million years. According to the United States Geologic Survey (USGS) Quaternary Faults Web Mapping Application (USGS, 2013), the California Wash fault and the Black Hills Fault have been active within the last 15,000 years (**Figure 2-4**), the Overton Arms faults, the Grand Wash Fault, and the Frenchman Mountain Fault have all been active within the last 130,000 years, and the Wheeler fault zone has been active within the last 750,000 years. None of the faults shown on **Figure 2-4** are located within five miles of any of the former firing range sites.

Figure 2-4: Regional Topography and Quaternary Faults

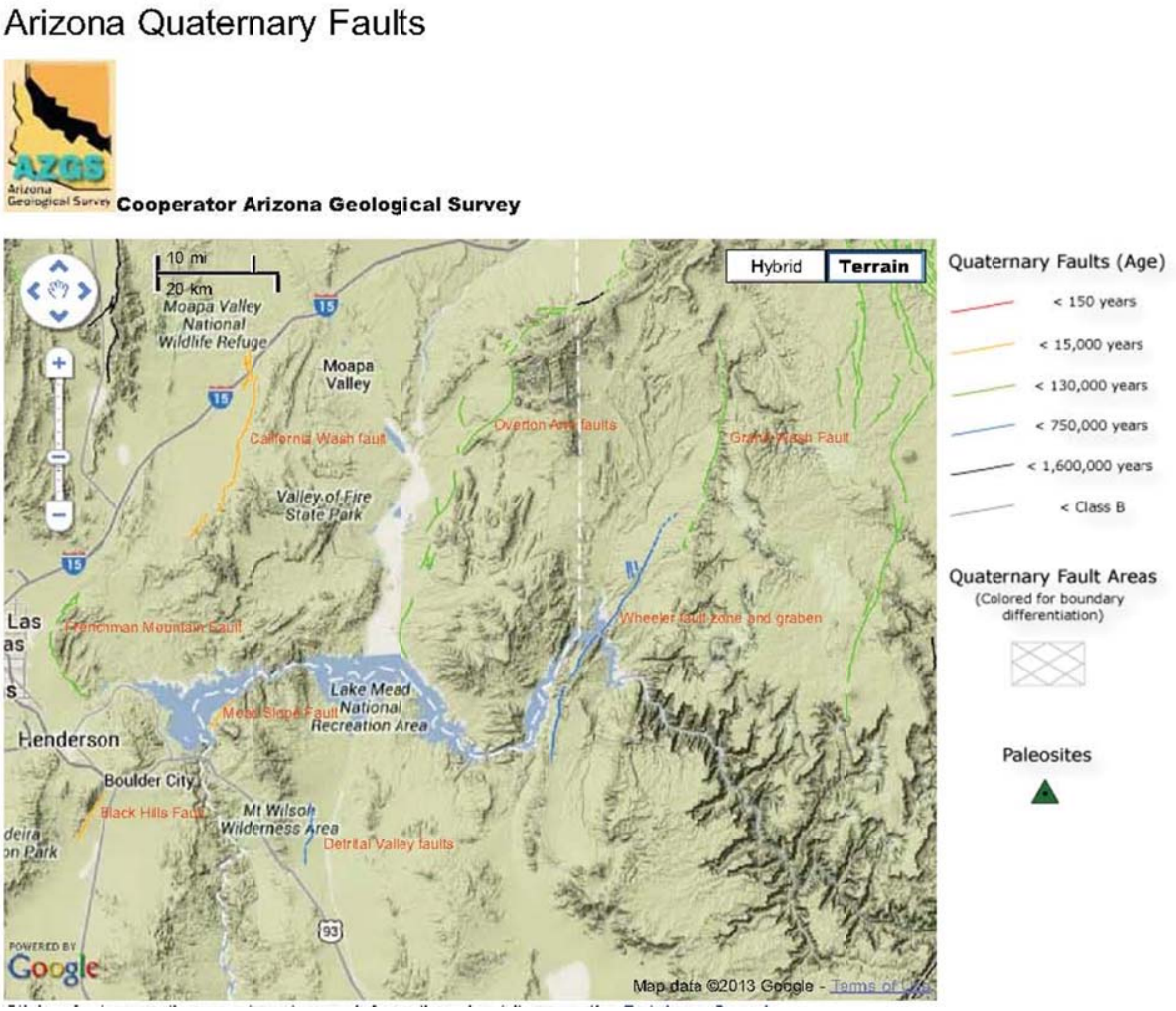

Table 2-12 presents all of the Class A and Class B Quaternary age faults within Clark and Mohave counties (USGS, 2013).

Table 2-12: Quaternary Age Faults in Mohave County, Arizona and Clark County, Nevada

Name	Fault Class	Primary County - State	Length (km)	Time of most recent deformation	Slip-rate category
Arrow Canyon Range fault	Class A	Clark - Nevada	25	Quaternary (<1.6 Ma)	< 0.2 mm/yr
Black Hills fault	Class A	Clark - Nevada	9	Latest Quaternary (<15 ka)	< 0.2 mm/yr
Cactus Spring faults	Class A	Clark - Nevada	16	Quaternary (<1.6 Ma)	< 0.2 mm/yr
California Wash fault	Class A	Clark - Nevada	32	Latest Quaternary (<15 ka)	Between 0.2 and 1.0 mm/yr
Central Spring Mountains faults	Class A	Clark - Nevada	16	Quaternary (<1.6 Ma)	< 0.2 mm/yr
Crossgrain Valley faults	Class A	Clark - Nevada	9	Middle and late Quaternary (<750 ka)	< 0.2 mm/yr
East Muddy Mountains fault	Class B	Clark - Nevada	4	Quaternary (<1.6 Ma)	< 0.2 mm/yr
Eglington fault	Class A	Clark - Nevada	11	Late Quaternary (<130 ka)	< 0.2 mm/yr
Frenchman Mountain fault	Class A	Clark - Nevada	18	Late Quaternary (<130 ka)	< 0.2 mm/yr
Indian Springs Valley fault	Class A	Clark - Nevada	27	Quaternary (<1.6 Ma)	< 0.2 mm/yr
La Madre fault	Class A	Clark - Nevada	22	Quaternary (<1.6 Ma)	< 0.2 mm/yr
Las Vegas Valley faults	Class B	Clark - Nevada	25	Late Quaternary (<130 ka)	< 0.2 mm/yr
Mercury Ridge faults	Class A	Clark - Nevada	9	Quaternary (<1.6 Ma)	< 0.2 mm/yr
Overton Arm faults	Class A	Mohave - Arizona	65	Late Quaternary (<130 ka)	< 0.2 mm/yr
Pahrump fault	Class A	Clark - Nevada	38	Latest Quaternary (<15 ka)	< 0.2 mm/yr
Sheep Basin fault	Class A	Clark - Nevada	38	Quaternary (<1.6 Ma)	< 0.2 mm/yr
Sheep-East Desert Ranges fault	Class A	Clark - Nevada	42	Late Quaternary (<130 ka)	< 0.2 mm/yr
Sheep Range fault	Class A	Clark - Nevada	46	Late Quaternary (<130 ka)	< 0.2 mm/yr
Spotted Range faults	Class A	Clark - Nevada	29	Quaternary (<1.6 Ma)	< 0.2 mm/yr
West Pintwater Range fault	Class A	Clark - Nevada	42	Quaternary (<1.6 Ma)	< 0.2 mm/yr
West Spring Mountains fault	Class A	Clark - Nevada	48	Latest Quaternary (<15 ka)	< 0.2 mm/yr
Wildcat Wash fault	Class A	Clark - Nevada	21	Middle and late Quaternary (<750 ka)	< 0.2 mm/yr
Andrus Canyon fault	Class A	Mohave - Arizona	6	Quaternary (<1.6 Ma)	< 0.2 mm/yr

Name	Fault Class	Primary County - State	Length (km)	Time of most recent deformation	Slip-rate category
Detrital Valley faults	Class A	Mohave - Arizona	10	Middle and late Quaternary (<750 ka)	< 0.2 mm/yr
Dutchman Draw fault	Class A	Mohave - Arizona	16	Late Quaternary (<130 ka)	< 0.2 mm/yr
Grand Wash fault zone	Class A	Mohave - Arizona	35	Late Quaternary (<130 ka)	< 0.2 mm/yr
Gyp Pocket graben and faults	Class A	Mohave - Arizona	12	Late Quaternary (<130 ka)	< 0.2 mm/yr
Hurricane fault zone, Shivwitz section	Class A	Mohave - Arizona	57	Latest Quaternary (<15 ka)	Between 0.2 and 1.0 mm/yr
Hurricane fault zone, Whitmore Canyon section	Class A	Mohave - Arizona	29	Latest Quaternary (<15 ka)	< 0.2 mm/yr
Littlefield Mesa faults	Class A	Mohave - Arizona	21	Middle and late Quaternary (<750 ka)	< 0.2 mm/yr
Main Street fault zone	Class A	Mohave - Arizona	87	Late Quaternary (<130 ka)	< 0.2 mm/yr
Mead Slope fault	Class A	Mohave - Arizona	7	Latest Quaternary (<15 ka)	< 0.2 mm/yr
Mesquite fault	Class A	Mohave - Arizona	36	Late Quaternary (<130 ka)	< 0.2 mm/yr
Needles graben faults	Class A	Mohave - Arizona	4	Late Quaternary (<130 ka)	< 0.2 mm/yr
Sevier/Toroweap fault zone, central Toroweap section	Class A	Mohave - Arizona	60	Latest Quaternary (<15 ka)	< 0.2 mm/yr
Sunshine faults	Class A	Mohave - Arizona	29	Late Quaternary (<130 ka)	< 0.2 mm/yr
Sunshine Trail graben and faults	Class A	Mohave - Arizona	17	Late Quaternary (<130 ka)	< 0.2 mm/yr
Uinkaret volcanic field faults	Class A	Mohave - Arizona	18	Quaternary (<1.6 Ma)	< 0.2 mm/yr
Washington fault zone, Mokaac section	Class A	Mohave - Arizona	11	Late Quaternary (<130 ka)	< 0.2 mm/yr
Washington fault zone, northern section	Class A	Mohave - Arizona	36	Late Quaternary (<130 ka)	< 0.2 mm/yr
Washington fault zone, Sullivan Draw section	Class A	Mohave - Arizona	34	Late Quaternary (<130 ka)	< 0.2 mm/yr
Wheeler fault zone and graben	Class A	Mohave - Arizona	45	Middle and late Quaternary (<750 ka)	< 0.2 mm/yr

Notes:

Class A: Geologic evidence demonstrates the existence of a Quaternary fault of tectonic origin, whether the fault is exposed by mapping or inferred from liquefaction or other deformational features.

Class B: Geologic evidence demonstrates the existence of Quaternary deformation, but either (1) the fault might not extend deeply enough to be a potential source of significant earthquakes, or (2) the currently available geologic evidence is too strong to confidently assign the feature to Class C but not strong enough to assign it to Class A.

Soils in LAKE are generally shallow, friable, wind-deposited, and of alluvial materials that are very susceptible to wind and water erosion. The three broad soil associations represented in Lake Mead National Recreation Area are as follows (NPS, 2007).

Lithosols are thin, stony surface soils derived from rocky parent materials which characterize the slopes and crests of parallel desert ranges. These soils support scant growths of desert shrubs. Areas include desert ranges, such as Eldorado, Newberry, Black, River, Muddy, and Virgin mountains; the crests, rocky slopes, and upper part of some associated alluvial lopes; and steep-walled canyons.

Red desert soils are pinkish, reddish, and brownish-gray soils, which are commonly only slightly leached, rich in lime and mineral plant nutrients. They are derived from alluvial outwash from a great variety of rocks in the mountain ranges (metamorphic, granitic, volcanic, sedimentary). Red desert soils include stony to gritty alluvium of fan deposits and finer basin interior deposits. These soils support creosote-bush, leguminous trees, cacti, *etc*. Areas include desert basins, Detrital Wash, Eldorado Valley, and others.

Catron soils are dark brownish-gray to black calcareous soils with moderately high organic content. They are derived from calcareous shales, sandstones, and hard limestone bedrock. Catron soils support a pinyon/juniper grassland association of plants. Areas include the Colorado Plateau section of the recreation area in regions interrupted by outcropping ledges, abrupt cliffs, and deep stream-carved canyons.

2.1.10 Hydrology and Hydrogeology

Lakes Mead and Mohave contain more than 140 mi (225.3 km) of former river channels, a combined 225,000 surface acres (**Table 2-13**), and a wide range of water depths and geomorphic configurations (Rosen, *et al*, 2012). The water level elevation in Lake Mead varies, but the average from 1939 to 2003 has been 1,176 feet amsl. In 2003, the average was 1,143 feet amsl. Lake Mead extends from Hoover Dam to Pearce Ferry at full pool and contains four large sub-basins: Boulder, Virgin, Temple, and Gregg; four narrow canyons: Black, Boulder, Virgin, and Iceberg; and the 30-mi long Overton Arm, which extends from the Virgin and Muddy Rivers to the Virgin Basin. The Colorado River, via discharges from Lake Powell, supplies approximately 98 percent of the annual inflow to Lake Mead (Las Vegas Valley Watershed Advisory Committee, 2009). The remainder is derived from the Virgin and Moapa (Muddy) rivers which discharge into the Overton Arm, the Las Vegas Wash which discharges into Las Vegas Bay, and a number of desert washes which surround the lake. The average annual discharge of the Muddy River above Lake Mead near Overton, Nevada is 8.91 cubic feet per second (ft^3/s) and the average annual discharge of Las Vegas Wash is 172 ft^3/s.

LAKE has dry washes of all sizes that flow only after thunderstorms or heavy winter rains. Streamflow in larger washes of LAKE occurs about once per year (Bentley, 1979). Outflows from Lake Mead include the Colorado River (below Hoover Dam) and water diversions located at Saddle Mountain and in the Overton Arm.

Table 2-13: Characteristics of Lake Mead and Lake Mohave[14]

Lake Characteristics (full pool)	Lake Mead	Lake Mohave
Surface Area	157,418 acres (637 km^2)	28.084×103 acres (114 km^2)
Volume	28.8×106 acre-ft (3.55×1010 m^3)	1.8×106 acre-ft (2.22×109 m^3)
Mean Depth	182 ft (55.5 m)	85 ft (25.9 m)
Maximum Depth	532 ft (162 m)	165 ft (50.3 m)
Watershed Area	167×103 mi2 (433×103 km^2)	168×103 mi^2 (435×103 km^2)
Mean Inflow	10.9×106 acre-ft/yr (1.34×1010 m^3/yr)	9.6×106 acre-ft/yr (1.18×1010 m^3/yr)
Hydraulic residence time	2.6 yr	60 days
Shoreline length	759 mi (1,221 km)	309 mi (497 km)
Watershed area to lake surface area ratio	681:1	3,813:1

Groundwater at the well located approximately 300 feet southeast of the former firing range at Temple Bar was reported at 141.9 feet below ground surface on August 9, 2013 (Brengman, 2013). The depth to groundwater at the NPS monitoring well located at the Las Vegas Bay former firing range was 169.22 feet from the top of casing on December 11, 2013. The depth to groundwater in a boring advanced at the Las Vegas Bay former firing range was 175.1 feet below ground surface on December 13, 2013.

Information on groundwater near LAKE between the Virgin River and Las Vegas Wash (Rosen, et. al., 2012) was obtained from an inventory of 13 springs and 6 wells. The sources of groundwater in this area include:

- Subsurface flow in local basins that drain to Lake Mead,
- Infiltration of water from Lake Mead into adjacent permeable rocks,
- Subsurface flow in valleys of perennial streams, and
- Subsurface flow from the consolidated rocks of the Muddy Mountains.

It is estimated that less than 1 percent of the total precipitation contributes to recharge due to low rates of average annual precipitation and high rates of evaporation (Rush, 1968). Rocks saturated by lake water probably extend less than 0.5 miles from the lake (Rosen, et. al., 2012).

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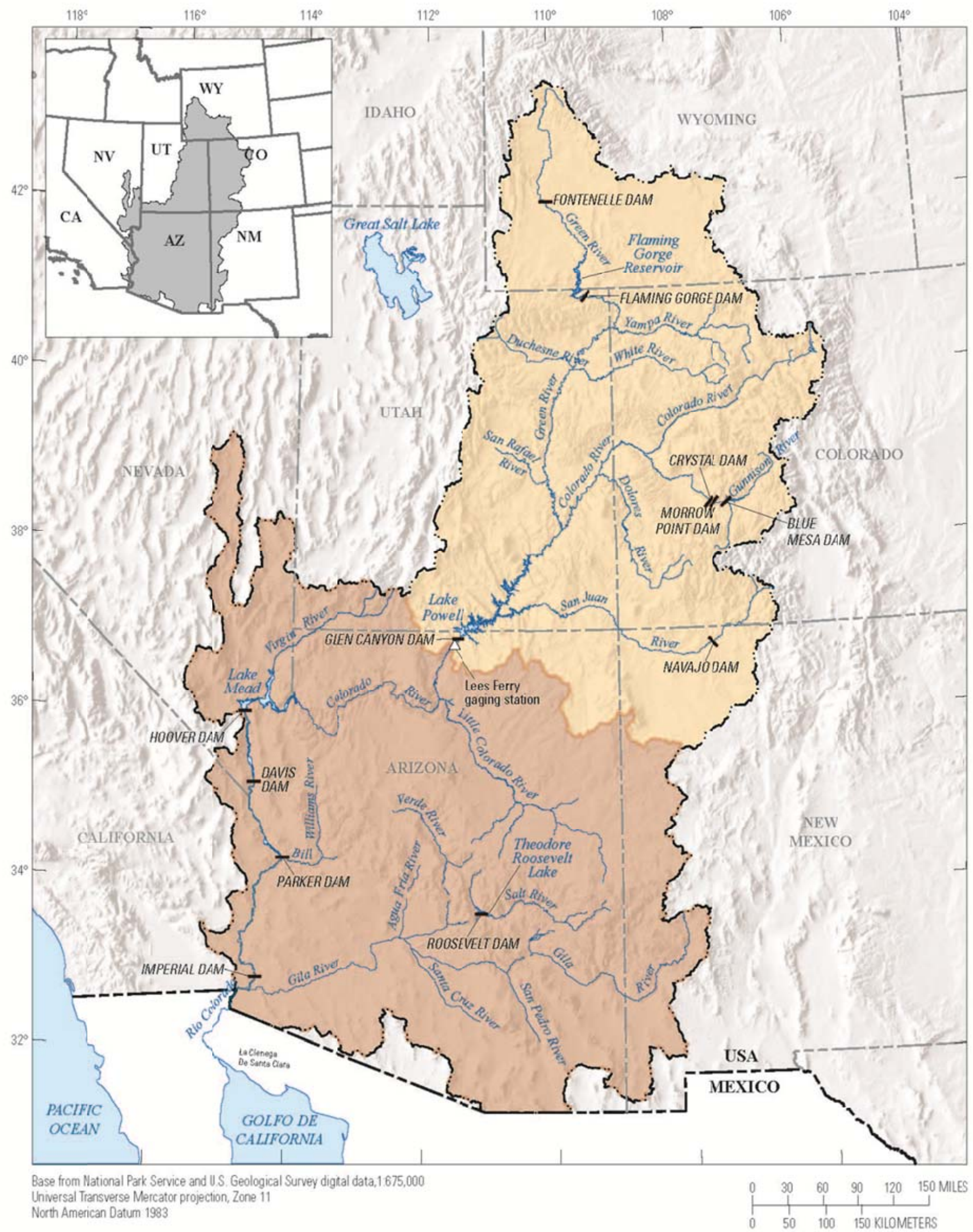
[14] Rosen, *et al*, 2012.

Figure 2-5: Colorado River Basin



Base from National Park Service and U.S. Geological Survey digital data, 1:675,000
Universal Transverse Mercator projection, Zone 11
North American Datum 1983

2.1.11 Fisheries

A fishery is an entity engaged in raising or harvesting fish for their commercial, recreational or subsistence value. Willow Beach National Fish Hatchery is located on the Arizona side of the Colorado River eleven miles below Hoover Dam, within Lake Mead National Recreation Area. The hatchery, operated by the USFWS, works with Rainbow trout for recreational fishing, two endangered species, bonytail chub and razorback sucker, and one candidate species, the relict leopard frog. Shortly after the Endangered Species Act was enacted in 1973, the hatchery began working with threatened and endangered fish native to the Colorado River. In the past the hatchery has worked with the endangered Colorado pikeminnow and humpback chub.

The Lake Mead Fish Hatchery, operated by the Nevada Department of Wildlife, is located on the west shore of Lake Mead and encompasses over 17 acres. There are 14 structures that support the fish hatchery operations. Lake Mead supplies the water required for hatchery operations. The site and several structures have undergone a remodel, which included new storage and hatchery buildings and site drainage and paving. The Lake Mead Fish Hatchery was closed in 2011 due to declining lake levels and the invasive quagga mussel.

2.1.12 Wetlands

2.1.12.1 Saturated

Both Lake Mead and Lake Mohave are identified as lake wetlands by the USFWS (USFWS, 2013). Freshwater Forested/Shrub Wetland is located along the eastern shore of Lake Mohave where the lake widens. Riverine wetlands are present along the Colorado River between Lake Mead and Lake Mohave. Freshwater emergent, Freshwater Forested/Shrub, and Riverine wetlands exist in the Pearce Bay area where the Colorado River enters Lake Mead and along the Overton Arm of Lake Mead where the Virgin River enters the lake. No former firing range is located within 4,300 feet of the shore of the lake.

2.1.12.2 Springs

Although no springs are associated with the four former firing range sites, several particular areas within LAKE host a number of springs. One such area is found along the west side of the Overton Arm of Lake Mead, just west of Northshore Road. This area is home to Rogers Spring which produces water at a fairly constant 720 gallons per minute, the greatest flow of any spring within the park (NPS, 2013e). The relatively constant year-round flow and the warm temperature (86 degrees Fahrenheit) are both indications of a regional source for this water.

Another area within LAKE rich with springs is the Black Canyon vicinity downstream of Hoover Dam. Here you can find springs of both the thermal and non-thermal variety with water temperatures ranging from about 55 to 136 degrees Fahrenheit. Spring discharge below the Black Canyon can be diffuse, often taking the form of large seeps with wet rock faces that may be up to 100 feet long. Some springs discharge into side canyons which produce brooks that then discharge into the Colorado River, while others discharge water from the Black Canyon walls directly.

2.2 PREVIOUS INVESTIGATIONS

NPS completed Preliminary Assessment and Site Inspection (PA/SI) field activities for the former firing ranges between 2007 and 2009. The PA/SI activities were part of a larger-scale investigation that included six firing range sites, four landfill/dump sites, and one former mine site. During the PA/SI field investigation, additional sites were observed and added to the reconnaissance, including five more landfills, one surface dumping area, and one additional firing range. The resulting PA/SI Report (Baker, 2009) documented conditions at all 18 locations and recommended additional characterization of the Echo Bay, Las Vegas Bay, Temple Bar, and Willow Beach former firing ranges.

The following summarizes the findings from the PA/SI Report.

2.2.1 Echo Bay Former Firing Range

Eight composite soil samples were collected at the former firing range on February 16, 2007. Two background composite samples were collected approximately 770 feet southwest and upgradient of the primary impact area. Results indicated the following:

- Soils within the primary impact area (natural embankment above the toe and drainage) had total lead concentrations exceeding the USEPA Action Level[15] for total lead and the USEPA Ecological Soil Screening Level for total lead (for both invertebrates and plants).
- Soils within the secondary impact area exceeded the USEPA Ecological Soil Screening Level for total lead for plants.
- Soils within adjacent, downgradient drainage areas did not exceed the USEPA Action Level and USEPA Ecological Soil Screening Level (collectively referred to in the PA/SI Report and herein as “screening criteria”) for plants, invertebrates, or humans.
- Leaching analysis performed via the Toxicity Characteristic Leaching Procedure (TCLP) indicated lead concentrations did not exceed the regulatory level for hazardous waste.

The PA/SI Report recommended that NPS conduct a site characterization to determine the nature and extent of potential lead contamination and to determine appropriate response actions.

2.2.2 Las Vegas Bay Former Firing Range

No samples were collected during the PA/SI investigation, as this site was not listed as one of the six firing ranges in the PA/SI scope of work. Therefore, the PA/SI Report recommended site characterization to determine potential impacts, the nature and extent of potential contamination, and appropriate response actions, if necessary.

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[15] USEPA Office of Solid Waste and Emergency Response (OSWER) action level for lead of 400 milligrams per kilogram (mg/kg) for residential settings (USEPA, OSWER Directive #9355.4-12, 1996).

2.2.3 Temple Bar Former Firing Range

Seven composite soil samples were collected at the former firing range on February 15, 2007. Two background composite samples were collected, including one from the natural hillside approximately 160 to 220 feet upgradient from the target area, and one from within the wash approximately 300 feet southwest and upgradient of the target area. The results indicated the following:

- Soils within the primary impact area appear to be impacted by lead. Total lead concentrations exceeded USEPA screening criteria for plants, invertebrates, and humans in one composite sample.
- Soils within adjacent, downgradient drainage areas did not exceed screening criteria.
- TCLP lead concentrations for two samples exceeded 5.0 mg/L, the regulatory level for hazardous waste. Consequently, if the associated soils were excavated as part of a removal action, these soils would require disposal at a permitted hazardous waste facility.

The PA/SI Report recommended that NPS conduct a site characterization to determine the nature and extent of potential lead contamination and to determine appropriate response actions. In addition, the PA/SI Report recommended removing the remaining components of the former firing range including the targets and markers.

2.2.4 Willow Beach Former Firing Range

Four composite soil samples were collected at the range on February 15, 2007. A background sample was also collected, approximately 240 feet southeast and upgradient of the backstop area. Results indicated the following:

- Soils within the primary impact area appear to be impacted by lead. Total lead concentrations exceeded USEPA screening criteria for invertebrates and humans in one sample and the screening criteria for plants in three samples.
- Soils within adjacent, downgradient drainage areas did not exceed screening criteria.
- TCLP concentrations did not exceed regulatory levels for hazardous waste.

The PA/SI Report recommended that NPS conduct a site characterization to determine the nature and extent of potential lead contamination and to determine appropriate response actions.

2.3 2013 EE/CA FIELD INVESTIGATION

Based on the history of the sites, NPS determined that potential adverse impacts to human health and to the environment would likely result from concentrations of lead. In April 2013, ECM completed an EE/CA field investigation to delineate the extent of lead-impacted soil to evaluate alternative non-time critical removal actions under CERCLA. A site visit in October 2011 and the PA/SI document provided the information necessary to develop the March 2013 EE/CA Work Plan (ECM, 2013). The EE/CA Work Plan served as a guideline for procedures, quality control (QC) requirements, health and safety requirements, and sampling requirements.

2.3.1 ISM Sample Collection and Data Analysis

ECM used the incremental sampling methodology (ISM) to characterize the naturally occurring background lead concentrations and the nature and extent of lead contamination at each site (ITRC, 2012). ECM collected ISM samples from the following decision units (DU) and background sampling units at each former firing range site:

1. Firing range target area (or impact berm) soils (TA)
2. Firing line (or range floor) area soils (FL)
3. Wash channel bed sediments (WC)
4. Background soils (BG)

ECM collected four samples, each consisting of 30 incremental subsamples from each DU and the background area at each former firing range site. Samples were collected from approximately 0 to 6 inches below ground surface at each subsample location. ECM collected the following solid matrix samples:

- 48 DU samples (12 per firing range site),
- 16 background samples (4 per firing range site), and
- 4 duplicate DU samples.

The ISM sampling results are summarized in **Appendix C**, Table C-1. The DU locations at each former firing line site are presented in **Figures 1-3** through **1-6** as well as in the figures in **Appendix C**. All laboratory reports are presented in **Appendix D**.

ECM also collected a total of 18 quality control equipment rinsate and water blank samples from the DUs at each former firing range site (**Appendix C**, Table C-2). None of the results for the quality control samples were above the reporting limit, indicating field personnel provided a sufficient level of equipment decontamination to provide defensible data results.

The ISM soil sampling results at two former firing ranges sites, Las Vegas Bay and Echo Bay indicated lead concentrations in soil exceeded the applicable site screening level protective of groundwater (USEPA Site Screening Level (SSL) of 14 mg/kg [see **Section 2.4.4**]). To address potential leaching of contaminants to groundwater and to evaluate whether subsequent groundwater sampling would be appropriate, ECM analyzed five samples from selected DUs for Synthetic Precipitation Leaching Procedure (SPLP).

ECM used the USEPA Region IX maximum contaminant level (MCL) as a screening level for the SPLP results for the Las Vegas Bay and Echo Bay samples (see **Section 2.4.4**). The leachate exceeded the MCL in four of the five samples.

Because of the way the leaching procedures are conducted, the theoretical correlation between the total metals test and leaching test can be no less than 20:1. This is the ratio at which the SPLP leaches 100% of the metal in the soil. The actual ratio varies from site to site and metal to metal but is usually much greater than 20:1 because some fraction of the metals in soil is usually not readily leachable and remains in a solid phase. Therefore, although the SPLP results indicated potential groundwater impact due to leaching, concentrations of lead may not have reached groundwater. Consequently, a groundwater sample provides the actual concentration of lead attributable to leaching from the overlying soil, if the background concentration is known. As with soil, there are background concentrations of naturally-occurring elements such as lead in groundwater.

2.3.2 Soil Boring and Groundwater Sampling

To obtain data that would establish a direct connection, if one exists, between surface lead impacts and any groundwater impacts, ECM conducted additional site investigation activities in December 2013 that included one boring to groundwater at the Las Vegas Bay former firing range site. A summary of the site investigation activities and the results of the sampling are presented in the *Soil and Groundwater Sampling* report in **Appendix E**. This investigation demonstrated that the lead impacts to surface soil at Las Vegas Bay do not adversely impact groundwater quality.

2.3.3 Leaching-to-Groundwater Modeling

ECM could find no groundwater data at or immediately downgradient of the impacted area of the Echo Bay former firing range that would provide direct evidence of the quality of groundwater. To address concerns expressed by NPS regarding difficult drill rig access to the Echo Bay former firing range site, a computer simulation, or model, addressed leaching potential instead of subsurface sampling. This model was tested on data collected at the Las Vegas Bay former firing range site to verify its accuracy. As such, it provided an indirect method of evaluating the potential for impact to groundwater due to the observed soil concentrations in the overlying soil.

ECM used the Nevada Division of Environmental Protection (NDEP) Basic Comparison Levels (BCLs) developed for the BMI Complex and Common Areas in Henderson, Nevada (NDEP, 2013) to evaluate the results of the computer modeling of the soil-leaching-to-groundwater pathway. The BCLs were generated as a technical screening tool to assist users in risk assessment components such as the evaluation of data usability, determination of extent of contamination, identifying chemicals of potential concern, and identifying preliminary remediation goals.

The leaching model showed that, similar to Las Vegas Bay, surface impacts at Echo Bay will not leach to groundwater and impact it. A description of the modeling approach, the model input data, and the results are presented in the *Leaching-to-Groundwater Modeling* report in **Appendix F**.

2.4 SOURCE, NATURE AND EXTENT OF CONTAMINATION

ECM based the 2013 field investigation on the 2007 PA/SI data and used the 2013 data results from the ISM total lead analysis to evaluate the nature and extent of contamination. Because ISM is a technique designed to statistically reduce or limit variability associated with discrete sampling, it provides a more representative and reproducible estimate of the mean concentration of analytes in the volume of material represented by each DU. The following sections detail the source, nature, location and estimated volume of contamination for each of the Four Former Firing Range Sites in LAKE.

2.4.1 Constituents of Potential Concern

Lead accounts for more than 85% of the weight of the projectiles and constitutes the greatest environmental concern in firing ranges (ITRC, 2003). Larger projectile lead fragments remained in the shallow soil. Based on the history of the former firing range sites and previous investigation (Baker, 2009), NPS identified lead as the only constituent of potential concern (COPC) related to this investigation.

2.4.2 Site-Specific Background Data

Under CERCLA (USEPA, 2002), concentrations of chemicals of concern below the naturally occurring background levels are not generally subject to removal actions. The site-specific background for each former firing range site was calculated using the ITRC's online calculator (ITRC, 2012) to determine the 95% upper confidence limit (UCL) using the background samples collected in April 2013. The soil data used to calculate the site-specific background values in **Table 2-14** are presented in full in **Appendix C** (Table C-1). ECM used the Student's t distribution for background because it provides a more conservative (lower) value for the mean and it assumes the variability in concentrations is low.

Table 2-14: Site-Specific Background Concentrations for Lead in Soil

Former Firing Range Site	95% UCL* (mg/kg)
Echo Bay	6.8
Las Vegas Bay	27.7
Temple Bar	7.0
Willow Beach	24.1

* Student's t distribution

2.4.3 ISM Soil Sampling Analytical Results

The results for ISM lead data are presented in **Table 2-15** below. ECM used the Chebyshev method for calculating the 95% UCL because the variability represented by discrete samples was high, or no discrete samples were collected within the area represented by a particular DU, so the variability is unknown. Although the Chebyshev method tends to yield higher UCL values for the same data set, it's statistical performance is desirable, because it achieves the desired 95% coverage of the mean under conditions when the variability of concentrations throughout the DU are moderate or high.

Table 2-15: Site-Specific Concentrations for Lead in Soil

DU	Mean (mg/kg)	SD	95% UCL* (mg/kg)
Echo Bay - WC	13.7	5.8	25.0
Echo Bay - FL	29.8	24.2	82.5
Echo Bay - TA	163.3	120.9	426.7
Echo Bay - BG	6.6	0.2	6.8

DU	Mean (mg/kg)	SD	95% UCL* (mg/kg)
Las Vegas Bay - FL	111.5	48.9	218.1
Las Vegas Bay - TA	3,825.0	1,335.1	6,734.8
Las Vegas Bay - WC	37.5	24.4	90.7
Las Vegas Bay - BG	24.6	3.3	27.7
Temple Bar - TA	57.8	62.4	193.7
Temple Bar - WC	5.5	0.3	6.2
Temple Bar - FL	5.6	0.4	6.4
Temple Bar - BG	6.3	0.6	7.0
Willow Beach - FL	16.3	1.0	18.3
Willow Beach - TA	47.2	17.9	82.2
Willow Beach - WC	15.0	1.2	17.5
Willow Beach - BG	17.3	5.9	24.1

Notes:

BG = Background
DU = Decision Unit
FL = Firing Line
mg/kg = milligram per kilogram
SD = Standard Deviation (this is a measure of consistency in estimates of the mean)
TA = Target Area
UCL = Upper Confidence Limit
WC = Wash Channel
* Chebyshev Method for DUs and Student’s t for background

2.4.4 Synthetic Precipitation Leaching Procedure Analytical Results

ISM lead analysis results showed that five samples from Las Vegas Bay and Echo Bay exceeded soil screening levels indicating that lead could potentially leach to groundwater. This did not indicate that leaching actually occurred; just that the potential existed. As an initial check, ECM submitted the individual sample with highest lead concentration from the Las Vegas Bay firing line, target area and wash channel DUs and from the Echo Bay firing line and target area DUs for SPLP lead analysis. The results are presented in **Table 2-16** below.

Table 2-16: SPLP Results for Select Former Firing Range Sites

SPLP Samples			Lead
Sample Name	Sample Date	Sample Location	(µg/L)
LAKE-LV-FL101	04/23/13	Las Vegas Bay	55
LAKE-LV-TA-105	04/23/13	Las Vegas Bay	610
LAKE-LV-WC-110	04/23/13	Las Vegas Bay	30
LAKE-EB-FL-111	04/22/13	Echo Bay	<9
LAKE-EB-TA-112	04/22/13	Echo Bay	20
EPA Region 9 MCL			15

Notes:

FL = firing line
TA = target area
WC = wash channel
µg/L = micrograms per liter

NPS elected to proceed with the collection of depth specific soil samples and groundwater samples at Las Vegas Bay as a direct evaluation of groundwater impact. Echo Bay was not accessible to drill rigs.

2.4.5 Las Vegas Bay Soil and Groundwater Sampling Results

ECM collected four (4) *in-situ* soil samples at the depths indicated in **Table 2-17** for analysis for total lead concentrations. The a description of the drilling and sampling activities and the results of the hydrogeologic analysis are presented in **Appendix E**.

Since several of the samples from boring B-1 contained total lead concentrations above 14 mg/kg (USEPA SSL protective of groundwater), ECM requested SPLP lead analysis for samples LAKE-LV-B1-60 (at 60 feet bgs) and LAKE-LV-B1-180 (at 180 feet bgs). Sufficient undisturbed sample volume was obtained at 60 feet, 100 feet, and 155 feet bgs to submit to Cooper Testing Laboratory for analysis of hydrogeological parameters to support leaching modeling. The SPLP results and the hydrogeological parameter data were used to refine groundwater fate and transport models and to evaluate leaching potential for the Echo Bay former firing ranges site (**Appendix F**).

Table 2-17: SPLP Former Firing Range Sites

Soil Sample Name	Depth (feet bgs)	Sample Date	Lead (mg/kg) EPA 6010B	SPLP Lead (mg/L) EPA 6010B
LAKE-LV-B1-60	60	12/10/2013	24	<0.50
LAKE-LV-B1-100	100	12/11/2013	7.1	NA
LAKE-LV-B1-155	155	12/12/2013	38	NA
LAKE-LV-B1-180	180	12/13/2013	60	<0.50

Notes:

bgs = below ground surface
EPA = Environmental Projection Agency
LV = Las Vegas Bay
mg/kg = micrograms per kilogram
mg/L = micrograms per liter

ECM gauged and sampled a cross-gradient monitoring well and the groundwater in boring B-1 at the Las Vegas Bay former firing range site. Groundwater samples from the boring were submitted for analysis for total and dissolved lead concentrations, since water from the borehole could not be purged prior to sampling. The total lead results represent water samples that may contain sediments and soil particles, and those can include background levels of lead. Dissolved lead results represent filtered samples, without those sediments and soil particles. Groundwater production and monitoring wells use filter packs to remove sediments and soil particles from drinking water. Open boreholes, such as B-1, have no such filter pack. Therefore, the dissolved lead results from B-1 are more representative of the actual lead content in groundwater, if it were to be used as drinking water, compared to the total lead results.

Table 2-18: Groundwater Sample Results

Soil Sample Name	Depth (feet bgs)	Sample Date	Total Lead (mg/L) EPA 6010B	Dissolved Lead (mg/L) EPA 6010B
LAKE-LV-MW-170	170	12/11/2013	<0.015	NA
LAKE-LV-MW-170 DUP	170	12/11/2013	<0.015	NA
LAKE-LV-B1-180	180	12/13/2013	0.12	<0.015
LAKE-LV-B1-180 DUP	180	12/13/2013	0.14	NA

2.4.6 Extent and Volume of Potentially Contaminated Soils

The areal extent of each DU for each of the former firing range sites is shown on the figures in **Appendix C**. Table 2-15 indicates that lead concentrations within all DUs at Echo Bay and Las Vegas Bay former firing range sites exceeded the site-specific background concentration. Only the target area DUs at Temple Bar and Willow Beach former firing range sites exceeded the site-specific background concentrations.

Although samples were collected from depths between 0 and 6 inches below ground surface, ECM used a conservative depth of 12 inches (1 foot) for the volume estimates in **Table 2-19**.

Table 2-19: Estimated Volume of Material within DUs at Former Firing Range Sites

Site	Firing Line		Target Area		Wash Channel		Total Impacts Above Background	
	Area (feet^2)	Volume (Yard^3)	Area (feet^2)	Volume (Yard^3)	Area (feet^2)	Volume (Yard^3)	Area (feet^2)	Volume (Yard^3)
Echo Bay	**12,326**	**456**	**9,625**	**356**	**15,830**	**586**	**37,781**	**1,398**
Las Vegas Bay	**8,554**	**317**	**6,529**	**242**	**2,030**	**75**	**17,113**	**634**
Temple Bar	7,032	260	**6,112**	**226**	1,822	67	**6,112**	**226**
Willow Beach	5,703	211	**492**	**18**	7,671	284	**492**	**18**

Note: bold values represent areas and volumes of decision units that exhibited lead impacts above site-specific background levels. The final set of columns, Total Impacts Above Background, presents the sums of those bolded values.

Note that none of the investigations addressed the overshot area south of the Las Vegas Bay target area. This is an area where bullets that were fired over the target area berm would have landed. This area of the Las Vegas Bay range drains to the wash channel. Further investigation is necessary to determine, if the Las Vegas Bay overshot area is a potential source area.

2.5 STREAMLINED RISK ASSESSMENT

As described in the EE/CA guidance (USEPA, 1993), a streamlined risk assessment is intermediate in scope between the limited risk assessment conducted for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions. The purpose of a streamlined risk assessment is to justify a removal action. Consistent with EE/CA guidance, the streamlined risk assessment will identify the potential for risk, if no removal action is taken within the removal action boundary.

The streamlined risk assessment approach identifies and addresses exposure pathways by evaluating potential ecological and human health risks. The assessment focuses on the human health and ecological risks associated with elevated lead concentrations and focuses on the media that the removal action is intended to address (USEPA, 1993), which is limited to surface soils (top 12 inches) at the four former firing ranges. Risks associated with surface water or groundwater will be assessed based the existence of a complete exposure pathway involving sediment transport or leaching potential of the solid media (**Section 2.5.2**).

2.5.1 Preliminary Exposure Pathways

The risk assessment is designed to identify risk from potential exposure pathways if no action is taken. An exposure pathway is considered complete if a chemical can travel from a source to a human or ecological receptor and is available to the receptor via one or more exposure routes (EPA, 2004). **Figure 2-5** and **Figure 2-6** depict the various exposure pathways in the form of a Human Health Risk Conceptual Model and an Ecological Risk Conceptual Model, respectively. If an exposure pathway is not complete, then that particular means of exposure does not pose a risk.

2.5.2 Threat to Water Quality

The risk to groundwater and surface water from water leachate containing lead from contaminated soil or sediment at the four former firing range sites was evaluated by direct sample analysis and via leachable metals analysis.

2.5.2.1 Groundwater

Chemicals, when present at sufficient quantity in the soil, may leach to groundwater. Synthetic Precipitation Leaching Procedure (SPLP) analysis provides a means of assessing the potential of a contaminated material left *in situ* to impact groundwater or surface water when exposed to normal weathering processes.

The Arizona (Arizona Department of Environmental Quality [ADEQ]) has developed risk-based Groundwater Protection Levels (GPLs) for selected constituents, including lead. GPLs are compared to soil sample analytical results to determine the potential of the constituent to leach to groundwater. The GPL for lead for Arizona, 290 mg/kg, applies to the Willow Beach and Temple Bar former firing range sites. No DUs at these sites were above the GPL; therefore, the soil concentrations at these sites do not threaten to impact groundwater. This exposure pathway can be considered incomplete.

The State of Nevada defaults to USEPA guidance which applies to results from Las Vegas Bay and Echo Bay. The maximum contaminant level-based, USEPA Site Screening Level (SSL) for the protection of groundwater for lead is 14 mg/kg. Lead concentrations in soil from DUs at the Las Vegas Bay and Echo Bay former firing range sites exceeded the SSL. Therefore, this exposure pathway was potentially complete, so NPS investigated it further to confirm that it was either complete or incomplete.

NPS authorized the drilling and sampling of one boring to collect depth-specific soil samples and a groundwater sample from beneath the Target Area DU at the Las Vegas Bay site (**Appendix E**). The lead concentration in the surface soil at this DU represents the highest surface soil lead concentration at any DU at any of the sites. Soil and SPLP sample results collected during drilling of the boring at the Las Vegas Bay site (**Table 2-17)** indicate that leaching from surface soil to subsurface soil and from surface soil to groundwater is not occurring at the Las Vegas Bay former firing range. This was confirmed by the groundwater sample results (**Table 2-18**) indicating no lead was present. Additionally, groundwater modeling described in **Appendix F** demonstrated that lead leaching to groundwater was not occurring at the Echo Bay former firing range. This result was expected, since similar site conditions and higher lead concentrations at Las Vegas Bay did not result in leaching to groundwater. Therefore, exposure pathways involving groundwater are considered incomplete and pose no risk.

2.5.2.2 Surface Water and Sediment

Although no persistent surface water is present at the four former firing range sites, all four sites have dry washes which flow during heavy precipitation events. At those times, surface water and sediment from the site can be transported to Lake Mead, exposing aquatic plants and animals and humans via incidental contact to potentially contaminated media.

Aquatic plants are primarily exposed via contaminated sediment. Although benthic invertebrates, fish, and amphibians may be exposed to contaminants via surface water or sediment, benthic invertebrates are primarily exposed through sediment, and fish and amphibians are primarily exposed through surface water. Terrestrial and aquatic wildlife (*e.g.*, herbivores, omnivores, insectivores, and carnivores), including reptiles, may be exposed directly to contaminants in surface water through ingestion and to contaminants in soil or sediment by incidental soil or sediment ingestion, by dermal contact, or by the inhalation of wind-borne particles.

Surface water in the vicinity of the Site is ephemeral and only occurs for hours or days following heavy rainfall events. No surface water was present during site assessment activities; therefore no surface water samples were collected. Surface water may be impacted by elevated lead concentrations in the suspended sediment load that it carries or directly from leachable lead concentrations originating from impacted surface soil. However, this would only occur for brief periods when such surface water is present due to severe storms.

Lead concentrations in the wash channel sediments at the Temple Bar and Willow Beach former firing range sites were below background concentrations; therefore, no impacts would be associated with sediments or with leaching or runoff to surface water at these sites. The lead concentration in the wash channel sediments at the Echo Bay former firing range site is below the USEPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Sediment Screening Benchmarks for sensitive food-chain species (35.8 mg/kg) and the site is located over 14,000 feet (2.6 miles) from Lake Mead.

At the Las Vegas Bay former firing range, the wash channel is located approximately 115 feet from the target area, and the wash channel sediment concentration is 98.7% lower than the target area (highest) source concentration. Because the Las Vegas Bay former firing range site is located approximately 5,600 feet (over 1 mile) from Lake Mead, and the wash channel sediment concentration is only 2.5 times higher than the BTAG screening level, the sediment concentration is expected to reach background level before reaching the lake. Therefore, the exposure pathways involving sediments and sediment to surface water are considered incomplete and pose no risk at Las Vegas Bay, either.

As described in **Section 2.5.2.1**, the evaluation of the potential for lead leaching from soils to groundwater at the Echo Bay or Las Vegas Bay former firing ranges indicated no risk of leaching. Lead has been resident in the soils at the Las Vegas Bay site for a time period much greater than the hours or days that surface water would be exposed to the soils. It is, therefore, unlikely that lead will leach to ephemeral surface water. The leaching-to-surface water exposure pathway at the Echo Bay and Las Vegas Bay former firing range sites is considered incomplete.

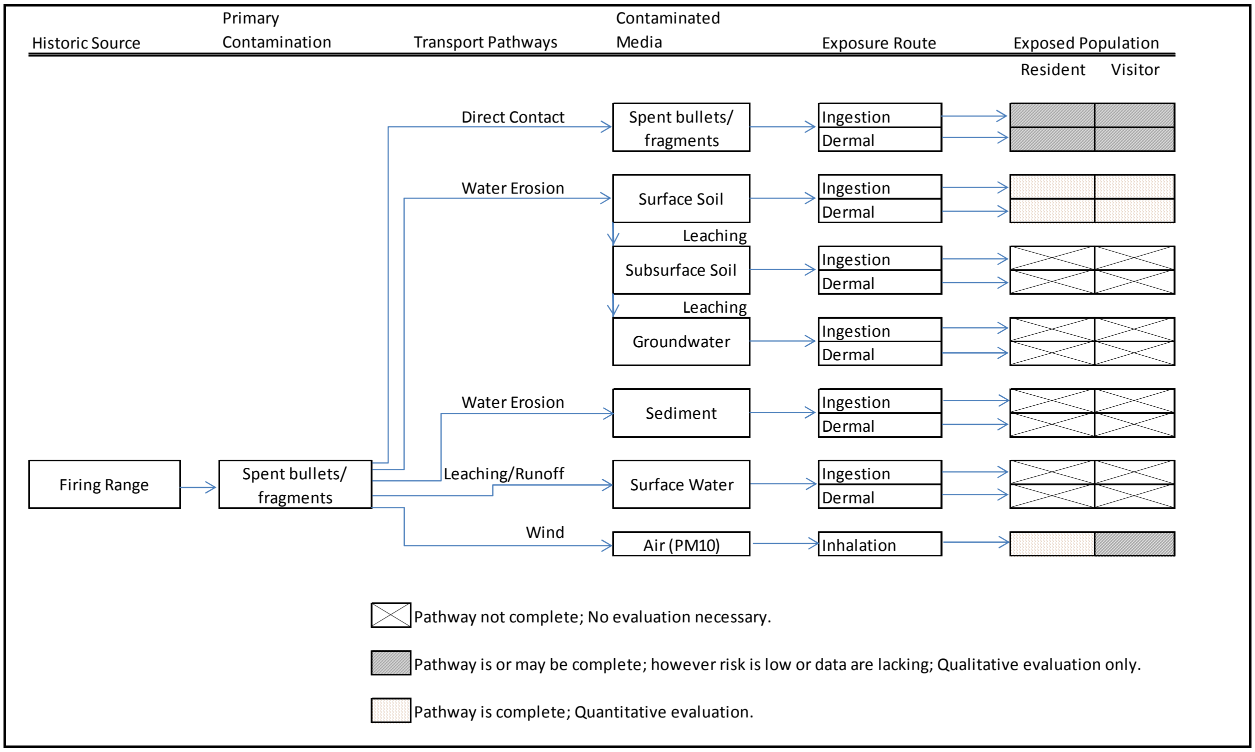
2.5.3 Human Risk Screening Criteria

In the streamlined risk assessment, ECM compared lead concentrations to regulatory screening criteria considered protective of human health. A conceptual site model (CSM) is used to evaluate and depict the possible lead exposure pathways and receptors for the impacted soil via relevant transport mechanisms.

The Human Health Risk CSM shown below is a conservative representation of the conditions present at all of the former firing range sites; however, based on results of laboratory analyses on soil and water samples or site-specific conditions, some of the exposure pathways or receptors may not be present at all of the sites. As shown in **Figure 2-6**, NPS eliminated the following receptors or pathways from all sites:

- Leaching pathway from the surface soil to the subsurface soil for all receptors (**Section 2.5.2.1**)
- Leaching pathway from the surface soil to the groundwater for all receptors (**Section 2.5.2.1**)
- Groundwater for all receptors (**Section 2.5.2.1**)
- Sediment for all receptors (**Section 2.5.3.2**)
- Surface water for all receptors (**Section 2.5.3.2**).

Figure 2-6: Human Health Risk Conceptual Model



All human health screening levels considered in the streamlined risk assessment are presented in **Appendix G,** Table G-3a and Table G-3b. A human health risk screening value of 400 mg/kg of lead was selected for the Site as this is the lowest level that applies for the Site CSM and current land use[16], based on a residential exposure scenario. The industrial exposure value is 800 mg/kg.

Lead at the Echo Bay TA (426.7 mg/kg) exceeds the residential screening value of 400 mg/kg but not the industrial value of 800 mg/kg. Lead at the Las Vegas Bay Bay TA (6,734.8 mg/kg) exceeds both screening criteria. Neither TA decision unit at Temple Bar and Willow Beach exceeds the residential screening value.

2.5.4 Ecological Risk Screening Criteria

The preliminary COPC identification process was integrated with streamlined risk assessment for a protective, risk-based approach, which compares contaminant concentrations to regulatory screening criteria that are considered protective of ecological receptors. A CSM (**Figure 2-6**) is used to evaluate the possible lead exposure pathways and receptors for the impacted soil via relevant transport mechanisms.

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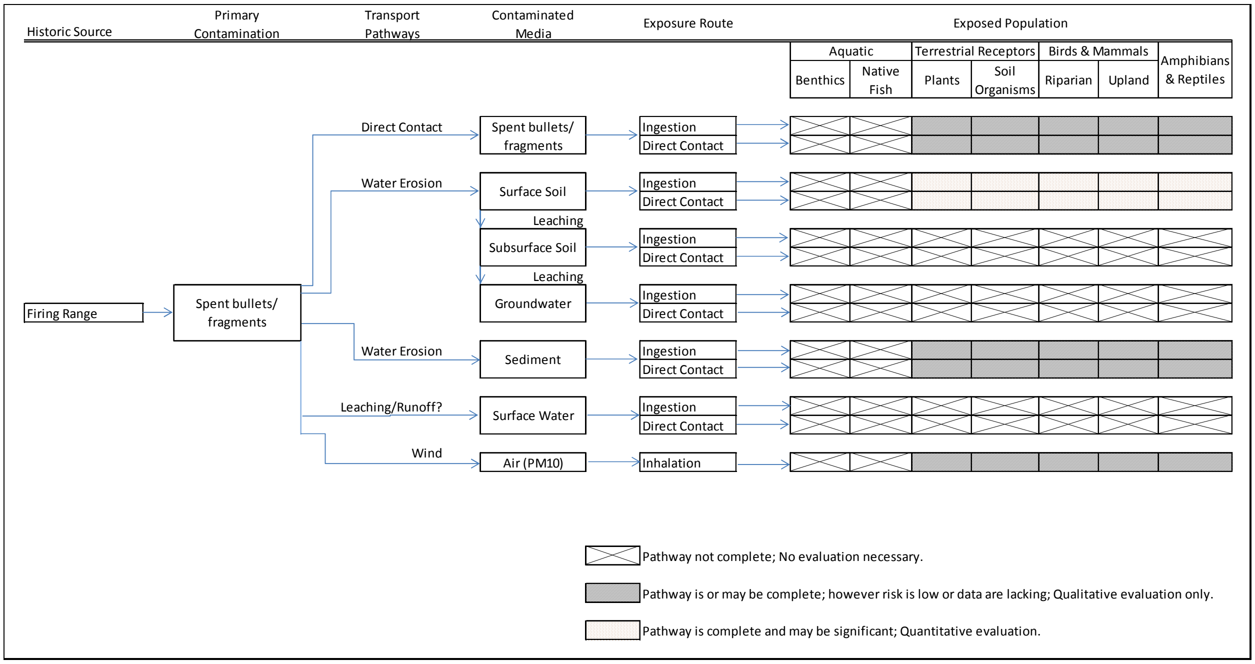
[16] EPA Region 9 Screening Levels for Soil - November 2011

Figure 2-7: Ecological Risk Conceptual Model



Based on **Figure 2-7**, NPS eliminated the following receptors or pathways:

- Leaching pathway from the surface soil to the subsurface soil
- Leaching pathway from the surface soil to the groundwater
- Sediment to aquatic
- Surface water to all receptors
- Groundwater to all receptors

All ecological screening levels considered in the streamlined risk assessment are presented in **Appendix G,** Table G-3a and Table G-3b. The minimum ecological risk screening value for lead is 11 mg/kg[17] for avian receptors.

2.5.5 Site Specific Screening Levels

A Site Specific Screening Level (SSSL) value for lead in surface soil was determined by evaluating all published screening levels for soil for wildlife species at the Site against background values. Screening levels below site-specific background levels were not selected. Plants were not considered as no endangered, threatened, or species of concern are present at any of the four former firing range sites and all plants will be removed from the impacted areas during the removal action. The risk screening value (RSV) of 11 mg/kg for avian potential receptors was selected as for the calculation of the SSSL because it is the lowest Eco-SSL for avian species at the Site. Similarly, the RSV of 56 mg/kg for mammalian potential receptors

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[17] Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php

was selected for the calculation of the SSSL because it is the lowest Eco-SSL for mammalian species at the Site.

These values were adjusted based on the area use factor (AUF) for the avian and mammalian species (**Appendix G**, Table G-6) with the smallest home range (most conservative) at each former firing range site to estimate their Toxicity Reference Value (TRV) as presented in **Appendix G,** Tables G-4a to G-4d. The AUF for the Yuma Clapper Rail at the Site was estimated at approximately 0.005 to 0.15 at Willow Beach Target Area and Echo Bay Wash Channel, respectively. The AUF for the Desert Pocket Mouse at the Site was estimated at approximately 0.01 to 0.40 at Willow Beach Target Area and Echo Bay Wash Channel, respectively. By dividing the avian RSV of 11 mg/kg by each estimated AUF, we obtain estimated TRV values ranging from approximately 73 mg/kg to 2,434 mg/kg of lead in soil. By dividing the mammalian RSV of 56 mg/kg by the AUF, we obtain an estimated TRV value ranging from approximately 140 mg/kg to 5,600 mg/kg of lead in soil as presented in **Appendix G**, Tables G-4a to G-4d. The smallest ecological TRV for each site area was selected as the ecological SSSL for that area.

SSSLs were not developed for aquatic receptors, due to the elimination of surface water impacts as described in **Section 2.5.2**.

2.5.6 Chemicals of Concern for Removal Action

The exposure point concentration (EPC) can be either the maximum detection or the 95% UCL of samples collected. ISM recommends estimating EPC as Chevyshev 95% UCL when data variability is unknown, as it is for the target area, firing line and wash channel DUs; therefore, the assumed EPC is the 95% UCL concentration (**Table 2-15**, above) from each DU exceeding background concentrations. These are as follows:

Table 2-20: Exposure Point Concentrations for Lead in Soil

DU	EPC (mg/kg)
Echo Bay - WC	25.0
Echo Bay - FL	82.5
Echo Bay - TA	426.7
Las Vegas Bay - FL	218.1
Las Vegas Bay - TA	6,734.8
Las Vegas Bay - WC	90.7
Temple Bar - TA	193.7
Willow Beach - TA	82.2

Notes:

DU = Decision Unit
FL = Firing Line
mg/kg = milligrams per kilogram
TA = Target Area
WC = Wash Channel

The FL and WC decision units at Temple Bar and Willow Beach did not exhibit lead concentrations exceeding background levels. DUs whose mean concentrations were below the site-specific background, including the wash channel and firing line DUs at Temple Bar and Willow Beach, do not require comparison to SSSLs and have been dropped from further evaluation.

EPCs from Table 2-20 were compared to the human health and ecological SSSLs to establish if lead should be a contaminant of concern (COC) (**Appendix G, Table G-2a to Table G-2d and Table G-5a to Table G-5d**). The comparison indicated surface soil lead concentrations exceeded SSSLs in at least one of the DUs at each range except Willow Beach. These data indicate lead from the projectiles migrated to surrounding shallow soils. Therefore, lead shall be considered a COC.

2.5.7 Risk Summary

Section 3.2 explains that this EE/CA must evaluate whether there is potential risk to human health or to the environment, if no action were to occur. These risks are represented by the following:

- Hazard quotient – human health
- Hazard quotient – ecological receptors

A hazard quotient (HQ)[18] is used to estimate COC non-cancer risk by dividing the estimated exposure point concentration (EPC) by TRV for human health risk evaluation. For ecological receptors, when AUF are taken into consideration, the HQ is estimated by dividing the exposure dose (ED) by TRV for non-cancer risk evaluation for ecological receptors (USEPA, 2005a). Lead is not a carcinogenic chemical and cancer risk evaluation is not needed.

The ED is estimated as the EPC multiplied by the AUF. In summary, EPC = 95% UCL for Human Health; ED = 95% UCL x AUF for Ecological Receptors.

The HQs were defined as: EPC divided by TRV of 400 mg/kg (Residential EPA Region 9 SSL) for human health risk and ED divided by the lower of the avian or mammalian TRV for ecological receptors risk. For the calculation of ecological HQs for each Area, an Area specific AUF was used in estimating its ED to estimate an Area specific ecological HQ. A HQ of 1 or less generally means that a particular COC does not pose a significant risk to human health or ecological receptors.

HQs above one for human health were estimated as 1.07 for the Echo Bay target area DU and 16.84 for the Las Vegas Bay target area DU (**Appendix G**, Table G-5a and Table G-5b) indicating that lead does pose a significant risk for human health at these DUs.

For ecological receptors, HQs above one were estimated as 3.5 for the Echo Bay target Area DU, 36.8 and 1.58 for the Las Vegas Bay target area and firing line DUs, respectively, and 1.06 for the Temple Bar target area DU (**Appendix G**, Table G-5a, Table G-5b, and Table G-5c); indicating that lead does pose a significant ecological risk for at these locations. No ecological

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[18] When more than one COC is present, the hazard index (HI) is the cumulative non-cancer hazard of all detected compounds based on non-carcinogenic effects. Since lead is the only COC for the Site, the HQ is equal to the HI.

risk was identified at any of the DUs at Willow Beach, therefore it will not be further evaluated for removal action. Recommendations for Willow Beach will be presented in **Section 6**.

The estimated HQ (HI) greater than 1 (one) for human and ecological receptors for indicates that leaving the surface lead impacted soil associated bullet fragments in place at the DUs indentified above poses an unacceptable risk to the environment. Therefore it is recommended to perform removal action activities at the Echo Bay target area DU, the Las Vegas Bay target area and firing line DUs, and the Temple Bar target area DU.

3.0 REMOVAL ACTION OBJECTIVES & APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

3.1 REMOVAL ACTION OBJECTIVES

Removal action objectives (RAOs) have been developed based on analysis of the sources of contamination, the nature and extent of contamination, results of the human health and ecological risk evaluations, and the ARARs that have been identified. The RAOs have been developed to control the contamination sources and eliminate the potential for exposure of human and ecological receptors to Site contamination.

The RAO is to prevent or reduce the potential for human and ecological exposure (through inhalation, ingestion, and dermal contact) to lead in soil. The RAO applies to the following four DUs, in the specified order of priority, based on hazard quotient:

1. Las Vegas Bay Target Area and Firing Line,
2. Echo Bay Target Area, and
3. Temple Bar Target Area.

3.2 REMOVAL ACTION JUSTIFICATION

According to 40 CFR 300.415(b), a removal action is justified, if there is a threat to human health or the environment based on **one** or a combination of any of the eight factors listed below:

Table 3-1: Removal Action Justification

Factor	Site Condition	Justified
(1) Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances, pollutants, or contaminants.	Public access to soil containing concentrations of lead exists, though is limited in some areas by fencing. Animal populations have access to the soil. The Hazard Index for exposure to all metals for human health and for ecological receptors is greater than 1 at several locations (**Section 2.5.7**).	Yes

Factor	Site Condition	Justified
(2) Actual or potential contamination of drinking water supplies or sensitive ecosystems.	Population centers near the site derive potable water from site surface water sources (Lake Mead). Drinking water aquifers do not appear impacted by site contaminants. There are no sensitive ecosystems within LAKE (**Section 2.1.6**) near the four former firing range sites.	No
(3) Hazardous substances, pollutants, or contaminants in drums, barrels, tanks, or other bulk storage containers that may pose a threat of release.	No drums, barrels, tanks, or bulk storage containers on the Site.	No
(4) High levels of hazardous substances, pollutants, or contaminants in soils largely at, or near, the surface, that may migrate.	Concentrations of lead in soils subject to erosion and migration, although observations do not indicate significant migration has occurred.	Yes
(5) Weather conditions that may cause hazardous substances, pollutants, or contaminants to migrate or be released.	Sediment subject to erosion during wind, high flows, rain events, and snowmelt could cause waste material migration, although observations do not indicate significant migration has occurred.	Yes
(6) Threat of fire or explosion.	No flammable materials on the Site.	No
(7) The availability of other appropriate federal or state response mechanisms to respond to the release.	The site is on NPS-administered land and is being addressed under NPS CERCLA authority.	Yes
(8) Other situations or factors that may pose threats to public health or the environment.	None.	No

3.3 IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The NPS is responsible for the identification of potential Applicable or Relevant and Appropriate Requirements (ARARs) that pertain to any CERCLA removal action proposed for the Site. Section 121(d) of CERCLA requires that on-site remedial actions attain or waive Federal environmental ARARs, or more stringent State environmental ARARs, upon completion of the remedial action. The NCP also requires compliance with ARARs during remedial actions and during removal actions to the extent practicable. ARARs are identified on a site-by-site basis for all on-site response actions where CERCLA authority is the basis for cleanup.

ARARs are presented in three general categories in the following sections:

1. Chemical-specific: ARARs that pertain to handling or control of certain chemicals based on health concerns or risks.
2. Location-specific: ARARs that control activities based on the location such as wetlands, historic sites, or sensitive ecosystems
3. Action-specific: ARARs that govern discrete actions which may include the use of certain technologies for remedial actions or use of certain types of equipment during remedial actions.

The ARARs are ranked as either: 1) Applicable 2) Relevant and Appropriate 3) To Be Considered, or 4) Not an ARAR. Substantive portions of an ARAR may be Applicable or Relevant and Appropriate.

1. Applicable requirements are cleanup standards, standards of control, and other substantive requirements, criteria or limitations that specifically address a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances found at a CERCLA site.
2. Relevant and Appropriate requirements are cleanup standards, standards of control, and other substantive requirements, criteria, or limitations that, while not “applicable” to a hazardous substance, pollutant, contaminant, remedial action, location or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site and are well-suited to the particular site.
3. To Be Considered (TBC) are non-promulgated advisories or guidance regarding: 1) health effects information with a high degree of credibility; 2) technical information on how to perform or evaluate site investigations or response actions; or 3) policy.

3.3.1 Chemical-Specific ARARs

Table 3-2: Chemical-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
CHEMICAL-SPECIFIC : FEDERAL			
Clean Water Act Water Quality Standards	33 USC 1251-1387, Section 303(c)(2)(B) 40 CFR Section 440.40-440.45 40 CFR Part 131, Quality Criteria for Water 1976, 1980, 1986	Establishes health-based standards for public water systems (maximum contaminant levels) and sets goals for contaminants. Establishes Water Quality Criteria for discharges into surface water. The NPDES permit program regulates discharges into "waters of the United States" by establishing numeric limits for such discharge.	**Applicable**
Safe Drinking Water Act National Primary Drinking Water Regulations Maximum Contamination Levels National Secondary Drinking Water Regulations	40 USC 300 40 CFR Part 141, Subpart B, pursuant to 42 USC 300(g)(1) and 300(j)(9) 40 CFR Part 141, Subpart F, pursuant to 42 USC 300(g)(1) 40 CFR Part 143, Subpart B pursuant to 42 USC 300(g)(1) and 300(j)(9)	Establishes health-based standards for public water systems (maximum contaminant levels) and sets goals for contaminants.	**Applicable**
USEPA Ambient Water Quality Criteria (AWQC)	http://water.epa.gov/scitech/swguidance/standards/current/index.cfm Human Health Criteria Table Aquatic Life Criteria Table	The EPA's compilation of national recommended water quality criteria for the protection of aquatic life and human health in surface water for approximately 150 pollutants.	**Applicable**
USEPA Ecological Soil Screening Levels (Eco-SSL)	http://www.epa.gov/ecotox/ecossl	The Ecological Soil Screening Levels (Eco-SSLs) represent the collaborative effort of a workgroup consisting of federal, state, consulting, industry and academic participants led by the USEPA.	To Be Considered
USEPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Screening Benchmarks and Freshwater Sediment Screening Benchmarks	USEPA Region 3, Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks for Screening Contaminants of Potential Concern (ORNL, 1997)	The Region III BTAG Screening Benchmarks are values to be used for the evaluation of sampling data at Superfund sites. These values facilitate consistency in screening level ecological risk assessments.	To Be Considered

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
USEPA Region 9 Regional Screening Levels (Formerly PRGs) - "Industrial Soil Supporting"	USEPA Region 9 Regional Screening Levels (Formerly 2004 Preliminary PRGs) (November 2010) http://www.epa.gov/region9/superfund/prg/	Combine current USEPA toxicity values with standard exposure factors to estimate acceptable contaminant concentrations in different environmental media (soil, air, and water) that are protective of human health."	To Be Considered
USEPA Region 9 Regional Screening Levels (Formerly PRGs) - "Residential Soil Supporting"	USEPA Region 9 Regional Screening Levels (Formerly 2004 Preliminary PRGs) (November 2010) http://www.epa.gov/region9/superfund/prg/	Combine current USEPA toxicity values with standard exposure factors to estimate acceptable contaminant concentrations in different environmental media (soil, air, and water) that are protective of human health."	To Be Considered
CHEMICAL-SPECIFIC : STATE/LOCAL			
Arizona Clean Water Act Water Quality Standards for Surface Waters	A.A.C. R18-11-108 A.A.C. R18-11-109	Sets chemical-specific narrative and numeric surface water standards.	**Applicable**
Arizona Clean Water Act Aquifer Water Quality Standards	A.A.C. R18-11-405 A.A.C. R18-11-406	Sets chemical-specific narrative and numeric groundwater standards.	**Applicable**
Arizona Soil Remediation Standards	A.A.C. R18-7-205 (Appendix A)	Provides residential and non-residential soil remediation standards for remedial actions.	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Arizona Groundwater Protection Levels (Guidance)	A Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, 2006. Prepared by the ADEQ Leachability Working Group of the Cleanup Standards/Policy Task Force	Vadose and saturated zone fate and transport of inorganic chemicals, such as metals, are not adequately described by organic contaminant partitioning models such as the ADEQ model. Therefore, for inorganic chemicals, the Working Group adopted an approach which combines a simple groundwater mixing cell calculation and the theoretical "worst case" correlation between total metals in soil and the corresponding leachable fraction of those metals. The Minimum GPLs for inorganic chemicals are based on this worst-case scenario. The Minimum GPLs are conservative because of the assumption that all metal leaches to groundwater regardless of the depth to groundwater.	**Applicable**
Nevada Water Pollution Control Law - Standards for Water Quality	N.A.C. R445A.070 through 445A.2234	The critical elements of the Nevada Water Pollution Control Law in the development of the Water Quality Compliance Protocol are the provisions that prohibit the discharge of any pollutant to waters of the State from a point source without a permit (N.R.S. 445A.465), authorize the establishment of water quality standards (N.R.S. 445A.520), and the authority of the State to enforce federal regulations regarding non-point source discharges. It provides the statutory authority for all regulations adopted regarding water quality and as part of the protection of waters of the State.	**Applicable**
Nevada Water Pollution Control Law - Action Levels for Contaminated Sites	N.A.C. 445A.226 through 445A.22755	Establishes surface water, groundwater and soil action levels and remedial levels. Defers to the Federal Standards defined in the Code of Federal Regulations.	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Nevada LBCLs (guidance)	Soil to Groundwater Leaching Guidance, BMI Plant Sites and Common Areas Projects, Henderson, Nevada. January 16, 2010, NDEP.	Provides a rationale and methodology for further evaluation of the soil leaching to groundwater pathway using the soil-water partition (SWP) equation with site-specific parameters, unsaturated zone fate-and-transport models, and the synthetic precipitation leaching procedure (SPLP) (U.S. EPA, 1994) to develop leaching BCLs (LBCLs).	**Relevant and Appropriate**

3.3.2 Location-Specific ARARs

Table 3-3: Location-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
LOCATION-SPECIFIC : FEDERAL			
Endangered Species Act	316 USC § 1531 (h) through 1543 40 CFR Part 6.302 50 CFR Part 402	Act to protect habitat of endangered and threatened species. Activities may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat.	Substantive requirements are **Applicable**
Fish and Wildlife Coordination Act	16 USC 1251 661 et seq.; 40 CFR 6.302(g)	Requires consultation when Federal agency proposes or authorizes any modification of any stream or other water body to assure adequate protection of fish and wildlife resources.	**Relevant and Appropriate**
Historic Sites, Buildings, and Antiquities Act and Executive Order 11593	16 USC 461 et seq. 40 CFR Part 6.301	EPA is subject to the requirements of the Historic Sites Act of 1935, 16 U.S.C. 461 et seq., the National Historic Preservation Act of 1966, as amended, 16 U.S.C. 470 et seq., the Archaeological and Historic Preservation Act of 1974, 16 U.S.C. 469 et seq., and Executive Order 11593, entitled Protection and Enhancement of the Cultural Environment.	Substantive requirements are **Applicable**

Standard, Requirement, Criteria, or Limitation	**Citation**	**Description**	**ARAR**
National Environmental Policy Act	7 CFR 799 (1969) http://www.epa.gov/region9/nepa/	Section (102)(2) of NEPA requires all Federal agencies to give appropriate consideration to the environmental effects of their proposed actions. The Council on Environmental Quality regulations at 40 CFR 1507.3(b) identify those items which must be addressed in agency procedures.	Substantive requirements are **Applicable**
The Historic and Archeological Data Preservation Act of 1974	16 USC 469 40 CFR 6.301	Establishes procedures to provide for preservation of historical and archeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program.	Substantive requirements are **Applicable**
Migratory Bird Treaty Act	16 USC §§ 703 et seq.	Establishes federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the US Fish and Wildlife Service during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	**Applicable**
National Park Service Wilderness Resource Management General Policy - Minimum Tool Concept	Reference Manual RM 41: Wilderness Preservation and Management. Washington, D.C.: National Park Service. 1999. Section 6.3.6.1	This policy requires that any scientific activity determined to be necessary to accomplish an essential task must make use of the least intrusive tool, equipment, device, force, regulation, or practice to achieve the wilderness management objective.	**Applicable**
Protection of Wetlands Order, Executive Order 11990	40 CFR Part 6	Requires minimizing and avoiding adverse impacts to wetlands	**Relevant and Appropriate**
Native American Graves Protection and Repatriation Act	25 USC § 3001	Establishes the ownership of cultural items excavated or discovered on federal or tribal land.	**Applicable**
Floodplain Management	40 CFR §6.302(b) and 40 CFR Part 6, Appendix A §6(a)(1), (a)(3), and (a)(5)	Federal agencies are required to evaluate the potential effects of actions they may take in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	**Relevant and Appropriate**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Consultation and Coordination With Indian Tribal Governments	Executive Order 13175	Agencies shall respect Indian tribal self-government and sovereignty, honor tribal treaty and other rights, and strive to meet the responsibilities that arise from the unique legal relationship between the Federal Government and Indian tribal governments.	To Be Considered
Protection of Indian Sacred Sites	Executive Order 13007	Each executive branch agency with statutory or administrative responsibility for the management of Federal lands shall, as appropriate, promptly implement procedures for the purposes of carrying out the provisions of section 1 of this order, including, where practicable and appropriate, procedures to ensure reasonable notice is provided of proposed actions or land management policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites. In all actions pursuant to this section, agencies shall comply with the Executive memorandum of April 29, 1994, "Government-to-Government Relations with Native American Tribal Governments."	To Be Considered
LOCATION-SPECIFIC : STATE/LOCAL			
Arizona State Historic Preservation Office	Arizona Revised Statutes §41-861 through §41-864	Directs state agencies to preserve historic properties under their ownership or control; consider the use of historic properties for agency responsibilities; establish a program to locate, inventory, and nominate properties to the Arizona Register of Historic Places; insure that properties are not destroyed or substantially altered by state action or assistance; make appropriate documentation in accordance with State Historic Preservation Office (SHPO) standards if a property is destroyed or altered; and seek review and comment from the SHPO on agency plans.	**Applicable**

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Nevada Office of Historic Preservation	Nevada Administrative Code Chapter 383	Allows for the creation of Office of Historic Preservation (Office). Office compiles and maintains an inventory of cultural resources in Nevada, designates repositories for the materials that comprise the inventory, provides staff assistance to the Commission for Cultural Affairs of the Department of Tourism and Cultural Affairs, and incorporates the Comstock Historic District Commission within the Office. Protects cultural resources located on public land and discourages acts of vandalism and the unlawful sale and trade of artifacts, including, without limitation, archeological and paleontological materials.	**Applicable**
Wilderness Act	16 USC 1131-1136, et seq.	Provides legal definition of wilderness, provides protection for wilderness, restrains human influences so that ecosystems can change over time in their own way, prohibits permanent roads and commercial enterprises, except commercial services that may provide for recreational or other purposes of the Wilderness Act. Wilderness areas generally do not allow motorized equipment, motor vehicles, mechanical transport, temporary roads, permanent structures or installations.	To be considered

3.3.3 Action-Specific ARARs

Table 3-4: Action-Specific ARARs

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
ACTION-SPECIFIC : FEDERAL			
Clean Air Act National Primary and Secondary Ambient Air Quality Standards National Emission Standards for Hazardous Air Pollutants	42 USC 7409 40 CFR Part 50 40 CFR Part 61, Subparts N, O, P, pursuant to 42 USC 7412	Establish air quality levels that protect public health, sets standards for air emissions Regulates emissions of hazardous chemicals to the atmosphere	**Applicable** to consolidation, removal, or treatment
Clean Water Act National Pollutant Discharge Elimination System Effluent Limitations	33 USC 1342 Section 404 40 CFR Parts 122, 125 33 USC 131140 CFR Part 440	Requires permits for the discharge of pollutants from any point source into waters of the United States. Sets standards for discharge of treated effluent to waters of the United States	Substantive requirements are **Applicable**
Closure Criteria for Municipal Solid Waste Landfills	40 CFR Part 258.60 (a)(1-3)	Establishes design for caps.	**Applicable** to capping alternative
Comprehensive Environmental Response, Compensation, and Liability Act	CERCLA Section 121	Requires all remedial actions which result in any hazardous substance, pollutants, or contaminants remaining on the site be subject to Five-Year Review to evaluate the performance of the remedy.	**Applicable**
Hazardous Materials Transportation Act: Standards Applicable to Transport of Hazardous Materials	49 USC § 1801-1813 49 CFR Parts 10, 171-173 and 177	Requires placing, packaging, documentation for the movement of hazardous materials on public roadways.	**Applicable** if hazardous wastes are transported off-site

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Resource Conservation and Recovery Act	40 CFR Part 261, Subpart D	Defines wastes which are subject to regulation as hazardous wastes under 40 CFR Parts 262-265 and Parts 124, 270, and 271	**Applicable** if hazardous wastes are transported off-site
National Park Resource Protection, Public Use and Recreation	36 CFR Part 2	Provides general park use regulations.	**Applicable**
Solid Waste Disposal In Units of the National Park System	36 CFR Part 6	Regulates the disposal of solid waste within the National Park System. Solid wastes, include mining waste, which are defined in Section 6.7(a) as wastes from mining including but not limited to mining overburden, mining byproducts, solid waste from the extraction, processing and beneficiation of ores and minerals, drilling fluids, produced waters, and other wastes associated with exploration, development, or production of oil, natural gas or geothermal energy and any garbage, refuse or sludge associated with mining and mineral operations.	**Applicable** to consolidation.
Solid Waste Disposal Act as amended by the Resource Conservation and Recovery Act Standards Applicable to Transporters of Hazardous Waste	42 USC 6901, et seq. 40 CFR Part 263, pursuant to 42 USC 6923 40 CFR Part 264, pursuant to 42 USC 6924, 6925	Establishes standards for persons transporting hazardous waste within the US if the transportation requires a manifest under 40 CFR Part 262 Defines acceptable management standards for owners and operators of facilities that treat, store, or dispose of hazardous waste	**Applicable** if hazardous wastes are disposed of off-site

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
ACTION-SPECIFIC : STATE/LOCAL			
Arizona Remedial Action Requirements	A.R.S. §49-282.06 (A)(2)	Treatment of groundwater must be conducted in a way to provide for the maximum beneficial use of the waters of the state.	**Not Applicable**
Arizona Groundwater Management Act	A.R.S. §§45-454.01; 45-494, 45-495, 45-496, 45-600	The regulation exempts new well construction, withdrawal, treatment and injection wells at CERCLA sites from obtaining ADWR approval to extract groundwater, subject to compliance with certain substantive provisions.	**Not Applicable**
Arizona Aquifer Protection Program	A.A.C. R18-9-A301(A)(2) and R18-9-A301(B)	Permitting for all types of injection/discharges to groundwater.	**Not Applicable**
Surface Water Discharge in Arizona	A.A.C. R18-11-101 A.R.S. § 49-221:	Regulates discharges to surface water. As a general matter, groundwater is not considered waters of the United States and discharges to groundwater do not require AZPDES permits (require APP Permit, above). The exception to this rule is where a "hydrological connection" exists with a nearby surface water; in these cases, a discharger may be required to apply for an AZPDES permit.	**Applicable** if alternative could cause sediment transport
Arizona Aquifer Classification	A.R.S. § 49-224;	All aquifers in the state identified under § 9-222(A) and any other aquifers subsequently discovered are classified for drinking water protected use.	**Applicable** if solid waste is transported away from site

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Arizona Air Pollution Control Regulations	A.A.C. R18-2-101 et seq. A.R.S. §49-480	Ambient air quality standards are the maximum permissible levels for a contaminant in air.	**Applicable** to surface stabilization, stormwater run-off controls, and/or consolidation removal action alternatives.
Arizona Department of Environmental Quality General Permit for De Minimis Discharges to Waters of the United States #AZG2010-001; (Arizona Pollutant Discharge Elimination System-AZPDES)	A.A.C. R18-9-C905 Applicable in Arizona except for Indian Country as defined by Federal law (Title 18 USC §1151);	A general permit for discharge of low volume, relatively pollutant-free water, known as De Minimis discharges, to surface water under the Arizona Pollutant Discharge Elimination System (AZPDES) program. The De Minimis discharges covered under the permit must meet applicable surface water quality standards, are generally infrequent and must be managed to protect water quality and the environment.	**Applicable** if alternative involves de minimus discharges
Nevada Fugitive Dust Emissions Nevada Administrative Code Chapter 445.734	N.A.C. 445.734	Requires that the handling, transporting or storing of any material be performed in a manner which does not allow controllable particulate matter to become airborne. The excavation of contaminated soils will need to comply with this requirement.	Substantive requirements are **Applicable**
Nevada Division of Environmental Protection Clean Water Discharge General Permit for De Minimis Discharges #NVG201000 (National Pollutiant Discharge Elimination System - NPDES)	N.R.S. 445A.465 Applicable in Nevada except for Indian Country as defined by Federal law (Title 18 USC §1151);	The purpose of NVG201000 is to provide timely authorization for DeMinimis - clean water - discharges to Waters of the U.S. pursuant to Nevada Revise Statutes NRS 445A.465; this regulation prohibits discharge of pollutants from a point source without a permit.	**Applicable** if alternative involves de minimus discharges

Standard, Requirement, Criteria, or Limitation	Citation	Description	ARAR
Nevada Division of Environmental Protection Temporary Discharge Permits	N.R.S. 445A.485	The Nevada DEP may issue temporary permits for the discharge of pollutants or the injection of fluids through a well. Temporary permits are issued by NDEP for discharges when the discharges are expected to last between 48 hours and six months (180 days). Two types of temporary permits are issued in by NDEP: The Temporary Discharge to Waters of the State Permit and the Working in Waterways Temporary Permit (covers temporary working or routine maintenance in surface waters of the State such as channel clearing and minor repairs to intake structures).This permit is required before operating earthmoving equipment in any body of water.	**Not Applicable**

4.0 IDENTIFICATION AND SCREENING OF REMOVAL ACTION ALTERNATIVES

This section identifies and evaluates diverse, individual *technologies* that can help achieve RAOs. Typically, no single technology will achieve most or all RAOs. Therefore, complimentary technologies are assembled into groups to create *alternatives* for a more complete evaluation based on effectiveness, implementability, and cost.

4.1 IDENTIFICATION OF REMOVAL ACTION TECHNOLOGIES

Table 4-1 below identifies technology types and process options within the technologies generally capable of meeting RAOs to be considered for removal action alternatives.

Table 4-1: Removal Action Technologies

Removal Action Technology	Description
1. No Action	This action leaves contaminated materials in their current condition and assumes no further intervention will occur. No response activities or monitoring are associated with this technology. All evaluations of technologies must include "No Action" as a baseline for comparison to the other technologies.
2. Institutional Controls	Institutional controls restrict access to or control the use of a site. They include construction of barriers, installation of fences and gates, moats, warning signs, hostile vegetation, and designation of the lands in public records as a repository with use restrictions. Enforcement of such controls would require periodic inspections and patrols, as wells as legal action against violators. Institutional controls can protect against exposures affecting human health, but they generally do not protect against all ecological exposure.
Zoning	*Zoning would be implemented to control present and future land uses on or around waste and source areas consistent with the potential hazards present, the nature of removal action implemented, and future land-use patterns. The objective of zoning would be to prevent public or private misuse of waste and source areas that could jeopardize the effectiveness of removal action or pose an unacceptable potential for human exposure to the contaminants present in the waste and source areas.*
Deed Restrictions	*Deed restrictions would prevent the transfer of property without notification of limitations on the use of the property or requirements related to preservation and protection of the effectiveness of the implemented removal action alternative.*
Environmental Control Easements	*This is an enforceable easement mechanism for imposing restrictions on the use of a site and requiring performance of operations and maintenance activities that may help protect public health, safety, and welfare, and the environment.*

Removal Action Technology	**Description**
Access Restrictions	*Access restrictions typically include physical barriers, such as fencing, that could prevent both human and wildlife access to preclude exposure to waste contamination or structures; and to protect the integrity of the action. Fencing can be installed around the perimeter of waste and source areas to prevent human and some animal access (not avian or burrowing animals) to the areas. Posted warnings would identify the potential hazards present at the waste and source areas to deter trespass and misuse.*
3. Engineering Controls	Engineering controls are used primarily to reduce the mobility of, and exposure to, contaminants. These goals are accomplished by creating a barrier that prevents direct exposure and transport of waste from the contaminated source to the surrounding media. Engineering controls do not reduce the volume or toxicity of the hazardous material. Typical engineering controls for solid media include surface controls, containment, and on-site and off-site disposal.
Engineering Controls – *Surface Controls*	*This technology involves grading, re-vegetation, erosion controls, or soil binding to reduce the mobility of, and exposure to, contaminants.*
Grading	*Grading is the general term for techniques used to reshape the ground surface to reduce slopes, manage surface water infiltration and runoff, restore eroded areas, and aid in erosion control. The spreading and compaction steps used in grading are routine construction practices.*
Re-vegetation	*Re-vegetation means fostering native plant growth to reduce surface erosion. It involves adding soil amendments to the waste surface to provide nutrients, organic material, and neutralizing agents, and to improve the water storage capacity of the contaminated media, as necessary. Re-vegetation can provide an erosion-resistant cover that protects the ground surface from surface water and wind erosion and reduces net infiltration through the contaminated medium and can also reduce the potential for direct contact.*
Erosion Controls	*Erosion control and protection includes using erosion-resistant materials, such as mulch, natural or synthetic fabric mats, gabions, velocity breaks, drainage channels, ditches, trenches, and riprap to reduce the erosion potential at the surface of the contaminated medium. The erosion-resistant materials are placed in areas susceptible to wind or surface water erosion (concentrated flow or overland flow). Surface water diversion controls or stormwater management structures are designed to prevent surface water from contacting contaminated materials and to appropriately manage any water that contacts those materials despite controls.*
Soil Binder	*Application of a chemical soil binder involves adding proprietary soil amendments to the waste surface to bond the individual soil particles together and form a flexible "crust" that strengthens the surface of the soil resulting in enhanced stability to reduce dust and to prevent further erosion. This is normally a temporary measure.*
Engineering Controls – *Surface Containment*	*This technology involves covering the waste material (or consolidated waste material) to limit the potential for human and ecological exposure to the contaminants, and limit the potential for off-site migration via erosion or leaching. The capping configuration would be graded so that drainage would follow the natural contours of the area. Capping would also limit stormwater flow and infiltration and promote runoff away from the contaminated areas, thereby preventing the transport of contaminated sediments to surface water bodies.*

Removal Action Technology	**Description**
Engineering Controls – *On-Site Disposal (CAMU)*	*This technology involves excavation, relocation, and placement of the waste materials in an on-site consolidation waste pile, cell or repository to minimize its footprint and concentrate its mass in a single, manageable area designated as a Corrective Action Management Unit (CAMU). It is normally implemented in conjunction with other containment technologies. The CAMU would be specifically designed and constructed to contain the waste materials.*
Engineering Controls – *Off-site Disposal*	*This action involves relocation and placement of contaminated materials in an off-site commercial landfill facility in open cells in a manner determined by the facility operator. The facility would be responsible for compliance with all applicable regulations governing solid waste disposal.*
5. Ex-Situ Removal and Treatment	This technology involves removal of contaminated soil and waste and subsequent treatment through processes that chemically, physically, or thermally reduces contaminant toxicity and/or volume. Excavated areas are backfilled with clean soil, returned to original grade, if necessary, and re-vegetated or otherwise stabilized to prevent erosion. In the case of excavating waste piles, backfilling may not be necessary, but restoration should occur.
Ex-Situ Removal/Treatment – *Physical Treatments*	*Physical treatment processes use physical characteristics to concentrate constituents into a relatively small volume for disposal or further treatment. Chemical treatment processes act through the addition of a chemical reagent that removes or fixates the contaminants.*
Hand Raking and Screening	*This technology is generally most applicable for small sites and involves hand raking and sifting bullet fragments from the soil. This is a low- technology and low-cost management alternative for lead reclamation. Once the soil has been raked and collected, it is manually passed through a series of stacked vibrating screens (usually two screens) of different mesh sizes and allows the user to sift and gather the lead shot-containing soil.*
Mechanical Raking and Screening	*This technology involves mechanical raking and sifting bullet fragments from the soil. The screening machine utilizes a series of stacked vibrating screens (usually two screens) of different mesh sizes and allows the user to sift and gather the lead shot-containing soil.*

Removal Action Technology	**Description**
Mechanical Soil Washing	*Soil washing is the separation of soils into its constituent particles of gravel, sand, silt and clay. Because of the much higher surface area and surface binding properties of clay, most lead contaminants tend to adhere to the clay particles. Typically, the soils are first excavated from the range and then mixed into a water-based wash solution. The wet soil is then separated using either wet screening or gravity separation techniques. Water used in soil washing is from a closed loop system and should only be disposed at completion of cleanup. Experience shows the water to not be a RCRA regulated hazardous waste, therefore probably allowing disposal to a local wastewater treatment plant. There are three types of mechanical soil washing as follows:* • *Wet Screening - With this method, particles larger and smaller than the surrounding soils are passed through a series of large-mesh to small-mesh screens. Each time the mixture passes through a screen the volume of the soil mixture is reduced. Large particles such as lead shot/bullets and fragments are screened out of the soil/wash mixture early in the process and can be taken off-site for recycling - allowing the soil to be placed back on-site.* • *Gravity Separation - This technique can be used in cases where the lead particles are the same size as surrounding soil particles. The wet soil/wash mixture is passed through equipment, which allows the more dense materials (i.e., lead materials) to settle to the bottom of unit and separate out of the soil/wash mixture.* • *Pneumatic Separation - Pneumatic separation utilizes an air stream, and specific density analysis, to effectively separate the shot/bullets from the other shot/bullet sized material.*
Reprocessing	*Reprocessing involves excavating and transporting materials to an existing, off-site, permitted mill facility for processing and economic recovery of target metals.*
Ex-Situ Removal/Treatment – *Chemical Treatment*	*This technology involves utilizing chemical reagents to reduce contaminant mobility and/or volume.*
Chemical Soil Washing	*Acid extraction applies an acidic solution to the contaminated medium in a heap, vat, or agitated vessel. Depending on temperature, pressure, and acid concentration, varying quantities of the metal constituents present in the contaminated medium would solubilize. This is similar to the heap leaching process used by mills to extract metals from processed ore. It requires the construction of a double-lined impoundment with leachate collection and removal systems.*
Chemical Solidification	*Ex-Situ chemical solidification involves removing the soil (via excavation or vacuum methods) and mixed wastes with a binding agent, which is a substance that makes loose materials stick together. Common binding agents include cement, asphalt, fly ash, and clay. Water must be added to most mixtures for binding to occur; then the mixture is allowed to dry and harden to form a solid block.*

Removal Action Technology	Description
Chemical Stabilization	*Similar to chemical solidification, ex-situ chemical stabilization also involves removing the soil (via excavation or vacuum methods) and mixed wastes with binding agents. However, the binding agents also cause a chemical reaction with contaminants to make them less likely to be released into the environment. For example, when soil contaminated with metals is mixed with water and lime (a white powder produced from limestone) a reaction changes the metals into a form that will not dissolve in water.*
Ex-Situ Removal/Treatment – *Thermal Treatment*	*This technology involves removing the soil (via excavation or vacuum methods) and applying heat to volatilize and oxidize metals and render them amenable to additional processing. Potentially applicable moderate-temperature thermal processes, which volatilize metals and form metallic oxide particulates, include the fluidized bed reactor, the rotary kiln, and the multi-hearth kiln.*
6. *In-Situ* Treatment	Stabilization and fixation of the contamination in-place reduces the mobility of contaminants in soil. The treatment seeks to permanently trap or immobilize the contamination within the soil using non-hazardous chemical binders to prevent erosion.
Chemical Solidification	*In-Situ chemical solidification involves removing the soil (via excavation or vacuum methods) and mixed wastes with a binding agent, which is a substance that makes loose materials stick together. Common binding agents include cement, asphalt, fly ash, and clay. Water must be added to most mixtures for binding to occur; then the mixture is allowed to dry and harden to form a solid block.*
Chemical Stabilization	*Similar to chemical solidification, in-situ chemical stabilization also involves removing the soil (via excavation or vacuum methods) and mixing wastes with binding agents. However, the binding agents also cause a chemical reaction with contaminants to make them less likely to be released into the environment. For example, when soil contaminated with metals is mixed with water and lime (a white powder produced from limestone) a reaction changes the metals into a form that will not dissolve in water.*
Thermal Treatment	*In-situ vitrification is a process used to melt contaminated solid media in-situ to immobilize metals into a glass-like, inert, non-leachable solid matrix.*

4.2 SCREENING OF REMOVAL ACTION TECHNOLOGIES

An evaluation of each response technology was performed to determine whether it would meet RAOs and ARARs. A summary of selected technologies is presented in **Table 4-2** showing the selection factors identified during the screening process.

Table 4-2: Removal Action Technology Screening

Removal Action Technology	Site Specific Screening Evaluation
1. No Action	Although No Action will not meet the RAOs, it is used as a baseline against other alternatives measured. For this reason, and because a No Action is required according to EPA guidance, it is retained for further evaluation as a Removal Action Alternative.
3. Engineering Controls - Chemical Stabilization	Chemical stabilization would help to meet the RAOs when employed in conjunction with other removal action technologies. The chemical stabilization process uses non-hazardous chemical binders to reduce the hazard potential of a waste by converting the contaminants into less soluble, mobile, or toxic forms. The treated soils contain stable metal-reagent compounds that eliminate the leaching of metals. The reagent can be applied in a wet or dry form and can be used to stabilize metals *in situ*. The most significant challenge in applying chemical stabilization *in situ* for contaminated soils is achieving complete and uniform mixing of the binder with the contaminated matrix. This technology requires access for large heavy construction equipment.
4. Institutional Controls	Land use restrictions would be necessary to prevent future activities that are inconsistent with the human health and ecological risk assessment's exposure pathway assumptions. Due to the remoteness of the Site, enforcement of ICs would be difficult, but not impossible. Additional fencing would prevent human trespassers but not ecological exposure or off-site migration of the contamination. Therefore, ICs would likely need to accompany another technology to adequately meet RAOs and ARARs. ICs can augment technologies such as capping and storm water controls to ensure that future construction projects do not disrupt or disturb them.
5. Engineering Controls – On-Site Disposal (CAMU)	Relocation of contaminated materials to one or more consolidation areas would eliminate the unchecked migration of contaminants when employed in conjunction with other removal action technologies to meet RAOs and ARARs. An on-site CAMU would reduce the waste volume's area and the potential for exposure to receptors and storm water runoff, and therefore the risk to humans and ecological receptors. This approach may require access for medium size vehicles and semi-heavy equipment.
6. Capping	Capping of contaminated materials (either in place or in a CAMU) would meet RAOs and ARARs when employed in conjunction with other removal action technologies to address areas where capping would not be technologically feasible or otherwise cost-effective. This approach requires access for large vehicles and heavy equipment.
7. Mechanical Soil Washing	Mechanical soil washing would help to meet the RAOs when employed in conjunction with other removal action technologies. Mechanical soil washing activities should be concentrated at the surface layer. The proposed alternative would use a combination of gravity and pneumatic separation. • Gravity separation would remove lead particles that are the same size as surrounding soil particles. • Pneumatic separation would effectively separate the shot/bullets from the other shot/bullet sized material. Once collected, the lead must be taken to a recycler or reused.

Removal Action Technology	Site Specific Screening Evaluation
8. Excavation	Excavation would meet RAOs and ARARs when applied with another technology to address the end use/disposal of the excavated contaminated materials. This approach may require access for medium size vehicles and semi-heavy equipment.
9. Off-site Disposal	Transportation of contaminated materials to an offsite disposal facility would meet RAOs and ARARs. However, this approach is often costly and simply transfers the problem to another location. It may require multiple truckloads transported over a long distance without a significant carbon footprint based on diesel emissions. Soil would require disposal at either a non-hazardous landfill or a hazardous waste landfill, depending on the concentrations of lead present in soil leachate derived from the Toxicity Characteristic Leaching Procedure (TCLP). If the lead in the TCLP leachate measures 5 milligrams per liter (mg/L) or higher, the soil is a toxicity characteristic RCRA waste requiring disposal at a hazardous waste landfill. This waste will have to comply with RCRA land disposal restrictions, which means treatment prior to disposal to reduce TCLP concentrations below 5 mg/L. Any soil sample that exhibits 100 mg/kg or more total lead can exceed 5 mg/L in TCLP leachate, if 100% of the lead dissolves during the leaching process. All decision units requiring a removal action exhibit lead exceeding 100 mg/kg. The South Yuma County landfill in Yuma, Arizona is a viable alternative for CERCLA-approved disposal of non-hazardous wastes. The U.S. Ecology hazardous waste landfill in Beatty, Nevada can accept soil that exceeds the RCRA hazardous waste threshold. This approach may require roadway access to accommodate mid-size dump trucks.

4.3 ASSEMBLY OF REMOVAL ACTION ALTERNATIVES

The removal action technologies described in the preceding section were assembled into four Removal Action Alternatives, which have been analyzed with respect to the evaluation criteria (RAOs and ARARs). These alternatives have been developed based on the known nature and extent of soil contamination and results of the risk evaluation.

- Alternative 1 – No Action
- Alternative 2 – Excavation, On-Site Disposal, Capping and Institutional Controls
- Alternative 3 – Excavation, Mechanical Soil Washing, Chemical Stabilization and Soil Replacement to Site
- Alternative 4 – Excavation and Off-Site Disposal (with optional Chemical Stabilization)

Section 5.0 presents an evaluation of these alternatives.

5.0 EVALUATION OF REMOVAL ACTION ALTERNATIVES

According to the USEPA's *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA* (USEPA, 1993), the efficacy of a removal action should be evaluated based on:

- I. Effectiveness:
  1. Protective of Public Health and the Community (Protectiveness)
  2. Protective of Workers During Implementation
  3. Protective of the Environment
  4. Compliance with ARARs
  5. Achievement of RAOs
  6. Level of Containment Expected
  7. Reduction or Elimination of Residual Concerns
- II. Implementability:
  1. Technical Feasibility
     - a. Availability of Equipment
     - b. Availability of Services
     - c. Site Accessibility
     - d. Availability of Laboratory Testing Capacity
     - e. Can be Implemented in One Year
  2. Administrative and Legal Feasibility
     - a. Acquisition of Permits Required for Offsite Work
     - b. Acquisition of Permits Required for Site Work
     - c. Acquisition of Easement or Rights-of-Way Required
     - d. Impact on Adjoining Property
     - e. Ability to Impose Institutional Controls
  3. Ease of Implementation
     - a. Regulatory Acceptance
     - b. Community Acceptance
- III. Cost:
  1. Capital Cost
  2. Post Removal Site Control Cost
  3. Long-Term Maintenance and Monitoring (O&M) Costs
  4. Present Worth Cost/Present Value

In accordance with EPA guidance (EPA 1993a, 2000), engineering costs are estimates within plus 50 to minus 30 percent of the actual, expected project cost (based on year 2014 dollars). Cost estimates were prepared in accordance with EPA guidelines (EPA 2000) using engineer's estimates, historical costs for similar projects, and vendor budgetary quotes. Changes in the cost elements are likely as new information and data collected during the removal action design become available. The present worth of each removal action alternative provides the basis for the cost comparison. The present worth cost represents the amount of money that, if invested in the initial year of the removal action at a given interest rate (this EE/CA uses a 3 percent discount rate, the historical average rate for a 30-year T-bill), would provide the funds required to make future payments to cover all costs associated with the removal action over its planned life. Inflation and depreciation were not considered in preparing the present worth costs. Tables H-2a through H-4c present detailed cost estimate spreadsheets for applicable sites under each alternative. Assumptions used in preparing the cost estimate spreadsheets are also provided in **Appendix H** by applicable site under each alternative.

Estimated costs relied on several assumptions regarding site conditions and are based on conceptual design only. The estimated costs are intended for alternative comparison only and are not suitable for construction bidding purposes in the absence of an approved design. Assumptions made in preparing the cost estimate include:

- Prior to removal action planning, archeological surveys of the four former firing ranges shall be completed by NPS.
- Site access road reconstruction or improvement will not be needed.
- A temporary staging area can be established at each former firing range site.
- No borrow pits will be established within LAKE. All cap material for on-site repositories or excavation backfill (if needed) would be imported from outside the park to meet NPS' minimum tool requirement.
- An archeological resource specialist will be present during site activities; however, no limitations to excavation, such as artifact removal, have been assumed.
- Post-removal action O&M monitoring of the site will be required to monitor the removal action effectiveness and compliance with the ARARs.

The following sections present an evaluation of each of the Removal Action Alternatives. These sections address all four former firing range sites in broad, general terms based on their many similarities. However, all sites involve unique characteristics as well. These may include waste volumes, costs, presence of cultural resources, site access, the availability of space for stockpiling wastes or constructing a repository, and the presence of dry washes. A comparative analysis of alternatives (**Section 5.5**) addresses these finer points at the individual firing ranges as well as the broader issues in **Table 5-1**.

5.1 ALTERNATIVE 1: NO ACTION

The No Action Alternative leaves contaminated materials at each former firing range site in their current condition and assumes no further intervention will occur. Under the No Action Alternative, no response activities or monitoring would occur at the Site as a baseline for comparison to the other alternatives.

5.1.1 Effectiveness of Alternative 1

The following subsections evaluate the effectiveness of a proposed No Action Alternative, as demonstrated by environmental conditions that would exist, if a removal action were not implemented.

5.1.1.1 Protectiveness

The No Action Alternative would not protect human health or the environment because it would not address lead which present an environmental risk. Conditions would not change on the site, and human health, ecology, and wildlife would remain at risk.

5.1.1.2 Compliance with ARARs

The No Action Alternative would not enforce complete compliance with ARARs because it does not address a number of human health, ecological, historical, and archaeological requirements from the ARARs listed on **Tables 3-2 through 3-4**; however it would meet National Park Service Wilderness Resource Management General Policy - Minimum Tool Concept.

5.1.1.3 Ability to Achieve RAOs

The No Action Alternative would not achieve the RAOs, since it would not prevent or reduce human or ecological exposure to lead in soil. Human health and ecological risks would persist.

5.1.1.4 Level of Treatment/Containment Expected

The No Action Alternative provides no containment or treatment options.

5.1.1.5 Reduction or Elimination of Residual Concerns

The No Action Alternative does not reduce the risk to human health or ecological receptors through ingestion, inhalation, and dermal contact pathways. The toxicity, mobility and volume of contaminants would not be reduced under this alternative.

5.1.2 Feasibility/Implementability of Alternative 1

5.1.2.1 Technical Feasibility

The No Action Alternative is technically implementable. This alternative requires no onsite equipment, onsite personnel or services, nor does it require laboratory testing.

5.1.2.2 Administrative and Legal Feasibility

The No Action Alternative is administratively feasible, and the availability of resources would not be an issue. Alternative 1 requires no acquisition of permits for offsite work, requires no acquisition of easements or rights-of-way, and requires no institutional controls.

5.1.2.3 Ease of Implementation

There is no implementation process associated with the No Action Alternative.

Regulatory acceptance is unlikely because this alternative does not achieve RAOs and ARARs. Community acceptance is unknown, but it is unlikely the community would accept this alternative.

5.1.3 Cost of Alternative 1

There are no capital costs or operation and maintenance costs associated with the No Action Alternative. However, there may be significant long-term costs associated with future impacts or releases. There may also be non-monetary costs associated with ecological impacts to ecological receptors.

5.2 ALTERNATIVE 2: EXCAVATION, ON-SITE DISPOSAL, CAPPING AND INSTITUTIONAL CONTROLS

Due to the remoteness of the four former firing range sites, the evaluation of on-site consolidation and capping was conducted separately for each site. However, Echo Bay and Las Vegas Bay could be combined because of their proximity and location in Nevada. Presented estimated costs do not directly account for this approach, since an engineering design would be required to assess final waste volumes and capping areas.

Alternative 2 will consist of the following components.

Documentation

This alternative would require minor engineering designs, construction management, health and safety plans. Contacts with appropriate agencies and tribes regarding historical and cultural resources and potential cultural items, remains, and funerary objects could be required.

A biological and botanical resource inventory report prepared by NPS concluding that the project would not impact sensitive species would be required before design and construction. In addition, a historical and cultural resources survey report prepared by NPS concluding that the project would not impact these resources would be required before design and construction.

Leaching Considerations for Corrective Action Management Unit

Based on collected groundwater samples, the lead detected in contaminated surface soil at the four former firing range sites does not leach to groundwater.

On-site Consolidation

Alternative 2 consists of creating an on-site repository or CAMU. The top 12 inches of soil would be excavated at four decision units. Approximately 1,141 cubic yards of lead-impacted soil will be excavated, transported and consolidated to a single on-site repository for each DU. Impacted soil would be disposed of into a new repository located outside areas of rapid geologic change unless designed and constructed to preclude failure, outside the 100-year flood plain, and not within 200 feet of Holocene faults. A new repository could be subject to the liner and Leachate Collection and Removal System (LCRS) requirements. However, the unit should qualify for a variance and would not require a bottom liner or LCRS due to the minimal precipitation and because groundwater is deep below the ground surface at the four former firing ranges. In addition, because leaching to groundwater is not a complete pathway (see the conceptual site model in **Figures 2-6 and 2-7**), a geosynthetic clay liner (GCL) and other cover components required in the regulations would not be necessary for this site.

Fugitive dust emissions would be eliminated by laying down water spray during excavation and soil operations, and will conform to applicable EPA regulations for earth-moving activities in non-contaminated areas.

Confirmation Sampling

Following the removal and placement of the contaminated material in the consolidation cell(s), confirmation sampling would verify removal of lead to the extent practicable. Confirmation samples would be collected for lead analysis. Once confirmation sampling shows that lead concentrations are below risk criteria designated for the project, capping and restoration activities would be completed.

Capping and Restoration

Requirements for CAMUs are identified at 40 CFR, Subpart S, § 264.552. Liner and LCRS requirements would not apply.

The CAMU cap will consist of 2 feet of native or imported clean fill compacted to 90 percent relative density followed by 1 foot of native or imported riprap and well graded gravel to limit erosion of the cover and discourage burrowing animals. The cap would be graded to promote drainage away from the CAMU.

The small depression left by excavated soil will be re-graded to direct surface water into natural channels and drainages. The disturbed area would be re-graded for positive drainage, and then vegetated with native species as soon as practicable to minimize construction-related sediment transport. Post removal site control (operations and maintenance) would consist of minor erosion repair to the channel systems.

Engineering Controls

Alternative 2 requires the majority of the contaminated materials to be consolidated and covered. Engineering controls would involve watershed diversion ditches uphill of the repository.

Institutional Controls

Periodic site visits would be conducted to monitor the integrity of the engineering controls and to perform repairs and maintenance activities as necessary. Park planning and engineering records would require update and a planning process should be implemented to ensure that no future ground disturbance occurs at the repositories.

5.2.1 Effectiveness of Alternative 2

The following subsections evaluate the effectiveness of Alternative 2 based on the environmental conditions that would exist, if such actions and/or controls were implemented.

5.2.1.1 Protectiveness

Alternative 2 would remove the majority source of contamination, limit infiltration of precipitation and surface water and prevent human and environmental exposure to contaminated soil. This alternative would reduce potential human and ecological exposure to lead-contaminated material from a site through consolidation and containment of lead impacted soil from all source areas, reducing erosion and transport of lead-contaminated material down a wash, and preventing wind erosion of the lead-contaminated material.

Access restrictions would deter public access to the site and physical hazards. Periodic inspections would be necessary to ensure the repository cover, surface controls, access restrictions, and warning signs remain intact over the long term.

This alternative would not reduce lead toxicity or volume of contaminated soil. However, risk associated with ingestion, dermal adsorption, and inhalation of lead would be reduced primarily through excavation, consolidation, and containment in one area. Although the presence of lead-contaminated material would remain unchanged, future activities at the site would be generally unencumbered except in the consolidation area. Protection of ecological receptors would also occur through containment and use of a rip-rap within the cover to discourage burrowing animals.

5.2.1.2 Compliance with ARARs

Alternative 2 would comply with chemical and location ARARs but will not comply with action specific ARARs related to 36 CFR condition §6.4(a)(2) that must be met before a new solid waste disposal site may be authorized in a National Park:

> *"There is no reasonable alternative site outside the boundaries of the unit suitable for solid waste disposal"*

Use of the smallest equipment practicable would address the National Park Service Wilderness Resource Management General Policy - Minimum Tool Concept. No borrow pits will be established within LAKE and all cap material will be imported, thus minimizing impact to sensitive ecosystems.

5.2.1.3 Ability to Achieve RAOs

Alternative 2 meets all RAOs, with explanations and minor exceptions noted:

- Minimize human and ecological exposure (through inhalation, ingestion, and dermal contact) to lead impacted soil;

  Alternative 2 meets this ARAR by reducing exposure and/or eliminating exposure in the areas where contaminated material is completely removed and by blocking exposure to human receptors and reducing exposure to ecological receptors. The potential for ecological exposure is not eliminated due to the ability for burrowing animals to enter the consolidation areas. A special precaution was addressed by placing a rip-rap cap to deter burrowing animals. Total protection of ecological receptors is not possible because background lead levels already exceed the ecological, risk-based screening levels at Las Vegas Bay and at Willow Beach former firing ranges. Alternative 2 still protects ecological receptors better than Alternative 1.

5.2.1.4 Level of Treatment/Containment Expected

No treatment is proposed with this alternative. Containment occurs by capping. A high level of containment, with the use of institutional controls in conjunction with the design of the consolidation cell, can be expected with proper maintenance.

5.2.1.5 Reduction or Elimination of Residual Concerns

Residual concerns are reduced considerably by excavation of the contaminated material and reducing the areal size of contamination.

5.2.2 Feasibility/Implementability of Alternative 2

The following sections provide an evaluation of the feasibility and implementability of Alternative 2.

5.2.2.1 Technical Feasibility

Grading construction requires the use of heavy equipment. Controlling fugitive dust emissions and stormwater discharge (if generated) during grading and construction would be required. Long-term monitoring and maintenance would be required, especially inspection and repair of repository caps.

Design methods, construction practices, and engineering requirements for installation of the components of repositories are well documented and understood. The availability of equipment, personnel and services, and obtaining a laboratory would not present any foreseeable obstacle to the technical feasibility of this alternative.

5.2.2.2 Administrative and Legal Feasibility

Alternative 2 is not legally or administratively feasible as it doesn't comply with 36 CFR condition §6.4(a)(2) which establishes that only if there is no reasonable alternative site outside the boundaries of the unit suitable for solid waste disposal a new solid waste disposal site may be authorized in a National Park.

5.2.2.3 Ease of Implementation

Alternative 2 is more difficult to implement than alternative 1 presented herein, due to the requirement of heavy machinery and site disturbance required to complete the task.

Regulatory acceptance is unlikely with Alternative 2 because it doesn't achieve all ARARs. Community acceptance is unknown at this time but will be determined during the EE/CA Report public comment period. It is likely the community would accept this alternative as protective.

5.2.3 Cost of Alternative 2

The costs for Alternative 2 have been evaluated in detail based on the evaluation criteria listed in Alternative 2 under this section. A complete break-out of costs is provided in **Appendix H**. Tables H-2a through H-2d provide a detailed summary of the costs for each former firing range site. Alternative 2 costs exceed those of Alternatives 3 and 4.

5.3 ALTERNATIVE 3: EXCAVATION, MECHANICAL SOIL WASHING, CHEMICAL STABILIZATION AND SOIL REPLACEMENT TO SITE

Alternative 3 will consist of the following components.

Documentation

This alternative would require minor engineering designs, construction management, health and safety plans. Contacts with appropriate agencies and tribes regarding historical and cultural resources and potential cultural items, remains, and funerary objects could be required.

A biological and botanical resource inventory report prepared by NPS concluding that the project would not impact sensitive species would be required before implementation. In addition, a historical and cultural resources survey report prepared by NPS concluding that the project would not impact these resources would be required before implementation.

Leaching Considerations for Soil Replacement to Site

Based on collected groundwater samples, the lead detected in contaminated surface soil at the four former firing range sites does not leach to groundwater.

Mechanical Soil Washing

Alternative 3 includes Mechanical Soil Washing the shallow soil at the impacted areas for the removal of lead particles from projectiles used during shooting practice.

Once collected, the lead must be taken to a recycler or reused.

The process would consist of the separation of soils into gravel, sand, silt and clay particles. No water will be used in the proposed mechanical soil washing at any of the sites. The soils would be excavated from the firing range and separated using gravity and pneumatic separation techniques. Gravity separation would be used in cases where the lead particles are the same size as surrounding soil particles. The soil mixture would be passed through equipment, which would allow the more dense materials (*i.e.*, lead bullet fragments) to settle to the bottom of the unit and be separated out of the soil mixture. Pneumatic separation utilizes an air stream, and specific density analysis, to effectively separate the shot/bullets from the other shot/bullet sized material.

Fugitive dust emissions would be eliminated by laying down water spray during separation operations, and will conform to applicable EPA regulations for earth-moving activities in non-contaminated areas.

Chemical Stabilization

Following the removal of the lead particles from the contaminated soil, chemical stabilization will be performed on the remaining soil. Chemical stabilization would reduce potential human and ecological exposure to lead-contaminated material. Chemical stabilization, or chemical treatment as it is often referred to, uses reagents added to the contaminated soils to form less soluble compounds while controlling pH in a range of minimum solubility.

Confirmation Sampling

Following the removal of the lead contaminated soil for chemical stabilization, confirmation sampling would verify removal of lead to the extent practicable. Confirmation samples would be collected for lead analysis. Once confirmation sampling shows that lead concentrations are below risk criteria designated for the project, restoration activities would be completed.

Soil Replacement and Restoration

The small depression left by excavated soil will be backfill with the chemically treated soil and re-graded to direct surface water into natural channels and drainages. The disturbed area would be re-graded for positive drainage, and then vegetated with native species as soon as practicable to minimize construction-related sediment transport. Post removal site control (operations and maintenance) would consist of minor erosion repair to the channel systems.

Engineering Controls

Alternative 3 requires the majority of the contaminated materials to be chemically treated and replaced on-site. Engineering controls would involve re-grading of the area for positive drainage.

Institutional Controls

Workers would be instructed to avoid contact with surface water, when present. Periodic site visits would be conducted to monitor the integrity of the engineering controls and to perform repairs and maintenance activities as necessary. Park planning and engineering records would require update and a planning process should be implemented to ensure that no future ground disturbance occurs at the sites.

5.3.1 Effectiveness of Alternative 3

The following subsections evaluate the effectiveness of Alternative 3 based on the environmental conditions that would exist, if such actions and/or controls were implemented.

5.3.1.1 Protectiveness

Alternative 3 would remove the majority source of contamination and stabilized the remaining impacted soil, limit infiltration of precipitation and surface water and prevent human and environmental exposure to contaminated soil. This alternative would reduce potential human and ecological exposure to lead-contaminated material from a site through chemical stabilization of lead impacted soil from all source areas.

Access restrictions would deter public access to the site and physical hazards. Periodic inspections would be necessary to ensure surface controls, access restrictions, and warning signs remain intact over a short term until the stabilization process is proved safe.

This alternative would reduce lead toxicity and volume of contaminated soil. Although the presence of lead-contaminated material would remain unchanged, future activities at the site would be generally unencumbered due to the stabilization process. Protection of ecological receptors would also occur through containment and use of a rip-rap within the cover to discourage burrowing animals.

Surface water is ephemeral and groundwater is not used at the site, so no change in exposure would occur.

5.3.1.2 Compliance with ARARs

Alternative 3 would comply with chemical and location ARARs but will not comply with action specific ARARs related to 36 CFR condition §6.4(a)(2) that must be met before a new solid waste disposal site may be authorized in a National Park:

> *"There is no reasonable alternative site outside the boundaries of the unit suitable for solid waste disposal"*

Use of the smallest equipment practicable would address the National Park Service Wilderness Resource Management General Policy - Minimum Tool Concept. No borrow pits will be established within LAKE, thus minimizing impact to sensitive ecosystems.

5.3.1.3 Ability to Achieve RAOs

Alternative 3 meets all RAOs, with explanations and minor exceptions noted:

- Minimize human and ecological exposure (through inhalation, ingestion, and dermal contact) to lead impacted soil;

Alternative 3 meets this ARAR by reducing exposure and/or eliminating exposure in the areas where contaminated material is stabilized and by blocking exposure to human receptors and reducing exposure to ecological receptors. The potential for ecological exposure is not eliminated due to the ability for burrowing animals to enter the remediated areas. Total protection of ecological receptors is not possible because background lead levels already exceed the ecological, risk-based screening levels at Las Vegas Bay and at Willow Beach former firing ranges. Alternative 3 still protects ecological receptors better than Alternative 1 and it is similar to Alternative 2.

5.3.1.4 Level of Treatment/Containment Expected

Most of the lead impacted soil will be treated via chemical stabilization providing a form of fixation to prevent exposure. A high level of containment, with the use of institutional controls, can be expected with proper maintenance.

5.3.1.5 Reduction or Elimination of Residual Concerns

Residual concerns are reduced considerably by stabilization of the contaminated material.

5.3.2 Feasibility/Implementability of Alternative 3

The following sections provide an evaluation of the feasibility and implementability of Alternative 3.

5.3.2.1 Technical Feasibility

Application of the chemical stabilization reagent requires the use of heavy equipment for proper mixing with the impacted soil. Controlling fugitive dust emissions and stormwater discharge (if generated) during implementation would be required. Short-term monitoring would be required, especially sampling of run-off water sediment near the sites.

Implementation methods and practices, and engineering requirements for the implementation of chemical stabilization are well documented and understood. The availability of equipment, personnel and services, and obtaining a laboratory would not present any foreseeable obstacle to the technical feasibility of this alternative.

5.3.2.2 Administrative and Legal Feasibility

Alternative 3 is not legally or administratively feasible as it doesn’t comply with 36 CFR condition §6.4(a)(2) which establishes that only if there is no reasonable alternative site outside the boundaries of the unit suitable for solid waste disposal a new solid waste disposal site may be authorized in a National Park. The chemically stabilized soil may be interpreted as a solid waste disposal area.

5.3.2.3 Ease of Implementation

Alternative 3 is more difficult to implement than alternative 1 and similar to Alternative 2 presented herein, due to the requirement of heavy machinery and site disturbance required to complete the task.

Regulatory acceptance is unlikely with Alternative 3 because it doesn't achieve all ARARs. Community acceptance is unknown at this time but will be determined during the EE/CA Report public comment period. It is likely the community would accept this alternative as protective.

5.3.3 Cost of Alternative 3

The costs for Alternative 3 have been evaluated in detail based on the evaluation criteria listed in Alternative 3 under this section. A complete break-out of costs is provided in **Appendix H**. Tables H-3a through H-3d provide a detailed summary of the costs for each former firing range site. Alternative 3 is less costly than Alternative 2 but more costly than Alternative 4.

5.4 ALTERNATIVE 4: EXCAVATION AND OFF-SITE DISPOSAL (WITH OPTIONAL CHEMICAL STABILIZATION)

Alternative 4 will consist of the following components.

Documentation

Documentation requirements and limitations described in Alternatives 2 and 3 are applicable to Alternative 4.

Excavation

Alternative 4 would involve excavating and removing the top 12 inches of lead-contaminated soil from source areas at four decision units and grading the excavation areas. The total excavation volume is expected to be 1,141 cubic yards. Appropriate storm water pollution prevention measures such as drainage swales, sediment ponds, or silt fencing will be incorporated into the project to minimize the potential for adverse impacts to water quality during construction and excavation activities. Fugitive dust emissions will be eliminated by laying down water spray during excavation and soil operations, and will conform to the applicable EPA regulations for earth-moving activities in non-contaminated areas. Backfilling is not necessary.

Off Site Disposal

Assuming each truck can haul 18 cubic yards, the 1,141 cubic yards of soil will require a total of 64 truckloads. Department of Transportation (DOT) waste management regulations apply to the transport of excavated soil to its final disposal site(s). This is an applicable ARAR which must be addressed if any solid waste is transported away from site. The disposal site must also comply with RCRA. This approach transfers the contamination to a new location, albeit more secure.

Confirmation Sampling

Following the removal of the contaminated material from each area, confirmation sampling would verify that contamination was fully removed to the extent practicable. Confirmation samples would be collected for lead. Once confirmation sampling shows that lead concentrations meet the removal action objectives designated for the project at each site, restoration activities would be completed.

Restoration Activities

The depressions left by excavated materials must be re-graded to direct surface water into natural channels and drainages. All disturbed areas would be re-graded for positive drainage, and then vegetated with native species, to the extent practicable and as soon as practicable to minimize construction-related sediment transport.

Institutional Controls

No institutional controls are necessary.

Chemical Stabilization

For any areas with TCLP lead concentration values that would make the removed soil a RCRA Hazardous Waste for off-site disposal purposes (at or above 5 mg/L in TCLP extract), chemical stabilization could be performed to reduce landfill disposal fees. Chemical stabilization uses reagents such as ECOBOND® added to the contaminated soils to form less soluble compounds while controlling pH in a range of minimum solubility. Because less soluble compounds are formed, stabilized waste is often considered more protective of groundwater and can be transported and disposed as a non-hazardous waste.

5.4.1 Effectiveness of Alternative 4

The following subsections evaluate the effectiveness of Alternative 4 as demonstrated by environmental conditions that would exist, if such actions were implemented.

5.4.1.1 Protectiveness

This alternative provides the highest possible level of environmental protection at the level of the immediate former firing range site. The complete removal of lead impacted soil from the currently exposed, uncontrolled environment to a permitted facility eliminates the on-site potential for human and/or ecological exposure through inhalation, ingestion, and dermal contact.

The hauling operations would not be confined to NPS property, and the hauling distance to the landfill poses a limited potential exposure to the public. Special care would be taken to assure trucks are decontaminated before leaving each site and that truck covers prevent wind-blown dust.

The off-site commercial landfill alternative has the highest level of long-term effectiveness, as the landfill would have a post-closure monitoring and maintenance period of 30 years or longer and will have site security, environmental monitoring, maintenance requirements, and other systems required of a commercial facility.

At the global sustainability level, this alternative involves the use of dump trucks for transporting contaminated material to an off-site landfill. It will create greenhouse gas (GHG) emissions.

5.4.1.2 Compliance with ARARs

Alternative 4 addresses all ARARs, except the introduction of GHG emissions due to transportation.

5.4.1.3 Ability to Achieve RAOs

Alternative 4 would meet all site RAOs, as follows:

- Minimize human and ecological exposure (through inhalation, ingestion, and dermal contact) to lead in impacted soils.

5.4.1.4 Level of Treatment/Containment Expected

Alternative 4 would provide nearly 100% containment of the known areas of lead contaminated soil at each former firing range site through excavation and off-site disposal. An extremely high level of containment can be expected at the off-site disposal facility.

5.4.1.5 Reduction or Elimination of Residual Concerns

This alternative is considered permanent, and is thus effective in both the short-term and long-term. This alternative will almost completely eliminate residual concerns at the four former firing range sites.

5.4.2 Feasibility/Implementability of Alternative 4

The following sections provide an evaluation of the feasibility and implementability of Alternative 4.

5.4.2.1 Technical Feasibility

Application of the chemical stabilization reagent, when needed, requires the use of heavy equipment for proper mixing with the impacted soil. Controlling fugitive dust emissions and stormwater discharge (if generated) during implementation would be required.

The necessary equipment, personnel, and laboratory services for excavating and transporting the waste are available to support implementation of this removal action.

5.4.2.2 Administrative and Legal Feasibility

Alternative 4 is both legally and administratively feasible. Off-site permits could be required for truck hauling outside the park or for traffic control during transport and disposal.

Waste profiling documentation would be required and disposal manifests or bills of landing would accompany waste during transportation.

NPS would conduct a historical and cultural resources survey for each site to identify all resources, resources that cannot be disturbed or that must be restored after excavation, and features that are not a resource requiring protection or mitigation.

5.4.2.3 Ease of Implementation

A low level of operational requirements, including excavation, consolidation, grading, and the transport of waste, would be incurred with Alternative 4. No major difficulties should be experienced in carrying out hauling scenario.

Regulatory acceptance is likely with Alternative 4 because it meets RAOs. Community acceptance is unknown at this time but will be determined during the EE/CA Report public comment period. The community would probably accept this alternative as protective, but they may object to highway congestion by waste haulers. If the dispatch of the 64 trucks for all three firing ranges can be phased, then the transportation impacts could be negligible.

5.4.3 Cost of Alternative 4

The costs for Alternative 4 have been evaluated in detail based on the evaluation criteria listed in Alternative 4 under this section. A complete break-out of costs is provided in **Appendix H**.

Tables H-4a through H-4c provide a detailed summary of the costs for each former firing range site. Alternative 4 is less costly than Alternatives 2 and 3.

5.5 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Table 5-1 summarizes the removal action alternatives and ranks the alternatives from most likely to least likely to achieve all of the RAOs and ARARs.

Table 5-1: Comparative Analysis of Removal Action Alternatives

EVALUATION CRITERIA	**ALTERNATIVE 1** NO ACTION	**ALTERNATIVE 2** ON-SITE CONSOLIDATION AND CAPPING	**ALTERNATIVE 3** CHEMICAL STABILIZATION AND SOIL REPLACEMENT	**ALTERNATIVE 4** EXCAVATION AND OFF-SITE DISPOSAL
EFFECTIVENESS	Does not achieve any ARARs or any RAOs	Achieves most ARARs and all RAOs	Achieves most ARARs and all RAOs	Achieves all ARARs and all RAOs
Protective of Public Health and Community	No	Yes	Yes	Yes
Protective of Workers During Implementation	Not Applicable	Yes, with proper health and safety plan implemented	Yes, with proper health and safety plan implemented	Yes, with proper health and safety plan implemented
Protective of the Environment	No	Yes, with continued maintenance of the cap	Yes	Yes
Complies with All ARARs	No	No	No	Yes
Achieves All RAOs	No	Yes	Yes	Yes
Level of Containment Expected	None	High level of containment requires proper maintenance	High level of containment requires proper monitoring	High level of containment. Maintenance at landfill only
Reduction or Elimination of Residual Concerns	None	Low; Residual concerns remain in maintaining cap	Low; Residual concerns remain in monitoring soil	High
IMPLEMENTABILITY	Easy to Implement; Not Administratively Feasible	Difficult to implement but feasible	Moderate to implement; Feasible	Moderate to implement; Feasible
Equipment Availability	None Required	Available	Available	Available

EVALUATION CRITERIA	**ALTERNATIVE 1** NO ACTION	**ALTERNATIVE 2** ON-SITE CONSOLIDATION AND CAPPING	**ALTERNATIVE 3** CHEMICAL STABILIZATION AND SOIL REPLACEMENT	**ALTERNATIVE 4** EXCAVATION AND OFF-SITE DISPOSAL
Services Availability	None Required	Available	Available	Available
Site Accessibility	None Required	Accessible	Accessible	Accessible
Availability of Laboratory Testing Capacity	None Required	Available	Available	Available
Off-site Treatment and Disposal Capacity	None Required	None Required	None Required	Available
Can Be Implemented in One Year	Yes	Yes, barring any significant consultation periods for NPS or other ARAR-related administration	Yes, barring any significant consultation periods for NPS or other ARAR-related administration	Yes, barring any significant consultation periods for NPS or other ARAR-related administration
Administrative and Legal Feasibility: Acquisition of Permits for Off-site Work	Not Applicable	Not Applicable	Not Applicable	Commercial landfill disposal profile required
Administrative and Legal Feasibility: Acquisition of Permits for Site Work	Not Applicable	Permits not required but substantive ecological; requirements are applicable	Permits not required but substantive ecological; requirements are applicable	Permits not required
Administrative and Legal Feasibility: Acquisition of Easement or Rights-of-Way	Not Applicable	Available	Available	Available
Administrative and Legal Feasibility: Impact on Adjoining Property	None	Low; Construction activities may impact off-site from truck traffic;	Low; Construction activities may impact off-site from truck traffic;	Low; Construction activities may impact off-site from truck traffic;

EVALUATION CRITERIA	**ALTERNATIVE 1** NO ACTION	**ALTERNATIVE 2** ON-SITE CONSOLIDATION AND CAPPING	**ALTERNATIVE 3** CHEMICAL STABILIZATION AND SOIL REPLACEMENT	**ALTERNATIVE 4** EXCAVATION AND OFF-SITE DISPOSAL
Administrative and Legal Feasibility: Ability to Impose Institutional Controls	Not Applicable	Recommended ICs are implementable	Recommended ICs are implementable	Not Applicable
Ease of Implementation: Regulatory Acceptance	Unlikely	Unlikely; Does not meet all ARARs	Unlikely; Does not meet all ARARs	Likely; Involves little truck hauling
Ease of Implementation: Community Acceptance	Unlikely	Unknown until public comment period	Unknown until public comment period	Likely; Creates insignificant disturbance
COST	No Capital, Monitoring, or Post-Removal Costs	Range below includes Capital, Monitoring, & Post-Removal Costs	Range below includes Capital, Monitoring, & Post-Removal Costs	Range below includes Capital. No Post Removal Costs Required
Echo Bay Former Firing Range Present Worth Cost / Present Value				
Cost Estimate	$0	$517,000	$218,000	$176,000
Low End Cost Estimate (-30%)	$0	$362,000	$153,000	$123,000
High End Cost Estimate (+50%)	$0	$775,000	$327,000	$264,000
Las Vegas Bay Former Firing Range Present Worth Cost / Present Value				
Cost Estimate	$0	$562,000	$292,000	$233,000
Low End Cost Estimate (-30%)	$0	$394,000	$205,000	$163,000
High End Cost Estimate (+50%)	$0	$843,000	$438,000	$349,000

EVALUATION CRITERIA	**ALTERNATIVE 1** NO ACTION	**ALTERNATIVE 2** ON-SITE CONSOLIDATION AND CAPPING	**ALTERNATIVE 3** CHEMICAL STABILIZATION AND SOIL REPLACEMENT	**ALTERNATIVE 4** EXCAVATION AND OFF-SITE DISPOSAL
Temple Bar Former Firing Range Present Worth Cost / Present Value				
Cost Estimate	$0	$494,000	$170,000	$139,000
Low End Cost Estimate (-30%)	$0	$346,000	$119,000	$97,000
High End Cost Estimate (+50%)	$0	$741,000	$254,000	$208,000

EVALUATION CRITERIA	ALTERNATIVE 1 NO ACTION	ALTERNATIVE 2 ON-SITE CONSOLIDATION AND CAPPING	ALTERNATIVE 3 CHEMICAL STABILIZATION AND SOIL REPLACEMENT	ALTERNATIVE 4 EXCAVATION AND OFF-SITE DISPOSAL
COST	No Capital, Monitoring, or Post-Removal Costs	Range below includes Capital, Monitoring, & Post-Removal Costs	Range below includes Capital, Monitoring, & Post-Removal Costs	Range below includes Capital. No Post Removal Costs Required
Total for Four Former Firing Ranges Present Worth Cost / Present Value				
Cost Estimate	$0	$1,573,000	$680,000	$548,000
Low End Cost Estimate (-30%)	$0	$1,102,000	$477,000	$383,000
High End Cost Estimate (+50%)	$0	$2,359,000	$1,019,000	$821,000

Notes:

ARAR: Applicable or Relevant and Appropriate Requirement
IC = Institutional Control (i.e.: fencing, signage, deed restriction)
RAO = Removal action objective
Green = Effective, implementable
Yellow = Effective, difficult to implement
Red = Ineffective, difficult to implement

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 RECOMMENDED REMOVAL ACTION ALTERNATIVE

Table 6-1 summarizes the recommended Alternative for three of the four Former Firing Range sites, as based on the results of the streamline risk assessment Willow Beach Former Firing Range site does not require removal action.

Alternative 2 would isolate and contain the wastes in repositories, thus eliminating exposure to human and ecological receptors as well as protect water resources; however, repositories require ongoing operations, maintenance, and monitoring (OM&M) to remain effective and construction of repositories within the boundaries of a national park is not in compliance with place specific ARARs.

Alternative 3 would stabilize the lead within the soil eliminating exposure to human and ecological receptors as well as protect water resources, however the lead would remain in the soil and some short term monitoring would be required to ensure that the stabilization process is working properly.

Alternative 4, excavation and off-site disposal, will best meet the evaluation criteria for the three Former Firing Ranges in which would be implemented. Alternative 4 is the most protective of human health, ecological, and water resources at LAKE and is less costly than Alternatives 2 and similarly costly to Alternative 3.

Table 6-1: Removal Action Alternative Selection for Four Former Firing Range Sites

Site Name	Selected Alternative	Effectiveness	Feasibility/ Implementability	Total Value = Capital Cost Plus Present Value of OM&M
Echo Bay	Alternative 4: Excavate, Transport and Dispose	Achieves ARARs. Achieves RAOs	Feasible and Implementable	$176,000
Las Vegas Bay	Alternative 4: Excavate, Transport and Dispose	Achieves ARARs. Achieves RAOs	Feasible and Implementable	$233,000
Temple Bar	Alternative 4: Excavate, Transport and Dispose	Achieves ARARs. Achieves RAOs	Feasible and Implementable	$139,000
Willow Beach	No Removal Action Required Based on Streamlined Risk Assessment	Achieves ARARs. Achieves RAOs	Feasible and Implementable	$0

NPS should consider investigating the overshot area at Las Vegas Bay to determine if additional impacts exist south of the target area. ECM and others (Baker, 2005) observed bullets and bullet fragments covering an extensive area south of the target area DU.

In accordance with Best Management practices for small firing ranges (USEPA, 2005b), NPS may wish to perform Raking and Screening activities or other lead removal practices for firing ranges at the Target Area of Willow Beach Former Firing Range site to remove the projectile fragments present in that area.

6.2 REMOVAL SCHEDULE

The NPS has determined that a non-time-critical removal action is appropriate at the Site. After completion of the EE/CA Report, NPS must complete an Action Memorandum. Following issuance of the Action Memorandum, NPS must secure congressional funding for the removal action. After receipt of funding, NPS will need to prepare a removal design and may need to contract the design implementation separately. A more detailed schedule can be developed once congressional funding has been secured, most likely no sooner than fiscal year 2016.

Congressional funding may not be allocated in large enough amounts to conduct all removal actions at once. If funding is only available incrementally, then the firing ranges should be addressed in the following order of priority:

1. Las Vegas Bay Target Area and Firing Line,
2. Echo Bay Target Area, and
3. Temple Bar Target Area.

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APPENDIX A

APPROVAL MEMORANDUM

United States Department of the Interior

NATIONAL PARK SERVICE
Lake Mead National Recreation Area
601 Nevada Way
Boulder City, NV 89005

IN REPLY REFER TO:

D20 (8361)

November 15, 2011

To: Regional Director, Pacific West Region

From: for Superintendent, Lake Mead National Recreation Area

Through: Stephen J. Mitchell, PE, NPS/PWR/FM, Operations/Environmental Program Lead

Subject: Engineering Evaluation & Cost Analysis Approval Memorandum
Four Former Firing Ranges at Lake Mead National Recreation Area

Purpose

This memorandum recommends and documents the decision of the National Park Service (NPS) to conduct an Engineering Evaluation/Cost Analysis (EE/CA) pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), 42 U.S.C. §§ 9601 *et seq.*, for four former firing ranges (Site) at Lake Mead National Recreation Area (LAKE), Nevada and Arizona. NPS is the CERCLA lead agency with authority to respond to the release or threatened release of hazardous substances at or from the Site. This Memorandum was prepared in accordance with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300, and the U.S. Environmental Protection Agency's (EPA) *Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA*, OSWER Publication 9360.0-32 (August 1993).

Background

Established in 1964, LAKE offers many types of recreation including boating, fishing, water skiing, and swimming. Lake Mead and Lake Mohave make up LAKE. Lake Mead, which is the largest man-made lake and reservoir in the United States, is located on the Colorado River about 30 miles southeast of Las Vegas, Nevada, in the states of Nevada and Arizona. Formed by water impounded by Hoover Dam, which was completed in 1935, Lake Mead extends 110 miles behind the dam. The water held in Lake Mead is released via aqueducts to communities in southern California and Nevada. Lake Mohave, a 67-mile stretch of the Colorado River below the Hoover Dam, is impounded by Davis Dam. Lake Mohave captures and delays the discharge of flash floods from side washes below Hoover Dam.

In 2007, Michael Baker Jr., Inc. (Baker) completed preliminary assessment/site inspections[1] (PA/SIs) at six Environmental and Disposal Liability[2] (EDL) firing range sites, four Locations of Concern (LOC)

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[1] Michael Baker Jr., Inc. 2009, *Final Preliminary Assessment and Site Inspection Report, Lake Mead National Recreation Area, Boulder City, Nevada*, July.

[2] United States Department of Interior, 2008. *Environmental and Disposal Liabilities Identification,*

In 2007, Michael Baker Jr., Inc. (Baker) completed preliminary assessment/site inspections[1] (PA/SIs) at six Environmental and Disposal Liability[2] (EDL) firing range sites, four Locations of Concern (LOC) landfill/dump sites, and one LOC former mine site within LAKE. In response to NPS requests, an additional seven potential LOC sites (five landfills, one surface dumping area, and one firing range) were observed during the field reconnaissance. The scope of the PA/SI[3] sampling was limited to berm and drainage areas, and background soils at the former firing range sites. Approximately 30 samples were collected from surface soil less than 1 foot depth and analyzed for Target Analyte List (TAL) total lead and Toxicity Characteristic Leaching Procedure (TCLP) lead. No samples were collected at the Las Vegas Bay firing range because it was active at the time of the PA/SI. The field sampling activities and analytical results were used to recommend further activities at the sites, if warranted. Lead was detected at concentrations that exceeded ecological and human health screening level criteria (SLC) at three locations:

Echo Bay,

Temple Bar, and

Willow Beach.

Exceedances of the screening levels indicate that additional information is necessary to determine background concentrations and, if appropriate, to develop proposed action levels (PALs) for the Site[4]. Because the Katherine Landing Firing Range is currently active, NPS will conduct future site characterization work at the firing range and nearby mine site separately from this NTCRA.

NPS has reviewed all available Site information and concluded that the PA/SI did not completely characterize the nature and extent of contamination for purposes of conducting a NTCRA. Further, NPS has determined that a non-time-critical removal action should be undertaken to address the known and potential threats to public health, welfare, and the environment at the Site. To address gaps in the characterization of contamination at the Site and to develop and to evaluate removal action alternatives in accordance with CERCLA and the NCP, this Memorandum recommends that NPS conduct an EE/CA at the Echo Bay, Temple Bar, Willow Beach, and Las Vegas Bay former firing ranges.

USE OF REMOVAL ACTION AUTHORITY

Pursuant to Sections 104(a)(1) and (b)(1) of CERCLA, 42 U.S.C. §§ 9604(a)(1) and (b)(1), whenever there is a release or substantial threat of a release of a hazardous substance into the environment, the President is authorized to act, consistent with the NCP, to remove or arrange for the removal of such hazardous substance or take any other response action, including appropriate investigations, deemed necessary to protect public health or welfare or the environment. Section 104(a) and (b) response authority (including the authority to perform a Non-Time-Critical Removal Action, including the EE/CA that is the subject of this Memorandum) has been delegated to the Secretary of the Department of the Interior (DOI) pursuant to Executive Order 12580, 52 Fed. Reg. 2923 (1987), and further delegated to NPS by

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[1] Michael Baker Jr., Inc. 2009, *Final Preliminary Assessment and Site Inspection Report, Lake Mead National Recreation Area, Boulder City, Nevada*, July.

[2] United States Department of Interior, 2008. *Environmental and Disposal Liabilities Identification, Documentation and Reporting Handbook v2.0*, December.

[3] Michael Baker Jr., Inc. 2009, *Final Preliminary Assessment and Site Inspection Report, Lake Mead National Recreation Area, Boulder City, Nevada*, July.

[4] Under CERCLA, a removal action is not required for levels below background concentrations.

DOI Departmental Manual Part 207, Chapter 7, with respect to property under the jurisdiction, custody; or control of NPS.
Section 300.415(b)(2) of the NCP establishes the criteria for determining the appropriateness of a removal action. The following are applicable criteria that support the determination to consider a removal action at the Site:

> Actual or potential exposure to nearby human populations, animals, or the food chain from hazardous substances or pollutants or contaminants;
>
> Actual or potential contamination of drinking water supplies or sensitive ecosystems;
>
> High levels of hazardous substances or pollutants or contaminants in soils largely at or near the surface, that may migrate; and
>
> Weather conditions that may cause hazardous substances or pollutants or contaminants to migrate or be released.

As summarized above, the results of the 2007 investigation indicated lead, a CERCLA hazardous substance, was present at elevated concentrations in the surface soils at three former firing ranges, Echo Bay, Temple Bar, and Willow Beach. Because no samples were collected at Las Vegas Bay, the site represents a gap in the characterization.

Units of the National Park System are considered sensitive ecosystems. See, *e.g.*, National Park Service Organic Act, 16 U.S.C. § 1 (National Park System units shall be managed "to conserve the scenery and the natural and historic objects and the wildlife therein and to provide f01' the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations.").

The sites are located within or adjacent to wash channels that direct surface flow into Lake Mead or into the Colorado River. Hazardous substances may have migrated, and remain susceptible to continued migration, due to precipitation.

Based upon these considerations, NPS has determined that the use of removal action authority at four former firing range Sites to investigate, abate, prevent, minimize, stabilize, mitigate, and/or eliminate the release or threat of release of hazardous substances at or from the Site is appropriate. Additionally, NPS has determined that a planning period of at least six months exists before on-Site activities must be initiated. Therefore, NPS is authorized to conduct an EE/CA (or its equivalent) pursuant to and in accordance with Section 300.415(b)(4) of the NCP. An EE/CA is performed to determine the nature and extent of contamination, assess potential risks posed to human and ecological receptors from exposure to such contamination identify and evaluate removal action alternatives to address unacceptable risk, and identify a recommended removal action alternative that best meets the evaluation criteria.

EE/CA IMPLEMENTATION AND FUNDING

NPS has received funding from the DOI Central Hazardous Materials Fund (CHF) to implement the Site EE/CA. Upon approval of the recommendation, the Site EE/CA will be implemented.

APPROVAL

Based upon the information and analysis presented in this memorandum, please indicate your concurrence on non-concurrence with the recommendation to perform an EE/CA as part of a NTCRA at the four inactive firing range sites identified herein and located within LAKE. If you have any questions, please contact Mike Moran at (702) 293-8705.

I Concur
______________________________ Date: 12/13/12

for Christine S. Lehnertz
National Park Service
Director, Pacific West Region

I Do Not Concur
______________________________ Date: ______________

Christine S. Lehnertz
National Park Service
Director, Pacific West Region

APPENDIX B

INDIVIDUAL FORMER FIRING RANGE SITE DESCRIPTIONS, FIGURES, AND PHOTOGRAPHS

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Figure B-1: Site Features at the Echo Bay Former Firing Range Site
Figure B-2: Site Features at the Las Vegas Bay Former Firing Range Site
Figure B-3: Site Features at the Temple Bar Former Firing Range Site
Figure B-4: Site Features at the Willow Beach Former Firing Range Site

ATTACHMENT

EE/CA Investigation Photographic Log

1.0 OVERALL SITE DESCRIPTIONS

In 2007, Baker conducted Preliminary Assessments and Site Inspections (PA/SIs) on six Environmental and Disposal Liability (EDL) firing range sites, four Locations of Concern (LOC) landfill/dump sites, one LOC former mine site, and seven potential LOC sites (five landfills, one surface dumping area, and one firing range) within LAKE. The PA/SIs provided a site history, technical review, current status, and recommendations, as necessary, for each site. Additionally, the report presented information and data obtained during the site reconnaissance and investigation field activities including a summary of the field sampling activities and analytical results gathered from the select firing range locations. Based on this information, recommendations were made in deciding whether further activities at selected sites were warranted[1] (Baker 2009). Historical site information including land use for each of the four former firing range sites from the PA/SI is summarized here. Additional historical information from other sources, where available, supplements the research conducted during the PA/SIs.

1.1 ECHO BAY FORMER FIRING RANGE

1.1.1 Location

Echo Bay is located on the western side of the Overton Arm section of Lake Mead in Nevada, can be accessed from Northshore Road (**Figure B-1**). The former firing range is located on the east side of Echo Bay Airport Road, approximately 0.7 mile from the intersection with Echo Bay Road. The Echo Bay former firing range site is located in the north half of the northeast quarter of Section 2, Township 19 South, Range 67 East, of the USGS 7.5-minute Echo Bay topographic quadrangle.

1.1.2 Current and Historical Land Use

The firing range, which was closed around 1993, was reported to have been minimally used by only NPS personnel. Numerous lead slugs and fragments were observed directly behind the suspected target area and south of the target area suggesting primary and secondary impact areas.

A northeasterly flowing wash drainage area is located to the north and adjacent to the range. Drainage located at the toe of the natural hill backstop flows into the wash drainage area. The wash drainage meanders in a northeast direction for approximately 2 miles before entering the Overton Arm section of Lake Mead (closest body of water).

Currently, the site has no known use.

1.1.3 Cultural Resources

The remaining range features consist of:

---

[1] Michael Baker Jr., Inc. (Baker). 2009. “Final Preliminary Assessment and Site Inspection Report, Lake Mead National Recreation Area, Boulder City, Nevada.” July.

- a natural hill backstop (primary and secondary impact areas);
- a firing range debris pile consisting of wood timbers, metal poles, and cable;
- plywood suspected of being a former target; and
- ground surface depressions suspected to be the backfilled holes of the former 25-, 50-, and 75-yard timber/pole markers

1.2 LAS VEGAS BAY FORMER FIRING RANGE

1.2.1 Location

Las Vegas Bay is located on the west side of Lake Mead (Nevada) and Boulder Basin off of Lakeshore Scenic Drive. The firing range is located adjacent to two sewage disposal ponds, and is approximately 750 feet west/southwest of the Las Vegas Bay Ranger Station and approximately 300 feet south of Lake Shore Road on a dirt road that accesses the firing range from the east (**Figure B-2**). The entrance to the firing range and the sewage disposal ponds is located west and adjacent to the firing range, and is cordoned off with a locked fence. The firing range and the sewage disposal ponds are completely fenced.

The former firing range is located in the Section 19, Township 21 South, Range 64 East, of the U.S. Geological Survey (USGS) 7.5-minute Boulder Beach topographic quadrangle.

1.2.2 Current and Historical Land Use

The firing range, which was reportedly opened in 1974, is bounded to the north, east and south by a man-made berm. The west side of the range is bounded by a natural hillside. The sewage disposal ponds are located on the top of this hillside. The old target area located adjacent to the eastern man-made berm was the primary target prior to 1992. The man-made berm area has reportedly not been regraded in the last 32 years. The majority of the man-made berm and a portion of the natural hillside is impacted by lead. NPS reported that lead bullets were visible 400 meters (1,310 feet) down range (south) of the current target area and that there is a potential, based on the trajectory of the standard caliber fired, for there to be lead 600 meters (1,970 feet) down range possibly reaching the BMI Aqueduct and the future River Mountain Loop Trail. Prior to closing November 1, 2007, the firing range was reported to be used approximately 10 days out of every quarter by the NPS and Las Vegas City Police Department.

The only site drainage features observed during the site reconnaissance were drainage channels flanking the impact berm, flowing northward (**Figure B-2**). Additionally, a drainage feature is located down gradient and east of the firing range. This drainage feature flows north/northeasterly for approximately 770 feet to a culvert beneath Lakeshore Road. From the culvert at Lakeshore Road, the drainage feature flows east for approximately 0.7 mile to the Boulder Basin portion of Lake Mead (closest body of water).

Currently, the site appears to be used for storage.

1.2.3 Cultural Resources

Site features include:

- six firing positions at the 25-yard and 50-yard marks, a 100-yard mark area
- a six-target area
- old target area
- site trailer
- picnic tables, two dumpsters, and two portable toilets
- monitoring well

1.3 TEMPLE BAR FORMER FIRING RANGE

1.3.1 Location

Temple Bar is located on the southern side of the Temple Basin section of Lake Mead in Arizona and can be accessed on Temple Bar Road (27 miles northeast from Route 93). The former firing range (**Figure B-3**) is located 1,700 feet northwest of the Temple Bar sewage disposal ponds and can be accessed off of Temple Bar Road (0.9 mile) by a dirt road that leads to the sewage disposal ponds and to well pump house #4. The dirt road leading to the former firing range is locked to prevent access to the sewage disposal ponds and well pump house #4.

The Temple Bar former firing range is located in the Section 32, Township 31 North, Range 19 West, of the USGS 7.5-minute Temple/Senate Mountain NE topographic quadrangle.

1.3.2 Current and Historical Land Use

There is no available historical information for the Temple Bar former firing range. The firing range, which has been inactive for many years (closed circa 1993), was reported to have been minimally used by only NPS personnel.

Drainage features at the site include northeasterly flowing swale along the toe of the natural hill backstop and the northeasterly flowing wash channel, in which the range is located. The wash channel flows for approximately 2,000 feet to the Temple Basin portion of Lake Mead (closest body of water).

The former firing range is located in a wash channel area and a water well pump house (well # 4) is located 540 feet southeast of the target area.

Currently, the site has no known use.

1.3.3 Cultural Resources

The remaining range features consist of:

- a natural hill backstop;
- two targets; and
- one 25-yard post and two 50-yard posts.

1.4 WILLOW BEACH FORMER FIRING RANGE

1.4.1 Location

Willow Beach is located approximately 14 miles south of Hoover Dam on the eastern side of the Colorado River in Arizona and 3.5 miles west off of Highway 93 on Willow Beach Road. The former firing range (**Figure B-4**) is located approximately 0.8 mile southeast of the Willow Beach Resort and approximately 500 feet south of Willow Beach Road. The site is accessed via a 300-foot dirt road off of Willow Beach Road that accesses the former landfill from the northwest. The former firing range is located along a wash channel approximately 300 feet south of the Willow Beach former landfill.

The Willow Beach Firing Range Site is located in the Section 33, Township 29 North, Range 22 West, of the USGS 7.5-Minute Willow Beach topographic quadrangle.

1.4.2 Current and Historical Land Use

The firing range, which has been inactive for many years, was reported to have been minimally used by only NPS personnel. The range reportedly had one or two targets and barricades.

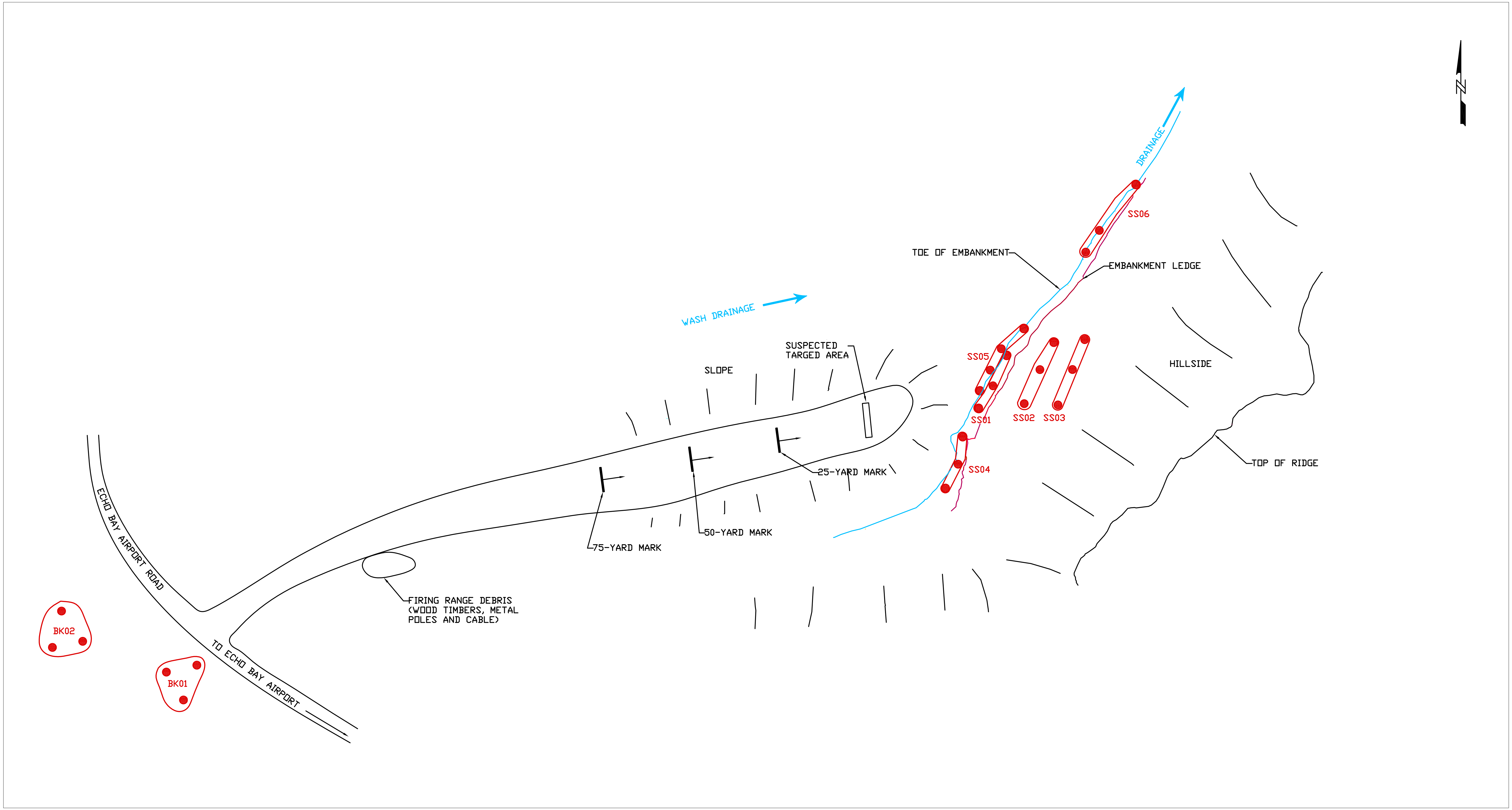
The former firing range is located in a wash channel area. Drainage features at the site include north flowing drainage from the side of the berm area and in front of the berm. The wash channel flows northwest for approximately 0.9 mile to the Colorado River (closest body of water).

Currently, the site has no known use.

1.4.3 Cultural Resources

Currently, the only remaining range feature is a natural hillside that had been cut to create a berm area.

Figures



ORIGINAL DRAWING SOURCE: BAKER, FIG 7-3
SITE FEATURES AND SOIL SAMPLE LOCATION
MAP, DATED: APRIL 2007

LEGEND

- ● SURFACE SOIL SAMPLE LOCATION
- ⬭ COMPOSITED SOIL SAMPLES
- 〰 DRAINAGE FEATURES

Note: Site features from Baker, Final Preliminary Assessment and Site Inspection Report, Lake Mead National Recreation Area, Boulder City, Nevada. July 2009.

40 0 80
1"=80'

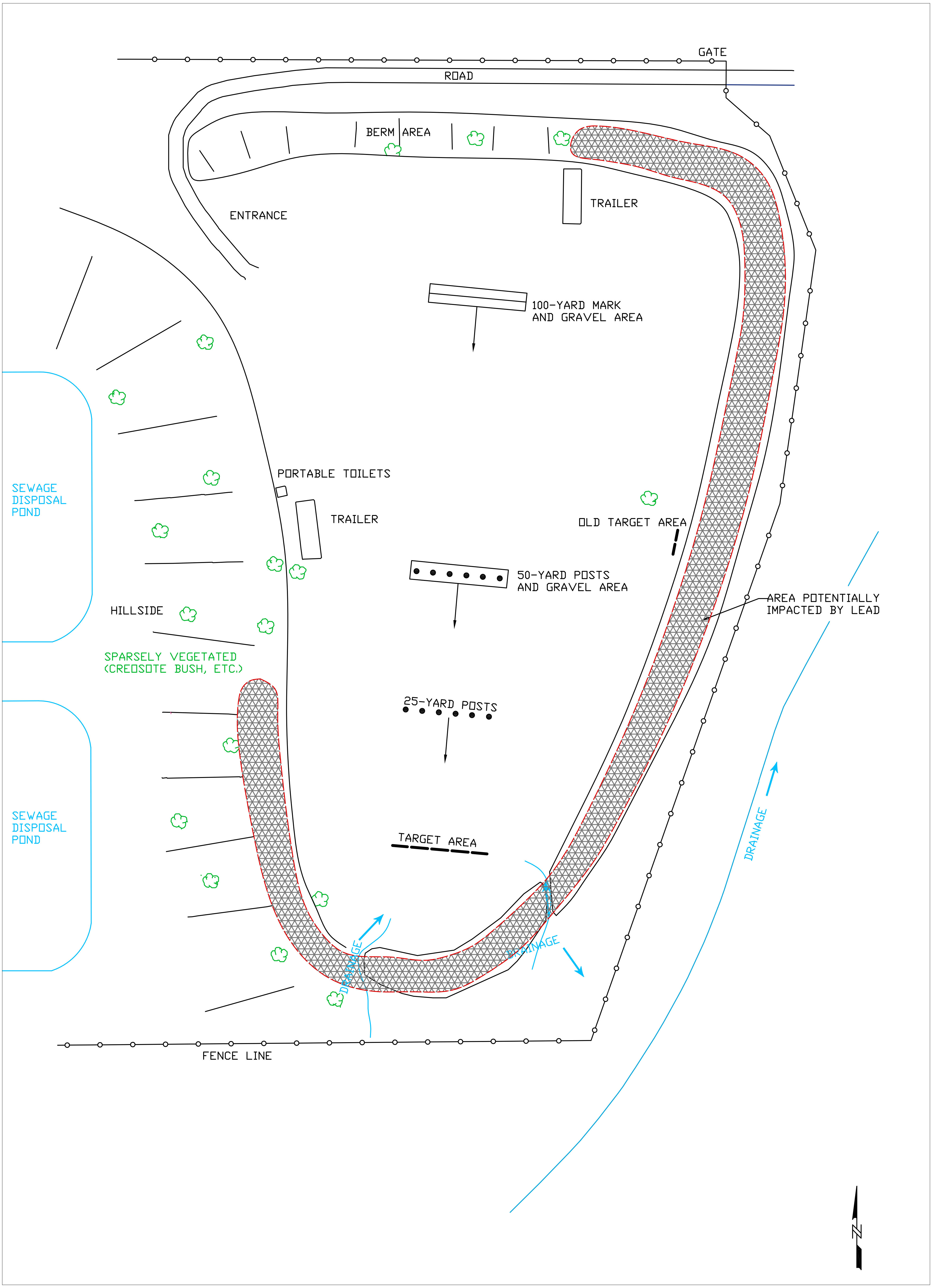
Project: NPS Lake Mead
Proj. Manager: TL
Date drafted: 9/06/2012
Chkd by: TL
Drafter: JWP
File Path: B:NPS/Lake Mead

National Park Service
Lake Mead National Recreational Area
Boulder City, Nevada

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
3525 Hyland Avenue, Suite 200 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

Site Features and Soil Sample Location Map
Former Firing Range (EDL Site 520)
Echo Bay

Figure
B-1



ORIGINAL DRAWING SOURCE: BAKER, FIG 9-3
SITE FEATURES ACTIVE FIRING RANGE (EDL SITE
2421) DATED: APRIL 2007

Note: Site features from Baker, Final Preliminary
Assessment and Site Inspection Report, Lake Mead
National Recreation Area, Boulder City, Nevada.
July 2009.

25 0 50
1"=50'

File Path: B:NPS\Lake Mead
Drafter: JWP
Chkd by: TL
Date drafted: 9/4/2012
Proj. Manager TL
Project: NPS Lake Mead

National Park Service
Lake Mead National Recreational Area
Boulder City, Nevada

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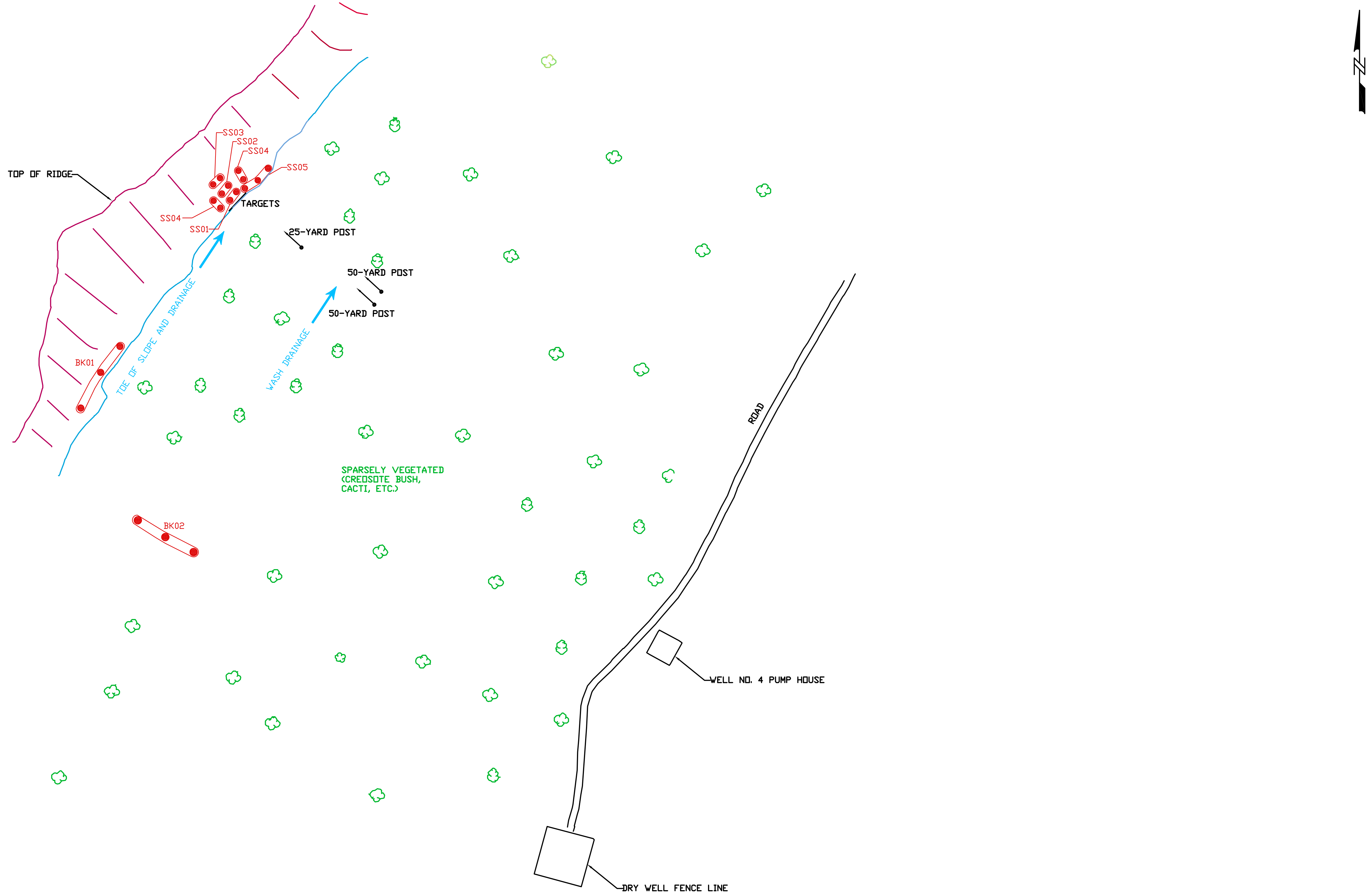
Site Features Map
Active Firing Range (EDL Site 2421)
Las Vegas Bay

Figure
B-2

Project: NPS Lake Mead
Proj. Manager TL
Date drafted: 9/06/2012
Chkd by: TL
Drafter: JWP
File Path: B:NPS/Lake Mead



ORIGINAL DRAWING SOURCE: BAKER, FIG 10-3
SITE FEATURES AND SOIL SAMPLE LOCATION
MAP, FORMER FIRING RANGE (EDL SITE 2044)
DATED: APRIL 2007

50 0 100
1"=100'

LEGEND

● SURFACE SOIL SAMPLE LOCATION
⬭ COMPOSITED SOIL SAMPLES
〰 DRAINAGE FEATURES

Note: Site features from Baker,
Final Preliminary Assessment and
Site Inspection Report, Lake Mead
National Recreation Area, Boulder
City, Nevada. July 2009.

National Park Service
Lake Mead National
Recreational Area
Boulder City, Nevada

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
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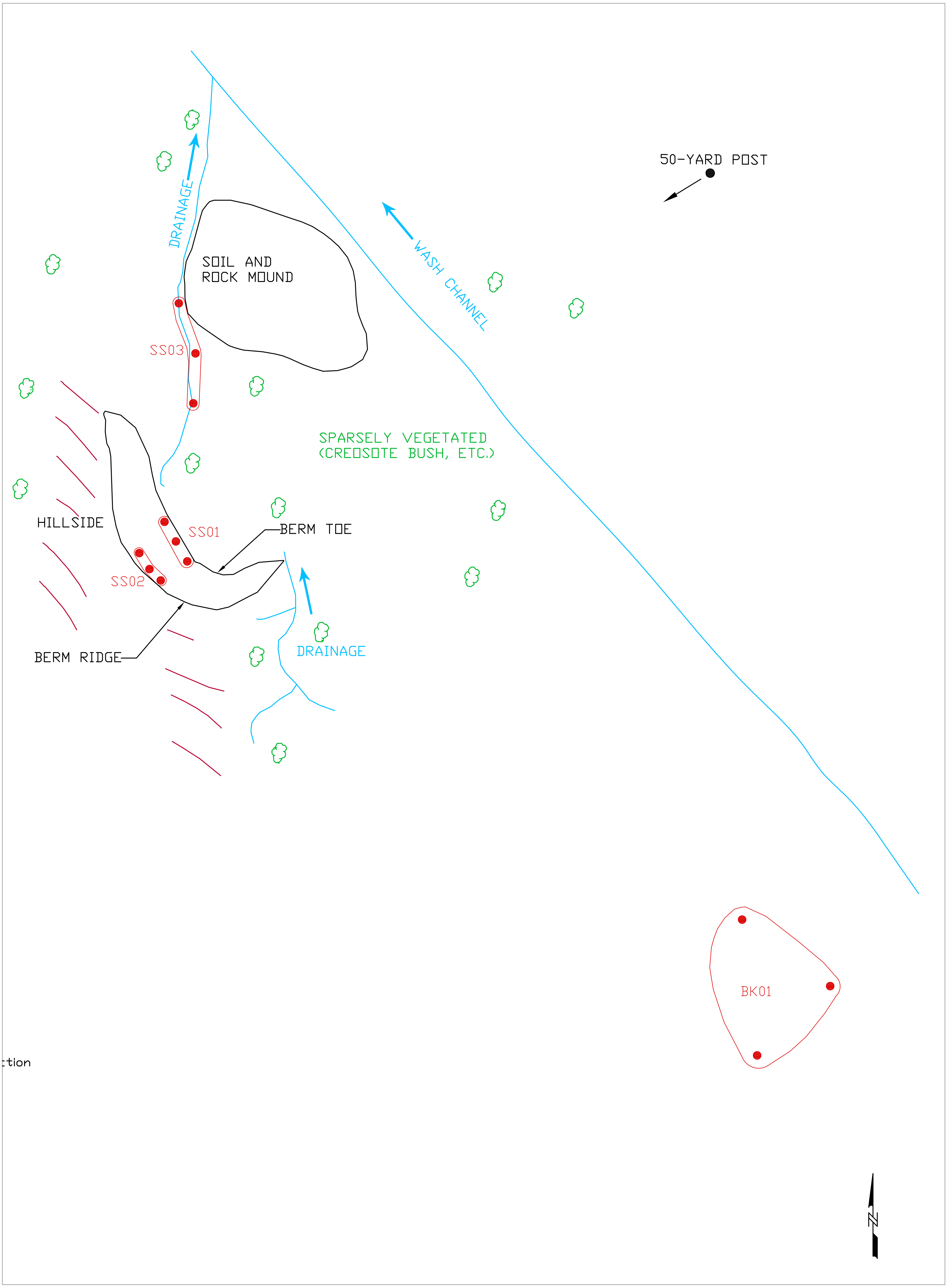
Site Features and Soil Sample Location Map
Former Firing Range (EDL Site 2044)
Temple Bar

Figure
B-3



ORIGINAL DRAWING SOURCE: BAKER, FIG 11-3
SITE FEATURES AND SOIL SAMPLE LOCATION
MAP, FORMER FIRING RANGE (EDL SITE 523)
DATED: APRIL 2007

15 0 30
1"=30'

LEGEND

● SURFACE SOIL SAMPLE LOCATION
⬭ COMPOSITED SOIL SAMPLES
〰 DRAINAGE FEATURES

Note: Site features from Baker, Final Preliminary Assessment and Site Inspection Report, Lake Mead National Recreation Area, Boulder City, Nevada. July 2009.

National Park Service
Lake Mead National Recreational Area
Boulder City, Nevada

ENVIRONMENTAL COST MANAGEMENT, INC.
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Tel: (714) 662-2759 ● Fax: (714) 662-2758

Site Features And Soil Sample Location Map
Former Firing Range (EDL Site 523)
Willow Beach

Figure
B-4

File Path: **B:NPS/Lake Mead**
Drafter: **JWP**
Chkd by: **TL**
Date drafted: **9/6/2012**
Proj. Manager **TL**
Project: **NPS Lake Mead**

Attachment

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo 1: Echo Bay Firing Line DU

Photo 2: Echo Bay Target Area DU from top of hill

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 3: Echo Bay Wash Channel DU, secondary to left, primary to right

Photo No. 4: Sampling Background at Las Vegas Bay

EE/CA INVESTIGATION PHOTOGRAPH LOG

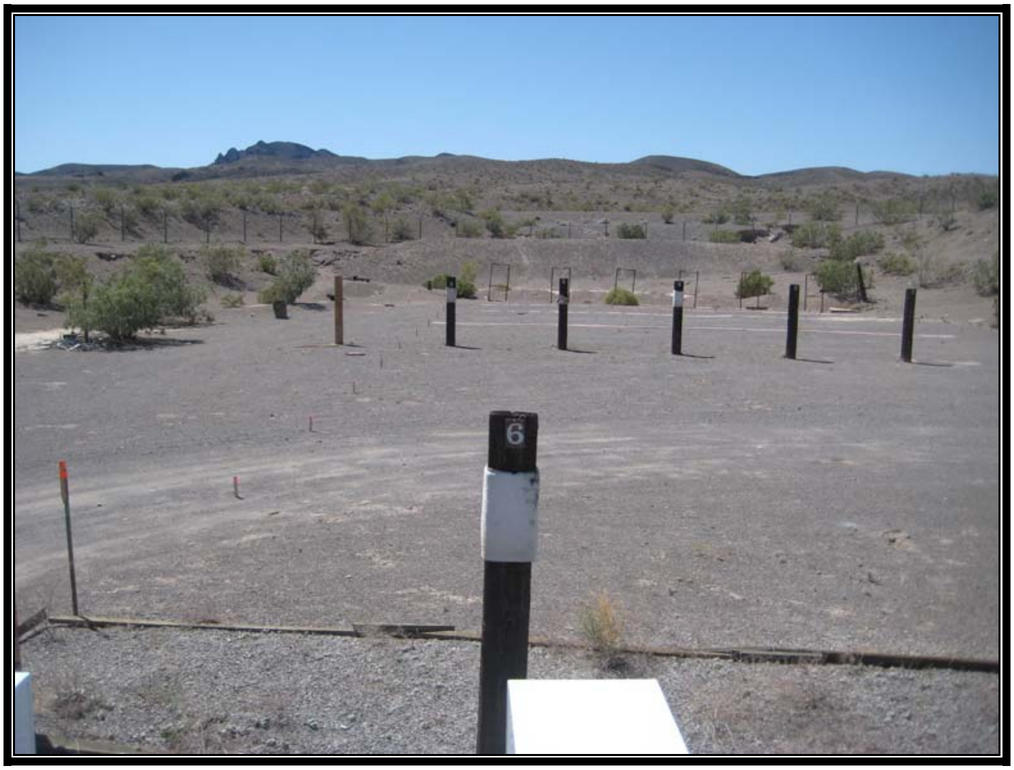

Photo No. 5: Las Vegas Bay Firing Line DU facing Target Area (south)

Photo No. 6: Surface grain size at Las Vegas Bay Target Area

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 7: Las Vegas Bay Target Area DU looking east

Photo No. 8: Las Vegas Bay Wash Channel DU looking downstream

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 9: Temple Bar background, view west.

Photo No. 10: View along firing line DU at Temple Bar.

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 11: Temple Bar Target Area DU.

Photo No. 12: Temple Bar Wash Channel DU sampling.

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 13: Temple Bar Wash Channel DU grain size

Photo No. 14: Willow Beach background facing east

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 15: Willow Beach Firing Line DU with Target Area in the background

Photo No. 16: Willow Beach Firing Line DU grain size

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 17: Willow Beach Target Area DU.

Photo No. 18: Willow Beach Target Area sample holes

EE/CA INVESTIGATION PHOTOGRAPH LOG

Photo No. 19: Willow Beach main wash channel DU

Photo No. 20:Willow Beach Wash Channel from Target Area

APPENDIX C

DATA TABLES FROM THE 2013 INVESTIGATION

Appendix C - Table C-1
Lead Laboratory Analytical Results for Soil Samples

Engineering Evaluation/Cost Analysis Report
Four Former Firing Range Sites

Sample Identification	Sample Date	Lead	Notes
	All results in mg/kg		
LAKE-WB-FL-100	4/21/2013	17.0	
LAKE-WB-FL-101	4/21/2013	17	
LAKE-WB-FL-102	4/21/2013	16	
LAKE-WB-FL-103	4/21/2013	15	
LAKE-WB-TA-108	4/21/2013	25	
LAKE-WB-TA-109	4/21/2013	75.0	
LAKE-WB-TA-110	4/21/2013	48	
LAKE-WB-TA-111	4/21/2013	45	
LAKE-WB-WC-112	4/21/2013	14	
LAKE WB-WC-113	4/21/2013	16	
LAKE WB-WC-114	4/21/2013	16	
LAKE WB-WC-115	4/21/2013	14	
LAKE-FD-WB-101	4/21/2013	43	TA Duplicate
LAKE-WB-BG-104	4/21/2013	14	
LAKE-WB-BG-105	4/21/2013	26	
LAKE-WB-BG-106	4/21/2013	15	
LAKE-WB-BG-107	4/21/2013	14	
LAKE-TB-TA-100	4/20/2013	150	
LAKE-TB-TA-101	4/20/2013	41	
LAKE-TB-TA-102	4/20/2013	24	
LAKE-TB-TA-103	4/20/2013	16	
LAKE-TB-WC-105	4/20/2013	5.2	
LAKE-TB-WC-106	4/20/2013	5.3	
LAKE-TB-WC-107	4/20/2013	5.7	
LAKE-TB-WC-108	4/20/2013	5.9	
LAKE-TB-FL-114	4/20/2013	6.2	
LAKE-TB-FL-115	4/20/2013	5.1	
LAKE-TB-FL-116	4/20/2013	5.8	
LAKE-TB-FL-117	4/20/2013	5.6	
LAKE-TB-FD-118	4/20/2013	5.4	FL Duplicate
LAKE-TB-BG-110	4/20/2013	6.9	
LAKE-TB-BG-111	4/20/2013	6.5	
LAKE-TB-BG-112	4/20/2013	5.5	
LAKE-TB-BG-113	4/20/2013	6.2	

Appendix C - Table C-1
Lead Laboratory Analytical Results for Soil Samples

Engineering Evaluation/Cost Analysis Report
Four Former Firing Range Sites

Sample Identification	Sample Date	Lead	Notes
	All results in mg/kg		
LAKE-LV-FL-100	4/23/2013	67	
LAKE-LV-FL-101	4/23/2013	180	
LAKE-LV-FL-102	4/23/2013	89	
LAKE-LV-FL-103	4/23/2013	110	
LAKE-LV-TA-104	4/23/2013	1900	
LAKE-LV-TA-105	4/23/2013	4900	
LAKE-LV-TA-106	4/23/2013	4000	
LAKE-LV-TA-107	4/23/2013	4500	
LAKE-LV-WC-108	4/23/2013	27	
LAKE-LV-WC-109	4/23/2013	23	
LAKE-LV-WC-110	4/23/2013	74	
LAKE-LV-WC-111	4/23/2013	26	
LAKE-FD-LV-103	4/24/2013	25	BG Duplicate
LAKE-LV-BG-112	4/24/2013	27	
LAKE-LV-BG-113	4/24/2013	27	
LAKE-LV-BG-114	4/24/2013	19	
LAKE-LV-BG-115	4/24/2013	25	
LAKE-EB-WC-104	4/22/2013	7.5	
LAKE-EB-WC-105	4/22/2013	8.2	
LAKE-EB-WC-106	4/22/2013	15	
LAKE-EB-WC-107	4/22/2013	17	
LAKE-EB-FL-108	4/22/2013	17	
LAKE-EB-FL-109	4/22/2013	19	
LAKE-EB-FL-110	4/22/2013	17	
LAKE-EB-FL-111	4/22/2013	66	
LAKE-EB-TA-112	4/22/2013	330	
LAKE-EB-TA-113	4/22/2013	98	
LAKE-EB-TA-114	4/22/2013	55	
LAKE-EB-TA-115	4/22/2013	170	
LAKE-FD-EB-102	4/22/2013	21	WC Duplicate
LAKE-EB-BG-100	4/22/2013	6.5	
LAKE-EB-BG-101	4/22/2013	6.5	
LAKE-EB-BG-102	4/22/2013	6.8	
LAKE-EB-BG-103	4/22/2013	6.5	

Notes:

WB = Willow Beach
EB = Echo Bay
TB = Temple Bar
LV = Las Vegas Bay

FL = Firing Line
TA = Target Area
WC = Wash Channel
BG = Background

▨ Revised result based on laborator re-analysis

Appendix C - Table C-2
Lead Laboratory Analytical Results for Quality Control Samples
Engineering Evaluation/Cost Analysis Report
Four Former Firing Range Sites

Quality Control Samples			Lead
Sample Date	**Sample Name**	**Sample Location**	(mg/L)
04/20/13	LAKE-ER-TA-100	Temple Bar	<0.015
04/20/13	LAKE-ER-WC-101	Temple Bar	<0.015
04/20/13	LAKE-ER-BG-102	Temple Bar	<0.015
04/20/13	LAKE-ER-FL-103	Temple Bar	<0.015
04/20/13	LAKE-FB-TB-100	Temple Bar	<0.015
04/21/13	LAKE-ER-TA-104	Willow Beach	<0.015
04/21/13	LAKE-ER-FL-105	Willow Beach	<0.015
04/21/13	LAKE-ER-WC-106	Willow Beach	<0.015
04/21/13	LAKE-ER-BG-107	Willow Beach	<0.015
04/21/13	LAKE-FB-WB-101	Willow Beach	<0.015
04/22/13	LAKE-ER-TA-108	Echo Bay	<0.015
04/22/13	LAKE-ER-FL-109	Echo Bay	<0.015
04/22/13	LAKE-ER-WC-110	Echo Bay	<0.015
04/22/13	LAKE-ER-BG-111	Echo Bay	<0.015
04/23/13	LAKE-LV-TA-112	Las Vegas Bay	<0.015
04/23/13	LAKE-LV-FL-113	Las Vegas Bay	<0.015
04/23/13	LAKE-LV-WC-114	Las Vegas Bay	<0.015
04/23/13	LAKE-LV-BG-115	Las Vegas Bay	<0.015

NOTES:

ER = Equipment Rinsate
FB = Field Blank
TB = Trip Blank
WB = Water Blank
LV = Las Vegas Bay
FL = Firing Line
TA = Target Area
WC = Wash Channel
BG = Background

APPENDIX D

LABORATORY ANALYTICAL REPORTS AND CHAIN OF CUSTODY DOCUMENTATION

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

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14

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-1517-1
Client Project/Site: Lake

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Carlene McCutcheon

Authorized for release by:
5/23/2013 3:53:56 PM

Carlene McCutcheon, Customer Service Manager
carlene.mccutcheon@testamericainc.com

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Chain of Custody 21
Receipt Checklists 23

Definitions/Glossary

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Job ID: 550-1517-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-1517-1

Comments
No additional comments.

Receipt
The samples were received on 4/25/2013 10:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 5.6º C.

Metals
No analytical or quality issues were noted.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1517-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-1517-1	LAKE-ER-TA-100	Water	04/20/13 15:01	04/25/13 10:00
550-1517-2	LAKE-ER-WC-101	Water	04/20/13 15:05	04/25/13 10:00
550-1517-3	LAKE-ER-BG-102	Water	04/20/13 15:10	04/25/13 10:00
550-1517-4	LAKE-ER-FL-103	Water	04/20/13 15:15	04/25/13 10:00
550-1517-5	LAKE-ER-TB-100	Water	04/20/13 15:20	04/25/13 10:00
550-1517-6	LAKE-ER-TA-104	Water	04/21/13 09:45	04/25/13 10:00
550-1517-7	LAKE-ER-FL-105	Water	04/21/13 07:46	04/25/13 10:00
550-1517-8	LAKE-ER-WC-106	Water	04/21/13 07:48	04/25/13 10:00
550-1517-9	LAKE-ER-BG-107	Water	04/21/13 07:50	04/25/13 10:00
550-1517-10	LAKE-ER-WB-101	Water	04/21/13 07:43	04/25/13 10:00
550-1517-11	LAKE-ER-TA-108	Water	04/22/13 07:45	04/25/13 10:00
550-1517-12	LAKE-ER-FL-109	Water	04/22/13 07:48	04/25/13 10:00
550-1517-13	LAKE-ER-WC-110	Water	04/22/13 07:52	04/25/13 10:00
550-1517-14	LAKE-ER-BG-111	Water	04/22/13 07:56	04/25/13 10:00
550-1517-15	LAKE-LV-TA-112	Water	04/23/13 10:20	04/25/13 10:00
550-1517-16	LAKE-LV-FL-113	Water	04/23/13 10:22	04/25/13 10:00
550-1517-17	LAKE-LV-WC-114	Water	04/23/13 10:24	04/25/13 10:00
550-1517-18	LAKE-LV-BG-115	Water	04/23/13 10:26	04/25/13 10:00

Detection Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1517-1

Client Sample ID: LAKE-ER-TA-100 Lab Sample ID: 550-1517-1

No Detections.

Client Sample ID: LAKE-ER-WC-101 Lab Sample ID: 550-1517-2

No Detections.

Client Sample ID: LAKE-ER-BG-102 Lab Sample ID: 550-1517-3

No Detections.

Client Sample ID: LAKE-ER-FL-103 Lab Sample ID: 550-1517-4

No Detections.

Client Sample ID: LAKE-ER-TB-100 Lab Sample ID: 550-1517-5

No Detections.

Client Sample ID: LAKE-ER-TA-104 Lab Sample ID: 550-1517-6

No Detections.

Client Sample ID: LAKE-ER-FL-105 Lab Sample ID: 550-1517-7

No Detections.

Client Sample ID: LAKE-ER-WC-106 Lab Sample ID: 550-1517-8

No Detections.

Client Sample ID: LAKE-ER-BG-107 Lab Sample ID: 550-1517-9

No Detections.

Client Sample ID: LAKE-ER-WB-101 Lab Sample ID: 550-1517-10

No Detections.

Client Sample ID: LAKE-ER-TA-108 Lab Sample ID: 550-1517-11

No Detections.

Client Sample ID: LAKE-ER-FL-109 Lab Sample ID: 550-1517-12

No Detections.

Client Sample ID: LAKE-ER-WC-110 Lab Sample ID: 550-1517-13

No Detections.

Client Sample ID: LAKE-ER-BG-111 Lab Sample ID: 550-1517-14

No Detections.

This Detection Summary does not include radiochemical test results.

Detection Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1517-1

Client Sample ID: LAKE-LV-TA-112 Lab Sample ID: 550-1517-15

No Detections.

Client Sample ID: LAKE-LV-FL-113 Lab Sample ID: 550-1517-16

No Detections.

Client Sample ID: LAKE-LV-WC-114 Lab Sample ID: 550-1517-17

No Detections.

Client Sample ID: LAKE-LV-BG-115 Lab Sample ID: 550-1517-18

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: LAKE-ER-TA-100

Lab Sample ID: 550-1517-1

Date Collected: 04/20/13 15:01
Date Received: 04/25/13 10:00
Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:16	1

Client Sample ID: LAKE-ER-WC-101

Lab Sample ID: 550-1517-2

Date Collected: 04/20/13 15:05
Date Received: 04/25/13 10:00
Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:19	1

Client Sample ID: LAKE-ER-BG-102

Lab Sample ID: 550-1517-3

Date Collected: 04/20/13 15:10
Date Received: 04/25/13 10:00
Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:22	1

Client Sample ID: LAKE-ER-FL-103

Lab Sample ID: 550-1517-4

Date Collected: 04/20/13 15:15
Date Received: 04/25/13 10:00
Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:25	1

Client Sample ID: LAKE-ER-TB-100

Lab Sample ID: 550-1517-5

Date Collected: 04/20/13 15:20
Date Received: 04/25/13 10:00
Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:29	1

Client Sample ID: LAKE-ER-TA-104

Lab Sample ID: 550-1517-6

Date Collected: 04/21/13 09:45
Date Received: 04/25/13 10:00
Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:38	1

Client Sample Results

1
2
3
4
5
6
7
8
9
10
11
12
13
14

Client Sample ID: LAKE-ER-FL-105

Lab Sample ID: 550-1517-7

Date Collected: 04/21/13 07:46

Matrix: Water

Date Received: 04/25/13 10:00

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:41	1

Client Sample ID: LAKE-ER-WC-106

Lab Sample ID: 550-1517-8

Date Collected: 04/21/13 07:48

Matrix: Water

Date Received: 04/25/13 10:00

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:44	1

Client Sample ID: LAKE-ER-BG-107

Lab Sample ID: 550-1517-9

Date Collected: 04/21/13 07:50

Matrix: Water

Date Received: 04/25/13 10:00

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:47	1

Client Sample ID: LAKE-ER-WB-101

Lab Sample ID: 550-1517-10

Date Collected: 04/21/13 07:43

Matrix: Water

Date Received: 04/25/13 10:00

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:50	1

Client Sample ID: LAKE-ER-TA-108

Lab Sample ID: 550-1517-11

Date Collected: 04/22/13 07:45

Matrix: Water

Date Received: 04/25/13 10:00

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:53	1

Client Sample ID: LAKE-ER-FL-109

Lab Sample ID: 550-1517-12

Date Collected: 04/22/13 07:48

Matrix: Water

Date Received: 04/25/13 10:00

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 22:57	1

Client Sample ID: LAKE-ER-WC-110

Lab Sample ID: 550-1517-13

Date Collected: 04/22/13 07:52
Date Received: 04/25/13 10:00

Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 23:00	1

Client Sample ID: LAKE-ER-BG-111

Lab Sample ID: 550-1517-14

Date Collected: 04/22/13 07:56
Date Received: 04/25/13 10:00

Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 23:03	1

Client Sample ID: LAKE-LV-TA-112

Lab Sample ID: 550-1517-15

Date Collected: 04/23/13 10:20
Date Received: 04/25/13 10:00

Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:38	05/03/13 23:06	1

Client Sample ID: LAKE-LV-FL-113

Lab Sample ID: 550-1517-16

Date Collected: 04/23/13 10:22
Date Received: 04/25/13 10:00

Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:55	05/03/13 20:48	1

Client Sample ID: LAKE-LV-WC-114

Lab Sample ID: 550-1517-17

Date Collected: 04/23/13 10:24
Date Received: 04/25/13 10:00

Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:55	05/03/13 20:51	1

Client Sample ID: LAKE-LV-BG-115

Lab Sample ID: 550-1517-18

Date Collected: 04/23/13 10:26
Date Received: 04/25/13 10:00

Matrix: Water

Method: 200.7 Rev 4.4 - Metals (ICP)

Analyte	Result mg/L	Result	Result	Qualifier	RL mg/L	Prepared	Analyzed	Dil Fac
Lead	ND				0.015	05/02/13 17:55	05/03/13 20:55	1

QC Sample Results

Method: 200.7 Rev 4.4 - Metals (ICP)

Lab Sample ID: MB 550-3869/1-A
Matrix: Water
Analysis Batch: 4045

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 3869

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		05/02/13 17:38	05/03/13 21:44	1

Lab Sample ID: LCS 550-3869/2-A
Matrix: Water
Analysis Batch: 4045

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 3869

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			1.00	1.03		mg/L		103	85 - 115		

Lab Sample ID: LCSD 550-3869/3-A
Matrix: Water
Analysis Batch: 4045

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 3869

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			1.00	1.04		mg/L		104	85 - 115	1	20

Lab Sample ID: 550-1505-C-4-C MS
Matrix: Water
Analysis Batch: 4045

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 3869

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	ND		1.00	1.01		mg/L		101	70 - 130		

Lab Sample ID: 550-1505-C-4-D MSD
Matrix: Water
Analysis Batch: 4045

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 3869

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	ND		1.00	1.01		mg/L		101	70 - 130	0	20

Lab Sample ID: MB 550-3874/1-A
Matrix: Water
Analysis Batch: 4044

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 3874

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		05/02/13 17:55	05/03/13 20:29	1

Lab Sample ID: LCS 550-3874/2-A
Matrix: Water
Analysis Batch: 4044

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 3874

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			1.00	1.01		mg/L		101	85 - 115		

Lab Sample ID: LCSD 550-3874/3-A
Matrix: Water
Analysis Batch: 4044

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 3874

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			1.00	0.995		mg/L		99	85 - 115	2	20

QC Sample Results

Lab Sample ID: 550-1545-C-3-A MS
Matrix: Water
Analysis Batch: 4044

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 3874

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	ND		1.00	0.966		mg/L		97	70 - 130		

Lab Sample ID: 550-1545-C-3-B MSD
Matrix: Water
Analysis Batch: 4044

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 3874

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	ND		1.00	0.966		mg/L		97	70 - 130	0	20

Metals

Prep Batch: 3869

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1505-C-4-C MS	Matrix Spike	Total/NA	Water	200.7	
550-1505-C-4-D MSD	Matrix Spike Duplicate	Total/NA	Water	200.7	
550-1517-1	LAKE-ER-TA-100	Total/NA	Water	200.7	
550-1517-2	LAKE-ER-WC-101	Total/NA	Water	200.7	
550-1517-3	LAKE-ER-BG-102	Total/NA	Water	200.7	
550-1517-4	LAKE-ER-FL-103	Total/NA	Water	200.7	
550-1517-5	LAKE-ER-TB-100	Total/NA	Water	200.7	
550-1517-6	LAKE-ER-TA-104	Total/NA	Water	200.7	
550-1517-7	LAKE-ER-FL-105	Total/NA	Water	200.7	
550-1517-8	LAKE-ER-WC-106	Total/NA	Water	200.7	
550-1517-9	LAKE-ER-BG-107	Total/NA	Water	200.7	
550-1517-10	LAKE-ER-WB-101	Total/NA	Water	200.7	
550-1517-11	LAKE-ER-TA-108	Total/NA	Water	200.7	
550-1517-12	LAKE-ER-FL-109	Total/NA	Water	200.7	
550-1517-13	LAKE-ER-WC-110	Total/NA	Water	200.7	
550-1517-14	LAKE-ER-BG-111	Total/NA	Water	200.7	
550-1517-15	LAKE-LV-TA-112	Total/NA	Water	200.7	
LCS 550-3869/2-A	Lab Control Sample	Total/NA	Water	200.7	
LCSD 550-3869/3-A	Lab Control Sample Dup	Total/NA	Water	200.7	
MB 550-3869/1-A	Method Blank	Total/NA	Water	200.7	

Prep Batch: 3874

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1517-16	LAKE-LV-FL-113	Total/NA	Water	200.7	
550-1517-17	LAKE-LV-WC-114	Total/NA	Water	200.7	
550-1517-18	LAKE-LV-BG-115	Total/NA	Water	200.7	
550-1545-C-3-A MS	Matrix Spike	Total/NA	Water	200.7	
550-1545-C-3-B MSD	Matrix Spike Duplicate	Total/NA	Water	200.7	
LCS 550-3874/2-A	Lab Control Sample	Total/NA	Water	200.7	
LCSD 550-3874/3-A	Lab Control Sample Dup	Total/NA	Water	200.7	
MB 550-3874/1-A	Method Blank	Total/NA	Water	200.7	

Analysis Batch: 4044

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1517-16	LAKE-LV-FL-113	Total/NA	Water	200.7 Rev 4.4	3874
550-1517-17	LAKE-LV-WC-114	Total/NA	Water	200.7 Rev 4.4	3874
550-1517-18	LAKE-LV-BG-115	Total/NA	Water	200.7 Rev 4.4	3874
550-1545-C-3-A MS	Matrix Spike	Total/NA	Water	200.7 Rev 4.4	3874
550-1545-C-3-B MSD	Matrix Spike Duplicate	Total/NA	Water	200.7 Rev 4.4	3874
LCS 550-3874/2-A	Lab Control Sample	Total/NA	Water	200.7 Rev 4.4	3874
LCSD 550-3874/3-A	Lab Control Sample Dup	Total/NA	Water	200.7 Rev 4.4	3874
MB 550-3874/1-A	Method Blank	Total/NA	Water	200.7 Rev 4.4	3874

Analysis Batch: 4045

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1505-C-4-C MS	Matrix Spike	Total/NA	Water	200.7 Rev 4.4	3869
550-1505-C-4-D MSD	Matrix Spike Duplicate	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-1	LAKE-ER-TA-100	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-2	LAKE-ER-WC-101	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-3	LAKE-ER-BG-102	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-4	LAKE-ER-FL-103	Total/NA	Water	200.7 Rev 4.4	3869

Metals (Continued)

Analysis Batch: 4045 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1517-5	LAKE-ER-TB-100	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-6	LAKE-ER-TA-104	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-7	LAKE-ER-FL-105	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-8	LAKE-ER-WC-106	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-9	LAKE-ER-BG-107	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-10	LAKE-ER-WB-101	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-11	LAKE-ER-TA-108	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-12	LAKE-ER-FL-109	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-13	LAKE-ER-WC-110	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-14	LAKE-ER-BG-111	Total/NA	Water	200.7 Rev 4.4	3869
550-1517-15	LAKE-LV-TA-112	Total/NA	Water	200.7 Rev 4.4	3869
LCS 550-3869/2-A	Lab Control Sample	Total/NA	Water	200.7 Rev 4.4	3869
LCSD 550-3869/3-A	Lab Control Sample Dup	Total/NA	Water	200.7 Rev 4.4	3869
MB 550-3869/1-A	Method Blank	Total/NA	Water	200.7 Rev 4.4	3869

Lab Chronicle

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1517-1

Client Sample ID: LAKE-ER-TA-100

Lab Sample ID: 550-1517-1

Date Collected: 04/20/13 15:01

Matrix: Water

Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:16	BB	TAL PHX

Client Sample ID: LAKE-ER-WC-101

Lab Sample ID: 550-1517-2

Date Collected: 04/20/13 15:05

Matrix: Water

Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:19	BB	TAL PHX

Client Sample ID: LAKE-ER-BG-102

Lab Sample ID: 550-1517-3

Date Collected: 04/20/13 15:10

Matrix: Water

Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:22	BB	TAL PHX

Client Sample ID: LAKE-ER-FL-103

Lab Sample ID: 550-1517-4

Date Collected: 04/20/13 15:15

Matrix: Water

Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:25	BB	TAL PHX

Client Sample ID: LAKE-ER-TB-100

Lab Sample ID: 550-1517-5

Date Collected: 04/20/13 15:20

Matrix: Water

Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:29	BB	TAL PHX

Client Sample ID: LAKE-ER-TA-104

Lab Sample ID: 550-1517-6

Date Collected: 04/21/13 09:45

Matrix: Water

Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:38	BB	TAL PHX

Lab Chronicle

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Client Sample ID: LAKE-ER-FL-105

Lab Sample ID: 550-1517-7
Date Collected: 04/21/13 07:46
Matrix: Water
Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:41	BB	TAL PHX

Client Sample ID: LAKE-ER-WC-106

Lab Sample ID: 550-1517-8
Date Collected: 04/21/13 07:48
Matrix: Water
Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:44	BB	TAL PHX

Client Sample ID: LAKE-ER-BG-107

Lab Sample ID: 550-1517-9
Date Collected: 04/21/13 07:50
Matrix: Water
Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:47	BB	TAL PHX

Client Sample ID: LAKE-ER-WB-101

Lab Sample ID: 550-1517-10
Date Collected: 04/21/13 07:43
Matrix: Water
Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:50	BB	TAL PHX

Client Sample ID: LAKE-ER-TA-108

Lab Sample ID: 550-1517-11
Date Collected: 04/22/13 07:45
Matrix: Water
Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:53	BB	TAL PHX

Client Sample ID: LAKE-ER-FL-109

Lab Sample ID: 550-1517-12
Date Collected: 04/22/13 07:48
Matrix: Water
Date Received: 04/25/13 10:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 22:57	BB	TAL PHX

Lab Chronicle

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1517-1

Client Sample ID: LAKE-ER-WC-110

Lab Sample ID: 550-1517-13

Date Collected: 04/22/13 07:52
Date Received: 04/25/13 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 23:00	BB	TAL PHX

Client Sample ID: LAKE-ER-BG-111

Lab Sample ID: 550-1517-14

Date Collected: 04/22/13 07:56
Date Received: 04/25/13 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 23:03	BB	TAL PHX

Client Sample ID: LAKE-LV-TA-112

Lab Sample ID: 550-1517-15

Date Collected: 04/23/13 10:20
Date Received: 04/25/13 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3869	05/02/13 17:38	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4045	05/03/13 23:06	BB	TAL PHX

Client Sample ID: LAKE-LV-FL-113

Lab Sample ID: 550-1517-16

Date Collected: 04/23/13 10:22
Date Received: 04/25/13 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3874	05/02/13 17:55	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4044	05/03/13 20:48	BB	TAL PHX

Client Sample ID: LAKE-LV-WC-114

Lab Sample ID: 550-1517-17

Date Collected: 04/23/13 10:24
Date Received: 04/25/13 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3874	05/02/13 17:55	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4044	05/03/13 20:51	BB	TAL PHX

Client Sample ID: LAKE-LV-BG-115

Lab Sample ID: 550-1517-18

Date Collected: 04/23/13 10:26
Date Received: 04/25/13 10:00

Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	200.7			3874	05/02/13 17:55	JRC	TAL PHX
Total/NA	Analysis	200.7 Rev 4.4		1	4044	05/03/13 20:55	BB	TAL PHX

Lab Chronicle

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

Certification Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1517-1

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-13
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-13
Nevada	State Program	9	AZ01030	07-31-13
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Method Summary

Method	Method Description	Protocol	Laboratory
200.7 Rev 4.4	Metals (ICP)	40CFR136A	TAL PHX

Protocol References:

40CFR136A = "Methods for Organic Chemical Analysis of Municipal Industrial Wastewater", 40CFR, Part 136, Appendix A, October 26, 1984 and subsequent revisions.

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

☒ Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 45
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

550-1517 Chain of Custody

Page 1 of 2

Client Name / Address: ECM
3525 Hyland Ave #202
Costa Mesa, CA 92620

Project / PO Number: LAKE

Project Manager: Tiffany Looff

Phone Number: 480-358-1480

Sampler: Carisa Davis & Chris McCormick

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Analysis Required: Total Lead EPA 200.7									Special Instructions
LAKE-ER-TA-100	Water	250 ml poly	1	4/20/13	1501	HNO3	X							-1		Temple Bar
LAKE-ER-WC-101	↓	↓	↓	↓	1505	↓	X							-2		↓
LAKE-ER-BG-102					1510		X							-3		
LAKE-ER-FL-103					1515		X							-4		
LAKE-FB-TB-100					1520		X							-5		
LAKE-ER-TA-104	Water	250 ml poly	1	4/21/13	0745	HNO3	X							-6		Willow Beach
LAKE-ER-FL-105	↓	↓	↓	↓	0746	↓	X							-7		↓
LAKE-ER-WC-106					0748		X							-8		
LAKE-ER-BG-107					~~0743~~ 0750		X							-9		
LAKE-FB-WB-101					0743		X							-10		
LAKE-ER-TA-108	Water	250 ml poly	1	4/22/13	0745	HNO3	X							-11		Echo Bay
LAKE-ER-FL-109	↓	↓	↓	↓	0748	↓	X							-12		↓
LAKE-ER-WC-110					0752		X							-13		
LAKE-ER-BG-111					0756		X							-14		

Relinquished By: Chris McCormick	Date / Time: 4-24-13 15:00	Received By: Fed Ex	Date / Time:
Relinquished By:	Date / Time:	Received By:	Date / Time:
Relinquished By:	Date / Time:	Received in Lab By:	Date / Time:

Turnaround Time: (Check)
same day ______ 72 hours ______
24 hours ______ 5 days ______
48 hours ______ normal X

Sample Integrity: (Check)
intact ______ on ice ______

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

Water

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

550-1517

[X] Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 454-9303
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 2 of 2

Client Name/Address:
ECM
3525 Hyland Ave #200
Costa Mesa, CA 92626

Project/PO Number: LAKE

Project Manager: Tiffany Looff

Sampler: Carisa Davis & Chris McCormack

Phone Number: 480-358-1480

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Total Lead EPA 200.7									Special Instructions
LAKE-LV-TA-112	Water	250 ml poly	1	4/23/13	1020	HNO3	X							-15		Las Vegas Bay
LAKE-LV-FL-113	↓	↓	↓	↓	1022	↓	X							-16		↓
LAKE-LV-WC-114	↓	↓	↓	↓	1024	↓	X							-17		↓
LAKE-LV-BG-115	↓	↓	↓	↓	1026	↓	X							-18		↓

Relinquished By: Chris McCormack	Date/Time: 4-24-13 15:00	Received By: Fed Ex	Date/Time:
Relinquished By:	Date/Time:	Received By:	Date/Time:
Relinquished By: FEDEX	Date/Time:	Received in Lab By: [illegible]	Date/Time: [illegible]

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal [✓]

Sample Integrity: (Check)
intact ____ on ice ____

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1517-1

Login Number: 1517

List Source: TestAmerica Phoenix

List Number: 1

Creator: Baker, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	Check done at department level as required.

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-1629-1
Client Project/Site: Lake
Revision: 1

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Authorized for release by:
6/5/2013 3:09:04 PM

Carlene McCutcheon, Customer Service Manager
carlene.mccutcheon@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

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Definitions/Glossary

Qualifiers

Metals

Qualifier	Qualifier Description
M1	Matrix spike recovery was high, the associated blank spike recovery was acceptable.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Job ID: 550-1629-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-1629-1

Comments
No additional comments.

Receipt
The samples were received on 4/26/2013 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 21.8º C.

Metals
Method(s) 6010B: The serial dilution performed for the following sample(s) associated with batch 172528 was outside control limits for Pb: (550-1629-14 SD), LAKE-FD-WB-101 (550-1629-13), LAKE-WB-BG-104 (550-1629-5), LAKE-WB-BG-105 (550-1629-6), LAKE-WB-BG-106 (550-1629-7), LAKE-WB-BG-107 (550-1629-8), LAKE-WB-FL-100 (550-1629-1), LAKE-WB-FL-101 (550-1629-2), LAKE-WB-FL-102 (550-1629-3), LAKE-WB-FL-103 (550-1629-4), LAKE-WB-TA-108 (550-1629-9), LAKE-WB-TA-109 (550-1629-10), LAKE-WB-TA-110 (550-1629-11), LAKE-WB-TA-111 (550-1629-12), LAKE-WB-WC-112 (550-1629-14), LAKE-WB-WC-113 (550-1629-15), LAKE-WB-WC-114 (550-1629-16), LAKE-WB-WC-115 (550-1629-17) (Analytical batch 173030)

No other analytical or quality issues were noted.

Organic Prep
Method(s) Increm, Prep: The following sample(s) was air dried and sieved per the procedure; however, the sample(s) contained material that would not pass through the sieve: LAKE-FD-WB-101 (550-1629-13), LAKE-WB-BG-104 (550-1629-5), LAKE-WB-BG-105 (550-1629-6), LAKE-WB-BG-106 (550-1629-7), LAKE-WB-BG-107 (550-1629-8), LAKE-WB-FL-100 (550-1629-1), LAKE-WB-FL-101 (550-1629-2), LAKE-WB-FL-102 (550-1629-3), LAKE-WB-FL-103 (550-1629-4), LAKE-WB-TA-108 (550-1629-9), LAKE-WB-TA-109 (550-1629-10), LAKE-WB-TA-110 (550-1629-11), LAKE-WB-TA-111 (550-1629-12), LAKE-WB-WC-112 (550-1629-14), LAKE-WB-WC-113 (550-1629-15), LAKE-WB-WC-114 (550-1629-16), LAKE-WB-WC-115 (550-1629-17). This material was removed and not extracted. The material appeared to be rocks.

Batch 172228 and 172237
Multi-Inc (6010)

No other analytical or quality issues were noted.

Method(s) 6010B-The Client was concerned with the level of Pb reported for sample 550-1629-13. The sample requested multi-incremental sampling. The reprep result for Pb came back a factor of 10x lower which puts it in line with the other results. The MS/MSD recoveries were over 200% so there is some variation in the results. It looks like we might have picked up an aliquot that was not representative of all the sample that we received. The reprep will be reported. Prep batch 176858.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1629-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-1629-1	LAKE-WB-FL-100	Solid	04/21/13 11:17	04/26/13 09:30
550-1629-2	LAKE-WB-FL-101	Solid	04/21/13 11:40	04/26/13 09:30
550-1629-3	LAKE-WB-FL-102	Solid	04/21/13 11:42	04/26/13 09:30
550-1629-4	LAKE-WB-FL-103	Solid	04/21/13 11:57	04/26/13 09:30
550-1629-5	LAKE-WB-BG-104	Solid	04/21/13 09:48	04/26/13 09:30
550-1629-6	LAKE-WB-BG-105	Solid	04/21/13 10:18	04/26/13 09:30
550-1629-7	LAKE-WB-BG-106	Solid	04/21/13 10:48	04/26/13 09:30
550-1629-8	LAKE-WB-BG-107	Solid	04/21/13 11:13	04/26/13 09:30
550-1629-9	LAKE-WB-TA-108	Solid	04/21/13 14:33	04/26/13 09:30
550-1629-10	LAKE-WB-TA-109	Solid	04/21/13 14:52	04/26/13 09:30
550-1629-11	LAKE-WB-TA-110	Solid	04/21/13 15:25	04/26/13 09:30
550-1629-12	LAKE-WB-TA-111	Solid	04/21/13 15:46	04/26/13 09:30
550-1629-13	LAKE-FD-WB-101	Solid	04/21/13 16:00	04/26/13 09:30
550-1629-14	LAKE-WB-WC-112	Solid	04/21/13 09:44	04/26/13 09:30
550-1629-15	LAKE-WB-WC-113	Solid	04/21/13 10:13	04/26/13 09:30
550-1629-16	LAKE-WB-WC-114	Solid	04/21/13 10:33	04/26/13 09:30
550-1629-17	LAKE-WB-WC-115	Solid	04/21/13 10:51	04/26/13 09:30

Detection Summary

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Client Sample ID: LAKE-WB-FL-100 — Lab Sample ID: 550-1629-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	17		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-FL-101 — Lab Sample ID: 550-1629-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	17		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-FL-102 — Lab Sample ID: 550-1629-3

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	16		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-FL-103 — Lab Sample ID: 550-1629-4

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	15		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-BG-104 — Lab Sample ID: 550-1629-5

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	14		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-BG-105 — Lab Sample ID: 550-1629-6

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	26		0.80		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-BG-106 — Lab Sample ID: 550-1629-7

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	15		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-BG-107 — Lab Sample ID: 550-1629-8

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	14		0.75		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-TA-108 — Lab Sample ID: 550-1629-9

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	25		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-TA-109 — Lab Sample ID: 550-1629-10

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	75		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-TA-110 — Lab Sample ID: 550-1629-11

This Detection Summary does not include radiochemical test results.

Client Sample ID: LAKE-WB-TA-110 (Continued) Lab Sample ID: 550-1629-11

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	48		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-TA-111 Lab Sample ID: 550-1629-12

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	45		0.75		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-FD-WB-101 Lab Sample ID: 550-1629-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	43	M1	0.80		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-WC-112 Lab Sample ID: 550-1629-14

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	14		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-WC-113 Lab Sample ID: 550-1629-15

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	16		0.80		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-WC-114 Lab Sample ID: 550-1629-16

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	16		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-WB-WC-115 Lab Sample ID: 550-1629-17

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	14		0.73		mg/Kg	1		6010B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: LAKE-WB-FL-100

Lab Sample ID: 550-1629-1

Date Collected: 04/21/13 11:17
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**17**		0.76		mg/Kg		05/04/13 09:00	05/06/13 20:56	1

Client Sample ID: LAKE-WB-FL-101

Lab Sample ID: 550-1629-2

Date Collected: 04/21/13 11:40
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**17**		0.78		mg/Kg		05/04/13 09:00	05/06/13 20:59	1

Client Sample ID: LAKE-WB-FL-102

Lab Sample ID: 550-1629-3

Date Collected: 04/21/13 11:42
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**16**		0.78		mg/Kg		05/04/13 09:00	05/06/13 21:02	1

Client Sample ID: LAKE-WB-FL-103

Lab Sample ID: 550-1629-4

Date Collected: 04/21/13 11:57
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**15**		0.78		mg/Kg		05/04/13 09:00	05/06/13 21:06	1

Client Sample ID: LAKE-WB-BG-104

Lab Sample ID: 550-1629-5

Date Collected: 04/21/13 09:48
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**14**		0.76		mg/Kg		05/04/13 09:00	05/06/13 21:08	1

Client Sample ID: LAKE-WB-BG-105

Lab Sample ID: 550-1629-6

Date Collected: 04/21/13 10:18
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**26**		0.80		mg/Kg		05/04/13 09:00	05/06/13 21:21	1

Client Sample ID: LAKE-WB-BG-106

Lab Sample ID: 550-1629-7

Date Collected: 04/21/13 10:48
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**15**		0.78		mg/Kg		05/04/13 09:00	05/06/13 21:24	1

Client Sample Results

Client Sample ID: LAKE-WB-BG-107

Lab Sample ID: 550-1629-8

Date Collected: 04/21/13 11:13

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**14**		0.75		mg/Kg		05/04/13 09:00	05/06/13 21:27	1

Client Sample ID: LAKE-WB-TA-108

Lab Sample ID: 550-1629-9

Date Collected: 04/21/13 14:33

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**25**		0.76		mg/Kg		05/04/13 09:00	05/06/13 21:30	1

Client Sample ID: LAKE-WB-TA-109

Lab Sample ID: 550-1629-10

Date Collected: 04/21/13 14:52

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**75**		0.78		mg/Kg		05/04/13 09:00	05/06/13 21:33	1

Client Sample ID: LAKE-WB-TA-110

Lab Sample ID: 550-1629-11

Date Collected: 04/21/13 15:25

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**48**		0.78		mg/Kg		05/04/13 09:00	05/06/13 21:37	1

Client Sample ID: LAKE-WB-TA-111

Lab Sample ID: 550-1629-12

Date Collected: 04/21/13 15:46

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**45**		0.75		mg/Kg		05/04/13 09:00	05/06/13 21:40	1

Client Sample ID: LAKE-FD-WB-101

Lab Sample ID: 550-1629-13

Date Collected: 04/21/13 16:00

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**43**	**M1**	0.80		mg/Kg		06/04/13 09:30	06/04/13 20:55	1

Client Sample ID: LAKE-WB-WC-112

Lab Sample ID: 550-1629-14

Date Collected: 04/21/13 09:44

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**14**		0.76		mg/Kg		05/04/13 09:00	05/06/13 21:55	1

Client Sample ID: LAKE-WB-WC-113

Lab Sample ID: 550-1629-15

Date Collected: 04/21/13 10:13

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**16**		0.80		mg/Kg		05/04/13 09:00	05/06/13 22:07	1

Client Sample ID: LAKE-WB-WC-114

Lab Sample ID: 550-1629-16

Date Collected: 04/21/13 10:33

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**16**		0.76		mg/Kg		05/04/13 09:00	05/06/13 22:09	1

Client Sample ID: LAKE-WB-WC-115

Lab Sample ID: 550-1629-17

Date Collected: 04/21/13 10:51

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**14**		0.73		mg/Kg		05/04/13 09:00	05/06/13 22:12	1

QC Sample Results

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 280-172528/1-A
Matrix: Solid
Analysis Batch: 173030

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 172528

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		05/04/13 09:00	05/06/13 20:52	1

Lab Sample ID: LCS 280-172528/2-A
Matrix: Solid
Analysis Batch: 173030

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 172528

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.0		mg/Kg		96	86 - 110		

Lab Sample ID: 550-1629-14 MS
Matrix: Solid
Analysis Batch: 173030

Client Sample ID: LAKE-WB-WC-112
Prep Type: Total/NA
Prep Batch: 172528

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	14		24.0	37.3		mg/Kg		95	70 - 200		

Lab Sample ID: 550-1629-14 MSD
Matrix: Solid
Analysis Batch: 173030

Client Sample ID: LAKE-WB-WC-112
Prep Type: Total/NA
Prep Batch: 172528

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	14		24.3	34.6		mg/Kg		83	70 - 200	7	40

Lab Sample ID: MB 280-176858/1-A
Matrix: Solid
Analysis Batch: 177262

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 176858

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		06/04/13 09:30	06/04/13 20:51	1

Lab Sample ID: LCS 280-176858/2-A
Matrix: Solid
Analysis Batch: 177262

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 176858

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.8		mg/Kg		99	86 - 110		

Lab Sample ID: 550-1629-13 MS
Matrix: Solid
Analysis Batch: 177262

Client Sample ID: LAKE-FD-WB-101
Prep Type: Total/NA
Prep Batch: 176858

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	43	M1	24.8	97.4	M1	mg/Kg		219	70 - 200		

Lab Sample ID: 550-1629-13 MSD
Matrix: Solid
Analysis Batch: 177262

Client Sample ID: LAKE-FD-WB-101
Prep Type: Total/NA
Prep Batch: 176858

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	43	M1	24.9	97.1	M1	mg/Kg		217	70 - 200	0	40

Metals

Leach Batch: 172237

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1629-1	LAKE-WB-FL-100	Total/NA	Solid	Increm, Prep	
550-1629-2	LAKE-WB-FL-101	Total/NA	Solid	Increm, Prep	
550-1629-3	LAKE-WB-FL-102	Total/NA	Solid	Increm, Prep	
550-1629-4	LAKE-WB-FL-103	Total/NA	Solid	Increm, Prep	
550-1629-5	LAKE-WB-BG-104	Total/NA	Solid	Increm, Prep	
550-1629-6	LAKE-WB-BG-105	Total/NA	Solid	Increm, Prep	
550-1629-7	LAKE-WB-BG-106	Total/NA	Solid	Increm, Prep	
550-1629-8	LAKE-WB-BG-107	Total/NA	Solid	Increm, Prep	
550-1629-9	LAKE-WB-TA-108	Total/NA	Solid	Increm, Prep	
550-1629-10	LAKE-WB-TA-109	Total/NA	Solid	Increm, Prep	
550-1629-11	LAKE-WB-TA-110	Total/NA	Solid	Increm, Prep	
550-1629-12	LAKE-WB-TA-111	Total/NA	Solid	Increm, Prep	
550-1629-13	LAKE-FD-WB-101	Total/NA	Solid	Increm, Prep	
550-1629-13 MS	LAKE-FD-WB-101	Total/NA	Solid	Increm, Prep	
550-1629-13 MSD	LAKE-FD-WB-101	Total/NA	Solid	Increm, Prep	
550-1629-14	LAKE-WB-WC-112	Total/NA	Solid	Increm, Prep	
550-1629-14 MS	LAKE-WB-WC-112	Total/NA	Solid	Increm, Prep	
550-1629-14 MSD	LAKE-WB-WC-112	Total/NA	Solid	Increm, Prep	
550-1629-15	LAKE-WB-WC-113	Total/NA	Solid	Increm, Prep	
550-1629-16	LAKE-WB-WC-114	Total/NA	Solid	Increm, Prep	
550-1629-17	LAKE-WB-WC-115	Total/NA	Solid	Increm, Prep	

Prep Batch: 172528

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1629-1	LAKE-WB-FL-100	Total/NA	Solid	3050B MOD	172237
550-1629-2	LAKE-WB-FL-101	Total/NA	Solid	3050B MOD	172237
550-1629-3	LAKE-WB-FL-102	Total/NA	Solid	3050B MOD	172237
550-1629-4	LAKE-WB-FL-103	Total/NA	Solid	3050B MOD	172237
550-1629-5	LAKE-WB-BG-104	Total/NA	Solid	3050B MOD	172237
550-1629-6	LAKE-WB-BG-105	Total/NA	Solid	3050B MOD	172237
550-1629-7	LAKE-WB-BG-106	Total/NA	Solid	3050B MOD	172237
550-1629-8	LAKE-WB-BG-107	Total/NA	Solid	3050B MOD	172237
550-1629-9	LAKE-WB-TA-108	Total/NA	Solid	3050B MOD	172237
550-1629-10	LAKE-WB-TA-109	Total/NA	Solid	3050B MOD	172237
550-1629-11	LAKE-WB-TA-110	Total/NA	Solid	3050B MOD	172237
550-1629-12	LAKE-WB-TA-111	Total/NA	Solid	3050B MOD	172237
550-1629-14	LAKE-WB-WC-112	Total/NA	Solid	3050B MOD	172237
550-1629-14 MS	LAKE-WB-WC-112	Total/NA	Solid	3050B MOD	172237
550-1629-14 MSD	LAKE-WB-WC-112	Total/NA	Solid	3050B MOD	172237
550-1629-15	LAKE-WB-WC-113	Total/NA	Solid	3050B MOD	172237
550-1629-16	LAKE-WB-WC-114	Total/NA	Solid	3050B MOD	172237
550-1629-17	LAKE-WB-WC-115	Total/NA	Solid	3050B MOD	172237
LCS 280-172528/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
MB 280-172528/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Analysis Batch: 173030

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1629-1	LAKE-WB-FL-100	Total/NA	Solid	6010B	172528
550-1629-2	LAKE-WB-FL-101	Total/NA	Solid	6010B	172528
550-1629-3	LAKE-WB-FL-102	Total/NA	Solid	6010B	172528
550-1629-4	LAKE-WB-FL-103	Total/NA	Solid	6010B	172528

QC Association Summary

Metals (Continued)

Analysis Batch: 173030 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1629-5	LAKE-WB-BG-104	Total/NA	Solid	6010B	172528
550-1629-6	LAKE-WB-BG-105	Total/NA	Solid	6010B	172528
550-1629-7	LAKE-WB-BG-106	Total/NA	Solid	6010B	172528
550-1629-8	LAKE-WB-BG-107	Total/NA	Solid	6010B	172528
550-1629-9	LAKE-WB-TA-108	Total/NA	Solid	6010B	172528
550-1629-10	LAKE-WB-TA-109	Total/NA	Solid	6010B	172528
550-1629-11	LAKE-WB-TA-110	Total/NA	Solid	6010B	172528
550-1629-12	LAKE-WB-TA-111	Total/NA	Solid	6010B	172528
550-1629-14	LAKE-WB-WC-112	Total/NA	Solid	6010B	172528
550-1629-14 MS	LAKE-WB-WC-112	Total/NA	Solid	6010B	172528
550-1629-14 MSD	LAKE-WB-WC-112	Total/NA	Solid	6010B	172528
550-1629-15	LAKE-WB-WC-113	Total/NA	Solid	6010B	172528
550-1629-16	LAKE-WB-WC-114	Total/NA	Solid	6010B	172528
550-1629-17	LAKE-WB-WC-115	Total/NA	Solid	6010B	172528
LCS 280-172528/2-A	Lab Control Sample	Total/NA	Solid	6010B	172528
MB 280-172528/1-A	Method Blank	Total/NA	Solid	6010B	172528

Prep Batch: 176858

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1629-13	LAKE-FD-WB-101	Total/NA	Solid	3050B MOD	172237
550-1629-13 MS	LAKE-FD-WB-101	Total/NA	Solid	3050B MOD	172237
550-1629-13 MSD	LAKE-FD-WB-101	Total/NA	Solid	3050B MOD	172237
LCS 280-176858/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
MB 280-176858/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Analysis Batch: 177262

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1629-13	LAKE-FD-WB-101	Total/NA	Solid	6010B	176858
550-1629-13 MS	LAKE-FD-WB-101	Total/NA	Solid	6010B	176858
550-1629-13 MSD	LAKE-FD-WB-101	Total/NA	Solid	6010B	176858
LCS 280-176858/2-A	Lab Control Sample	Total/NA	Solid	6010B	176858
MB 280-176858/1-A	Method Blank	Total/NA	Solid	6010B	176858

Lab Chronicle

Client Sample ID: LAKE-WB-FL-100

Lab Sample ID: 550-1629-1

Date Collected: 04/21/13 11:17

Matrix: Solid

Date Received: 04/26/13 09:30

	Batch	Batch		Dilution	Batch	Prepared		
Prep Type	**Type**	**Method**	**Run**	**Factor**	**Number**	**or Analyzed**	**Analyst**	**Lab**
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 20:56	HEB	TAL DEN

Client Sample ID: LAKE-WB-FL-101

Lab Sample ID: 550-1629-2

Date Collected: 04/21/13 11:40

Matrix: Solid

Date Received: 04/26/13 09:30

	Batch	Batch		Dilution	Batch	Prepared		
Prep Type	**Type**	**Method**	**Run**	**Factor**	**Number**	**or Analyzed**	**Analyst**	**Lab**
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 20:59	HEB	TAL DEN

Client Sample ID: LAKE-WB-FL-102

Lab Sample ID: 550-1629-3

Date Collected: 04/21/13 11:42

Matrix: Solid

Date Received: 04/26/13 09:30

	Batch	Batch		Dilution	Batch	Prepared		
Prep Type	**Type**	**Method**	**Run**	**Factor**	**Number**	**or Analyzed**	**Analyst**	**Lab**
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:02	HEB	TAL DEN

Client Sample ID: LAKE-WB-FL-103

Lab Sample ID: 550-1629-4

Date Collected: 04/21/13 11:57

Matrix: Solid

Date Received: 04/26/13 09:30

	Batch	Batch		Dilution	Batch	Prepared		
Prep Type	**Type**	**Method**	**Run**	**Factor**	**Number**	**or Analyzed**	**Analyst**	**Lab**
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:06	HEB	TAL DEN

Client Sample ID: LAKE-WB-BG-104

Lab Sample ID: 550-1629-5

Date Collected: 04/21/13 09:48

Matrix: Solid

Date Received: 04/26/13 09:30

	Batch	Batch		Dilution	Batch	Prepared		
Prep Type	**Type**	**Method**	**Run**	**Factor**	**Number**	**or Analyzed**	**Analyst**	**Lab**
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:08	HEB	TAL DEN

Client Sample ID: LAKE-WB-BG-105
Lab Sample ID: 550-1629-6
Date Collected: 04/21/13 10:18
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:21	HEB	TAL DEN

Client Sample ID: LAKE-WB-BG-106
Lab Sample ID: 550-1629-7
Date Collected: 04/21/13 10:48
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:24	HEB	TAL DEN

Client Sample ID: LAKE-WB-BG-107
Lab Sample ID: 550-1629-8
Date Collected: 04/21/13 11:13
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:27	HEB	TAL DEN

Client Sample ID: LAKE-WB-TA-108
Lab Sample ID: 550-1629-9
Date Collected: 04/21/13 14:33
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:30	HEB	TAL DEN

Client Sample ID: LAKE-WB-TA-109
Lab Sample ID: 550-1629-10
Date Collected: 04/21/13 14:52
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:33	HEB	TAL DEN

Client Sample ID: LAKE-WB-TA-110

Lab Sample ID: 550-1629-11
Date Collected: 04/21/13 15:25
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:37	HEB	TAL DEN

Client Sample ID: LAKE-WB-TA-111

Lab Sample ID: 550-1629-12
Date Collected: 04/21/13 15:46
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:40	HEB	TAL DEN

Client Sample ID: LAKE-FD-WB-101

Lab Sample ID: 550-1629-13
Date Collected: 04/21/13 16:00
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			176858	06/04/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	177262	06/04/13 20:55	JKH	TAL DEN

Client Sample ID: LAKE-WB-WC-112

Lab Sample ID: 550-1629-14
Date Collected: 04/21/13 09:44
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 21:55	HEB	TAL DEN

Client Sample ID: LAKE-WB-WC-113

Lab Sample ID: 550-1629-15
Date Collected: 04/21/13 10:13
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 22:07	HEB	TAL DEN

Client Sample ID: LAKE-WB-WC-114

Date Collected: 04/21/13 10:33
Date Received: 04/26/13 09:30

Lab Sample ID: 550-1629-16
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 22:09	HEB	TAL DEN

Client Sample ID: LAKE-WB-WC-115

Date Collected: 04/21/13 10:51
Date Received: 04/26/13 09:30

Lab Sample ID: 550-1629-17
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172237	05/01/13 22:43	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172528	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173030	05/06/13 22:12	HEB	TAL DEN

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Certification Summary

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-13
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-13
Nevada	State Program	9	AZ01030	07-31-13
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
California	State Program	9	2513	08-31-14
Colorado	State Program	8	N/A	09-30-13
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-13
Idaho	State Program	10	CO00026	09-30-13
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Louisiana	NELAP	6	30785	06-30-13
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	07-30-13
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-13
New Mexico	State Program	6	CO00026	06-30-13
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-13
Oklahoma	State Program	6	8614	08-31-13
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-31-13
South Carolina	State Program	4	72002	06-30-13
Texas	NELAP	6	T104704183-08-TX	09-30-13
USDA	Federal		P330-08-00036	02-08-14
Utah	NELAP	8	QUAN5	06-30-13
Virginia	NELAP	3	460232	06-14-13
Washington	State Program	10	C583	08-03-13
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-13
Wyoming (UST)	A2LA	8		10-31-13

Method Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1629-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL DEN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Willow Beach

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTOI

☒ Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, A
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

550-1629 Chain of Custody

58-1629

Page 1 of 2

Client Name / Address: ECM
3525 Hyland Ave #200
Costa Mesa, CA 92626

Project / PO Number: LAKE

Project Manager: Tiffany Luff

Phone Number: 476-358-1486

Sampler: Carson Davis

Fax Number: 714-662-2758

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	WD ~~Total Lead EPA 200.7~~	Total Lead EPA 6010B								Special Instructions
LAKE-WB-FL-100	Soil	1 qt Bag	1	4/24/13	1117	None		X								-1
LAKE-WB-FL-101			1		1140			X								-2
LAKE-WB-FL-102			1		1142			X								-3
LAKE-WB-FL-103			1		1157			X								-4
LAKE-WB-BG-104			1		0947			X								-5
LAKE-WB-BG-105			1		1017			X								-6
LAKE-WB-BG-106			1		1048			X								-7
LAKE-WB-BG-107			1		1113			X								-8
LAKE-WB-TA-108			1		1433			X								-9
LAKE-WB-TA-109			1		1452			X								-10
LAKE-WB-TA-110			1		1525			X					/			-11
LAKE-WB-TA-111			1		1546			X								-12
LAKE-FD-WB-101			1		1600			X								-13
LAKE-WB-WC-112	V	V	1	✓	0944	V		X								-14

Relinquished By: Chris McConnell Date / Time: 4-24-13 15:00
Received By: FedEx Date / Time:

Relinquished By: Date / Time:
Received By: Date / Time:

Relinquished By: FEDEX Date / Time: 0930 4/26/13
Received in Lab By: Date / Time: 4/26/13 0930

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal X

Sample Integrity: (Check)
intact ✓ on ice NO

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

21.8°C

Willow Beach

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF COUSTODY FORM

550-1629

☒ Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 454-9303
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 2 of 2

Client Name/Address: ECM
3525 Hyland Ave #202
Costa Mesa, CA 92626

Project/PO Number: LAKE

Project Manager: Tiffany Looff

Phone Number: 480-358-1480

Sampler: Christina Davis & Chris McCormack

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	~~Total Lead EPA 200.7~~	Total Lead EPA 6010B							Special Instructions
LAKE WB-WC-113	~~Water~~ Soil	250ml Poly	1	4/21/13	1013	None		/						-15	
LAKE-WB-WC-114	Soil	16 oz plastic	↓	↓	1023	↓		/						-16	
LAKE-WB-WC-115	Soil	bag	↓	↓	10:51 ~~[illegible]~~	↓		/						-17	10:51
~~LAKE EP FA 104~~	Water	250 ml poly			0745	HNO3	X								
~~LAKE ER FI 105~~	↓	↓			0746		X								
~~LAKE EP WC 106~~					0748		X								
~~LAKE ER RCT 107~~	↓				0756		X								
~~LAKE-FB-WB-101~~	↓	↓	↓	↓	0743	↓	X								

Relinquished By: Chris McCormack Date/Time: 4-24-13 15:00 Received By: FedEx Date/Time:

Relinquished By: Date/Time: Received By: Date/Time:

Relinquished By: FEDEX 4/26/13 0930 Date/Time: Received in Lab By: Date/Time: 4/26/13 0930

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal X

Sample Integrity: (Check)
intact ____ on ice NO

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

21.8°C

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1629-1

Login Number: 1629

List Source: TestAmerica Phoenix

List Number: 1

Creator: Baker, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1629-1

Login Number: 1629

List Number: 1

Creator: Eichelberger, Elizabeth M

List Source: TestAmerica Denver

List Creation: 05/01/13 06:59 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	17.1
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-1630-1
Client Project/Site: Lake
Revision: 1

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Carlene McCutcheon

Authorized for release by:
6/29/2013 9:00:15 PM

Carlene McCutcheon, Customer Service Manager
carlene.mccutcheon@testamericainc.com

LINKS

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www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Job ID: 550-1630-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-1630-1

Comments

No additional comments.

Receipt

The samples were received on 4/26/2013 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 22.1° C.

Metals

Method(s) 3050B MOD: Insufficient sample volume was available to perform batch matrix spike/matrix spike duplicate (MS/MSD) associated with batch. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.

No other analytical or quality issues were noted.

Organic Prep

Method(s) Increm, Prep: The following sample(s) was air dried and sieved per the procedure; however, the sample(s) contained material that would not pass through the sieve: LAKE-TB-BG-110 (550-1630-9), LAKE-TB-BG-111 (550-1630-10), LAKE-TB-BG-112 (550-1630-11), LAKE-TB-BG-113 (550-1630-12), LAKE-TB-FD-118 (550-1630-17), LAKE-TB-FL-114 (550-1630-13), LAKE-TB-FL-115 (550-1630-14), LAKE-TB-FL-116 (550-1630-15), LAKE-TB-FL-117 (550-1630-16), LAKE-TB-TA-100 (550-1630-1), LAKE-TB-TA-101 (550-1630-2), LAKE-TB-TA-102 (550-1630-3), LAKE-TB-TA-103 (550-1630-4), LAKE-TB-WC-105 (550-1630-5), LAKE-TB-WC-106 (550-1630-6), LAKE-TB-WC-107 (550-1630-7), LAKE-TB-WC-108 (550-1630-8). This material was removed and not extracted. The material appeared to be rocks.

Batch 172228 and 172237
Multi-Inc (6010)

No other analytical or quality issues were noted.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-1630-1	LAKE-TB-TA-100	Solid	04/20/13 10:35	04/26/13 09:30
550-1630-2	LAKE-TB-TA-101	Solid	04/20/13 11:29	04/26/13 09:30
550-1630-3	LAKE-TB-TA-102	Solid	04/20/13 12:04	04/26/13 09:30
550-1630-4	LAKE-TB-TA-103	Solid	04/20/13 12:28	04/26/13 09:30
550-1630-5	LAKE-TB-WC-105	Solid	04/20/13 10:30	04/26/13 09:30
550-1630-6	LAKE-TB-WC-106	Solid	04/20/13 11:27	04/26/13 09:30
550-1630-7	LAKE-TB-WC-107	Solid	04/20/13 12:30	04/26/13 09:30
550-1630-8	LAKE-TB-WC-108	Solid	04/20/13 12:59	04/26/13 09:30
550-1630-9	LAKE-TB-BG-110	Solid	04/20/13 11:02	04/26/13 09:30
550-1630-10	LAKE-TB-BG-111	Solid	04/20/13 11:54	04/26/13 09:30
550-1630-11	LAKE-TB-BG-112	Solid	04/20/13 12:46	04/26/13 09:30
550-1630-12	LAKE-TB-BG-113	Solid	04/20/13 14:16	04/26/13 09:30
550-1630-13	LAKE-TB-FL-114	Solid	04/20/13 12:58	04/26/13 09:30
550-1630-14	LAKE-TB-FL-115	Solid	04/20/13 14:29	04/26/13 09:30
550-1630-15	LAKE-TB-FL-116	Solid	04/20/13 14:30	04/26/13 09:30
550-1630-16	LAKE-TB-FL-117	Solid	04/20/13 14:50	04/26/13 09:30
550-1630-17	LAKE-TB-FD-118	Solid	04/20/13 15:20	04/26/13 09:30

Detection Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Client Sample ID: LAKE-TB-TA-100 — Lab Sample ID: 550-1630-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	150		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-TA-101 — Lab Sample ID: 550-1630-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	41		0.75		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-TA-102 — Lab Sample ID: 550-1630-3

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	24		0.75		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-TA-103 — Lab Sample ID: 550-1630-4

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	16		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-WC-105 — Lab Sample ID: 550-1630-5

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.2		0.79		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-WC-106 — Lab Sample ID: 550-1630-6

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.3		0.74		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-WC-107 — Lab Sample ID: 550-1630-7

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.7		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-WC-108 — Lab Sample ID: 550-1630-8

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.9		0.79		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-BG-110 — Lab Sample ID: 550-1630-9

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.9		0.73		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-BG-111 — Lab Sample ID: 550-1630-10

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.5		0.74		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-BG-112 — Lab Sample ID: 550-1630-11

This Detection Summary does not include radiochemical test results.

Detection Summary

Client Sample ID: LAKE-TB-BG-112 (Continued) — Lab Sample ID: 550-1630-11

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.5		0.79		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-BG-113 — Lab Sample ID: 550-1630-12

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.2		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-FL-114 — Lab Sample ID: 550-1630-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.2		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-FL-115 — Lab Sample ID: 550-1630-14

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.1		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-FL-116 — Lab Sample ID: 550-1630-15

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.8		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-FL-117 — Lab Sample ID: 550-1630-16

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.6		0.74		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-TB-FD-118 — Lab Sample ID: 550-1630-17

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	5.4		0.76		mg/Kg	1		6010B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Client Sample ID: LAKE-TB-TA-100

Lab Sample ID: 550-1630-1

Date Collected: 04/20/13 10:35
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**150**		0.78		mg/Kg		06/27/13 08:15	06/27/13 23:03	1

Client Sample ID: LAKE-TB-TA-101

Lab Sample ID: 550-1630-2

Date Collected: 04/20/13 11:29
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**41**		0.75		mg/Kg		05/04/13 09:00	05/07/13 20:32	1

Client Sample ID: LAKE-TB-TA-102

Lab Sample ID: 550-1630-3

Date Collected: 04/20/13 12:04
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**24**		0.75		mg/Kg		05/04/13 09:00	05/07/13 20:34	1

Client Sample ID: LAKE-TB-TA-103

Lab Sample ID: 550-1630-4

Date Collected: 04/20/13 12:28
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**16**		0.76		mg/Kg		05/04/13 09:00	05/07/13 20:37	1

Client Sample ID: LAKE-TB-WC-105

Lab Sample ID: 550-1630-5

Date Collected: 04/20/13 10:30
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.2**		0.79		mg/Kg		05/04/13 09:00	05/07/13 20:39	1

Client Sample ID: LAKE-TB-WC-106

Lab Sample ID: 550-1630-6

Date Collected: 04/20/13 11:27
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.3**		0.74		mg/Kg		05/04/13 09:00	05/07/13 20:51	1

Client Sample ID: LAKE-TB-WC-107

Lab Sample ID: 550-1630-7

Date Collected: 04/20/13 12:30
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.7**		0.77		mg/Kg		05/04/13 09:00	05/07/13 20:54	1

Client Sample Results

Client Sample ID: LAKE-TB-WC-108

Lab Sample ID: 550-1630-8
Date Collected: 04/20/13 12:59
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.9**		0.79		mg/Kg		05/04/13 09:00	05/07/13 20:58	1

Client Sample ID: LAKE-TB-BG-110

Lab Sample ID: 550-1630-9
Date Collected: 04/20/13 11:02
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.9**		0.73		mg/Kg		05/04/13 09:00	05/07/13 21:00	1

Client Sample ID: LAKE-TB-BG-111

Lab Sample ID: 550-1630-10
Date Collected: 04/20/13 11:54
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.5**		0.74		mg/Kg		05/04/13 09:00	05/07/13 21:03	1

Client Sample ID: LAKE-TB-BG-112

Lab Sample ID: 550-1630-11
Date Collected: 04/20/13 12:46
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.5**		0.79		mg/Kg		05/04/13 09:00	05/07/13 21:16	1

Client Sample ID: LAKE-TB-BG-113

Lab Sample ID: 550-1630-12
Date Collected: 04/20/13 14:16
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.2**		0.77		mg/Kg		05/04/13 09:00	05/07/13 21:19	1

Client Sample ID: LAKE-TB-FL-114

Lab Sample ID: 550-1630-13
Date Collected: 04/20/13 12:58
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.2**		0.77		mg/Kg		05/04/13 09:00	05/07/13 21:22	1

Client Sample ID: LAKE-TB-FL-115

Lab Sample ID: 550-1630-14
Date Collected: 04/20/13 14:29
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.1**		0.78		mg/Kg		05/04/13 09:00	05/07/13 21:25	1

Client Sample ID: LAKE-TB-FL-116

Lab Sample ID: 550-1630-15

Date Collected: 04/20/13 14:30

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.8**		0.78		mg/Kg		05/04/13 09:00	05/07/13 21:28	1

Client Sample ID: LAKE-TB-FL-117

Lab Sample ID: 550-1630-16

Date Collected: 04/20/13 14:50

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.6**		0.74		mg/Kg		05/04/13 09:00	05/07/13 21:32	1

Client Sample ID: LAKE-TB-FD-118

Lab Sample ID: 550-1630-17

Date Collected: 04/20/13 15:20

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**5.4**		0.76		mg/Kg		05/04/13 09:00	05/07/13 21:34	1

QC Sample Results

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 280-172530/1-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 172530

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		05/04/13 09:00	05/07/13 20:23	1

Lab Sample ID: LCS 280-172530/2-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 172530

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.6		mg/Kg		98	86 - 110		

Lab Sample ID: LCSD 280-172530/20-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 172530

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			25.0	25.1		mg/Kg		100	86 - 110	2	20

Lab Sample ID: MB 280-178634/1-A
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 178634

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		06/27/13 08:15	06/27/13 22:50	1

Lab Sample ID: LCS 280-178634/2-A
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 178634

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.9		mg/Kg		99	86 - 110		

Lab Sample ID: LCSD 280-178634/3-B
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 178634

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			25.0	24.8		mg/Kg		99	86 - 110	0	20

QC Association Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Metals

Leach Batch: 172228

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1630-2	LAKE-TB-TA-101	Total/NA	Solid	Increm, Prep	
550-1630-3	LAKE-TB-TA-102	Total/NA	Solid	Increm, Prep	
550-1630-4	LAKE-TB-TA-103	Total/NA	Solid	Increm, Prep	
550-1630-5	LAKE-TB-WC-105	Total/NA	Solid	Increm, Prep	
550-1630-6	LAKE-TB-WC-106	Total/NA	Solid	Increm, Prep	
550-1630-7	LAKE-TB-WC-107	Total/NA	Solid	Increm, Prep	
550-1630-8	LAKE-TB-WC-108	Total/NA	Solid	Increm, Prep	
550-1630-9	LAKE-TB-BG-110	Total/NA	Solid	Increm, Prep	
550-1630-10	LAKE-TB-BG-111	Total/NA	Solid	Increm, Prep	
550-1630-11	LAKE-TB-BG-112	Total/NA	Solid	Increm, Prep	
550-1630-12	LAKE-TB-BG-113	Total/NA	Solid	Increm, Prep	
550-1630-13	LAKE-TB-FL-114	Total/NA	Solid	Increm, Prep	
550-1630-14	LAKE-TB-FL-115	Total/NA	Solid	Increm, Prep	
550-1630-15	LAKE-TB-FL-116	Total/NA	Solid	Increm, Prep	
550-1630-16	LAKE-TB-FL-117	Total/NA	Solid	Increm, Prep	
550-1630-17	LAKE-TB-FD-118	Total/NA	Solid	Increm, Prep	

Prep Batch: 172530

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1630-2	LAKE-TB-TA-101	Total/NA	Solid	3050B MOD	172228
550-1630-3	LAKE-TB-TA-102	Total/NA	Solid	3050B MOD	172228
550-1630-4	LAKE-TB-TA-103	Total/NA	Solid	3050B MOD	172228
550-1630-5	LAKE-TB-WC-105	Total/NA	Solid	3050B MOD	172228
550-1630-6	LAKE-TB-WC-106	Total/NA	Solid	3050B MOD	172228
550-1630-7	LAKE-TB-WC-107	Total/NA	Solid	3050B MOD	172228
550-1630-8	LAKE-TB-WC-108	Total/NA	Solid	3050B MOD	172228
550-1630-9	LAKE-TB-BG-110	Total/NA	Solid	3050B MOD	172228
550-1630-10	LAKE-TB-BG-111	Total/NA	Solid	3050B MOD	172228
550-1630-11	LAKE-TB-BG-112	Total/NA	Solid	3050B MOD	172228
550-1630-12	LAKE-TB-BG-113	Total/NA	Solid	3050B MOD	172228
550-1630-13	LAKE-TB-FL-114	Total/NA	Solid	3050B MOD	172228
550-1630-14	LAKE-TB-FL-115	Total/NA	Solid	3050B MOD	172228
550-1630-15	LAKE-TB-FL-116	Total/NA	Solid	3050B MOD	172228
550-1630-16	LAKE-TB-FL-117	Total/NA	Solid	3050B MOD	172228
550-1630-17	LAKE-TB-FD-118	Total/NA	Solid	3050B MOD	172228
LCS 280-172530/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
LCSD 280-172530/20-A	Lab Control Sample Dup	Total/NA	Solid	3050B MOD	
MB 280-172530/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Analysis Batch: 173235

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1630-2	LAKE-TB-TA-101	Total/NA	Solid	6010B	172530
550-1630-3	LAKE-TB-TA-102	Total/NA	Solid	6010B	172530
550-1630-4	LAKE-TB-TA-103	Total/NA	Solid	6010B	172530
550-1630-5	LAKE-TB-WC-105	Total/NA	Solid	6010B	172530
550-1630-6	LAKE-TB-WC-106	Total/NA	Solid	6010B	172530
550-1630-7	LAKE-TB-WC-107	Total/NA	Solid	6010B	172530
550-1630-8	LAKE-TB-WC-108	Total/NA	Solid	6010B	172530
550-1630-9	LAKE-TB-BG-110	Total/NA	Solid	6010B	172530
550-1630-10	LAKE-TB-BG-111	Total/NA	Solid	6010B	172530
550-1630-11	LAKE-TB-BG-112	Total/NA	Solid	6010B	172530

Metals (Continued)

Analysis Batch: 173235 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1630-12	LAKE-TB-BG-113	Total/NA	Solid	6010B	172530
550-1630-13	LAKE-TB-FL-114	Total/NA	Solid	6010B	172530
550-1630-14	LAKE-TB-FL-115	Total/NA	Solid	6010B	172530
550-1630-15	LAKE-TB-FL-116	Total/NA	Solid	6010B	172530
550-1630-16	LAKE-TB-FL-117	Total/NA	Solid	6010B	172530
550-1630-17	LAKE-TB-FD-118	Total/NA	Solid	6010B	172530
LCS 280-172530/2-A	Lab Control Sample	Total/NA	Solid	6010B	172530
LCSD 280-172530/20-A	Lab Control Sample Dup	Total/NA	Solid	6010B	172530
MB 280-172530/1-A	Method Blank	Total/NA	Solid	6010B	172530

Prep Batch: 178634

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1630-1	LAKE-TB-TA-100	Total/NA	Solid	3050B MOD	180601
LCS 280-178634/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
LCSD 280-178634/3-B	Lab Control Sample Dup	Total/NA	Solid	3050B MOD	
MB 280-178634/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Leach Batch: 180601

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1630-1	LAKE-TB-TA-100	Total/NA	Solid	Increm, Prep	

Analysis Batch: 180867

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1630-1	LAKE-TB-TA-100	Total/NA	Solid	6010B	178634
LCS 280-178634/2-A	Lab Control Sample	Total/NA	Solid	6010B	178634
LCSD 280-178634/3-B	Lab Control Sample Dup	Total/NA	Solid	6010B	178634
MB 280-178634/1-A	Method Blank	Total/NA	Solid	6010B	178634

Lab Chronicle

Client Sample ID: LAKE-TB-TA-100

Lab Sample ID: 550-1630-1
Date Collected: 04/20/13 10:35
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			180601	06/26/13 15:12	EER	TAL DEN
Total/NA	Prep	3050B MOD			178634	06/27/13 08:15	NF	TAL DEN
Total/NA	Analysis	6010B		1	180867	06/27/13 23:03	JKH	TAL DEN

Client Sample ID: LAKE-TB-TA-101

Lab Sample ID: 550-1630-2
Date Collected: 04/20/13 11:29
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 20:32	HEB	TAL DEN

Client Sample ID: LAKE-TB-TA-102

Lab Sample ID: 550-1630-3
Date Collected: 04/20/13 12:04
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 20:34	HEB	TAL DEN

Client Sample ID: LAKE-TB-TA-103

Lab Sample ID: 550-1630-4
Date Collected: 04/20/13 12:28
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 20:37	HEB	TAL DEN

Client Sample ID: LAKE-TB-WC-105

Lab Sample ID: 550-1630-5
Date Collected: 04/20/13 10:30
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 20:39	HEB	TAL DEN

Lab Chronicle

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Client Sample ID: LAKE-TB-WC-106

Lab Sample ID: 550-1630-6

Date Collected: 04/20/13 11:27
Date Received: 04/26/13 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 20:51	HEB	TAL DEN

Client Sample ID: LAKE-TB-WC-107

Lab Sample ID: 550-1630-7

Date Collected: 04/20/13 12:30
Date Received: 04/26/13 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 20:54	HEB	TAL DEN

Client Sample ID: LAKE-TB-WC-108

Lab Sample ID: 550-1630-8

Date Collected: 04/20/13 12:59
Date Received: 04/26/13 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 20:58	HEB	TAL DEN

Client Sample ID: LAKE-TB-BG-110

Lab Sample ID: 550-1630-9

Date Collected: 04/20/13 11:02
Date Received: 04/26/13 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:00	HEB	TAL DEN

Client Sample ID: LAKE-TB-BG-111

Lab Sample ID: 550-1630-10

Date Collected: 04/20/13 11:54
Date Received: 04/26/13 09:30

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:03	HEB	TAL DEN

Lab Chronicle

Client Sample ID: LAKE-TB-BG-112

Lab Sample ID: 550-1630-11

Date Collected: 04/20/13 12:46

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:16	HEB	TAL DEN

Client Sample ID: LAKE-TB-BG-113

Lab Sample ID: 550-1630-12

Date Collected: 04/20/13 14:16

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:19	HEB	TAL DEN

Client Sample ID: LAKE-TB-FL-114

Lab Sample ID: 550-1630-13

Date Collected: 04/20/13 12:58

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:22	HEB	TAL DEN

Client Sample ID: LAKE-TB-FL-115

Lab Sample ID: 550-1630-14

Date Collected: 04/20/13 14:29

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:25	HEB	TAL DEN

Client Sample ID: LAKE-TB-FL-116

Lab Sample ID: 550-1630-15

Date Collected: 04/20/13 14:30

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:28	HEB	TAL DEN

Client Sample ID: LAKE-TB-FL-117 Lab Sample ID: 550-1630-16

Date Collected: 04/20/13 14:50 **Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:32	HEB	TAL DEN

Client Sample ID: LAKE-TB-FD-118 Lab Sample ID: 550-1630-17

Date Collected: 04/20/13 15:20 **Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172228	05/01/13 20:50	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172530	05/04/13 09:00	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:34	HEB	TAL DEN

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Certification Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-13
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-13
Nevada	State Program	9	AZ01030	07-31-13
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Colorado	State Program	8	N/A	09-30-13
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Idaho	State Program	10	CO00026	09-30-13
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	07-30-13
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-13
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-13 *
Oklahoma	State Program	6	8614	08-31-13
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-31-13
South Carolina	State Program	4	72002	06-30-13 *
Texas	NELAP	6	T104704183-08-TX	09-30-13
USDA	Federal		P330-08-00036	02-08-14
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	08-03-13
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-13
Wyoming (UST)	A2LA	8		10-31-13

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1630-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL DEN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Temple Bar

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

550-1630

[✓] Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-33
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

550-1630 Chain of Custody

f 2

Client Name/Address: ECM
3525 Hyland Ave #200
Costa Mesa, CA 92626

Project/PO Number: LAKE

Project Manager: Tiffany Looff

Phone Number: 480-358-1480

Sampler: Carisa Davis & Chris McCormack

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	~~Total Lead EPA 200.7~~	Total Lead EPA 6010B								Special Instructions
LAKE-TB-TA-100	Soil	1 Qt Bag	1	4/20/13	1035	None		X					-1			
LAKE-TB-TA-101			1		1129			X					-2			
LAKE-TB-TA-102			1		1204			X					-3			
LAKE-TB-TA-103			1		1228			X					-4			
LAKE-TB-WC-105*			1		1030			X					-5			* Sample 104 skipped in sequence
LAKE-TB-WC-106			1		1127			X					-6			
LAKE-TB-WC-107			1		1230			X					-7			
LAKE-TB-WC-108			1		1259			X					-8			
LAKE-TB-BG-~~100~~ 110**			1		1102			X					-9			** Sample -109 skipped in sequence
LAKE-TB-BG-111			1		1154			X					-10			
LAKE-TB-BG-112			1		1246			X					-11			
LAKE-TB-BG-113			1		1416			X					-12			
LAKE-TB-FL-114			1		1258			X					-13			
LAKE-TB-FL-115			1		1429			X					-14			

Relinquished By: Chris McCormack Date/Time: 4-24-13 15:00 Received By: Fed EX Date/Time:

Relinquished By: Date/Time: Received By: Date/Time:

Relinquished By: Fed Ex Date/Time: Received in Lab By: Date/Time: 4/26/13 9:30

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal X

Sample Integrity: (Check)
intact X on ice no

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

22.6

Temple Out

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

550-1630

☒ Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 454-9303
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 2 of 2

Client Name / Address:
ECM
3525 Hyland Ave. #200
Costa Mesa, CA 92626

Project / PO Number: LAKE

Project Manager: Tiffany Looff

Phone Number: 480-358-1480

Sampler: Carisa Davis & Chris McCormick

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Analysis Required									Special Instructions
							~~Total Lead EPA 200.7~~ CWD	Total Lead EPA 6010B								
LAKE-TB-FL-116	Soil	1 qt Bag	1	4/20/13	1430	None		X						-15		
LAKE-TB-FL-117	↓	↓	1	↓	1450	↓		X						-16		
LAKE-TB-FD-118	↓	↓	1	↓	1520	↓		X						-17		
~~LAKE-ER-TA-100~~	~~Water~~	~~250ml poly~~	~~1~~	~~4/20/13~~	~~1501~~	~~HNO3~~	~~X~~									CWD
~~LAKE-ER-WC-101~~	↓	↓	~~1~~	↓	~~1505~~	↓	~~X~~									CWD
~~LAKE-ER-BG-102~~	↓	↓	~~1~~	↓	~~1510~~	↓	~~X~~									CWD
~~LAKE-ER-FL-103~~	↓	↓	~~1~~	↓	~~1515~~	↓	~~X~~									CWD
~~LAKE-FB-XX FB 100~~	↓	↓	~~1~~	↓	~~1520~~	↓	~~X~~									CWD

Relinquished By:	Date / Time:	Received By:	Date / Time:
Chris McCormick	4-2413 1500	Fed Ex	
Fed Ex			4/20/13 9:30

Relinquished By: Chris McCormick — Date / Time: 4-2413 1500 — Received By: Fed Ex — Date / Time:

Relinquished By: — Date / Time: — Received By: — Date / Time:

Relinquished By: Fed Ex — Date / Time: — Received in Lab By: — Date / Time: 4/20/13 9:30

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal X

Sample Integrity: (Check)
intact ✓ on ice no

Note: *By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project.* Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

22.1°c

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1630-1

Login Number: 1630

List Source: TestAmerica Phoenix

List Number: 1

Creator: Baker, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1630-1

Login Number: 1630
List Number: 1
Creator: Eichelberger, Elizabeth M

List Source: TestAmerica Denver
List Creation: 05/01/13 06:52 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	16.8
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-1632-1
Client Project/Site: Lake
Revision: 1

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Authorized for release by:
7/11/2013 12:35:37 PM

Carlene McCutcheon, Customer Service Manager
carlene.mccutcheon@testamericainc.com

LINKS

Review your project results through TotalAccess

Have a Question? Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-1

Qualifiers

Metals

Qualifier	Qualifier Description
M2	Matrix spike recovery was low, the associated blank spike recovery was acceptable.
M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The associated blank spike was acceptable.
R4	MS/MSD RPD exceeded the method control limit. Recovery met acceptance criteria.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Job ID: 550-1632-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-1632-1

Comments
No additional comments.

Receipt
The samples were received on 4/26/2013 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 22.1° C.

Metals
Method(s) 6010B: The serial dilution performed for the following sample(s) associated with batch 172631 was outside control limits for Pb: (550-1632-1 SD), LAKE-FD-LV-103 (550-1632-17), LAKE-LV-BG-112 (550-1632-13), LAKE-LV-BG-113 (550-1632-14), LAKE-LV-BG-114 (550-1632-15), LAKE-LV-BG-115 (550-1632-16), LAKE-LV-FL-100 (550-1632-1), LAKE-LV-FL-101 (550-1632-2), LAKE-LV-FL-102 (550-1632-3), LAKE-LV-FL-103 (550-1632-4), LAKE-LV-TA-104 (550-1632-5), LAKE-LV-TA-105 (550-1632-6), LAKE-LV-TA-106 (550-1632-7), LAKE-LV-TA-107 (550-1632-8), LAKE-LV-WC-108 (550-1632-9), LAKE-LV-WC-109 (550-1632-10), LAKE-LV-WC-110 (550-1632-11), LAKE-LV-WC-111 (550-1632-12) (Analytical batch 173235)

No other analytical or quality issues were noted.

Organic Prep
Method(s) Increm, Prep: The following samples were air dried and sieved per the procedure; however, the samples contained material that would not pass through the sieve: LAKE-FD-LV-103 (550-1632-17), LAKE-LV-BG-112 (550-1632-13), LAKE-LV-BG-113 (550-1632-14), LAKE-LV-BG-114 (550-1632-15), LAKE-LV-BG-115 (550-1632-16), LAKE-LV-FL-100 (550-1632-1), LAKE-LV-FL-101 (550-1632-2), LAKE-LV-FL-102 (550-1632-3), LAKE-LV-FL-103 (550-1632-4), LAKE-LV-TA-104 (550-1632-5), LAKE-LV-TA-105 (550-1632-6), LAKE-LV-TA-106 (550-1632-7), LAKE-LV-TA-107 (550-1632-8), LAKE-LV-WC-108 (550-1632-9), LAKE-LV-WC-109 (550-1632-10), LAKE-LV-WC-110 (550-1632-11), LAKE-LV-WC-111 (550-1632-12). This material was removed and not extracted. The material appeared to be rock and/or vegetation.
For Method MULTI_INC/6010B
Prep Batches 172233 & 172235

No other analytical or quality issues were noted.
REVISED Report: Pleasse note that this report has been revised to add re-analysis metals data for sample 550-1632-09.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-1632-1	LAKE-LV-FL-100	Solid	04/23/13 10:55	04/26/13 09:30
550-1632-2	LAKE-LV-FL-101	Solid	04/23/13 11:00	04/26/13 09:30
550-1632-3	LAKE-LV-FL-102	Solid	04/23/13 11:40	04/26/13 09:30
550-1632-4	LAKE-LV-FL-103	Solid	04/23/13 11:50	04/26/13 09:30
550-1632-5	LAKE-LV-TA-104	Solid	04/23/13 11:58	04/26/13 09:30
550-1632-6	LAKE-LV-TA-105	Solid	04/23/13 12:30	04/26/13 09:30
550-1632-7	LAKE-LV-TA-106	Solid	04/23/13 12:50	04/26/13 09:30
550-1632-8	LAKE-LV-TA-107	Solid	04/23/13 13:02	04/26/13 09:30
550-1632-9	LAKE-LV-WC-108	Solid	04/23/13 15:50	04/26/13 09:30
550-1632-10	LAKE-LV-WC-109	Solid	04/23/13 16:04	04/26/13 09:30
550-1632-11	LAKE-LV-WC-110	Solid	04/23/13 16:20	04/26/13 09:30
550-1632-12	LAKE-LV-WC-111	Solid	04/23/13 16:30	04/26/13 09:30
550-1632-13	LAKE-LV-BG-112	Solid	04/24/13 08:15	04/26/13 09:30
550-1632-14	LAKE-LV-BG-113	Solid	04/24/13 08:35	04/26/13 09:30
550-1632-15	LAKE-LV-BG-114	Solid	04/24/13 09:05	04/26/13 09:30
550-1632-16	LAKE-LV-BG-115	Solid	04/24/13 09:30	04/26/13 09:30
550-1632-17	LAKE-FD-LV-103	Solid	04/24/13 09:10	04/26/13 09:30

Detection Summary

Client Sample ID: LAKE-LV-FL-100 Lab Sample ID: 550-1632-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	67	M2	0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-FL-101 Lab Sample ID: 550-1632-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	180		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-FL-102 Lab Sample ID: 550-1632-3

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	89		0.73		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-FL-103 Lab Sample ID: 550-1632-4

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	110		0.80		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-TA-104 Lab Sample ID: 550-1632-5

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	1900		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-TA-105 Lab Sample ID: 550-1632-6

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	4900		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-TA-106 Lab Sample ID: 550-1632-7

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	4000		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-TA-107 Lab Sample ID: 550-1632-8

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	4500		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-WC-108 Lab Sample ID: 550-1632-9

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	27		0.79		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-WC-109 Lab Sample ID: 550-1632-10

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	23		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-WC-110 Lab Sample ID: 550-1632-11

This Detection Summary does not include radiochemical test results.

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Detection Summary

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Client Sample ID: LAKE-LV-WC-110 (Continued) — Lab Sample ID: 550-1632-11

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	74		0.74		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-WC-111 — Lab Sample ID: 550-1632-12

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	26		0.75		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-BG-112 — Lab Sample ID: 550-1632-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	27		0.80		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-BG-113 — Lab Sample ID: 550-1632-14

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	27		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-BG-114 — Lab Sample ID: 550-1632-15

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	19		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-BG-115 — Lab Sample ID: 550-1632-16

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	25		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-FD-LV-103 — Lab Sample ID: 550-1632-17

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	25		0.75		mg/Kg	1		6010B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: LAKE-LV-FL-100

Lab Sample ID: 550-1632-1

Date Collected: 04/23/13 10:55

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**67**	**M2**	0.78		mg/Kg		05/06/13 09:30	05/07/13 21:54	1

Client Sample ID: LAKE-LV-FL-101

Lab Sample ID: 550-1632-2

Date Collected: 04/23/13 11:00

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**180**		0.77		mg/Kg		05/06/13 09:30	05/07/13 22:05	1

Client Sample ID: LAKE-LV-FL-102

Lab Sample ID: 550-1632-3

Date Collected: 04/23/13 11:40

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**89**		0.73		mg/Kg		05/06/13 09:30	05/07/13 22:08	1

Client Sample ID: LAKE-LV-FL-103

Lab Sample ID: 550-1632-4

Date Collected: 04/23/13 11:50

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**110**		0.80		mg/Kg		05/06/13 09:30	05/07/13 22:11	1

Client Sample ID: LAKE-LV-TA-104

Lab Sample ID: 550-1632-5

Date Collected: 04/23/13 11:58

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**1900**		0.77		mg/Kg		05/06/13 09:30	05/09/13 03:27	1

Client Sample ID: LAKE-LV-TA-105

Lab Sample ID: 550-1632-6

Date Collected: 04/23/13 12:30

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**4900**		0.76		mg/Kg		05/06/13 09:30	05/09/13 03:30	1

Client Sample ID: LAKE-LV-TA-106

Lab Sample ID: 550-1632-7

Date Collected: 04/23/13 12:50

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**4000**		0.77		mg/Kg		05/06/13 09:30	05/09/13 03:33	1

Client Sample Results

Client: Environmental Cost Management, Inc. TestAmerica Job ID: 550-1632-1
Project/Site: Lake

Client Sample ID: LAKE-LV-TA-107 Lab Sample ID: 550-1632-8

Date Collected: 04/23/13 13:02 **Matrix: Solid**
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**4500**		0.76		mg/Kg		05/06/13 09:30	05/09/13 03:36	1

Client Sample ID: LAKE-LV-WC-108 Lab Sample ID: 550-1632-9

Date Collected: 04/23/13 15:50 **Matrix: Solid**
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**27**		0.79		mg/Kg		07/03/13 12:30	07/08/13 13:59	1

Client Sample ID: LAKE-LV-WC-109 Lab Sample ID: 550-1632-10

Date Collected: 04/23/13 16:04 **Matrix: Solid**
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**23**		0.76		mg/Kg		05/06/13 09:30	05/09/13 03:41	1

Client Sample ID: LAKE-LV-WC-110 Lab Sample ID: 550-1632-11

Date Collected: 04/23/13 16:20 **Matrix: Solid**
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**74**		0.74		mg/Kg		05/06/13 09:30	05/09/13 03:53	1

Client Sample ID: LAKE-LV-WC-111 Lab Sample ID: 550-1632-12

Date Collected: 04/23/13 16:30 **Matrix: Solid**
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**26**		0.75		mg/Kg		05/06/13 09:30	05/09/13 03:56	1

Client Sample ID: LAKE-LV-BG-112 Lab Sample ID: 550-1632-13

Date Collected: 04/24/13 08:15 **Matrix: Solid**
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**27**		0.80		mg/Kg		05/06/13 09:30	05/09/13 03:59	1

Client Sample ID: LAKE-LV-BG-113 Lab Sample ID: 550-1632-14

Date Collected: 04/24/13 08:35 **Matrix: Solid**
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**27**		0.77		mg/Kg		05/06/13 09:30	05/09/13 04:02	1

Client Sample Results

Client Sample ID: LAKE-LV-BG-114

Lab Sample ID: 550-1632-15

Date Collected: 04/24/13 09:05

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**19**		0.78		mg/Kg		05/06/13 09:30	05/09/13 04:05	1

Client Sample ID: LAKE-LV-BG-115

Lab Sample ID: 550-1632-16

Date Collected: 04/24/13 09:30

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**25**		0.77		mg/Kg		05/06/13 09:30	05/09/13 04:08	1

Client Sample ID: LAKE-FD-LV-103

Lab Sample ID: 550-1632-17

Date Collected: 04/24/13 09:10

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**25**		0.75		mg/Kg		05/06/13 09:30	05/09/13 04:11	1

QC Sample Results

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-1

1 2 3 4 5 6 7 8 9 10 11 12 13 14

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 280-172631/1-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 172631

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		05/06/13 09:30	05/07/13 21:49	1

Lab Sample ID: LCS 280-172631/2-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 172631

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	25.3		mg/Kg		101	86 - 110		

Lab Sample ID: 550-1632-1 MS
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: LAKE-LV-FL-100
Prep Type: Total/NA
Prep Batch: 172631

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	67	M2	23.3	64.5	M2	mg/Kg		-11	70 - 200		

Lab Sample ID: 550-1632-1 MSD
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: LAKE-LV-FL-100
Prep Type: Total/NA
Prep Batch: 172631

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	67	M2	23.4	66.5	M2	mg/Kg		-2	70 - 200	3	40

Lab Sample ID: MB 280-181322/1-A
Matrix: Solid
Analysis Batch: 181825

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 181322

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		07/03/13 12:30	07/08/13 13:43	1

Lab Sample ID: LCS 280-181322/2-A
Matrix: Solid
Analysis Batch: 181825

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 181322

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.6		mg/Kg		99	86 - 110		

Lab Sample ID: 550-1636-A-14-D MS ^5
Matrix: Solid
Analysis Batch: 181892

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 181322

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	330	M3 R4	24.5	421	M3	mg/Kg		381	70 - 200		

Lab Sample ID: 550-1636-A-14-E MSD ^5
Matrix: Solid
Analysis Batch: 181892

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 181322

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	330	M3 R4	24.8	245	M3 R4	mg/Kg		-332	70 - 200	53	40

QC Association Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-1

Metals

Leach Batch: 172233

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-1	LAKE-LV-FL-100	Total/NA	Solid	Increm, Prep	
550-1632-1 MS	LAKE-LV-FL-100	Total/NA	Solid	Increm, Prep	
550-1632-1 MSD	LAKE-LV-FL-100	Total/NA	Solid	Increm, Prep	
550-1632-2	LAKE-LV-FL-101	Total/NA	Solid	Increm, Prep	
550-1632-3	LAKE-LV-FL-102	Total/NA	Solid	Increm, Prep	
550-1632-4	LAKE-LV-FL-103	Total/NA	Solid	Increm, Prep	
550-1632-5	LAKE-LV-TA-104	Total/NA	Solid	Increm, Prep	
550-1632-6	LAKE-LV-TA-105	Total/NA	Solid	Increm, Prep	
550-1632-7	LAKE-LV-TA-106	Total/NA	Solid	Increm, Prep	
550-1632-8	LAKE-LV-TA-107	Total/NA	Solid	Increm, Prep	
550-1632-9	LAKE-LV-WC-108	Total/NA	Solid	Increm, Prep	
550-1632-10	LAKE-LV-WC-109	Total/NA	Solid	Increm, Prep	
550-1632-11	LAKE-LV-WC-110	Total/NA	Solid	Increm, Prep	
550-1632-12	LAKE-LV-WC-111	Total/NA	Solid	Increm, Prep	
550-1632-13	LAKE-LV-BG-112	Total/NA	Solid	Increm, Prep	
550-1632-14	LAKE-LV-BG-113	Total/NA	Solid	Increm, Prep	
550-1632-15	LAKE-LV-BG-114	Total/NA	Solid	Increm, Prep	
550-1632-16	LAKE-LV-BG-115	Total/NA	Solid	Increm, Prep	
550-1632-17	LAKE-FD-LV-103	Total/NA	Solid	Increm, Prep	

Leach Batch: 172235

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-A-14-D MS ^5	Matrix Spike	Total/NA	Solid	Increm, Prep	
550-1636-A-14-E MSD ^5	Matrix Spike Duplicate	Total/NA	Solid	Increm, Prep	

Prep Batch: 172631

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-1	LAKE-LV-FL-100	Total/NA	Solid	3050B MOD	172233
550-1632-1 MS	LAKE-LV-FL-100	Total/NA	Solid	3050B MOD	172233
550-1632-1 MSD	LAKE-LV-FL-100	Total/NA	Solid	3050B MOD	172233
550-1632-2	LAKE-LV-FL-101	Total/NA	Solid	3050B MOD	172233
550-1632-3	LAKE-LV-FL-102	Total/NA	Solid	3050B MOD	172233
550-1632-4	LAKE-LV-FL-103	Total/NA	Solid	3050B MOD	172233
550-1632-5	LAKE-LV-TA-104	Total/NA	Solid	3050B MOD	172233
550-1632-6	LAKE-LV-TA-105	Total/NA	Solid	3050B MOD	172233
550-1632-7	LAKE-LV-TA-106	Total/NA	Solid	3050B MOD	172233
550-1632-8	LAKE-LV-TA-107	Total/NA	Solid	3050B MOD	172233
550-1632-10	LAKE-LV-WC-109	Total/NA	Solid	3050B MOD	172233
550-1632-11	LAKE-LV-WC-110	Total/NA	Solid	3050B MOD	172233
550-1632-12	LAKE-LV-WC-111	Total/NA	Solid	3050B MOD	172233
550-1632-13	LAKE-LV-BG-112	Total/NA	Solid	3050B MOD	172233
550-1632-14	LAKE-LV-BG-113	Total/NA	Solid	3050B MOD	172233
550-1632-15	LAKE-LV-BG-114	Total/NA	Solid	3050B MOD	172233
550-1632-16	LAKE-LV-BG-115	Total/NA	Solid	3050B MOD	172233
550-1632-17	LAKE-FD-LV-103	Total/NA	Solid	3050B MOD	172233
LCS 280-172631/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
MB 280-172631/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Analysis Batch: 173235

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-1	LAKE-LV-FL-100	Total/NA	Solid	6010B	172631

TestAmerica Phoenix

Metals (Continued)

Analysis Batch: 173235 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-1 MS	LAKE-LV-FL-100	Total/NA	Solid	6010B	172631
550-1632-1 MSD	LAKE-LV-FL-100	Total/NA	Solid	6010B	172631
550-1632-2	LAKE-LV-FL-101	Total/NA	Solid	6010B	172631
550-1632-3	LAKE-LV-FL-102	Total/NA	Solid	6010B	172631
550-1632-4	LAKE-LV-FL-103	Total/NA	Solid	6010B	172631
LCS 280-172631/2-A	Lab Control Sample	Total/NA	Solid	6010B	172631
MB 280-172631/1-A	Method Blank	Total/NA	Solid	6010B	172631

Analysis Batch: 173489

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-5	LAKE-LV-TA-104	Total/NA	Solid	6010B	172631
550-1632-6	LAKE-LV-TA-105	Total/NA	Solid	6010B	172631
550-1632-7	LAKE-LV-TA-106	Total/NA	Solid	6010B	172631
550-1632-8	LAKE-LV-TA-107	Total/NA	Solid	6010B	172631
550-1632-10	LAKE-LV-WC-109	Total/NA	Solid	6010B	172631
550-1632-11	LAKE-LV-WC-110	Total/NA	Solid	6010B	172631
550-1632-12	LAKE-LV-WC-111	Total/NA	Solid	6010B	172631
550-1632-13	LAKE-LV-BG-112	Total/NA	Solid	6010B	172631
550-1632-14	LAKE-LV-BG-113	Total/NA	Solid	6010B	172631
550-1632-15	LAKE-LV-BG-114	Total/NA	Solid	6010B	172631
550-1632-16	LAKE-LV-BG-115	Total/NA	Solid	6010B	172631
550-1632-17	LAKE-FD-LV-103	Total/NA	Solid	6010B	172631

Prep Batch: 181322

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-9	LAKE-LV-WC-108	Total/NA	Solid	3050B MOD	172233
550-1636-A-14-D MS ^5	Matrix Spike	Total/NA	Solid	3050B MOD	172235
550-1636-A-14-E MSD ^5	Matrix Spike Duplicate	Total/NA	Solid	3050B MOD	172235
LCS 280-181322/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
MB 280-181322/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Analysis Batch: 181825

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-9	LAKE-LV-WC-108	Total/NA	Solid	6010B	181322
LCS 280-181322/2-A	Lab Control Sample	Total/NA	Solid	6010B	181322
MB 280-181322/1-A	Method Blank	Total/NA	Solid	6010B	181322

Analysis Batch: 181892

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-A-14-D MS ^5	Matrix Spike	Total/NA	Solid	6010B	181322
550-1636-A-14-E MSD ^5	Matrix Spike Duplicate	Total/NA	Solid	6010B	181322

Lab Chronicle

Client Sample ID: LAKE-LV-FL-100

Lab Sample ID: 550-1632-1
Date Collected: 04/23/13 10:55
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 21:54	HEB	TAL DEN

Client Sample ID: LAKE-LV-FL-101

Lab Sample ID: 550-1632-2
Date Collected: 04/23/13 11:00
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 22:05	HEB	TAL DEN

Client Sample ID: LAKE-LV-FL-102

Lab Sample ID: 550-1632-3
Date Collected: 04/23/13 11:40
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 22:08	HEB	TAL DEN

Client Sample ID: LAKE-LV-FL-103

Lab Sample ID: 550-1632-4
Date Collected: 04/23/13 11:50
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 22:11	HEB	TAL DEN

Client Sample ID: LAKE-LV-TA-104

Lab Sample ID: 550-1632-5
Date Collected: 04/23/13 11:58
Matrix: Solid
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:27	JKH	TAL DEN

Client Sample ID: LAKE-LV-TA-105

Lab Sample ID: 550-1632-6

Date Collected: 04/23/13 12:30

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:30	JKH	TAL DEN

Client Sample ID: LAKE-LV-TA-106

Lab Sample ID: 550-1632-7

Date Collected: 04/23/13 12:50

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:33	JKH	TAL DEN

Client Sample ID: LAKE-LV-TA-107

Lab Sample ID: 550-1632-8

Date Collected: 04/23/13 13:02

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:36	JKH	TAL DEN

Client Sample ID: LAKE-LV-WC-108

Lab Sample ID: 550-1632-9

Date Collected: 04/23/13 15:50

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			181322	07/03/13 12:30	RC	TAL DEN
Total/NA	Analysis	6010B		1	181825	07/08/13 13:59	HEB	TAL DEN

Client Sample ID: LAKE-LV-WC-109

Lab Sample ID: 550-1632-10

Date Collected: 04/23/13 16:04

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:41	JKH	TAL DEN

Lab Chronicle

Client Sample ID: LAKE-LV-WC-110

Lab Sample ID: 550-1632-11

Date Collected: 04/23/13 16:20

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:53	JKH	TAL DEN

Client Sample ID: LAKE-LV-WC-111

Lab Sample ID: 550-1632-12

Date Collected: 04/23/13 16:30

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:56	JKH	TAL DEN

Client Sample ID: LAKE-LV-BG-112

Lab Sample ID: 550-1632-13

Date Collected: 04/24/13 08:15

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 03:59	JKH	TAL DEN

Client Sample ID: LAKE-LV-BG-113

Lab Sample ID: 550-1632-14

Date Collected: 04/24/13 08:35

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 04:02	JKH	TAL DEN

Client Sample ID: LAKE-LV-BG-114

Lab Sample ID: 550-1632-15

Date Collected: 04/24/13 09:05

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 04:05	JKH	TAL DEN

Client Sample ID: LAKE-LV-BG-115

Date Collected: 04/24/13 09:30

Date Received: 04/26/13 09:30

Lab Sample ID: 550-1632-16

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 04:08	JKH	TAL DEN

Client Sample ID: LAKE-FD-LV-103

Date Collected: 04/24/13 09:10

Date Received: 04/26/13 09:30

Lab Sample ID: 550-1632-17

Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172233	05/01/13 21:25	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172631	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173489	05/09/13 04:11	JKH	TAL DEN

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Certification Summary

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-15
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-13
Nevada	State Program	9	AZ01030	07-31-13
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Arkansas DEQ	State Program	6	88-0687	06-01-13 *
Colorado	State Program	8	N/A	09-30-13
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Idaho	State Program	10	CO00026	09-30-13
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	07-30-13
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-13 *
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-13 *
Oklahoma	State Program	6	8614	08-31-13
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-31-13
South Carolina	State Program	4	72002	06-30-13 *
Texas	NELAP	6	T104704183-08-TX	09-30-13
USDA	Federal		P330-13-00202	02-08-14
Utah	NELAP	8	CO000262012-4	07-08-13 *
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	08-03-13
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-13
Wyoming (UST)	A2LA	8		10-31-13

* Expired certification is currently pending renewal and is considered valid.

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Method Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL DEN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Las Vegas Bay

550-1632

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTC

☒ Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix,
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 8570
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV

550-1632 Chain of Custody

Page 1 of 2

Client Name/Address:
CCM
[illegible] Hyland Ave. # 200
Costa Mesa, CA 92626

Project/PO Number: LAKE

Project Manager: Tiffany Leff

Phone Number: 480 357-1481

Sampler: Christina Davis & Chris McCormack

Fax Number: 714 [illegible] 2758

Analysis Required

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	~~[illegible]~~	[illegible]								Special Instructions
LAKE-LV-FL-100	Soil	1 Qt Bag	1	4/23/13	1055	None		X								-1
LAKE-LV-FL-101					1100			X								-2
LAKE-LV-FL-102					1140			X								-3
LAKE-LV-FL-103					1150			X								-4
LAKE-LV-TA-104					1158			X								-5
LAKE-LV-TA-105					1230			X								-6
LAKE-LV-TA-106					1250			X								-7
LAKE-LV-TA-107					1302			X								-8
LAKE-LV-WC-108					1550			X								-9
LAKE-LV-WC-109					1604			X								-10
LAKE-LV-WC-110					1620			X								-11
LAKE-LV-WC-111	↓	↓	↓	↓	1630			X								-12
LAKE-LV-BG-112	Soil	1 Qt Bag	1	4/24/13	0815			X								-13
LAKE-LV-BG-113	↓	↓	↓	↓	0835	↓		X								-14

Relinquished By: Chris McCormack Date/Time: 4-24-13 15:00 Received By: Fed Ex Date/Time:

Relinquished By: Date/Time: Received By: Date/Time:

Relinquished By: Date/Time: Received in Lab By: Date/Time:

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal X

Sample Integrity: (Check)
intact ____ on ice ____

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

Las Vegas Bay

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

550-1632

[X] Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 454-9303
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 2 of 2

Client Name/Address:
C&M
3525 Hyland Ave #200
Costa Mesa, CA 92626

Project/PO Number: LAKE

Project Manager: Tiffany Leiff

Phone Number: 480-352-1488

Sampler: Carissa Davis & Chris McCormack

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Analysis Required									Special Instructions
							WD ~~Total Lead EPA 200.7~~	Total Lead EPA 6010B								
LAKE-LV-BG-114	Soil	1 Qt Bag	1	4/24/13	0905	None		X								-15
LAKE-LV-BG-115	↓	↓	↓	↓	0930	↓		X								-16
LAKE-FD-LV-103	↓	↓	↓	↓	0910	↓		X								-17

Relinquished By: Chris McCormack	Date/Time: 4-24-13 15:00	Received By: Fed Ex	Date/Time:	Turnaround Time: (Check) same day ____ 72 hours ____ 24 hours ____ 5 days ____ 48 hours ____ normal X
Relinquished By:	Date/Time:	Received By:	Date/Time:	
Relinquished By:	Date/Time:	Received in Lab By:	Date/Time:	Sample Integrity: (Check) intact ____ on ice ____

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1632-1

Login Number: 1632

List Source: TestAmerica Phoenix

List Number: 1

Creator: Baker, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1632-1

Login Number: 1632
List Number: 1
Creator: Eichelberger, Elizabeth M

List Source: TestAmerica Denver
List Creation: 05/01/13 06:55 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	18.4
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-1632-2
Client Project/Site: Lake

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Authorized for release by:
8/14/2013 1:23:35 PM

Carlene McCutcheon, Customer Service Manager
carlene.mccutcheon@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

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Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-2

Job ID: 550-1632-2

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-1632-2

Comments

No additional comments.

Receipt

The samples were received on 4/26/2013 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 22.1° C.

Metals

No analytical or quality issues were noted.

Organic Prep

No analytical or quality issues were noted.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-1632-2	LAKE-LV-FL-101	Solid	04/23/13 11:00	04/26/13 09:30
550-1632-6	LAKE-LV-TA-105	Solid	04/23/13 12:30	04/26/13 09:30
550-1632-11	LAKE-LV-WC-110	Solid	04/23/13 16:20	04/26/13 09:30

Detection Summary

Client: Environmental Cost Management, Inc. TestAmerica Job ID: 550-1632-2
Project/Site: Lake

Client Sample ID: LAKE-LV-FL-101 Lab Sample ID: 550-1632-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	160		0.71		mg/Kg	1		6010B	Total/NA
Lead	0.055		0.0090		mg/L	1		6010B	SPLP West

Client Sample ID: LAKE-LV-TA-105 Lab Sample ID: 550-1632-6

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	11000		0.77		mg/Kg	1		6010B	Total/NA
Lead	0.61		0.0090		mg/L	1		6010B	SPLP West

Client Sample ID: LAKE-LV-WC-110 Lab Sample ID: 550-1632-11

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	30		0.71		mg/Kg	1		6010B	Total/NA
Lead	0.030		0.0090		mg/L	1		6010B	SPLP West

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-2

Client Sample ID: LAKE-LV-FL-101

Lab Sample ID: 550-1632-2

Date Collected: 04/23/13 11:00
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**160**		0.71		mg/Kg		08/02/13 07:30	08/02/13 19:36	1

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.055**		0.0090		mg/L		08/09/13 12:30	08/10/13 09:42	1

Client Sample ID: LAKE-LV-TA-105

Lab Sample ID: 550-1632-6

Date Collected: 04/23/13 12:30
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**11000**		0.77		mg/Kg		08/02/13 07:30	08/02/13 19:38	1

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.61**		0.0090		mg/L		08/09/13 12:30	08/10/13 09:44	1

Client Sample ID: LAKE-LV-WC-110

Lab Sample ID: 550-1632-11

Date Collected: 04/23/13 16:20
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**30**		0.71		mg/Kg		08/02/13 07:30	08/02/13 19:40	1

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.030**		0.0090		mg/L		08/09/13 12:30	08/10/13 09:47	1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 280-185351/1-A
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 185351

	MB	MB							
Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		08/02/13 07:30	08/02/13 19:07	1

Lab Sample ID: LCS 280-185351/2-A
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 185351

			Spike	LCS	LCS				%Rec.		
Analyte			Added	Result	Qualifier	Unit	D	%Rec	Limits		
Lead			50.0	48.2		mg/Kg		96	86 - 110		

Lab Sample ID: 280-44963-A-1-B MS
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 185351

	Sample	Sample	Spike	MS	MS				%Rec.		
Analyte	Result	Qualifier	Added	Result	Qualifier	Unit	D	%Rec	Limits		
Lead	2.1		45.0	43.5		mg/Kg		92	70 - 200		

Lab Sample ID: 280-44963-A-1-C MSD
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 185351

	Sample	Sample	Spike	MSD	MSD				%Rec.		RPD
Analyte	Result	Qualifier	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Lead	2.1		48.1	46.3		mg/Kg		92	70 - 200	6	20

Lab Sample ID: LB2 280-186231/1-B LB2
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: Method Blank
Prep Type: SPLP West
Prep Batch: 186514

	LB2	LB2							
Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.0090		mg/L		08/09/13 12:30	08/10/13 09:38	1

Lab Sample ID: LCS 280-186231/2-B
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: Lab Control Sample
Prep Type: SPLP West
Prep Batch: 186514

			Spike	LCS	LCS				%Rec.		
Analyte			Added	Result	Qualifier	Unit	D	%Rec	Limits		
Lead			0.500	0.480		mg/L		96	89 - 110		

Lab Sample ID: 550-1636-A-14-J MS
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: Matrix Spike
Prep Type: SPLP West
Prep Batch: 186514

	Sample	Sample	Spike	MS	MS				%Rec.		
Analyte	Result	Qualifier	Added	Result	Qualifier	Unit	D	%Rec	Limits		
Lead	0.020		0.500	0.484		mg/L		93	80 - 120		

Lab Sample ID: 550-1636-A-14-K MSD
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: Matrix Spike Duplicate
Prep Type: SPLP West
Prep Batch: 186514

	Sample	Sample	Spike	MSD	MSD				%Rec.		RPD
Analyte	Result	Qualifier	Added	Result	Qualifier	Unit	D	%Rec	Limits	RPD	Limit
Lead	0.020		0.500	0.463		mg/L		89	80 - 120	5	20

QC Association Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-2

Metals

Prep Batch: 185351

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-44963-A-1-B MS	Matrix Spike	Total/NA	Solid	3050B	
280-44963-A-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	3050B	
550-1632-2	LAKE-LV-FL-101	Total/NA	Solid	3050B	
550-1632-6	LAKE-LV-TA-105	Total/NA	Solid	3050B	
550-1632-11	LAKE-LV-WC-110	Total/NA	Solid	3050B	
LCS 280-185351/2-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 280-185351/1-A	Method Blank	Total/NA	Solid	3050B	

Analysis Batch: 185828

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-44963-A-1-B MS	Matrix Spike	Total/NA	Solid	6010B	185351
280-44963-A-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	6010B	185351
550-1632-2	LAKE-LV-FL-101	Total/NA	Solid	6010B	185351
550-1632-6	LAKE-LV-TA-105	Total/NA	Solid	6010B	185351
550-1632-11	LAKE-LV-WC-110	Total/NA	Solid	6010B	185351
LCS 280-185351/2-A	Lab Control Sample	Total/NA	Solid	6010B	185351
MB 280-185351/1-A	Method Blank	Total/NA	Solid	6010B	185351

Leach Batch: 186231

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-2	LAKE-LV-FL-101	SPLP West	Solid	1312	
550-1632-6	LAKE-LV-TA-105	SPLP West	Solid	1312	
550-1632-11	LAKE-LV-WC-110	SPLP West	Solid	1312	
550-1636-A-14-J MS	Matrix Spike	SPLP West	Solid	1312	
550-1636-A-14-K MSD	Matrix Spike Duplicate	SPLP West	Solid	1312	
LB2 280-186231/1-B LB2	Method Blank	SPLP West	Solid	1312	
LCS 280-186231/2-B	Lab Control Sample	SPLP West	Solid	1312	

Prep Batch: 186514

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-2	LAKE-LV-FL-101	SPLP West	Solid	3010A	186231
550-1632-6	LAKE-LV-TA-105	SPLP West	Solid	3010A	186231
550-1632-11	LAKE-LV-WC-110	SPLP West	Solid	3010A	186231
550-1636-A-14-J MS	Matrix Spike	SPLP West	Solid	3010A	186231
550-1636-A-14-K MSD	Matrix Spike Duplicate	SPLP West	Solid	3010A	186231
LB2 280-186231/1-B LB2	Method Blank	SPLP West	Solid	3010A	186231
LCS 280-186231/2-B	Lab Control Sample	SPLP West	Solid	3010A	186231

Analysis Batch: 186832

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1632-2	LAKE-LV-FL-101	SPLP West	Solid	6010B	186514
550-1632-6	LAKE-LV-TA-105	SPLP West	Solid	6010B	186514
550-1632-11	LAKE-LV-WC-110	SPLP West	Solid	6010B	186514
550-1636-A-14-J MS	Matrix Spike	SPLP West	Solid	6010B	186514
550-1636-A-14-K MSD	Matrix Spike Duplicate	SPLP West	Solid	6010B	186514
LB2 280-186231/1-B LB2	Method Blank	SPLP West	Solid	6010B	186514
LCS 280-186231/2-B	Lab Control Sample	SPLP West	Solid	6010B	186514

Lab Chronicle

Client Sample ID: LAKE-LV-FL-101

Lab Sample ID: 550-1632-2

Date Collected: 04/23/13 11:00

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			185351	08/02/13 07:30	JAM	TAL DEN
Total/NA	Analysis	6010B		1	185828	08/02/13 19:36	JKH	TAL DEN
SPLP West	Leach	1312			186231	08/07/13 16:22	SPF	TAL DEN
SPLP West	Prep	3010A			186514	08/09/13 12:30	JAM	TAL DEN
SPLP West	Analysis	6010B		1	186832	08/10/13 09:42	JKH	TAL DEN

Client Sample ID: LAKE-LV-TA-105

Lab Sample ID: 550-1632-6

Date Collected: 04/23/13 12:30

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			185351	08/02/13 07:30	JAM	TAL DEN
Total/NA	Analysis	6010B		1	185828	08/02/13 19:38	JKH	TAL DEN
SPLP West	Leach	1312			186231	08/07/13 16:22	SPF	TAL DEN
SPLP West	Prep	3010A			186514	08/09/13 12:30	JAM	TAL DEN
SPLP West	Analysis	6010B		1	186832	08/10/13 09:44	JKH	TAL DEN

Client Sample ID: LAKE-LV-WC-110

Lab Sample ID: 550-1632-11

Date Collected: 04/23/13 16:20

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			185351	08/02/13 07:30	JAM	TAL DEN
Total/NA	Analysis	6010B		1	185828	08/02/13 19:40	JKH	TAL DEN
SPLP West	Leach	1312			186231	08/07/13 16:22	SPF	TAL DEN
SPLP West	Prep	3010A			186514	08/09/13 12:30	JAM	TAL DEN
SPLP West	Analysis	6010B		1	186832	08/10/13 09:47	JKH	TAL DEN

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Certification Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-2

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-15
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-13
Nevada	State Program	9	AZ01030	07-31-14
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alabama	State Program	4	40730	09-30-13 *
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Arkansas DEQ	State Program	6	88-0687	09-01-13
California	ELAP	9	2513	08-31-14 *
Colorado	State Program	8	N/A	09-30-13
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Idaho	State Program	10	CO00026	09-30-13
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Louisiana	NELAP	6	02096	09-01-13 *
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	09-01-13
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-14 *
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-14 *
Oklahoma	State Program	6	8614	08-31-13
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-30-14
South Carolina	State Program	4	72002	09-01-13 *
Texas	NELAP	6	T104704183-08-TX	09-30-13
USDA	Federal		P330-13-00202	07-02-16
Utah	NELAP	8	CO000262012-4	07-31-14
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	09-01-13 *
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-13
Wyoming (UST)	A2LA	8		10-31-13

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1632-2

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL DEN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc. Job Number: 550-1632-2

Login Number: 1632 **List Source: TestAmerica Phoenix**

List Number: 1

Creator: Baker, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1632-2

Login Number: 1632
List Number: 1
Creator: Eichelberger, Elizabeth M

List Source: TestAmerica Denver
List Creation: 05/01/13 06:55 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	18.4
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-1636-1
Client Project/Site: Lake
Revision: 1

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Carlene McCutcheon

Authorized for release by:
7/11/2013 12:44:58 PM

Carlene McCutcheon, Customer Service Manager
carlene.mccutcheon@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Qualifiers

Metals

Qualifier	Qualifier Description
M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The associated blank spike was acceptable.
R4	MS/MSD RPD exceeded the method control limit. Recovery met acceptance criteria.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-1

Job ID: 550-1636-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-1636-1

Comments:
REVISED Report:Please note that this report has been revised to provide re-analysis metals data.

Receipt
The samples were received on 4/26/2013 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 21.3° C.

Metals
Method(s) 3050B MOD: Insufficient sample volume was available to perform batch matrix spike/matrix spike duplicate (MS/MSD) associated with batch. The laboratory control sample (LCS) was performed in duplicate to provide precision data for this batch.

No other analytical or quality issues were noted.

Organic Prep
Method(s) Increm, Prep: The following samples were air dried and sieved per the procedure; however, the samples contained material that would not pass through the sieve: LAKE-EB-BG-100 (550-1636-1), LAKE-EB-BG-101 (550-1636-2), LAKE-EB-BG-102 (550-1636-3), LAKE-EB-BG-103 (550-1636-4), LAKE-EB-FL-108 (550-1636-10), LAKE-EB-FL-109 (550-1636-11), LAKE-EB-FL-110 (550-1636-12), LAKE-EB-FL-111 (550-1636-13), LAKE-EB-TA-112 (550-1636-14), LAKE-EB-TA-113 (550-1636-15), LAKE-EB-TA-114 (550-1636-16), LAKE-EB-TA-115 (550-1636-17), LAKE-EB-WC-104 (550-1636-5), LAKE-EB-WC-105 (550-1636-6), LAKE-EB-WC-106 (550-1636-7), LAKE-EB-WC-107 (550-1636-8), LAKE-FD-EB-102 (550-1636-9). This material was removed and not extracted. The material appeared to be rock and/or vegetation.
For Method MULTI_INC/6010B
Prep Batches 172233 & 172235

No other analytical or quality issues were noted.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-1636-1	LAKE-EB-BG-100	Solid	04/22/13 09:40	04/26/13 09:30
550-1636-2	LAKE-EB-BG-101	Solid	04/22/13 09:45	04/26/13 09:30
550-1636-3	LAKE-EB-BG-102	Solid	04/22/13 10:00	04/26/13 09:30
550-1636-4	LAKE-EB-BG-103	Solid	04/22/13 10:22	04/26/13 09:30
550-1636-5	LAKE-EB-WC-104	Solid	04/22/13 11:20	04/26/13 09:30
550-1636-6	LAKE-EB-WC-105	Solid	04/22/13 12:20	04/26/13 09:30
550-1636-7	LAKE-EB-WC-106	Solid	04/22/13 14:05	04/26/13 09:30
550-1636-8	LAKE-EB-WC-107	Solid	04/22/13 14:10	04/26/13 09:30
550-1636-9	LAKE-FD-EB-102	Solid	04/22/13 14:30	04/26/13 09:30
550-1636-10	LAKE-EB-FL-108	Solid	04/22/13 11:00	04/26/13 09:30
550-1636-11	LAKE-EB-FL-109	Solid	04/22/13 11:35	04/26/13 09:30
550-1636-12	LAKE-EB-FL-110	Solid	04/22/13 12:02	04/26/13 09:30
550-1636-13	LAKE-EB-FL-111	Solid	04/22/13 12:28	04/26/13 09:30
550-1636-14	LAKE-EB-TA-112	Solid	04/22/13 17:35	04/26/13 09:30
550-1636-15	LAKE-EB-TA-113	Solid	04/22/13 18:18	04/26/13 09:30
550-1636-16	LAKE-EB-TA-114	Solid	04/22/13 18:20	04/26/13 09:30
550-1636-17	LAKE-EB-TA-115	Solid	04/22/13 17:55	04/26/13 09:30

Detection Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-1

Client Sample ID: LAKE-EB-BG-100 Lab Sample ID: 550-1636-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.5		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-BG-101 Lab Sample ID: 550-1636-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.5		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-BG-102 Lab Sample ID: 550-1636-3

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.8		0.79		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-BG-103 Lab Sample ID: 550-1636-4

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	6.5		0.74		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-WC-104 Lab Sample ID: 550-1636-5

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	7.5		0.74		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-WC-105 Lab Sample ID: 550-1636-6

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	8.2		3.8		mg/Kg	5		6010B	Total/NA

Client Sample ID: LAKE-EB-WC-106 Lab Sample ID: 550-1636-7

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	15		0.78		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-WC-107 Lab Sample ID: 550-1636-8

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	17		3.9		mg/Kg	5		6010B	Total/NA

Client Sample ID: LAKE-FD-EB-102 Lab Sample ID: 550-1636-9

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	21		0.79		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-FL-108 Lab Sample ID: 550-1636-10

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	17		0.74		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-FL-109 Lab Sample ID: 550-1636-11

This Detection Summary does not include radiochemical test results.

Client Sample ID: LAKE-EB-FL-109 (Continued) Lab Sample ID: 550-1636-11

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	19		0.79		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-FL-110 Lab Sample ID: 550-1636-12

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	17		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-FL-111 Lab Sample ID: 550-1636-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	66		0.77		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-TA-112 Lab Sample ID: 550-1636-14

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	330	M3 R4	3.9		mg/Kg	5		6010B	Total/NA

Client Sample ID: LAKE-EB-TA-113 Lab Sample ID: 550-1636-15

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	98		0.76		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-TA-114 Lab Sample ID: 550-1636-16

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	55		0.80		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-TA-115 Lab Sample ID: 550-1636-17

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	170		0.77		mg/Kg	1		6010B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: LAKE-EB-BG-100

Lab Sample ID: 550-1636-1

Date Collected: 04/22/13 09:40
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.5**		0.76		mg/Kg		05/06/13 09:30	05/07/13 23:25	1

Client Sample ID: LAKE-EB-BG-101

Lab Sample ID: 550-1636-2

Date Collected: 04/22/13 09:45
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.5**		0.76		mg/Kg		05/06/13 09:30	05/07/13 23:31	1

Client Sample ID: LAKE-EB-BG-102

Lab Sample ID: 550-1636-3

Date Collected: 04/22/13 10:00
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.8**		0.79		mg/Kg		05/06/13 09:30	05/07/13 23:34	1

Client Sample ID: LAKE-EB-BG-103

Lab Sample ID: 550-1636-4

Date Collected: 04/22/13 10:22
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**6.5**		0.74		mg/Kg		05/06/13 09:30	05/07/13 23:37	1

Client Sample ID: LAKE-EB-WC-104

Lab Sample ID: 550-1636-5

Date Collected: 04/22/13 11:20
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**7.5**		0.74		mg/Kg		05/06/13 09:30	05/07/13 23:49	1

Client Sample ID: LAKE-EB-WC-105

Lab Sample ID: 550-1636-6

Date Collected: 04/22/13 12:20
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**8.2**		3.8		mg/Kg		06/27/13 08:15	06/28/13 08:11	5

Client Sample ID: LAKE-EB-WC-106

Lab Sample ID: 550-1636-7

Date Collected: 04/22/13 14:05
Matrix: Solid
Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**15**		0.78		mg/Kg		05/06/13 09:30	05/07/13 23:56	1

Client Sample Results

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-1

Client Sample ID: LAKE-EB-WC-107

Lab Sample ID: 550-1636-8

Date Collected: 04/22/13 14:10
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**17**		3.9	mg/Kg		06/27/13 08:15	06/28/13 08:20	5

Client Sample ID: LAKE-FD-EB-102

Lab Sample ID: 550-1636-9

Date Collected: 04/22/13 14:30
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**21**		0.79	mg/Kg		05/06/13 09:30	05/08/13 00:02	1

Client Sample ID: LAKE-EB-FL-108

Lab Sample ID: 550-1636-10

Date Collected: 04/22/13 11:00
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**17**		0.74	mg/Kg		05/06/13 09:30	05/08/13 00:05	1

Client Sample ID: LAKE-EB-FL-109

Lab Sample ID: 550-1636-11

Date Collected: 04/22/13 11:35
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**19**		0.79	mg/Kg		05/06/13 09:30	05/08/13 00:08	1

Client Sample ID: LAKE-EB-FL-110

Lab Sample ID: 550-1636-12

Date Collected: 04/22/13 12:02
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**17**		0.77	mg/Kg		05/06/13 09:30	05/08/13 00:20	1

Client Sample ID: LAKE-EB-FL-111

Lab Sample ID: 550-1636-13

Date Collected: 04/22/13 12:28
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**66**		0.77	mg/Kg		05/06/13 09:30	05/08/13 00:24	1

Client Sample ID: LAKE-EB-TA-112

Lab Sample ID: 550-1636-14

Date Collected: 04/22/13 17:35
Date Received: 04/26/13 09:30

Matrix: Solid

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL	Unit	D	Prepared	Analyzed	Dil Fac
Lead	**330**	**M3 R4**	3.9	mg/Kg		07/03/13 12:30	07/08/13 17:15	5

Client Sample ID: LAKE-EB-TA-113

Lab Sample ID: 550-1636-15

Date Collected: 04/22/13 18:18

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	98		0.76		mg/Kg		05/06/13 09:30	05/08/13 00:30	1

Client Sample ID: LAKE-EB-TA-114

Lab Sample ID: 550-1636-16

Date Collected: 04/22/13 18:20

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	55		0.80		mg/Kg		05/06/13 09:30	05/08/13 00:33	1

Client Sample ID: LAKE-EB-TA-115

Lab Sample ID: 550-1636-17

Date Collected: 04/22/13 17:55

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	170		0.77		mg/Kg		05/06/13 09:30	05/08/13 00:36	1

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 280-172632/1-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 172632

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		05/06/13 09:30	05/07/13 23:18	1

Lab Sample ID: LCS 280-172632/2-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 172632

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.3		mg/Kg		97	86 - 110		

Lab Sample ID: LCSD 280-172632/3-A
Matrix: Solid
Analysis Batch: 173235

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 172632

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			25.0	24.2		mg/Kg		97	86 - 110	0	20

Lab Sample ID: MB 280-178634/1-A
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 178634

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		06/27/13 08:15	06/27/13 22:50	1

Lab Sample ID: LCS 280-178634/2-A
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 178634

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.9		mg/Kg		99	86 - 110		

Lab Sample ID: LCSD 280-178634/3-B
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 178634

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			25.0	24.8		mg/Kg		99	86 - 110	0	20

Lab Sample ID: 550-1636-6 MS
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: LAKE-EB-WC-105
Prep Type: Total/NA
Prep Batch: 178634

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	8.2		23.7	29.8		mg/Kg		91	70 - 200		

Lab Sample ID: 550-1636-6 MSD
Matrix: Solid
Analysis Batch: 180867

Client Sample ID: LAKE-EB-WC-105
Prep Type: Total/NA
Prep Batch: 178634

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	8.2		24.3	39.0		mg/Kg		127	70 - 200	27	40

QC Sample Results

Lab Sample ID: MB 280-181322/1-A
Matrix: Solid
Analysis Batch: 181825

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 181322

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		07/03/13 12:30	07/08/13 13:43	1

Lab Sample ID: LCS 280-181322/2-A
Matrix: Solid
Analysis Batch: 181825

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 181322

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			25.0	24.6		mg/Kg		99	86 - 110		

Lab Sample ID: 550-1636-14 MS
Matrix: Solid
Analysis Batch: 181892

Client Sample ID: LAKE-EB-TA-112
Prep Type: Total/NA
Prep Batch: 181322

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	330	M3 R4	24.5	421	M3	mg/Kg		381	70 - 200		

Lab Sample ID: 550-1636-14 MSD
Matrix: Solid
Analysis Batch: 181892

Client Sample ID: LAKE-EB-TA-112
Prep Type: Total/NA
Prep Batch: 181322

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	330	M3 R4	24.8	245	M3 R4	mg/Kg		-332	70 - 200	53	40

Metals

Leach Batch: 172235

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-1	LAKE-EB-BG-100	Total/NA	Solid	Increm, Prep	
550-1636-2	LAKE-EB-BG-101	Total/NA	Solid	Increm, Prep	
550-1636-3	LAKE-EB-BG-102	Total/NA	Solid	Increm, Prep	
550-1636-4	LAKE-EB-BG-103	Total/NA	Solid	Increm, Prep	
550-1636-5	LAKE-EB-WC-104	Total/NA	Solid	Increm, Prep	
550-1636-7	LAKE-EB-WC-106	Total/NA	Solid	Increm, Prep	
550-1636-9	LAKE-FD-EB-102	Total/NA	Solid	Increm, Prep	
550-1636-10	LAKE-EB-FL-108	Total/NA	Solid	Increm, Prep	
550-1636-11	LAKE-EB-FL-109	Total/NA	Solid	Increm, Prep	
550-1636-12	LAKE-EB-FL-110	Total/NA	Solid	Increm, Prep	
550-1636-13	LAKE-EB-FL-111	Total/NA	Solid	Increm, Prep	
550-1636-14	LAKE-EB-TA-112	Total/NA	Solid	Increm, Prep	
550-1636-14 MS	LAKE-EB-TA-112	Total/NA	Solid	Increm, Prep	
550-1636-14 MSD	LAKE-EB-TA-112	Total/NA	Solid	Increm, Prep	
550-1636-15	LAKE-EB-TA-113	Total/NA	Solid	Increm, Prep	
550-1636-16	LAKE-EB-TA-114	Total/NA	Solid	Increm, Prep	
550-1636-17	LAKE-EB-TA-115	Total/NA	Solid	Increm, Prep	

Prep Batch: 172632

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-1	LAKE-EB-BG-100	Total/NA	Solid	3050B MOD	172235
550-1636-2	LAKE-EB-BG-101	Total/NA	Solid	3050B MOD	172235
550-1636-3	LAKE-EB-BG-102	Total/NA	Solid	3050B MOD	172235
550-1636-4	LAKE-EB-BG-103	Total/NA	Solid	3050B MOD	172235
550-1636-5	LAKE-EB-WC-104	Total/NA	Solid	3050B MOD	172235
550-1636-7	LAKE-EB-WC-106	Total/NA	Solid	3050B MOD	172235
550-1636-9	LAKE-FD-EB-102	Total/NA	Solid	3050B MOD	172235
550-1636-10	LAKE-EB-FL-108	Total/NA	Solid	3050B MOD	172235
550-1636-11	LAKE-EB-FL-109	Total/NA	Solid	3050B MOD	172235
550-1636-12	LAKE-EB-FL-110	Total/NA	Solid	3050B MOD	172235
550-1636-13	LAKE-EB-FL-111	Total/NA	Solid	3050B MOD	172235
550-1636-15	LAKE-EB-TA-113	Total/NA	Solid	3050B MOD	172235
550-1636-16	LAKE-EB-TA-114	Total/NA	Solid	3050B MOD	172235
550-1636-17	LAKE-EB-TA-115	Total/NA	Solid	3050B MOD	172235
LCS 280-172632/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
LCSD 280-172632/3-A	Lab Control Sample Dup	Total/NA	Solid	3050B MOD	
MB 280-172632/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Analysis Batch: 173235

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-1	LAKE-EB-BG-100	Total/NA	Solid	6010B	172632
550-1636-2	LAKE-EB-BG-101	Total/NA	Solid	6010B	172632
550-1636-3	LAKE-EB-BG-102	Total/NA	Solid	6010B	172632
550-1636-4	LAKE-EB-BG-103	Total/NA	Solid	6010B	172632
550-1636-5	LAKE-EB-WC-104	Total/NA	Solid	6010B	172632
550-1636-7	LAKE-EB-WC-106	Total/NA	Solid	6010B	172632
550-1636-9	LAKE-FD-EB-102	Total/NA	Solid	6010B	172632
550-1636-10	LAKE-EB-FL-108	Total/NA	Solid	6010B	172632
550-1636-11	LAKE-EB-FL-109	Total/NA	Solid	6010B	172632
550-1636-12	LAKE-EB-FL-110	Total/NA	Solid	6010B	172632
550-1636-13	LAKE-EB-FL-111	Total/NA	Solid	6010B	172632

Metals (Continued)

Analysis Batch: 173235 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-15	LAKE-EB-TA-113	Total/NA	Solid	6010B	172632
550-1636-16	LAKE-EB-TA-114	Total/NA	Solid	6010B	172632
550-1636-17	LAKE-EB-TA-115	Total/NA	Solid	6010B	172632
LCS 280-172632/2-A	Lab Control Sample	Total/NA	Solid	6010B	172632
LCSD 280-172632/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	172632
MB 280-172632/1-A	Method Blank	Total/NA	Solid	6010B	172632

Prep Batch: 178634

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-6	LAKE-EB-WC-105	Total/NA	Solid	3050B MOD	180601
550-1636-6 MS	LAKE-EB-WC-105	Total/NA	Solid	3050B MOD	180601
550-1636-6 MSD	LAKE-EB-WC-105	Total/NA	Solid	3050B MOD	180601
550-1636-8	LAKE-EB-WC-107	Total/NA	Solid	3050B MOD	180601
LCS 280-178634/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
LCSD 280-178634/3-B	Lab Control Sample Dup	Total/NA	Solid	3050B MOD	
MB 280-178634/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Leach Batch: 180601

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-6	LAKE-EB-WC-105	Total/NA	Solid	Increm, Prep	
550-1636-6 MS	LAKE-EB-WC-105	Total/NA	Solid	Increm, Prep	
550-1636-6 MSD	LAKE-EB-WC-105	Total/NA	Solid	Increm, Prep	
550-1636-8	LAKE-EB-WC-107	Total/NA	Solid	Increm, Prep	

Analysis Batch: 180867

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-6	LAKE-EB-WC-105	Total/NA	Solid	6010B	178634
550-1636-6 MS	LAKE-EB-WC-105	Total/NA	Solid	6010B	178634
550-1636-6 MSD	LAKE-EB-WC-105	Total/NA	Solid	6010B	178634
550-1636-8	LAKE-EB-WC-107	Total/NA	Solid	6010B	178634
LCS 280-178634/2-A	Lab Control Sample	Total/NA	Solid	6010B	178634
LCSD 280-178634/3-B	Lab Control Sample Dup	Total/NA	Solid	6010B	178634
MB 280-178634/1-A	Method Blank	Total/NA	Solid	6010B	178634

Prep Batch: 181322

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-14	LAKE-EB-TA-112	Total/NA	Solid	3050B MOD	172235
550-1636-14 MS	LAKE-EB-TA-112	Total/NA	Solid	3050B MOD	172235
550-1636-14 MSD	LAKE-EB-TA-112	Total/NA	Solid	3050B MOD	172235
LCS 280-181322/2-A	Lab Control Sample	Total/NA	Solid	3050B MOD	
MB 280-181322/1-A	Method Blank	Total/NA	Solid	3050B MOD	

Analysis Batch: 181825

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
LCS 280-181322/2-A	Lab Control Sample	Total/NA	Solid	6010B	181322
MB 280-181322/1-A	Method Blank	Total/NA	Solid	6010B	181322

Analysis Batch: 181892

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-14	LAKE-EB-TA-112	Total/NA	Solid	6010B	181322
550-1636-14 MS	LAKE-EB-TA-112	Total/NA	Solid	6010B	181322

Metals (Continued)

Analysis Batch: 181892 (Continued)

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-14 MSD	LAKE-EB-TA-112	Total/NA	Solid	6010B	181322

Lab Chronicle

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-1

Client Sample ID: LAKE-EB-BG-100

Lab Sample ID: 550-1636-1

Date Collected: 04/22/13 09:40
Date Received: 04/26/13 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 23:25	HEB	TAL DEN

Client Sample ID: LAKE-EB-BG-101

Lab Sample ID: 550-1636-2

Date Collected: 04/22/13 09:45
Date Received: 04/26/13 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 23:31	HEB	TAL DEN

Client Sample ID: LAKE-EB-BG-102

Lab Sample ID: 550-1636-3

Date Collected: 04/22/13 10:00
Date Received: 04/26/13 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 23:34	HEB	TAL DEN

Client Sample ID: LAKE-EB-BG-103

Lab Sample ID: 550-1636-4

Date Collected: 04/22/13 10:22
Date Received: 04/26/13 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 23:37	HEB	TAL DEN

Client Sample ID: LAKE-EB-WC-104

Lab Sample ID: 550-1636-5

Date Collected: 04/22/13 11:20
Date Received: 04/26/13 09:30
Matrix: Solid

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 23:49	HEB	TAL DEN

Client Sample ID: LAKE-EB-WC-105　　Lab Sample ID: 550-1636-6

Date Collected: 04/22/13 12:20　　**Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			180601	06/26/13 15:12	EER	TAL DEN
Total/NA	Prep	3050B MOD			178634	06/27/13 08:15	NF	TAL DEN
Total/NA	Analysis	6010B		5	180867	06/28/13 08:11	JKH	TAL DEN

Client Sample ID: LAKE-EB-WC-106　　Lab Sample ID: 550-1636-7

Date Collected: 04/22/13 14:05　　**Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/07/13 23:56	HEB	TAL DEN

Client Sample ID: LAKE-EB-WC-107　　Lab Sample ID: 550-1636-8

Date Collected: 04/22/13 14:10　　**Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			180601	06/26/13 15:12	EER	TAL DEN
Total/NA	Prep	3050B MOD			178634	06/27/13 08:15	NF	TAL DEN
Total/NA	Analysis	6010B		5	180867	06/28/13 08:20	JKH	TAL DEN

Client Sample ID: LAKE-FD-EB-102　　Lab Sample ID: 550-1636-9

Date Collected: 04/22/13 14:30　　**Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:02	HEB	TAL DEN

Client Sample ID: LAKE-EB-FL-108　　Lab Sample ID: 550-1636-10

Date Collected: 04/22/13 11:00　　**Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:05	HEB	TAL DEN

Client Sample ID: LAKE-EB-FL-109 Lab Sample ID: 550-1636-11

Date Collected: 04/22/13 11:35 **Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:08	HEB	TAL DEN

Client Sample ID: LAKE-EB-FL-110 Lab Sample ID: 550-1636-12

Date Collected: 04/22/13 12:02 **Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:20	HEB	TAL DEN

Client Sample ID: LAKE-EB-FL-111 Lab Sample ID: 550-1636-13

Date Collected: 04/22/13 12:28 **Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:24	HEB	TAL DEN

Client Sample ID: LAKE-EB-TA-112 Lab Sample ID: 550-1636-14

Date Collected: 04/22/13 17:35 **Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			181322	07/03/13 12:30	RC	TAL DEN
Total/NA	Analysis	6010B		5	181892	07/08/13 17:15	HEB	TAL DEN

Client Sample ID: LAKE-EB-TA-113 Lab Sample ID: 550-1636-15

Date Collected: 04/22/13 18:18 **Matrix: Solid**
Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:30	HEB	TAL DEN

Lab Chronicle

Client Sample ID: LAKE-EB-TA-114

Lab Sample ID: 550-1636-16

Date Collected: 04/22/13 18:20

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:33	HEB	TAL DEN

Client Sample ID: LAKE-EB-TA-115

Lab Sample ID: 550-1636-17

Date Collected: 04/22/13 17:55

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Leach	Increm, Prep			172235	05/01/13 21:55	CDC	TAL DEN
Total/NA	Prep	3050B MOD			172632	05/06/13 09:30	JA	TAL DEN
Total/NA	Analysis	6010B		1	173235	05/08/13 00:36	HEB	TAL DEN

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Certification Summary

Client: Environmental Cost Management, Inc.
TestAmerica Job ID: 550-1636-1
Project/Site: Lake

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-15
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-13
Nevada	State Program	9	AZ01030	07-31-13
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Arkansas DEQ	State Program	6	88-0687	06-01-13 *
Colorado	State Program	8	N/A	09-30-13
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Idaho	State Program	10	CO00026	09-30-13
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	07-30-13
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-13 *
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-13 *
Oklahoma	State Program	6	8614	08-31-13
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-31-13
South Carolina	State Program	4	72002	06-30-13 *
Texas	NELAP	6	T104704183-08-TX	09-30-13
USDA	Federal		P330-13-00202	02-08-14
Utah	NELAP	8	CO000262012-4	07-08-13 *
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	08-03-13
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-13
Wyoming (UST)	A2LA	8		10-31-13

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL DEN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

[illegible]

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF COUSTODY FORM

☒ Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-
☐ Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FA
☐ Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-126

550-1636 Chain of Custody

1 of 1

Client Name / Address: ECM
3525 Hyland Ave #201
Costa Mesa, CA 92626

Project / PO Number: LAKE

Project Manager: Tiffany Leoff

Phone Number: 480-358-1488

Sampler: Carissa Davis & Chris McCormell

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	~~Total Lead EPA 200.7~~ CWA	Total Lead EPA 6010B	Analysis Required							Special Instructions
LAKE-CB BG-100	Soil	1Qt Bag	1	4/22/13	0940	None		X							-1	
LAKE-CB-BG-101					0945			X							-2	
LAKE-CB-BG-102					1600			X							-3	
LAKE-CB-BG-103					1622			X							-4	SB 4/24/13
LAKE-CB-WC-104					1120			X							-5	
LAKE-CB-WC-105					1220			X							-6	
LAKE-CB-WC-106					1405			X							-7	
LAKE-CB-WC-107					1410			X							-8	
LAKE-FD-CB-102					1430			X							-9	
~~LAKE-CB-TA-1~~					1501				(cancel)							
LAKE-CB-FL-108					~~1505~~	1100		X							-10	11:00
LAKE-CB-FL-109					~~1510~~	1135		X							-11	11:35
LAKE-CB-FL-110					~~1520~~	1202		X							-12	12:02
LAKE-CB-FL-111	✓	✓	✓	✓	1228	↓		X							-13	

Relinquished By: Chris McCormell Date / Time: 4-24-13 15:00 Received By: Fed EX Date / Time:

Relinquished By: Date / Time: Received By: Date / Time:

Relinquished By: FEDEX Date / Time: 04/26/13 0930 Received in Lab By: Date / Time: 04/26/13 0930

Turnaround Time: (Check)
same day ____ 72 hours ____
24 hours ____ 5 days ____
48 hours ____ normal X

Sample Integrity: (Check)
intact ✓ on ice NO

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

21.3°C

Cola Bay

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

TAL-0013-550 (10/10)

CHAIN OF CUSTODY FORM

☒ Phoenix - 4625 E. Cotton Center Blvd., Suite 189, Phoenix, AZ 85040 (602) 437-3340 FAX (602) 454-9303
[ ] Tucson - 1870 W. Prince Road, Suite 59, Tucson, AZ 85705 (520) 807-3801 FAX (520) 807-3803
[ ] Las Vegas - 6000 S Eastern Ave., Suite 5E, Las Vegas, NV 89119 (702) 429-1264

Page 2 of 2

Client Name/Address: ECM
3575 Hyland Ave #200
Costa Mesa, CA 92626

Project/PO Number: LAKE

Project Manager: Tiffany Loeff

Phone Number: 480-357-1482

Sampler: [illegible] Davis & Chris McCormack

Fax Number: 714-662-2758

Sample Description	Sample Matrix	Container Type	# of Cont.	Sampling Date	Sampling Time	Preservatives	Analysis Required: CWD ~~Total Lead EPA 200.7~~	Total Lead EPA 6010B								Special Instructions
LAKE-CB-TA-112	Soil	1 oz bag	1	4/22/13	1735	None		X								-14
LAKE-CB-TA-113	↓	↓	↓	↓	1812	↓		X								-15
LAKE-CB-TA-114	↓	↓	↓	↓	1820	↓		X								-16
LAKE-CB-TA-115	↓	↓	↓	↓	1755	↓		X								-17
~~LAKE-CR-TA-109~~	~~Water~~	~~250ml poly~~	~~↓~~	~~↓~~	~~0745~~	~~HNO3~~	~~X~~		CWD							
~~LAKE-CR-FL-107~~	~~↓~~	~~↓~~	~~↓~~	~~↓~~	~~0747~~	~~↓~~	~~X~~		CWD							
~~LAKE-CR-WC-110~~	~~↓~~	~~↓~~	~~↓~~	~~↓~~	~~0752~~	~~↓~~	~~X~~		CWD							
~~LAKE-CR-BG-111~~	~~↓~~	~~↓~~	~~↓~~	~~↓~~	~~0756~~	~~↓~~	~~X~~		CWD							
~~LAKE~~ (CWD)																

Relinquished By: Chris McCormack	Date/Time: 4-24-13 15:00	Received By: FEDEX	Date/Time:	Turnaround Time: (Check) same day ____ 72 hours ____ 24 hours ____ 5 days ____ 48 hours ____ normal X
Relinquished By:	Date/Time:	Received By:	Date/Time:	
Relinquished By: FEDEX	Date/Time: 04/26/13 0930	Received in Lab By:	Date/Time: 04/26/13 0930	Sample Integrity: (Check) intact ✓ on ice NO

Note: By relinquishing samples to TestAmerica, client agrees to pay for the services requested on this chain of custody form and any additional analyses performed on this project. Payment for services is due within 30 days from the date of invoice. Sample(s) will be disposed of after 30 days.

21.3°C

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1636-1

Login Number: 1636

List Source: TestAmerica Phoenix

List Number: 1

Creator: Baker, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1636-1

Login Number: 1636
List Number: 1
Creator: Eichelberger, Elizabeth M

List Source: TestAmerica Denver
List Creation: 05/01/13 07:02 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	17.1
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-1636-2
Client Project/Site: Lake

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Authorized for release by:
8/14/2013 1:27:01 PM

Carlene McCutcheon, Customer Service Manager
carlene.mccutcheon@testamericainc.com

LINKS

Review your project results through
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Ask The Expert

Visit us at:
www.testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Definitions/Glossary

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-2

Job ID: 550-1636-2

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-1636-2

Comments
No additional comments.

Receipt
The samples were received on 4/26/2013 9:30 AM; the samples arrived in good condition, properly preserved and, where required, on ice.
The temperature of the cooler at receipt was 21.3º C.

Metals
No analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-2

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-1636-13	LAKE-EB-FL-111	Solid	04/22/13 12:28	04/26/13 09:30
550-1636-14	LAKE-EB-TA-112	Solid	04/22/13 17:35	04/26/13 09:30

Detection Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-2

Client Sample ID: LAKE-EB-FL-111

Lab Sample ID: 550-1636-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	160		0.80		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-EB-TA-112

Lab Sample ID: 550-1636-14

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	230		0.69		mg/Kg	1		6010B	Total/NA
Lead	0.020		0.0090		mg/L	1		6010B	SPLP West

This Detection Summary does not include radiochemical test results.

Client Sample ID: LAKE-EB-FL-111

Lab Sample ID: 550-1636-13

Date Collected: 04/22/13 12:28

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**160**		0.80		mg/Kg		08/02/13 07:30	08/02/13 19:43	1

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.0090		mg/L		08/09/13 12:30	08/10/13 09:49	1

Client Sample ID: LAKE-EB-TA-112

Lab Sample ID: 550-1636-14

Date Collected: 04/22/13 17:35

Matrix: Solid

Date Received: 04/26/13 09:30

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**230**		0.69		mg/Kg		08/02/13 07:30	08/02/13 19:45	1

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.020**		0.0090		mg/L		08/09/13 12:30	08/10/13 10:00	1

QC Sample Results

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 280-185351/1-A
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 185351

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.80		mg/Kg		08/02/13 07:30	08/02/13 19:07	1

Lab Sample ID: LCS 280-185351/2-A
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 185351

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			50.0	48.2		mg/Kg		96	86 - 110		

Lab Sample ID: 280-44963-A-1-B MS
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 185351

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	2.1		45.0	43.5		mg/Kg		92	70 - 200		

Lab Sample ID: 280-44963-A-1-C MSD
Matrix: Solid
Analysis Batch: 185828

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 185351

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	2.1		48.1	46.3		mg/Kg		92	70 - 200	6	20

Lab Sample ID: LB2 280-186231/1-B LB2
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: Method Blank
Prep Type: SPLP West
Prep Batch: 186514

Analyte	LB2 Result	LB2 Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.0090		mg/L		08/09/13 12:30	08/10/13 09:38	1

Lab Sample ID: LCS 280-186231/2-B
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: Lab Control Sample
Prep Type: SPLP West
Prep Batch: 186514

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			0.500	0.480		mg/L		96	89 - 110		

Lab Sample ID: 550-1636-14 MS
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: LAKE-EB-TA-112
Prep Type: SPLP West
Prep Batch: 186514

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	0.020		0.500	0.484		mg/L		93	80 - 120		

Lab Sample ID: 550-1636-14 MSD
Matrix: Solid
Analysis Batch: 186832

Client Sample ID: LAKE-EB-TA-112
Prep Type: SPLP West
Prep Batch: 186514

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	0.020		0.500	0.463		mg/L		89	80 - 120	5	20

Metals

Prep Batch: 185351

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-44963-A-1-B MS	Matrix Spike	Total/NA	Solid	3050B	
280-44963-A-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	3050B	
550-1636-13	LAKE-EB-FL-111	Total/NA	Solid	3050B	
550-1636-14	LAKE-EB-TA-112	Total/NA	Solid	3050B	
LCS 280-185351/2-A	Lab Control Sample	Total/NA	Solid	3050B	
MB 280-185351/1-A	Method Blank	Total/NA	Solid	3050B	

Analysis Batch: 185828

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
280-44963-A-1-B MS	Matrix Spike	Total/NA	Solid	6010B	185351
280-44963-A-1-C MSD	Matrix Spike Duplicate	Total/NA	Solid	6010B	185351
550-1636-13	LAKE-EB-FL-111	Total/NA	Solid	6010B	185351
550-1636-14	LAKE-EB-TA-112	Total/NA	Solid	6010B	185351
LCS 280-185351/2-A	Lab Control Sample	Total/NA	Solid	6010B	185351
MB 280-185351/1-A	Method Blank	Total/NA	Solid	6010B	185351

Leach Batch: 186231

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-13	LAKE-EB-FL-111	SPLP West	Solid	1312	
550-1636-14	LAKE-EB-TA-112	SPLP West	Solid	1312	
550-1636-14 MS	LAKE-EB-TA-112	SPLP West	Solid	1312	
550-1636-14 MSD	LAKE-EB-TA-112	SPLP West	Solid	1312	
LB2 280-186231/1-B LB2	Method Blank	SPLP West	Solid	1312	
LCS 280-186231/2-B	Lab Control Sample	SPLP West	Solid	1312	

Prep Batch: 186514

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-13	LAKE-EB-FL-111	SPLP West	Solid	3010A	186231
550-1636-14	LAKE-EB-TA-112	SPLP West	Solid	3010A	186231
550-1636-14 MS	LAKE-EB-TA-112	SPLP West	Solid	3010A	186231
550-1636-14 MSD	LAKE-EB-TA-112	SPLP West	Solid	3010A	186231
LB2 280-186231/1-B LB2	Method Blank	SPLP West	Solid	3010A	186231
LCS 280-186231/2-B	Lab Control Sample	SPLP West	Solid	3010A	186231

Analysis Batch: 186832

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-1636-13	LAKE-EB-FL-111	SPLP West	Solid	6010B	186514
550-1636-14	LAKE-EB-TA-112	SPLP West	Solid	6010B	186514
550-1636-14 MS	LAKE-EB-TA-112	SPLP West	Solid	6010B	186514
550-1636-14 MSD	LAKE-EB-TA-112	SPLP West	Solid	6010B	186514
LB2 280-186231/1-B LB2	Method Blank	SPLP West	Solid	6010B	186514
LCS 280-186231/2-B	Lab Control Sample	SPLP West	Solid	6010B	186514

1 2 3 4 5 6 7 8 9 10 11 12 13

Client Sample ID: LAKE-EB-FL-111

Lab Sample ID: 550-1636-13

Date Collected: 04/22/13 12:28

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			185351	08/02/13 07:30	JAM	TAL DEN
Total/NA	Analysis	6010B		1	185828	08/02/13 19:43	JKH	TAL DEN
SPLP West	Leach	1312			186231	08/07/13 16:22	SPF	TAL DEN
SPLP West	Prep	3010A			186514	08/09/13 12:30	JAM	TAL DEN
SPLP West	Analysis	6010B		1	186832	08/10/13 09:49	JKH	TAL DEN

Client Sample ID: LAKE-EB-TA-112

Lab Sample ID: 550-1636-14

Date Collected: 04/22/13 17:35

Matrix: Solid

Date Received: 04/26/13 09:30

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			185351	08/02/13 07:30	JAM	TAL DEN
Total/NA	Analysis	6010B		1	185828	08/02/13 19:45	JKH	TAL DEN
SPLP West	Leach	1312			186231	08/07/13 16:22	SPF	TAL DEN
SPLP West	Prep	3010A			186514	08/09/13 12:30	JAM	TAL DEN
SPLP West	Analysis	6010B		1	186832	08/10/13 10:00	JKH	TAL DEN

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Certification Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-2

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-15
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-13
Nevada	State Program	9	AZ01030	07-31-14
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Laboratory: TestAmerica Denver

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
A2LA	DoD ELAP		2907.01	10-31-13
A2LA	ISO/IEC 17025		2907.01	10-31-13
Alabama	State Program	4	40730	09-30-13 *
Alaska (UST)	State Program	10	UST-30	04-05-14
Arizona	State Program	9	AZ0713	12-19-13
Arkansas DEQ	State Program	6	88-0687	09-01-13
California	ELAP	9	2513	08-31-14 *
Colorado	State Program	8	N/A	09-30-13
Connecticut	State Program	1	PH-0686	09-30-14
Florida	NELAP	4	E87667	06-30-14
Idaho	State Program	10	CO00026	09-30-13
Illinois	NELAP	5	200017	04-30-14
Iowa	State Program	7	370	12-01-14
Kansas	NELAP	7	E-10166	04-30-14
Louisiana	NELAP	6	02096	09-01-13 *
Maine	State Program	1	CO0002	03-03-15
Maryland	State Program	3	268	03-31-14
Minnesota	NELAP	5	8-999-405	12-31-13
Nevada	State Program	9	CO0026	09-01-13
New Hampshire	NELAP	1	205310	04-28-14
New Jersey	NELAP	2	CO004	06-30-14
New Mexico	State Program	6	CO00026	06-30-14 *
New York	NELAP	2	11964	04-01-14
North Carolina DENR	State Program	4	358	12-31-13
North Dakota	State Program	8	R-034	06-30-14 *
Oklahoma	State Program	6	8614	08-31-13
Oregon	NELAP	10	CO200001	01-16-14
Pennsylvania	NELAP	3	68-00664	07-30-14
South Carolina	State Program	4	72002	09-01-13 *
Texas	NELAP	6	T104704183-08-TX	09-30-13
USDA	Federal		P330-13-00202	07-02-16
Utah	NELAP	8	CO000262012-4	07-31-14
Virginia	NELAP	3	460232	06-14-14
Washington	State Program	10	C583	09-01-13 *
West Virginia DEP	State Program	3	354	11-30-13
Wisconsin	State Program	5	999615430	08-31-13
Wyoming (UST)	A2LA	8		10-31-13

* Expired certification is currently pending renewal and is considered valid.

Method Summary

Client: Environmental Cost Management, Inc.
Project/Site: Lake

TestAmerica Job ID: 550-1636-2

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL DEN

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL DEN = TestAmerica Denver, 4955 Yarrow Street, Arvada, CO 80002, TEL (303)736-0100

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1636-2

Login Number: 1636

List Source: TestAmerica Phoenix

List Number: 1

Creator: Baker, Elizabeth

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	False	
Cooler Temperature is acceptable.	N/A	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	No analysis requiring residual chlorine check assigned.

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-1636-2

Login Number: 1636
List Number: 1
Creator: Eichelberger, Elizabeth M

List Source: TestAmerica Denver
List Creation: 05/01/13 07:02 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	17.1
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	False	

APPENDIX E

SOIL AND GROUNDWATER SAMPLING REPORT

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability

3525 Hyland Avenue, Suite 200
Costa Mesa, California 92626
Main: (714) 662-2759 Fax: (714) 662-2758
www.ecostmanage.com

April 1, 2014

Mr. Russell Brengman
Hazardous Materials
Lake Mead National Recreation Area
601 Nevada Way
Boulder City, NV 89005

RE: SOIL AND GROUNDWATER SAMPLING
LAS VEGAS BAY FORMER FIRING RANGE SITE
LAKE MEAD NATIONAL RECREATION AREA
CLARK COUNTY, NEVADA AND MOHAVE COUNTY, ARIZONA

Dear Mr. Brengman:

Environmental Cost Management Inc. (ECM) has prepared this Soil and Groundwater Sampling Report (Report) for soil boring and sampling and groundwater sampling at the Las Vegas Bay former firing range site at Lake Mead National Recreation Area (LAKE[a]).

The soil and groundwater sampling were conducted to obtain data that establish a direct connection, if one exists, between surface lead impacts and any groundwater impacts. Although Synthetic Precipitation Leaching Procedure (SPLP) results at the site indicate potential groundwater impact due to leaching, concentrations of lead may not have reached groundwater. Since no groundwater data were available, a boring was drilled to obtain a groundwater sample beneath the site to evaluate the actual concentration of lead attributable to leaching from the overlying soil. Additionally, a well located near the percolation ponds was sampled and analyzed to establish background concentrations of lead in the vicinity of the site.

This report discusses the sampling locations and analysis of soil and groundwater. It includes a brief description of the site work, a site map of the boring location, boring log, summarized laboratory analysis data, and conclusions.

1 SITE HISTORY

Las Vegas Bay is located on the west side of Lake Mead (Nevada) and Boulder Basin off of Lakeshore Scenic Drive. The firing range is located adjacent to two sewage disposal ponds. It is approximately 750 feet west/southwest of the Las Vegas Bay Ranger Station and approximately 300 feet south of Lake Shore Road on a dirt road that

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[a] Also referred to as LAME and LMNRA.

accesses the firing range from the east (**Figure 1**). The entrance to the firing range and the sewage disposal ponds is located west and adjacent to the firing range, and is cordoned off with a locked fence. The firing range and the sewage disposal ponds are completely fenced.

The firing range, which was reportedly opened in 1974, is bounded to the north, east and south by a man-made berm. The west side of the range is bounded by a natural hillside (**Figure 2**). The sewage disposal ponds are located on the top of this hillside. The old target area located adjacent to the eastern man-made berm was the primary target prior to 1992. The majority of the man-made berm and a portion of the natural hillside are impacted by lead. Drainage channels flank the impact berm, flowing northward. Additionally, a drainage feature is located down gradient and east of the firing range. This drainage feature flows north/northeasterly for approximately 770 feet to a culvert beneath Lakeshore Road. From the culvert at Lakeshore Road, the drainage feature flows east for approximately 0.7 mile to the Boulder Basin portion of Lake Mead (closest body of water).

NPS completed Preliminary Assessment and Site Inspection (PA/SI) field activities for the former firing ranges between 2007 and 2009 as part of a larger-scale investigation. No samples were collected during the PA/SI investigation, as this site was still active at the time. The PA/SI Report recommended site characterization to determine potential impacts, the nature and extent of potential contamination, and appropriate response actions, if necessary.

In 2012, ECM collected shallow soil samples from the firing range target area, firing line, and wash channel bed decision units (DUs) and background at the former firing range site (**Figure 2**) using the incremental sampling methodology (ISM). Soil sampling results at two former firing range sites, Las Vegas Bay and Echo Bay, indicated lead concentrations in soil exceeded the EPA Soil Screening Level (SSL) protective of groundwater. If impacted, groundwater movement may carry contaminants to locations such as drinking water wells, where human exposure to any contamination could potentially occur. Therefore, ECM collected additional information regarding groundwater quality and the potential for lead to leach to groundwater at the Las Vegas Bay former firing range site to evaluate whether an exposure pathway exists via groundwater.

2 SUMMARY OF SITE INVESTIGATION ACTIVITIES

Site investigation activities were conducted in accordance with the Work Plan Addendum[b]. ECM completed a single boring at the Las Vegas Bay firing range and sampled it for lead impacts to soil and groundwater and for geotechnical characteristics that may influence lead leaching. Soil samples were collected at selected intervals in

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[b] Environmental Cost Management, Inc., *Work Plan Addendum for Additional Soil Sampling and Modeling, Lake Mead National Recreation Area – Las Vegas Bay and Echo Bay Former Firing Range Sites, Clark County, Nevada*, December 6, 2013.

the boring. A more detailed description of the field activities is discussed in the subsections below.

Prior to initiating the field activities, ECM submitted a request to locate and mark public utilities in the vicinity of the proposed subsurface investigation to USA North Dig-Alert. The Dig-Alert inspection consisted of marking of underground utility locations by utility representatives, including water, natural gas, petroleum, electricity, telephone, including fiber optic, and cable. ECM also coordinated with the NPS to identify the locations of utilities in the area of the proposed soil boring.

2.1 DRILLING

Enviro-Drill, Inc., a Nevada-licensed drilling contractor, performed all drilling activities during this investigation. Prior to use, all drilling equipment was decontaminated according to standard practice for environmental drilling projects. Due to the difficult drilling conditions anticipated, a CME 75 ODEX rig was used to install the borings. This drilling method uses a pneumatic hammer located at the bottom of the drill casing. Impact occurs directly to the formation rather than at the top of the drill pipe as in the air percussion method.

All drilling was performed under the supervision of an ECM geologist. The soil boring was advanced to a depth of 180 feet below ground surface (bgs). ECM marked the location of the boring with a handheld GPS unit.

The borehole was logged by examining the drill cuttings. At intervals where discrete samples were recovered, ECM logged soil characteristics directly from the samples. The geologist entered a full description of the drilling and sampling activities associated with the boring. The original boring log, produced in the field by the site geologist, was formatted, and is presented in **Appendix A**.

2.2 DECONTAMINATION PROCEDURES

Prior to beginning drilling operations, the drill pipe was steam-cleaned. Prior to use, and between sampling locations, sampling equipment and the water level sounder were decontaminated using a three-stage decontamination process consisting of a laboratory detergent and water wash, nitric acid rinse, and a final de-ionized organic-free water rinse. Equipment was allowed to air dry.

2.3 SOIL AND GROUNDWATER SAMPLING

The soil and groundwater sampling conducted at the Las Vegas Bay former firing range site are described in the subsections below.

2.3.1 Monitor and Sample Cross-Gradient Well

ECM gauged the depth to water at the cross-gradient monitoring well (**Figure 2**) and collected a groundwater sample from this well to evaluate the background concentration of lead in the groundwater at this location.

On December 11, 2013 ECM measured the total well depth and depth to groundwater relative to the well's top of casing. An electric water level sounder was used to measurement the depth to groundwater to the nearest 0.01 feet relative to the north end of the top of the well's casing. Recorded depth to water was 169.22 feet. ECM recorded the well location to within 5 feet with a hand-held Garmin eTrex 20 GPS unit, since survey data for the well were unavailable.

ECM collected an unpurged grab sample from the on-site well with a disposable bailer attached to new nylon twine. A portion of the sample was field-filtered using a 0.2 micron filter for analysis of dissolved lead. Samples were placed in laboratory supplied containers and labeled with the sampling point, date, time, sampler's initials, and required analyses. The samples were preserved with nitric acid at the TestAmerica Laboratories, Inc. (TestAmerica) drop facility prior to shipment under chain-of-custody to the TestAmerica laboratory in Phoenix, Arizona. The groundwater samples were submitted for total and dissolved lead concentrations in accordance with EPA method 6010B.

2.3.2 Soil Boring

ECM collected four (4) *in-situ* soil samples at various depths for analysis for total lead concentrations. Due to difficult drilling and sampling conditions, soil samples were attempted at select depth intervals determined by the field geologist and based on drilling conditions. Soil samples were successfully retrieved from depths of 60 feet, 100 feet, 155 feet, and 180 feet below ground surface (bgs).

Soil samples were collected using a 18-inch split-spoon sampler loaded with three 6-inch long by 2-inch diameter brass sample liners during the sampling activities. At each sample interval, the sampler was lowered to the bottom of the borehole and then driven into undisturbed soils. The sampler was retrieved and then opened to obtain the sample liner. Both ends of each sample liner were secured by pushing end-caps on tightly and secured with electrical tape. The orientation of the sample was marked on the brass liner. Sufficient undisturbed sample volume was obtained at 60 feet, 100 feet, and 155 feet bgs to submit to Cooper Testing Laboratory for analysis of hydrogeological parameters, fraction organic carbon (f_{OC}), and pH. Additional soil from each sample interval was transferred from the sample liners that were not used for hydrogeologic parameter analysis to sample jars and submitted to the TestAmerica Phoenix analytical laboratory.

On December 12, 2013, groundwater was encountered at approximately 180 feet bgs. The driller pulled the casing up 12 inches to allow water to enter the boring overnight. The depth to water in boring B-1 on December 13, 2013 was 175.10 feet bgs. ECM collected a groundwater sample from the boring using a new disposable bailer. One portion of the sample was field-filtered using a 0.2 micron filter. Samples were placed in laboratory supplied containers. The sample was labeled with the sampling point, date, time, sampler's initials, and required analyses. The samples were preserved with nitric acid at the TestAmerica laboratory drop facility prior to shipment under chain-of-custody to TestAmerica Phoenix.

Samples were labeled with the project name and number, sample location, sample designation (borehole number and depth), date and time of sample collection, and initials of the sample collector. Soil and groundwater samples submitted for lead analysis were placed in a water-tight plastic bag, and then packed in a plastic ice chest with sufficient ice to maintain 4°C ± 2°C during transport to the laboratory. The geologist submitted chain-of-custody forms identifying all the sample containers, chemical analysis requirements, and other field data required by the laboratory with each sample cooler to the off-site laboratory.

The soil samples were analyzed for lead concentration in accordance with EPA method 6010B. Selected samples were extracted according to the SPLP method (EPA method 3010A), and the extract was subsequently analyzed for lead by EPA method 6010B. Additional hydrogeological soil samples were submitted for Dry Bulk Density by ASTM D2937; Grain Density by ASTM D854; Moisture Content by ASTM D2216; Grain Size by ASTM D422 using both sieve and hydrometer for soil particles finer than No. 200 sieve; Fraction Organic Carbon by the Walkley-Black method (Nelson and Sommers, 1992); and soil pH by ASTM 4972. Groundwater samples were submitted for analysis for total and dissolved lead concentrations in accordance with EPA method 6010B.

2.4 BOREHOLE ABANDONMENT AND DISPOSAL OF DERIVED WASTE

The boring was properly abandoned according to Nevada Division of Water Resources protocol. One bag of bentonite and 5 gallons water were used to seal the bottom 5 feet of the hole after removing 20 feet of casing. The driller then filled the boring from 175 feet bgs to 20 feet bgs with cuttings powdered by the drilling method. The top 20 feet of the boring was sealed with four bags of cement and 1 bag of bentonite after all of the casing had been removed.

Drilling-derived wastes consisted of soil cuttings, minimal decontamination water, used personal protective equipment (PPE), disposable sampling supplies, and miscellaneous debris. Drilling cuttings not replaced in the boring were spread at ground surface within the same decision unit where the triggering leachable lead concentrations were found. Containerized decontamination water was allowed to evaporate.

All used PPE and used disposable sampling equipment was securely contained in plastic bags and properly disposed.

3 SAMPLING RESULTS

Analytical results for soil and groundwater samples collected during the drilling of boring B-1 are listed in **Table 1** and **Table 2**, respectively. Table 3 summarizes the results of the hydrogeological parameter analyses. Copies of the laboratory analytical results and chain-of-custody documents are presented in **Appendix B**.

3.1 SOIL SAMPLES

The concentrations of lead in the soil samples ranged from 7.1 mg/kg to 60 mg/kg (**Table 1**). Sample LAKE-LV-B1-60 collected at 60 feet bgs contained 24 mg/kg lead. The lead concentration in the 100-foot sample, LAKE-LV-B1-60 was 7.1 mg/kg. The lead concentration in sample LAKE-LV-B1-155 was 38 mg/kg and in sample LAKE-LV-B1-180 was 60 mg/kg.

The maximum contaminant level used by the State of Nevada is based on the USEPA Site Screening Level (SSL) for the protection of groundwater. This concentration for lead is 14 mg/kg. Because several of the samples from boring B-1 contained total lead concentrations above 14 mg/kg, ECM requested SPLP lead analysis for samples LAKE-LV-B1-60 and LAKE-LV-B1-180, collected at 60 feet and 180 feet bgs, respectively. The results were below the reporting limit for both samples (**Table 1**).

The SPLP results and the hydrogeological parameter data (**Table 3**) will be used to refine groundwater fate and transport models and to evaluate leaching potential for the Echo Bay former firing ranges sites. The results of the modeling will be discussed under separate cover.

3.2 GROUNDWATER SAMPLES

The groundwater sample and duplicate sample, (LAKE-LV-MW-170 and LAKE-LV-MW-170 DUP, respectively) collected from the on-site well were below the reporting limit for total lead (**Table 2**). Groundwater samples LAKE-LV-B1-180 and LAKE-LV-B1-180 DUP collected from boring B-1 contained 0.12 mg/L and 0.14 mg/L total lead, respectively. The total lead samples were collected as grab samples from the unpurged borehole, and may have contained material from the surface of the boring containing elevated concentrations of lead. Therefore, field filtered samples were submitted and analyzed for dissolved lead. Concentrations of dissolved lead above the reporting limit were not present in the groundwater sample and duplicate sample from boring B-1.

4 CONCLUSIONS AND RECOMMENDATIONS

ECM presents the following conclusions from the data collected as a result of the field activities associated with the soil and groundwater sampling at the site:

- Although lead is present in soil beneath the former firing range, concentrations are approximately two orders of magnitude lower than lead concentrations in surface soil.
- In general, lead concentrations tend to increase with depth. This is not consistent with a hypothetical scenario in which surface lead impacts would leach to groundwater. Therefore, these deeper impacts are most likely related to the natural lead content found in igneous rocks which have weathered and been deposited as the erosional material comprising the alluvial fan at the site. The B-1 boring log indicates the presence of dark igneous material (basalt) related to the active volcanism in the vicinity of Lake Mead National Recreation Area approximately 15 million years ago. This material comprises the sand and silt alluvium of the subsurface at the site. Metals such as lead, iron, and magnesium are associated with the volcanic rocks.

- SPLP results for subsurface samples were below the reporting limit, indicating that no significant leaching occurred from these samples. None of the total lead impacts are related to soluble lead leaching from the surface, either.
- The groundwater sample from the cross gradient on-site well did not contain a lead concentration above the reporting limit. It can be assumed at this location that the background concentration of lead in groundwater is less than 0.015 mg/L.
- The dissolved lead concentration in groundwater from boring B-1 beneath the site was below the reporting limit. This is evidence that lead has not leached from the surface to groundwater.

ECM recommends completing the modeling for evaluation of leaching potential as additional evidence that lead has not leached to groundwater and for application to potential leaching scenarios at the Echo Bay firing range in the Lake Mead NRA. The Echo Bay range is not accessible to drill rigs; hence, NPS will rely on computer simulations calibrated from the Las Vegas Bay results.

If you have any questions or require additional information, please contact ECM at (916) 241-9290.

Best regards,

Environmental Cost Management, Inc.

Tiffany O. Looff

Tiffany O. Looff

Senior Geologist, AZ34508

Environmental Cost Management, Inc.

Andrew Campbell, PE

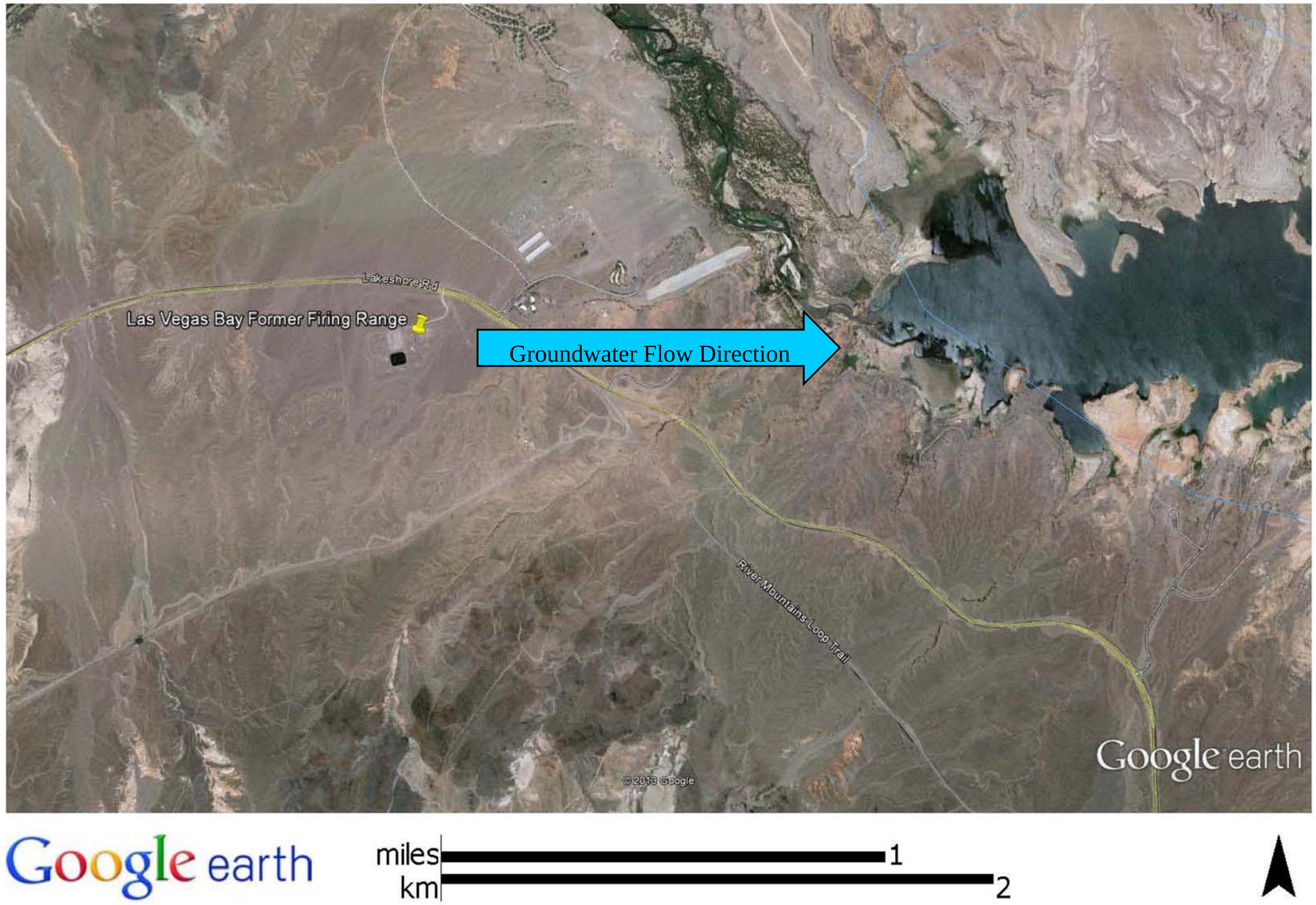
Program Manager

Enclosures:

Figure 1: Site Location Map
Figure 2: Soil Boring and Well Location Map

Table 1: Soil Sample Analysis Summary
Table 2: Groundwater Sample Analysis Summary
Table 3: Hydrogeological Parameter Analysis Summary

Appendix A: Log of Soil Boring B-1
Appendix B: Laboratory Analytical Reports and Chain of Custody Documents



Las Vegas Bay Former Firing Range
Lake Mead National Recreation Area
Clark County, Nevada

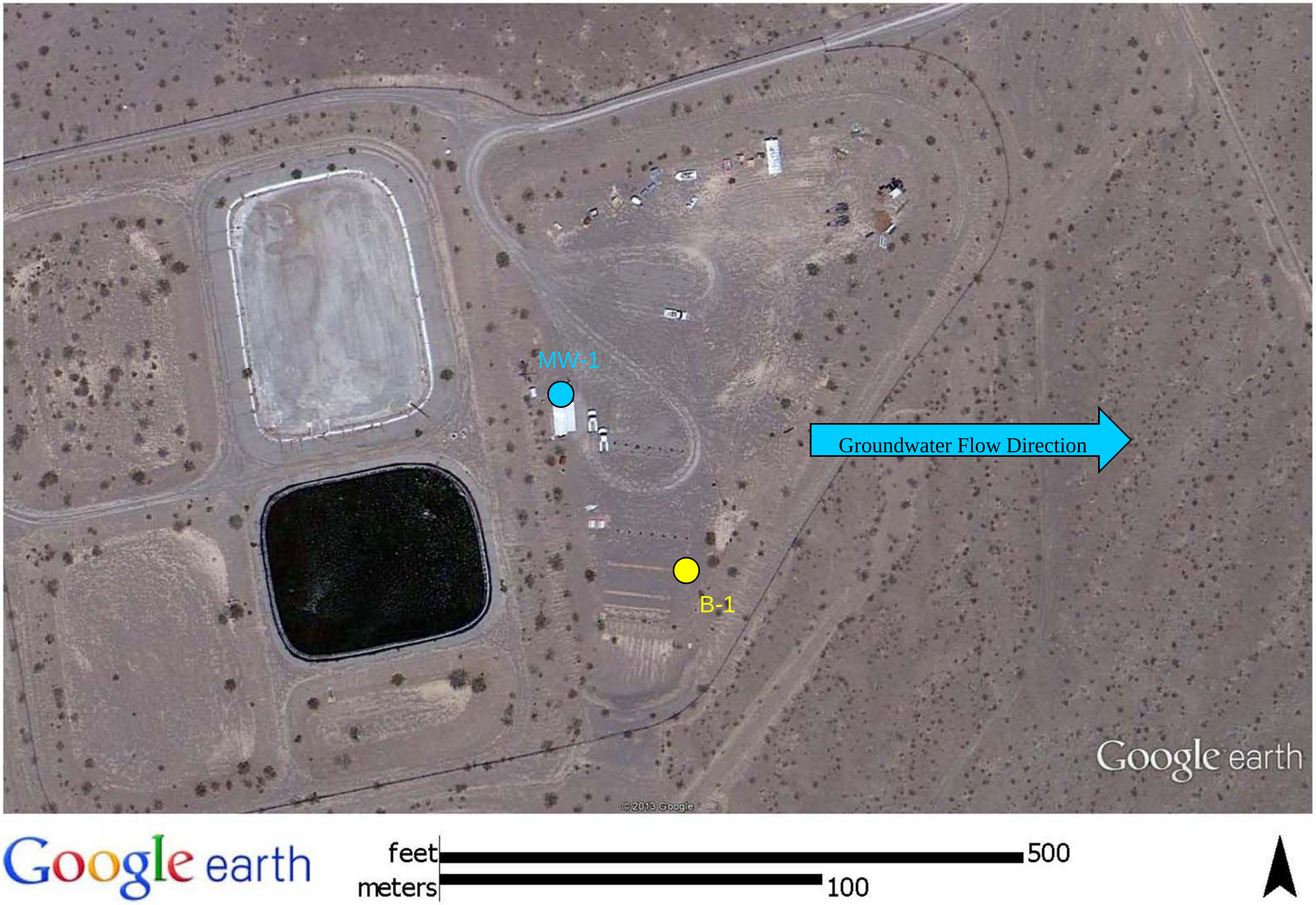
ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
3525 Hyland Ave., Suite 200 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

Site Location Map

Soil and Groundwater Sampling Report

Figure

1



● Approximate Monitoring Well Location

● Approximate Boring Location

Las Vegas Bay Former Firing Range
Lake Mead National Recreation Area
Clark County, Nevada

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
3525 Hyland Ave., Suite 200 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

Soil Boring and Well Location Map

Soil and Groundwater Sampling Report

Figure

2

Table 1: Soil Sample Analysis Summary

Soil and Groundwater Sampling Report

Las Vegas Bay Former Firing Range Site

Lake Mead National Recreation Area

Soil Sample Name	**Depth (feet bgs)**	**Sample Date/ Time**	**Lead (mg/kg) EPA 6010B**	**SPLP Lead (mg/L) EPA 6010B**
LAKE-LV-B1-60	60	12/10/2013 / 15:30	24	<0.50
LAKE-LV-B1-100	100	12/11/2013 / 15:20	7.1	NA
LAKE-LV-B1-155	155	12/12/2013 / 12:30	38	NA
LAKE-LV-B1-180	180	12/13/2013 / 8:40	60	<0.50

Notes:
NA: not analyzed.
bgs: below ground surface
The laboratory data package is attached as Appendix B to this report.

Table 2: Groundwater Sample Analysis Summary

Soil and Groundwater Sampling Report
Las Vegas Bay Former Firing Range Site
Lake Mead National Recreation Area

Soil Sample Name	Depth (feet bgs)	Sample Date/ Time	Total Lead (mg/L) EPA 6010B	Dissolved Lead (mg/L) EPA 6010B
LAKE-LV-MW-170	170	12/11/2013 / 9:00	<0.015	NA
LAKE-LV-MW-170 DUP	170	12/11/2013 / 9:00	<0.015	NA
LAKE-LV-B1-180	180	12/13/2013 / 22:00	0.12	<0.015
LAKE-LV-B1-180 DUP	180	12/13/2013 / 22:00	0.14	NA

Notes:
NA: not analyzed.
bgs: below ground surface
The laboratory data package is attached as Appendix B to this report.

Table 3: Hydrogeological Parameter Analysis Summary

Soil and Groundwater Sampling Report
Las Vegas Bay Former Firing Range Site
Lake Mead National Recreation Area

Soil Sample Name	Depth (feet bgs)	Sample Date/ Time	pH Cal 643	Grain Size Distribution	Moisture, % ASTM D 2937	Hydraulic Conductivity, cm/sec ASTM D 5084	Specific Gravity ASTM D 854	Organic Matter, % Walkley - Black
LAKE-LV-B1-60	60	12/10/2013 / 15:30	8.0	0.4% gravel 67.2% sand 24.5% silt 7.9% clay	13.8	NM	2.698	0.48
LAKE-LV-B1-100	100	12/11/2013 / 15:20	8.1	52.1% sand 43.7% silt 4.2% clay	NM	0.0003	2.672	0.55
LAKE-LV-B1-155	155	12/12/2013 / 12:30	8.3	41.6% sand 41.6% silt 15.8% clay	19.8	NM	2.700	0.55

Appendix A

Log of Boring B-1

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
3525 Hyland Ave, Suite 200 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

FIELD BOREHOLE LOG

BOREHOLE NO.: B-1

TOTAL DEPTH: 180 feet

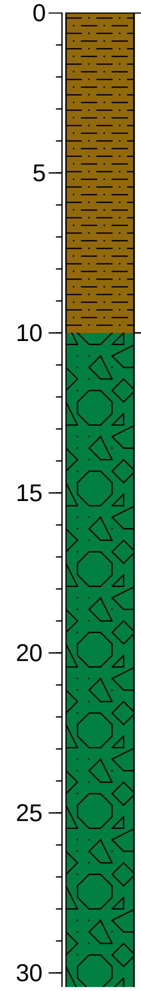
PROJECT INFORMATION

PROJECT: NPS Lake Mead, NV
SITE LOCATION: Las Vegas Bay
JOB NO.:
FIELD GEOLOGIST: Chris McCormack
PROJECT MANAGER: Tiffany Looff
DATES DRILLED: 12/10/2013 - 12/13/2013
GROUND SURFACE ELEVATION: 1363 feet amsl est.
TOP OF CASING ELEVATION: NA

DRILLING INFORMATION

DRILLING CO.: Enviro Drill
DRILLER: Jason Poltroff
RIG TYPE: ODEX - CME75
METHOD OF DRILLING: Direct Push
SAMPLING METHODS: Split Spoon
BOREHOLE DIAMETER: 4.5 inch
NORTHING Y-COORDINATE: N 36 deg 06.990'
EASTING X-COORDINATE: W 114 deg 52.495'

▽ Water Table Encountered During Drilling
▼ Static Water Level Measured from the Surface



DEPTH bgs (vertical)	LITHOLOGY	USCS	SOIL DESCRIPTION	COMMENTS
		SM	0-10': silty sand, light brown to pinkish tan fine drill cuttings. Top soil	12:02 spud in Casing in 5' sections, LH thread
		Alluvium	10-46': ALLUVIUM, basalt, dark gray, angular fresh broken fragments, 85% silty fines, 10% basalt, <2% pink quartzite/ kspar	

FIELD BOREHOLE LOG

BOREHOLE NO.: B-1

TOTAL DEPTH: 180 feet

PROJECT INFORMATION

PROJECT: NPS Lake Mead, NV
SITE LOCATION: Las Vegas Bay
JOB NO.:
FIELD GEOLOGIST: Chris McCormack
PROJECT MANAGER: Tiffany Looff
DATES DRILLED: 12/10/2013 - 12/13/2013
GROUND SURFACE ELEVATION: 1363 feet amsl est.
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DRILLING CO.: Enviro Drill
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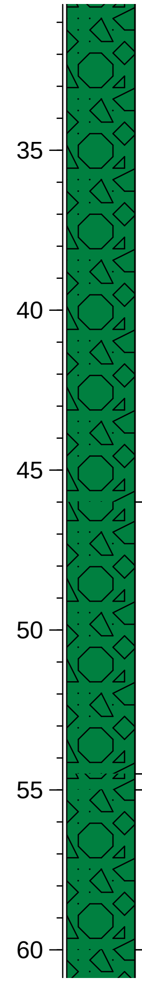
NORTHING Y-COORDINATE: N 36 deg 06.990'
EASTING X-COORDINATE: W 114 deg 52.495'

▽ Water Table Encountered During Drilling

▼ Static Water Level Measured from the Surface



DEPTH bgs (vertical)	LITHOLOGY	USCS	SOIL DESCRIPTION	COMMENTS
		Alluvium	46-54.5': 80% dark gray basalt clasts, 20% tan to pinkish silt matrix, cooler, slightly moist returns	46' slow drilling
		Alluvium	54.5-55': increase in silt to 70%, drill rate faster to 55'.	
		Alluvium	55-60': 95% pink moderately soft siltstone with <5% basalt clasts, slower drill rate.	
			60-65': silt and sand, grades to siltstone, pink, 40% dark gray	sample attempt 120 blowcount for 6", too hard

FIELD BOREHOLE LOG

BOREHOLE NO.: B-1

TOTAL DEPTH: 180 feet

PROJECT INFORMATION

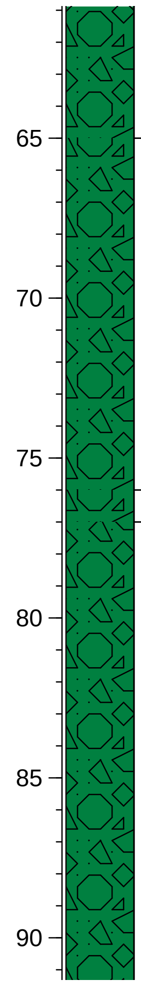
PROJECT: NPS Lake Mead, NV
SITE LOCATION: Las Vegas Bay
JOB NO.:
FIELD GEOLOGIST: Chris McCormack
PROJECT MANAGER: Tiffany Looff
DATES DRILLED: 12/10/2013 - 12/13/2013
GROUND SURFACE ELEVATION: 1363 feet amsl est.
TOP OF CASING ELEVATION: NA

DRILLING INFORMATION

DRILLING CO.: Enviro Drill
DRILLER: Jason Poltroff
RIG TYPE: ODEX - CME75
METHOD OF DRILLING: Direct Push
SAMPLING METHODS: Split Spoon
BOREHOLE DIAMETER: 4.5 inch
NORTHING Y-COORDINATE: N 36 deg 06.990'
EASTING X-COORDINATE: W 114 deg 52.495'

▽ Water Table Encountered During Drilling

▼ Static Water Level Measured from the Surface



DEPTH bgs (vertical)	LITHOLOGY	USCS	SOIL DESCRIPTION	COMMENTS
		Alluvium	and pink, 60% coarse sub angular silty sandstone.	LAKE-LV-B1-60
65		Alluvium	65-76': soft clayey silt, slow drilling.	65' drilling depth on 12/10/2013
		Alluvium	76-77': decrease in clay, increasing hard silt, pink to gray.	
		Alluvium	77-92': basalt clasts, increased drill rate.	

FIELD BOREHOLE LOG

BOREHOLE NO.: B-1

TOTAL DEPTH: 180 feet

PROJECT INFORMATION

PROJECT: NPS Lake Mead, NV
SITE LOCATION: Las Vegas Bay
JOB NO.:
FIELD GEOLOGIST: Chris McCormack
PROJECT MANAGER: Tiffany Looff
DATES DRILLED: 12/10/2013 - 12/13/2013
GROUND SURFACE ELEVATION: 1363 feet amsl est.
TOP OF CASING ELEVATION: NA

DRILLING INFORMATION

DRILLING CO.: Enviro Drill
DRILLER: Jason Poltroff
RIG TYPE: ODEX - CME75
METHOD OF DRILLING: Direct Push
SAMPLING METHODS: Split Spoon
BOREHOLE DIAMETER: 4.5 inch
NORTHING Y-COORDINATE: N 36 deg 06.990'
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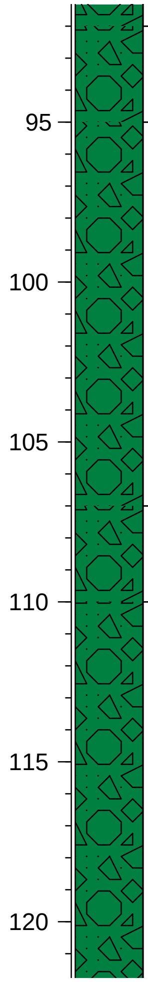
▽ Water Table Encountered During Drilling ▼ Static Water Level Measured from the Surface



USCS	SOIL DESCRIPTION	COMMENTS
Alluvium	92-95': 80% silt-siltstone, pink, hard, 20% clayey silt, pink, soft, drill rate slowing, increased clay content seems to slow drilling rate.	
Alluvium	95-107': Interbedded sandstone (pink) and clayey silt layers, trace basalt boulders? 1/8"-1/4" chips.	LAKE-LV-B1-100 Blow count 60/86 Observed slight moisture in the bottom of the drive shoe. 100' drilling depth on 12/11/2013
Alluvium	107-110': 100% pink silt, clumping in cuttings, possible sign of moisture?	
Alluvium	110-118': 100% pink-grayish pink silt.	

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
3525 Hyland Ave, Suite 200 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

FIELD BOREHOLE LOG

BOREHOLE NO.: B-1

TOTAL DEPTH: 180 feet

PROJECT INFORMATION

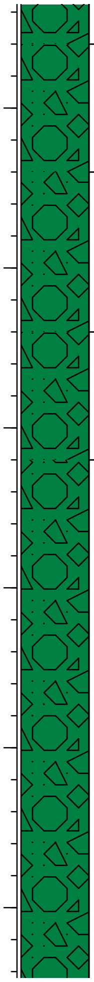
PROJECT: NPS Lake Mead, NV
SITE LOCATION: Las Vegas Bay
JOB NO.:
FIELD GEOLOGIST: Chris McCormack
PROJECT MANAGER: Tiffany Looff
DATES DRILLED: 12/10/2013 - 12/13/2013
GROUND SURFACE ELEVATION: 1363 feet amsl est.
TOP OF CASING ELEVATION: NA

DRILLING INFORMATION

DRILLING CO.: Enviro Drill
DRILLER: Jason Poltroff
RIG TYPE: ODEX - CME75
METHOD OF DRILLING: Direct Push
SAMPLING METHODS: Split Spoon
BOREHOLE DIAMETER: 4.5 inch
NORTHING Y-COORDINATE: N 36 deg 06.990'
EASTING X-COORDINATE: W 114 deg 52.495'

▽ Water Table Encountered During Drilling

▼ Static Water Level Measured from the Surface

DEPTH bgs (vertical)	LITHOLOGY	USCS	SOIL DESCRIPTION	COMMENTS
125		Alluvium	123-124.5': gray color change, possible basalt layer? 127-129' increase in fines slowing drill rate.	
130		Alluvium	127-132': ALLUVIUM, 80% basalt, dark gray, 129-130' increased drill rate.	
135		Alluvium	132-136': ALLUVIUM, 70% pink silt, 30% dark gray basalt, good drill rate.	
140 145 150		Alluvium	136-153': ALLUVIUM, 70-100% pink silt, 0-30% gray silt, 0-10% dark gray basalt?	

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FIELD BOREHOLE LOG

BOREHOLE NO.: B-1

TOTAL DEPTH: 180 feet

PROJECT INFORMATION

PROJECT: NPS Lake Mead, NV
SITE LOCATION: Las Vegas Bay
JOB NO.:
FIELD GEOLOGIST: Chris McCormack
PROJECT MANAGER: Tiffany Looff
DATES DRILLED: 12/10/2013 - 12/13/2013
GROUND SURFACE ELEVATION: 1363 feet amsl est.
TOP OF CASING ELEVATION: NA

DRILLING INFORMATION

DRILLING CO.: Enviro Drill
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METHOD OF DRILLING: Direct Push
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BOREHOLE DIAMETER: 4.5 inch
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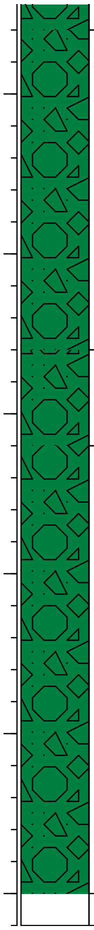
▽ Water Table Encountered During Drilling

▼ Static Water Level Measured from the Surface

DEPTH bgs (vertical)	LITHOLOGY	USCS	SOIL DESCRIPTION	COMMENTS
155 160		Alluvium	153-163': clayey silt, pink, poor returns, very slow drilling	LAKE-LV-B1-155, blow count 60/76
165		Alluvium	163-166': ALLUVIUM, 80% dark gray basalt, 20% pink silt	
170 ▽ ▼ 175 180		Alluvium	166-180': 50% dark gray powder(basalt?), 50% pink powder(siltstone?)	180' drilling depth on 12/12/2013 Water encountered at 173' bgs during drilling attempt to drive LAKE-LV-B1-180 failed Static water at 175.10' measured from ground surface Sample water TD of boring at 180' bgs, backfill boring from 0-20 with cement/ bentonite, 20-175 with cuttings, and 175-180 with bentonite.

Appendix B

Laboratory Analytical Reports and Chain of Custody Documents

TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-16165-1
Client Project/Site: NPS Lake

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Authorized for release by:
12/26/2013 6:32:26 PM

Carlene McCutcheon, Project Manager II
(602)659-7612
carlene.mccutcheon@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

Table of Contents

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Definitions/Glossary

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Job ID: 550-16165-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-16165-1

Comments
No additional comments.

Receipt
The samples were received on 12/14/2013 11:00 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 4.6º C.

Metals
No analytical or quality issues were noted.

Field Service / Mobile Lab
No analytical or quality issues were noted.

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Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16165-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-16165-1	LAKE-LV-B1-60	Solid	12/10/13 15:30	12/14/13 11:00
550-16165-2	LAKE-LV-B1-100	Solid	12/11/13 15:20	12/14/13 11:00
550-16165-3	LAKE-LV-B1-155	Solid	12/12/13 12:30	12/14/13 11:00
550-16165-4	LAKE-LV-B1-180	Solid	12/13/13 08:40	12/14/13 11:00
550-16165-5	LAKE-LV-MW-170	Water	12/11/13 09:00	12/14/13 11:00
550-16165-7	LAKE-LV-MW-170 DUP	Water	12/11/13 09:00	12/14/13 11:00
550-16165-9	LAKE-LV-EB	Water	12/11/13 09:30	12/14/13 11:00
550-16165-11	LAKE-LV-B1-180	Water	12/12/13 22:00	12/14/13 11:00
550-16165-13	LAKE-LV-B1-180 DUP	Water	12/12/13 22:00	12/14/13 11:00

Detection Summary

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16165-1

Client Sample ID: LAKE-LV-B1-60

Lab Sample ID: 550-16165-1

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	24		4.9		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-B1-100

Lab Sample ID: 550-16165-2

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	7.1		4.9		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-B1-155

Lab Sample ID: 550-16165-3

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	38		5.0		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16165-4

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	60		4.9		mg/Kg	1		6010B	Total/NA

Client Sample ID: LAKE-LV-MW-170

Lab Sample ID: 550-16165-5

No Detections.

Client Sample ID: LAKE-LV-MW-170 DUP

Lab Sample ID: 550-16165-7

No Detections.

Client Sample ID: LAKE-LV-EB

Lab Sample ID: 550-16165-9

No Detections.

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16165-11

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	0.12		0.015		mg/L	1		6010B	Total/NA

Client Sample ID: LAKE-LV-B1-180 DUP

Lab Sample ID: 550-16165-13

Analyte	Result	Qualifier	RL		Unit	Dil Fac	D	Method	Prep Type
Lead	0.14		0.015		mg/L	1		6010B	Total/NA

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: LAKE-LV-B1-60

Lab Sample ID: 550-16165-1

Date Collected: 12/10/13 15:30
Matrix: Solid
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**24**		4.9		mg/Kg		12/17/13 16:00	12/18/13 19:27	1

Client Sample ID: LAKE-LV-B1-100

Lab Sample ID: 550-16165-2

Date Collected: 12/11/13 15:20
Matrix: Solid
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**7.1**		4.9		mg/Kg		12/17/13 16:00	12/18/13 19:33	1

Client Sample ID: LAKE-LV-B1-155

Lab Sample ID: 550-16165-3

Date Collected: 12/12/13 12:30
Matrix: Solid
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**38**		5.0		mg/Kg		12/17/13 16:00	12/18/13 19:38	1

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16165-4

Date Collected: 12/13/13 08:40
Matrix: Solid
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**60**		4.9		mg/Kg		12/17/13 16:00	12/18/13 19:44	1

Client Sample ID: LAKE-LV-MW-170

Lab Sample ID: 550-16165-5

Date Collected: 12/11/13 09:00
Matrix: Water
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		12/17/13 07:35	12/17/13 22:46	1

Client Sample ID: LAKE-LV-MW-170 DUP

Lab Sample ID: 550-16165-7

Date Collected: 12/11/13 09:00
Matrix: Water
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		12/17/13 07:35	12/17/13 22:52	1

Client Sample ID: LAKE-LV-EB

Lab Sample ID: 550-16165-9

Date Collected: 12/11/13 09:30
Matrix: Water
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		12/17/13 07:35	12/17/13 22:58	1

Client Sample Results

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16165-11
Date Collected: 12/12/13 22:00
Matrix: Water
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.12**		0.015		mg/L		12/17/13 07:35	12/17/13 23:01	1

Client Sample ID: LAKE-LV-B1-180 DUP

Lab Sample ID: 550-16165-13
Date Collected: 12/12/13 22:00
Matrix: Water
Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP)

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	**0.14**		0.015		mg/L		12/17/13 07:35	12/17/13 23:06	1

QC Sample Results

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 550-23049/1-A
Matrix: Water
Analysis Batch: 23159

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 23049

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		12/17/13 07:35	12/17/13 21:25	1

Lab Sample ID: LCS 550-23049/2-A
Matrix: Water
Analysis Batch: 23159

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 23049

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			1.00	1.01		mg/L		101	88 - 116		

Lab Sample ID: LCSD 550-23049/3-A
Matrix: Water
Analysis Batch: 23159

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 23049

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			1.00	1.02		mg/L		102	88 - 116	0	20

Lab Sample ID: 550-16057-C-1-B MS
Matrix: Water
Analysis Batch: 23159

Client Sample ID: Matrix Spike
Prep Type: Total/NA
Prep Batch: 23049

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	ND		1.00	0.995		mg/L		100	75 - 125		

Lab Sample ID: 550-16057-C-1-C MSD
Matrix: Water
Analysis Batch: 23159

Client Sample ID: Matrix Spike Duplicate
Prep Type: Total/NA
Prep Batch: 23049

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	ND		1.00	0.999		mg/L		100	75 - 125	0	20

Lab Sample ID: MB 550-23123/1-A
Matrix: Solid
Analysis Batch: 23291

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 23123

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		4.9		mg/Kg		12/17/13 16:00	12/18/13 17:59	1

Lab Sample ID: LCS 550-23123/2-A
Matrix: Solid
Analysis Batch: 23291

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 23123

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			49.4	45.6		mg/Kg		92	84 - 107		

Lab Sample ID: LCSD 550-23123/3-A
Matrix: Solid
Analysis Batch: 23291

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 23123

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			49.0	46.0		mg/Kg		94	84 - 107	1	20

Lab Sample ID: 550-16198-A-10-C MS **Client Sample ID: Matrix Spike**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 23291 **Prep Batch: 23123**

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	ND		49.9	48.6		mg/Kg		91	75 - 125		

Lab Sample ID: 550-16198-A-10-D MSD **Client Sample ID: Matrix Spike Duplicate**
Matrix: Solid **Prep Type: Total/NA**
Analysis Batch: 23291 **Prep Batch: 23123**

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	ND		49.0	47.5		mg/Kg		91	75 - 125	2	20

QC Association Summary

Metals

Prep Batch: 23049

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16057-C-1-B MS	Matrix Spike	Total/NA	Water	3005A	
550-16057-C-1-C MSD	Matrix Spike Duplicate	Total/NA	Water	3005A	
550-16165-5	LAKE-LV-MW-170	Total/NA	Water	3005A	
550-16165-7	LAKE-LV-MW-170 DUP	Total/NA	Water	3005A	
550-16165-9	LAKE-LV-EB	Total/NA	Water	3005A	
550-16165-11	LAKE-LV-B1-180	Total/NA	Water	3005A	
550-16165-13	LAKE-LV-B1-180 DUP	Total/NA	Water	3005A	
LCS 550-23049/2-A	Lab Control Sample	Total/NA	Water	3005A	
LCSD 550-23049/3-A	Lab Control Sample Dup	Total/NA	Water	3005A	
MB 550-23049/1-A	Method Blank	Total/NA	Water	3005A	

Prep Batch: 23123

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16165-1	LAKE-LV-B1-60	Total/NA	Solid	3050B	
550-16165-2	LAKE-LV-B1-100	Total/NA	Solid	3050B	
550-16165-3	LAKE-LV-B1-155	Total/NA	Solid	3050B	
550-16165-4	LAKE-LV-B1-180	Total/NA	Solid	3050B	
550-16198-A-10-C MS	Matrix Spike	Total/NA	Solid	3050B	
550-16198-A-10-D MSD	Matrix Spike Duplicate	Total/NA	Solid	3050B	
LCS 550-23123/2-A	Lab Control Sample	Total/NA	Solid	3050B	
LCSD 550-23123/3-A	Lab Control Sample Dup	Total/NA	Solid	3050B	
MB 550-23123/1-A	Method Blank	Total/NA	Solid	3050B	

Analysis Batch: 23159

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16057-C-1-B MS	Matrix Spike	Total/NA	Water	6010B	23049
550-16057-C-1-C MSD	Matrix Spike Duplicate	Total/NA	Water	6010B	23049
550-16165-5	LAKE-LV-MW-170	Total/NA	Water	6010B	23049
550-16165-7	LAKE-LV-MW-170 DUP	Total/NA	Water	6010B	23049
550-16165-9	LAKE-LV-EB	Total/NA	Water	6010B	23049
550-16165-11	LAKE-LV-B1-180	Total/NA	Water	6010B	23049
550-16165-13	LAKE-LV-B1-180 DUP	Total/NA	Water	6010B	23049
LCS 550-23049/2-A	Lab Control Sample	Total/NA	Water	6010B	23049
LCSD 550-23049/3-A	Lab Control Sample Dup	Total/NA	Water	6010B	23049
MB 550-23049/1-A	Method Blank	Total/NA	Water	6010B	23049

Analysis Batch: 23291

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16165-1	LAKE-LV-B1-60	Total/NA	Solid	6010B	23123
550-16165-2	LAKE-LV-B1-100	Total/NA	Solid	6010B	23123
550-16165-3	LAKE-LV-B1-155	Total/NA	Solid	6010B	23123
550-16165-4	LAKE-LV-B1-180	Total/NA	Solid	6010B	23123
550-16198-A-10-C MS	Matrix Spike	Total/NA	Solid	6010B	23123
550-16198-A-10-D MSD	Matrix Spike Duplicate	Total/NA	Solid	6010B	23123
LCS 550-23123/2-A	Lab Control Sample	Total/NA	Solid	6010B	23123
LCSD 550-23123/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	23123
MB 550-23123/1-A	Method Blank	Total/NA	Solid	6010B	23123

Lab Chronicle

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16165-1

Client Sample ID: LAKE-LV-B1-60

Lab Sample ID: 550-16165-1

Date Collected: 12/10/13 15:30
Matrix: Solid
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			23123	12/17/13 16:00	JRC	TAL PHX
Total/NA	Analysis	6010B		1	23291	12/18/13 19:27	CCT	TAL PHX

Client Sample ID: LAKE-LV-B1-100

Lab Sample ID: 550-16165-2

Date Collected: 12/11/13 15:20
Matrix: Solid
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			23123	12/17/13 16:00	JRC	TAL PHX
Total/NA	Analysis	6010B		1	23291	12/18/13 19:33	CCT	TAL PHX

Client Sample ID: LAKE-LV-B1-155

Lab Sample ID: 550-16165-3

Date Collected: 12/12/13 12:30
Matrix: Solid
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			23123	12/17/13 16:00	JRC	TAL PHX
Total/NA	Analysis	6010B		1	23291	12/18/13 19:38	CCT	TAL PHX

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16165-4

Date Collected: 12/13/13 08:40
Matrix: Solid
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3050B			23123	12/17/13 16:00	JRC	TAL PHX
Total/NA	Analysis	6010B		1	23291	12/18/13 19:44	CCT	TAL PHX

Client Sample ID: LAKE-LV-MW-170

Lab Sample ID: 550-16165-5

Date Collected: 12/11/13 09:00
Matrix: Water
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3005A			23049	12/17/13 07:35	SGO	TAL PHX
Total/NA	Analysis	6010B		1	23159	12/17/13 22:46	HLK	TAL PHX

Client Sample ID: LAKE-LV-MW-170 DUP

Lab Sample ID: 550-16165-7

Date Collected: 12/11/13 09:00
Matrix: Water
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3005A			23049	12/17/13 07:35	SGO	TAL PHX
Total/NA	Analysis	6010B		1	23159	12/17/13 22:52	HLK	TAL PHX

Lab Chronicle

Client Sample ID: LAKE-LV-EB

Lab Sample ID: 550-16165-9

Date Collected: 12/11/13 09:30

Matrix: Water

Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3005A			23049	12/17/13 07:35	SGO	TAL PHX
Total/NA	Analysis	6010B		1	23159	12/17/13 22:58	HLK	TAL PHX

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16165-11

Date Collected: 12/12/13 22:00

Matrix: Water

Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3005A			23049	12/17/13 07:35	SGO	TAL PHX
Total/NA	Analysis	6010B		1	23159	12/17/13 23:01	HLK	TAL PHX

Client Sample ID: LAKE-LV-B1-180 DUP

Lab Sample ID: 550-16165-13

Date Collected: 12/12/13 22:00

Matrix: Water

Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Prep	3005A			23049	12/17/13 07:35	SGO	TAL PHX
Total/NA	Analysis	6010B		1	23159	12/17/13 23:06	HLK	TAL PHX

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

Certification Summary

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16165-1

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-15
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-14
Nevada	State Program	9	AZ01030	07-31-14
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Method Summary

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16165-1

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL PHX

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

TEST AMERICA Phoenix
4625 East Cotton Center Blvd. Suite # 189
Phoenix, AZ 85040
(602) 437-3340 FAX (602) 454-9303

Chain of Custody Record

Client Contact
Environmental Cost Management Inc. (ECM)
3525 Hyland Ave. Suite 200
Costa Mesa, CA 92626
(714) 662-2759 Phone
(714) 662-2758 FAX
Project Name: NPS LAKE
Site: Las Vegas Bay Drilling
P O #

Project Manager: Tiffany Looff
Cell: (602) 339-3750 Office (480) 358-1480
Analysis Turnaround Time
STANDARD
☒ Standard
☐
☐
☐

Project Geologist: Tiffany Looff

Site Contact: Chris McCormack
Cell: (925) 584-2416

Lab Contact:
PAGE 1 **of** 2
Job No. 550-16165

550-16165 Chain of Custody

Sample Identification	Sample Date	Sample Time	Pres.	Matrix	# of Cont.	Lead EPA method 6010B	SPLP Lead EPA method 3010A		HOLD	Sample Specific Notes:
LAKE-LV- B1-60	12/10/13	15:30	None	Soil	1	X		01		Save all excess sample for possible future SPLP
LAKE-LV- B1-100	12/11/13	15:20	None	Soil	1	X		02		
LAKE-LV- B1-155	12/12/13	12:30	None	Soil	1	X		03		
LAKE-LV- B1-180	12/13/13	8:40	None	Soil	1	X		04		
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						

CM

☐ ☐ ☐ ☐ ☐ ☐ ☒ Disposal By Lab ☐

Special Instructions/QC Requirements & Comments: REPORT DATA IN EDF FORMAT, Include ALL applicable chromatographs

4.6°c PHX

Relinquished by: Chris McCormack	Company: Environmental Cost Management Inc.	Date: 12/13/13 Time: 16:10	Received by:	Company: TA/LV [redacted]	Date/Time: 12/13/13 2020
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time: 12/14/13 1100 2.2

TEST AMERICA Phoenix
4625 East Cotton Center Blvd. Suite # 189
Phoenix, AZ 85040
(602) 437-3340 FAX (602) 454-9303

Chain of Custody Record

Client Contact	Project Manager: Tiffany Looff	Project Geologist: Tiffany Looff	Site Contact: Chris McCormack	Lab Contact:
Environmental Cost Management Inc. (ECM)	Cell: (602) 339-3750 Office (480) 358-1480		Cell: (925) 584-2416	PAGE 2 of 2
3525 Hyland Ave. Suite 200	Analysis Turnaround Time			Job No. 550-16165
Costa Mesa, CA 92626	STANDARD			
(714) 662-2759 Phone	☒ Standard			
(714) 662-2758 FAX	☐			
Project Name: NPS LAKE	☐			
Site: Las Vegas Bay Drilling	☐			
P O #				

Sample Identification	Sample Date	Sample Time	Pres.	Matrix	# of Cont.	FILTERED	Total Lead	Dissolved LEAD		HOLD	Sample Specific Notes:
LAKE-LV-MW-170	12/	9:00	~~None~~ HNO3	H2O	1		X		05		
LAKE-LV-MW-170	11/	9:00	HNO3	H2O	1	X		X	06		
LAKE-LV-MW-170 Dup	13	9:00	~~[illegible]~~ HNO3		1		X		07		
LAKE-LV-MW-170 Dup		9:00	HNO3		1	X		X	08		
LAKE-LV-EB		9:30	~~O3~~ HNO3		1		X		09		
LAKE-LV-EB		9:30	HNO3		1	X		X	10		
LAKE-LV-B1-180	12/	22:00	~~O3 Ø~~ HNO3		1		X		11		
LAKE-LV-B1-180	12/	22:00	HNO3		1	X		X	12		
LAKE-LV-B1-180 Dup	13	22:00	~~[illegible]~~ HNO3		1		X		13		
LAKE-LV-B1-180 Dup		22:00	HNO3		1	X		X	14		

☐ ☐ ☐ ☐ ☐ ☐ ☒ Disposal By Lab ☐

Special Instructions/QC Requirements & Comments: REPORT DATA IN EDF FORMAT, Include ALL applicable chromatographs

4.6°c PHX

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by: Chris McCormack	Company: Environmental Cost Management Inc.	Date: 12/13/13 Time: 16:10	Received by:	Company: TA/LV [redacted]	Date/Time: 12/13/13 1620
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company: 12/14/13	Date/Time: 1100 2.2

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-16165-1

Login Number: 16165

List Source: TestAmerica Phoenix

List Number: 1

Creator: Hamel, Alan

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	Not requested on COC.
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	Check done at department level as required.

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ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Phoenix
4625 East Cotton Ctr Blvd
Suite 189
Phoenix, AZ 85040
Tel: (602)437-3340

TestAmerica Job ID: 550-16942-1
TestAmerica Sample Delivery Group: Las Vegas Bay Drilling
Client Project/Site: NPS Lake

For:
Environmental Cost Management, Inc.
3525 Hyland Avenue
Costa Mesa, California 92626

Attn: Ms. Tiffany Looff

Authorized for release by:
1/13/2014 6:50:11 PM

Carlene McCutcheon, Project Manager II
(602)659-7612
carlene.mccutcheon@testamericainc.com

This report has been electronically signed and authorized by the signatory. Electronic signature is intended to be the legally binding equivalent of a traditionally handwritten signature.

Results relate only to the items tested and the sample(s) as received by the laboratory.

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Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CNF	Contains no Free Liquid
DER	Duplicate error ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision level concentration
MDA	Minimum detectable activity
EDL	Estimated Detection Limit
MDC	Minimum detectable concentration
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative error ratio
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Case Narrative

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16942-1
SDG: Las Vegas Bay Drilling

Job ID: 550-16942-1

Laboratory: TestAmerica Phoenix

Narrative

Job Narrative
550-16942-1

Comments
No additional comments.

Receipt
The samples were received on 1/3/2014 12:00 PM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 2.2º C.

Metals
No analytical or quality issues were noted.

Field Service / Mobile Lab
No analytical or quality issues were noted.

Sample Summary

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16942-1
SDG: Las Vegas Bay Drilling

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
550-16942-1	LAKE-LV-B1-180	Solid	12/13/13 08:40	12/14/13 11:00
550-16942-2	LAKE-LV-B1-180	Water	12/12/13 22:00	12/14/13 11:00
550-16942-3	LAKE-LV-B1-60	Solid	12/10/13 15:30	01/03/14 12:00

Detection Summary

Client: Environmental Cost Management, Inc. TestAmerica Job ID: 550-16942-1
Project/Site: NPS Lake SDG: Las Vegas Bay Drilling

Client Sample ID: LAKE-LV-B1-180 Lab Sample ID: 550-16942-1

No Detections.

Client Sample ID: LAKE-LV-B1-180 Lab Sample ID: 550-16942-2

No Detections.

Client Sample ID: LAKE-LV-B1-60 Lab Sample ID: 550-16942-3

No Detections.

This Detection Summary does not include radiochemical test results.

Client Sample Results

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16942-1

Date Collected: 12/13/13 08:40

Matrix: Solid

Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.50		mg/L		01/07/14 16:02	01/08/14 15:10	1

Client Sample ID: LAKE-LV-B1-180

Lab Sample ID: 550-16942-2

Date Collected: 12/12/13 22:00

Matrix: Water

Date Received: 12/14/13 11:00

Method: 6010B - Metals (ICP) - Dissolved

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		01/06/14 12:25	01/08/14 14:35	1

Client Sample ID: LAKE-LV-B1-60

Lab Sample ID: 550-16942-3

Date Collected: 12/10/13 15:30

Matrix: Solid

Date Received: 01/03/14 12:00

Method: 6010B - Metals (ICP) - SPLP West

Analyte	Result	Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.50		mg/L		01/08/14 16:19	01/09/14 18:40	1

QC Sample Results

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16942-1
SDG: Las Vegas Bay Drilling

Method: 6010B - Metals (ICP)

Lab Sample ID: MB 550-24376/1-A
Matrix: Water
Analysis Batch: 24615

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 24376

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.015		mg/L		01/06/14 12:25	01/08/14 14:16	1

Lab Sample ID: LCS 550-24376/2-A
Matrix: Water
Analysis Batch: 24615

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 24376

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			1.00	1.06		mg/L		106	88 - 116		

Lab Sample ID: LCSD 550-24376/3-A
Matrix: Water
Analysis Batch: 24615

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 24376

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			1.00	1.03		mg/L		103	88 - 116	2	20

Lab Sample ID: MB 550-24503/1-A
Matrix: Solid
Analysis Batch: 24616

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 24503

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.50		mg/L		01/07/14 16:02	01/08/14 14:49	1

Lab Sample ID: LCS 550-24503/2-A
Matrix: Solid
Analysis Batch: 24616

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 24503

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			5.00	4.94		mg/L		99	83 - 113		

Lab Sample ID: LCSD 550-24503/3-A
Matrix: Solid
Analysis Batch: 24616

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 24503

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			5.00	4.91		mg/L		98	83 - 113	1	20

Lab Sample ID: MB 550-24580/1-A
Matrix: Solid
Analysis Batch: 24781

Client Sample ID: Method Blank
Prep Type: Total/NA
Prep Batch: 24580

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.50		mg/L		01/08/14 16:19	01/09/14 18:17	1

Lab Sample ID: LCS 550-24580/2-A
Matrix: Solid
Analysis Batch: 24781

Client Sample ID: Lab Control Sample
Prep Type: Total/NA
Prep Batch: 24580

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead			5.00	4.86		mg/L		97	83 - 113		

QC Sample Results

Lab Sample ID: LCSD 550-24580/3-A
Matrix: Solid
Analysis Batch: 24781

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA
Prep Batch: 24580

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead			5.00	4.94		mg/L		99	83 - 113	2	20

Lab Sample ID: 550-16942-2 MS
Matrix: Water
Analysis Batch: 24615

Client Sample ID: LAKE-LV-B1-180
Prep Type: Dissolved
Prep Batch: 24376

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	ND		1.00	0.970		mg/L		97	75 - 125		

Lab Sample ID: 550-16942-2 MSD
Matrix: Water
Analysis Batch: 24615

Client Sample ID: LAKE-LV-B1-180
Prep Type: Dissolved
Prep Batch: 24376

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	ND		1.00	0.955		mg/L		95	75 - 125	2	20

Lab Sample ID: MB 550-24411/1-B
Matrix: Solid
Analysis Batch: 24616

Client Sample ID: Method Blank
Prep Type: SPLP West
Prep Batch: 24503

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.50		mg/L		01/07/14 16:02	01/08/14 15:07	1

Lab Sample ID: 550-16942-1 MS
Matrix: Solid
Analysis Batch: 24616

Client Sample ID: LAKE-LV-B1-180
Prep Type: SPLP West
Prep Batch: 24503

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	ND		5.00	5.11		mg/L		101	75 - 125		

Lab Sample ID: 550-16942-1 MSD
Matrix: Solid
Analysis Batch: 24616

Client Sample ID: LAKE-LV-B1-180
Prep Type: SPLP West
Prep Batch: 24503

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	ND		5.00	5.20		mg/L		102	75 - 125	2	20

Lab Sample ID: MB 550-24517/1-B
Matrix: Solid
Analysis Batch: 24781

Client Sample ID: Method Blank
Prep Type: SPLP West
Prep Batch: 24580

Analyte	MB Result	MB Qualifier	RL		Unit	D	Prepared	Analyzed	Dil Fac
Lead	ND		0.50		mg/L		01/08/14 16:19	01/09/14 18:36	1

Lab Sample ID: 550-16942-3 MS
Matrix: Solid
Analysis Batch: 24781

Client Sample ID: LAKE-LV-B1-60
Prep Type: SPLP West
Prep Batch: 24580

Analyte	Sample Result	Sample Qualifier	Spike Added	MS Result	MS Qualifier	Unit	D	%Rec	%Rec. Limits		
Lead	ND		5.00	4.94		mg/L		99	75 - 125		

QC Sample Results

Method: 6010B - Metals (ICP) (Continued)

Lab Sample ID: 550-16942-3 MSD
Matrix: Solid
Analysis Batch: 24781

Client Sample ID: LAKE-LV-B1-60
Prep Type: SPLP West
Prep Batch: 24580

Analyte	Sample Result	Sample Qualifier	Spike Added	MSD Result	MSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
Lead	ND		5.00	4.77		mg/L		95	75 - 125	4	20

QC Association Summary

Metals

Prep Batch: 24376

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-2	LAKE-LV-B1-180	Dissolved	Water	3005A	
550-16942-2 MS	LAKE-LV-B1-180	Dissolved	Water	3005A	
550-16942-2 MSD	LAKE-LV-B1-180	Dissolved	Water	3005A	
LCS 550-24376/2-A	Lab Control Sample	Total/NA	Water	3005A	
LCSD 550-24376/3-A	Lab Control Sample Dup	Total/NA	Water	3005A	
MB 550-24376/1-A	Method Blank	Total/NA	Water	3005A	

Leach Batch: 24411

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-1	LAKE-LV-B1-180	SPLP West	Solid	1312	
550-16942-1 MS	LAKE-LV-B1-180	SPLP West	Solid	1312	
550-16942-1 MSD	LAKE-LV-B1-180	SPLP West	Solid	1312	
MB 550-24411/1-B	Method Blank	SPLP West	Solid	1312	

Prep Batch: 24503

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-1	LAKE-LV-B1-180	SPLP West	Solid	3010A	24411
550-16942-1 MS	LAKE-LV-B1-180	SPLP West	Solid	3010A	24411
550-16942-1 MSD	LAKE-LV-B1-180	SPLP West	Solid	3010A	24411
LCS 550-24503/2-A	Lab Control Sample	Total/NA	Solid	3010A	
LCSD 550-24503/3-A	Lab Control Sample Dup	Total/NA	Solid	3010A	
MB 550-24411/1-B	Method Blank	SPLP West	Solid	3010A	24411
MB 550-24503/1-A	Method Blank	Total/NA	Solid	3010A	

Leach Batch: 24517

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-3	LAKE-LV-B1-60	SPLP West	Solid	1312	
550-16942-3 MS	LAKE-LV-B1-60	SPLP West	Solid	1312	
550-16942-3 MSD	LAKE-LV-B1-60	SPLP West	Solid	1312	
MB 550-24517/1-B	Method Blank	SPLP West	Solid	1312	

Prep Batch: 24580

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-3	LAKE-LV-B1-60	SPLP West	Solid	3010A	24517
550-16942-3 MS	LAKE-LV-B1-60	SPLP West	Solid	3010A	24517
550-16942-3 MSD	LAKE-LV-B1-60	SPLP West	Solid	3010A	24517
LCS 550-24580/2-A	Lab Control Sample	Total/NA	Solid	3010A	
LCSD 550-24580/3-A	Lab Control Sample Dup	Total/NA	Solid	3010A	
MB 550-24517/1-B	Method Blank	SPLP West	Solid	3010A	24517
MB 550-24580/1-A	Method Blank	Total/NA	Solid	3010A	

Analysis Batch: 24615

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-2	LAKE-LV-B1-180	Dissolved	Water	6010B	24376
550-16942-2 MS	LAKE-LV-B1-180	Dissolved	Water	6010B	24376
550-16942-2 MSD	LAKE-LV-B1-180	Dissolved	Water	6010B	24376
LCS 550-24376/2-A	Lab Control Sample	Total/NA	Water	6010B	24376
LCSD 550-24376/3-A	Lab Control Sample Dup	Total/NA	Water	6010B	24376
MB 550-24376/1-A	Method Blank	Total/NA	Water	6010B	24376

Metals (Continued)

Analysis Batch: 24616

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-1	LAKE-LV-B1-180	SPLP West	Solid	6010B	24503
550-16942-1 MS	LAKE-LV-B1-180	SPLP West	Solid	6010B	24503
550-16942-1 MSD	LAKE-LV-B1-180	SPLP West	Solid	6010B	24503
LCS 550-24503/2-A	Lab Control Sample	Total/NA	Solid	6010B	24503
LCSD 550-24503/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	24503
MB 550-24411/1-B	Method Blank	SPLP West	Solid	6010B	24503
MB 550-24503/1-A	Method Blank	Total/NA	Solid	6010B	24503

Analysis Batch: 24781

Lab Sample ID	Client Sample ID	Prep Type	Matrix	Method	Prep Batch
550-16942-3	LAKE-LV-B1-60	SPLP West	Solid	6010B	24580
550-16942-3 MS	LAKE-LV-B1-60	SPLP West	Solid	6010B	24580
550-16942-3 MSD	LAKE-LV-B1-60	SPLP West	Solid	6010B	24580
LCS 550-24580/2-A	Lab Control Sample	Total/NA	Solid	6010B	24580
LCSD 550-24580/3-A	Lab Control Sample Dup	Total/NA	Solid	6010B	24580
MB 550-24517/1-B	Method Blank	SPLP West	Solid	6010B	24580
MB 550-24580/1-A	Method Blank	Total/NA	Solid	6010B	24580

Lab Chronicle

Client Sample ID: LAKE-LV-B1-180 **Lab Sample ID: 550-16942-1**
Date Collected: 12/13/13 08:40 **Matrix: Solid**
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			24411	01/06/14 15:45	JTG	TAL PHX
SPLP West	Prep	3010A			24503	01/07/14 16:02	JTG	TAL PHX
SPLP West	Analysis	6010B		1	24616	01/08/14 15:10	HLK	TAL PHX

Client Sample ID: LAKE-LV-B1-180 **Lab Sample ID: 550-16942-2**
Date Collected: 12/12/13 22:00 **Matrix: Water**
Date Received: 12/14/13 11:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Dissolved	Prep	3005A			24376	01/06/14 12:25	SGO	TAL PHX
Dissolved	Analysis	6010B		1	24615	01/08/14 14:35	HLK	TAL PHX

Client Sample ID: LAKE-LV-B1-60 **Lab Sample ID: 550-16942-3**
Date Collected: 12/10/13 15:30 **Matrix: Solid**
Date Received: 01/03/14 12:00

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
SPLP West	Leach	1312			24517	01/07/14 16:35	JTG	TAL PHX
SPLP West	Prep	3010A			24580	01/08/14 16:19	JTG	TAL PHX
SPLP West	Analysis	6010B		1	24781	01/09/14 18:40	HLK	TAL PHX

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

Certification Summary

Client: Environmental Cost Management, Inc.
Project/Site: NPS Lake

TestAmerica Job ID: 550-16942-1
SDG: Las Vegas Bay Drilling

Laboratory: TestAmerica Phoenix

All certifications held by this laboratory are listed. Not all certifications are applicable to this report.

Authority	Program	EPA Region	Certification ID	Expiration Date
AIHA	IHLAP		154268	07-01-15
Arizona	State Program	9	AZ0728	06-09-14
California	NELAP	9	01109CA	11-30-14
Nevada	State Program	9	AZ01030	07-31-14
New York	NELAP	2	11898	04-01-14
Oregon	NELAP	10	AZ100001	03-09-14
USDA	Federal		P330-09-00024	06-09-15

Method Summary

Method	Method Description	Protocol	Laboratory
6010B	Metals (ICP)	SW846	TAL PHX

Protocol References:

SW846 = "Test Methods For Evaluating Solid Waste, Physical/Chemical Methods", Third Edition, November 1986 And Its Updates.

Laboratory References:

TAL PHX = TestAmerica Phoenix, 4625 East Cotton Ctr Blvd, Suite 189, Phoenix, AZ 85040, TEL (602)437-3340

TEST AMERICA Phoenix
4625 East Cotton Center Blvd. Suite # 189
Phoenix AZ 85040
(602) 437-3340 FAX (602) 454-9303

Chain of Custody Record

Client Contact	Project Manager: Tiffany Looff	Project Geologist: Tiffany Looff	Site Contact: Chris McCormack	Lab Contact:
Environmental Cost Management Inc (ECM)	Cell: (602) 339-3750 Office (480) 358-1480		Cell: (925) 584-2416	PAGE 1 of 2
3525 Hyland Ave. Suite 200	Analysis Turnaround Time			Job No. 550-16163
Costa Mesa, CA 92626	STANDARD			
(714) 662-2759 Phone	☑ Standard			
(714) 662-2758 FAX	☐			
Project Name: NPS LAKE	☐			
Site: Las Vegas Bay Drilling	☐			
P O #				

550-16942 Chain of Custody

Sample Identification	Sample Date	Sample Time	Pres.	Matrix	# of Cont.	Lead EPA method 6010B	SPLP Lead EPA method 3010A			HOI	Sample Specific Notes
LAKE-LV- B1-60	12/10/13	15:30	None	Soil	1	X			01		
LAKE-LV- B1-100	12/11/13	15:20	None	Soil	1	X			02		
LAKE-LV- B1-155	12/12/13	12:30	None	Soil	1	X			03		
LAKE-LV- B1-180	12/13/13	8:40	None	Soil	1	X	X	[illegible]	04		
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							

CM

Save all excess sample for possible future SPLP

☐ ☐ ☐ ☐ ☐ ☐ ☒ Disposal By Lab ☐

Special Instructions/QC Requirements & Comments: REPORT DATA IN EDF FORMAT, Include ALL applicable chromatographs

4.6°C PHX

Relinquished by: Chris McCormack	Company: Environmental Cost Management Inc.	Date: 12/13/13 Time: 16:10	Received by:	Company: TA/LV	Date/Time: 12/13/13 2:20
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time: 12/14/13 1100 2.2

TEST AMERICA Phoenix
4625 East Cotton Center Blvd. Suite # 189
Phoenix, AZ 85040
(602) 437-3340 FAX (602) 454-9303

Chain of Custody Record

Client Contact	**Project Manager: Tiffany Looff**	**Project Geologist: Tiffany Looff**	**Site Contact: Chris McCormack**	**Lab Contact:**
Environmental Cost Management Inc. (ECM)	Cell: (602) 339-3750 Office (480) 358-1480		Cell: (925) 584-2416	PAGE 2 of 2
3525 Hyland Ave. Suite 200	**Analysis Turnaround Time**			Job No. 550-16165
Costa Mesa, CA 92626	STANDARD			
(714) 662-2759 Phone	☑ Standard			
(714) 662-2758 FAX	☐			
Project Name NPS LAKE	☐			
Site: Las Vegas Bay Drilling	☐			
P O #				

Sample Identification	Sample Date	Sample Time	Pres.	Matrix	# of Cont.	FILTERED	Total Lead	Dissolved LEAD		HOLD	Sample Specific Notes.
LAKE-LV-MW-170	12/	9:00	~~None~~ HNO3	H2O	1		X		05		
LAKE-LV-MW-170	11/	9:00	HNO3	H2O	1	X		X	06		HOLD T.O.I.
LAKE-LV-MW-170 Dup	13	9:00	HNO3		1		X		07		
LAKE-LV-MW-170 Dup		9:00	HNO3		1	X		X	08		HOLD T.O.I.
LAKE-LV-EB		9:30	HNO3		1		X		09		
LAKE-LV-EB		9:30	HNO3		1	X		X	10		HOLD T.O.I.
LAKE-LV-B1-180	12/	22:00	HNO3		1		X		11		
LAKE-LV-B1-180	12/	22:00	HNO3		1	X		X	12		~~HOLD T.O.I.~~ ANALYZE T.O.I.
LAKE-LV-B1-180 Dup	13	22:00	HNO3		1		X		13		
LAKE-LV-B1-180 Dup		22:00	HNO3		1	X		X	14		HOLD T.O.I.

☐ ☐ ☐ ☐ ☐ ☐ ☒ Disposal By Lab ☐

Special Instructions/QC Requirements & Comments: REPORT DATA IN EDF FORMAT, Include ALL applicable chromatographs

4.6°C PHX

TA/LV

Relinquished by: Chris McCormack	Company: Environmental Cost Management Inc.	Date: 12/13/13 Time: 16:10	Received by:	Company: [redacted]	Date/Time: 12/13/13 1620
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company: 12/14/13	Date/Time: 1100 2.2

TEST AMERICA Phoenix
4625 East Cotton Center Blvd. Suite # 189
Phoenix, AZ 85040
(602) 437-3340 FAX (602) 454-9303

Chain of Custody Record

Client Contact	Project Manager: Tiffany Looff	Project Geologist: Tiffany Looff	Site Contact: Chris McCormack	Lab Contact:
Environmental Cost Management Inc. (ECM)	Cell: (602) 339-3750 Office (480) 358-1480		Cell: (925) 584-2416	PAGE 1 of 2
3525 Hyland Ave. Suite 200	Analysis Turnaround Time			Job No. 550-16165
Costa Mesa, CA 92626	STANDARD			
(714) 662-2759 Phone	☒ Standard			
(714) 662-2758 FAX	☐			
Project Name: NPS LAKE	☐			
Site: Las Vegas Bay Drilling	☐			
P O #				

550-16942 Chain of Custody

Sample Identification	Sample Date	Sample Time	Pres.	Matrix	# of Cont.	Lead EPA method 6010B	SPLP Lead EPA method 3010A			HOL	Sample Specific Notes:
LAKE-LV- B1-60	12/10/13	15:30	None	Soil	1	X			01		
LAKE-LV- B1-100	12/11/13	15:20	None	Soil	1	X			02		
LAKE-LV- B1-155	12/12/13	12:30	None	Soil	1	X		ck	03		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							
LAKE-LV-			None	Soil							

-01

Cm

Save all excess sample for possible future SPLP

☐ ☐ ☐ ☐ ☐ ☐ ☒ Disposal By Lab ☐

Special Instructions/QC Requirements & Comments: REPORT DATA IN EDF FORMAT, Include ALL applicable chromatographs

4.6°C PHX

TA/LV

Relinquished by: Chris McCormack	Company: Environmental Cost Management Inc.	Date: 12/13/13 Time: 16:10	Received by:	Company:	Date/Time: 12/13/13 1120
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time: 12/14/13 1100 2.2

TEST AMERICA Phoenix
4625 East Cotton Center Blvd. Suite # 189
Phoenix, AZ 85040
(602) 437-3340 FAX (602) 454-9303

Chain of Custody Record

Client Contact	Project Manager: Tiffany Looff	Project Geologist: Tiffany Looff	Site Contact: Chris McCormack	Lab Contact:
Environmental Cost Management Inc. (ECM)	Cell: (602) 339-3750 Office (480) 358-1480		Cell: (925) 584-2416	PAGE 2 of 2
3525 Hyland Ave. Suite 200	Analysis Turnaround Time			Job No.
Costa Mesa, CA 92626	STANDARD			550-16165
(714) 662-2759 Phone	☑ Standard			
(714) 662-2758 FAX	☐			
Project Name: NPS LAKE	☐			
Site: Las Vegas Bay Drilling	☐			
P O #				

550 - 16942

-02

Sample Identification	Sample Date	Sample Time	Pres.	Matrix	# of Cont.	FILTERED	Total Lead	Dissolved Lead		HOLD	Sample Specific Notes:
LAKE-LV-MW-170	12/	9:00	~~None~~ HNO3	H2O	1		X		05		
LAKE-LV-MW-170	/11/	9:00	HNO3	H2O	1	X		X	06		HOLD T.O.T
LAKE-LV-MW-170 Dup	/13	9:00	HNO3		1		X		07		
LAKE-LV-MW-170 Dup		9:00	HNO3		1	X		X	08		HOLD T.O.T.
LAKE-LV-EB		9:30	HNO3		1		X		09		
LAKE-LV-EB	V	9:30	HNO3	V	1	X		X	10		HOLD T.O.T.
LAKE-LV-B1-180	12/	22:00	HNO3		1		X		11		
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]		~~HOLD T.O.T~~ ANALYZE T.O.T.
LAKE-LV-B1-180 Dup	/13	22:00	HNO3		1		X		13		
LAKE-LV-B1-180 Dup	V	22:00	HNO3	V	1	X		X	14		HOLD T.O.T

☐ ☐ ☐ ☐ ☐ ☐ ☒ Disposal By Lab ☐

Special Instructions/QC Requirements & Comments: REPORT DATA IN EDF FORMAT, Include ALL applicable chromatographs

4.6°C PHX

TA/LV

Relinquished by: Chris McCormack	Company: Environmental Cost Management Inc.	Date: 12/13/13 Time: 16:10	Received by:	Company:	Date/Time: 12/13/13 1620
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company: 12/14/13	Date/Time: 1100 2.2

550-16942

Chain of Custody Record

TEST AMERICA Phoenix
4625 East Cotton Center Blvd. Suite # 189
Phoenix, AZ 85040
(602) 437 3340 FAX (602) 454-9303

Client Contact	Project Manager: Tiffany Looff	Project Geologist: Tiffany Looff	Site Contact: Chris McCormack	Lab Contact:
Environmental Cost Management Inc. (ECM)	Cell: (602) 339-3750 Office (480) 358-1480		Cell: (925) 584-2416	PAGE 1 of 2
3525 Hyland Ave. Suite 200	Analysis Turnaround Time			Job No. 550-16165
Costa Mesa, CA 92626	STANDARD			
(714) 662-2759 Phone	☒ Standard			
(714) 662-2758 FAX	☐			
Project Name: NPS LAKE	☐			
Site: Las Vegas Bay Drilling	☐			
P O #				

550-16165 Chain of Custody

Sample Identification	Sample Date	Sample Time	Pres.	Matrix	# of Cont.	Lead EPA method 6010B	SPLP Lead EPA method 3010A		HOLD	Sample Specific Notes:
-03 [redacted]	/10/13	15:30	None	Soil	1	X	[redacted]	01		Save all excess sample for possible future SPLP
LAKE-LV- B1 - 100	12/11/13	15:20	None	Soil	1	X		02		
LAKE-LV- B1 - 155	12/12/13	12:30	None	Soil	1	X		03		
LAKE-LV- B1 - 180	12/13/13	8:40	None	Soil	1	X	X Sol	04		
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil		CM				
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						
LAKE-LV-			None	Soil						

☐ ☐ ☐ ☐ ☐ ☐ ☒ Disposal By Lab ☐

Special Instructions/QC Requirements & Comments: REPORT DATA IN EDF FORMAT. Include ALL applicable chromatographs

4.6°C PHX

Relinquished by: Chris McCormack	Company: Environmental Cost Management Inc.	Date: 12/13/13 Time: 1610	Received by:	Company: TA/LV	Date/Time: 12/13/13 1420
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time: 12/14/13 1100 2.2

Login Sample Receipt Checklist

Client: Environmental Cost Management, Inc.

Job Number: 550-16942-1
SDG Number: Las Vegas Bay Drilling

Login Number: 16942
List Number: 1
Creator: Hamel, Alan

List Source: TestAmerica Phoenix

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	True	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	False	Not requested on COC.
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	Check done at department level as required.

Report Number
14-007-0050 **Page:** 1 of 3

Account Number
15024

Soil & Plant Laboratory, Inc.
Leaders in Soil & Plant Testing Since 1946
4741 E. Hunter Ave, Suite A Anaheim, CA 92807 714-282-8777 (phone) 714-282-8575 (fax)
www.soilandplantlaboratory.com

Send To: Cooper Testing Labs, Inc.
937 Commercial St

Palo Alto , CA 94303

Purchase Order :
Report Date : 01/14/2014
Date Received : 01/07/2014

Project : Environmental Cost Management-Lake
Job # 842-001

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 25482
Sample Id : Lake-LV-60

Analysis	**Result**	**Quantitation Limit**	**Method**	**Date and Time Test Started**	**Analyst**
Organic Matter (Titration) , %	0.48	0.05	Walkley-Black	01/10/2014 07:34	SNS

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

Report Number
14-007-0050 **Page:** 2 of 3

Account Number
15024

Soil & Plant Laboratory, Inc.
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4741 E. Hunter Ave, Suite A Anaheim, CA 92807 714-282-8777 (phone) 714-282-8575 (fax)
www.soilandplantlaboratory.com

Send To: Cooper Testing Labs, Inc.
937 Commercial St

Palo Alto , CA 94303

Purchase Order :
Report Date : 01/14/2014
Date Received : 01/07/2014

Project : Environmental Cost Management-Lake
Job # 842-001

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 25483
Sample Id : Lake-LV-100

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.55	0.05	Walkley-Black	01/10/2014 07:34	SNS

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

Report Number
14-007-0050 **Page:** 3 of 3

Account Number
15024

Send To: Cooper Testing Labs, Inc.
937 Commercial St

Palo Alto , CA 94303

Purchase Order :
Report Date : 01/14/2014
Date Received : 01/07/2014

Project : Environmental Cost Management-Lake
Job # 842-001

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 25484
Sample Id : Lake-Lv-B1-155

Analysis	**Result**	**Quantitation Limit**	**Method**	**Date and Time Test Started**	**Analyst**
Organic Matter (Titration) , %	0.55	0.05	Walkley-Black	01/10/2014 07:34	SNS

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

COOPER TESTING LABORATORY

Specific Gravity by Pycnometer

ASTM D 854

CTL Job#:	842-001	**Project Name:**	Lake	**Date:**	01/13/14
Client:	Environmental Cost Management	**Project No.:**		**Run By:**	MD
				Checked	DC

Boring:	B1	B1	B1					
Sample:								
Depth, ft.:	60	100	155					
Pan No.:								
Soil Description (visual)	Reddish Brown Clayey SAND	Light Red Silty SAND (slightly plastic)	Reddish Brown Sandy CLAY					
Pycnometer ID:	3	6	E					
Mass of Clean, Dry Pycnometer (g):	166.25	164.22	171.63					
Mass of Pycnometer, Soil, and Water (g):	738.18	704.99	726.90					
Temperature of Slurry (°C):	20.3	20.3	20.3					
Tare ID:								
Mass of Tare (g):	225.47	229.75	228.04					
Mass of Dry Soil and Tare (g):	342.02	297.08	318.00					
Mass of Dry Soil (g):	116.55	67.33	89.96					
Mass of Pycnometer and Water at Test Temp (g):	664.83	662.86	670.25					
Specific Gravity @ Test Temp:	2.698	2.672	2.701					
Specific Gravity @ 20 °C:	**2.698**	**2.672**	**2.700**					

Hydraulic Conductivity

ASTM D 5084

Method C: Falling Head Rising Tailwater

Job No:	842-001	**Boring:**	LAKE-LV-B1-100	**Date:**	01/07/14
Client:	Environmental Cost Management	**Sample:**		**By:**	MD/PJ
Project:	LAKE	**Depth, ft.:**	100	**Remolded:**	

Visual Classification: Light Red Silty SAND (slightly plastic)

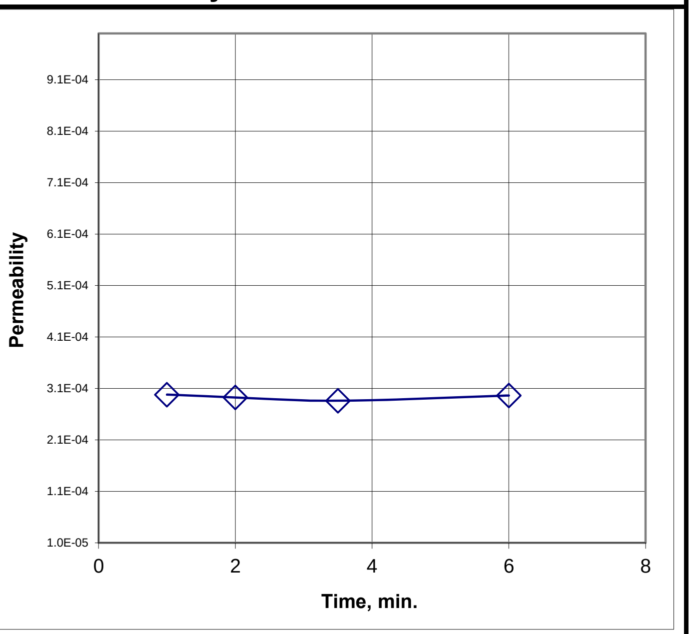
Max Sample Pressures, psi:

Cell:	Bottom	Top	Avg. Sigma3
63.5	58.5	58.5	5

B: = >0.95 **("B" is an indication of saturation)**

Max Hydraulic Gradient: = 7

Date	Minutes	Head, (in)	K,cm/sec
1/1/2014	0.00	15.00	**Start of Test**
1/1/2014	1.00	12.60	3.0E-04
1/1/2014	2.00	10.65	2.9E-04
1/1/2014	3.50	8.35	2.9E-04
1/1/2014	6.00	5.30	3.0E-04



Average Hydraulic Conductivity: **3.E-04** **cm/sec**

Sample Data:	**Initial (As-Received)**	**Final (At-Test)**
Height, in	2.00	2.01
Diameter, in	1.89	1.88
Area, in2	2.80	2.79
Volume in3	5.60	5.59
Total Volume, cc	91.8	91.7
Volume Solids, cc	38.2	38.2
Volume Voids, cc	53.5	53.5
Void Ratio	1.4	1.4
Total Porosity, %	58.4	58.3
Air-Filled Porosity (θa),%	17.4	0.5
Water-Filled Porosity (θw),%	41.0	57.8
Saturation, %	70.2	99.1
Specific Gravity	2.67	2.67
Wet Weight, gm	139.7	155.1
Dry Weight, gm	102.1	102.1
Tare, gm	0.00	0.00
Moisture, %	36.8	51.9
Wet Bulk Density, pcf	95.0	105.6
Dry Bulk Density, pcf	69.4	69.5
Wet Bulk Dens.ρb, (g/cm^3)	1.52	1.69
Dry Bulk Dens.ρb, (g/cm^3)	1.11	1.11

Remarks:

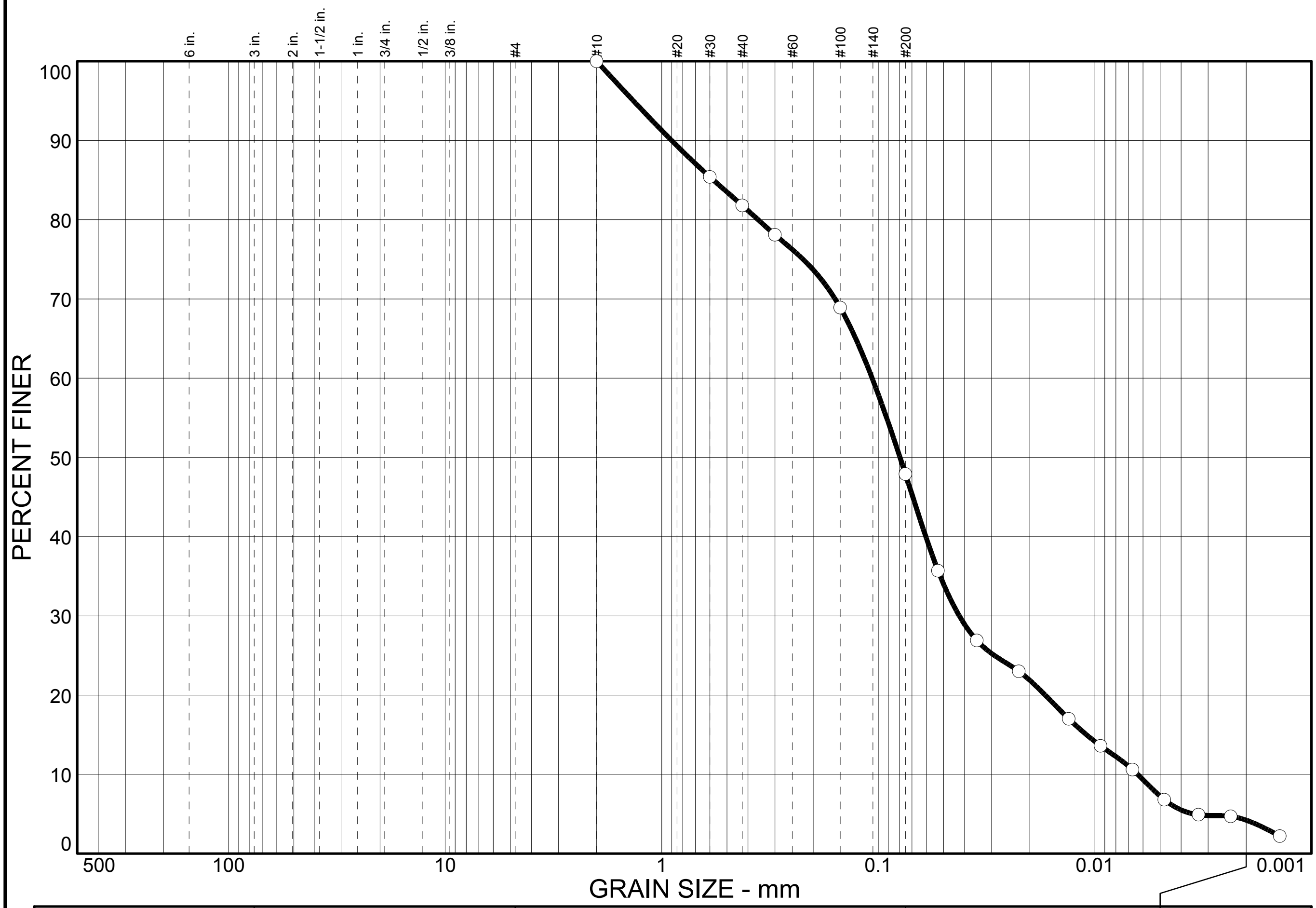
Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D 2937)

CTL Job No: 842-001
Project No.
By: RU
Client: Environmental Cost Management
Date: 01/13/14
Project Name: Lake
Remarks:

Boring:	B1	B1						
Sample:								
Depth, ft:	60	155						
Visual Description:	Reddish Brown Clayey SAND	Reddish Brown Sandy CLAY						
Actual G_s								
Assumed G_s								
Moisture, %	13.8	19.8						
Wet Unit wt, pcf								
Dry Unit wt, pcf								
Dry Bulk Dens.pb, (g/cc)								
Saturation, %								
Total Porosity, %								
Volumetric Water Cont,Өw								
Volumetric Air Cont., Өa								
Void Ratio								
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	52.1	43.7	4.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	85.4		
#40	81.8		
#50	78.1		
#100	68.9		
#200	47.9		
#270	35.7		
0.0351 mm.	26.9		
0.0225 mm.	23.0		
0.0132 mm.	17.0		
0.0094 mm.	13.6		
0.0067 mm.	10.6		
0.0048 mm.	6.8		
0.0033 mm.	4.9		
0.0024 mm.	4.7		
0.0014 mm.	2.2		

* (no specification provided)

Soil Description

Light Red Silty SAND (slightly plastic)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.578 D_{60}= 0.107 D_{50}= 0.0795

D_{30}= 0.0423 D_{15}= 0.0109 D_{10}= 0.0064

C_u= 16.83 C_c= 2.63

Classification

USCS= AASHTO=

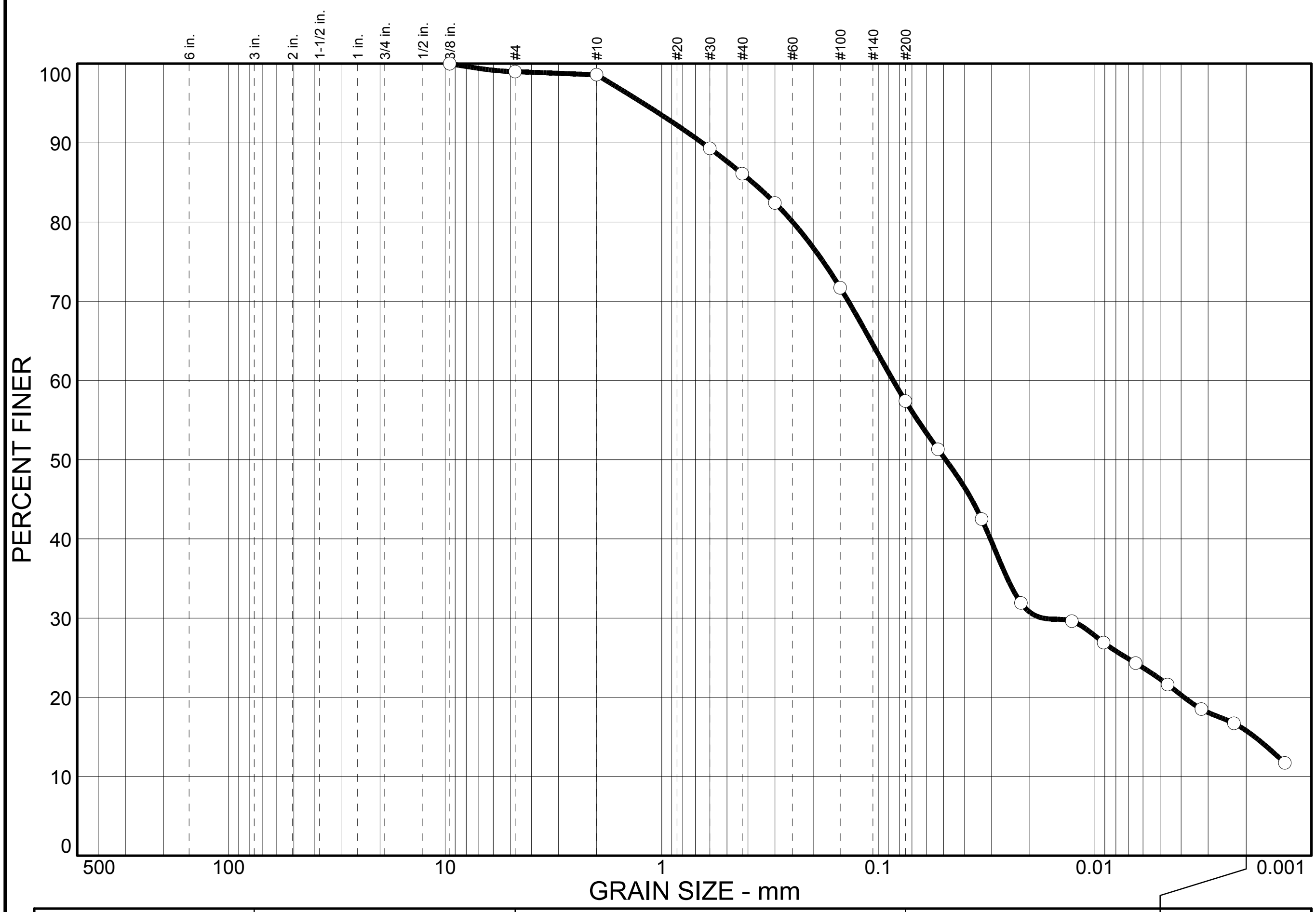
Remarks

Sample No.:
Source of Sample: LAKE-LV-B1-100
Date: 1/13/14
Location:
Elev./Depth: 100'

COOPER TESTING LABORATORY

Client: Environmental Cost Management, Inc.
Project: LAKE
Project No: 842-001
Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.0	41.6	41.6	15.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.0		
#10	98.6		
#30	89.3		
#40	86.1		
#50	82.4		
#100	71.7		
#200	57.4		
#270	51.3		
0.0334 mm.	42.5		
0.0219 mm.	31.9		
0.0128 mm.	29.6		
0.0091 mm.	26.9		
0.0065 mm.	24.3		
0.0046 mm.	21.6		
0.0032 mm.	18.5		
0.0023 mm.	16.7		
0.0013 mm.	11.7		

* (no specification provided)

Soil Description

Reddish Brown Sandy CLAY

Atterberg Limits

PL=
LL=
PI=

Coefficients

D_{85}= 0.380
D_{60}= 0.0855
D_{50}= 0.0489
D_{30}= 0.0174
D_{15}= 0.0018
D_{10}=
C_u=
C_c=

Classification

USCS=
AASHTO=

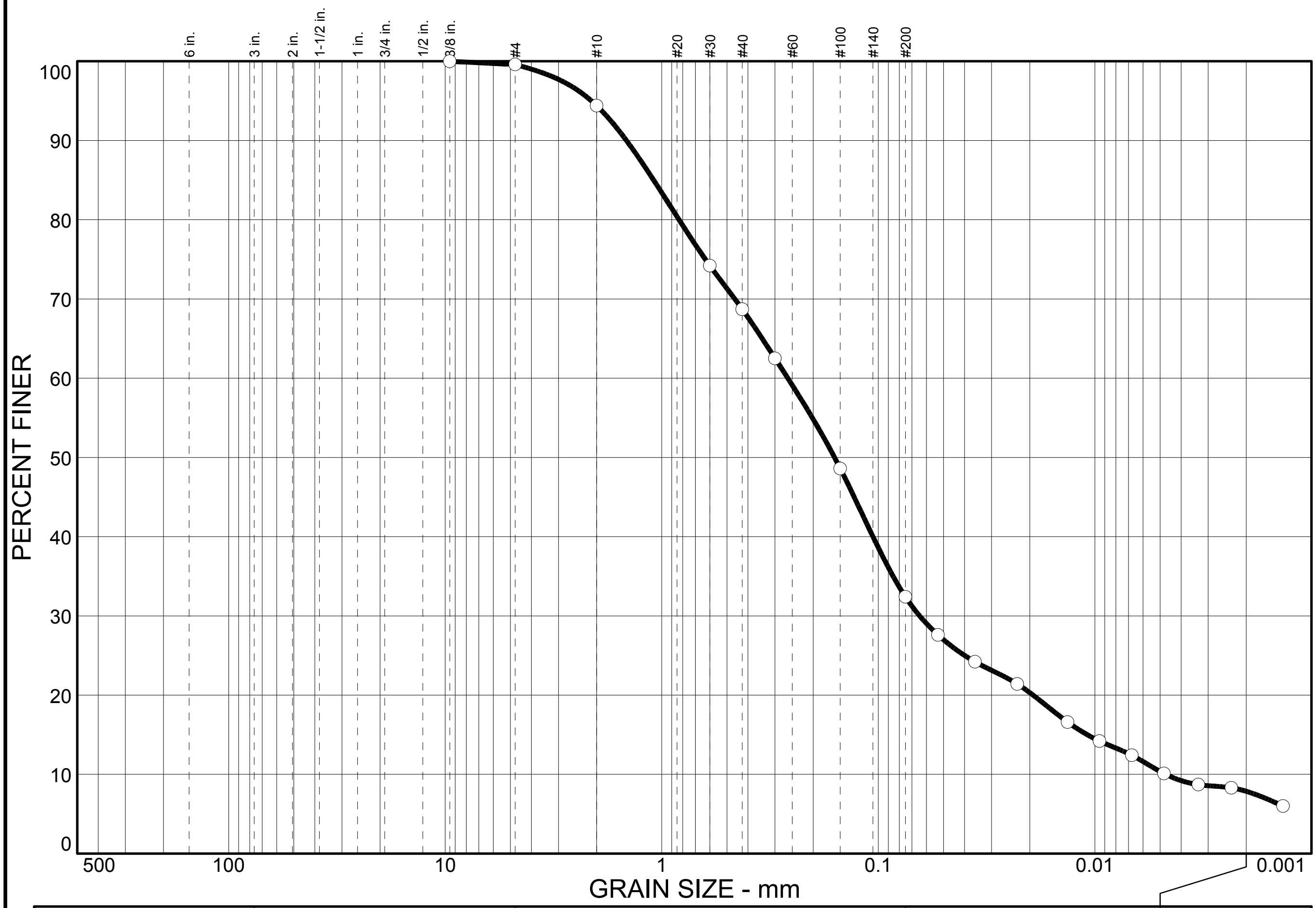
Remarks

Sample No.:
Source of Sample: LAKE-LV-B1-155
Date: 1/7/13
Location:
Elev./Depth: 155'

COOPER TESTING LABORATORY

Client: Environmental Cost Management, Inc.
Project: LAKE
Project No: 842-001
Figure

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.4	67.2	24.5	7.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.6		
#10	94.4		
#30	74.2		
#40	68.7		
#50	62.5		
#100	48.6		
#200	32.4		
#270	27.6		
0.0358 mm.	24.2		
0.0228 mm.	21.4		
0.0134 mm.	16.6		
0.0095 mm.	14.2		
0.0068 mm.	12.4		
0.0048 mm.	10.1		
0.0033 mm.	8.7		
0.0023 mm.	8.3		
0.0014 mm.	6.0		

* (no specification provided)

Soil Description

Reddish Brown Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.09 D_{60}= 0.262 D_{50}= 0.159

D_{30}= 0.0645 D_{15}= 0.0109 D_{10}= 0.0047

C_u= 55.57 C_c= 3.37

Classification

USCS= AASHTO=

Remarks

Sample No.: **Source of Sample:** LAKE-LV-B1-60 **Date:** 1/7/13

Location: **Elev./Depth:** 60'

COOPER TESTING LABORATORY

Client: Environmental Cost Management, Inc.

Project: LAKE

Project No: 842-001 **Figure**

COOPER TESTING LABORATORY

Corrosivity Test Summary

CTL # 842-001 **Date:** 1/13/2014 **Tested By:** PJ **Checked:** PJ

Client: Environmental Cost Management **Project:** LAKE **Proj. No:**

Remarks:

Sample Location or ID			**Resistivity @ 15.5 °C (Ohm-cm)**			**Chloride**	**Sulfate**		**pH**	**ORP**	**Moisture**	**Soil Visual Description**
Boring	**Sample, No.**	**Depth, ft.**	**As Rec.**	**Minimum**	**Saturated**	**mg/kg**	**mg/kg**	**%**		(Redox)	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		mv	**%**	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
LAKE-LV-B1	-	60	-	-	-	-	-	-	8.0	-	-	Reddish Brown Clayey SAND
LAKE-LV-B1	-	100	-	-	-	-	-	-	8.1	-	-	Light Red Silty SAND (slightly plastic)
LAKE-LV-B1	-	155	-	-	-	-	-	-	8.3	-	-	Reddish Brown Sandy CLAY

APPENDIX F

LEACHING-TO-GROUNDWATER MODELING REPORT

ENVIRONMENTAL COST MANAGEMENT, INC.
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July 14, 2014

Mr. Russell Brengman
Hazardous Materials
Lake Mead National Recreation Area
601 Nevada Way
Boulder City, NV 89005

RE: LEACHING-TO-GROUNDWATER MODELING
LAS VEGAS BAY AND ECHO BAY FORMER FIRING RANGE SITES
LAKE MEAD NATIONAL RECREATION AREA
CLARK COUNTY, NEVADA AND MOHAVE COUNTY, ARIZONA

Dear Mr. Brengman:

Environmental Cost Management, Inc. (ECM) has prepared this technical letter report on behalf of the National Park Service (NPS) to summarize a leaching-to-groundwater (if any) pathway evaluation of lead-impacted soils located at the Las Vegas and Echo Bay firing ranges located at the Lake Mead National Recreation Area (LAKE[a]) in Nevada (**Figure 1**). Specifically, the potential (if any) for lead to migrate from impacted unsaturated soils in the firing range areas to groundwater has been evaluated by both the synthetic precipitation leaching procedures (SPLP) and by modeling with an unsaturated zone fate and transport model (SESOIL) employing site-specific data. The purpose of this evaluation is to ensure that lead concentrations detected in soils in the firing range areas remain protective of the leaching-to-groundwater pathway under the Nevada Division of Environmental Protection (NDEP) guidance.

1 INTRODUCTION

ECM collected soil samples at four former firing range sites in LAKE to evaluate potential contamination under a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Non-Time Critical Removal Action (NTCRA). Analytical results of samples from the Las Vegas Bay and Echo Bay former firing range sites indicated lead concentrations in soil exceeded the USEPA Region 9 Site Screening Level (SSL) protective of groundwater (14 mg/kg); therefore, there is a potential for lead contamination to reach groundwater. If impacted, groundwater movement may carry

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[a] Also referred to as LAME and LMNRA.

contaminants to locations such as drinking water wells, where human exposure to the contamination may occur.

For evaluation of the soil leaching to groundwater pathway, the Nevada Division of Environmental Protection (NDEP) developed Basic Comparison Levels (BCLs) for the BMI Complex and Common Areas in Henderson, Nevada[b]. The BCLs were generated as a technical screening tool to assist users in risk assessment components such as the evaluation of data usability, determination of extent of contamination, identifying chemicals of potential concern, and identifying preliminary remediation goals. Although the guidance was developed by the NDEP for a particular site; therefore, for a particular set of site conditions, ECM assumes that the NDEP will accept application of the guidance to LAKE.

1.1 PURPOSE

This letter report will provide the results of the December 2013 soil sampling program at the Las Vegas Bay (LVB) and Echo Bay (EB) former firing ranges (Section 1.2). Based on the site-specific data collected at the firing ranges, the leachate simulation results of the SESOIL models for the Las Vegas Bay and Echo Bay former firing range locations will also be reported (Sections 2 and 3). Section 4 provides a summary of this letter report.

1.2 DEVELOPMENT OF SITE CONCEPTUAL MODEL

The NDEP has adopted SESOIL as the default unsaturated zone fate- and-transport model. SESOIL is a one-dimensional vertical transport screening-level model for the unsaturated (vadose) zone that produces a leachate concentration based on diffusion, adsorption, volatilization, biodegradation, cation exchange and hydrolysis. Input parameters for the model are based on components of the conceptual model for the site including climate, soil and groundwater conditions, and chemical properties, such as concentration and distribution, of the contaminant. These are discussed below.

1.2.1 Climate, Geology, and Hydrology

The LAKE climate is arid. Average annual rainfall in Boulder City, Nevada is approximately 5.5 inches. The average annual precipitation at Lake Mead, based on data from several weather stations around the lake, is only 5.74 inches per year. Although rain events are rare in the Mojave Desert, rain during the summer thunderstorm season and occasional winter rains can result in heavy precipitation that may lead to flood events.

LAKE spans two physiographic provinces, the Basin and Range and the Colorado Plateau. Most of LAKE, including Lake Mead and Lake Mohave, lies in the Basin and

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[b] NDEP, User’s Guide and Background Technical Document for the Nevada Division of Environmental Protection (NDEP) Basic Comparison Levels (BCLs) for Human Health for the BMI Complex and Common Areas, Revision 11, April, 2013.

Range. The portion of LAKE west of the Colorado Plateau is transitional between the Grand Canyon sequence and Basin and Range volcanics and conglomerates. In the Northshore Road and Overton Beach areas, the youngest units consist of Holocene fanglomerates, playa deposits, and alluvium sourced by Tertiary volcanics that range from basalts to rhyolites.

The Las Vegas Bay former firing range is located on erosional material comprising an alluvial fan. The B1 boring log indicates the presence of dark igneous material (basalt) related to the active volcanism in the vicinity of Lake Mead National Recreation Area approximately 15 million years ago[c]. This material comprises the sand and silt alluvium observed during drilling.

The sources of groundwater in the vicinity of the sites include:

- Subsurface flow in local basins that drain to Lake Mead,
- Infiltration of water from Lake Mead into adjacent permeable rocks,
- Subsurface flow in valleys of perennial streams, and
- Subsurface flow from the consolidated rocks of the Muddy Mountains.

It is estimated that less than 1 percent of the total precipitation contributes to recharge due to low rates of average annual precipitation and high rates of evaporation (Rush, 1968). According to Laney and Bales (1996), rocks saturated by lake water probably extend less than 0.5 miles from the lake. Both sites are located more than one mile from Lake Mead.

The depth to groundwater at the Las Vegas Bay former firing range existing monitoring well was 169.22 feet below ground surface (bgs) on December 11, 2013. The depth to groundwater in Boring B1 at the Las Vegas Bay former firing range was 175.10 feet bgs on December 13, 2013. There are no wells in the vicinity of the Echo Bay former firing range site. A NPS monitoring well located approximately two miles east of the Echo Bay site, between the site and Lake Mead, reported a depth to groundwater of approximately 40 feet bgs in March 2013.

1.2.2 Soil Samples

A soil boring was advanced to a depth of 180 feet below ground surface (bgs) at the Las Vegas Bay former firing range site (**Figure 2**). The concentrations of lead in the soil samples from Boring B1 ranged from 7.1 mg/kg to 60 mg/kg (**Table 1**). Because several of the samples from boring B1 contained total lead concentrations above the SSL for the protection of groundwater, 14 mg/kg, SPLP lead analysis was performed for samples LAKE-LV-B1-60 and LAKE-LV-B1-180, collected at 60 feet and 180 feet bgs,

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[c] ECM, Inc., Soil and Groundwater Sampling Report, Las Vegas Bay Former Firing Range Site, Lake Mead National Recreation Area, Clark County, Nevada and Mohave County, Arizona, April 2014.

respectively. The SPLP results were below the reporting limit for both samples (**Table 1**).

Table 1: LVB Soil Sample Analysis Summary

Soil Sample Name	**Depth (feet bgs)**	**Lead (mg/kg) EPA 6010B**	**SPLP Lead (mg/L) EPA 6010B**
LAKE-LV-B1-60	60	24	<0.50
LAKE-LV-B1-100	100	7.1	NA
LAKE-LV-B1-155	155	38	NA
LAKE-LV-B1-180	180	60	<0.50

Undisturbed soil samples were collected during the drilling of Boring B1 at Las Vegas Bay former firing range site to obtain *in-situ* hydrogeological parameter data (**Table 2**). The use of these data as input to evaluate leaching potential for the Las Vegas Bay and Echo Bay former firing ranges sites via the SESOIL fate and transport model is discussed in subsequent sections of this report.

Table 2: LVB Hydrogeological Parameter Analysis Summary

Soil Sample Name	**Depth (feet bgs)**	**pH Cal 643**	**Grain Size Distribution**	**Moisture ASTM D 2937**	**Hydraulic Conductivity (cm/sec) ASTM D 5084**	**Specific Gravity ASTM D 854**	**Organic Matter Walkley - Black**
LAKE-LV-B1-60	60	8.0	0.4% gravel 67.2% sand 24.5% silt 7.9% clay	13.8%	NM	2.698	0.48%
LAKE-LV-B1-100	100	8.1	52.1% sand 43.7% silt 4.2% clay	NM	0.0003	2.672	0.55%
LAKE-LV-B1-155	155	8.3	41.6% sand 41.6% silt 15.8% clay	19.8%	NM	2.700	0.55%

1.2.3 Groundwater Samples

The groundwater sample and duplicate sample, (LAKE-LV-MW-170 and LAKE-LV-MW-170 DUP, respectively) collected from the on-site well were below the reporting limit for total lead (**Table 3**). Groundwater samples LAKE-LV-B1-180 and LAKE-LV-B1-180 DUP collected from Boring B1 contained 0.12 mg/L and 0.14 mg/L total lead, respectively. The total lead samples were collected as grab samples from the unpurged borehole, and may have contained material from the surface of the boring containing elevated concentrations of lead. Therefore, field filtered samples were submitted and analyzed for dissolved lead. Concentrations of dissolved lead above the reporting limit were not present in the groundwater sample and duplicate sample from Boring B1.

Table 3: LVB Groundwater Sample Analysis Summary

Soil Sample Name	Depth (feet bgs)	Total Lead (mg/L) EPA 6010B	Dissolved Lead (mg/L) EPA 6010B
LAKE-LV-MW-170	170	<0.015	NA
LAKE-LV-MW-170 DUP	170	<0.015	NA
LAKE-LV-B1-180	180	0.12	<0.015
LAKE-LV-B1-180 DUP	180	0.14	NA

2 MODELING APPROACH USING SESOIL

The NDEP has adopted SESOIL as the default unsaturated fate and transport model for evaluation of the leaching-to-groundwater pathway for metals (100116 NDEP Leaching Guidance, Attachment A). SESOIL is an acronym for SEasonal SOIL Compartment model. SESOIL was developed as a public domain software for the EPA's Office of Water and the Office of Toxic Substances in 1981 by Bonazountas and Wagner, then was later modified by Arthur D. Little, Incorporated. The version of SESOIL (under the commercial name SEVIEW) utilized in this project includes modifications made in 1997 by M. J. Barden, then at the Wisconsin Department of Natural Resources, to correct a mass balance error.

SESOIL is a well-benchmarked, one-dimensional vertical transport screening-level model for the unsaturated (vadose) zone. SESOIL simulates contaminant transport and fate based on diffusion, adsorption, volatilization, biodegradation, and hydrolysis. The model defines the soil compartment as a soil column extending from the ground surface through the unsaturated zone and to the upper level of the saturated soil zone. Processes simulated in SESOIL are categorized in three cycles – the hydrologic cycle, sediment cycle, and chemical cycle. Each of the three cycles is a separate submodel in the SESOIL code. The hydrologic cycle includes location-specific rainfall, surface runoff, infiltration, soil water content, evapotranspiration, and groundwater runoff (recharge). The sediment cycle (if applicable) includes sediment washload as a result of rainstorms (*i.e.*, soil erosion that results from surface runoff). The chemical cycle includes convective transport, volatilization, adsorption/desorption, and degradation/decay. The SESOIL model calculates the concentration of leachate moving downward into the groundwater zone, but does not calculate the resulting groundwater concentrations. Governing equations and algorithms for SESOIL are presented in the original publication (Bonazountas, M., D. H. Hetrick, P. T. Kostecki and E. J. Calabrese, SESOIL in Environmental Fate and Risk Modeling, 1997, Amherst Scientific Publishers).

SESOIL contains five basic input files for constructing a vadose zone modeling scenario; climate, chemical, soil, washload, and application. The use of the washload file was not required for this modeling effort due to the soil type present, average slope of the site, and reported hydrologic cycle which indicated that soil erosion and surface runoff would have a negligible effect on leachate concentrations over the simulation period. The following subsections describe the SESOIL input data for the Las Vegas Bay and Echo Bay former firing range sites found in **Appendix A**.

2.1 CLIMATE INPUT

SESOIL's climate file database contains averaged data from thousands of meteorological stations which describe air temperature, cloud cover, relative humidity, short wave albedo, mean evapotranspiration rate, monthly precipitation, mean length of precipitation events, number of precipitation events per month, and the distribution of precipitation events throughout the month. The meteorological station located at Boulder City, Nevada was selected from available sites listed in SESOIL's climate database for use in this modeling effort. LAKE Headquarters is located in Boulder City, Nevada, which is suitably close to the former firing ranges. **Table A-1** summarizes the climate input data for SESOIL at the Boulder City, Nevada station. These data were applied at both the Las Vegas and Echo Bay sites and represent the 30-year (ending in the year 2000) monthly meteorological average for the Boulder City station.

2.2 SESOIL CHEMICAL FILE

SESOIL's chemical database lists chemical and physical data for hundreds of inorganic and organic chemical compounds. The majority of default chemical and physical data included in the database are very conservative. The database provides information on water solubilities, air and water diffusion coefficients, Henry's Law constants, molecular weights, octanol-carbon adsorption (Koc) coefficients, and soil partition coefficients (Kd), which are the most commonly used chemical input parameters for SESOIL modeling. The SESOIL chemical database was utilized for lead for both the Las Vegas Bay and Echo Bay sites. This modeling application was limited to SESOIL's partitioning algorithm since the metal complexation algorithm has not been scientifically validated at this time. **Table A-2** provides the relevant input data, including lead's water solubility (9580 micrograms per milliliter [µg/ml]) and Kd value (900 µg per gram over µg/ml [µg/gram over µg/ml]). A literature review of these selected SESOIL chemical input was performed. Kd and solubility values for lead listed in the SESOIL chemical database generally represent the most conservative (*i.e.* lowest) value for a range of values reported in the literature or determined experimentally in the field or laboratory. The use of conservative Kd and solubility values potentially results in significantly higher predicted movement of chemicals in the vadose zone than would be reasonably expected under actual site conditions.

2.3 SESOIL SOIL INPUT

To obtain modeling results most representative of site conditions, application of site-specific physical soils data in the soil column is critical. Two of the most sensitive input parameters in the SESOIL model are effective soil porosity and intrinsic permeability. A falling head test (ASTM D 5084) was performed on a silty soil sample collected at Boring B1 at a depth of 100 feet from the Las Vegas Bay former firing range (**Appendix B**). The resulting average hydraulic conductivity was 3.0 x 10-4 cm/sec for this soil sample test. A site-specific intrinsic permeability of 3.0 x 10-9 centimeters squared was calculated based on this hydraulic conductivity value. This intrinsic permeability value was assigned to all but the bottom-most layer (100 to 170-feet bgs) of the Las Vegas Bay soil column. Due to the higher clay content present logged in the B1 soil boring, the bottom-most layer of the Las Vegas Bay soil column was assigned an intrinsic permeability of 3.0 x 10-10. All soils simulated in the Echo Bay SESOIL model column were assigned an intrinsic permeability of 3.0 x 10-9.

A gravimetric moisture content of 13.8 % (Boring B1, clayey sand at 60-feet below ground surface (bgs)) and 19.8% (Boring B1, sandy clay at 155-feet bgs) (Appendix B) indicated SESOIL's default value of 0.25 for effective soil porosity for silty sand was reasonable. Tests performed on a soil sample collected at Boring B1 at a depth of 100-feet indicated a dry bulk density of 1.11. Tests (Walkley-Black method) performed on a soil sample collected at Boring B1 at a depth of 60-feet indicated 0.48% organic matter for the clayey sand. SESOIL's default value of 3.90 for soil pore disconnectedness in silty sand was selected for model input for both sites. A literature review of federal and state guidance for this parameter indicated 3.90 was a suitably conservative value. These soil input data were applied at both the Las Vegas Bay and Echo Bay sites.

2.4 SESOIL APPLICATION FILE INPUT

SESOIL's application file contains five sub-files; column, ratio, layer, sublayer load, and Summers equation. Calculation of the groundwater concentration resulting from the SESOIL-calculated leachate concentration by the Summers equation was not necessary in this modeling effort. The column sub-file requires site specific inputs for site latitude, number of layers in the vadose zone column, thickness of each layer, number of sublayers per layer, and selection of release type, instantaneous or continuous. The area of the release was not relevant since resulting groundwater concentrations were not calculated.

- **<u>Las Vegas Bay Site Column Design</u>**: Four layers with ten equally spaced sublayers were selected (**Table A-2**). The layer and sublayer configuration was selected based on the depth of the various soil samples collected during the December 2013 field program. Layer 1 extended from surface to 4-feet bgs;

Layer 2 extended from 4- to 60-feet bgs; Layer 3 extended from 60- to 100-feet bgs; and Layer 4 extended from 100- to the groundwater table at 170-feet bgs.

- **Echo Bay Site Column Design**: Four layers with ten equally spaced sublayers were selected (**Table A-3**). The layer and sublayer configuration was selected based on the depth of the various soil samples collected during the December 2013 field program. Each layer was 10-feet thick.

Model input (Tables **A-2** and **A-3**) required for the selected portioning SESOIL algorithm, included pH, intrinsic permeability, organic carbon, Freundlich exponent and adsorption coefficient assigned to each layer. The four layer sub-files also contain seven categories; contaminant load (POLIN), mass of contaminant transformed (TRAN), mass of contaminant removed (SINK), ligand load (LIG), volatilization index (VOLF), index of contaminant transport in surface runoff (ISRM), and ratio of contaminant concentration in rainwater to vadose zone water (ASL). For this particular modeling effort, these input categories were not necessary.

Initial soil concentrations were assigned to sublayers based on lead concentrations detected throughout the soil column in surficial samples (April 2013) collected at the Las Vegas Bay and Echo Bay former firing ranges, and in Boring B1 (December 2013) at the Las Vegas Bay former firing range site. The source loading option was not applicable for this modeling effort. The maximum concentration of lead detected in soil samples collected at various depths at the Echo Bay and Las Vegas Bay sites were selected for this modeling effort.

- **Las Vegas Bay Site**: As detailed in **Table A-2**, an initial lead concentration of 4900 milligrams per kilogram (mg/kg) was assigned to Sublayer 1 of Layer 1 based on lab surficial soil sample LV-TA-105. An initial lead concentration of 24 mg/kg was assigned to Sublayer 10 of Layer 2 based on B1 soil sample LV-B1-60. An initial lead concentration of 7.1 mg/kg was assigned to Sublayer 10 of Layer 3 based on B1 soil sample LV-B1-100. An initial lead concentration of 38 mg/kg was assigned to Sublayer 9 of Layer 4 based on B1 soil sample LV-B1-155. Based on sample LV-MW-170, no initial lead concentration was assigned to the lowest sublayer in the SESOIL column.
- **Echo Bay Site**: An initial lead concentration of 330 mg/kg was assigned to Sublayer 1 of Layer 1 based on lab surficial soil sample EB-TA-112. An initial lead concentration of 24 mg/kg was assigned to Sublayer 9 of Layer 4. As detailed in **Table A-3**, initial lead concentrations were assigned to all remaining sublayers (except Sublayer 10 of Layer 4), based on the detected initial concentrations of lead.

2.5 TRANSPORT SIMULATION

SESOIL was run in the monthly mode over a 100-year period for both the Las Vegas Bay and Echo Bay sites. Because both firing ranges are inactive, the vadose zone modeling conducted assumed that no continuous releases of lead would occur. Therefore, the release of lead into the soil column was considered instantaneous that is, the entire mass of the lead released in the modeling scenario occurred on the first day of the first month of the first year of the 100-year simulation. SESOIL then calculated lead concentrations in leachate at the interface of the vadose zone and groundwater table (170-feet bgs) on a monthly basis for a 100-year simulation period. The long simulation time was selected due to the high Kd value and low recharge rate at the firing range locations.

3 SESOIL RESULTS AND DISCUSSION

Based on the modeling input described in Section 2, SESOIL provided the following modeling results and predictions.

3.1 SESOIL MODELING RESULTS

As indicated in the SESOIL output tables (Tables **A-4** to **A-7**), lead concentrations did not migrate appreciably downward from their original locations over the 100-year period. The very low recharge rate in combination with lead's high adsorption rate to soil (Kd=900 µg/g over µg/ml) severely limited lead's transport through the soil column. The SESOIL simulations results for each site is discussed below.

Las Vegas Bay Site: As indicated in **Table A-4**, an average annual groundwater recharge rate of 0.69 inches per year was calculated by SESOIL at the site location. Evapotranspiration captured 83% of the net rainfall infiltration in the average year. As indicated in **Table A-5**, lead concentrations did not migrate appreciably downward from their original locations over the 100-year period. The very low recharge rate in combination with lead's high adsorption rate to soil (Kd=900 µg/g over µg/ml) severely limited lead's transport through the soil column. As indicated in Table 5, SESOIL's calculations indicated no lead was present in the 0.69 inches per average year of infiltrating rainwater moving into the groundwater system. Approximately 99.5% of the lead remains adsorbed on the vadose zone soils.

Echo Bay Site: As indicated in **Table A-7**, lead concentrations did not migrate appreciably from their original locations over the 100-year period, despite twice the calculated recharge rate of 1.25 inches per year at the Echo Bay site as compared to the Las Vegas Bay site. Evapotranspiration captured 79% of the net rainfall infiltration in the average year at this site (**Table A-6**). The very low annual recharge rate of 1.25 inches per year in combination with lead's high adsorption rate to soil (Kd=900 µg/g over µg/ml) severely limited lead's downward transport through the soil column. As indicated in **Table A-7**, SESOIL's calculations indicated no lead was present in the 1.25 inches per average year of infiltrating rainwater moving into the groundwater system. Approximately 99.7% of the lead remains adsorbed on the vadose zone soils.

3.2 SENSITIVITY ANALYSES

Comparison of the recharge rates (Echo Bay twice Las Vegas Bay site) and depth to water (Echo Bay 40-feet bgs, Las Vegas Bay 170-feet bgs) between the Las Vegas Bay and Echo Bay former firing range sites indicates reasonable variation of these input values does not result in lead concentrations in the leachate moving into the groundwater zone. **Appendix C** provides the SESOIL input/output for two sensitivity analyses simulations varying the initial lead concentrations and the intrinsic permeability for this modeling effort. The Las Vegas Bay former firing range site was selected for the sensitivity analyses due to the deeper soil column with a higher initial total mass of lead as compared to the Echo Bay location.

As detailed in the SESOIL Profile and Load Report of Sensitivity Analyses #1, the initial mass of lead assigned to the soil column was increased approximately 5-fold from the initial mass of lead simulated in the original Las Vegas firing range SESOIL simulation run (**Table A-2**). The initial mass of lead was distributed continuously throughout the soil column, except in the last sublayer. As detailed in the SESOIL Pollutant Cycle Report of Sensitivity Analyses #1, no lead was present in the 0.69 inches of infiltrating rainwater moving in the groundwater zone in an average year.

As detailed in the SESOIL Profile and Load Report of Sensitivity Analyses #2, the intrinsic permeability in Layers 1 through 3 was increased two orders of magnitude from the initial intrinsic permeability simulated in the original Las Vegas Bay former firing range SESOIL simulation run (**Table A-2**). The intrinsic permeability in Layer 4 was increased three orders of magnitude from the initial intrinsic permeability simulated in the original Las Vegas Bay former firing range SESOIL simulation run (**Table A-2**). As detailed in the SESOIL Pollutant Cycle Report of Sensitivity Analyses #1, no lead was present in the 0.69 inches of infiltrating rainwater moving in the groundwater zone in an average year.

These sensitivity analyses in conjunction with the mass balance calculations provided by SESOIL indicate the model runs for these two sites are valid and providing a “true solution” according to proper application of the model algorithms.

4 SUMMARY

The SESOIL model was applied to the Las Vegas Bay and Echo Bay Former Firing Ranges with a rationale and very conservative methodology consistent with NDEP guidance for leachate modeling of metals. Sensitivity analyses in conjunction with mass balance calculations provided by SESOIL indicated the model runs for these two sites are valid and providing a “true solution” according to proper application of the model algorithms.

Under a 100-year transport scenario utilizing site-specific soil parameters and initial lead concentrations in the vadose zone, SESOIL modeling results indicated no appreciable amount of lead would be present in the low amount of infiltrating rainfall moving into the groundwater zone at both the Las Vegas Bay and Echo Bay former firing ranges. The SESOIL results indicate the currently detected concentrations of lead in the vadose zone soils at the Las Vegas Bay and Echo Bay Former Firing Ranges remain protective of the leaching-to-groundwater pathway as required by NDEP.

If you have any questions or require additional information, please contact ECM at (916) 241-9290.

Best regards,

Environmental Cost Management, Inc.

Tiffany O. Looff

Tiffany O. Looff
Senior Geologist, AZ34508

Environmental Cost Management, Inc.

Sandra Maxfield
Senior Hydrogeologist

Enclosures:

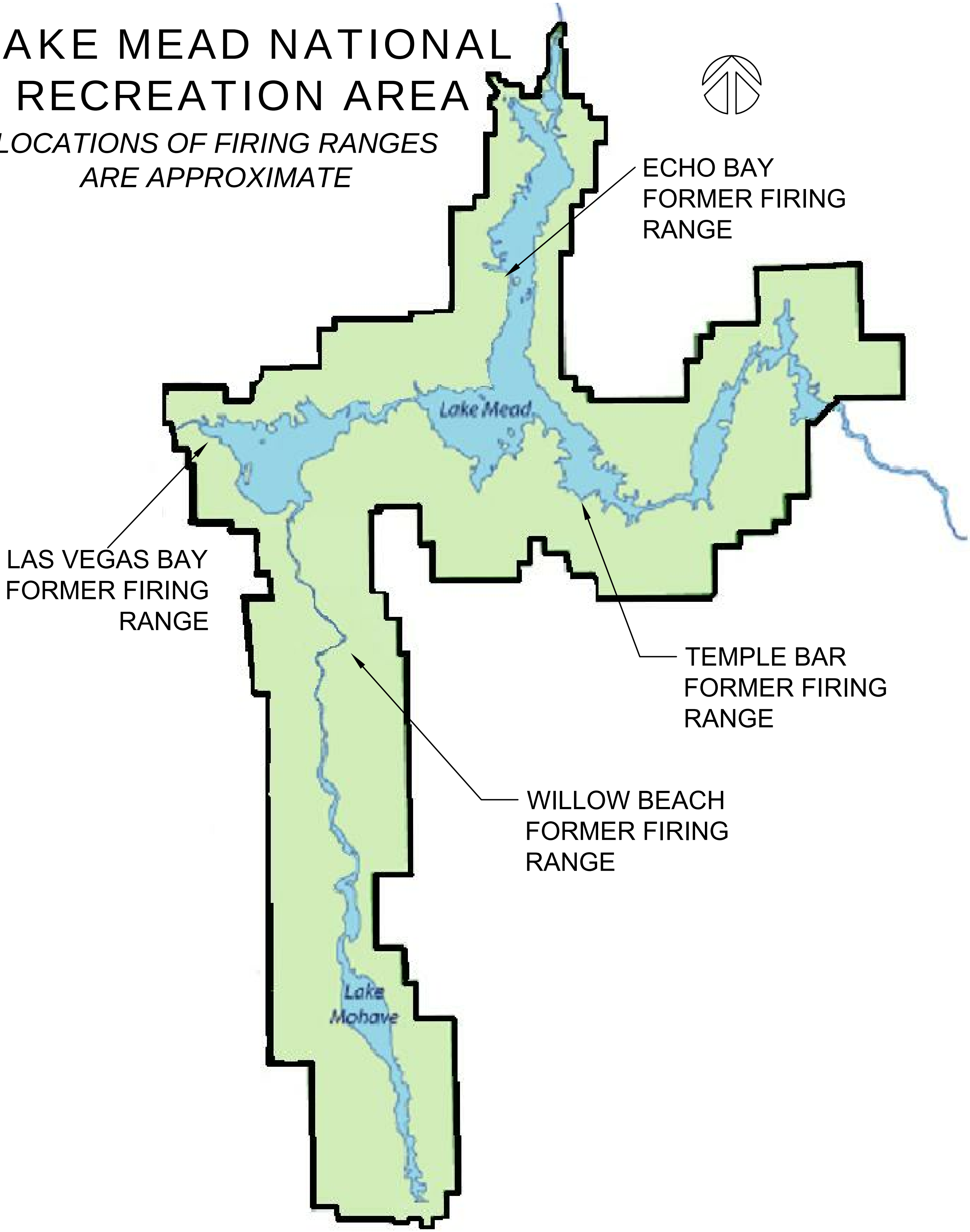
Figure 1: Former Firing Range Sites
Figure 2: Soil Boring and Well Location Map

Appendix A: SESOIL Model Input Data and Model Output
Appendix B: Laboratory Analytical Reports and Chain of Custody Documents
Appendix C: SESOIL Modeling Sensitivity Analyses

Figures

LAKE MEAD NATIONAL RECREATION AREA

LOCATIONS OF FIRING RANGES ARE APPROXIMATE



U.S. Department of the Interior
National Park Service
Park Facility Management Division
1050 Walnut Street, Suite 220

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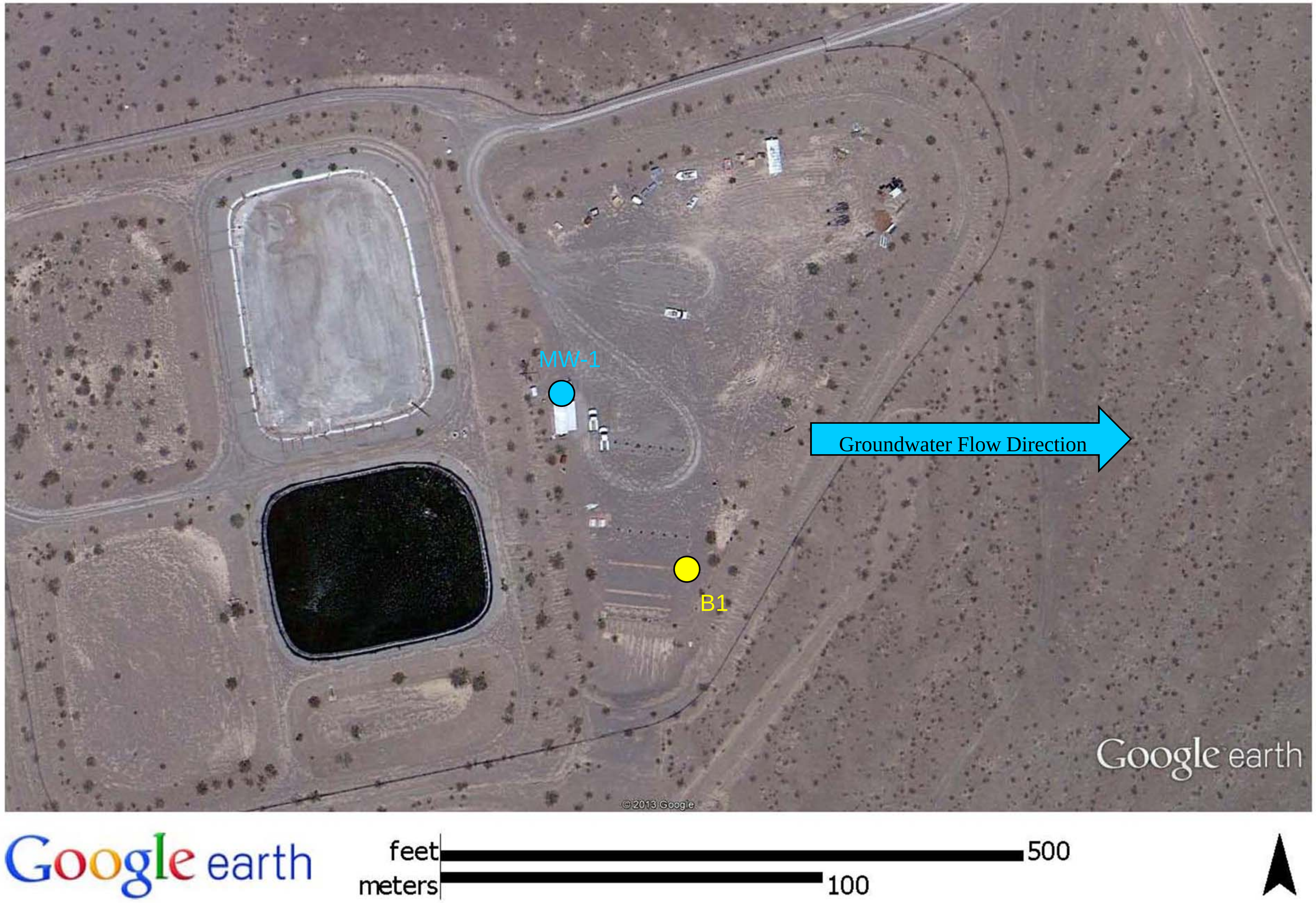
Tel: (714) 662-2759 ● Fax: (714) 662-2758

FORMER FIRING RANGE SITES
LAKE MEAD NATIONAL RECREATION AREA

Leaching-to Groundwater Modeling

Figure
1

File Path: Ecmsrvr/
Drafter: jp
Chkd by:
Date drafted: 2/10/12
Proj. Manager
Project: NPS LAKE



● Approximate Monitoring Well Location

● Approximate Boring Location

Las Vegas Bay Former Firing Range
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Clark County, Nevada

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Soil Boring and Well Location Map

Leaching-to-Groundwater Modeling

Figure

2

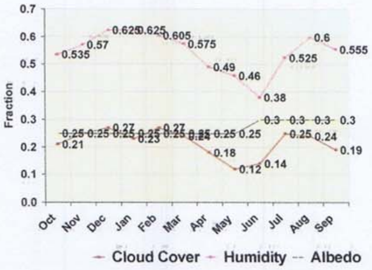
Appendix A

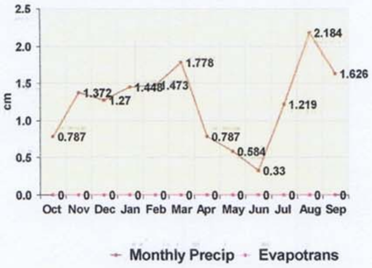
SESOIL Model Input Data and Model Output

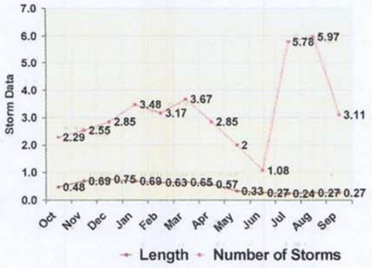
Climate Report

Location Description: BOULDER CITY
Climatic Input File: C:\SEV7 WIN7\BOULDER CITY.CLM

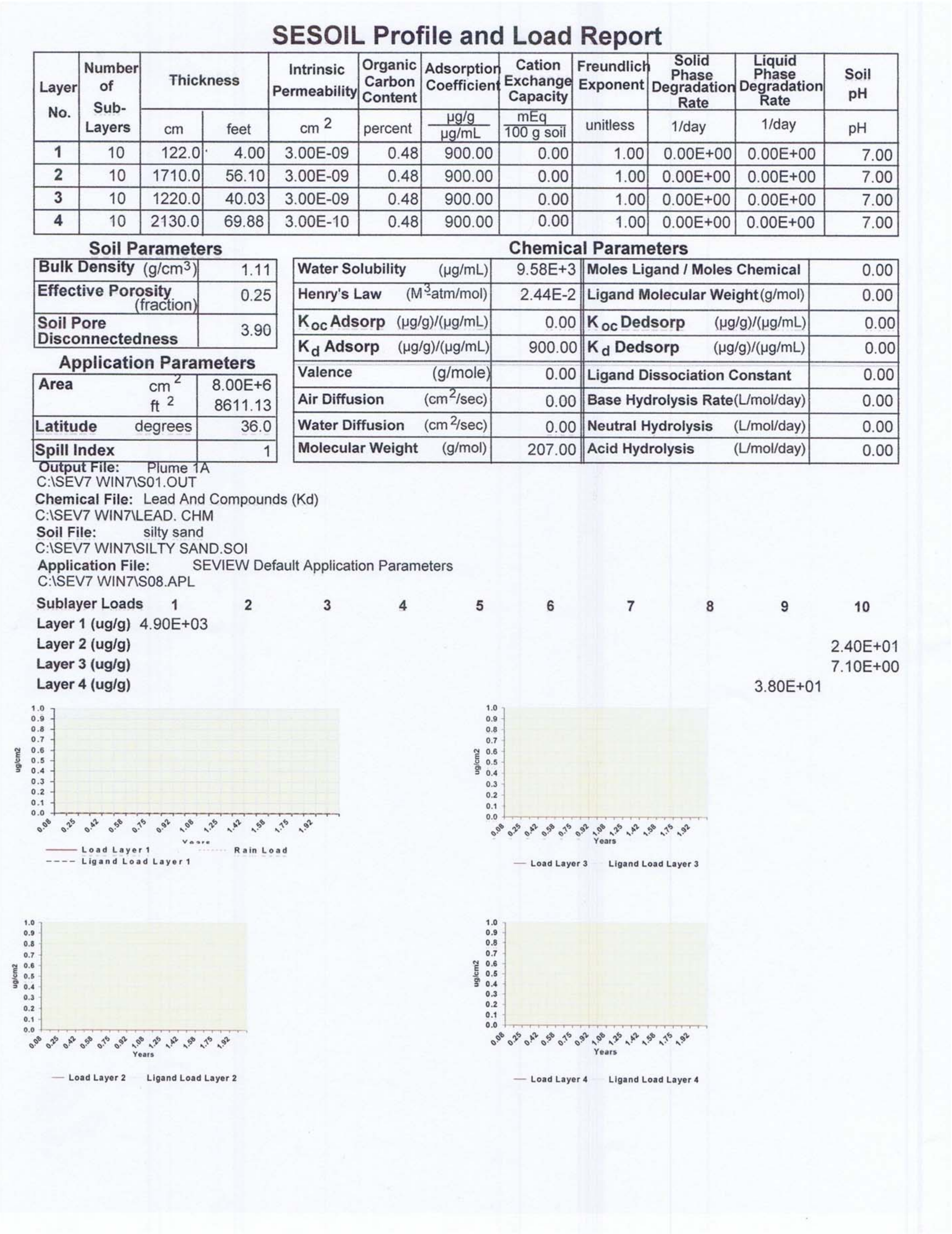
Month	Temperature		Precipitation		Evapotranspiration Rate		Storms		Cloud Cover	Albedo	Humidity
Units	°C	°F	cm	Inches	cm	Inches	# per Month	Length Days	Fraction	Fraction	Fraction
October	20.61	69.10	0.787	0.31	0.00	0.00	2.29	0.480	0.210	0.250	0.535
November	13.28	55.90	1.372	0.54	0.00	0.00	2.55	0.690	0.250	0.250	0.570
December	8.500	47.30	1.270	0.50	0.00	0.00	2.85	0.750	0.270	0.250	0.625
January	8.278	46.90	1.448	0.57	0.00	0.00	3.48	0.690	0.230	0.250	0.625
February	11.22	52.20	1.473	0.58	0.00	0.00	3.17	0.630	0.270	0.250	0.605
March	14.06	57.31	1.778	0.70	0.00	0.00	3.67	0.650	0.240	0.250	0.575
April	18.28	64.90	0.787	0.31	0.00	0.00	2.85	0.570	0.180	0.250	0.490
May	23.33	73.99	0.584	0.23	0.00	0.00	2.00	0.330	0.120	0.250	0.460
June	28.61	83.50	0.330	0.13	0.00	0.00	1.08	0.270	0.140	0.300	0.380
July	31.72	89.10	1.219	0.48	0.00	0.00	5.78	0.240	0.250	0.300	0.525
August	30.61	87.10	2.184	0.86	0.00	0.00	5.97	0.270	0.240	0.300	0.600
September	26.67	80.01	1.626	0.64	0.00	0.00	3.11	0.270	0.190	0.300	0.555
Total			14.86	5.85	0.00	0.00					







Las Vegas Bay & Echo Bay Former Firing Range Sites Lake Mead National Recreation Area Clark County, Nevada	**ENVIRONMENTAL COST MANAGEMENT, INC.** *Managing Cost and Liability* 3525 Hyland Avenue, Suite 200 ● Costa Mesa, CA 92626 Tel: (714) 662-2759 ● Fax: (714) 662-2758	SESOIL Climate Input for Las Vegas Bay and Echo Bay Sites	Table A-1



SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm ^{2}	percent	μg/g / μg/mL	mEq / 100 g soil	unitless	1/day	1/day	pH
1	10	122.0	4.00	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	1710.0	56.10	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
3	10	1220.0	40.03	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	2130.0	69.88	3.00E-10	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00

Soil Parameters

Bulk Density (g/cm^3)	1.11
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

Area	cm ^{2}	8.00E+6
	ft ^{2}	8611.13
Latitude	degrees	36.0
Spill Index		1

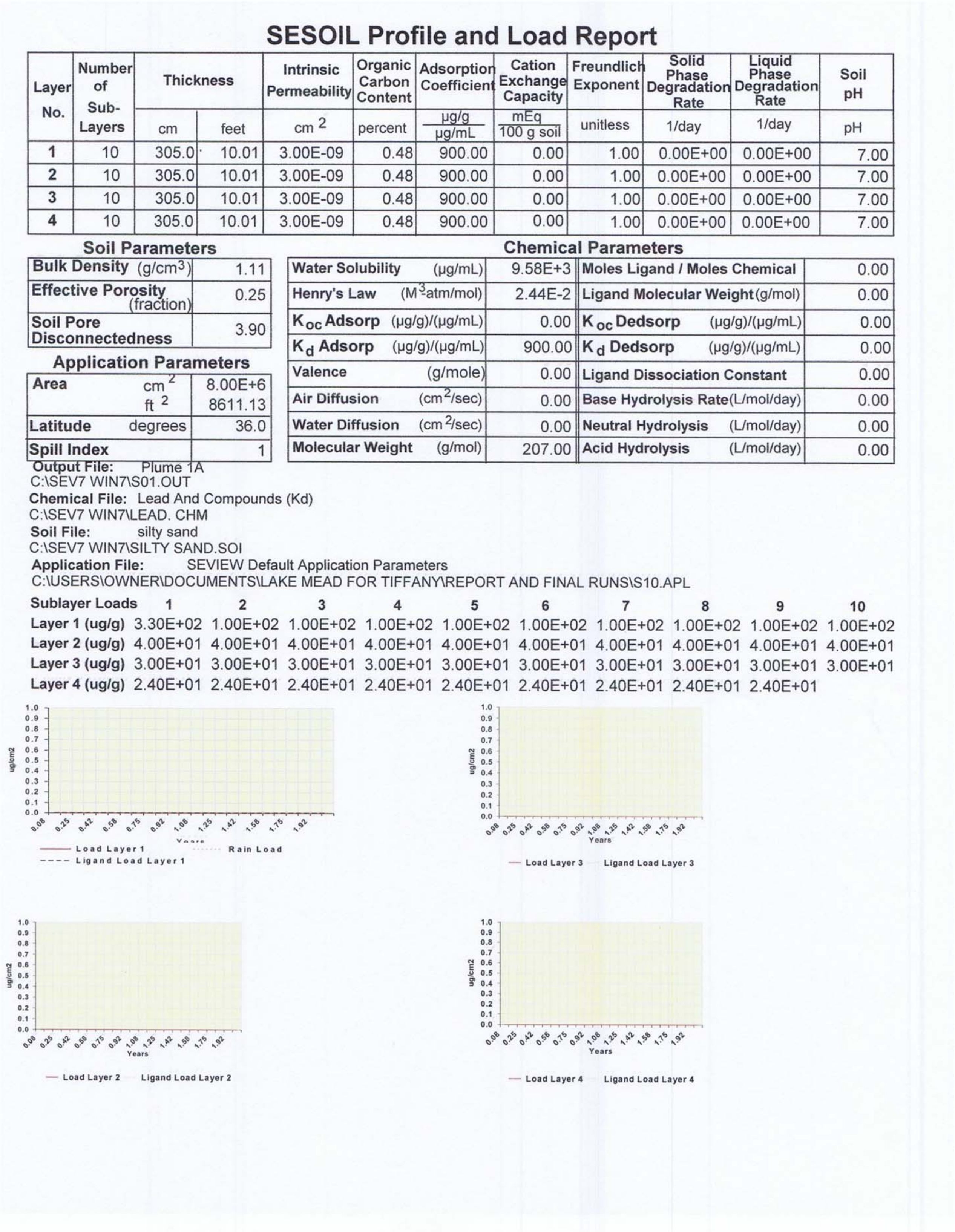
Chemical Parameters

Water Solubility (μg/mL)	9.58E+3	**Moles Ligand / Moles Chemical**	0.00
Henry's Law (M^{3}atm/mol)	2.44E-2	**Ligand Molecular Weight** (g/mol)	0.00
K_{oc} Adsorp (μg/g)/(μg/mL)	0.00	**K_{oc} Dedsorp** (μg/g)/(μg/mL)	0.00
K_d Adsorp (μg/g)/(μg/mL)	900.00	**K_d Dedsorp** (μg/g)/(μg/mL)	0.00
Valence (g/mole)	0.00	**Ligand Dissociation Constant**	0.00
Air Diffusion (cm^2/sec)	0.00	**Base Hydrolysis Rate** (L/mol/day)	0.00
Water Diffusion (cm^2/sec)	0.00	**Neutral Hydrolysis** (L/mol/day)	0.00
Molecular Weight (g/mol)	207.00	**Acid Hydrolysis** (L/mol/day)	0.00

Output File: Plume 1A
C:\SEV7 WIN7\S01.OUT
Chemical File: Lead And Compounds (Kd)
C:\SEV7 WIN7\LEAD. CHM
Soil File: silty sand
C:\SEV7 WIN7\SILTY SAND.SOI
Application File: SEVIEW Default Application Parameters
C:\SEV7 WIN7\S08.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)	4.90E+03									
Layer 2 (ug/g)										2.40E+01
Layer 3 (ug/g)										7.10E+00
Layer 4 (ug/g)									3.80E+01	

Las Vegas Bay & Echo Bay Former Firing Range Sites Lake Mead National Recreation Area Clark County, Nevada	ENVIRONMENTAL COST MANAGEMENT, INC. *Managing Cost and Liability* 3525 Hyland Avenue, Suite 200 ● Costa Mesa, CA 92626 Tel: (714) 662-2759 ● Fax: (714) 662-2758	SESOIL Soil and Application Input for Las Vegas Bay Site	Table A-2



SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm^2	percent	$\frac{\mu g/g}{\mu g/mL}$	$\frac{mEq}{100\ g\ soil}$	unitless	1/day	1/day	pH
1	10	305.0	10.01	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	305.0	10.01	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
3	10	305.0	10.01	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	305.0	10.01	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00

Soil Parameters

Bulk Density (g/cm^3)	1.11
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

Area	cm^2	8.00E+6
	ft^2	8611.13
Latitude	degrees	36.0
Spill Index		1

Chemical Parameters

Water Solubility (μg/mL)	9.58E+3	**Moles Ligand / Moles Chemical**	0.00
Henry's Law (M^3atm/mol)	2.44E-2	**Ligand Molecular Weight** (g/mol)	0.00
K_{oc} Adsorp (μg/g)/(μg/mL)	0.00	**K_{oc} Dedsorp** (μg/g)/(μg/mL)	0.00
K_d Adsorp (μg/g)/(μg/mL)	900.00	**K_d Dedsorp** (μg/g)/(μg/mL)	0.00
Valence (g/mole)	0.00	**Ligand Dissociation Constant**	0.00
Air Diffusion (cm^2/sec)	0.00	**Base Hydrolysis Rate** (L/mol/day)	0.00
Water Diffusion (cm^2/sec)	0.00	**Neutral Hydrolysis** (L/mol/day)	0.00
Molecular Weight (g/mol)	207.00	**Acid Hydrolysis** (L/mol/day)	0.00

Output File: Plume 1A
C:\SEV7 WIN7\S01.OUT
Chemical File: Lead And Compounds (Kd)
C:\SEV7 WIN7\LEAD. CHM
Soil File: silty sand
C:\SEV7 WIN7\SILTY SAND.SOI
Application File: SEVIEW Default Application Parameters
C:\USERS\OWNER\DOCUMENTS\LAKE MEAD FOR TIFFANY\REPORT AND FINAL RUNS\S10.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)	3.30E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02
Layer 2 (ug/g)	4.00E+01	4.00E+01	4.00E+01	4.00E+01	4.00E+01	4.00E+01	4.00E+01	4.00E+01	4.00E+01	4.00E+01
Layer 3 (ug/g)	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01	3.00E+01
Layer 4 (ug/g)	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	

Las Vegas Bay & Echo Bay Former Firing Range Sites
Lake Mead National Recreation Area
Clark County, Nevada

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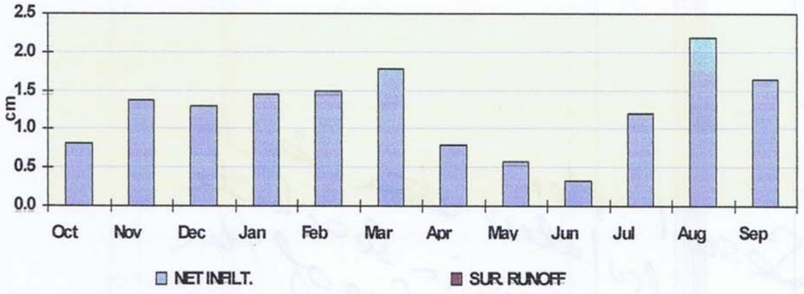
SESOIL Soil and Application Input for Echo Bay Site

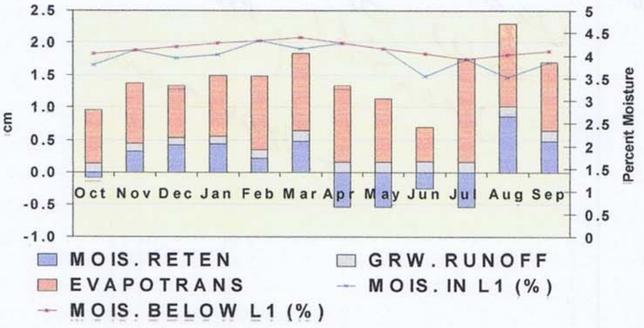
Table
A-3

SESOIL Hydrologic Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT





	Surface Water Runoff		Net Infiltration		Evapotranspiration		Soil Moisture Retention		Groundwater Runoff (Recharge)		Soil Moisture	
											Layer 1	Below Layer 1
Units	cm	Inches	cm	Inches	cm	Inches	cm	Inches	cm	Inches	Percent	Percent
October	0.00	0.00	0.81	0.32	0.82	0.32	-0.09	-0.04	0.14	0.06	3.79	4.04
November	0.00	0.00	1.38	0.54	0.93	0.37	0.32	0.13	0.12	0.05	4.12	4.12
December	0.00	0.00	1.29	0.51	0.80	0.31	0.42	0.17	0.11	0.04	3.94	4.19
January	0.00	0.00	1.45	0.57	0.94	0.37	0.44	0.17	0.12	0.05	4.02	4.27
February	0.00	0.00	1.49	0.59	1.13	0.44	0.22	0.09	0.14	0.06	4.32	4.32
March	0.00	0.00	1.78	0.70	1.19	0.47	0.48	0.19	0.16	0.06	4.14	4.39
April	0.00	0.00	0.80	0.31	1.18	0.46	-0.54	-0.21	0.16	0.06	4.27	4.27
May	0.00	0.00	0.59	0.23	0.97	0.38	-0.54	-0.21	0.16	0.06	4.14	4.14
June	0.00	0.00	0.34	0.13	0.54	0.21	-0.25	-0.10	0.16	0.06	3.54	4.04
July	0.00	0.00	1.21	0.48	1.60	0.63	-0.54	-0.21	0.15	0.06	3.92	3.92
August	0.00	0.00	2.19	0.86	1.27	0.50	0.86	0.34	0.17	0.07	3.52	4.02
September	0.00	0.00	1.64	0.65	1.06	0.42	0.48	0.19	0.16	0.06	3.84	4.09
Total	0.00	0.00	14.97	5.89	12.43	4.89	1.26	0.49	1.75	0.69	- -	- -

Las Vegas Bay & Echo Bay Former
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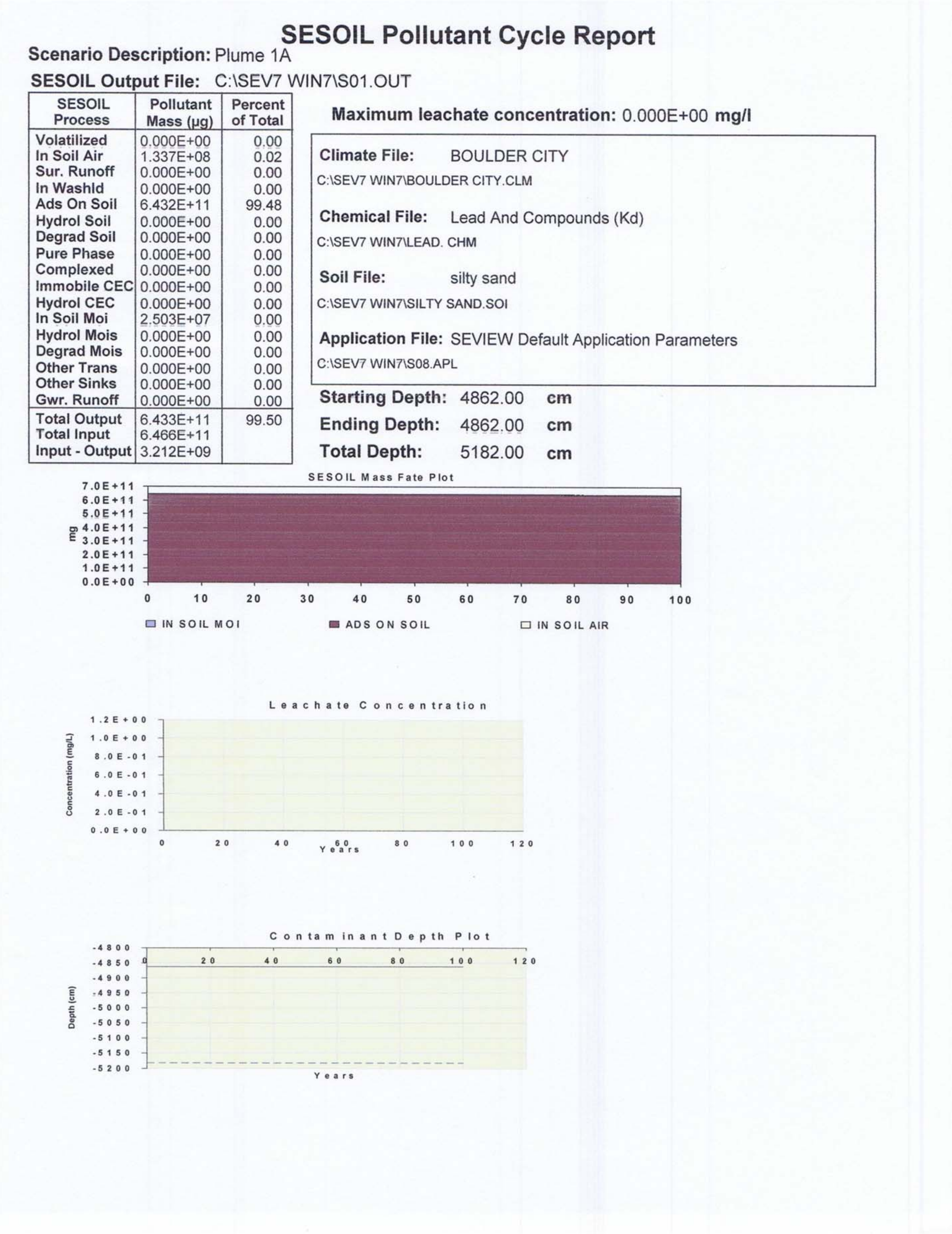
SESOIL Groundwater Recharge and Climate Output for Las Vegas Bay Site

Table
A-4



SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (µg)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	1.337E+08	0.02
Sur. Runoff	0.000E+00	0.00
In Washld	0.000E+00	0.00
Ads On Soil	6.432E+11	99.48
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	2.503E+07	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	6.433E+11	99.50
Total Input	6.466E+11	
Input - Output	3.212E+09	

Maximum leachate concentration: 0.000E+00 **mg/l**

Climate File: BOULDER CITY
C:\SEV7 WIN7\BOULDER CITY.CLM

Chemical File: Lead And Compounds (Kd)
C:\SEV7 WIN7\LEAD. CHM

Soil File: silty sand
C:\SEV7 WIN7\SILTY SAND.SOI

Application File: SEVIEW Default Application Parameters
C:\SEV7 WIN7\S08.APL

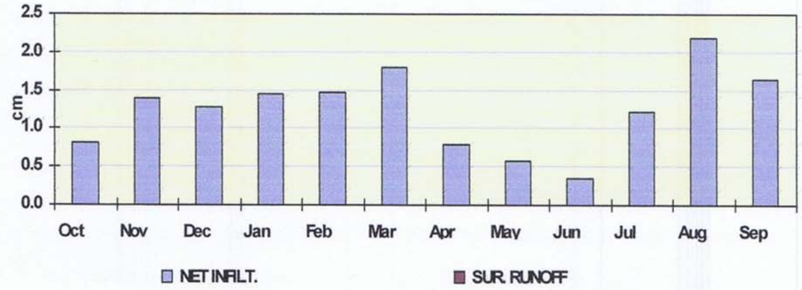
Starting Depth: 4862.00 **cm**
Ending Depth: 4862.00 **cm**
Total Depth: 5182.00 **cm**

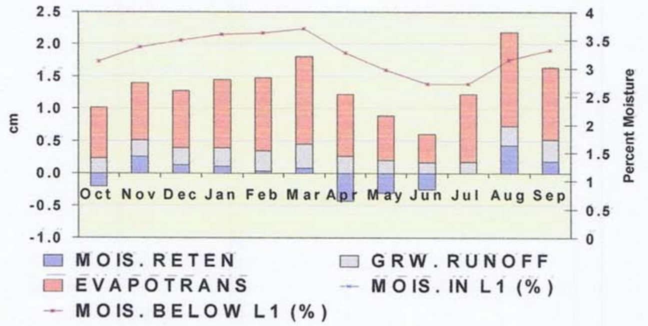
Las Vegas Bay & Echo Bay Former Firing Range Sites Lake Mead National Recreation Area Clark County, Nevada	**ENVIRONMENTAL COST MANAGEMENT, INC.** *Managing Cost and Liability* 3525 Hyland Avenue, Suite 200 ● Costa Mesa, CA 92626 Tel: (714) 662-2759 ● Fax: (714) 662-2758	SESOIL Lead Output Including Soil and Leachate Concentrations, Las Vegas Bay Site	Table A-5

SESOIL Hydrologic Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT



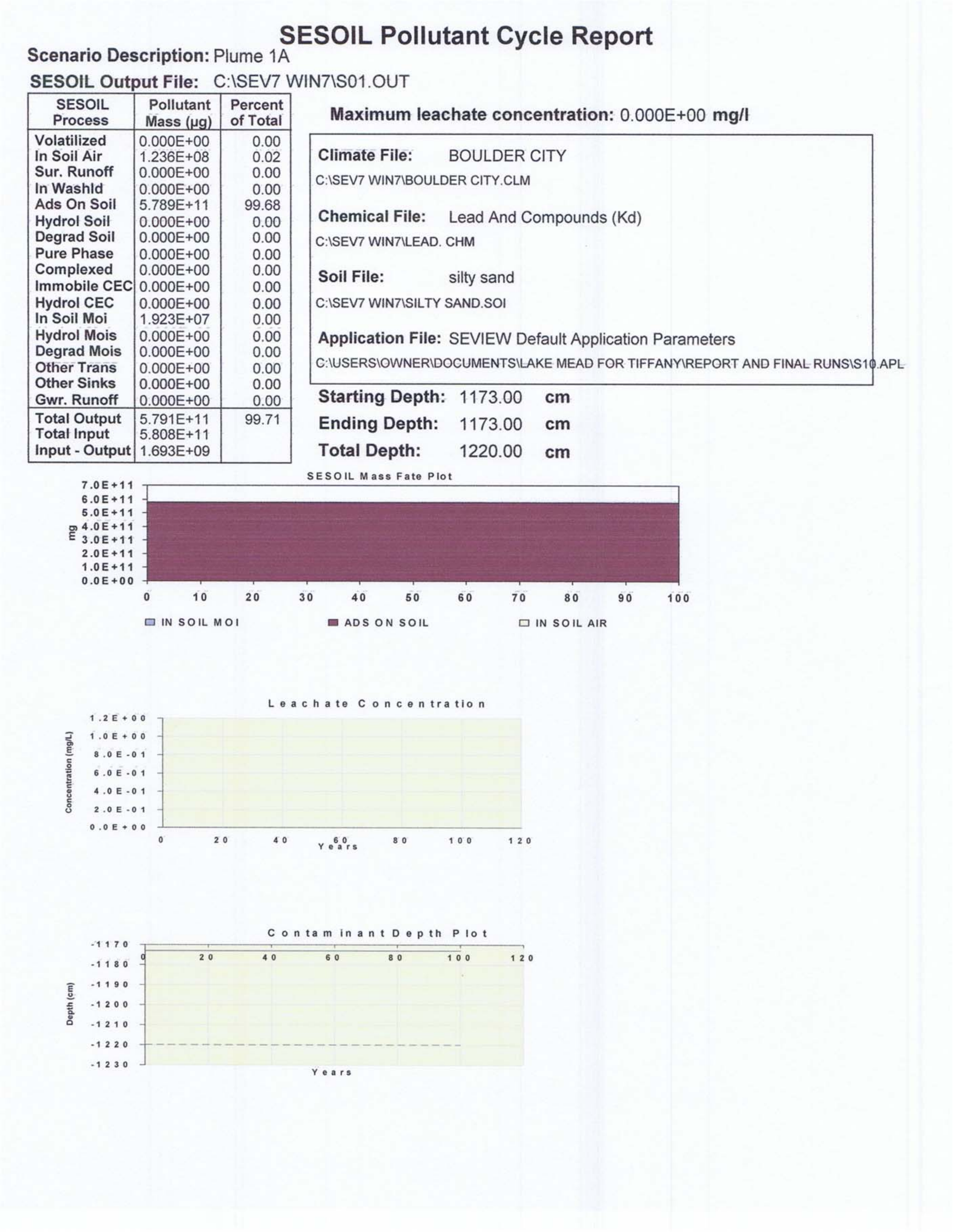


	Surface Water Runoff		Net Infiltration		Evapotranspiration		Soil Moisture Retention		Groundwater Runoff (Recharge)		Soil Moisture	
											Layer 1	Below Layer 1
Units	cm	Inches	cm	Inches	cm	Inches	cm	Inches	cm	Inches	Percent	Percent
October	0.00	0.00	0.81	0.32	0.79	0.31	-0.20	-0.08	0.23	0.09	3.12	3.12
November	0.00	0.00	1.39	0.55	0.88	0.35	0.25	0.10	0.26	0.10	3.37	3.37
December	0.00	0.00	1.27	0.50	0.89	0.35	0.13	0.05	0.26	0.10	3.49	3.49
January	0.00	0.00	1.45	0.57	1.06	0.42	0.10	0.04	0.29	0.11	3.59	3.59
February	0.00	0.00	1.48	0.58	1.13	0.44	0.03	0.01	0.32	0.13	3.62	3.62
March	0.00	0.00	1.81	0.71	1.35	0.53	0.08	0.03	0.38	0.15	3.69	3.69
April	0.00	0.00	0.79	0.31	0.96	0.38	-0.43	-0.17	0.26	0.10	3.27	3.27
May	0.00	0.00	0.58	0.23	0.69	0.27	-0.31	-0.12	0.20	0.08	2.97	2.97
June	0.00	0.00	0.35	0.14	0.44	0.17	-0.25	-0.10	0.16	0.06	2.72	2.72
July	0.00	0.00	1.23	0.48	1.05	0.41	0.00	0.00	0.17	0.07	2.72	2.72
August	0.00	0.00	2.18	0.86	1.45	0.57	0.43	0.17	0.30	0.12	3.14	3.14
September	0.00	0.00	1.64	0.65	1.12	0.44	0.18	0.07	0.34	0.13	3.32	3.32
Total	0.00	0.00	14.98	5.90	11.80	4.65	0.00	0.00	3.18	1.25	- -	- -

SESOIL Groundwater Recharge and Climate Output for Echo Bay Site

Table

A-6



SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (µg)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	1.236E+08	0.02
Sur. Runoff	0.000E+00	0.00
In Washld	0.000E+00	0.00
Ads On Soil	5.789E+11	99.68
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	1.923E+07	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	5.791E+11	99.71
Total Input	5.808E+11	
Input - Output	1.693E+09	

Maximum leachate concentration: 0.000E+00 **mg/l**

Climate File: BOULDER CITY
C:\SEV7 WIN7\BOULDER CITY.CLM

Chemical File: Lead And Compounds (Kd)
C:\SEV7 WIN7\LEAD. CHM

Soil File: silty sand
C:\SEV7 WIN7\SILTY SAND.SOI

Application File: SEVIEW Default Application Parameters
C:\USERS\OWNER\DOCUMENTS\LAKE MEAD FOR TIFFANY\REPORT AND FINAL RUNS\S10.APL

Starting Depth: 1173.00 **cm**
Ending Depth: 1173.00 **cm**
Total Depth: 1220.00 **cm**

Las Vegas Bay & Echo Bay Former
Firing Range Sites
Lake Mead National Recreation Area
Clark County, Nevada

ENVIRONMENTAL COST MANAGEMENT, INC.
Managing Cost and Liability
3525 Hyland Avenue, Suite 200 ● Costa Mesa, CA 92626
Tel: (714) 662-2759 ● Fax: (714) 662-2758

SESOIL Lead Output Including Soil and Leachate Concentrations, Echo Bay Site

Table
A-7

Appendix B

Laboratory Analytical Reports and Chain of Custody Documents

Soil & Plant Laboratory, Inc.
Leaders in Soil & Plant Testing Since 1946
4741 E. Hunter Ave, Suite A Anaheim, CA 92807 714-282-8777 (phone) 714-282-8575 (fax)
www.soilandplantlaboratory.com

Report Number
14-007-0050 **Page:** 1 of 3

Account Number
15024

Send To: Cooper Testing Labs, Inc.
937 Commercial St

Palo Alto , CA 94303

Purchase Order :
Report Date : 01/14/2014
Date Received : 01/07/2014

Project : Environmental Cost Management-Lake
Job # 842-001

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 25482
Sample Id : Lake-LV-60

Analysis	**Result**	**Quantitation Limit**	**Method**	**Date and Time Test Started**	**Analyst**
Organic Matter (Titration) , %	0.48	0.05	Walkley-Black	01/10/2014 07:34	SNS

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

Report Number
14-007-0050

Account Number
15024

Send To: Cooper Testing Labs, Inc.
937 Commercial St

Palo Alto , CA 94303

Project : Environmental Cost Management-Lake
Job # 842-001

Purchase Order :
Report Date : 01/14/2014
Date Received : 01/07/2014

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 25483
Sample Id : Lake-LV-100

Analysis	**Result**	**Quantitation Limit**	**Method**	**Date and Time Test Started**	**Analyst**
Organic Matter (Titration) , %	0.55	0.05	Walkley-Black	01/10/2014 07:34	SNS

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

Account Number
15024

Soil & Plant Laboratory, Inc.
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Send To: Cooper Testing Labs, Inc.
937 Commercial St

Palo Alto , CA 94303

Purchase Order :
Report Date : 01/14/2014
Date Received : 01/07/2014

Project : Environmental Cost Management-Lake
Job # 842-001

REPORT OF ANALYSIS

Date Sampled :

Lab Number: 25484
Sample Id : Lake-Lv-B1-155

Analysis	Result	Quantitation Limit	Method	Date and Time Test Started	Analyst
Organic Matter (Titration) , %	0.55	0.05	Walkley-Black	01/10/2014 07:34	SNS

Method Reference:
Methods of Soil Analysis, Part 3 - Chemical Methods, 2nd Ed. Rev. Soil Science Society of America, Black, C.A et al. 1982, pages 995-996.

Comments:

COOPER
TESTING LABORATORY

Specific Gravity by Pycnometer

ASTM D 854

CTL Job#: 842-001 **Project Name:** Lake **Date:** 01/13/14
Client: Environmental Cost Management **Project No.:** **Run By:** MD
Checked DC

Boring:	B1	B1	B1					
Sample:								
Depth, ft.:	60	100	155					
Pan No.:								
Soil Description (visual)	Reddish Brown Clayey SAND	Light Red Silty SAND (slightly plastic)	Reddish Brown Sandy CLAY					
Pycnometer ID:	3	6	E					
Mass of Clean, Dry Pycnometer (g):	166.25	164.22	171.63					
Mass of Pycnometer, Soil, and Water (g):	738.18	704.99	726.90					
Temperature of Slurry (°C):	20.3	20.3	20.3					
Tare ID:								
Mass of Tare (g):	225.47	229.75	228.04					
Mass of Dry Soil and Tare (g):	342.02	297.08	318.00					
Mass of Dry Soil (g):	116.55	67.33	89.96					
Mass of Pycnometer and Water at Test Temp (g):	664.83	662.86	670.25					
Specific Gravity @ Test Temp:	2.698	2.672	2.701					
Specific Gravity @ 20 °C:	**2.698**	**2.672**	**2.700**					

Hydraulic Conductivity
ASTM D 5084
Method C: Falling Head Rising Tailwater

Job No:	842-001	**Boring:**	LAKE-LV-B1-100	**Date:**	01/07/14
Client:	Environmental Cost Management	**Sample:**		**By:**	MD/PJ
Project:	LAKE	**Depth, ft.:**	100	**Remolded:**	

Visual Classification: Light Red Silty SAND (slightly plastic)

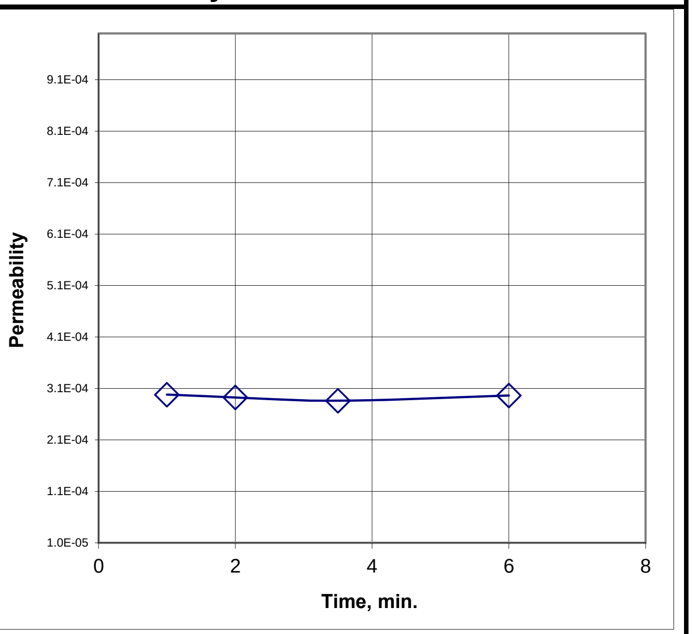
Max Sample Pressures, psi:

Cell:	Bottom	Top	Avg. Sigma3
63.5	58.5	58.5	5

B: = >0.95 **("B" is an indication of saturation)**

Max Hydraulic Gradient: = 7

Date	Minutes	Head, (in)	K,cm/sec
1/1/2014	0.00	15.00	**Start of Test**
1/1/2014	1.00	12.60	3.0E-04
1/1/2014	2.00	10.65	2.9E-04
1/1/2014	3.50	8.35	2.9E-04
1/1/2014	6.00	5.30	3.0E-04



Average Hydraulic Conductivity: **3.E-04** **cm/sec**

Sample Data:	Initial (As-Received)	Final (At-Test)
Height, in	2.00	2.01
Diameter, in	1.89	1.88
Area, in2	2.80	2.79
Volume in3	5.60	5.59
Total Volume, cc	91.8	91.7
Volume Solids, cc	38.2	38.2
Volume Voids, cc	53.5	53.5
Void Ratio	1.4	1.4
Total Porosity, %	58.4	58.3
Air-Filled Porosity (θa),%	17.4	0.5
Water-Filled Porosity (θw),%	41.0	57.8
Saturation, %	70.2	99.1
Specific Gravity	2.67	2.67
Wet Weight, gm	139.7	155.1
Dry Weight, gm	102.1	102.1
Tare, gm	0.00	0.00
Moisture, %	36.8	51.9
Wet Bulk Density, pcf	95.0	105.6
Dry Bulk Density, pcf	69.4	69.5
Wet Bulk Dens.ρb, (g/cm^3)	1.52	1.69
Dry Bulk Dens.ρb, (g/cm^3)	1.11	1.11

Remarks:

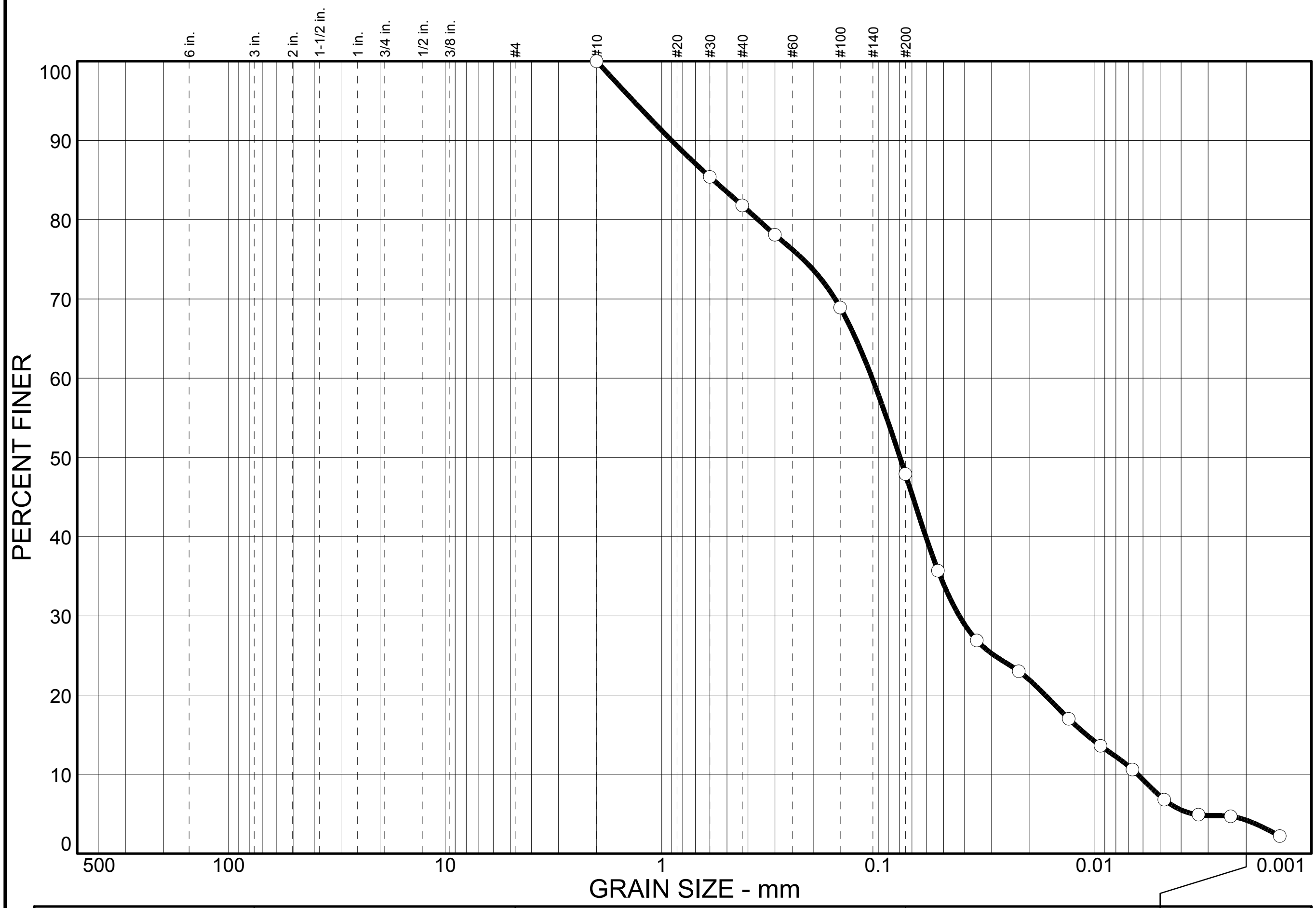
Moisture-Density-Porosity Report
Cooper Testing Labs, Inc. (ASTM D 2937)

CTL Job No: 842-001
Project No.
By: RU
Client: Environmental Cost Management
Date: 01/13/14
Project Name: Lake
Remarks:

Boring:	B1	B1						
Sample:								
Depth, ft:	60	155						
Visual Description:	Reddish Brown Clayey SAND	Reddish Brown Sandy CLAY						
Actual G_s								
Assumed G_s								
Moisture, %	13.8	19.8						
Wet Unit wt, pcf								
Dry Unit wt, pcf								
Dry Bulk Dens.pb, (g/cc)								
Saturation, %								
Total Porosity, %								
Volumetric Water Cont,Θw								
Volumetric Air Cont., Θa								
Void Ratio								
Series	1	2	3	4	5	6	7	8

Note: All reported parameters are from the as-received sample condition unless otherwise noted. If an assumed specific gravity (Gs) was used then the saturation, porosities, and void ratio should be considered approximate.

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.0	52.1	43.7	4.2

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
#10	100.0		
#30	85.4		
#40	81.8		
#50	78.1		
#100	68.9		
#200	47.9		
#270	35.7		
0.0351 mm.	26.9		
0.0225 mm.	23.0		
0.0132 mm.	17.0		
0.0094 mm.	13.6		
0.0067 mm.	10.6		
0.0048 mm.	6.8		
0.0033 mm.	4.9		
0.0024 mm.	4.7		
0.0014 mm.	2.2		

* (no specification provided)

Soil Description

Light Red Silty SAND (slightly plastic)

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.578 D_{60}= 0.107 D_{50}= 0.0795
D_{30}= 0.0423 D_{15}= 0.0109 D_{10}= 0.0064
C_u= 16.83 C_c= 2.63

Classification

USCS= AASHTO=

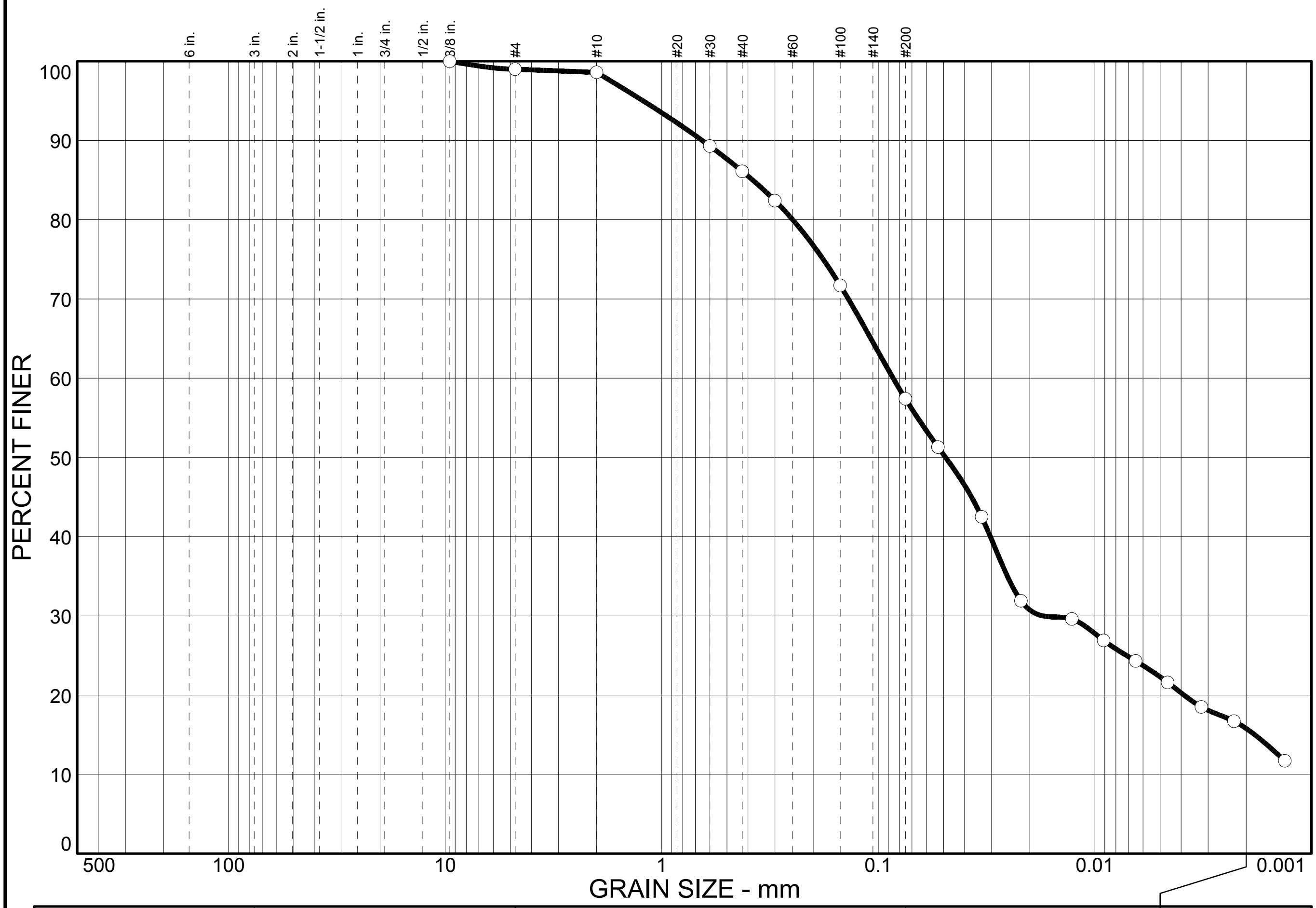
Remarks

Sample No.: **Source of Sample:** LAKE-LV-B1-100 **Date:** 1/13/14
Location: **Elev./Depth:** 100'

COOPER TESTING LABORATORY

Client: Environmental Cost Management, Inc.
Project: LAKE
Project No: 842-001 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	1.0	41.6	41.6	15.8

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.0		
#10	98.6		
#30	89.3		
#40	86.1		
#50	82.4		
#100	71.7		
#200	57.4		
#270	51.3		
0.0334 mm.	42.5		
0.0219 mm.	31.9		
0.0128 mm.	29.6		
0.0091 mm.	26.9		
0.0065 mm.	24.3		
0.0046 mm.	21.6		
0.0032 mm.	18.5		
0.0023 mm.	16.7		
0.0013 mm.	11.7		

* (no specification provided)

Soil Description

Reddish Brown Sandy CLAY

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 0.380 D_{60}= 0.0855 D_{50}= 0.0489
D_{30}= 0.0174 D_{15}= 0.0018 D_{10}=
C_u= C_c=

Classification

USCS= AASHTO=

Remarks

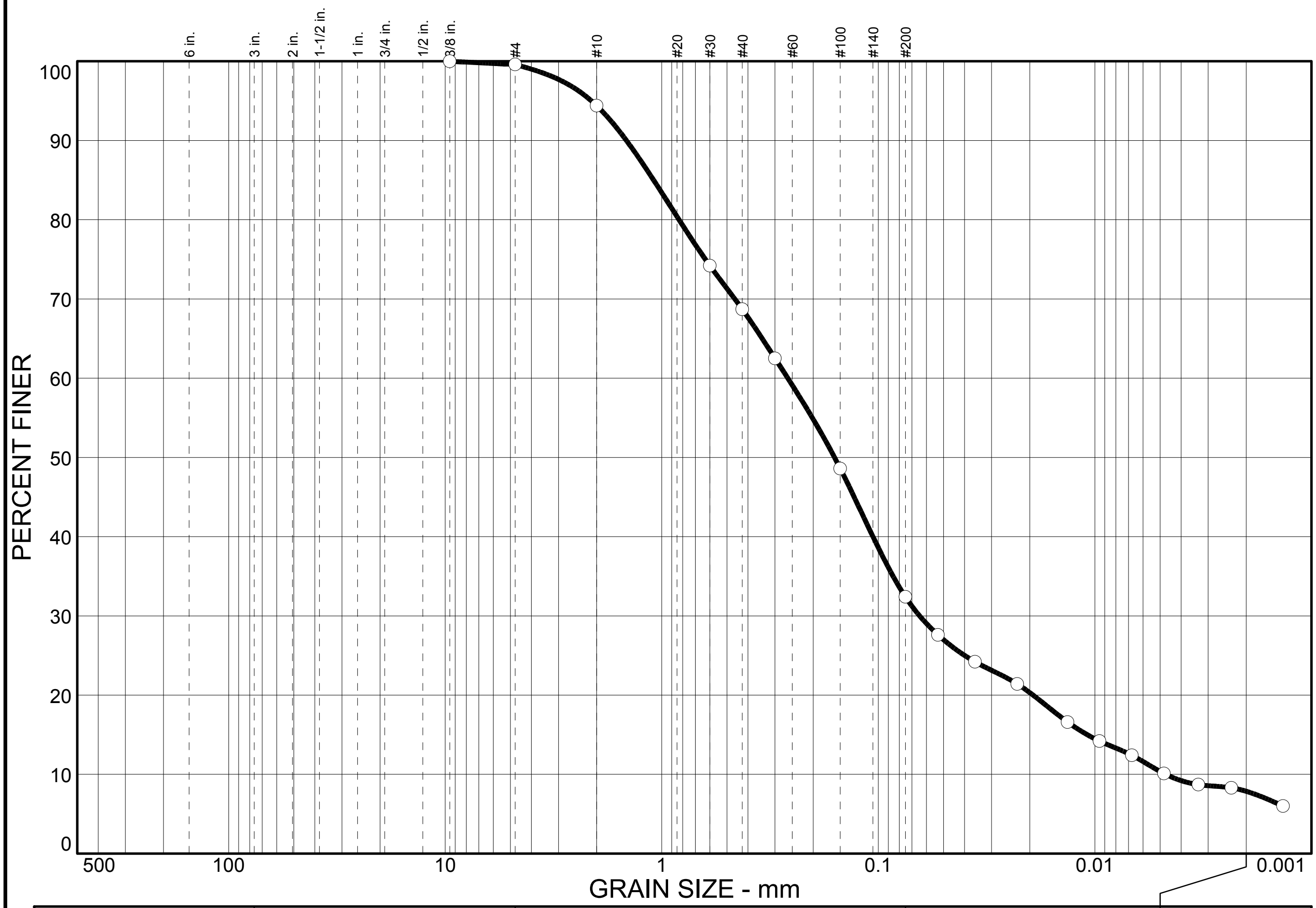
Sample No.: **Source of Sample:** LAKE-LV-B1-155 **Date:** 1/7/13
Location: **Elev./Depth:** 155'

COOPER TESTING LABORATORY

Client: Environmental Cost Management, Inc.
Project: LAKE

Project No: 842-001 **Figure**

Particle Size Distribution Report



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
0.0	0.4	67.2	24.5	7.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/8 in.	100.0		
#4	99.6		
#10	94.4		
#30	74.2		
#40	68.7		
#50	62.5		
#100	48.6		
#200	32.4		
#270	27.6		
0.0358 mm.	24.2		
0.0228 mm.	21.4		
0.0134 mm.	16.6		
0.0095 mm.	14.2		
0.0068 mm.	12.4		
0.0048 mm.	10.1		
0.0033 mm.	8.7		
0.0023 mm.	8.3		
0.0014 mm.	6.0		

* (no specification provided)

Soil Description

Reddish Brown Clayey SAND

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 1.09 D_{60}= 0.262 D_{50}= 0.159
D_{30}= 0.0645 D_{15}= 0.0109 D_{10}= 0.0047
C_u= 55.57 C_c= 3.37

Classification

USCS= AASHTO=

Remarks

Sample No.: **Source of Sample:** LAKE-LV-B1-60 **Date:** 1/7/13
Location: **Elev./Depth:** 60'

COOPER TESTING LABORATORY

Client: Environmental Cost Management, Inc.
Project: LAKE

Project No: 842-001 **Figure**

Corrosivity Test Summary

CTL # 842-001 **Date:** 1/13/2014 **Tested By:** PJ **Checked:** PJ

Client: Environmental Cost Management **Project:** LAKE **Proj. No:**

Remarks:

Sample Location or ID			**Resistivity @ 15.5 °C (Ohm-cm)**			**Chloride**	**Sulfate**		**pH**	**ORP**	**Moisture**	**Soil Visual Description**
Boring	**Sample, No.**	**Depth, ft.**	**As Rec.**	**Minimum**	**Saturated**	**mg/kg**	**mg/kg**	**%**		(Redox)	At Test	
						Dry Wt.	Dry Wt.	Dry Wt.		mv	**%**	
			ASTM G57	Cal 643	ASTM G57	Cal 422-mod.	Cal 417-mod.	Cal 417-mod.	Cal 643	SM 2580B	ASTM D2216	
LAKE-LV-B1	-	60	-	-	-	-	-	-	8.0	-	-	Reddish Brown Clayey SAND
LAKE-LV-B1	-	100	-	-	-	-	-	-	8.1	-	-	Light Red Silty SAND (slightly plastic)
LAKE-LV-B1	-	155	-	-	-	-	-	-	8.3	-	-	Reddish Brown Sandy CLAY

Appendix C

SESOIL Modeling Sensitivity Analyses

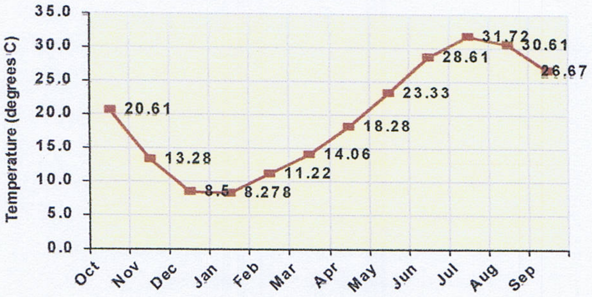
Appendix C

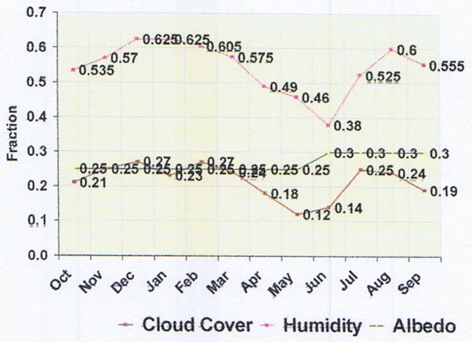
Sensitivity Analyses #1
Increase Initial Mass of Lead Across the Soil Column
(Las Vegas Bay Former Firing Range)

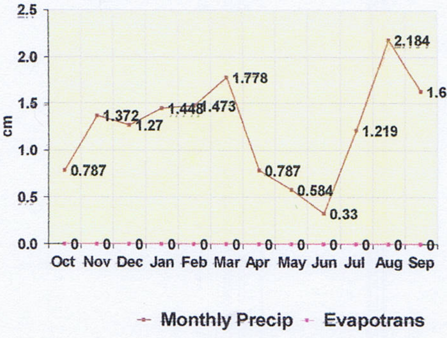
Climate Report

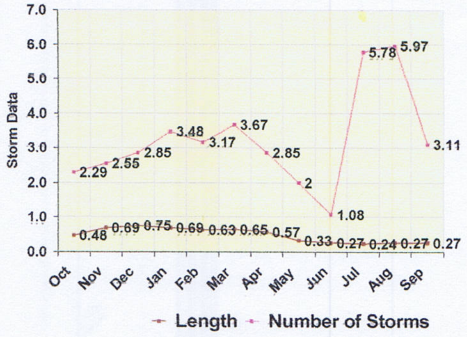
Location Description: BOULDER CITY
Climatic Input File: C:\SEV7 WIN7\BOULDER CITY.CLM

Month	Temperature		Precipitation		Evapotranspiration Rate		Storms		Cloud Cover	Albedo	Humidity
Units	°C	°F	cm	Inches	cm	Inches	# per Month	Length Days	Fraction	Fraction	Fraction
October	20.61	69.10	0.787	0.31	0.00	0.00	2.29	0.480	0.210	0.250	0.535
November	13.28	55.90	1.372	0.54	0.00	0.00	2.55	0.690	0.250	0.250	0.570
December	8.500	47.30	1.270	0.50	0.00	0.00	2.85	0.750	0.270	0.250	0.625
January	8.278	46.90	1.448	0.57	0.00	0.00	3.48	0.690	0.230	0.250	0.625
February	11.22	52.20	1.473	0.58	0.00	0.00	3.17	0.630	0.270	0.250	0.605
March	14.06	57.31	1.778	0.70	0.00	0.00	3.67	0.650	0.240	0.250	0.575
April	18.28	64.90	0.787	0.31	0.00	0.00	2.85	0.570	0.180	0.250	0.490
May	23.33	73.99	0.584	0.23	0.00	0.00	2.00	0.330	0.120	0.250	0.460
June	28.61	83.50	0.330	0.13	0.00	0.00	1.08	0.270	0.140	0.300	0.380
July	31.72	89.10	1.219	0.48	0.00	0.00	5.78	0.240	0.250	0.300	0.525
August	30.61	87.10	2.184	0.86	0.00	0.00	5.97	0.270	0.240	0.300	0.600
September	26.67	80.01	1.626	0.64	0.00	0.00	3.11	0.270	0.190	0.300	0.555
Total			14.86	5.85	0.00	0.00					









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm ^{2}	percent	$\frac{\mu g/g}{\mu g/mL}$	$\frac{mEq}{100\ g\ soil}$	unitless	1/day	1/day	pH
1	10	122.0	4.00	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	1710.0	56.10	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
3	10	1220.0	40.03	3.00E-09	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	2130.0	69.88	3.00E-10	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00

Soil Parameters

Bulk Density (g/cm^3)	1.11
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

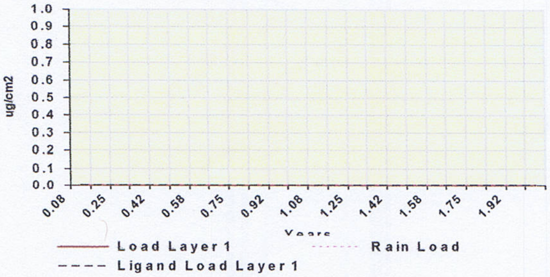
Area cm ^{2}	8.00E+6
ft ^{2}	8611.13
Latitude degrees	36.0
Spill Index	1

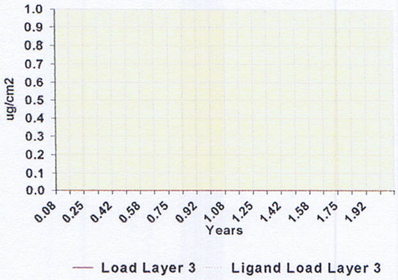
Chemical Parameters

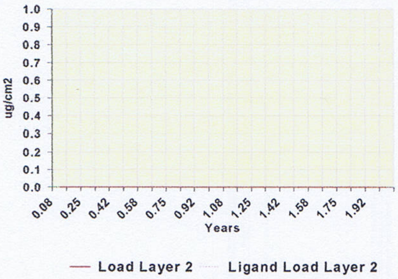
Water Solubility (µg/mL)	9.58E+3	**Moles Ligand / Moles Chemical**	0.00
Henry's Law (M^{3}atm/mol)	2.44E-2	**Ligand Molecular Weight** (g/mol)	0.00
K_{oc} Adsorp (µg/g)/(µg/mL)	0.00	**K_{oc} Dedsorp** (µg/g)/(µg/mL)	0.00
K_d Adsorp (µg/g)/(µg/mL)	900.00	**K_d Dedsorp** (µg/g)/(µg/mL)	0.00
Valence (g/mole)	0.00	**Ligand Dissociation Constant**	0.00
Air Diffusion (cm^2/sec)	0.00	**Base Hydrolysis Rate** (L/mol/day)	0.00
Water Diffusion (cm ^{2}/sec)	0.00	**Neutral Hydrolysis** (L/mol/day)	0.00
Molecular Weight (g/mol)	207.00	**Acid Hydrolysis** (L/mol/day)	0.00

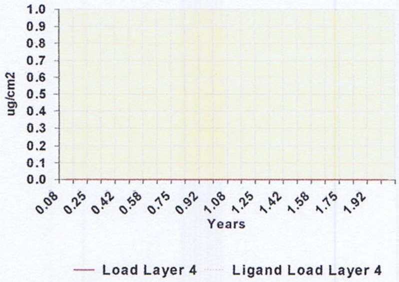
Output File: Plume 1A
C:\SEV7 WIN7\S01.OUT
Chemical File: Lead And Compounds (Kd)
C:\SEV7 WIN7\LEAD. CHM
Soil File: silty sand
C:\SEV7 WIN7\SILTY SAND.SOI
Application File: SEVIEW Default Application Parameters
C:\USERS\OWNER\DOCUMENTS\LAKE MEAD FOR TIFFANY\REPORT AND FINAL RUNS\S08.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)	4.90E+03	4.90E+03	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02	4.90E+02
Layer 2 (ug/g)	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	1.00E+02	7.50E+01	7.50E+01	5.00E+01	2.40E+01
Layer 3 (ug/g)	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	2.40E+01	1.00E+01	7.10E+00
Layer 4 (ug/g)	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.00E+01	1.50E+01	2.00E+01	3.00E+01	3.80E+01	





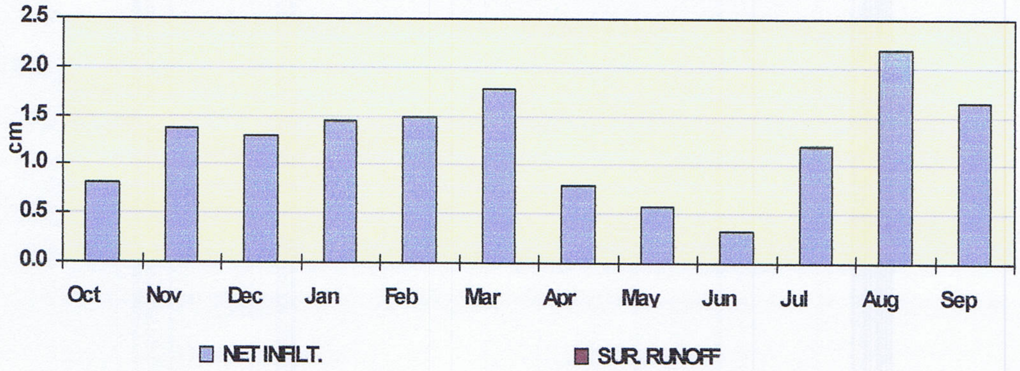


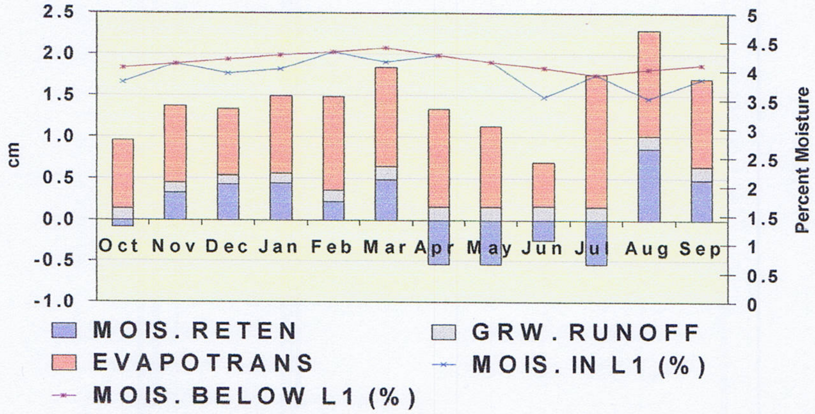


SESOIL Hydrologic Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT





	Surface Water Runoff		Net Infiltration		Evapotranspiration		Soil Moisture Retention		Groundwater Runoff (Recharge)		Soil Moisture	
											Layer 1	Below Layer 1
Units	cm	Inches	cm	Inches	cm	Inches	cm	Inches	cm	Inches	Percent	Percent
October	0.00	0.00	0.81	0.32	0.82	0.32	-0.09	-0.04	0.14	0.06	3.79	4.04
November	0.00	0.00	1.38	0.54	0.93	0.37	0.32	0.13	0.12	0.05	4.12	4.12
December	0.00	0.00	1.29	0.51	0.80	0.31	0.42	0.17	0.11	0.04	3.94	4.19
January	0.00	0.00	1.45	0.57	0.94	0.37	0.44	0.17	0.12	0.05	4.02	4.27
February	0.00	0.00	1.49	0.59	1.13	0.44	0.22	0.09	0.14	0.06	4.32	4.32
March	0.00	0.00	1.78	0.70	1.19	0.47	0.48	0.19	0.16	0.06	4.14	4.39
April	0.00	0.00	0.80	0.31	1.18	0.46	-0.54	-0.21	0.16	0.06	4.27	4.27
May	0.00	0.00	0.59	0.23	0.97	0.38	-0.54	-0.21	0.16	0.06	4.14	4.14
June	0.00	0.00	0.34	0.13	0.54	0.21	-0.25	-0.10	0.16	0.06	3.54	4.04
July	0.00	0.00	1.21	0.48	1.60	0.63	-0.54	-0.21	0.15	0.06	3.92	3.92
August	0.00	0.00	2.19	0.86	1.27	0.50	0.86	0.34	0.17	0.07	3.52	4.02
September	0.00	0.00	1.64	0.65	1.06	0.42	0.48	0.19	0.16	0.06	3.84	4.09
Total	0.00	0.00	14.97	5.89	12.43	4.89	1.26	0.49	1.75	0.69	--	--

SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (µg)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	6.702E+08	0.02
Sur. Runoff	0.000E+00	0.00
In Washld	0.000E+00	0.00
Ads On Soil	3.237E+12	99.60
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	1.290E+08	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	3.238E+12	99.62
Total Input	3.251E+12	
Input - Output	1.224E+10	

Maximum leachate concentration: 0.000E+00 **mg/l**

Climate File: BOULDER CITY

C:\SEV7 WIN7\BOULDER CITY.CLM

Chemical File: Lead And Compounds (Kd)

C:\SEV7 WIN7\LEAD. CHM

Soil File: silty sand

C:\SEV7 WIN7\SILTY SAND.SOI

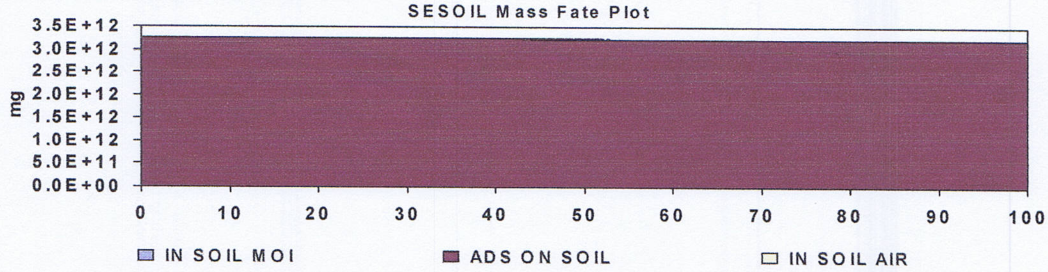
Application File: SEVIEW Default Application Parameters

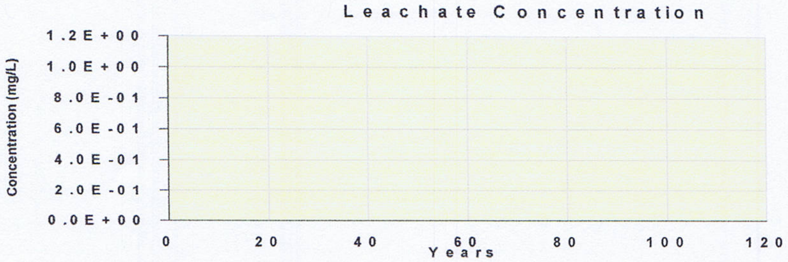
C:\USERS\OWNER\DOCUMENTS\LAKE MEAD FOR TIFFANY\REPORT AND FINAL RUNS\S08.APL

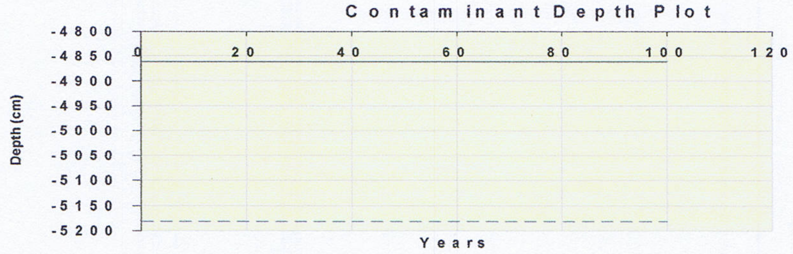
Starting Depth: 4862.00 **cm**

Ending Depth: 4862.00 **cm**

Total Depth: 5182.00 **cm**







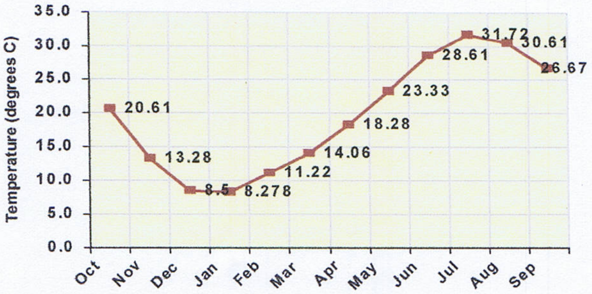
Appendix C

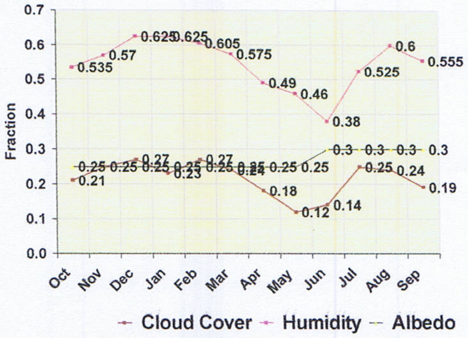
Sensitivity Analyses #2
Decrease Intrinsic Permeability Across the Soil Column
(Las Vegas Bay Former Firing Range)

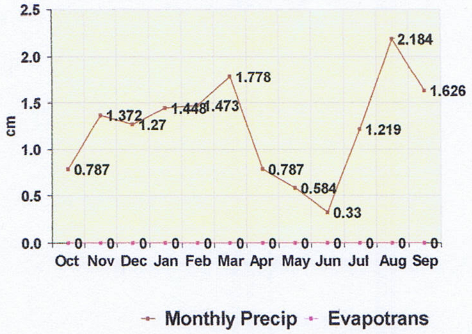
Climate Report

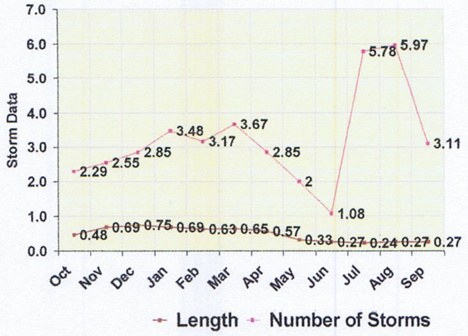
Location Description: BOULDER CITY
Climatic Input File: C:\SEV7 WIN7\BOULDER CITY.CLM

Month	Temperature		Precipitation		Evapotranspiration Rate		Storms		Cloud Cover	Albedo	Humidity
Units	^{o}C	^{o}F	cm	Inches	cm	Inches	# per Month	Length Days	Fraction	Fraction	Fraction
October	20.61	69.10	0.787	0.31	0.00	0.00	2.29	0.480	0.210	0.250	0.535
November	13.28	55.90	1.372	0.54	0.00	0.00	2.55	0.690	0.250	0.250	0.570
December	8.500	47.30	1.270	0.50	0.00	0.00	2.85	0.750	0.270	0.250	0.625
January	8.278	46.90	1.448	0.57	0.00	0.00	3.48	0.690	0.230	0.250	0.625
February	11.22	52.20	1.473	0.58	0.00	0.00	3.17	0.630	0.270	0.250	0.605
March	14.06	57.31	1.778	0.70	0.00	0.00	3.67	0.650	0.240	0.250	0.575
April	18.28	64.90	0.787	0.31	0.00	0.00	2.85	0.570	0.180	0.250	0.490
May	23.33	73.99	0.584	0.23	0.00	0.00	2.00	0.330	0.120	0.250	0.460
June	28.61	83.50	0.330	0.13	0.00	0.00	1.08	0.270	0.140	0.300	0.380
July	31.72	89.10	1.219	0.48	0.00	0.00	5.78	0.240	0.250	0.300	0.525
August	30.61	87.10	2.184	0.86	0.00	0.00	5.97	0.270	0.240	0.300	0.600
September	26.67	80.01	1.626	0.64	0.00	0.00	3.11	0.270	0.190	0.300	0.555
Total			14.86	5.85	0.00	0.00					









SESOIL Profile and Load Report

Layer No.	Number of Sub-Layers	Thickness		Intrinsic Permeability	Organic Carbon Content	Adsorption Coefficient	Cation Exchange Capacity	Freundlich Exponent	Solid Phase Degradation Rate	Liquid Phase Degradation Rate	Soil pH
		cm	feet	cm ^{2}	percent	μg/g / μg/mL	mEq / 100 g soil	unitless	1/day	1/day	pH
1	10	122.0	4.00	3.00E-7	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
2	10	1710.0	56.10	3.00E-7	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
3	10	1220.0	40.03	3.00E-7	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00
4	10	2130.0	69.88	3.00E-7	0.48	900.00	0.00	1.00	0.00E+00	0.00E+00	7.00

Soil Parameters

Bulk Density (g/cm^3)	1.11
Effective Porosity (fraction)	0.25
Soil Pore Disconnectedness	3.90

Application Parameters

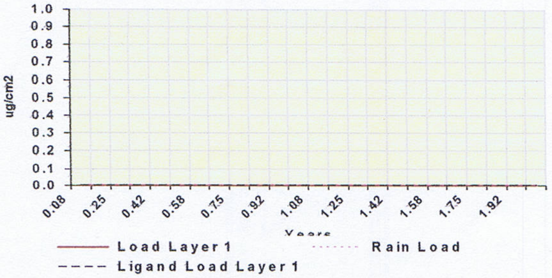
Area	cm ^{2}	8.00E+6
	ft ^{2}	8611.13
Latitude	degrees	36.0
Spill Index		1

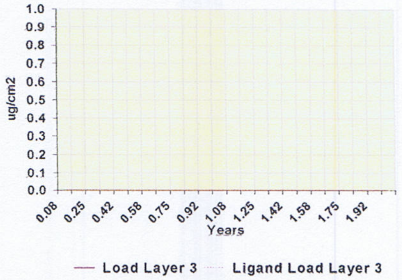
Chemical Parameters

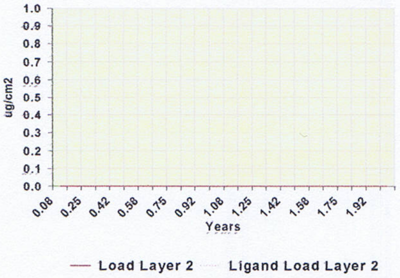
Water Solubility	(μg/mL)	9.58E+3	**Moles Ligand / Moles Chemical**		0.00
Henry's Law	(M^{3}atm/mol)	2.44E-2	**Ligand Molecular Weight**	(g/mol)	0.00
K_{oc} Adsorp	(μg/g)/(μg/mL)	0.00	**K_{oc} Dedsorp**	(μg/g)/(μg/mL)	0.00
K_d Adsorp	(μg/g)/(μg/mL)	900.00	**K_d Dedsorp**	(μg/g)/(μg/mL)	0.00
Valence	(g/mole)	0.00	**Ligand Dissociation Constant**		0.00
Air Diffusion	(cm^2/sec)	0.00	**Base Hydrolysis Rate**	(L/mol/day)	0.00
Water Diffusion	(cm^2/sec)	0.00	**Neutral Hydrolysis**	(L/mol/day)	0.00
Molecular Weight	(g/mol)	207.00	**Acid Hydrolysis**	(L/mol/day)	0.00

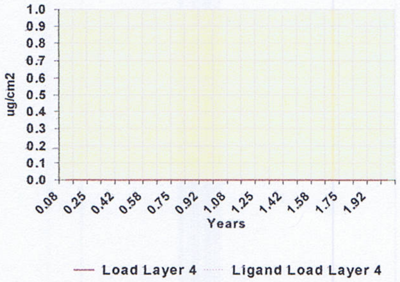
Output File: Plume 1A
C:\SEV7 WIN7\S01.OUT
Chemical File: Lead And Compounds (Kd)
C:\SEV7 WIN7\LEAD. CHM
Soil File: silty sand
C:\SEV7 WIN7\SILTY SAND.SOI
Application File: SEVIEW Default Application Parameters
C:\USERS\OWNER\DOCUMENTS\LAKE MEAD FOR TIFFANY\REPORT AND FINAL RUNS\S09.APL

Sublayer Loads	1	2	3	4	5	6	7	8	9	10
Layer 1 (ug/g)	4.90E+03									
Layer 2 (ug/g)										2.40E+01
Layer 3 (ug/g)										7.10E+00
Layer 4 (ug/g)									3.80E+01	





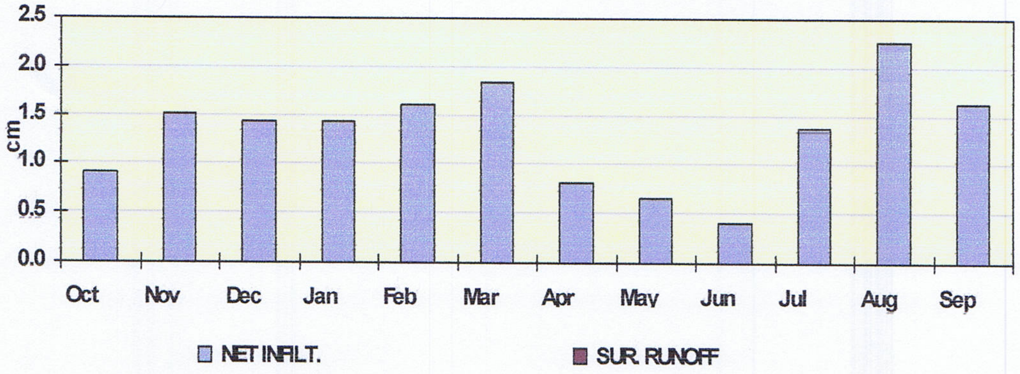


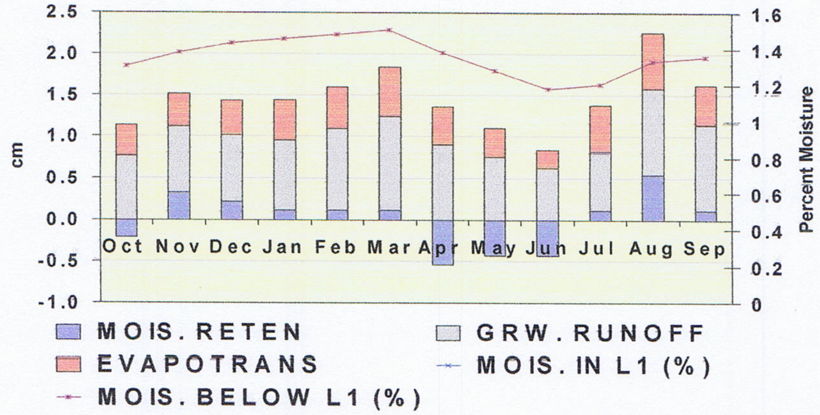


SESOIL Hydrologic Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT





	Surface Water Runoff		Net Infiltration		Evapotranspiration		Soil Moisture Retention		Groundwater Runoff (Recharge)		Soil Moisture	
											Layer 1	Below Layer 1
Units	cm	Inches	cm	Inches	cm	Inches	cm	Inches	cm	Inches	Percent	Percent
October	0.00	0.00	0.92	0.36	0.36	0.14	-0.22	-0.09	0.77	0.30	1.30	1.30
November	0.00	0.00	1.52	0.60	0.40	0.16	0.32	0.13	0.80	0.31	1.38	1.38
December	0.00	0.00	1.43	0.56	0.42	0.17	0.22	0.09	0.80	0.31	1.43	1.43
January	0.00	0.00	1.44	0.57	0.48	0.19	0.11	0.04	0.85	0.33	1.45	1.45
February	0.00	0.00	1.60	0.63	0.51	0.20	0.11	0.04	0.99	0.39	1.48	1.48
March	0.00	0.00	1.84	0.72	0.60	0.24	0.11	0.04	1.14	0.45	1.50	1.50
April	0.00	0.00	0.82	0.32	0.45	0.18	-0.54	-0.21	0.91	0.36	1.38	1.38
May	0.00	0.00	0.67	0.26	0.34	0.13	-0.43	-0.17	0.76	0.30	1.28	1.28
June	0.00	0.00	0.41	0.16	0.22	0.09	-0.43	-0.17	0.63	0.25	1.18	1.18
July	0.00	0.00	1.38	0.54	0.55	0.22	0.11	0.04	0.73	0.29	1.20	1.20
August	0.00	0.00	2.27	0.89	0.69	0.27	0.54	0.21	1.04	0.41	1.33	1.33
September	0.00	0.00	1.63	0.64	0.49	0.19	0.11	0.04	1.03	0.41	1.35	1.35
Total	0.00	0.00	15.92	6.27	5.48	2.16	0.00	0.00	10.44	4.11	- -	- -

SESOIL Pollutant Cycle Report

Scenario Description: Plume 1A

SESOIL Output File: C:\SEV7 WIN7\S01.OUT

SESOIL Process	Pollutant Mass (µg)	Percent of Total
Volatilized	0.000E+00	0.00
In Soil Air	1.500E+08	0.02
Sur. Runoff	0.000E+00	0.00
In Washld	0.000E+00	0.00
Ads On Soil	6.443E+11	99.65
Hydrol Soil	0.000E+00	0.00
Degrad Soil	0.000E+00	0.00
Pure Phase	0.000E+00	0.00
Complexed	0.000E+00	0.00
Immobile CEC	0.000E+00	0.00
Hydrol CEC	0.000E+00	0.00
In Soil Moi	8.735E+06	0.00
Hydrol Mois	0.000E+00	0.00
Degrad Mois	0.000E+00	0.00
Other Trans	0.000E+00	0.00
Other Sinks	0.000E+00	0.00
Gwr. Runoff	0.000E+00	0.00
Total Output	6.445E+11	99.68
Total Input	6.466E+11	
Input - Output	2.098E+09	

Maximum leachate concentration: 0.000E+00 **mg/l**

Climate File: BOULDER CITY

C:\SEV7 WIN7\BOULDER CITY.CLM

Chemical File: Lead And Compounds (Kd)

C:\SEV7 WIN7\LEAD. CHM

Soil File: silty sand

C:\SEV7 WIN7\SILTY SAND.SOI

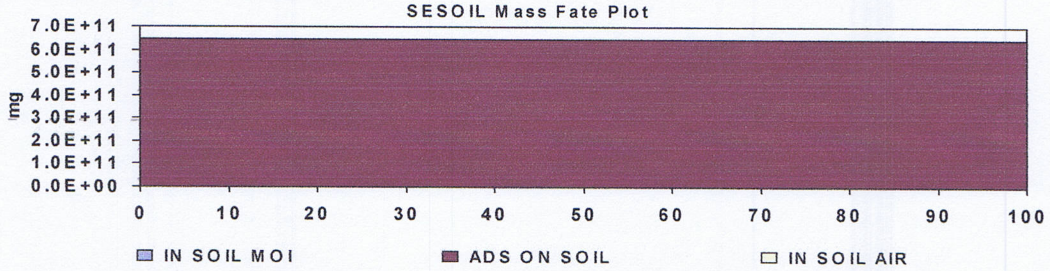
Application File: SEVIEW Default Application Parameters

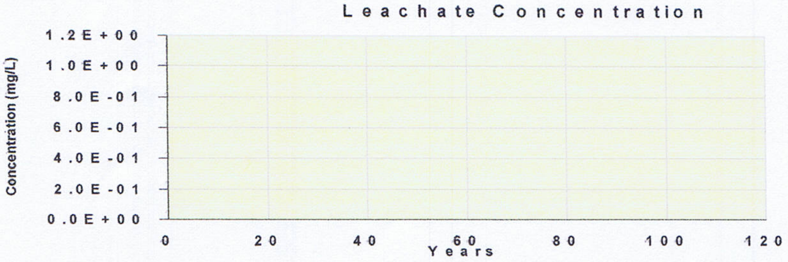
C:\USERS\OWNER\DOCUMENTS\LAKE MEAD FOR TIFFANY\REPORT AND FINAL RUNS\S09.APL

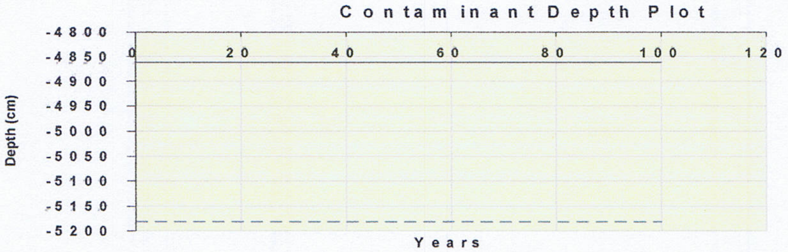
Starting Depth: 4862.00 **cm**

Ending Depth: 4862.00 **cm**

Total Depth: 5182.00 **cm**







APPENDIX G

COMPLETE BACKGROUND CALCULATIONS AND RISK SCREENING LEVELS FOR SOIL, SEDIMENT, AND SURFACE WATER

Attachment G
Table G-1
Habitat Type and Species Inventory
Lake Mead National Recreation Area

The habitat type in the vicinity of the four former firing ranges is the Creosote-Bush Community.

Creosote-Bush Community - lower elevations of the Colorado Plateau and at higher elevations in the Basin and Range. Typically dominated by creosote-bush and bursage. Vegetation cover is sparse.

Avian Species							
Common Name	**Scientific Name**	**Subgroup**	**Location**	**Home Range/Territory Description***	**Area****	**Units**	**Area in acres**
Bald Eagle	*Haliaeetus leucocephalus*	Carnivore	Mohave County, Arizona	Home range sizes of bald eagles vary widely depending on the area, season, availability of and distance to food resources, and the breeding status of the individual (Buehler 2000). Breeding adults in Saskatchewan utilized home ranges no smaller than 1,730 acres in size (Gerrard et al. 1992a). Garrett et al. (1993) reported that average home range sizes during breeding season on the Columbia River, OR, was 5,337 acres. Immature bald eagles generally occupy much larger areas than breeding adults, presumably because they are not tied to a nest site. Nonbreeding birds hatched on the northern Chesapeake Bay ranged throughout the Chesapeake area year round, and some traveled to Maine and Maritime Canada in summer and returned in the winter (Buehler et al. 1991). Two radio-tracked immatures, one from the Southwest U.S. and one from the Great Lakes area, were shown to use summer ranges of more than 13.6 million acres each, with winter home ranges of more than 5 million for one and 9 million acres for the other (Buehler 2000). Griffin and Baskett (1985) reported winter home range sizes of juvenile and adult bald eagles in Missouri to be 4,522 acres (± 3,608 SD) and 4,645 acres (± 2,224 SD), respectively. Craig et al. (1988) reported that linear foraging distances for eagles wintering on the Connecticut River ranged from 1.9 to 4.3 miles. Eagles that roost together in large numbers in winter share a common foraging home range (USEPA 1993).	4,059	acres	4,059
American Peregrine falcon	*Falco peregrinus anatum*	Carnivore	Mohave County, Arizona	The breeding range of the Peregrine Falcon is significantly diminished from its original range due to the impacts of DDT and other chemical poisons; and is local and spotty throughout most of North America. Areas where the range is particularly diminished are the mid-western and eastern United States, where most of the distribution is urban, but reportedly growing quickly. Areas of Alaska and the western United States including Utah, Arizona, western Colorado and northern California are where the Peregrine Falcon is most widely found (White et al. 2002). The Peregrine Falcon is a long-distance migrant that travels one of the longest distances of any raptor and may undertake long water crossings. It is a leap-frog migrant that commonly follows leading and diversion lines and that travels alone or in small groups of 10-20 individuals Peregrine Falcons hunt during migration and may stay as long as eight days at stopovers for this purpose. Satellite tracked individuals have been shown to migrate distances of between 87-124 miles per day. Migration for Peregrine Falcons occurs mostly from morning through late afternoon. Migration movements can be broad front or narrow front in form. The Peregrine Falcon is known to migrate at heights at or below 2,953 ft. The Peregrine has clear migration routes which either occur along leading lines or coastal areas with ideal habitat on the Eastern and Gulf Coasts and Eastern Mexico such as Chincoteague and Assateague Island in MD and VA and Padre Island, TX and Veracruz, Mexico. Peregrines also migrate in lesser concentrations along shores of the Great Lakes, the West Coast of the U.S., western Mexico, and the eastern front of the Rocky Mountains (Goodrich and Smith 2008, p. 138).	n/a		
California Condor	*Gymnogyps californianus*	Carnivore	Mohave County, Arizona	California condors live in rocky, forested regions including canyons, gorges and mountains. They historically ranged throughout the western U.S. from Canada to Mexico, with some populations as far east as Florida and New York. The species' current range includes California's southern coastal ranges from Big Sur to Ventura County, east through the Transverse Range and the southern Sierra Nevada, with other populations in northern Baja California and in the Grand Canyon ecoregion in Arizona.	n/a		
Brown pelican	Pelecanus occidentalis	Carnivore	Mohave County, Arizona	Coastal land and islands; species found occasionally around Arizona's lakes and rivers.Considered an uncommon transient in Arizona. Most observations recorded along the Colorado River and in the Gila Valley. Individuals known to wander up from Mexico in summer and fall. No breeding has been documented in Arizona. Delisted on November 17, 2009 (74 FR 59444).	452	Square Miles	289,280.0
California Least tern	Sterna antillarum browni	Carnivore	Mohave County, Arizona	Open, bare or sparsely vegetated sand, sandbars, gravel pits, or exposed flats along shorelines of inland rivers, lakes, reservoirs, or drainage systems.Breeding occasionally documented in Arizona; migrants may occur more frequently. Feeds primarily on fish in shallow waters and secondarily on invertebrates. Nests in a simple scrape on sandy or gravelly soil.	n/a		

Table G-1
Habitat Type and Species Inventory
Lake Mead National Recreation Area

Mexican Spotted Owl	*Strix occidentalis lucida*	Carnivore	Mohave County, Arizona, Clark County, Nevada	Mated pairs are territorial. The breeding season activity centers tend to be smaller than the non breeding season activity centers, with considerable overlap between the two. Adults may or may not leave the territory during the winter. Most adults remain on the same territory year afte year. Juveniles leave their natal territory in September, and while they are capable of moving long distances, many successfully establish themselves nearby. Some juveniles will travel through a variety of vegetation communities until they settle down. Distribution: The owl occupies a broad geographical area, but does not occur uniformly throughout its range. Instead, the owl occurs in disjunct localities that correspond to isolated mountain systems and canyons. The owl is frequently associated with mature mixed-conifer (Douglas-fir (Psuedotsuga menziesii), white fir (Abies concolor), limber pine (Pinus flexilis) or blue spruce (Picea pungens)), pine-oak (ponderosa pine (Pinus ponderosa) and Gambel oak (Quercus gambellii)), and riparian forests (various species of broadleaved deciduous trees and shrubs). Typically found between 4,100 and 9,000 feet of elevation. Ninety-one percent of known owls existing in the United States between 1990 and 1993 occurred on land administered by the U.S. Forest Service, the primary administrator of lands supporting owls. Most owls have been found within the 11 National Forests of Arizona and New Mexico. It is unknown why Colorado and Utah support fewer owls.	10.45	acres	10.5
Yuma Clapper rail	*Rallus longirostris yumanensis*	Carnivore	Mohave County, Arizona, Clark County, Nevada	Species is associated with dense emergent riparian vegetation. Requires wet substrate (mudflat, sandbar) with dense herbaceous or woody vegetation for nesting and foraging. Fresh-water marshes dominated by cattail or bulrush are preferred habitat. Early successional marshes with little residual vegetation may be preferred as well. Habitat should be in a mosaic of vegetated areas interspersed with shallow (less than 12") open water areas. Minimum size of suitable habitats is unclear, but have been found in areas as small as 2-3 acres depending on the quality of the mosaic. Typically found below 4,500 feet of elevation. Most individuals do not migrate, but have minor seasonal changes in their activity areas. Juveniles do disperse to nearby habitats. The recent extension of the range north along the lower Colorado River implies that rails are capable of longer distance movements, although the presence of scattered habitat patches for resting is likely important. Seasonal availability of food may be important factor in the need to migrate greater distances.	2.5	acres	2.5
Yellow-Billed Cuckoo	*Coccyzus americanus*	Insectivore	Mohave County, Arizona, Clark County, Nevada	The average home range size of breeding cuckoos on the Lower Colorado River(LCR) restoration sites has been found to be approximately 20 ha (McNeil et al 2011).	20	hectares	49.4
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	Insectivore	Mohave County, Arizona, Clark County, Nevada	The flycatcher is a summer breeder within its range in the United States. It is gone to wintering areas in Central America by the end of September. Nest territories are set up for breeding, and there is some site fidelity to nest territories. Riparian habitats that support songbird populations are limited along the shores of Lakes Mead and Mohave. Of conservation importance, surveys for the Federally endangered southwestern willow flycatcher (Empidonax traillii extimus) conducted through the Lower Colorado River Multi-Species Conservation Program have found low numbers of migrating flycatchers along Lake Mohave, but none along Lake Mead.Nesting habitat for southwestern willow flycatchers occurs along the Virgin River adjacent to LMNRA, and tributary delta areas of Lake Mead have potential to become new habitats, particularly where declining lake levels have exposed new riparian areas near tributary inflows of the Virgin and Muddy Rivers.	n/a		
Arizona Bell's vireo	*Vireo bellii arizonae*	Insectivore		Little is known about the migratory routes of this species (Table 3). Individuals leave the northernmost breeding grounds by August or September (Barlow 1962). Most have left the United States by early October, although some may remain in the Lower Colorado River Valley until late November (Brown 1993). During spring migration, adults return to their breeding grounds in early to mid-March and reach the northern limits of the breeding range in May (Brown 1993; Kus 1999). Home range and movement during the breeding season is limited to areas within dense riparian corridors. Territories are often linear in nature, following the stream course. Size of home range is dependent on the quality of breeding habitat available and the number of breeding individuals that the area will support.	n/a		
						Avian Smallest Average Home Range	**2.5**

Attachment G
Table G-1
Habitat Type and Species Inventory
Lake Mead National Recreation Area

Mammalian Species

Common Name	Scientific Name	Subgroup		Home Range/Territory Description*	Area**	Units	Area in acres
Desert pocket mouse	*Chaetodipus penicillatus sobrinus*	Herbivore	Mohave County, Arizona, Clark County, Nevada	Home range less then one acre.	0.9	acre	0.9
Hualapai Mexican vole	*Microtus mexicanus hualpaiensis*	Herbivore	Mohave County, Arizona	Moist, grass/sedge habitats along permanent or semi-permanent waters (springs or seeps). Also found in pinyon-juniper and pine oak associations with a variety of shrubs and grasses. Species confirmed only in the Hualapai Mountain Range and possible in the Prospect Valley and Music Mountains. Ongoing research suggests that populations may occur in the Hualapai Nation, Aubrey Cliffs, Chino Wash, Santa Maria Mountains, Bradshaw Mountains, Round Mountain, and Sierra Prieta Mountains. The taxon may ultimately be renamed.	n/a		
Mammalia Smallest Average Home Range							**0.90**

Reptile Species

Common Name	Scientific Name	Subgroup		Home Range/Territory Description*	Area**	Units	Area in acres
Gila Monster	*Heloderma suspectum*	Carnivore		160 acre	160	acre	160
Mojave desert tortoise	*Gopherus agassizii*	Herbivore	Mohave County, Arizona, Clark County, Nevada	Home range sizes vary, but a typical female tortoise home range in Arizona is 10 ha; males' territories may be larger, overlapping the range of several females (Van Devender 2002, Averill Murray et al. 2002). The size of desert tortoise home ranges varies with respect to location and year (Berry 1986) and also serves as an indicator of resource availability and opportunity for reproduction and social interactions (O'Connor et al. 1994). Females have long-term home ranges that may be as little as or less than half that of the average male, which can range to 80 or more hectares (200 acres) (Burge 1977; Berry 1986; Duda et al. 1999; Harless et al. 2009). Core areas used within tortoises' larger home ranges depend on the number of burrows used within those areas (Harless et al. 2009). Over its lifetime, each desert tortoise may use more than 3.9 square kilometers (1.5 square miles) of habitat and may make periodic forays of more than 11 kilometers (7 miles) at a time (Berry 1986).	25	acre	25
Sonoran desert tortoise	*Gopherus morafkai*	Herbivore	Mohave County, Arizona	Home range generally average from 10 to 100 acres (4–40 ha). In general, males have larger home ranges than females, and home range size increases with increasing resources and rainfall	55	acre	55
Northern Mexican gartersnake	*Thamnophis eques megalops*	Carnivore	Mohave County, Arizona				
Reptile Smallest Average Home Range							**25.00**

Amphibian Species

Common Name	Scientific Name	Subgroup	Location	Home Range/Territory Description*	Area**	Units	Area in acres
Relict leopard frog	*Lithobates (Rana) onca*	Carnivore	Mohave County, Arizona, Clark County, Nevada	LMNRA also is home to a regional endemic species, the relict leopard frog (R. [L.] onca). Once occurring along the historical Colorado River in the areas now covered by Lakes Mead and Mohave, and in the basins of the Virgin and Muddy Rivers as far as southern Utah, natural populations of this frog are now limited to a few spring and stream habitats in Black Canyon and in the region of Overton Arm of Lake Mead (Jaeger and others, 2001; Bradford and others, 2004). Although the relict leopard frog was once thought to be extinct, it has persisted despite losses of suitable habitat and isolation of populations. As a result, the relict leopard frog is the subject of a multi-agency conservation effort (Relict Leopard Frog Conservation Team, 2005), which, so far, has been successful at establishing additional populations within the region and maintaining a few remaining wild populations.			
Amphibian Smallest Average Home Range							**0.00**

Insect Species

Common Name	Scientific Name	Subgroup		Home Range/Territory Description*	Area**	Units	Area in acres
MacNeill's sootywings	*Hesperopsis gracielae*	Herbivore	Mohave County, Arizona, Clark County, Nevada				
Insect Smallest Average Home Range							**0.00**

Attachment G
Table G-1
Habitat Type and Species Inventory
Lake Mead National Recreation Area

Fish Species							
Common Name	**Scientific Name**	**Subgroup**		**Home Range/Territory Description***	**Area****	**Units**	**Area in acres**
Razorback sucker	*Xyrauchen texanus*		Mohave County, Arizona, Clark County, Nevada	Endemic to Colorado River Basin. Federally listed as endangered. Maximum size 36 in. (0.9 m), 13 lbs (5.9 kg), with a hardened cartilaginous dorsal ridge behind head and large fleshy mouth. Historically found in middle and lower elevation rivers, tributaries, and flood-plain habitats. Presently found in small numbers in rivers and reservoirs. Warm water species that reproduces and grows best at 54–64°F (12–18°C). Matures at 1–3 years of age and lives to 44 years. Young feed on zooplankton (cladocerans, copepods, and rotifers), juveniles consume algae and bottom ooze, and adults eat immature mayflies (Baetidae), stoneflies (Plecoptera, Protonemoura), and midges (Chironomidae), and algae and detritus (U.S. Fish and Wildlife Service, 1998). Two separate populations found in Lake Mead National Recreation Area: one i Lake Mohave and one in Lake Mead. Recently found spawning at the Colorado River inflow area to Lake Mead (Albrecht and others, 2010a, 2010b). The Lake Mead population appears t be the only one to reproduce successfully in the lower Colorado River Basin.			
Humpback chub	*Gila cypha*		Mohave County, Arizona	Large, warm turbid rivers especially canyon areas with deep fast water. Species found in the Upper Colorado River basin in Utah and Colorado, and in the Little Colorado and Colorado Rivers in Marble and Grand Canyons, Arizona. Critical habitat designated in Arizona, Colorado and Utah (59 FR 13374).			
Virgin River Chub	*Gila seminude (=robusta)*		Mohave County, Arizona, Clark County, Nevada	Deep swift waters but not turbulent, occurs over sand and gravel substrates in water less than 86 degrees F. Tolerant of high salinity and turbidity. Critical habitat designated in the 100-year floodplain of the Virgin River (65 FR4140). Presently found in the Moapa River and mainstem Virgin River. Species also occurs in Washington County, UT and Clark County, NV.			
Moapa dace	*Moapa coriacea*		Clark County, Nevada				
Bonytail chub	*Gila elegans*		Mohave County, Arizona, Clark County, Nevada	Endemic to Colorado River Basin. Federally listed as endangered. Maximum size 24 in. (0.6 m with fine scales a streamlined body, and very narrow caudal peduncle. Generally prefer backwaters with rocky or muddy bottoms and flowing pools, although they have been reported in swiftly moving water and feeds on surface. Spawning has been observed during May where eggs are laid randomly over the bottom, and no parental care occurs. Young bonytail chubs typically eat aquatic plants, while adults feed mostly on small fish, algae, plant debris, and terrestrial insects. In Lake Mead National Recreation Area, only a few adult individuals remain in Lake Mohave, although larger numbers of stocked bonytail chub survive in locations downstream (U.S. Fish and Wildlife Service, 2002a).			
Colorado pikeminnow	*Ptychocheilus lucius*		Mohave County, Arizona, Clark County, Nevada	Endemic to Colorado River Basin. Federally listed as endangered. Maximum size historically u to 6-ft (1.8 m) long and weighing more than 100 lbs (45.4 kg) although fish found now only gro up to 24 in. (0.6 m) and between 4 and 9 lbs (1.8 and 4.1 kg). It has an elongated body, a cone-shaped and somewhat flattened head forming nearly a quarter of the body length. Their usual habitat is the backwaters of the turbulent and turbid streams in the Colorado River system. Young pikeminnows eat cladocerans, copepods, and chironomid larvae, then shift to insects at around 4 in. (10.2 cm), gradually eating more fish as they mature. Once they achieve a length of about 1 ft (30.5 cm), they feed almost entirely upon fish. Natural populations survive only in the Upper Basin and are not currently found in Lake Mead National Recreation Area (U.S. Fish and Wildlife Service, 2002b).			
Pahrump poolfish	*Empetrichthys latos*		Clark County, Nevada				
Lahontan cutthroat trout	*Oncorhynchus clarkii henshawi*		Clark County, Nevada				
Woundfin	*Plagopterus argentissimus*		Mohave County, Arizona, Clark County, Nevada	Inhabits shallow, warm, turbid, fast-flowing water. Tolerates high salinity. Native population only in Virgin River. Designated critical habitat includes the Virgin River and its 100-year floodplain (65 FR 4140). Experimental non-essential populations (50 FR 30188) designated in portions of the Verde, Gila, San Francisco, and Hassayampa rivers and Tonto Creek. Species also occurs in Washington County, UT and Clark County, NV.			
Roundtail chub	*Gila robusta*		Mohave County, Arizona	Cool to warm waters of rivers and streams, often occupy the deepest pools and eddies of large streams. Historical range of roundtail chub included both the upper and lower Colorado River basins. A 2009 status review determined that the lower Colorado River basin roundtail chub population segment (Arizona and New Mexico) qualifies as a distinct vertebrate population segment (DPS). Populations in the Little Colorado, Bill Williams, and Gila River basins are considered candidate species.			
					Fish Smallest Average Home Range		**0.00**

Attachment G
Table G-1
Habitat Type and Species Inventory
Lake Mead National Recreation Area

Plant Species							
Common Name	**Scientific Name**	**Subgroup**	**Location**	**Home Range/Territory Description***	**Area****	**Units**	**Area in acres**
Jones cycladenia	*Cycladenia humilis var. jonesii*		Mohave County, Arizona	Mixed desert scrub, juniper, or wild buckwheat- mormon tea. It is found on gypsiferous, saline soils of the Cutler, Summerville, and Chinle formations.			
Welsh's milkweed	*Asclepias welshii*		Mohave County, Arizona, Clark County, Nevada				
Sticky Buckwheat	*Eriogonum viscidulum*		Mohave County, Arizona, Clark County, Nevada				
Threecorner milkvetch	*Astragalus geyeri* var. *triquetrus*		Mohave County, Arizona, Clark County, Nevada				
Bear-paw poppy	*Arctomecon californica*		Mohave County, Arizona, Clark County, Nevada				
Las Vegas buckwheat	*Eriogonum corymbosum var.*		Clark County, Nevada				
Fickeisen Plains cactus	*Pediocactus peeblesianus fickeiseniae*		Mohave County, Arizona	Shallow soils derived from exposed layers of Kaibab limestone. Found on canyon margins, well- drained hills in Navajoan Desert, or Great Plains grassland. Widely scattered small populations occur on the Arizona Strip, near the rims of the Colorado and Little Colorado Rivers, and in the vicinity of Gray Mountain. Critical habitat is being proposed for a total of 49,186 ac in Coconino and Mohave counties (77 FR 60510).			
Siler Pincushion cactus	*Pediocactus (=echinocactus,=utahia) sileri*		Mohave County, Arizona	Desertscrub transitional areas of Navajo, sagebrush and Mohave Deserts. Grows on gypsiferous clay and sandy soils of Moenkopi formation.			
Arizona Cliff-rose	*Purshia (=cowania) subintegra*		Mohave County, Arizona				
Holmgren milk-vetch	*Astragalus holmgreniorum*		Mohave County, Arizona	Just under limestone ridges and along draws in gravelly clay hills. Critical habitat occurs in Mohave County, Arizona and Washington County, Utah (71 FR 77972). Two additional populations known near St. George, Utah. Species also known as Paradox Milk-Vetch.			
Gierisch mallow	*Sphaeralcea gierischii*		Mohave County, Arizona	Found only on gypsum outcrops associated with Harrisburg member of Kaibab Formation. Plant has limited distribution in northern Mohave County and in adjacent Washington County (UT). A total of 12,822 ac are being proposed for designated critical habitat (77 FR 49894).			
Plant Smallest Average Home Range							**0.00**

Notes:

* Data from CWHR Life History Accounts and Range Maps at http://www.dfg.ca.gov/biogeodata/cwhr/cawildlife.asp

** Home Range Area is the reported average or an estimated average unsing the smalles ant largest reported home range

Attachment G
Table G-2a
Echo Bay Former Firing Range
ISM Calculator for 1-sided UCL for the Mean
Lake Mead National Recreation Area

Note on Selecting a UCL Method. This worksheet can be used to calculate a 95 UCL from ISM data using both the Chebyshev and Student's-t methods. If you have discrete data or other knowledge that indicates the variability in contaminant concentrations within the DU is low, use the Student's t method. If discrete data or other knowledge suggests that the variability may be high or the variability is unknown, use the Chebyshev method. Because the Chebyshev method tends to yield higher UCL values for the same data set, it's statistical performance is desirable - it achieves the desired 95% coverage of the mean under conditions when the variability of concentrations throughout the DU are moderate or high (See Table 4-4). One drawback of this performance is that the Chebyshev will tend to more severely overestimate the true mean than Student's t. Nevertheless, if no discrete data are available to estimate this variability, then Chebyshev is generally preferred over Student's. Do not mistake the standard deviation (SD) of replicates as a measure of this variability. The SD of replicates is a measure of consistency in estimates of the mean - this is considered a reliable indicator of the laboratory processing steps, but not an indicator of the degree of variability in the distribution of

Echo Bay Former Firing Range

Replicate Number	Replicate Results				Summary Statistics		
	TA	FL	WC	BG	Stats A	Stats B	Explanation
Rep 1	330.0	17.0	7.5	6.5	--	--	If you have replicate ISM results, enter data in the first section "Replicate Results"
Rep 2	98.0	19.0	8.2	6.5	--	--	If you have summary statistics, enter data in the second section "Summary Statistics"
Rep 3	55.0	17.0	15.0	6.8	--	--	
Rep 4	170.0	66.0	17.0	6.5	--	--	
Rep 5			21.0		--	--	
arithmetic mean	163.3	29.8	13.7	6.6			sample mean of replicate results
standard deviation	120.9	24.2	5.8	0.2			sample standard deviation of replicate results
CV = SD / mean	0.74	0.81	0.42	0.02			CV gives a measure of spread of the replicates, which is different from CV of underlying distribution
count (r)	4	4	5	4	4	5	For ISM, the sample size in the UCL calculation is the number of replicates, not the number of increments.
alpha (95% = 0.05)	0.05	0.05	0.05	0.05	0.05	0.05	standard choice is alpha = 0.05
t $_{(\alpha, r-1)}$	2.35	2.35	2.13	2.35	2.35	2.13	from Student's t distribution
Student's t UCL	305.47	58.21	19.27	**6.75**			Note that the UCL for these relatively small sample sizes will typically exceed the maximum.
Chebyshev UCL	**426.67**	**82.46**	**25.05**	6.90			The calculated UCL should be used (do not use the maximum).

Notes:
TA: Target Area
FL: Firing Line
WC: Wash Channel
ISM: incremental sampling methodology
UCL: upper confidence limit
CV: coefficient of variation
SD: standard deviation
t(α, df=r-1): (1-α)th quantile of the Student's t distribution
r-1: degrees of freedom equal to count (r) minus one.

Attachment G
Table G-2b
Las Vegas Bay Former Firing Range
ISM Calculator for 1-sided UCL for the Mean
Lake Mead National Recreation Area

Note on Selecting a UCL Method. This worksheet can be used to calculate a 95 UCL from ISM data using both the Chebyshev and Student's-t methods. If you have discrete data or other knowledge that indicates the variability in contaminant concentrations within the DU is low, use the Student's t method. If discrete data or other knowledge suggests that the variability may be high or the variability is unknown, use the Chebyshev method. Because the Chebyshev method tends to yield higher UCL values for the same data set, it's statistical performance is desirable - it achieves the desired 95% coverage of the mean under conditions when the variability of concentrations throughout the DU are moderate or high (See Table 4-4). One drawback of this performance is that the Chebyshev will tend to more severely overestimate the true mean than Student's t. Nevertheless, if no discrete data are available to estimate this variability, then Chebyshev is generally preferred over Student's. Do not mistake the standard deviation (SD) of replicates as a measure of this variability. The SD of replicates is a measure of consistency in estimates of the mean - this is considered a reliable indicator of the laboratory processing steps, but not an indicator of the degree of variability in the distribution of

Las Vegas Bay Former Firing Range

Replicate Number	Replicate Results				Summary Statistics		
	TA	**FL**	**WC**	**BG**	**Stats A**	**Stats B**	**Explanation**
Rep 1	1900.0	67.0	27.0	27.0	--	--	If you have replicate ISM results, enter data in the first section "Replicate Results"
Rep 2	4900.0	180.0	23.0	27.0	--	--	If you have summary statistics, enter data in the second section "Summary Statistics"
Rep 3	4000.0	89.0	74.0	19.0	--	--	
Rep 4	4500.0	110.0	26.0	25.0	--	--	
Rep 5				25.0	--	--	
arithmetic mean	3825.0	111.5	37.5	24.6			sample mean of replicate results
standard deviation	1335.1	48.9	24.4	3.3			sample standard deviation of replicate results
CV = SD / mean	0.35	0.44	0.65	0.13			CV gives a measure of spread of the replicates, which is different from CV of underlying distribution
count (r)	4	4	4	5	4	5	For ISM, the sample size in the UCL calculation is the number of replicates, not the number of increments.
alpha (95% = 0.05)	0.05	0.05	0.05	0.05	0.05	0.05	standard choice is alpha = 0.05
$t_{(\alpha, r-1)}$	2.35	2.35	2.35	2.13	2.35	2.13	from Student's t distribution
Student's t UCL	5395.99	169.07	66.20	**27.73**			Note that the UCL for these relatively small sample sizes will typically exceed the maximum.
Chebyshev UCL	**6734.79**	**218.13**	**90.66**	31.01			The calculated UCL should be used (do not use the maximum).

Notes:
TA: Target Area
FL: Firing Line
WC: Wash Channel
ISM: incremental sampling methodology
UCL: upper confidence limit
CV: coefficient of variation
SD: standard deviation

Attachment G
Table G-2c
Temple Bar Former Firing Range
ISM Calculator for 1-sided UCL for the Mean
Lake Mead National Recreation Area

<u>Note on Selecting a UCL Method.</u> This worksheet can be used to calculate a 95 UCL from ISM data using both the Chebyshev and Student's-t methods. If you have discrete data or other knowledge that indicates the variability in contaminant concentrations within the DU is low, use the Student's t method. If discrete data or other knowledge suggests that the variability may be high or the variability is unknown, use the Chebyshev method. Because the Chebyshev method tends to yield higher UCL values for the same data set, it's statistical performance is desirable - it achieves the desired 95% coverage of the mean under conditions when the variability of concentrations throughout the DU are moderate or high (See Table 4-4). One drawback of this performance is that the Chebyshev will tend to more severely overestimate the true mean than Student's t. Nevertheless, if no discrete data are available to estimate this variability, then Chebyshev is generally preferred over Student's. Do not mistake the standard deviation (SD) of replicates as a measure of this variability. The SD of replicates is a measure of consistency in estimates of the mean - this is considered a reliable indicator of the laboratory processing steps, but not an indicator of the degree of variability in the distribution of

Temple Bar Former Firing Range

Replicate Number	Replicate Results				Summary Statistics		Explanation
	TA	FL	WC	BG	Stats A	Stats B	
Rep 1	150.0	6.2	5.2	6.9	--	--	If you have replicate ISM results, enter data in the first section "Replicate Results"
Rep 2	41.0	5.1	5.3	6.5	--	--	If you have summary statistics, enter data in the second section "Summary Statistics"
Rep 3	24.0	5.8	5.7	5.5	--	--	
Rep 4	16.0	5.6	5.9	6.2	--	--	
Rep 5		5.4			--	--	
arithmetic mean	57.8	5.6	5.5	6.3			sample mean of replicate results
standard deviation	62.4	0.4	0.3	0.6			sample standard deviation of replicate results
CV = SD / mean	1.08	0.07	0.06	0.09			CV gives a measure of spread of the replicates, which is different from CV of underlying distribution
count (r)	4	5	4	4	4	5	For ISM, the sample size in the UCL calculation is the number of replicates, not the number of increments.
alpha (95% = 0.05)	0.05	0.05	0.05	0.05	0.05	0.05	standard choice is alpha = 0.05
$t_{(\alpha, r-1)}$	2.35	2.13	2.35	2.35	2.35	2.13	from Student's t distribution
Student's t UCL	131.15	6.02	5.91	**6.97**			Note that the UCL for these relatively small sample sizes will typically exceed the maximum.
Chebyshev UCL	**193.70**	**6.43**	**6.25**	7.56			The calculated UCL should be used (do not use the maximum).

Notes:
TA: Target Area
FL: Firing Line
WC: Wash Channel
ISM: incremental sampling methodology
UCL: upper confidence limit
CV: coefficient of variation
SD: standard deviation

Attachment G
Table G-2d
Willow Beach Former Firing Range
ISM Calculator for 1-sided UCL for the Mean
Lake Mead National Recreation Area

Note on Selecting a UCL Method. This worksheet can be used to calculate a 95 UCL from ISM data using both the Chebyshev and Student's-t methods. If you have discrete data or other knowledge that indicates the variability in contaminant concentrations within the DU is low, use the Student's t method. If discrete data or other knowledge suggests that the variability may be high or the variability is unknown, use the Chebyshev method. Because the Chebyshev method tends to yield higher UCL values for the same data set, it's statistical performance is desirable - it achieves the desired 95% coverage of the mean under conditions when the variability of concentrations throughout the DU are moderate or high (See Table 4-4). One drawback of this performance is that the Chebyshev will tend to more severely overestimate the true mean than Student's t. Nevertheless, if no discrete data are available to estimate this variability, then Chebyshev is generally preferred over Student's. Do not mistake the standard deviation (SD) of replicates as a measure of this variability. The SD of replicates is a measure of consistency in estimates of the mean - this is considered a reliable indicator of the laboratory processing steps, but not an indicator of the degree of variability in the distribution of

Willow Beach Former Firing Range

Replicate Number	Replicate Results				Summary Statistics		Explanation
	TA	FL	WC	BG	Stats A	Stats B	
Rep 1	25.0	17.0	14.0	14.0	--	--	If you have replicate ISM results, enter data in the first section "Replicate Results"
Rep 2	75.0	17.0	16.0	26.0	--	--	If you have summary statistics, enter data in the second section "Summary Statistics"
Rep 3	48.0	16.0	16.0	15.0	--	--	
Rep 4	45.0	15.0	14.0	14.0	--	--	
Rep 5	43.0				--	--	
arithmetic mean	47.2	16.3	15.0	17.3			sample mean of replicate results
standard deviation	17.9	1.0	1.2	5.9			sample standard deviation of replicate results
CV = SD / mean	0.38	0.06	0.08	0.34			CV gives a measure of spread of the replicates, which is different from CV of underlying distribution
count (r)	5	4	4	4	4	5	For ISM, the sample size in the UCL calculation is the number of replicates, not the number of increments.
alpha (95% = 0.05)	0.05	0.05	0.05	0.05	0.05	0.05	standard choice is alpha = 0.05
$t_{(\alpha, r-1)}$	2.13	2.35	2.35	2.35	2.35	2.13	from Student's t distribution
Student's t UCL	64.31	17.38	16.36	**24.14**			Note that the UCL for these relatively small sample sizes will typically exceed the maximum.
Chebyshev UCL	**82.19**	**18.34**	**17.52**	30.00			The calculated UCL should be used (do not use the maximum).

Notes:
TA: Target Area
FL: Firing Line
WC: Wash Channel
ISM: incremental sampling methodology
UCL: upper confidence limit
CV: coefficient of variation
SD: standard deviation

Attachment G
Table G-3a
Nevada ARAR Soil Screening Levels
Lake Mead National Recreation Area

SOIL ARAR	RECEPTOR	Lead (mg/kg)
Site Specific Background; 95% Student's UCL for Echo Bay		*6.75*
Site Specific Background; 95% Student's UCL for Las Vegas Bay		*27.73*
Eco-SSL Soil Screening Benchmark*	Avian	11
	Mammals	56
	Invertebrates	500
	Plants	50
USEPA Region 9 Screening Levels for Soil - November 2011	Residential	400
	Industrial	800
U.S. DOE, OEM, Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks	Invertebrates	500
	Microbes	900
	Plants	50
SEDIMENT ARAR	**RECEPTOR**	**Lead** (mg/kg)
USEPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Sediment Screening Benchmarks	Sensitive Food-Chain Species	35.8
GROUNDWATER ARAR	**RECEPTOR**	**Lead** (µg/L)
EPA Region 9 Maximum Contaminant Level	Federal Maximum Contaminant Level	15
SURFACE WATER ARAR	**RECEPTOR**	**Lead** (µg/L)
USEPA Ambient Water Quality Criteria for Metals in Surface Water	Human Health - Water & Fish Ingestion	NE
	Freshwater Aquatic Life Acute Exposure[1]	2.5
	Freshwater Aquatic Life Chronic Exposure[1]	65
USEPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Screening Benchmarks	Sensitive Food-Chain Species	2.5

Notes:

* From The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php

** 400 mg/L represents maximum value reported in the table and is a water quality standard.

Key:

[1] Designated use for Lake Mead (http://water.epa.gov/scitech/swguidance/standards/current/index.cfm Human Health criteria Table and Aquatic Life Criteria Table)

[2] Designated use for Lake Mead A.A.C R18-11-108 to A.A.C R18-11-109, Appendix A

NE: Not Established

T = total recoverable

UCL = Upper Confidence Limit

USEPA = United States Environmental Protection Agency (Federal)

Attachment G
Table G-3a
Arizona ARAR Soil Screening Levels

Lake Mead National Recreation Area

SOIL ARAR	**RECEPTOR**	**Lead** (mg/kg)
Site Specific Background; 95% Student's UCL for Temple Bar		*6.97*
Site Specific Background; 95% Student's UCL for Willow Beach		*24.14*
Eco-SSL Soil Screening Benchmark*	Avian	11
	Mammals	56
	Invertebrates	500
	Plants	50
U.S. DOE, OEM, Oak Ridge National Laboratory (ORNL) Toxicological Benchmarks	Invertebrates	500
	Microbes	900
	Plants	50
Arizona Soil Remediation Level	Residential Non-Carcinogen	400
Arizona GPL	Leaching to Groundwater	290
SEDIMENT ARAR	**RECEPTOR**	**Lead** (mg/kg)
USEPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Sediment Screening Benchmarks	Sensitive Food-Chain Species	35.8
GROUNDWATER ARAR	**RECEPTOR**	**Lead** (µg/L)
Arizona Maximum Contaminant Level	State Maximum Contaminant Level	50
SURFACE WATER ARAR	**RECEPTOR**	**Lead** (µg/L)
USEPA Region 3 Biological Technical Assistance Group (BTAG) Freshwater Screening Benchmarks	Sensitive Food-Chain Species	2.5
Arizona Surface Water Quality Standard[2]	DWS	15,000 (T)
	FBC	15,000 (T)
	A&Wc Acute (400 mg/L**)	280.85
	A&Wc Chronic (400 mg/L**)	10.94
	AgI	10,000 (T)
	AgL	100 (T)

Notes:

* From The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php

** 400 mg/L represents maximum value reported in the table and is a water quality standard.

Acute and chronic A&Wc lead concentration standards are based on water hardness (See Tables 13, 14, and 15 of AAC R18 11) and are dissolved concentrations.

GPL is based on a Screening Method to Determine Soil Concentrations Protective of Groundwater Quality, 2006. Prepared by the ADEQ Leachability Working Group of the Cleanup Standards/Policy Task Force.

Key:

[1] Designated use for Lake Mead (http://water.epa.gov/scitech/swguidance/standards/current/index.cfm Human Health Criteria

[2] Designated use for Lake Mead A.A.C R18-11-108 to A.A.C R18-11-109, Appendix A

AgI = surface water use for crop irrigation

AgL = surface water use for livestock

A&Wc = aquatic and wildlife (cold water) use of a surface water by animals, plants, or other cold-water organisms, generally occurring at an elevation greater than 5000 feet, for habitation, growth, or propagation

DWS = domestic water source

FBC = full body contact

NE: Not Established

T = total recoverable

UCL = Upper Confidence Limit

USEPA = United States Environmental Protection Agency (Federal)

Attachment G
Table G-4a
Echo Bay Former Firing Range
Site Specific Screen Level Calculation
Lake Mead National Recreation Area

Risk Screening Values for Lead (mg/kg)	**TA**	**FL**	**WC**
Human Health Risk Screening Value (Residential)	400	400	400
Ecological Soil Screening Benchmark (EcoSSL - Avian)	11	11	11
Ecological Soil Screening Benchmark (EcoSSL - Mammalian)	56	56	56
Area Use Factor (AUF) (Avian)	0.09	0.11	0.15
Area Use Factor (AUF) (Mammalian)	0.25	0.31	0.40
Toxicity Reference Value (TRV) (Human Health)	400	400	400
Toxicity Reference Value (TRV) (Ecological - Avian)	122	100	73
Toxicity Reference Value (TRV) (Ecological - Mammalian)	224	181	140
Site Specific Screening Level (Lowest Estimated TRV)	**122**	**100**	**73**

Notes:

TA: Target Area
FL: Firing Line
WC: Wash Channel
mg/kg: milligram per kilogram
EcoSSL: Ecological soil screening level from The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php

Attachment G
Table G-4b
Las Vegas Bay Former Firing Range
Site Specific Screen Level Calculation

Lake Mead National Recreation Area

Risk Screening Values for Lead (mg/kg)	**TA**	**FL**	**WC**
Human Health Risk Screening Value (Residential)	400	400	400
Ecological Soil Screening Benchmark (EcoSSL - Avian)	11	11	11
Ecological Soil Screening Benchmark (EcoSSL - Mammalian)	56	56	56
Area Use Factor (AUF) (Avian)	0.06	0.08	0.02
Area Use Factor (AUF) (Mammalian)	0.17	0.22	0.05
Toxicity Reference Value (TRV) (Human Health)	400	400	400
Toxicity Reference Value (TRV) (Ecological - Avian)	183	138	550
Toxicity Reference Value (TRV) (Ecological - Mammalian)	329	255	1,120
Site Specific Screening Level (Lowest Estimated TRV)	**183**	**138**	**400**

Notes:

TA: Target Area
FL: Firing Line
WC: Wash Channel
mg/kg: milligram per kilogram
EcoSSL: Ecological soil screening level from The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php

AUF for TA, FL and WC together

Attachment G
Table G-4c
Temple Bar Former Firing Range
Site Specific Screen Level Calculation
Lake Mead National Recreation Area

Risk Screening Values for Lead (mg/kg)	**TA**
Human Health Risk Screening Value (Residential)	400
Ecological Soil Screening Benchmark (EcoSSL - Avian)	11
Ecological Soil Screening Benchmark (EcoSSL - Mammalian)	56
Area Use Factor (AUF) (Avian)	0.06
Area Use Factor (AUF) (Mammalian)	0.16
Toxicity Reference Value (TRV) (Human Health)	400
Toxicity Reference Value (TRV) (Ecological - Avian)	183
Toxicity Reference Value (TRV) (Ecological - Mammalian)	350
Site Specific Screening Level (Lowest Estimated TRV)	**183**

Notes:
TA: Target Area
FL: Firing Line
WC: Wash Channel
mg/kg: milligram per kilogram
EcoSSL: Ecological soil screening level from The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php

Attachment G
Table G-4d
Willow Beach Former Firing Range
Site Specific Screen Level Calculation
Lake Mead National Recreation Area

Risk Screening Values for Lead (mg/kg)	**TA**
Human Health Risk Screening Value (Residential)	400
Ecological Soil Screening Benchmark (EcoSSL - Avian)	11
Ecological Soil Screening Benchmark (EcoSSL - Mammalian)	56
Area Use Factor (AUF) (Avian)	0.00
Area Use Factor (AUF) (Mammalian)	0.01
Toxicity Reference Value (TRV) (Human Health)	400
Toxicity Reference Value (TRV) (Ecological - Avian)	2,434
Toxicity Reference Value (TRV) (Ecological - Mammalian)	5,600
Site Specific Screening Level (Lowest Estimated TRV)	**400**

Notes:
TA: Target Area
FL: Firing Line
WC: Wash Channel
mg/kg: milligram per kilogram
EcoSSL: Ecological soil screening level from The Risk Assessment Information System ecological benchmark tool at http://rais.ornl.gov/tools/eco_search.php

Attachment G
Table G-5a
Echo Bay Former Firing Range
Decision Unit Hazard Quotient Calculation

Lake Mead National Recreation Area

Echo Bay			
Sample Area	**TA**	**FL**	**WC**
ISM Sample Results **Lead** (mg/kg)	330	17	7.5
	98	19	8.2
	55	17	15
	170	66	17
			21
Toxicity Reference Value (TRV) (HHRSV - Residential)	400	400	400
Area Use Factor (AUF)	0.25	0.31	0.40
Toxicity Reference Value (TRV) (Ecological)	122	100	73
Minimum Concentration	55	17	8
Maximum Concentration	330	66	17
Average Concentration	163	30	12
Standard Deviation	121	24	5
Number of Detections	4	4	4
Exposure Point Concentration*	427	82	22
Exposure Dose**	107	26	9
Hazard Quotient (HQ) - Human Health	**1.07**	0.21	0.06
Hazard Quotient (HQ) - Ecological	**3.50**	0.82	0.31

NOTES:

TA: Target Area

FL: Firing Line

WC: Wash Channel

mg/kg: milligrams per kilogram

HHRSV: human health risk screening value

EcoSSL: ecological soil screening level

* Exposure Point Concentration is the 95% Chebyshev UCL concentration.

** Considers area use factor for most sensitive (smallest home range) species.

Attachment G
Table G-5b
Las Vegas Bay Former Firing Range
Decision Unit Hazard Quotient Calculation
Lake Mead National Recreation Area

Las Vegas Bay			
Sample Area	**TA**	**FL**	**WC**
ISM Sample Results **Lead** (mg/kg)	1900	67	27
	4900	180	23
	4000	89	74
	4500	110	26
Toxicity Reference Value (TRV) (HHRSV - Residential)	400	400	400
Area Use Factor (AUF)	0.17	0.22	0.05
Toxicity Reference Value (TRV) (Ecological)	183	138	550
Minimum Concentration	1900	67	23
Maximum Concentration	4900	180	74
Average Concentration	3825	112	38
Standard Deviation	1335	49	24
Number of Detections	4	4	4
Exposure Point Concentration*	6735	218	91
Exposure Dose**	1145	48	5
Hazard Quotient (HQ) - Human Health	**16.84**	0.55	0.23
Hazard Quotient (HQ) - Ecological	**36.80**	**1.58**	0.16

NOTES:

TA: Target Area
FL: Firing Line
WC: Wash Channel
mg/kg: milligrams per kilogram
HHRSV: human health risk screening value
EcoSSL: ecological soil screening level
* Exposure Point Concentration is the 95% Chebyshev UCL concentration.
** Considers area use factor for most sensitive (smallest home range) species.

Attachment G
Table G-5c
Temple Bar Former Firing Range
Decision Unit Hazard Quotient Calculation
Lake Mead National Recreation Area

Temple Bar	
Sample Area	**TA**
ISM Sample Results **Lead** (mg/kg)	150
	41
	24
	16
Toxicity Reference Value (TRV) (HHRSV - Residential)	400
Area Use Factor (AUF)	0.16
Toxicity Reference Value (TRV) (Ecological)	183
Minimum Concentration	16
Maximum Concentration	150
Average Concentration	58
Standard Deviation	62
Number of Detections	4
Exposure Point Concentration*	194
Exposure Dose**	31
Hazard Quotient (HQ) - Human Health	0.48
Hazard Quotient (HQ) - Ecological	**1.06**

NOTES:

TA: Target Area

mg/kg: milligrams per kilogram

HHRSV: human health risk screening value

EcoSSL: ecological soil screening level

* Exposure Point Concentration is the 95% Chebyshev UCL concentration.

** Considers area use factor for most sensitive (smallest home range) species.

Attachment G
Table G-5d
Willow Beach Former Firing Range
Decision Unit Hazard Quotient Calculation

Lake Mead National Recreation Area

Willow Beach	
Sample Area	**TA**
ISM Sample Results **Lead** (mg/kg)	25
	75
	48
	45
	43
Toxicity Reference Value (TRV) (HHRSV - Residential)	400
Area Use Factor (AUF)	0.01
Toxicity Reference Value (TRV) (Ecological)	2,434
Minimum Concentration	25
Maximum Concentration	75
Average Concentration	47
Standard Deviation	18
Number of Detections	5
Exposure Point Concentration*	82
Exposure Dose**	1
Hazard Quotient (HQ) - Human Health	0.21
Hazard Quotient (HQ) - Ecological	0.03

NOTES:
TA: Target Area
mg/kg: milligrams per kilogram
HHRSV: human health risk screening value
EcoSSL: ecological soil screening level
* Exposure Point Concentration is the 95% Chebyshev UCL concentration.
** Considers area use factor for most sensitive (smallest home range) species.

Attachment G

Table G-6

Area Use Factor Calculations

Lake Mead National Recreation Area

Site ID	Area ID	Area (ft^2)	Area (ac)	Avian		Mammalian	
				Home Range (ac)	AUF	Home Range (ac)	AUF
EB	TA	9,625	0.22	2.50	0.090	0.90	0.25
	FL	12,326	0.28	2.50	0.110	0.90	0.31
	WC	15,830	0.36	2.50	0.150	0.90	0.40
	Total	**37,781**	**0.87**	2.50	**0.350**	0.90	**0.96**
LV	TA	6,529	0.15	2.50	0.060	0.90	0.17
	FL	8,554	0.20	2.50	0.080	0.90	0.22
	WC	2,030	0.05	2.50	0.020	0.90	0.05
	Total	**17,114**	**0.39**	2.50	**0.160**	0.90	**0.44**
TB	TA	6,112	0.14	2.50	0.060	0.90	0.16
WB	TA	492	0.01	2.50	0.005	0.90	0.01

Notes:

EB: Echo Bay
LV: Las Vegas Bay
TB: Temple Bar
WB: Willow Beach
TA: Target Area
FL: Firing Line
WC: Wash Channel

AUF: area use factor
ft = feet
ft^2 = square feet
ac = acre
in = inch
ft^3= cubic feet
yd^3 = cubic yard

APPENDIX H

DETAILED COST ESTIMATES

Lake Mead National Recreation Area
Location: Mohave County, Arizona and Clark County, Nevada
Phase: EE/CA (-30% / +50%)
Base Year: 2014
CAPITAL COSTS:

Site	**Alternative 2 Consolidation and Capping/ Institutional Controls**			**Alternative 3 Chemical Stabilization and Soil Replacement to Site**			**Alternative 4 Excavation/ Off-Site Disposal**		
	Cost		**Cross-reference**	**Cost**		**Cross-reference**	**Cost**		**Cross-reference**
Echo Bay	-30%	$362,000	**H-2a**	-30%	$153,000	**H-3a**	-30%	$123,000	**H-4a**
		$517,000			$218,000			$176,000	
	+50%	$775,000		+50%	$327,000		+50%	$264,000	
Las Vegas Bay	-30%	$394,000	**H-2b**	-30%	$205,000	**H-3b**	-30%	$163,000	**H-4b**
		$562,000			$292,000			$233,000	
	+50%	$843,000		+50%	$438,000		+50%	$349,000	
Temple Bar	-30%	$346,000	**H-2c**	-30%	$119,000	**H-3c**	-30%	$97,000	**H-4c**
		$494,000			$170,000			$139,000	
	+50%	$741,000		+50%	$254,000		+50%	$208,000	
Total	-30%	$1,102,000	**H-1**	-30%	$477,000	**H-1**	-30%	$383,000	**H-1**
		$1,573,000			$680,000			$548,000	
	+50%	$2,359,000		+50%	$1,019,000		+50%	$821,000	

Notes:
Rough cost estimate and minus 30% and plus 50% range.
Estimated costs include capital costs and annual recurring costs.

Alternative 2 consists of excavation of lead impacted soil, on-site disposal, capping, and institutional controls.	**Echo Bay Former Firing Range**				
CAPITAL COST					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 84,000
Project Design	1	ls	$ 60,000	$ 60,000	
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Excavation and On-Site Disposal					
Soil Excavation					$ 30,800
Mob/Demob	1	ls	$ 20,000	$ 20,000	
Excavate and Transport to Onsite Repository	360	yd^3	$ 30	$ 10,800	
Repository Construction					$ 51,450
Import Fill for Cap	383	yd^3	$ 50	$ 19,150	
Riprap	118	yd^3	$ 100	$ 11,800	
Laboratory/Compaction testing	1	ls	$ 500	$ 500	
Compaction Test Report	1	ls	$ 2,000	$ 2,000	
Monitoring Well Installation	4	each	$ 4,500	$ 18,000	
Oversight					$ 22,500
Oversight labor	15	day	$ 1,500	$ 22,500	
Materials and Equipment					$ 1,650
Support Vehicle	3	wk	$ 550	$ 1,650	
Institutional Controls					$ 12,250
Construct perimeter fence barrier	250	lf	$ 45	$ 11,250	
Install Signage	10	each	$ 100	$ 1,000	
Site Restoration					$ 3,500
Site Survey	1	ls	$ 3,500	$ 3,500	
Reporting					$ 12,500
Cap Completion Summary Report	1	ls	$ 12,500	$ 12,500	
SUBTOTAL					**$ 218,650**
Project Management	20%	cc	$ 218,650	$ 43,730	
Prime Contractor Overhead	10%	cc	$ 218,650	$ 21,865	
Profit	10%	cc	$ 218,650	$ 21,865	
Bonding	2%	cc	$ 218,650	$ 4,373	$ 91,833
TOTAL CAPITAL COST					**$ 310,483**
Annual Recurring Cost					
OM&M and Reporting	1	yr	$ 10,000	$ 10,000	
Incidental Repairs	1	yr	$ 500	$ 500	
TOTAL ANNUAL RECURRING COST					**$ 10,500**
PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 310,483	0.03	$ 310,483	
Annual Recurring Cost	30	$ 10,500	0.03	$ 205,805	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 2b					**$ 516,288**
		Current Value	**- 30% Value**	**+ 50% Value**	
EE/CA (-30% / +50%) VALUE		**$ 516,288**	**$ 361,401**	**$ 774,431**	

Key:
ac = acre
cc = capital cost
ft = feet
ft^2 square feet
lf = linear feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

Alternative 2 consists of excavation of lead impacted soil, on-site disposal, capping, and institutional controls.	**Las Vegas Bay Former Firing Range**				
CAPITAL COST					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 84,000
Project Design	1	ls	$ 60,000	$ 60,000	
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Excavation and On-Site Disposal					
<u>Soil Excavation</u>					$ 36,800
Mob/Demob	1	ls	$ 20,000	$ 20,000	
Excavate and Transport to Onsite Repository	560	yd^3	$ 30	$ 16,800	
<u>Repository Construction</u>					$ 67,200
Import Fill for Cap	586	yd^3	$ 50	$ 29,300	
Riprap	174	yd^3	$ 100	$ 17,400	
Laboratory/Compaction testing	1	ls	$ 500	$ 500	
Compaction Test Report	1	ls	$ 2,000	$ 2,000	
Monitoring Well Installation	4	each	$ 4,500	$ 18,000	
<u>Oversight</u>					$ 30,000
Oversight labor	20	day	$ 1,500	$ 30,000	
<u>Materials and Equipment</u>					$ 2,200
Support Vehicle	4	wk	$ 550	$ 2,200	
Institutional Controls					$ 14,410
Construct perimeter fence barrier	298	lf	$ 45	$ 13,410	
Install Signage	10	each	$ 100	$ 1,000	
Site Restoration					$ 3,500
Site Survey	1	ls	$ 3,500	$ 3,500	
Reporting					$ 12,500
Cap Completion Summary Report	1	ls	$ 12,500	$ 12,500	
SUBTOTAL					**$ 250,610**
Project Management	20%	cc	$ 250,610	$ 50,122	
Prime Contractor Overhead	10%	cc	$ 250,610	$ 25,061	
Profit	10%	cc	$ 250,610	$ 25,061	
Bonding	2%	cc	$ 250,610	$ 5,012	$ 105,256
TOTAL CAPITAL COST					**$ 355,866**
Annual Recurring Cost					
OM&M and Reporting	1	yr	$ 10,000	$ 10,000	
Incidental Repairs	1	yr	$ 500	$ 500	
TOTAL ANNUAL RECURRING COST					**$ 10,500**
PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 355,866	0.03	$ 355,866	
Annual Recurring Cost	30	$ 10,500	0.03	$ 205,805	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 2b					**$ 561,671**
		Current Value	**- 30% Value**	**+ 50% Value**	
EE/CA (-30% / +50%) VALUE		**$ 561,671**	**$ 393,170**	**$ 842,506**	

Key:
ac = acre
cc = capital cost
ft = feet
ft^2 square feet
lf = linear feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

Alternative 2 consists of excavation of lead impacted soil, on-site disposal, capping, and institutional controls.	**Temple Bar Former Firing Range**				
CAPITAL COST					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 84,000
Project Design	1	ls	$ 60,000	$ 60,000	
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Excavation and On-Site Disposal					
<u>Soil Excavation</u>					$ 26,900
Mob/Demob	1	ls	$ 20,000	$ 20,000	
Excavate and Transport to Onsite Repository	230	yd^3	$ 30	$ 6,900	
<u>Repository Construction</u>					$ 41,000
Import Fill for Cap	250	yd^3	$ 50	$ 12,500	
Riprap	80	yd^3	$ 100	$ 8,000	
Laboratory/Compaction testing	1	ls	$ 500	$ 500	
Compaction Test Report	1	ls	$ 2,000	$ 2,000	
Monitoring Well Installation	4	each	$ 4,500	$ 18,000	
<u>Oversight</u>					$ 22,500
Oversight labor	15	day	$ 1,500	$ 22,500	
<u>Materials and Equipment</u>					$ 1,650
Support Vehicle	3	wk	$ 550	$ 1,650	
Institutional Controls					$ 10,450
Construct perimeter fence barrier	210	lf	$ 45	$ 9,450	
Install Signage	10	each	$ 100	$ 1,000	
Site Restoration					$ 3,500
Site Survey	1	ls	$ 3,500	$ 3,500	
Reporting					$ 12,500
Cap Completion Summary Report	1	ls	$ 12,500	$ 12,500	
SUBTOTAL					**$ 202,500**
Project Management	20%	cc	$ 202,500	$ 40,500	
Prime Contractor Overhead	10%	cc	$ 202,500	$ 20,250	
Profit	10%	cc	$ 202,500	$ 20,250	
Bonding	2%	cc	$ 202,500	$ 4,050	$ 85,050
TOTAL CAPITAL COST					**$ 287,550**
Annual Recurring Cost					
OM&M and Reporting	1	yr	$ 10,000	$ 10,000	
Incidental Repairs	1	yr	$ 500	$ 500	
TOTAL ANNUAL RECURRING COST					**$ 10,500**
PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 287,550	0.03	$ 287,550	
Annual Recurring Cost	30	$ 10,500	0.03	$ 205,805	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 2b					**$ 493,355**
		Current Value	**- 30% Value**	**+ 50% Value**	
EE/CA (-30% / +50%) VALUE		**$ 493,355**	**$ 345,348**	**$ 740,032**	

Key:
ac = acre
cc = capital cost
ft = feet
ft^2 square feet

lf = linear feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

Alternative 3 consists of excavation of lead impacted soil, screening, treatment (as required), and soil replacement to site.	**Echo Bay Former Firing Range**				
CAPITAL COSTS					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 24,000
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Lead Removal					
Lead Removal					$ 106,800
Mob/Demob	1	ls	$ 15,000	$ 15,000	
Excavate, Screen, Treat, Replace Soil to Site	360	yd^3	$ 255	$ 91,800	
Oversight					$ 3,000
Oversight labor	2	day	$ 1,500	$ 3,000	
Laboratory Cost - Soil Confirmation Samples					$ 120
Lead and TCLP Analysis	2	each	$ 60	$ 120	
Materials and Equipment					$ 250
Support Vehicle	2	day	$ 125	$ 250	
Site Restoration					$ 2,500
Regrade for Drainage	0.25	ac	$ 10,000	$ 2,500	
Reporting					$ 8,500
Lead Removal Summary Report	1	ls	$ 8,500	$ 8,500	
SUBTOTAL					**$ 145,170**
Project Management	20%	cc	$ 145,170	$ 29,034	
Prime Contractor Overhead	10%	cc	$ 145,170	$ 14,517	
Profit	10%	cc	$ 145,170	$ 14,517	
Bonding	2%	cc	$ 145,170	$ 2,903	$ 60,971
TOTAL CAPITAL COST					**$ 206,141**
Annual Recurring Cost					
Stabilization Testing and Reporting	1	yr	$ 2,500	$ 2,500	
TOTAL ANNUAL RECURRING COST					**$ 2,500**
PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 206,141	0.03	$ 206,141	
Annual Recurring Cost	5	$ 2,500	0.03	$ 11,449	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 3b					**$ 217,591**
		Current Value	**- 30% Value**	**+ 50% Value**	
EE/CA (-30% / +50%) VALUE		**$ 217,591**	**$ 152,313**	**$ 326,386**	

Key:
ac = acre
cc = capital cost
ft = feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

U.S. Department of Interior
National Park Service
Lake Mead National Recreation Area
Las Vegas Bay Former Firing Range

Table H-3b - Cost Estimate
EE/CA Report

Alternative 3 consists of excavation of lead impacted soil, screening, treatment (as required), and soil replacement to site.	**Las Vegas Bay Former Firing Range**				
CAPITAL COSTS					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 24,000
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Lead Removal					
Lead Removal					$ 157,800
Mob/Demob	1	ls	$ 15,000	$ 15,000	
Excavate, Screen, Treat, Replace Soil to Site	560	yd^3	$ 255	$ 142,800	
Oversight					$ 3,000
Oversight labor	2	day	$ 1,500	$ 3,000	
Laboratory Cost - Soil Confirmation Samples					$ 180
Lead and TCLP Analysis	3	each	$ 60	$ 180	
Materials and Equipment					$ 250
Support Vehicle	2	day	$ 125	$ 250	
Site Restoration					$ 3,500
Regrade for Drainage	0.35	ac	$ 10,000	$ 3,500	
Reporting					$ 8,500
Lead Removal Summary Report	1	ls	$ 8,500	$ 8,500	
SUBTOTAL					**$ 197,230**
Project Management	20%	cc	$ 197,230	$ 39,446	
Prime Contractor Overhead	10%	cc	$ 197,230	$ 19,723	
Profit	10%	cc	$ 197,230	$ 19,723	
Bonding	2%	cc	$ 197,230	$ 3,945	$ 82,837
TOTAL CAPITAL COST					**$ 280,067**
Annual Recurring Cost					
Stabilization Testing and Reporting	1	yr	$ 2,500	$ 2,500	
TOTAL ANNUAL RECURRING COST					**$ 2,500**
PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 280,067	0.03	$ 280,067	
Annual Recurring Cost	5	$ 2,500	0.03	$ 11,449	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 3b					**$ 291,516**
		Current Value	**- 30% Value**	**+ 50% Value**	
EE/CA (-30% / +50%) VALUE		**$ 291,516**	**$ 204,061**	**$ 437,274**	

Key:
ac = acre
cc = capital cost
ft = feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

Alternative 3 consists of excavation of lead impacted soil, screening, treatment (as required), and soil replacement to site.	**Temple Bar Former Firing Range**				
CAPITAL COSTS					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 24,000
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Lead Removal					
Lead Removal					$ 73,650
Mob/Demob	1	ls	$ 15,000	$ 15,000	
Excavate, Screen, Treat, Replace Soil to Site	230	yd^3	$ 255	$ 58,650	
Oversight					$ 3,000
Oversight labor	2	day	$ 1,500	$ 3,000	
Laboratory Cost - Soil Confirmation Samples					$ 120
Lead and TCLP Analysis	2	each	$ 60	$ 120	
Materials and Equipment					$ 250
Support Vehicle	2	day	$ 125	$ 250	
Site Restoration					$ 1,500
Regrade for Drainage	0.15	ac	$ 10,000	$ 1,500	
Reporting					$ 8,500
Lead Removal Summary Report	1	ls	$ 8,500	$ 8,500	
SUBTOTAL					**$ 111,020**
Project Management	20%	cc	$ 111,020	$ 22,204	
Prime Contractor Overhead	10%	cc	$ 111,020	$ 11,102	
Profit	10%	cc	$ 111,020	$ 11,102	
Bonding	2%	cc	$ 111,020	$ 2,220	$ 46,628
TOTAL CAPITAL COST					**$ 157,648**
Annual Recurring Cost					
Stabilization Testing and Reporting	1	yr	$ 2,500	$ 2,500	
TOTAL ANNUAL RECURRING COST					**$ 2,500**
PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 157,648	0.03	$ 157,648	
Annual Recurring Cost	5	$ 2,500	0.03	$ 11,449	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 3b					**$ 169,098**
		Current Value	**- 30% Value**	**+ 50% Value**	
EE/CA (-30% / +50%) VALUE		**$ 169,098**	**$ 118,368**	**$ 253,647**	

Key:
ac = acre
cc = capital cost
ft = feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

U.S. Department of Interior
National Park Service
Lake Mead National Recreation Area
Echo Bay Former Firing Range

Table H-4a - Cost Estimate
EE/CA Report

Alternative 4 consists of excavation of lead impacted soil, treatment (as required), transportation, and disposal at off-site landfill.	**Echo Bay Former Firing Range**

CAPITAL COSTS					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 24,000
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Lead Removal					
Lead Removal					$ 85,200
Mob/Demob (includes treatability testing)	1	ls	$ 15,000	$ 15,000	
Excavate, Treat, Load, and T&D as Non-Hazardous	360	yd^3	$ 195	$ 70,200	
Oversight					$ 3,000
Oversight labor	2	day	$ 1,500	$ 3,000	
Laboratory Cost - Soil Confirmation Samples					$ 120
Lead and TCLP Analysis	2	each	$ 60	$ 120	
Materials and Equipment					$ 250
Support Vehicle	2	day	$ 125	$ 250	
Site Restoration					$ 2,500
Regrade for drainage	0.25	ac	$ 10,000	$ 2,500	
Reporting					$ 8,500
Lead Removal Summary Report	1	ls	$ 8,500	$ 8,500	
SUBTOTAL					**$ 123,570**
Project Management	20%	cc	$ 123,570	$ 24,714	
Prime Contractor Overhead	10%	cc	$ 123,570	$ 12,357	
Profit	10%	cc	$ 123,570	$ 12,357	
Bonding	2%	cc	$ 123,570	$ 2,471	$ 51,899
TOTAL CAPITAL COST					**$ 175,469**

PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 175,469	0.03	$ 175,469	
Annual Recurring Cost	0	$ -	0.03	$ -	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 4b					**$ 175,469**

	Current Value	**- 30% Value**	**+ 50% Value**
EE/CA (-30% / +50%) VALUE	**$ 175,469**	**$ 122,829**	**$ 263,204**

Key:
ac = acre
cc = capital cost
ft = feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

U.S. Department of Interior
National Park Service
Lake Mead National Recreation Area
Las Vegas Bay Former Firing Range

Table H-4b - Cost Estimate
EE/CA Report

Alternative 4 consists of excavation of lead impacted soil, treatment (as required), transportation, and disposal at off-site landfill.	**Las Vegas Bay Former Firing Range**				
CAPITAL COSTS					
DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 24,000
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Lead Removal					
Lead Removal					$ 124,200
Mob/Demob (includes treatability testing)	1	ls	$ 15,000	$ 15,000	
Excavate, Treat, Load, and T&D as Non-Hazardous	560	yd^3	$ 195	$ 109,200	
Oversight					$ 3,000
Oversight labor	2	day	$ 1,500	$ 3,000	
Laboratory Cost - Soil Confirmation Samples					$ 180
Lead and TCLP Analysis	3	each	$ 60	$ 180	
Materials and Equipment					$ 250
Support Vehicle	2	day	$ 125	$ 250	
Site Restoration					$ 3,500
Regrade for drainage	0.35	ac	$ 10,000	$ 3,500	
Reporting					$ 8,500
Lead Removal Summary Report	1	ls	$ 8,500	$ 8,500	
SUBTOTAL					**$ 163,630**
Project Management	20%	cc	$ 163,630	$ 32,726	
Prime Contractor Overhead	10%	cc	$ 163,630	$ 16,363	
Profit	10%	cc	$ 163,630	$ 16,363	
Bonding	2%	cc	$ 163,630	$ 3,273	$ 68,725
TOTAL CAPITAL COST					**$ 232,355**

PRESENT VALUE ANALYSIS					
Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 232,355	0.03	$ 232,355	
Annual Recurring Cost	0	$ -	0.03	$ -	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 4b					**$ 232,355**

	Current Value	**- 30% Value**	**+ 50% Value**
EE/CA (-30% / +50%) VALUE	**$ 232,355**	**$ 162,648**	**$ 348,532**

Key:
ac = acre
cc = capital cost
ft = feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard

U.S. Department of Interior
National Park Service
Lake Mead National Recreation Area
Temple Bar Former Firing Range

Table H-4c - Cost Estimate
EE/CA Report

Alternative 4b consists of excavation of lead impacted soil, treatment (as required), transportation, and disposal at off-site landfill.	**Temple Bar Former Firing Range**

CAPITAL COSTS

DESCRIPTION	**QTY**	**UNIT**	**UNIT COST**	**COST**	**SUBTOTAL**
Site Preparation					$ 24,000
Work Plan/HASP	1	ls	$ 15,000	$ 15,000	
Storm Water Pollution Prevention Plan	1	ls	$ 8,000	$ 8,000	
Site Visit	1	ls	$ 1,000	$ 1,000	
Lead Removal					
<u>Lead Removal</u>					$ 59,850
Mob/Demob (includes treatability testing)	1	ls	$ 15,000	$ 15,000	
Excavate, Treat, Load, and T&D as Non-Hazardous	230	yd^3	$ 195	$ 44,850	
<u>Oversight</u>					$ 3,000
Oversight labor	2	day	$ 1,500	$ 3,000	
<u>Laboratory Cost - Soil Confirmation Samples</u>					$ 120
Lead and TCLP Analysis	2	each	$ 60	$ 120	
<u>Materials and Equipment</u>					$ 250
Support Vehicle	2	day	$ 125	$ 250	
Site Restoration					$ 1,500
Regrade for drainage	0.15	ac	$ 10,000	$ 1,500	
Reporting					$ 8,500
Lead Removal Summary Report	1	ls	$ 8,500	$ 8,500	
SUBTOTAL					**$ 97,220**
Project Management	20%	cc	$ 97,220	$ 19,444	
Prime Contractor Overhead	10%	cc	$ 97,220	$ 9,722	
Profit	10%	cc	$ 97,220	$ 9,722	
Bonding	2%	cc	$ 97,220	$ 1,944	$ 40,832
TOTAL CAPITAL COST					**$ 138,052**

PRESENT VALUE ANALYSIS

Cost Type	**Year**	**Total Cost**	**Interest Rate (3%)**	**Present Value**	
Capital Cost	0	$ 138,052	0.03	$ 138,052	
Annual Recurring Cost	0	$ -	0.03	$ -	
TOTAL PRESENT VALUE OF ALTERNATIVE NO. 4b					**$ 138,052**

	Current Value	**- 30% Value**	**+ 50% Value**
EE/CA (-30% / +50%) VALUE	**$ 138,052**	**$ 96,637**	**$ 207,079**

Key:
ac = acre
cc = capital cost
ft = feet
ls = lump sum
Qty = quantity
yd^3 = cubic yard